CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

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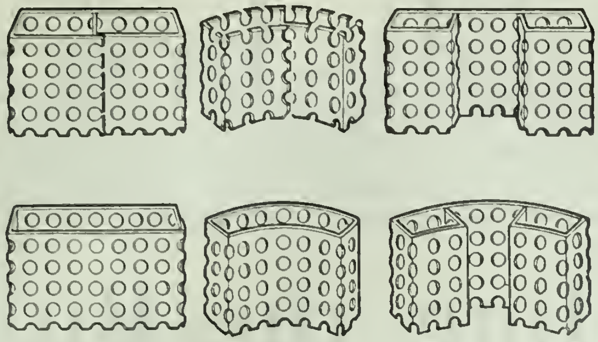


Why Not Use Perforated Chaplets?

They are easily adapted to many kinds of work. They have strength, are light in weight, and can be made in almost any shape.

A heavy button or stem chaplet oftentimes will not amalgamate readily with the molten metal, with the result that leaks are caused.

Our perforated chaplets will not do that because they fuse readily, yet have enough strength to hold up the core during the process of amalgamation.

We manufacture them in our own factory from special perforated tin plate made up to our specifications.

We have capable and experienced men in our employ who are turning them out by the thousands all ready for your order.

When sending for Woodison Perfect Perforated Chaplets, be sure to specify (1) the thickness of metal desired, (2) the length of the chaplet, (3) the width, (4) if curved, the radius of core chaplet is to support.

Send for Price List and order some right away!

VENT YOUR CORES WITH
WOODISON "QUALITY" VENT WAX

Manufactured in our factory from waxes that make the finished product hard but pliable.

"Quality" Vent Wax is far better than Beeswax or Paraffin in that it will not soften the core but will act as a binder for it. Every foundryman realizes the value of such a vent.

It will not run together or stick at ordinary temperatures, and that a perfect vent is assured. "Blowing" of cores, due to poor venting, is thus entirely eliminated.

We make round vent wax from 1-32″ to ½″, and can furnish flat oval wax in four sizes, 1-16″ x 3-16″, 3-32″ x ¼″, ⅛″ x ⅜″, and 3-16″ x ½″.

Also furnished in 5-lb. cakes. Samples will be sent on request. May we have your order now?

The E. J. Woodison Company, Limited

Montreal **TORONTO, ONT.** **Windsor**

Foundry Facings, Fire Brick, Woodseed Liquid Core Compound, Polishers' and Platers' Supplies, Compounds and Equipment, Cupola Blocks, Foundry Supplies and Equipment

The Publisher's Page

TORONTO January, 1917

Selling the Buyer

(No. 3 of a Series of Short Articles)

Educating Future Customers

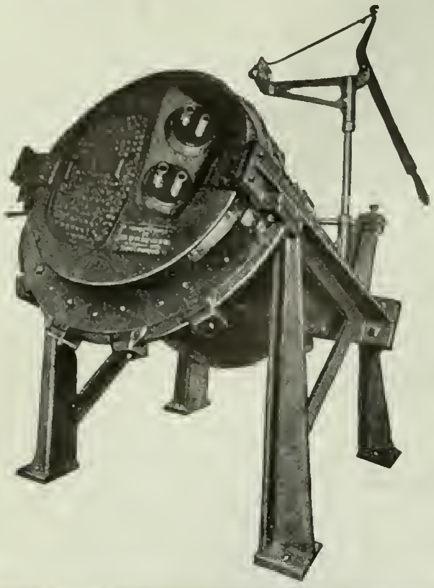
NO manufacturer is in business to-day with the avowed purpose of retiring to-morrow. Rather do the majority wish to leave behind them, in their businesses, proud monuments to their earlier efforts and to their integrity and ability.

The importance of educating the coming superintendents, foremen and managers will not be disputed by the far-seeing. It is perhaps a too seldom recognized truth in connection with advertising in reputable technical journals like Canadian Foundryman, that future buyers can be educated while present sales are being influenced. We would like that thought to STICK.

As one leading manufacturer said to us not long ago in arranging for the use of increased space, "I have been thinking about our advertising a very great deal lately and I have reached this conclusion; that it would be nothing short of absolute folly for us to discontinue our advertising even temporarily. New men are coming into the field, new companies are being formed, new plants being erected. The foremen of to-day will soon be superintendents. The superintendents of old plants will secure the same or higher positions in new foundries. Changes are constantly taking place. I am signing cheques for firms from whom we ourselves are buying and who were not in existence when I did the buying, personally, a few years ago. If we wish to continue to be as well known as we are to-day, I am convinced we must continue to educate the future buyers through uninterrupted advertising."

CANADIAN FOUNDRYMAN
and METAL INDUSTRY NEWS
143-153 University Avenue - Toronto

The SLY Sand Blast Machine



THE NO-WEAR NOZZLE (AN EXCLUSIVE SLY FEATURE)

The No-Wear Nozzle (an exclusive Sly feature), holds the air consumption down to a minimum and keeps the supply constant at all times.

As there is practically no wear to this nozzle, its life is prolonged indefinitely—there is no constant expense for new nozzles; nor the annoyance of replacing them.

The ideal mill for heavy, continuous service.

3 H.P. will run the "Sly" nicely and turn out a bunch of work—good work. The mill is thoroughly balanced, with adjusting rollers to compensate for any wear.

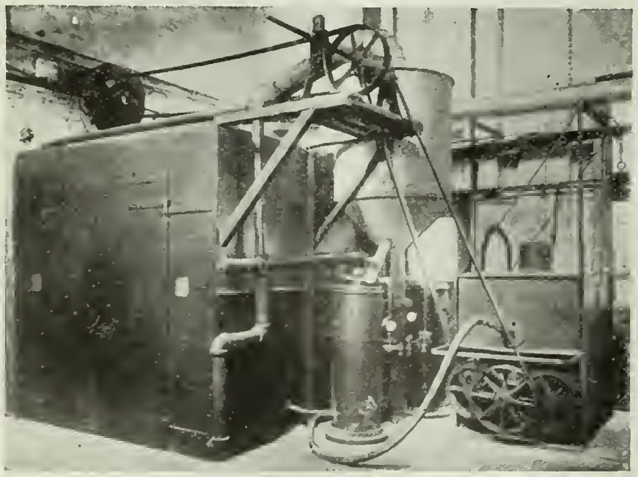
Let us tell you all about this machine; getting full particulars is the first step to "Sly and Satisfaction."

WE MANUFACTURE

CLEANING MILLS
MINDER MILLS
DUST ARRESTERS
ROSIN MILLS
SAND BLAST MILLS
CUPOLAS
SAND BLAST MACHINES
SAND BLAST ROTARY TABLES
SAND BLAST ROOMS
LADLES
CORE OVENS
CRANES

We are properly prepared with a consulting engineer, and an efficient engineering department, to make plans and specifications, not only for complete foundry equipment, but also for the building itself from the foundation up. Our years of building construction experience assures you one of the most modern well equipped foundries in the country and a saving of considerable time and money.

The W. W. Sly Manufacturing Company
CLEVELAND, OHIO
Complete Sand Blast Rooms and Equipment a Specialty



SAND BLAST EQUIPMENT
FOR EVERY PURPOSE

Get our estimates before buying and save 33 1-3% of operation costs.

We make special machines for special work.

We handle sand blast hose, nozzles, gloves, helmets, respirators and goggles.

Buy Tilghman's machines and increase your output.

TILGHMAN-BROOKSBANK SAND BLAST CO.
1126 South 11th St., Philadelphia, Pa.
Chicago Office: 1511-12 Lytton Building.
Canadian Office: McLean & Barker, 301 Unity Bldg., Montreal
"Thirty years ahead of them all."

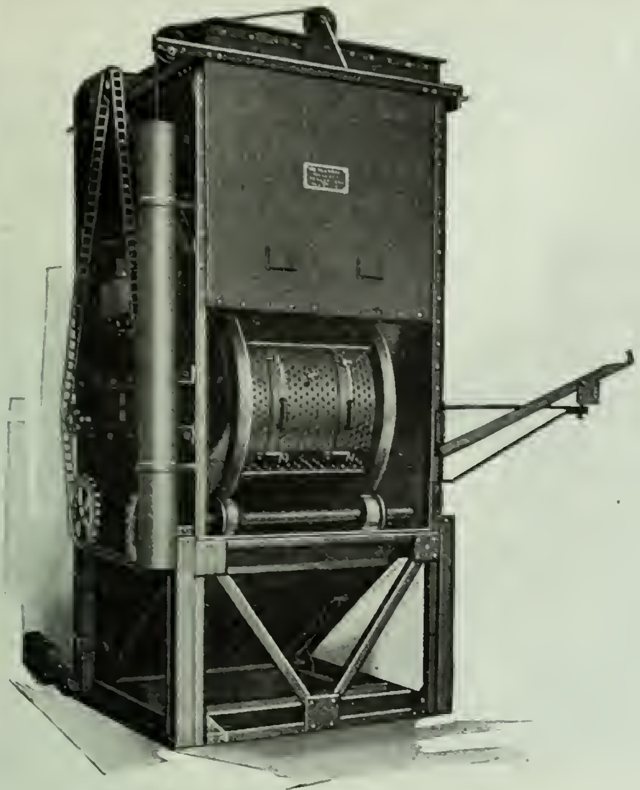
USE KAOLIN

For lining and patching the Cupola or Open-Hearth Furnace, Lining Ladles, Clay Wash, etc.

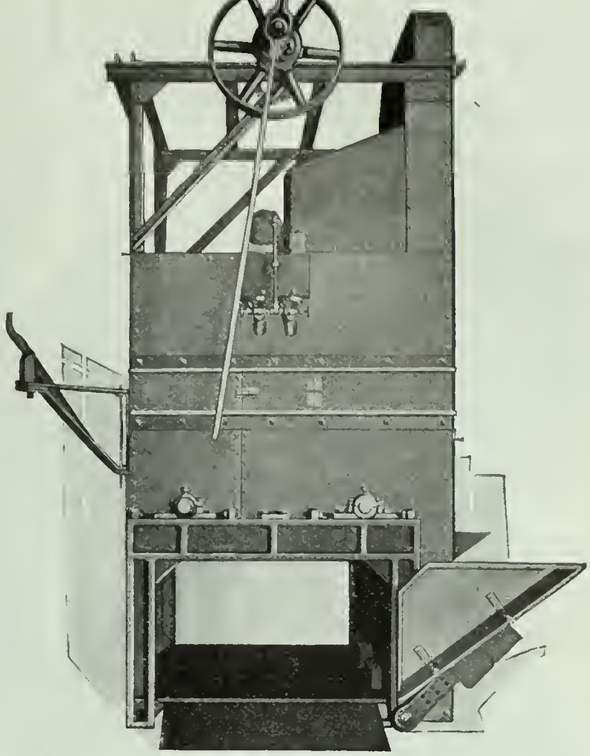
It will save your fire brick and the time of your men.

Whitehead Bros. Co.

Providence
New York
Buffalo



Front View With Sliding Door Raised

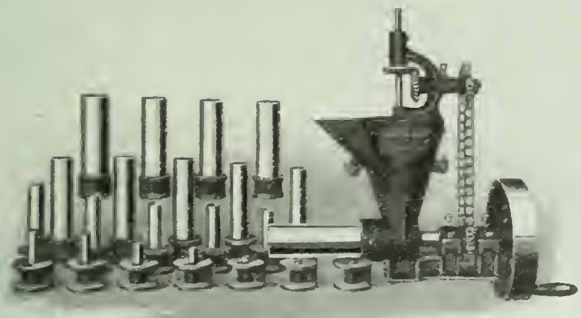


Side View. Truck is Run Underneath Barrel

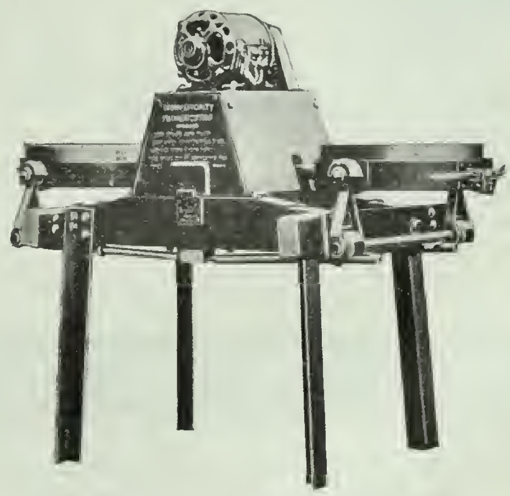
No. 3 Revolving Barrel Sandblast Machine

showing front and side views. Truck is run directly underneath the barrel and load is automatically dumped when the barrel revolves.

We will gladly refer you to malleable steel and iron manufacturers who are operating one or more of these barrels. Many of them have competing makes and can give comparative results. Learn from the operators what results they are getting.



Style A Hammer Core Machine
Other styles to make up to 7" round cores



Electric Duplex Shaker
The fastest, most substantial shaker built

Send for Catalogues

Brown Specialty Machinery Company

2424 West 22nd Street, Chicago

Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
CRUCIBLES
Our Specialty.

Catalogue on request

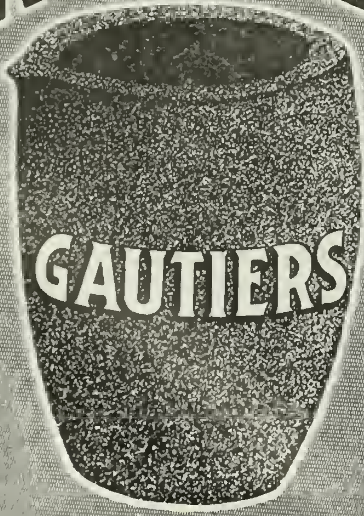
A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

THE STANDARD IN

CRUCIBLES



Manufactured For Over 50 Years

J. H. Gautier & Co.

JERSEY CITY, N.J. U.S.A.

Our Inspection and Laboratory Service Stamps Out Profit Leaks

Thousands of dollars are saved every year by our clients—because we have Experts who are trained to make exhaustive tests of all material they are purchasing, whether raw material or finished products, and tell them whether they are getting what they are supposed to get—because our Experts go right to the plant and make inspection of methods, mixtures and equipment, etc., and point out where practical economies can be effected.

No doubt you have some problems right now that would pay you to have us look into.

Chemical Laboratory

Analyses of Metals, Alloys, Ores, Cement, Materials, Oils, Paints, Coal, Coke, Water, etc.

Physical Laboratory

Tensile, transverse and compression tests of Iron, Steel, Copper, Brass, Stone, Brick, Wood, etc.

THE PIONEER INSPECTION COMPANY OF CANADA

CANADIAN INSPECTION AND TESTING LABORATORIES, LIMITED

Head Office and Main Laboratories—MONTREAL

Branch Offices and Laboratories:
TORONTO, WINNIPEG, EDMONTON, VANCOUVER, NEW GLASGOW.

? Are You Melting Sand

"WABANA"

Machine Cast Pig Iron

Cast in specially shaped moulds to permit of easy Handling, Piling and Breaking.

Chill Cast—*"SANDLESS"*—Pig Iron melts quicker or with lower fuel consumption than Sand Cast Iron. Machine Cast Iron is shipped 2240 pounds to the ton and it is *ALL METAL*—no sand.

We grade this iron according to the Silicon, as follows:

No. 1 Soft	Silicon	3.25% and over
1	"	2.50 to 3.24
2	"	2.00 to 2.49
3	"	1.75 to 1.99
4	"	1.30 to 1.74

An iron therefore for every Foundry purpose. Enquiries solicited. May we have the pleasure of quoting on your next requirements?

Dominion Iron & Steel Co., Limited

Head Office and Works, Sydney, N.S.

SALES OFFICES:

Sydney, N.S.; 112 St. James St., Montreal; 18 Wellington St. East, Toronto

Review of the Past Year's Iron, Steel and Metal Markets

Staff Article

A year ago we stated that prosperity was rampant so far as the production of iron and steel was concerned, and only in slightly lesser degree was the like condition true with regard to the more prominent metals. The year now closing has added materially to the prosperity of its predecessor, a circumstance due almost entirely to the insistent and ever-developing demand for munitions by Great Britain and her Allies. The charts, together with the accompanying data amply evidence the altogether abnormal situation above indicated.

IRON AND STEEL

THE unusual activity which prevailed in the iron and steel trade in Canada at the close of 1915 has been continued during the year just closing only to a far greater degree. There never has been in the history of the trade such a year of unexampled prosperity as during 1916. All records have been broken both as regards prices and tonnage output, and the coming year bids fair to eclipse the 1916 record in every way, as far as can be judged at the present time. The situation is due almost entirely to the enormous demand for shells, although there has been considerable export business done in wire rods and wire products. The output of the steel companies has to a large extent been at the disposal of the Imperial Munitions Board, and for this reason a comparatively small tonnage has been available for purposes other than munitions. The development of export business in steel products which was widely discussed during 1915 has been held up indefinitely for reasons above stated, and it is doubtful if the question will be reopened until the present urgent demand for shells has been satisfied.

Increased Output Provision

One particularly satisfactory feature has been the ability of the steel companies to largely increase their output in view of the famine in steel which threatened towards the end of last year. Although there is now a decided shortage of steel, it cannot be said to approach a famine in the general acceptance of the word. If, however, a famine had developed, the results might easily have been serious in view of the enormous tonnage required for munitions. Considerable credit is therefore due to the steel companies and the Munitions Board for the way in which they have handled the situation. The shortage of steel is of course general, but fortunately is not affecting the production of munitions as this industry has the first call on the output of the mills. In other respects however, the shortage is serious and the increase in values of practically all iron and steel products, semi-finished and finished, has been the natural result. One effect of this shortage has been the partial and in some cases complete suspension of building operations while many industrial plants using iron or steel in the manufacture of their products have been badly handicapped and their output restricted in volume. Very little relief has been obtainable from the United States, as the mills there are as badly congested as our own plants. Canadian dealers having contracts with American mills were for a time in a better position, although the advantage which they enjoyed in the early days of the boom has now practically disappeared. The shortage from U.S. sources has been felt to a greater degree perhaps than that from Canadian mills, particularly as regards structural shapes and ship material.

Plates

The marked decline in building, and consequently less demand for structural shapes relieved the situation to some extent. During the year however, there was an important revival in the shipbuilding industry affecting every ship-building yard in Canada; a rush for ship plates accordingly resulted. Prices of plates had already reached a high level and deliveries were so backward that shipbuilders have only been able to obtain material by paying premium prices. It was only by reason of the urgent demand for tonnage that shipowners were able to pay the increase in cost of construction. The present cost of plates and the great difficulty in obtaining them is tending to restrict for a time, further development in the shipbuilding industry. Plates have made a gain of 2¼c per pound during the year.

Rails

During the year a scarcity of steel rails developed. The railways, during the year and also in 1915, had purchased comparatively small tonnages of rails owing to the policy adopted of keeping down expenses to a minimum. Only one concern, the Algoma Steel Co., kept their rail mill in operation. The Dominion Steel Corporation who also roll rails used their entire output of steel for other purposes. The C.P.R. has already shipped a quantity of old rails from sidings, etc. to France for military railways, while arrangements are now being made for further large tonnages of similar material to be sent overseas. Little relief was obtainable from the States owing to the oversold condition of the mills there and very backward deliveries. The situation continues to become more acute with no sign of relief in sight. During the summer the price of rails advanced $5 per ton from $28 to $33, the first price change in 12 years. Later they were advanced to $38 per ton f.o.b. mill, which is now the ruling price. The advance created some sensation in the market but was inevitable under the circumstances.

Pipe and Tubes

Prices of tubular goods have advanced rapidly during the year and like all other steel products have attained record levels. With regard to boiler tubes, conditions in the U.S. market have affected the situation here rather than any influence in the Canadian Market. The demand for merchant and boiler tubes in the States has been so heavy that the mills are sold up for practically twelve months and prices consequently are high. The situation in wrought pipe differs little from that in tubes although the increase in cost of raw material is the principal reason for the prevailing high prices. Boiler tubes are now 100 per cent. higher on an average than at the beginning of this year.

Sheets

The market for black and galvanized sheets has been very firm throughout the year and prices have been steadily advancing. In black sheets Canada is now entirely dependent upon the United States for supplies, and conditions there consequently affect the situation in this market. The demand in the primary market, during the year has been good, and sheet mills have for the most part been behind on deliveries. A shortage of sheet bars has on more than one occasion tended to restrict production which has usually been accompanied by an advance in prices. Towards the end of the year the situation became more acute, sheet bars became scarce and higher, while shortage of fuel and labour also hampered operations at the mills. Prices of galvanized sheets have, of course, been materially affected by the high cost of black sheets, while the consistent high price of spelter has also helped to keep prices up. The high cost of materials, principally spelter, has had the effect of considerably curtailing production of galvanized sheets, and the demand also fell off during the year. Some makers reduced their output by 50 per cent. and others even more. Owing to the war, the importations of British made sheets have been light and quotations have been largely nominal. The trade has been and still is in an unsatisfactory condition owing to the high cost and scarcity of all raw materials and the uncertainty of the spelter market. Black sheets have made a gain during the year of approximately $1.50 per 100 lbs. while galvanized sheets are about $1.25 per 100 lbs. higher than at the beginning of the year.

Bars

Prices of iron and steel bars have advanced steadily during the year from 2.75c to 3.75c per lb., a clear gain of 1c. Several times during the year makers have withdrawn prices on bars, this being always followed by an advance. Deliveries on steel bars have been getting more backward all the time with the result that iron bars are now being offered instead of steel owing to the quicker delivery on the former. Prices are to some extent nominal as quotations given are for delivery at mill convenience which may be anywhere from nine to twelve months. Bars 2 in. and larger quoted at 5.25c base, have also made a substantial advance since the beginning of the year. The bar production is notable this year in that it has been confined almost entirely to meeting the demand for shrapnel bars.

Billets

The biggest gain in prices during the year has been made in semi-finished steel, such as billets, sheet bars and wire rods, the shortage of these having been more apparent than in any other steel products. On more than one occasion the situation was acute, but nothing developed of a more serious nature than a jump in prices. Bessemer and open-hearth billets and open hearth sheet bars started the year at $32 a ton, they are now quoted at $55 a ton. Forging billets which were $55, are now $80 a ton, while wire rods have advanced from $40 to $70 a ton, all Pittsburg prices. The Canadian mills making billets are absorbing their entire production for shell and other purposes.

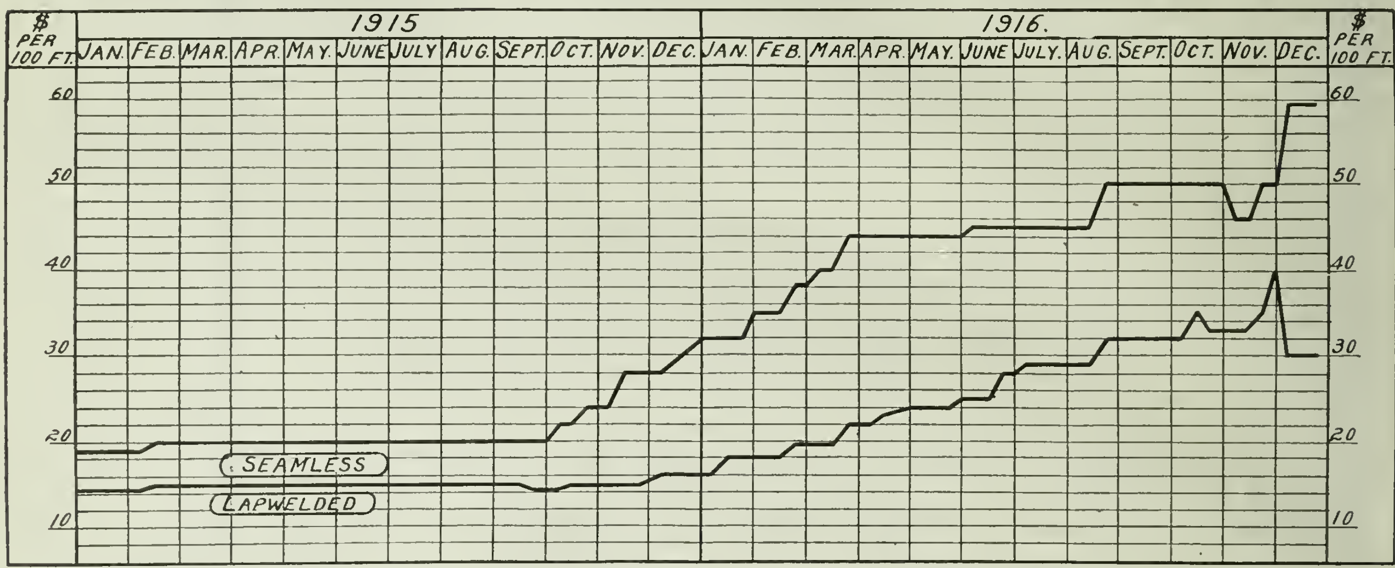
Pig Iron

During the latter part of the year, the activity in the pig iron market has been the outstanding feature. It is somewhat remarkable that, although steel has been steadily rising all the the year, it was not until September that pig iron began to move. For nine months, pig iron relatively with steel was getting further behind, notwithstanding the big demand for steel-making pig irons. At the close of the year, pig iron is not so very far below steel and is getting more into line with steel prices. The pig iron market in Canadian is rather restricted as all the big steel companies make their own pig, and in normal times have more than enough for their own purposes. There was therefore in ordinary times considerable tonnage available for grey iron foundries and prices consequently were reasonable. As the demand for steel increased, foundry iron gradually became scarcer and eventually up went prices. The most important independent furnace formerly producing foundry iron exclusively, is now turning out basic iron for steel making which has intensified the shortage of foundry grades. There has only been a comparatively light demand for foundry pig, otherwise the situation would have been very acute in the foundry business.

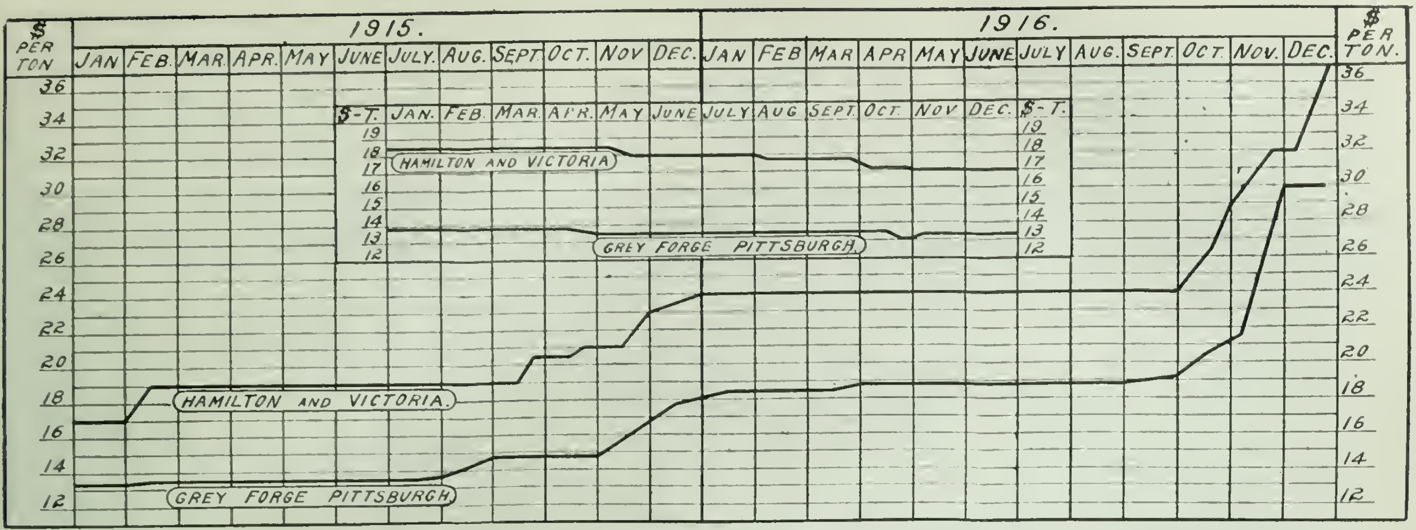
The upward movement in prices started in September at which time the two principal domestic irons were quoted around $24 a ton, this price having been current since the beginning of the year. When the movement got under way, the market seemed to go wild and prices advanced rapidly, the $32 mark being reached early in December. Shortly afterwards all quotations were withdrawn but based on U.S. prices $38 is about the market value at the close of the year. It will thus be seen that prices of pig iron have advanced more rapidly than at any time in the history of the trade, all previous records have been broken. The movement in Canada of course followed the activity which originated in the United States where prices advanced in a most extraordinary manner, being now approximately $12 higher than early in September. Stocks of pig iron at the furnaces were soon depleted and orders now on hand will take several months to fill. To make matters worse, transportation difficulties have hindered the movement of coke to the furnaces, and the winter weather will aggravate the situation. Only recently it was feared that the Hamilton, Ont, furnace would have to shut down owing to the shortage of coke. Although the coke production has increased, it is barely keeping up with the demand, while, in addition, there is a shortage of cars making the situation a difficult one to handle. There is ever present a possibility of a short supply for the furnaces.

Production Increases

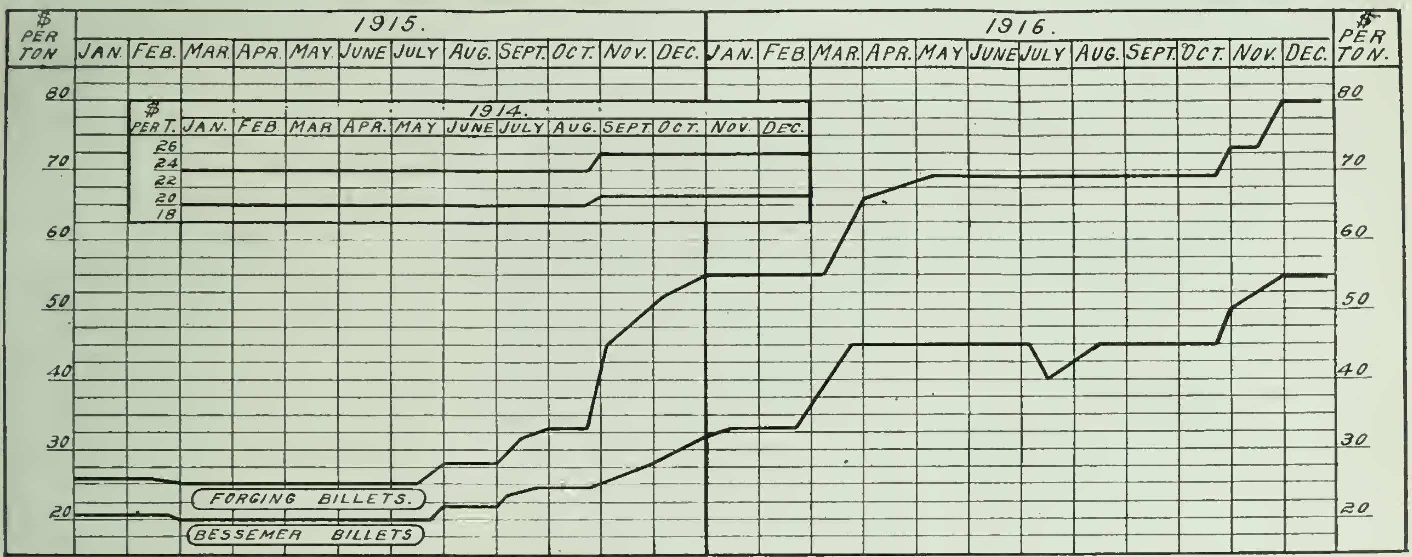
During the year the steel companies have made important extensions, and the physical condition of the plants has been greatly improved. New open-



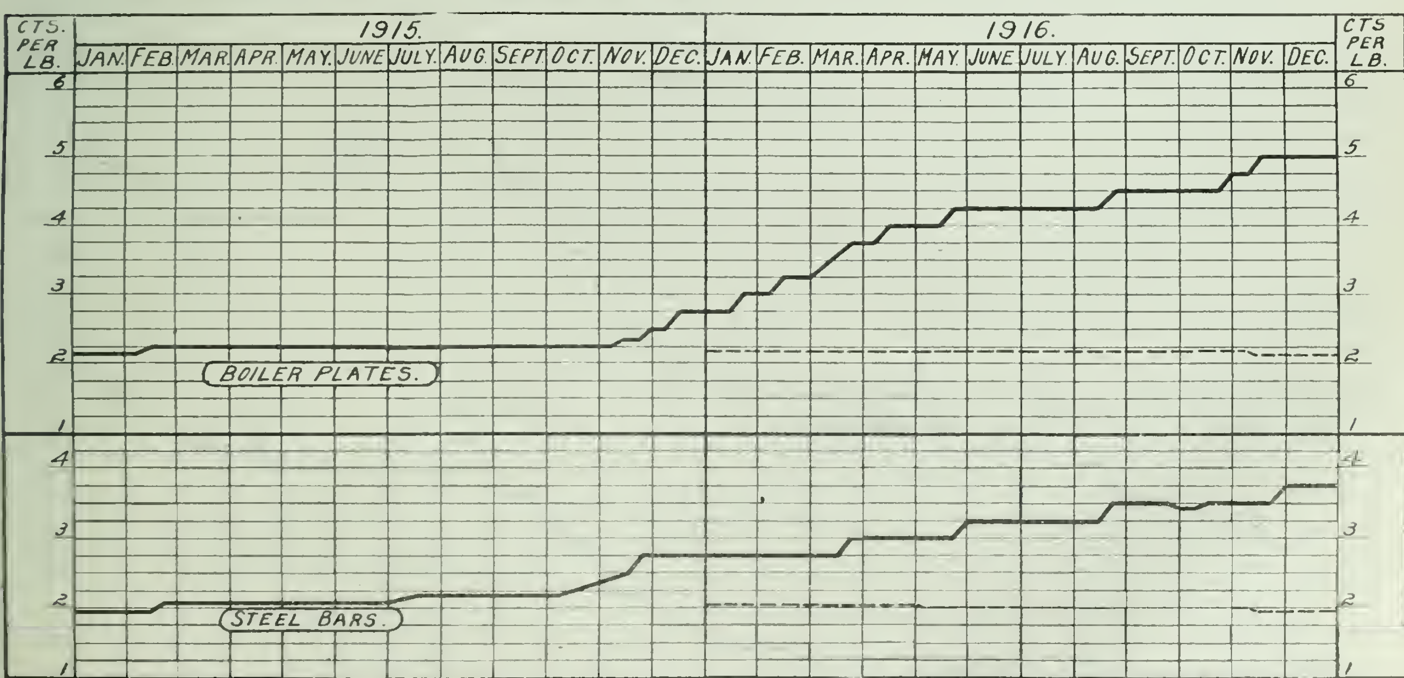
PRICE FLUCTUATIONS PER 100 FT. OF 3½ INS. SEAMLESS AND LAPWELDED BOILER TUBES, DURING 1915 AND 1916.



PRICE FLUCTUATIONS OF PIG IRON DURING 1914 (INSET), 1915 AND 1916.



PRICE FLUCTUATIONS OF FORGING, AND BESSEMER BILLETS, DURING 1914, 1915 AND 1916.

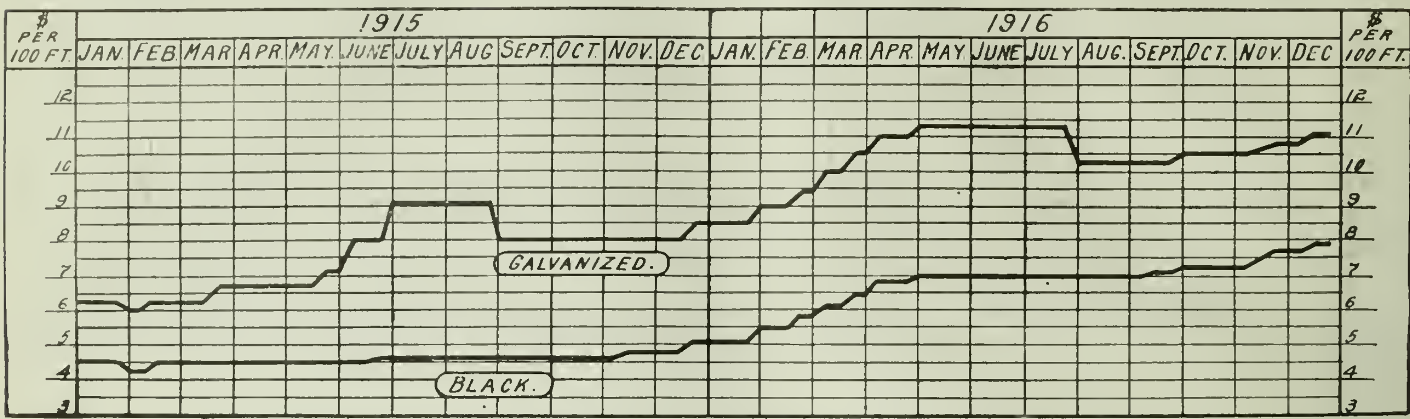


PRICE FLUCTUATIONS OF BOILER PLATE (¼" TO ½") AND STEEL BARS DURING 1914, 1915 AND 1916.

hearth furnaces have been constructed and rolling mills extended. The capacity output at our steel concerns is now greater than it ever has been, and the profits which have undoubtedly been made, have placed the companies in a sound condition, financially, and have put the steel industry figuratively speaking on its feet. The effect of this will be felt more in normal times when the demand is lighter and competition keener. It is to be hoped that when the present rush is over some effort will be made to establish a plant or plants for rolling structural shapes and plates for which there will be an increasing demand in Canada. This country has so far been entirely dependent upon the States for plates and for all shapes, except small angles, etc. Now seems the time to give the matter some consideration so that the work can be proceeded with when the opportunity arrives. During the year some progress has been made on the new steel plant at Ojibway, Ont., which when completed will make an important addition to the steel producing facilities in Canada.

Future Uncertain

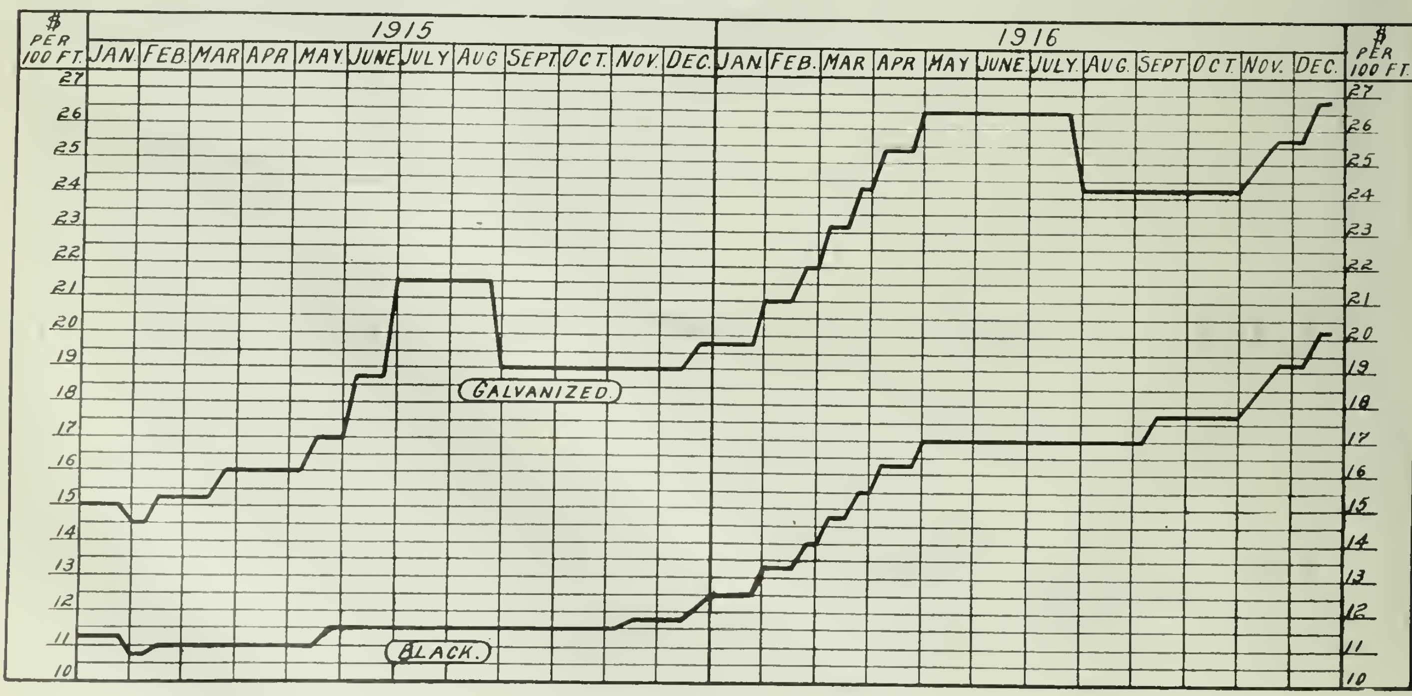
How long the prevailing prosperity in the steel industry will last is a debatable question. Until quite recently, twelve months was a fairly easy guess, but Germany's peace proposals, although promptly rejected, have served to remind people that it is almost entirely due to the great war that the industry is booming. It is true that the mills have all the business they can take care of for almost a year, but if by any good stroke of fortune, cessation of hostilities came within the next twelve months, then a part of that business would almost certainly be cancelled. Of course the tonnage might be taken out in some other form than shell steel, but conditions arising after peace has been declared will be discounted before this actually happens. It is just here that prices are liable to be affected before the activity at the mills slows down. Prices have reached a dangerous level and a sharp slump is not desirable. A note of warning is thus not out of place. That prices will go still higher is quite possible particularly on certain steel products where there is a decided shortage, but it is likely that the market has received a wholesome check in the meantime, and further developments in Europe will decide the swing of the pendulum.



PRICE FLUCTUATIONS OF ONE-INCH WROUGHT IRON BUTT-WELDED PIPE, DURING 1915 AND 1916.

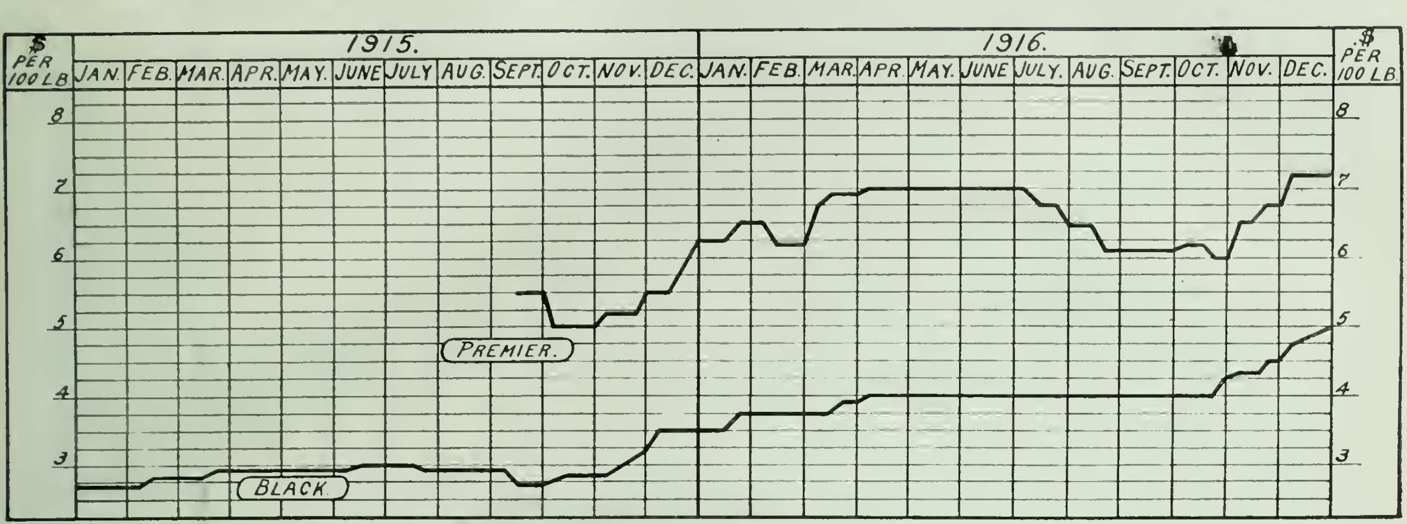
METALS

THE metal markets have experienced another twelve months of war influence, but, generally speaking, they have not been quite so erratic as last year. The principal feature this year has been the big increase in volume of business, particularly in copper, which has reached enormous tonnages. The production of, so-called, war metals has increased greatly, and has assumed large proportions. New mines have been opened up and old mines reopened, while new refineries have been established to take care of the big increase in mines output.



PRICE FLUCTUATIONS OF 2 IN. LAP-WELDED WROUGHT IRON PIPE DURING 1915 AND 1916.

Although the largest percentage of the production of war metals still comes from the United States, this country has been the scene of remarkable activity, and the metal mining industry has developed in a corresponding degree. The production of copper has easily beaten all former records, the industry enjoying unparalleled prosperity. The output of lead and spelter in the United States is also much larger than in normal years owing to supplies from Europe having been cut off. For the same reason aluminum has reached record levels, large quantities having been exported to Europe instead of imported from there, as was the case before the war. Tin not being a war metal, has occupied rather a different position, and is the least likely of any metal to decline in value at the conclusion of the war. Antimony is a war metal, although not a very important one. At one time prices were very high, but this year there has been a sharp decline in value.



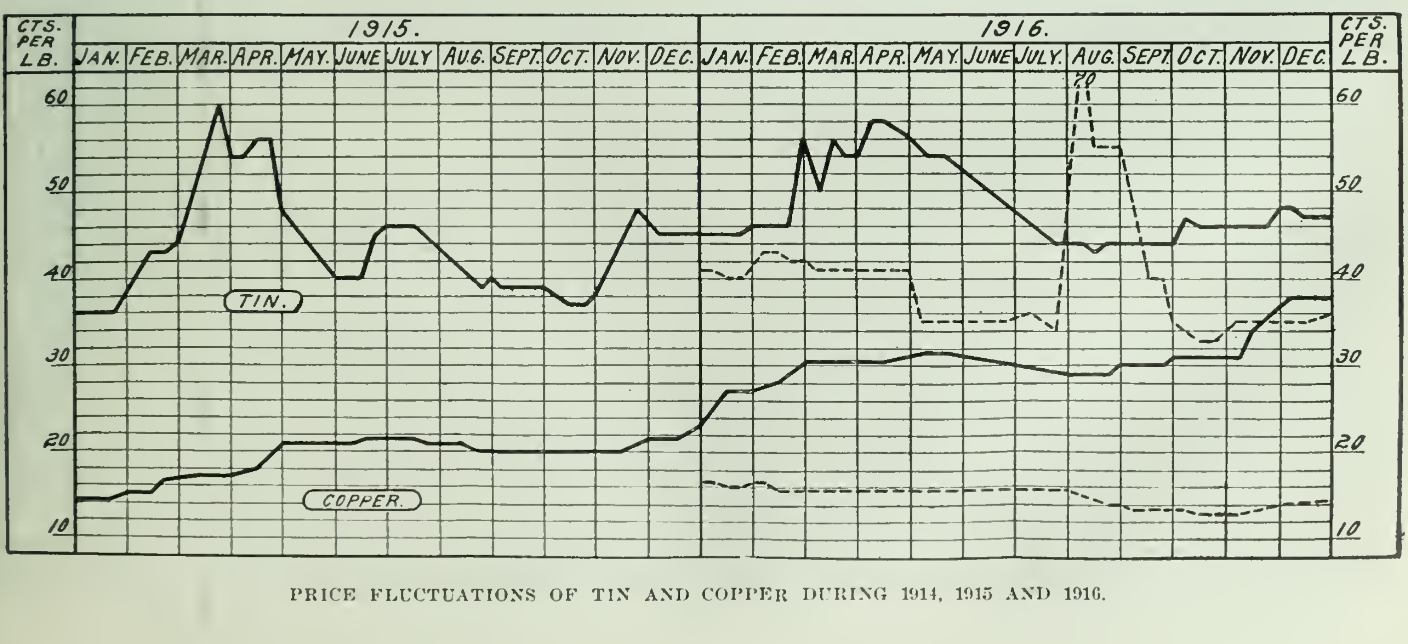
PRICE FLUCTUATIONS PER 100 POUNDS OF GALVANIZED (PREMIER) AND BLACK SHEETS (28 GAUGE), DURING 1915 AND 1916.

Considerable progress has been made in Canada in the metal industry. Copper and zinc refineries have been established at Trail, B.C., and the output, although not very important at the present time, is steadily increasing. The war has stimulated this industry, and in time no doubt all copper and zinc mined in Canada will be refined within her borders. At Port Colborne, Ont., the International Nickel Co. is building a refinery for treating nickel matte from the Sudbury district. There is also another concern who propose to establish a plant for refining nickel in Canada.

After War Situation

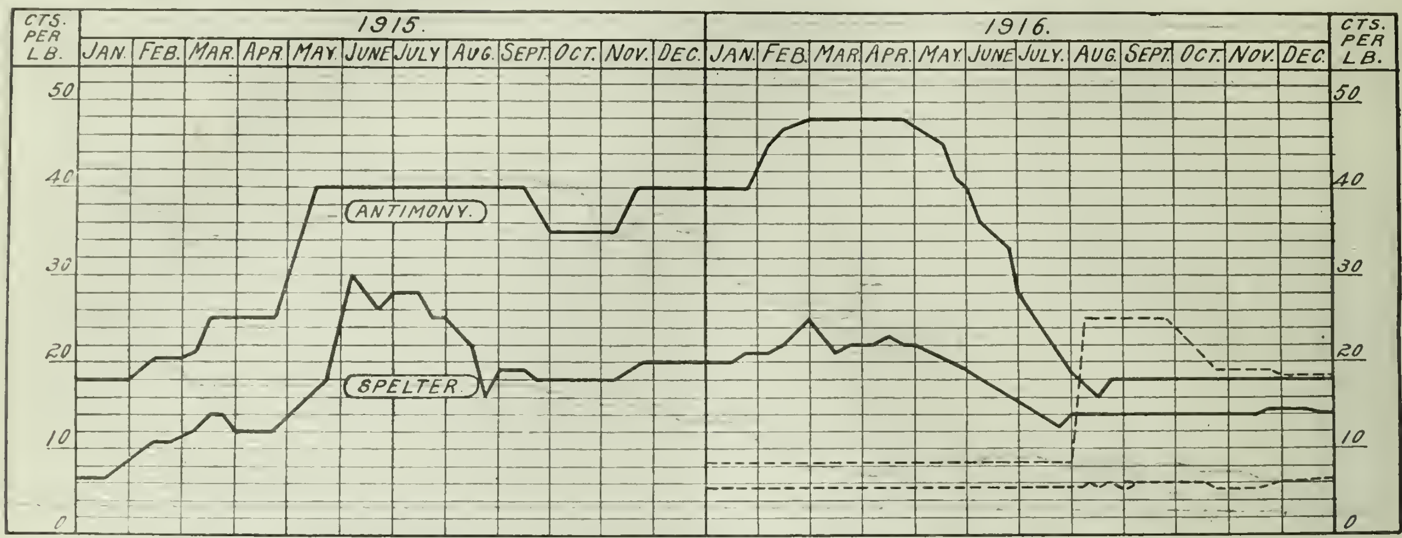
Although the German peace overtures have been rejected, there is still a possibility that before the end of 1917 peace will have been concluded or negotiations to that end finally begun. Although this may be an optimistic view, there is little doubt that during the coming year the possibilities of peace will be felt in the market, which will have a tendency towards lower prices. The situation will likely be unsettled for some time previous to the actual cessation of hostilities and the market discounted before the war ends. Whether prices decline gradually or rapidly depends upon developments in Europe.

That prices will decline after the war is a fair supposition, although to what extent it is difficult to say. The probability is that the price situation will have been adjusted to a great extent by the time peace is concluded. As far as can be seen the only metal that is likely to appreciate in value is tin, being essentially a peace metal. Copper will no doubt decline, but not to the same extent as other metals. The war demand will be replaced by a peace demand, which will doubtless be considerable, although a large quantity of metal used in munitions will have been recovered from the battlefields and utilized for other purposes. There will, however, always be a



PRICE FLUCTUATIONS OF TIN AND COPPER DURING 1914, 1915 AND 1916.

plentiful supply of copper, which will tend to depress the market. When the German and Belgian supplies of spelter become available and the Australian supply gets on the market, production in the United States will fall off considerably, and prices as a result decline. Lead will probably not suffer a serious decline, as it has not been affected by the war to the same extent as some other metals. There will be a marked depreciation in antimony, as the demand will be small after the war. That aluminum will decline to its former position is likely, as the war demand will have stopped.



PRICE FLUCTUATIONS OF ANTIMONY AND SPELTER DURING 1914, 1915 ND 1916.

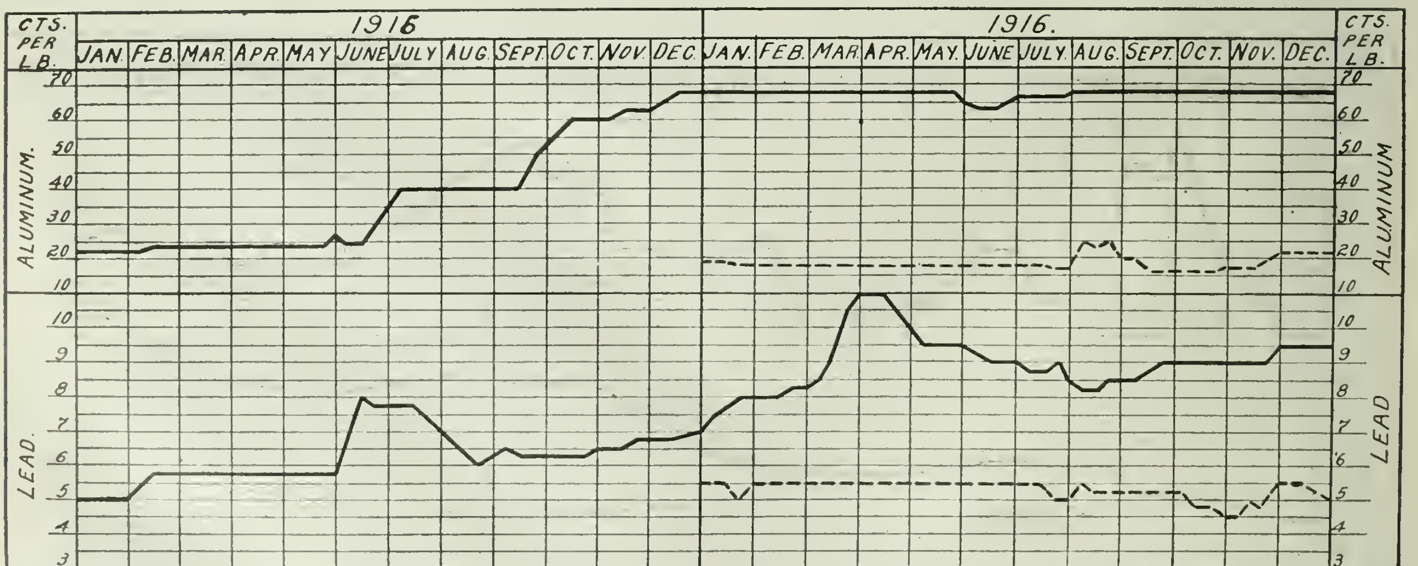
Copper

Chief interest this year has centered in copper, this being the most important of all war ingot metals. As the war increased in intensity, with a prodigious expenditure of shells, the demand for copper became more insistent, culminating in contracts being placed in the United States for enormous tonnages by the Allied Governments. This was additional to other large contracts placed earlier in the year. At the same time, large quantities of copper were required by the brass mills. The result was that by the end of the year the entire output of the United States' producers was taken up, and now there is no copper to be had for at least the first five months of 1917. With the market in such an oversold condition, the price naturally jumped up. It is estimated that the producing capacity of the States will soon be over one million tons per annum, which gives an idea of the enormous consumption of copper at the present time. The position of copper is now, of course, very strong, and is likely to be for some months to come. Opinions, however, differ as to what will happen to the market at the conclusion of the war, but it is probable that while prices will decline in sympathy with other metals, there will still be a big demand during the period of reconstruction, which will materially help to support the market.

During the year the market has been firm, with a steady rise in prices, and not much fluctuation. At the beginning of the year copper was about 23c, reaching to 27c by the middle of January. There was a gradual rise through February to 30½c, which was continued until the middle of May, when a new high price of 32c was registered. About this time the market weakened, and there was a steady decline to 29c in August. The market recovered and prices began to advance gradually through September and October up to the middle of November, when the market became very active and worked up to 38c by the end of that month. That price was maintained throughout December with a strong market. On an average the market was higher this year than in 1915.

Tin

Tin being a peace metal, has been adversely affected by the war, the con-



PRICE FLUCTUATIONS OF ALUMINUM AND LEAD DURING 1914, 1915 AND 1916.

sumption having fallen off, and prices being low when compared with other metals. The fluctuations that have taken place have been caused by the activities of submarines in destroying shipping. Tin being obtained from the Far East, ships carrying this metal are more likely to be interfered with than in the Atlantic, and on more than one occasion the fear of cargoes being lost has caused a sharp advance in price. This has been more in evidence on the New York market, as tin can only be imported into the United States on a permit obtained in London, and these permits have been generally difficult to obtain. Dealers have endeavored to carry large stocks of tin, but the increased consumption has sometimes depleted supplies of spot metal. It is generally believed that at the conclusion of the war there will be a considerable increase in the demand for tin and prices will advance. During the war there will not likely be much change in the situation. The position of this metal, however, is a strong one, as it is indispensable for many lines of manufacture and price has little effect on demand.

The market has been steady throughout the year except in the spring, when during April the highest point of the year was reached. It started at 45c and by the end of February jumped to 56c. Early in March the market declined to 50c, but soon recovered, and by the end of that month was 56c. Prices continued advancing until the highest level of 58c was reached about the second week in April. These advances were due to scares over submarine activities. The market soon began to react, and by the end of July the price had dropped to 44c, which was maintained until the end of September. Early in October the market became firmer, and the price advanced to 48c, which was held until the middle of December, when the market weakened slightly, and lost one point, finishing the year at 47c. Compared with 1915, prices have had a higher average, although the highest point of that year, 60c, was not reached, nor the lowest of 30c.

Spelter

This metal has been affected by the war, principally by reason of the fact that supplies from two big producing countries, Germany and Belgium, have been cut off. The pre-war situation has been considerably changed. When war started, America was called upon to supply the spelter requirements of the Allies and the demand was so great that the producers had to immediately increase their output. Eventually the production increased to such an extent that it became equal to the demand, and the situation became adjusted to meet the new conditions. The present output of spelter in the States is about 650,000 tons a year. As spelter is used in making brass, this accounts for the big export business and domestic consumption. The big business has been done with the brass mills in high-grade spelter, the galvanizers having been operating at reduced capacity all the year owing to the high cost of all raw materials. The outlook is not very favorable for the spelter industry in the States after the war, as this metal will probably be affected more than any other. The British Government has agreed to take over the entire spelter production of Australia. During each year of the war, the Government will take 45,000 tons of spelter and 100,000 tons of concentrates, also for ten years after the war. There will be a big decrease in the production of spelter in the United States and prices will decline. Belgian and German supplies will be available and the situation the same as before the war.

During the year spelter has lost ground, opening at 20c and closing at 14c, with a highest point of 24½c in February. A slight rise in January to 21c was continued through February, reaching 24½c, after which the market weakened and the price dropped back during March to 21c, recovering to 22c. Prices fluctuated during April, and at the end of the month began to fall, touching 12½c, the lowest point of the year, at the end of July. Another recovery brought the price up to 14c, which was maintained during August, September and October, gaining slightly in November, but finishing weaker at 13½c. The market was steadier than in 1915, and did not touch either the highest or lowest levels of that year.

Lead

Lead, although a war metal, has not been affected in the same degree as spelter or copper. The position of this metal has, however, for the most part, been a strong one, and the demand has absorbed the supply. The market this year has been generally stronger than during 1915, and prices higher. There has been a heavy war demand, and also an increase in ordinary consumption. In the States there has been a steady increase in production in order to take care of the larger demand, both export and domestic. There will be a depreciation in the price of lead after the war, but the market will no doubt decline gradually.

Prices show a net gain for the year. The market started at 7c, the lowest point of the year, and advanced steadily to 12c in April. During this month the market weakened and prices declined until 8¼c was touched in the middle of August. The market then recovered, and the price advanced to 9c up to the end of November, when another advance brought the price up to 9½c, which was maintained during December.

Antimony

As antimony is used in making shrapnel bullets, it has become a fairly important metal during war time. English antimony has been off the market, but supplies have been coming from China and Japan. The production of antimony in the Far East has been more than doubled, and there will be a large excess of supplies after the war. Comparatively little antimony is used in peace times, so prices will likely be considerably lower after the war than at present.

Antimony started the year at 40c and finished at 18c. A sharp advance at the end of January brought the price up to 48c by the end of February. This level was maintained during March and part of April, when a decline set in, and the market fell off badly, touching the lowest point of the year, 16c during August. The market then rallied to 18c, and has been steady since, that price having been maintained. The fall in 1916 was more pronounced than the rise in 1916.

Aluminum

This metal has been more or less scarce all through the year owing to the big demand and restricted production. This trade, as in the case of spelter, has been reversed, the United States having been called upon to export large supplies, which has had the effect of boosting prices. After the war prices will drop when trade is readjusted. Aluminum is becoming a more important metal for commercial purposes, a circumstance that will necessarily increase consumption. The market throughout the year has been high and steady, the price ranging around 68c, with a slight decline in June to 64c.

BURLINGTON STEEL CO. YEAR

DURING the past year the rolling mills of Burlington Steel Co. plant at Hamilton, Ont., have been operating 24 hours a day, the capacity at present being 40,000 tons of steel bars per annum. The output consists of all types of bars for reinforcing concrete, angles and flats for the manufacture of agricultural implements, and various sections for almost every commercial and industrial requirement. The mills are electrically operated, calling for between 2,000 and 3,000 horse-power. The mill installation consists of a 7-stand, 12-inch unit, and a combination 8-inch unit for small material.

In addition to the production of steel bars, the manufacture of 4.5-in. high explosive shells has been in progress during the year, an order for 25,000 having been already completed. Business during 1916 has expanded very considerably, a nice export connection having been formed with France and Australia, and further substantial orders from these countries are meantime being negotiated.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

MOULDING A LEAD SAUCER FOR EXPLOSIVES MANUFACTURE

By J. H. Eastham.

A DENSITY of 708 pounds per cubic foot, and specific gravity of 11.35, regarding water as unity, together with its searching

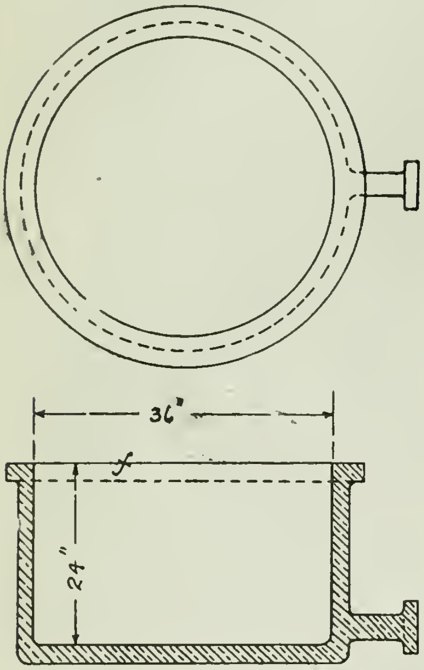


FIG. 1. PLAN AND SECTIONAL VIEWS OF WORK.

qualities when poured at a reasonably high temperature, render lead the most uncertain of the non-ferrous metals; hence the use of loam or dry sand moulds in preference to green sand in most cases where castings of heavy section or considerable depth are

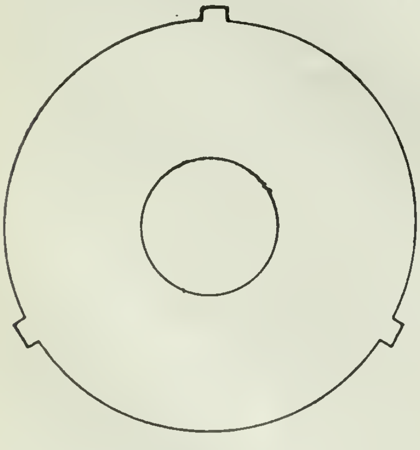


FIG. 2. FOUNDATION PLATE.

required, a case in point being the denitrating tower saucer shown in plan and section at Fig. 1, this piece, 36 in. dia. x 24 in. deep, x 2 in. section, weighing approximately 3,700 lbs.

Conditions of Production

A concern engaged in the manufacture of explosives, frequently requiring lead castings of this type, but of varying proportions, supplied blue print and pig metal to the foundry receiving the order, with a free hand as to methods of production, at a fixed price per piece on machined castings of good quality and appearance.

To insure good results these castings were for some time swept up in loam by established methods, at considerable cost for rigging, a foundation plate of diameter convenient to the specified area of casting ordered and approximately 3 in. thick, being first made, and set level; a 2 in. spindle inserted in the three-armed socket of usual type. The core foundation and sloping parting necessary to the formation of the lower extremity of the cheek portion of the mould were next swept up on a single course of bricks, the structure being then ready to receive the cheek lifting ring shown at Fig. 3.

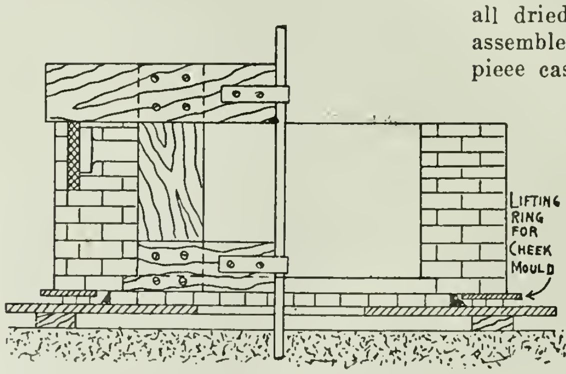


FIG. 4. CHEEK MOULD AND STRICKLE.

The sweep was then bolted to the spindle arms, and the outside face of the mould built up, after which the flanged branch pattern was bedded in at the correct height above the main flange, and drawn outwards, the outside face of the branch flange being covered by a cake core. The mould at this stage is shown in cross section in Fig. 4.

Sweeping the Core

The sweep board was next removed, and the cheek mould hoisted on the stove car. The core sweep was then bolted to the spindle and the core built on a light brick wall, with a circular perforated grating covering the inside cavity one brick depth from the full height, as indicated in Fig. 5.

The spiked plate illustrated in Fig. 6,

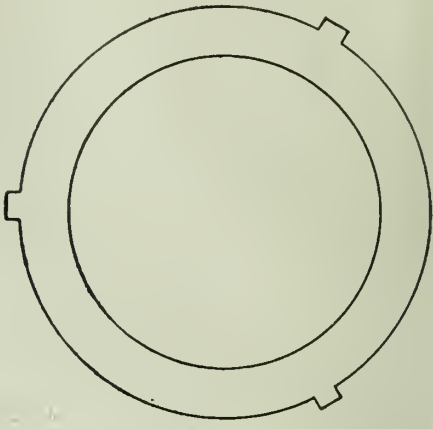


FIG. 3. CHECK MOULD LIFTING RING.

technically termed the crown or cope plate, with pouring gate and riser perforations, was now swept up, the rounded edge on the seat of the casting being taken care of by a slight increase in the length of the prods on the plate. The three mould sections were afterwards all dried on one carload, blackwashed, assembled as shown in Fig. 7, and the piece cast the following day, 4,500 lbs. of pig lead being melted in a small emergency cupola, and poured from an ordinary sand-lined geared ladle.

Cost Demands Change of Method

The method just described occupied a moulder and helper about 20 hours on ordinary sizes, exclusive of the time spent on plates and other equipment, and would have served indefinitely, had not competition rendered a heavy curtailment in cost of production imperative, the system of moulding afterwards employed being as follows:—

A pit approximately 48 in. diameter by 34 in. deep, was opened up in the foundry floor, the 2 in. spindle-centre bedded a few

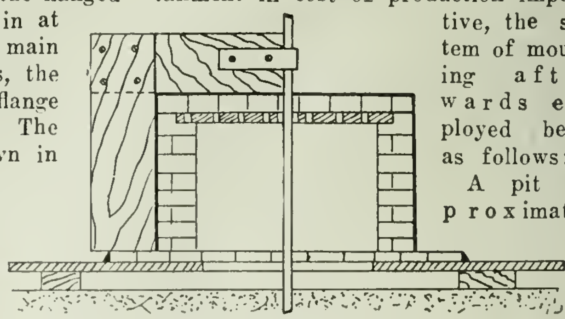


FIG. 5. CORE.

inches below the pit face and rammed hard to secure its rigidity, the spindle inserted, and the sweep A bolted to position as shown by Fig. 8. A runner core, B, was laid level so as

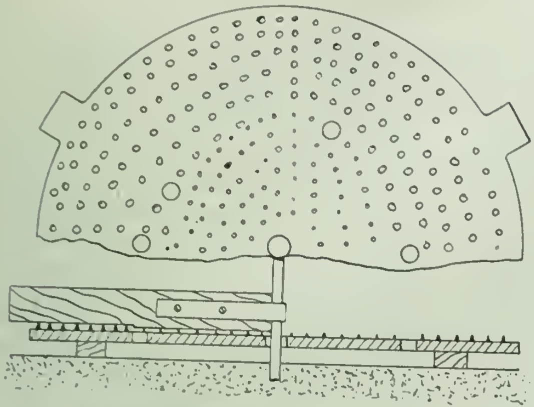


FIG. 6. COPE PLATE AND STRICKLE.

to feed the casting by the "bottom pour" system, the runner stick C being rammed up at the same time as the outside face of the mould. The flanged or

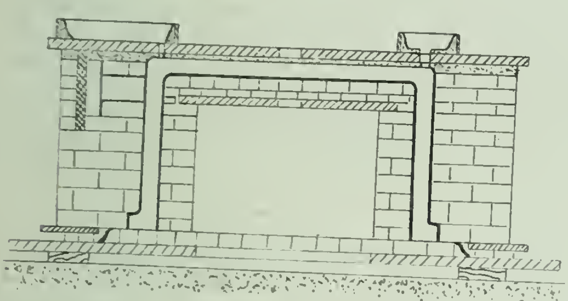


FIG. 7. LOAM MOULD ASSEMBLED.

open end of the saucer being cast upward in this instance, ⅜ in. extra thickness was allowed on the upper face to ensure clean machining as well as to overcome any unevenness on slight shrinkage which might occur on account of the piece being cast open sand.

A heavy, well bound facing sand was prepared, the mould being rubbed over with dry plumbago and afterwards washed with molasses before the application

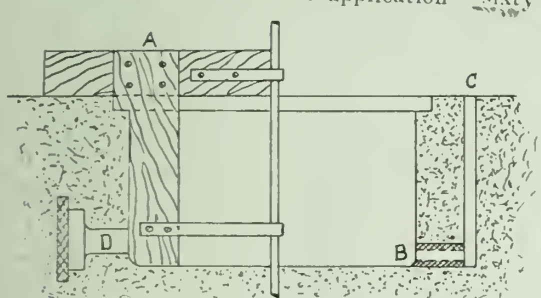


FIG. 8. DRAG MOULD IN SAND.

of the charcoal fire used as a skin drying medium.

A Suspended Core

The loam core shown in Fig. 9, built on a cast grid instead of the foundation used in the former method, was now lowered to position, lead spool chaplets 2 in. thick being used at six points on cast iron blocks bedded in as indicated in the cross section view of the finished mould at Fig. 10. The core was finally hooked up to rail sections laid across the mould, this precaution being necessary on account of the certainty of the lead chaplets being melted by the metal during the operation of pouring, with consequent danger of the core sinking. The rails referred to also acted as weight supports, all risk of the core moving being thereby eliminated.

Economies Effected

By this method the moulding time was reduced to ten hours, the time occupied in building the core being about four hours, a saving of six hours on each piece. The castings produced were free

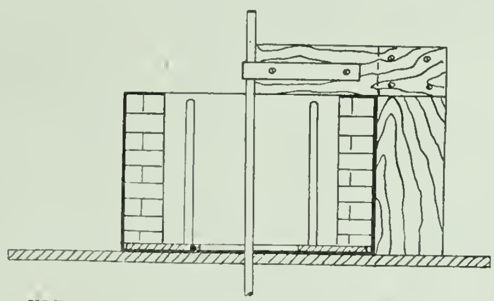


FIG. 9. LOAM CORE FOR SAND MOULD

from "strikes" or "fins" and of as good quality as those formerly turned out of the expensive loam mould, with its initial cost in rigging.

Cost of Living.—The cost of living is still going up. According to a Labor Department Bulletin of December 16, the average cost of 29 staple articles in sixty cities in November was $10.05, as compared with $9.30 in October, and $8.02 in November, 1915. In the wholesale prices of 272 commodities, the index figure rose to 198.4 for November, compared with 187.2 for October and 158.7 for November, 1915.

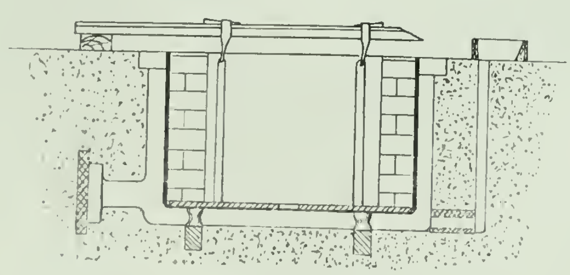


FIG. 10. ASSEMBLED SAND MOULD WITH LOAM CORE.

MELTING STEEL IN THE IRON FOUNDRY CUPOLA

by J. E. Hurst

DURING recent years, the addition of steel to iron foundry mixtures has become quite a common practice. In addition to finding an outlet for comparatively valueless steel scrap, such additions present an easy and effective means to the ironfounder of producing low silicon cast iron.

The process of melting steel in the iron foundry cupola is now fairly well understood. The steel in the cupola in contact with carbon—coke—and in an atmosphere containing carbon monoxide, absorbs increasing amounts of carbon as the temperature rises, exactly as is the case in the cementation and casehardening processes for the treatment of steel. As the carbon content of the steel increases, the melting point correspondingly decreases, and it will readily be seen that the melting point of the steel in the cupola is rapidly reduced by the absorption of carbon to a figure within the temperature range of the cupola. Approximately, the average maximum temperature in the cupola is in the region of from 1,350 deg. to 1,400 deg. Cent., and, therefore, the very fact that the steel is successfully melted indicates that it must have absorbed between 3 to 4 per cent. of carbon. This being the case, it was considered impossible to melt steel alone in the cupola, and if successful, to produce an iron of, say, from 3 to 4 per cent. total carbon, with a low silicon, phosphorus, and, with due care, sulphur contents.

Experimental Data

The following account of an experiment in this connection will doubtless prove of interest. The steel scrap charged into the cupola consisted of borings and turnings, crop ends from 5-in. billets, and miscellaneous scrap, consisting largely of old files and the like. A small proportion of hematite pig iron was added, the object being to ensure melting. It has subsequently been found that this addition was unnecessary. The cupola charges were 560 lbs. each, consisting of scrap in the following proportions: 560 lbs. of steel borings; 280 lbs. of crop ends; 112 lbs. of miscellaneous scrap; 19½ lbs. of hematite No. 3 pig. The mean carbon content of the above charge would be approximately 0.45 per cent.

Limestone and coke were charged as in the usual practice, a slight excess of each being allowed. The blast was started and the charge soon showed signs of melting. The blast pressure as indicated by the gauge was very high—28 in. of water—a fact that was ascribed to the closeness of packing of the charge. The melting continued successfully though at a somewhat slower rate, as would be expected, than is the case in an ordinary pig iron charge. The metal tapped out was very "wild" and emitted showers of sparks; but was readily quietened by the addition of ferro-manganese or ferro-silicon. The molten metal was cast into pig bed and allowed to cool. On breaking the cold metal, which was exceptionally tough, it presented a close white fracture. During melting a thick, black, sluggish slag was formed which from its appearance evidently contained a high percentage of iron. An analysis made of the pig produced gave the following results:—

	Per Cent.
C	3.98
Cr.	——
Si.	0.13
Mn.	0.45
S.	0.071
P.	0.034

Obviously it would be an easy matter to produce any desired silicon content by the addition of ferro-silicon to the molten metal and, with the possible exception of a rather high sulphur content, it will be readily seen by the above analysis that the pig iron produced could be classed alongside of hematite or even cold blast irons.

The total weight of metal charged into the cupola was 7,056 lbs., and the total weight of metal tapped out and recovered from the "dump" was 6,496 lbs., thus showing a fairly heavy loss of 560 lbs., or approximately 8 per cent. It is considered that this heavy loss was due largely to the oxidation of the very fine borings which constituted the major portion of the borings used in the charge. With a heavier class of borings, or such material as plate punchings and cuttings, the extent of this loss can be easily reduced to 3 or 4 per cent. Even with such a heavy loss as that experienced in this particular case, the whole experiment proved to be a paying proposition. If the market value of the original scrap is reckoned to be on an average $14.68 per ton, the total cost of the pig iron produced by the melting of this scrap, including melting costs, labor and standing charges, and also the melting loss, works out at approximately $23 per ton. The market value of the pig iron produced at the present time is at least $31.60 per ton. Undoubtedly a paying proposition.

The two great drawbacks to the melting of steel in this manner are, first, as already pointed out, the excessive loss through oxidation, and secondly, the tendency of largely increasing the sulphur content. By avoiding the very small and fine class of borings, or resorting to some form of briquetting process, the first drawback can be materially reduced to a normal figure. In connection with the sulphur content, the greatest possible care must be taken in the selection of the fuel. The addition of extra limestone together with sand is a most efficacious method of keeping the sulphur content down, and in addition gives a more fluid and manageable slag.

The action of limestone and sand in the reduction of the sulphur content is possibly somewhat similar to that of the blast furnace, in which the sand and limestone react with the oxide of iron, forming a basic double silicate, which at temperatures between 1150 deg. and 1300 deg. Cent. is capable of dissolving sulphur from the iron according to the equation:

$$\underbrace{Fe\,O + Ca\,O + Si\,O_2}_{\text{basic silicate}} + Fe\,Si =$$

$$Fe_2\,Si + Ca\,SO_4$$

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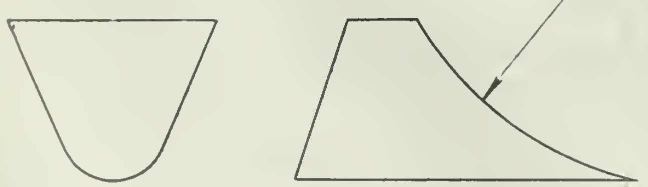
FIG. 1.



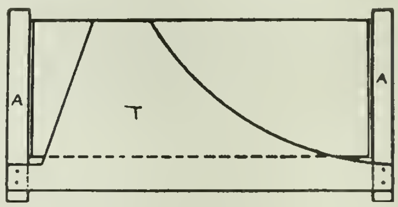
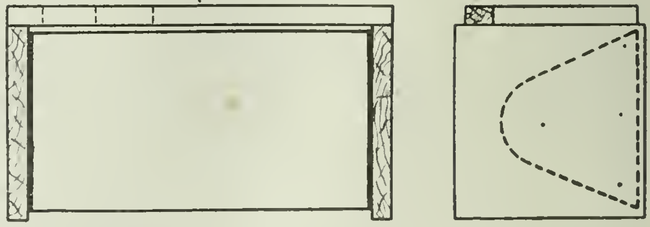


FIG. 2



A PATTERNMAKING KINK.

By A. L. Loy.

WHILE watching the pattern work production on a large engine bed recently, the writer saw the following kink used in getting out one of the rather odd-shaped pieces used in its construction. While there is little new or unusual in its application, yet one will often see journeymen patternmakers doing an almost endless amount of fitting when getting out similarly shaped pieces, and even then it is generally necessary to use a large quantity of putty, and a large fillet to cover up an ill-fitting job.

Fig. 1 shows the piece to be cut out. One end was cut at an angle, while the other was the circumference of a circle. There was, of course, nothing difficult in laying it out on a plane surface, but the trouble arose when trying to saw out these ends, due to the angularity of the sides giving only a line bearing on the saw table. The block was shaped according to the end view and slightly longer than necessary. The end pieces, AA, were nailed on, the nails being place so as not to be hit later by the saw. The template T was then laid out to the desired shape and nailed to these end pieces with its one edge corresponding to the edge of the block. The block was next sawn out, the saw teeth just clearing the template T. When laid in place, the block fitted almost exactly, and the process described above required hardly any more time in its application than does its description, which may at least be of service to some one under similar circumstances.

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CONTRACTS involving a sum said to be between $2,500,000 and $3,000,000 have been let to the H. Koppers Co., Pittsburgh, a by-product ovens concern, by the Dominion Iron & Steel Co., Sydney, N.S., for the construction of a large number of by-product coke ovens. They will be built on the most improved plans, that by-products from the coke production can be extracted to full advantage.

The Koppers Company is one of the largest concerns of its kind in the world, and has received some very large contracts recently for the erection of by-products ovens. To handle the above order, a large force of men will be employed.

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Vol. VIII. JANUARY, 1917 No. 1

SENTIMENT NO FACTOR IN POST-WAR TRADE

TO buy in the best and cheapest markets, and sell to the best advantage in the same or other markets are sound business principles. Expediency and disability have, however, to be reckoned with, and, relative to our Dominion, the necessary upbuilding of a sound industrial fabric on the one hand, the lack of a merchant marine and in some considerable degree the lack of knowledge of outside requirements and possibilities on the other, militate against practical exposition of such a propaganda either whole or in part. During the past two years, numerous happenings in the prosecution of the war have made stirring appeals to sentiment, with the result that not a few hastily conceived schemes have been publicly suggested and launched concerning future trade relations with our meantime enemies. In a word, the commercial enterprise of the latter was to be circumscribed and restricted, if not altogether eliminated as a world factor. That such an undertaking was too stupendous,—a sheer impossibility fits better, perhaps, because impracticable—has come to be realized, however.

Is a trade war, following that of blood and destruction, inevitable? In some quarters such a contingency is not anticipated, being even flouted. Why, may we ask, shouldn't a trade war be the logical outcome of the other? The world owes neither of the meantime fighting nor neutral nations, in their individuality as such, a living, nor, in the enlarged sense a progressive development. They each owe it to themselves and to the world to shoulder the relative responsibility, and, as in the past, considerable effort will be expended in demonstrating the fact that such is their attitude. War as practised on the battlefields of Europe and on the sea may be hell, yet only does it differ from trade war in absence of harrowing episode and detail, although even these may be evidenced in lesser or greater degree.

Germany, we may rest assured, is going to have and take a place in the Sun following the war of blood, and her intensity of application to the furtherance of her object is likely to be less dependent on peace term detail than we are prone to imagine. Whether the war has had the like revivifying, yes and revolutionizing effect on her industrial and commercial enterprise as it has had in these directions on the other nations—warring and neutral, we are not in a position to say; this much may, however, be said, that preceding the war, Germany was in many respects an easy leader. We are inclined to think that her pre-war advantage is at least eliminated, and that little evidence of any individual nation monopoly meantime exists.

While Canada, on account of the war, may not have developed a manufacturing capacity to entitle her to rank as a world power, she has made much of the opportunity afforded, and relatively as regards manufactured products her record will bear the keenest comparison. She has nevertheless lagged in industrial and scientific research, in a word, the utilization of waste products and hitherto unused natural resources, the development of new processes—mechanical, electrical, chemical and metallurgical, have been given little attention, and therefore have found but meagre practical application. The establishment of an Advisory Council on Industrial and Scientific Research is announced, and although unnecessarily tardy of creation, may be accepted as "better late than never." Our Minister of Trade and Commerce, Sir George Foster, has been so busy gallivanting, and between times twitting our manufacturers in gallery orations with "being asleep"—even "soundly asleep,'" when opportunities were knocking at their door, as to allow two and a quarter years to elapse before realizing what were his own responsibilities and duties as well as those of his Cabinet associates.

Much is looked for from the work of this newly appointed Advisory Research Board, even in the making-up of the lost leeway. Our manufacturers are better equipped to make use of both the data and materials available than they are apt to get credit for, and it may not be assuming too much to observe that they will be called upon to both measure up to and successfully overcome the industrial competition of well-nigh a full hand of prewar German equivalents, quite some considerable time before much research data becomes available. Our metalworking plants in munitions production constituted themselves into research boards and made good. Nothing succeeds like success, and when the pressure of competition begins to be felt in other than war-commodity manufactures, we shall be surprised if history does not repeat itself

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

PROTECTION OF IRON BY ELECTROPLATING—I.*

By O. P. Watts and P. L. DeVerter

ALTHOUGH nickel-plated iron is satisfactory for use indoors, when exposed to the weather it almost invariably rusts. Brass plated steel is extensively employed for the cheaper grade of builders' hardware, but is even more unsatisfactory than nickel plate for out-of-door use. In reply to an inquiry concerning the possibility of a durable brass plate on steel for use out of doors, a trade journal says, "An electro-deposit of zinc on steel or iron is the only one that will withstand atmospheric conditions for any length of time, and a demand is now being made for hardware that has received an electro-deposit of zinc before being plated with any other metal for ornamental purposes, such as nickel, copper, brass or bronze. This double coating gives good service and is the only satisfactory one for hardware which is exposed to the weather."

Electro-Galvanizing

The superior protective action of electro-galvanizing in comparison with deposits of other metals on iron is well recognized. This has generally been ascribed to voltaic action. Whenever a hole is broken or worn through the plating a voltaic cell is formed between the metallic coating and the exposed iron. If the coating consists of a metal which is electro-positive to iron, the latter is cathode and is protected from corrosion, but if the coating is electro-negative to iron this becomes anode, and is corroded worse than if the "protective coating" were entirely absent. Examination of tables of potentials of the metals shows that, of the metals which can be satisfactorily plated out of aqueous solutions, only zinc and cadmium are electro-positive to iron. Since cadmium is not used for commercial plating on account of the expense, zinc remains as the only electroplate which can protect iron by voltaic or galvanic action. Theory and practice appear to be in harmony.

Galvanic action requires that two unlike conductors be in electrical connection with each other and with an electrolyte. So long as the iron is completely covered by the electroplate there is no opportunity for voltaic action, either corrosive or protective, and, so far as rusting of the iron is concerned, it is immaterial what metal constitutes the coating. The protection of iron by deposits of zinc and its universal rusting when plated with other metals seem to indicate either that electro-deposits of zinc are less porous than those of other metals, or that, in the thickness used commercially, all electro-deposits are porous, or on exposure soon become so, and thus the superior protection by zinc is due solely to its galvanic action.

To investigate the porosity of electroplating, and to determine the protection afforded to iron by deposits of different metals, a series of experiments has recently been carried out in the electrochemical laboratory of the University, and it is thought that these are of sufficient interest to electroplaters to merit publication.

Protection of Iron by Deposits of Nickel, Copper and Brass.

Since it is generally conceded that commercial plating with these metals does not protect iron from rust, it was decided to try much thicker deposits than those usually employed. A company which makes great quantities of an article in daily use by millions of people specifies ten milligrams of nickel per square inch as the minimum for good deposits, and fifteen for their heaviest plate. The latter corresponds to an average thickness of 0.00348 mm. or 0.000137 inches, and requires an hour at five amperes per square foot for its deposition. For indoor use this deposit stands well the constant handling to which these articles are subjected. The deposits range from this thickness to ten and in a few cases twenty times heavier.

Strips of sheet iron were pickled in sulphuric acid to remove scale, cleaned in the electric cleaner, dried, weighed, returned to the electric cleaner for a few seconds, raised, and hung in the plating bath. After plating the strips were reweighed, and the average thickness of the deposit calculated. The brass and copper deposits were made from hot cyanide baths containing caustic soda; the zinc solution consisted of the sulphate and a little chloride. The nickel was plated from a rapid solution recommended by the writer, which was used hot except for two samples. The conditions of deposition are given in Tables I. to IV. below.

The samples were placed in wood racks, exposed to the weather, and examined occasionally for their appearance in regard to rust. The results are shown in Tables V to VIII.

Table I—Brass Deposits on Iron.

No.	Time Min.	Tem	Amp./dm.2	Thickness Inches	Thickness m.m.	Amp. Hrs./dm.2	Cur. Eff. %
1	55	Hot	11.5	0.00028	0.0071	1.0	26.7
2	10	Hot	11.5	0.00061	0.0155	1.9	30.1
4	15	Hot	12.3	0.0008	0.0203	3.07	25.5
6	30	Hot	12.6	0.00228	0.059	6.3	32.1
7	60	Hot	8.75	0.00327	0.0832	8.75	33.9
41	150	Hot	8.0	0.00607	0.1543	20.0	34.5

Table II—Copper Deposits on Iron.

No.	Time Min.	Tem.	Amp./dm.2	Thickness Inches	Thickness m.m.	Amp. Hrs./dm.2	Cur. Eff. %
36	3	Hot	7.32	0.00027	0.0069	.37	58.2
3	10	Hot	6.83	0.00096	0.0245	1.12	71.2
5	15	Hot	6.82	0.00099	0.0251	1.58	51.8
9	45	Hot	5.55	0.00129	0.0327	4.1	31.9
8	75	Hot	5.68	0.00271	0.0689	7.1	39.1
42	120	Hot	3.25	0.00248	0.063	6.5	33.1
46	180	Hot	3.27	0.00686	0.1745	9.81	60.8

Table III—Zinc Deposits on Iron.

No.	Time Min.	Tem.	Amp./dm.2	Thickness Inches	Thickness m.m.	Amp. Hrs./dm.2	Cur. Eff. %
21	4	Hot	4.88	0.00019	0.0049	0.32	71.6
19	1	Cold	14.7	0.000196	0.0050	0.24	97.4
14	3	Cold	13.25	0.00043	0.0109	0.66	85.3
10	5	Cold	13.65	0.00077	0.0195	1.14	86.2
11	12	Cold	12.5	0.00103	0.0263	2.3	63.1
13	30	Cold	9.55	0.00237	0.0603	4.77	60.5
12	25	Cold	14.7	0.00266	0.0667	6.1	52.0

Table IV—Nickel Deposits on Iron.

No.	Time Min.	Tem.	Amp./dm.2	Thickness Inches	Thickness m.m.	Amp. Hrs./dm.2	Cur. Eff. %
30	20	Cold	1.3	0.00016	0.0042	0.43	45.5
25	10	Cold	2.3	0.00022	0.0055	0.4	51.0
21	15	Hot	4.35	0.00069	0.0176	1.2	78.5
33	90	Cold	1.0	0.00091	0.0231	1.5	62.5
29	20	Hot	5.28	0.00102	0.0255	1.76	72.0
32	25	Hot	6.48	0.00146	0.0371	2.7	63.5
34	40	Hot	7.2	0.00249	0.0633	4.8	55.0
44	180	Hot	4.23	0.00598	0.152	12.75	48.1
45	165	Hot	5.56	0.00702	0.178	15.05	42.7

*From a paper presented before the annual meeting of the American Electro-chemical Society.

The most striking feature of the weathering tests is the complete protection against rust during four months of very wet weather afforded by electro-galvanizing less than 0.0002 inch thick, while rusting occurred through deposits of copper 0.0027, of brass 0.00327, and of nickel 0.00102 inch in thickness. With thin plating, rusting was serious and widely distributed, but on the thicker deposits it was confined to a few widely scattered spots. Although Nos. 42, 46 and 41 showed no signs of rust after seventy days exposure, they had tarnished so badly that all resemblance to the original copper or brass was lost. Specimens Nos. 44 and 45 not only were free from rust, but the nickel plate appeared as bright as when deposited.

Table V—Copper-plated Iron.

No.	Amp. Hrs. dm 2	Thickness Inches	Days required for rusting Slight	Moderate	Very bad
36	0.37	0.00027	8	10	14
3	1.12	0.00096	47	72	88
5	1.58	0.00089	47	73	88
9	4.1	0.00129	47.	73	88
8	7.1	0.00271	67	88	..
42	6.5	0.00248	No rust in 70 days.		
46	9.81	0.00686	No rust in 70 days.		

Table VI—Brass-plated Iron.

No.	Amp. Hrs. /dm.2	Thickness Inches	Days required for rusting. Slight	Moderate	Very bad
1	0.98	0.00023	20	32	73
2	1.9	0.00051	46	73	88
4	3.07	0.00066	47	73	88
6	6.3	0.00228	53	73	88
7	8.75	0.00327	53	73	88
41	20.0	0.00607	Tarnished, but no rust in 70 days.		

Table VII—Nickel-plated Iron.

No.	Amp. Hrs./dm.2	Thickness Inches	Days required for rusting. Slight	Moderate	Very bad
20	0.43	0.00017	9	19	40
25	0.4	0.00022	9	19	40
31	1.21	0.00069	12	19	53
33	1.5	0.00091	19	40	73
29	1.76	0.00102	19	40	73
32	2.7	0.00146	Tarnished, but no rust in 122 days.		
34	4.8	0.00249	Tarnished, but no rust in 122 days.		
44	12.75	0.00598	Bright, not even tarnished in 70 days.		
45	15.02	0.00702	Bright, not even tarnished in 70 days.		

Table VIII.—Zinc-plated Iron.

No samples rusted in 122 days.

Questions and Answers

Question.—Do you consider acid pickling of grey iron castings detrimental to good plating practice?—M. N.

Answer.—Decidedly so; it is now universally conceded to be very bad practice to pickle iron previous to plating. Sand blasting is more efficient, and less expensive in the long run.

* * *

Question.—Which process would you advise installing for treating iron castings with zinc—a Sherardizing outfit or a zinc plating outfit? We desire a durable coating of zinc for protective purposes on agricultural implement parts. —T. W.

Answer.—There exists a great diversity of opinion regarding the comparative value of the two processes for obtaining a protective coating of zinc on iron or steel. Both methods no doubt have their respective advantages. Sherardizing forms an alloy with the iron or steel and also forms a coating over the surface of the treated metal. There are many manufactured iron and steel articles which cannot be Sherardized as inexpensively as they can be treated by the electric method, while for many purposes the hot galvanizing process is to be preferred. Our personal opinion favors the electro-zincing process for particular work. We have seen a great number of ridiculous failures from Sherardized metal, but have noted some truly splendid results from the intelligent application of zinc by the electroplating process. If you contemplate engaging in the business extensively, we would advise you to procure samples of metal treated by each process and subject them to severe tests. Visit a few plants where different methods are in use, and by so doing you will be better able to judge of the merits of the respective processes.

* * *

Question.—We have a few hundred gallons of nickel solution which we prepared from imported patented nickel salts. The solution when new possessed a density of 16 deg. Be. It now registers 3 degs. Be., and is quite transparent to a depth of two feet in the tank. We cannot obtain a deposit of ordinary thickness in several hours, yet when new the solution produced splendid plates in thirty minutes. Owing to the information furnished us when the salts were purchased, relative to the unusual composition of the salts, we have abstained from making any additions. The solution is now practically useless. If you can assist us to rebuild the solution we shall be glad to attempt it, atherwise we shall dispose of it and prepare an ordinary nickel bath.—P. W.

Answer.—To every hundred gallons of the solution add, after dissolving, one hundred pounds of nickel sulphate. This will increase the density to approximately 10 degs. Be. If you wish an increased density, add more sulphate.

CADMIUM IN SPELTER

AS to what is the maximum percentage of cadmium permissible in spelter, destined for the manufacture of cartridge brass, the best American authorities on brass-making say they do not know, states Professor Ingalls in an addition to his paper read at the last meeting of the Institute of Metals. Cartridge brass has been made successfully with spelter containing as much as 0.3 per cent. cadmium. Cartridge brass is ordinarily cast at a temperature considerably above the boiling point of zinc, which is far above the boiling point of cadmium, and it is generally impossible to find any cadmium in the brass, by the most careful analytical work, not even where the constituent spelter contains 0.3 to 0.4 per cent. cadmium.

There is no doubt that large amounts of cadmium, say, 1 or 2 per cent., make brass brittle, but it is hard to keep so much cadmium in brass anyhow. There is no reliable information at present respecting the effect of small amounts of cadmium in brass, and the evidence on this point is extremely conflicting. So far as the author knows, it has been definitely established that cadmium is injurious only in spelter to be used for sheet rolling, for galvanizing telephone and telegraph wires, and for making ornamental slush castings. The Zinc Committee of the American Society for Testing Materials commits itself no further.

DOMINION COPPER PRODUCTS CAPITAL INCREASE

THE Dominion Copper Products Co., for the second time in four months, has secured authority to increase its capital, this time from $1,000,000 to $3,500,000. The company is one of two successful subsidiaries organized by the Dominion Bridge Co. since the war began. It started off with a capital of $400,000, which was increased last August to $1,000,000. Now, by supplementary letters patent just issued at Ottawa, authorization is given for an increase to $3,500,000. The other subsidiary, the Montreal Ammunition Co., so far as is known remains with its original capital of $300,000, although that is absurdly small relative to the actual cash investment in the enterprise and the volume of business the company transacts.

It has been conjectured for some time that the Dominion Bridge directors had some plan for the consolidation of the two subsidiaries under consideration.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey, Forge, Pittsburg	$26 95	
Lake Superior, charcoal, Chicago	26 75	
Standard low phos., Philadelphia	47 00	
Bessemer, Pittsburgh	30 95	
Basic, Valley, furnace	25 50	
	Montreal	Toronto
Middlesboro, No. 3	.....	.....
Cleveland, No. 3	.....	.....
Clarence, No. 3	.....	.....
Victoria	$32 25	$32 00
Hamilton	32 25	32 00

FINISHED IRON AND STEEL

Per Lb. to Large Buyers.	Cents
Iron bars, base	$3 50
Steel bars, base	3 70
Steel bars, 2 in. larger, base	5 25
Small shapes, base	3 90

METALS

Aluminum	$ 68
Antimony	18
Cobalt, 97% pure	1 50
Copper lake	37 00
Copper, electrolytic	37 00
Copper, casting	36 00
Lead	9½
Mercury	100 00
Nickel	50 00
Silver, per oz.	79
Tin	46
Zinc	14

Prices Per Lb.

OLD MATERIAL.

Dealers' Buying Prices

	Montreal.	Toronto
Copper, light	$23 00	$22 00
Copper, crucible	27 00	25 00
Copper, heavy	27 00	25 00
Copper, wire	27 00	25 00
No. 1 mach. comp'n.	21 00	20 00
No. 1 comp'n turn'gs	17 00	18 00
No. 1 wrought iron	11 00	11 00
Heavy melting steel	12 00	12 00
No. 1 mach'y cast iron	15 00	15 00
New brass clippings	17 00	17 00
New brass turnings	15 00	15 00
Heavy lead	7 50	7 50
Tea lead	6 00	6 50
Scrap zinc	8 00	8 00
Aluminum	35 00	35 00

COKE AND COAL.

Solvay foundry coke, on application
Connellsville foundry coke.
Yough steam lump coal....
Pittsburg steam lump coal
Best slack
Net ton f.o.b. Toronto.

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburg	$52 50
Open hearth billets, Pittsburg	52 50
Forging billets, Pittsburg	78 00
Wire rods, Pittsburg	65 00

PROOF COIL CHAIN.

¼ inch	$9 45
5-16 inch	9 10
⅜ inch	8 35
7-16 inch	7 15
½ inch	6 95
9-16 inch	6 95
⅝ inch	6 80
¾ inch	6 70
⅞ inch	6 55
1 inch	6 40

Above quotations are per 100 lbs.

MISCELLANEOUS.

Solder, guaranteed	$0.31½
Babbitt metals	.11 to .60
Putty, 100-lb. drums	3.00
Red dry lead, 100-lb. kegs, per cwt.	13.87
Glue, French medal, per lb.	.20
Motor gasoline, single bbls., per gal.	.26½
Benzine, single bbls., per gal.	.26
Pure turpentine, single bbls.	.71
Linseed oil, boiled, single bbls.	1.03
Linseed oil, raw, single bbls.	1.00
Plaster of Paris, per bbl.	2.50
Plumbers' oakum, per 100 lbs.	8.00
Lead wool, per lb.	.12
Pure Manila rope	.22½
Transmission rope, Manila	.26½
Drilling cables, Manila	.24½
Lard oil, per gal.	1.35

SHEETS.

	Montreal.	Toronto
Sheets, black, No. 10	$5 50	$5 50
Sheets, black, No. 28	4 50	4 50
Canada plates, dull, 52 sheets	4 75	4 75
Canada plates, all bright	6 30	6 50
Apollo brand, 10¾ oz. (galvanized)	6 95	6 95
Queen's Head, 28, B.W.G.	7 75	7 75
Fleur-de-Lis, 28, B.W.G.	7 45	7 35
Gorbal's best, No. 28	7 75	7 50
Colborne Crown, No. 28	7 25	6 75
Premier, No. 28, U.S.	6 50	6 75
Premier, 10¾oz.	6 80	7 00

ELECTRIC WELD COIL CHAIN B.B.

3-16 inch	$11 70
¼ inch	8 40
5-16 inch	7 40
⅜ inch	6 35
7-16 inch	6 35
½ inch	6 35
⅝ inch	6 35
¾ inch	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, net; B and C, 20 and 5 per cent.; cast iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples 72½; malleable, lipped union 60.

ANODES.

Nickel	$0.50	to	$0.54
Cobalt	1.75	to	2.00
Copper	.44	to	.46
Tin	.40	to	.56
Silver, per oz.	.82	to	.84
Zinc	.23	to	.25

Prices per lb.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper carbonate, anhy.	.35
Copper, sulphate	.17½
Cobalt, sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate ....(per oz.)	.55
Silver nitrate ....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130 per cent.	.41
Sodium cyanide, 98-100 per cent.	.32
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheels, felt, per lb.			$2.25
Polishing wheels, bullneck			1.35
Emery composition	$0.12	to	.14
Pumice ground			.04
Emery composition	.08	to	.09
Tripoli composition	.04	to	.06
Crocus composition	.07	to	.08
Rouge, powder	.30	to	.35
Rouge, silver	.35	to	.50

Prices per lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

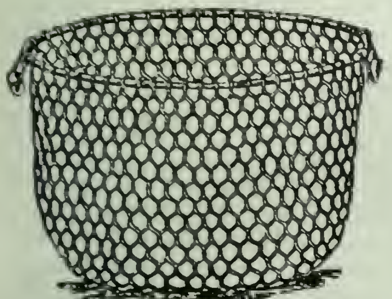
Toronto, Ont., Jan. 2.—The refusal of the Allies to enter into peace negotiations at the present time will help to clear the air of business uncertainty recently in evidence.

The year just closed has been one of remarkable prosperity for Canada, and this new year, so far as can be seen at the present time, promises to eclipse its immediate predecessor. Many industries have developed to such an extent that variety of output as well as volume has increased to a surprising extent. There has been a remarkable expansion in export trade, while Customs revenues have also made a big increase. For December the Customs revenue amounted to $11,884,000, as compared with $9,432,000 for the corresponding month of last year. In the nine months of the fiscal year the Customs revenue has reached a total of $106,613,000, an increase of $34,891,000.

Steel

The market has been quiet during the holiday season, as is usually the case, consequently there are few price changes to note. The New Year opens with the iron and steel trade in a sound position, with a year of big business undertaken and good prospects for another twelve months, or at the least a good part of it, of at least equal activity. Much depends, of course, upon the duration of the war, but the mills are already assured of practically twelve months' business, it being unlikely that any contracts now placed will be cancelled. If peace be declared during the year, it is more than likely that the tonnage will be delivered in some form other than munitions. The productive capacity of the mills has been greatly increased and requires a corresponding increase in volume of business to keep them operating at capacity. To what extent this output will be required after the war is a matter of speculation, but it is there to be taken advantage of, if needed. While there will probably be a subsidence of peace talk for some months, prices may be subject to more or less disturbance. The situation in the steel trade at present is similar to that of last June, when it was generally thought that prices had about reached the top. Whether the upward movement has stopped or not is a matter of conjecture, but there is little doubt that the peace talk has already affected the market to some extent, and that it will help to check any upward tendency in prices. Some steel products, such as black sheets and plates, are expected to reach higher levels regardless of the general trend of the market, as the situation in each is rather exceptional.

As regards black sheets, the mills are experiencing a shortage of sheet bars,



Foundry Equipment Economy

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OUR reasonable prices are not the only reason of the popularity of our goods. Our service is like a magnet—on one end are our exceptional prices, on the other end is the quality of our products. Any need you have in your foundry we can fill to your entire satisfaction.

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The Hamilton Facing Mill Company, Limited

HAMILTON ONTARIO CANADA

while the scarcity of labor is helping to curtail the sheets output. Most large sheet mills have no material to offer for first quarter delivery, while some have made fairly large sales for second quarter. The leading interest in the U. S. has advanced prices which will affect the local situation in due course. The demand for plates continues heavy, and most mills are sold up for the whole of 1917. The market for wire rods continues very firm at advancing prices. It is understood that Canadian interests have paid $80 a ton at mill for wire rods in the U. S.

Pig Iron

The pig iron market is quieter, and no further price changes have been made. Prices on domestic brands of pig iron are still withdrawn, and no intimation has been made as to when new prices are likely to be issued. The pig iron market in the States is quieter, buying being lighter owing to limited amounts of iron available and congested freight conditions. There have been no price changes in the U. S. on pig irons.

Supplies

On account of the holidays, business has been quiet during the month. It is understood that new and higher prices on lubricating oils will be announced very shortly, due, it is stated, to the higher cost of crude oil, which has recently advanced. Gasoline is unchanged in the meantime, but very firm. Pennsylvania crude oil advanced 10c a few days ago, and is now quoted at $2.85 a barrel, Pittsburg, the highest price ever quoted for this grade. Other grades were each advanced 5c. The advances were brought about by the continued demand of refiners, who state that there is an abundance of oil above ground, but producers are holding it for still higher prices. Jenkins globe, angle, and check valves have advanced approximately 7½ per cent., the new discount being 15 per cent. on standard grade. Gate valves are now selling at 20 per cent. off list. Iron body gate and globe valves are quoted at 40 per cent. off.

Metals

The metal market has been seasonably quiet this week on account of the holidays and stock-taking. The situation with regard to most metals is unchanged, and prices are the same as were recorded last week. The temporary passing of peace talk will tend to make the markets firmer, but any pronounced upward movement in any metal is very unlikely. The possibility of peace proposals being renewed later on in the year will tend to check any tendency to inflated prices.

Copper.—The market is steadier, but quiet. Producers, in view of their sold-up condition, have not changed their quotations for any part of the first half. There is practically no spot copper to be had except resale metal, which has been quoted under the market. Local prices are unchanged and nominal at 36c per pound.

Tin.—The market is dull and unsettled, although there has been no change in prices. The action of the British Government in prohibiting the publication of steamship arrivals and departures has affected the tin market, as the movements of tin cargoes cannot be followed by the trade. Local price, 45c per pound.

Spelter.—There has been no change in the spelter situation at the mines; the market is steadier and quiet. Local price, 13c per pound.

Lead.—There is some scarcity of lead, but quotations are unchanged, with the market quiet. Local price, 9½c per pound.

Antimony.—The market is very dull, with prices nominal and unchanged at 18c per pound.

Aluminum.—The situation is unchanged, but the market has an easier tendency. Local price, 68c per pound.

TRADE GOSSIP

Sarnia, Ont.—The Sarnia Metal Products Co., plans an addition to its plant.

Gordon Perry has been elected a director of the National Iron Works, Toronto.

Sarnia, Ont.—The H. Mueller Mfg. Co., will erect and equip buildings to manufacture brass.

Owen Sound, Ont.—The Canadian Malleable Iron Co. are building an extension to their plant.

Hull, Que.—The Hull Steel Foundries, Ltd., propose making improvements to their plant, including a blast furnace.

Trail, B.C.—The Consolidated Mining & Smelting Co., is erecting an addition to its electrolytic zinc plant, 165 x 200 ft.

New Toronto, Ont.—The Dominion Abrasive Wheel Co., who sold their factory here to the Brown's Copper & Brass Rolling Mills, will build a new factory at Mimico at a cost of about $65,000. Mr. Sawyer is the manager.

W. W. Butler has been appointed vice-president and general managing director, and **F. A. Skelton** vice-president and sec-treasurer of the Canadian Car & Foundry Co., Montreal.

Sarnia, Ont.—It is understood here that the Mueller Mfg. Co. propose making considerable extensions to their factory to take care of the increase in demand for their brass products.

Cobourg, Ont.—It is understood that owing to prospects of increased business the Cobourg Steel Co., have under consideration the enlarging of their present plant.

Frederick J. Brule has resigned from the staff of the Anaconda Copper Co., to accept the position of chief engineer of the British American Nickel Corporation with headquarters in Toronto.

The Foundry & Machine Co., Montreal, have bought out the Federal Brass Foundy Co. and are putting up a brick addition to the plant which will be 45 feet square and two storeys high.

Vancouver, B.C. — It is understood that a new steel plant will probably be established at Eburne, near here. W. H. McLaws president of the Alberta Rolling Mills at Medicine Hat, Alta., is interested in the scheme.

The Foundry Products Ltd., of Calgary, which has recently been incorporated, is an off-shoot of the Canadian Western Foundry and Supply Co. W. A. McLaws is president of the new company, and Geo. A. MacKenzie is general manager.

International Magnesite, Ltd., has been incorporated at Ottawa, with a capital of $250,000, to manufacture magnesite, graphite, and other minerals. The head office is at Montreal, and the incorporators are: Leon Daoust, Aime Daoust, and Ernest D. White, all of Montreal.

Port Arthur Copper Co. has been incorporated at Toronto, with a capital of $2,500,000, to acquire and develop mineral deposits, with head office at Toronto. The incorporators are: Arthur E. Way, William D. McKay and James H. Young, all of Toronto.

Hudson Copper Co. has been incorporated at Toronto, with a capital of $2,000,000 to acquire and develop mineral lands and deposits, with head office at Thessalon, Ont. Provisional directors are Robert H. Wilson, Robert E. Laidlaw, and Edgar & Raney, all of Toronto.

Metal Foundries of Canada, Ltd., has been incorporated at Ottawa, with a capital of $50,000, to develop mineral deposits and to carry on the business of smelting, refining, milling and foundry company. Head office is at Toronto, and the incorporators are: John M. Duff and James G. Hamilton, of Toronto.

Col. Thomas Cantley, president and general manager of the Nova Scotia Steel & Coal Co., has returned from a trip to England and France. He was away about seven weeks, a considerable part of the time being spent in France, his company having large contracts with the French Government.

John I. Reid has been made superintendent of the Longue Pointe plant of the Canadian Steel Foundries, Ltd., Montreal. He assumes his duties at once. He was formerly works manager of the American Steel Foundries' plant at Chester, Pa., and recently sales agent for the company at 30 Church Street, New York City.

The Ohio Iron & Metal Co., of Chicago, Ill., dealers in iron and steel scrap, have opened a branch office at 505 Transportation Building, Montreal, in charge of John M. Zehner, formerly with the Canadian Fairbanks-Morse Co. The Ohio Iron & Metal Co. also have branch offices in Pittsburg, Cleveland and St. Louis.

Victoria, B.C.—The Aetna Iron and Steel Co., has been organized here with a capital of $250,000 to manufacture bars and small structural shapes. As soon as possible the smelting of ores will be taken up to supply the requirements of the plant. David Milne of Medicine Hat, Alta., is the president.

Welland, Ont.—The Canadian Steel Foundries, Ltd., here, have let a contract to Ryan & Gardner to build two open hearth furnaces and an extension 100 feet long to their machine shop. One new open-hearth furnace has lately been completed and with the above will double the capacity of the plant. The total extension will cost about half a million dollars.

Quebec, Que.—The Dominion Iron & Wrecking Co., have secured the plant of the Standard Steel Foundries at Outremont, Que., and that of the Consolidated Brass Foundries at Pointe au Tremble. It is the intention to consolidate these plants and engage in the manufacture of munitions. New equipment is to be installed, including 15 electric furnaces of the newest type at the Consolidated Brass plant.

Absence of Labor Troubles—The year 1916 ended with practical immunity from labor troubles in Canada. Only one Board of Conciliation has been sitting of late, and its report was recently submitted. It deals with the application of employees of the Ottawa city waterworks for a 15 per cent. increase. The Board unanimously recommends individual increases, which amount to ten per cent. in every case, and in some instances to more than 15 per cent. Forty-five employees of long standing are affected.

New Copper District.—During the past twelve months development work has been carried out on a new copper discovery at Newport, County of Gaspe, P.Q. Some very rich ore has been taken out on wide veins assaying as high as 57 per cent. copper content in massive ore from 14 veins already uncovered. Over a large area assays run in payable ore. American interests are contemplating larger development on the recommendation of expert geologists, who have made exhaustive examination of the properties.

British Firms Order Canadian Metals.—The value of the work which is being done by the Commercial Intelligence branch of the Trade and Commerce Department, Ottawa is illustrated in the result which has followed the publication by the Department of one inquiry from a British firm, asking for Canadian metals. A Montreal company answered the inquiry and received an order immediately amounting to $123,000, followed soon after by a second order amounting to $427,000 making a total of $550,000 in three months.

FOR SALE

FOR SALE—HAMMER CORE MACHINE. Apply Gurney Foundry Co., Ltd., West Toronto. (3)

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Stevens, Frederic B., Detroit, Mich.

ANODES, BRASS, COPPER, NICKEL, ZINC
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Northern Crane Works, Ltd., Walkerville, Ont.
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Tlighman-Brookshank Sand Blast Co., Philadelphia.
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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
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BLAST GAUGES—CUPOLA
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Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRASS MELTING FURNACES—SEE FURNACES

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Stevens, Frederic B., Detroit, Mich.
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BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Osborn Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
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Ford-Smith Mach. Co., Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CARS, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
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CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Stevens, Frederic B., Detroit, Mich.
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Brown Specialty Machy. Co., Chicago, Ill.
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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Mumford, E. H. Co., Elizabeth, N.J.
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Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Mumford Molding Machine Co., Chicago, Ill.
J. W. Paxson Co., Philadelphia, Pa.
Tabor Mfg. Co., Philadelphia, Pa.
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CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Stevens, Frederic B., Detroit, Mich.
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Stevens, Frederic B., Detroit, Mich.
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CYANIDE OF POTASSIUM.
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W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Gautier, J. H., & Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Can. Hanson & Van Winkle Co., Toronto, Ont.
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EMERY WHEELS—SEE WHEELS

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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Stevens, Frederic B., Detroit, Mich.
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Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hawley Down Draft Furnace Co., Easton,
Monarch Eng. & Mfg. Co., Baltimore.
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Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
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Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
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McCulloch-Dalzell Crucible Company, Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
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Mumford Molding Mach. Co., Chicago, Ill.
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Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
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Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
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Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
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McCulloch-Dalzell Crucible Company, Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Charles C. Kawin Co., Toronto.
Toronto Testing Laboratories, Toronto.

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J. W. Paxson Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
E. H. Mumford Co., Elizabeth, N.J.
Midland Machine Co., Detroit.
Mumford Molding Mach. Co., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Wadsworth Core Mach. & Equip. Co., Akron, Ohio
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Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Dom. Iron & Steel Co., Sydney, N.S.
Steel Co. of Canada, Hamilton, Ont.

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Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Company, Pittsburg.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POLISHING WHEELS—SEE BUFFING WHEELS

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
New Haven Sand Blast Co., New Haven, Conn.
J. W. Paxson, Philadelphia, Pa.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Standard Sand & Mach. Co., Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Standard Sand & Mach. Co., Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
J. W. Paxson, Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison E. J. Co., Toronto, Ont.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPIT PATTERN MACHINES
Mumford, E. H., Co., Elizabeth, N.J.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
E. H. Mumford Co., Elizabeth, N.J.
Mumford Molding Mach. Co., Chicago, Ill.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Mumford, E. H. Co., Elizabeth, N.J.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Wm. McGregor, Scottish Steel Grit Works, Airdire, Scotland.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Northern Crane Works, Walkerville.
J. W. Paxson Co., Philadelphia, Pa.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
E. J. Woodison Co., Toronto.
J. W. Paxson Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
McCulloch-Dalzell Crucible Company, Pittsburg.

TRIPOLI
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRACK, OVERHEAD

TROLLEYS AND TROLLEY SYSTEMS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Mumford, E. H. Co., Elizabeth, N.J.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

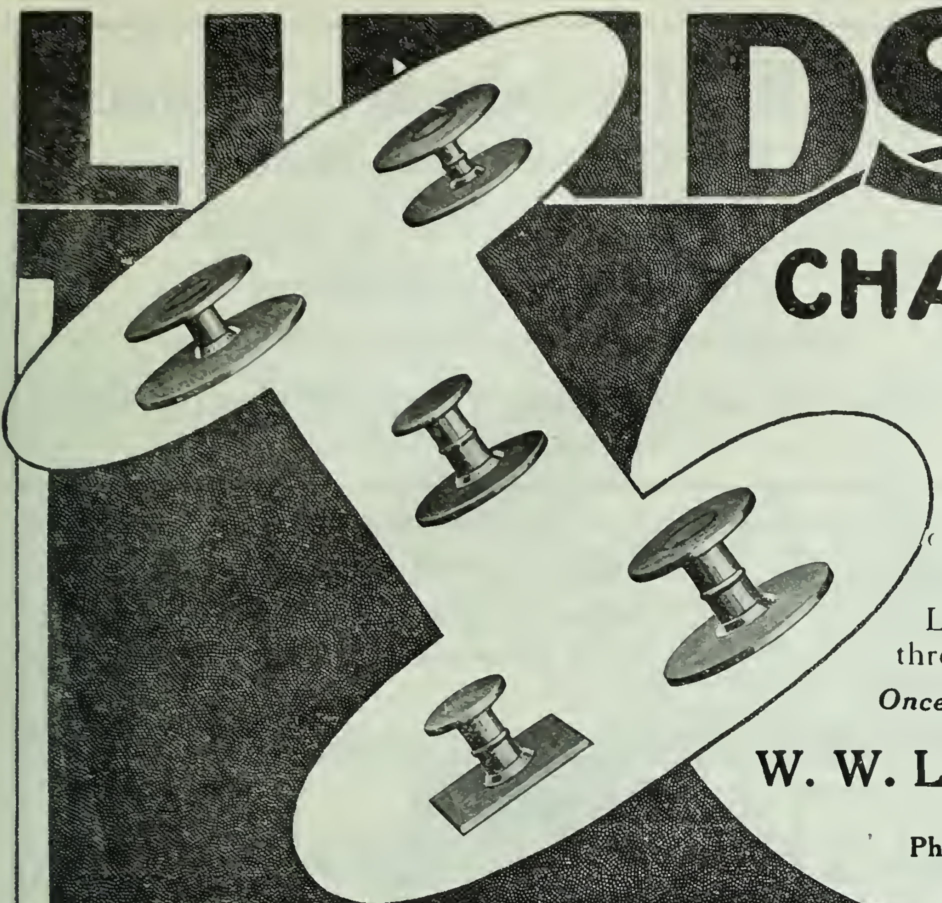
WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

LINDSAY



CHAPLETS

are small but their importance is great.

Big jobs depend upon them.

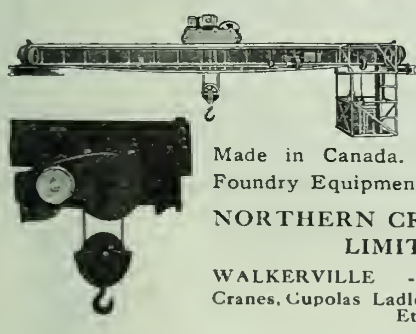
They are the only barrier between perfect castings and make-overs.

Lindsay Chaplets are quality through and through.

Once known, always used.

W. W. LINDSAY & CO.
Harrison Bldg.
Philadelphia, Pa.,
U. S. A.

CRANES



Don't buy a crane or hoist without investigating Northern Products—Made in Canada. Also a line of Foundry Equipment.

NORTHERN CRANE WORKS
LIMITED
WALKERVILLE - - ONTARIO
Cranes, Cupolas Ladles, Hoists, Tumblers Etc.

ANODES

Any style or shape
Quality Guaranteed

Why import your anodes when you can get guaranteed quality, quicker delivery, and can save duty and eliminate the annoyance of clearing at the customs by buying from us?

May we send you descriptive pamphlet and full particulars?

W. W. WELLS, Toronto

In Brass Bronze Copper Nickel Tin & Zinc

Let us assist you in "Grinding Down Costs"

To do this simply give us an outline of your grinding operation and we will furnish the **best possible wheel** for the purpose.

Gresolite
for Grey and Chilled Iron.

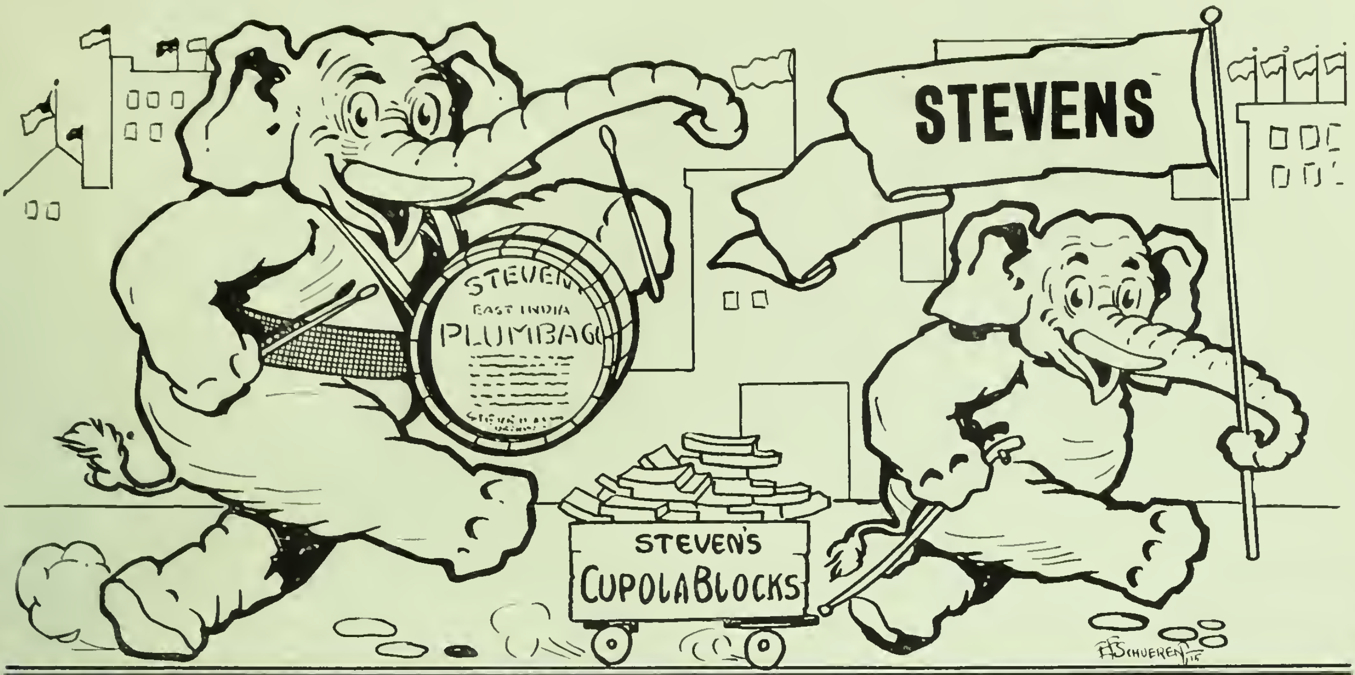
Emery
for Steel Foundry and General Purpose.

Corundum and Rexite
for Precision and Fine Tool Grinding.

Write for booklet "Safety as Applied to Grinding Wheels."

Canadian Hart Wheels
LIMITED
Manufacturers Grinding Wheels and Machinery
456 Barton Street East
HAMILTON, CANADA

ADVERTISING INDEX



A Happy New Year

To Foundrymen and Platers everywhere. Connect with a good supply establishment in 1917—substantial, resourceful, ready with the goods YOU WANT when you want them.

Phone, wire or write for my prices on anything listed here and you'll never have cause for regrets.

Foundry Supplies

- Stevens Pure East India Plumbago
- Stevens King Kore Kompound
- Stevens Columbia Parting
- Stevens Carbon Blacking
- Stevens Stopper (Iron Cement)
- Stevens Core Oil
- Stevens Core Gum
- Fire Brick
- Fire Clay
- Cupola Blocks
- Crucibles
- Core Ovens

Foundry Supplies

- Talc
- Coke
- Rosin
- Seacoal
- Molding Sand
- Foundry Machinery

Plater's Supplies

- Stevens Tripoli Compositions
- Buffing Compositions
- Stevens Improved American Emery
- Buffs
- Glue
- Felt Wheels
- Polishing Wheels
- Platers' Supplies
- Chemical Sundries

FREDERIC B. STEVENS

Manufacturer Foundry Facings and Supplies, Buffing Compositions and Platers' Supplies

DETROIT, MICH.

Export Warehouse: WINDSOR ONT.

FACING MILL:
Cor. Isabella Avenue & M.C.R.R.

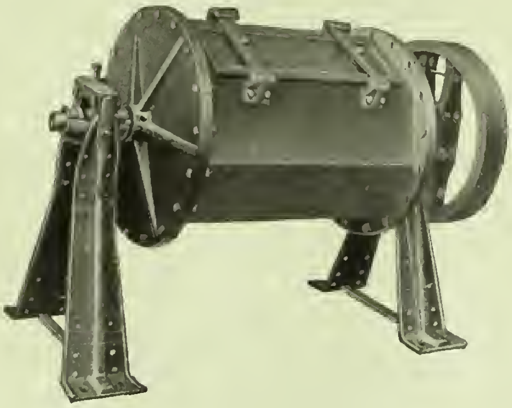
WAREHOUSE & OFFICE:
Cor. Larned & Third Streets.

BRANCH:
Hoosier Supply Co.
Indianapolis, Ind.

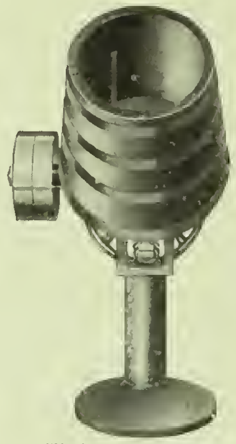
NEW ENGLAND BRANCH:
Frederic B. Stevens
Cor. Water & Olive Sts.
New Haven, Conn.
E. E. Seeley, Manager

Cleaning and Burnishing Castings

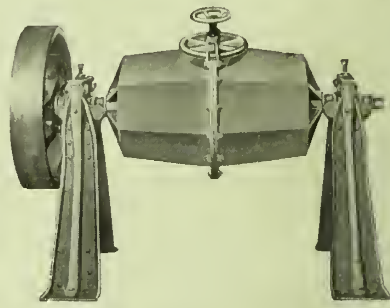
BRASS IRON STEEL



Horizontal Barrels



Tilting Barrels

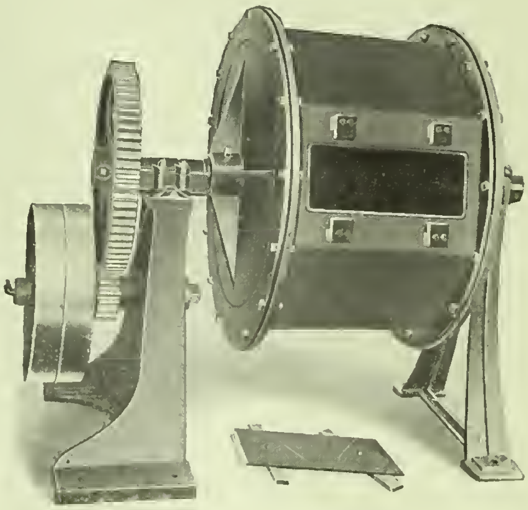


Tapered Hexagonal Barrels

Made in several sizes to suit your work

These are the most approved types of horizontal barrels in use to-day, and are a great improvement over the ordinary tumbling barrels. Both these types are water-tight, and can be used for either dry or wet tumbling.

Mechanical Apparatus of All Kinds



Burnishing Barrels

Specialty— Economy and Service

The barrels are especially constructed for burnishing with steel balls. The process is used both as a preliminary to nickel or other plating and after plating as a final finishing process. This system will save you money. Look into it.

We manufacture everything for

Polishing and Plating of Metals

CONSULT US AND REDUCE YOUR COSTS

CANADIAN HANSON & VAN WINKLE COMPANY, LIMITED

TORONTO : : CANADA

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, FEBRUARY, 1917 No. 2

The Publisher's Page

TORONTO February, 1917

A High Example of Faith in Advertising

WE are quite accustomed to the idea that advertising is more highly developed in the United States than elsewhere. We are prone to assure ourselves that American business have a stronger faith in advertising, a clearer understanding of its powers, and a higher efficiency in its use than is possessed abroad. We have been told so, often enough, by advertising men from other countries, so our belief is not attributable soley to egotism. Since the war began, however, England has been setting some examples of advertising which are not easily duplicated.

We have referred many times to the British Government's advertising for soldiers and for subscriptions to the war loans—an unprecedented and extremely profitable use of advertising on a tremendous scale. We have noted many instances of British concerns which have made far-sighted investments in advertising to protect their good-will under adverse circumstances. And now comes the British automobile industry with an example of faith in advertising which puts to the blush some of our American advertisers who are "oversold"—and cancel their advertising orders in consequence.

If it takes a high degree of faith in advertising to advertise when the factory is over-sold, what about the faith which continues to advertise when it is practically impossible to sell any goods at all? That is just about the condition of the British automobile industry. In the first place, every available automobile factory which is not making cars for the army is making war munitions. There is an embargo upon the importation of pleasure cars from other countries. Private owners of automobiles are under an allowance of six gallons of gasoline per month. Sir Hedley Le Bas, the official advertising manager for the Government, is placarding the country with such warnings as: "You are helping the Germans when you use a motor car for pleasure." According to a special investigation sent by *Automobile Topics*, the retail trade is absolutely paralyzed. It is not only impossible to get cars, but to sell those cars which are already on hand. Yet, in spite of such discouraging circumstances, the British newspapers and magazines continue to carry automobile advertising.

The investigator above referred to specifically mentions Willys-Overland, Limited, Daimler and Wolseley as advertising for "after-war" business. Dunlop and Michelin tires are featured almost as prominently as ever. "The day is steadily drawing nearer when we shall resume the production of motor carriages for private owners," says a piece of Daimler copy, and when that day comes the company expects to occupy the same high place in the public mind which it had before the war began. It is using advertising as the best possible insurance against public forgetfulness.

The British automobile industry is setting a high standard of faith in advertising, and understanding of its true functions. American advertisers cannot afford to be too complacent over their "leadership" in the face of such examples as these—*Printers' Ink.*

CANADIAN FOUNDRYMAN

143-153 University Avenue - Toronto

Safe Practice at Blast Furnaces and Its Development-I.

By Frederick H. Willcox

In its efforts to increase safety in the metallurgical industries, the Bureau of Mines, Washington, D.C., has been studying the causes of accidents at blast furnace plants also methods for their prevention. This article describes the known dangers and makes suggestion of means whereby the risk of accident may be lessened or, better still, wholly avoided.

IN all efforts to reduce accidents, the management should take the leading part. If officials believe that accidents can be prevented, and show a determination to prevent them, the rest of the force will reflect that attitude. Improvement in carefulness follows insistence on safety, as increase of output or reduction of costs follows insistence on efficiency, and for the same obvious reasons. In either case, the management must make special efforts to effect improvement, either by employing experts or by having the department heads make special study of safety conditions, and must supply necessary funds, for rarely or never can improvement be effected without the means to make necessary changes in plant equipment. It is true that all safeguards do not pay a direct financial return by preventing the accidents for the reduction of which they are installed. It is just as true that these same safeguards do pay when supplemented by other accident-prevention methods, because they show that the company is in earnest in its efforts to reduce accidents, by accepting the responsibility for cause entirely within its control.

FIG. 1—FOREMAN WARNING MEN AWAY FROM CYLINDER HEAD OF STEAM ENGINE

If the management gives tangible evidence of its interest in safety, and consequently has aroused the interest of the rest of the force, the foremen can do more to lessen risks and reduce accidents than any other group of men in the plant. As the foremen, in plant practice, organize the force for co-operation and efficiency in plant operation, and train themselves to observe and analyze the causes of trouble with mechanical equipment or furnace practice, so is it necessary for them to organize the force and train themselves for the best results in accident reduction. Although in blast-furnace works, defective plant arrangement or design, insufficient instructions, and lack of safeguards are sources of accidents, a considerable proportion of the accidents are, nevertheless, due to carelessness, thoughtlessness, ignorance, and clumsiness. However, men can not be expected to be always alert for obscure dangers, to adopt new practices that aim to put safety on a par with quickness or convenience, or to be thinking about not taking chances that rarely result in accident, unless their foremen exhibit as much personal interest, co-operation, and attention to details of work and equipment relating to accident prevention as they do in matters of practice.

The Foremen

To prevent all accidents about furnace plants, to eliminate them entirely, is impossible because many accidents happen by chance and are accidental in the most literal sense. To bring about a permanent reduction, however, does not require great study, analysis, or planning. The methods used to get out the tonnage, the incentives to good practice and maintenance of equipment, and the precautions against incompetence can be applied equally well to avoiding accidents from ignorance, carelessness, awkwardness, or unnecessarily hazardous conditions.

Should two or three tuyeres burst, or a blowpipe and cooler burn every day, or a certain bearing get hot every week, or an armature burn out persistently every month, or a car becomes derailed on a certain curve frequently, some one "gets busy" and finds out the trouble, whether mechanical or personal. To make a record in tonnage, it is not sufficient to go to the blowing room and "put the wind up," a get-together spirit is necessary. If a furnace has to be repaired every crew and foreman should understand and co-operate in the work. Any unusual and dangerous task is given constant personal attention. Such work is not done by making a preliminary inspection, preparing recommendations, and warning the men of the hazard; one or more foremen are on the job to have the work done safely. Past experience and common sense require this. However, the percentage of accidents from asphyxiation, break-outs, explosions, or slips is very small compared with the percentage of accidents that happen in regular daily work. Dozens of accidents are repetitions of the same circumstances, the cause, nature, and result being essentially identical.

Accident prevention should be handled in the same way as operating difficulties. If it is going to cost more to pay for accidents than to prevent them, if the prospect is that every fourth, sixth, or tenth man in the plant will lose 20 to 35 days' work every year by accident and during that time be replaced by a less skilled employee who will have to be trained and will possibly cause vexations delays and mistakes, and if better and safer working conditions attract better men, operating methods and instructions should be applied to the safety problem. The same methods that have been developed for efficiency may be used to increase safety.

FIG. 2—SCRAP PILED AT FOOT OF LADDER

Responsibility of Safety Inspectors

Safety inspectors are invaluable for looking after recommendations, investigating accidents, pointing out possible improvements in equipment and methods, and organizing safety work, but if there is an inspector at the plant do not put the responsibility for betterment on him. His suggestions can no more eliminate accidents than suggestions can eliminate off-grade iron unless his recommendations, as well as the foremen's, are followed by improvements, detailed instructions, co-operation, and personal supervision. Moreover, if the safety inspector is not familiar with operating methods in detail, there are scores of hazardous places and practices that he will become familiar with only as accidents happen. Accident prevention is too big a job for the safety inspector unless he has the cordial co-operation of the foremen.

Plant-inspection Committee

From the sub-foremen and workmen, a plant-inspection committee of two to four men should be selected and entrusted to inspect the plant every month on a certain date, one man being replaced each month or two months, thus keeping a working nucleus of experienced men on the committee. Each sub-foreman should serve on the committee, as it may be assumed that these men have obtained promotion by displaying qualities that will be as valuable in promoting safety as in developing efficient operation. Select the workmen on the committee from those who are familiar with their work and give some promise of being permanent employees, as only a certain percentage of a plant crew can be considered a permanent asset. These men should be given opportunity to serve on the plant committee and be drawn in turn from the cast house, stock house, trestle, boiler house, and all parts of the plant.

Duties of the Committee.

The work of the inspection committee may be laid out under three heads:—

1.—Study of the accidents that have happened during the preceding month. After the committee has examined an accident report it should confer with the foreman in charge, the injured man, the man who caused the accident, any witnesses, and visit the place of the accident and see how the work is done. The comments and recommendations of the committee may be attached to the accident report for the superintendent's information.

FIG. 3—A DANGEROUS PRACTICE, CLIMBING BETWEEN CARS

2.—Inspection of the plant for improper physical conditions. These conditions may include insufficient lighting, uncleanliness, refuse and debris under foot and overhead, slippery places, holes, lack of railings, overhead obstructions, poor walks, unguarded machinery, insanitation, and so on. Experience has shown that this field is the one most likely to receive attention from an inspection committee. It is unnecessary to give detailed instructions here, as in all probability 75 per cent. of the recommendations of the committee will at first concern this phase of the work.

3.—Inspection of the plant for unsafe practices. Especial emphasis should be placed on this feature of the committee's duties. Men engaged in accident prevention estimate the proportion of accidents due to the neglect of the worker at 40 to 70 per cent. Emphasize the meaning of these figures and encourage attention to this side of accident prevention. Insist that at least half of the time devoted to inspection be spent in observing operations, such as unloading or handling material, casting or pouring, method of using and condition of hand tools, condition of ladders, trestlework, and repair work. The big accident problem is unsafe practices, and these are largely a result of ignorance, carelessness, thoughtlessness, lack of instruction, lack of supervision, and mistaken eagerness or haste in accomplishing work by taking uncalled-for risks. Bettering methods of work as related to accidents is an unlimited field for the committee.

4.—First-aid instruction. Have the men on the plant committee devote as much time as is necessary to the study of first aid, such as bandaging, stretcher drill, and resuscitation methods.

Obtaining Co-operation and Recommendations

How much real interest is induced and how much good is accomplished by the above means are problems that largely solve themselves. Safety is a matter of common sense, foresight, and carefulness. Accident reduction is not insured by committees any more than larger production would be; their purpose is to arouse the interest of every man in being watchful.

FIG. 4—SAFEST WAYS OF RIDING ON RAILROAD CARS

Men will feel an interest in a particular subject and pride in their own work if they are given responsibility and their advice accepted. Their thoroughness in inspection work and conscientiousness in reporting will largely depend on the attitude of the superintendent and foremen. If they treat the matter lightly the men will do likewise, but, if they show a desire to lessen accidents, the men will respond and will take the necessary precautions. It is hardly correct to assume that any reduction in accidents is of benefit to the workmen alone, as compensation or liability insurance are factors to be considered. Some form of appreciation of the workmen's efforts has usually been found essential and productive of results. The form which this appreciation should assume is for the management to decide. The following methods are suggested:—

1.—The use of a "suggestion box" in which any employee may place a signed suggestion for promoting safety. Reward the best suggestion with a substantian token such as a cash prize, watch, technical book, tool, or subscription to a trade journal. The award should be made monthly if practicable.

2.—Divide the various crews under the different foremen into divisions, and to each division that has no lost-time accidents for one to three months, or has reduced its percentage of accidents in that period, give a prize such as cigars, and award the foreman a cash bonus or a prize. In case the accident percentage rate is taken as the basis, it may be advisable to take the accumulative rate, rather than the flat rate for each distinct period. The names of those who win the awards should be posted, together with the records on which the awards were based.

Foremen's Committee

The chief foremen, such as the general foreman, master mechanic, electrician, and yard or labor foreman, and any other foremen desired, should meet with the superintendent or assistant superintendent once a month for the purpose of discussing accident prevention.

At this meeting discuss each accident that has happened during the preceding month. Find out the cause, whether negligence of employer or employee, or trade risk, and whether the accident was preventable and could have been avoided by safeguards, by instructions, by different procedure, or by more care. Use the notes of the plant-inspection committee, and if feasible have the injured man, an eye-witness, or the sub-foreman describe the accident and find out how he thinks it might have been avoided.

Should this conference with the men be made a basis of discipline, it will discourage frankness. Discipline concerns carelessness and incompetence, and this question should be decided outside of and previous to this meeting. If the accident seems to have resulted from ignorance it should be the duty of the sub-foreman to explain why the man was not instructed and to see that the men are told of this danger and of a safe way of doing the work. If the accident is due to your own oversight be frank to say so; this will not destroy discipline. If the accident is clearly due to the lack of

FIG. 5—UNSAFE WAYS OF RIDING ON RAILROAD CARS

a safeguard see that the safeguard is placed promptly, though the accident may be the first one of its kind in years.

Go over the recommendations of the plant-inspection committee, note each safety measure suggested, and put it into effect immediately or explain why it is not feasible—for instance, because it interferes with something else, must be postponed until relining, may not serve the purpose, or will cost too much. It can be accepted that many railings, toe boards, guards, steps, and signs will be

FIG. 6—SAFE AND UNSAFE SHOES

suggested, and that there will be futile recommendations. Before disapproving a committee's recommendation because of the cost, refer it to the management It will prove worth-while to concur in many apparently trivial suggestions, to avoid discouraging the men offering them and to encourage the submission of really valuable ideas. If a different method of work is recommended, try it if it seems practicable. If it is thoroughly impracticable or useless and cannot be tried, explain why.

Putting Recommendations into Effect

After the plant-inspection committee recommendations have been accepted and approved by the foreman's committee, they should be submitted to the superintendent for approval. Approved recommendations may be put into effect in two ways. The inspection committee may locate the accident risk most thoroughly, but the design and installing of adequate mechanical safeguards is work for a skilled mechanic who has the advice of men familiar with the particular risk. To delegate the responsibility for and installation of a safeguard to a group or a committee is to make it nobody's business. Place the responsibility for this on the master mechanic.

Recommendations that deal with unsafe practices are largely made effective through education and by example. Therefore, each active or past member of the inspection committee should be made to feel that it is as much a part of his daily task to work for safety by setting a good example, giving warnings, supervising the work, and contriving how to accomplish the intent of safety recommendations, as it is to execute duties that relate solely to plant operation. It has been found feasible, assuming that these committeemen are selected by reason of their rank, experience, or intelligence, to make them gang safety leaders and to give them some little authority and responsibility in matters relating to elimination of accident risk in methods of doing work. If this is practicable locally, it is a more desirable recognition of committee service than a "safety" lapel button or watch fob, and more effective in sustaining interest. The button or fob is useful chiefly as a token of such responsibility.

Responsibility of the Foreman

The final responsibility for safety work cannot be placed on committees, gang leaders, or workmen. Practicable results in safety cannot be obtained in that way any more than a plant can be run on such a basis. To put safety work on a sound and sensible basis the foreman must give the subject serious observation, study, planning, and direction, such as is given to operating work. The safety of the workmen always has been given foremost attention by foremen, but the reduction in accidents effected by many companies indicates that this attention has been concerned more with obviously dangerous factors than with injuries due to hand labor, use of hand tools, falls, falling objects, and similar causes incident to daily work. To these causes, however, the greater part of blast-furnace accidents is due. Following are the causes of accidents at blast-furnace plants, arranged in the order of their importance:—

1.—Hand labor.
2.—Hand tools.
3.—Flying and falling material.
4.—Falls of person.
5.—Burns from hot metal.
6.—Machines and machinery.
7.—Cranes, hoists, and rigging.
8.—Hat water and steam.
9.—Burns from cinder.

10.—Flames.
11.—Railroads.
12.—Asphyxiation.
13.—Slips.
14.—Illness (including intoxication).
15.—Hot flue dust.
16.—Electric machinery.
17.—Explosives.
18.—Fighting and playing.

If burns from hot metal and burns from cinder were grouped together they would rank third. Hand labor and hand tools cause over 40 per cent. of all accidents; if flying and falling objects and falls of person are included, over 60 per cent. of all accidents are represented; and if burns from hot metal and cinder are added, the total represents approximately 75 per cent. of all blast-furnace accidents. This shows where the accident problem lies. Effective prevention of accident from these causes requires study, observation, experience, and instruction. No one in the plant is more capable of doing this than the foreman, no one is in such close contact with the men, and no one can combine such work with operating supervision so advantageously and effectively.

Precautions to be Observed by Foremen

The following suggestions, which cover the dangers incident to different kinds of work about the blast furnace, are not intended to serve as rules, but as useful memoranda to foremen and workmen. It is not necessary to call in the men and discuss this matter with them from beginning to end; it is even of questionable benefit to call a crew together at their place of work and repeat a long string of "don't"; precautions can better be impressed on the men gradually and at opportune times. As the precautions given in these notes gradually come to be subconsciously in the minds of both foremen and workmen at their work, to that degree will the number of accidents permanently decrease.

Avoid employing a man whose language no one of your crew can speak. Do not place a slow, heavy man where a quick, active one is required, or a slow-thinking men where a quick-witted one is required, nor keep on the same job a man who gets hurt frequently in that occupation unless the labor supply is inadequate or men cannot be shifted. When a man is employed or put to work on a new job instruct him as to his work and how to avoid accidents, warn him of unusual or obscure danger, and then put him under the charge of the gang leader or "straw boss." You should consider yourself personally responsible for accidents that happen to your men from their ignorance of danger or of safe methods. Therefore, watch for dangerous practices, ignorance, lack of skill, and carelessness, and take the necessary steps to correct faults when first noticed. Most men can be taught and encouraged to use proper methods of work, but when necessary impress on the men by admonition, warning, suspension, or discharge your attitude against carelessness or indifference. Drill your men to report immediately when injured, however slightly; send an injured man to the doctor or first-aid man, and then investigate the accident at once and discuss it with the sub-foreman and workmen in order to bring out clearly the cause and impress it on their minds.

Where it is possible, make dangerous places safe rather than attempt to guard them with signs. Where signs are necessary accept the responsibility for placing them, see that they are in good condition and that they are used. Make it your business to see that machinery, hand tools, tackle, scaffolds, or any other appliances are safe. Do not allow men to start or operate machinery unless they are so authorized. Avail yourself of all safeguards provided for the men under your direction, such as goggles, leggings, and congress shoes, when on duty about the cast house or pig machine. Exhibit carefulness in necessary personal work with machinery, electrical and steam equipment, and hand tools. Place and use prescribed safeguards or signs. In this way you will be better able to insist that the men under you observe similar precautions.

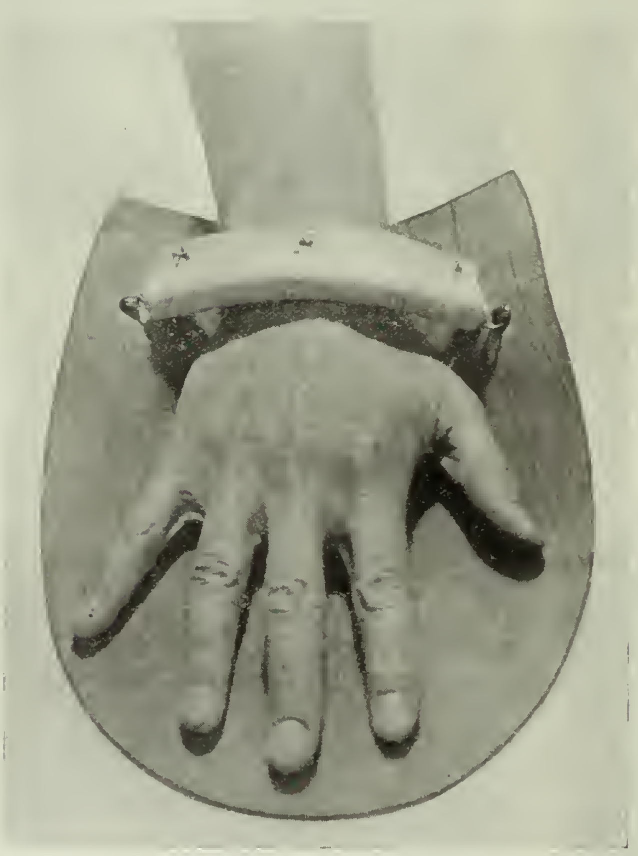


FIG. 7—SAFETY HAND LEATHER

Personally supervise any work involving unusual accident hazard, such as work in gas mains or cleaners, tearing out linings, work in the cast house and about the stoves, when blowing in or blowing out, or in event of a bad "mess" (piles of red-hot coke, slag, or iron spilled about the furnace, or in the yard, or on the tracks near the cast house), and any work about the bells or stock line. Don't allow men to go into any place dangerous from gas, falls, or falling material without breathing apparatus, safety belts and life lines, or watchers, as the nature of the work demands and circumstances permit. Never send inexperienced men to dangerous places or set them at hazardous work. Before sending or allowing men on top or where they will be exposed to material from slips, and escape is difficult, make sure that the furnace is not hanging. If the furnace is working stiff or slipping, the necessary precautions should be taken in regard to checking it or taking the wind off temporarily. Recognize that work about blast-furnace plants will still be hazardous, even after all safety measures have been taken and the force is at the "top notch" of training, skill, and carefulness. Impress this fact on the crew and insist on thorough instruction and care of every man by his gang boss.

On occasions, you will have to give detailed advice and directions to the workmen concerning dangers not here described. The more common dangers arise in work about gas-containing equipment, work about the furnace in event of a breakout, heavy scaffolding and slipping of the furnace, stopping the furnace, blowing in, loosing the water supply, and so on. Many other hazardous operations will occur to you. For such work a set of rules or notes intended for some particular plant conditions are futile or may even be dangerous unless varied to meet the situation. When unusual situations arise, safety depends on the measures taken by the foreman. Experience, coolness, and common sense are more essential than rules. Certain emergencies can be largely eliminated, however, by careful examination, forethought, and planning before undertaking dangerous work. At most plants it is the rule that, before any dangerous work is done, the superintendent and foremen together definitely determine the various steps to be taken. This should be the rule at every plant.

Following are some notes addressed to men in various occupations about the plant. Many of the men will be experienced in the different positions and know of all the principal dangers and practices mentioned. With such men all that is necessary is, when you notice them becoming careless or forgetful, to show them wherein they are becoming careless. In placing new men it is worse than useless to give them a large number of instructions as they will only be confused. Keep these notes in mind and give them general instructions and any special instruction you think they need at first. Then continue to instruct them from time to time and have the "straw boss," gang leader, or sub-foreman do the same. Personally supervise their work as much as possible, and take advantage of every opportunity to forcibly impress on their minds the advantages of safe practice. More and more, managements are valuing foremen by their care of the men as well as by their records for tonnage and cost. Keep the safety of your crew in mind always, and when you think of some new precaution in work or practice refer it to the superintendent at once and try to have it put into effect.

General Observations

If you see anyone in a dangerous place (Fig. 1), doing anything in a way liable to injure himself or others, clumsy in the use of tools, ignorant of danger, or ignoring the use of safeguards or safety rules, show him the danger and report the case if your warning is disregarded. Report at once unsafe equipment or tools, safeguards, or signs not in use or not replaced, and dangerous places unguarded. Watch other men's work for dangerous or unsafe methods, but be careful that your own work is done safely.

Keep things cleaned up. This is part of your work. Don't leave tools or materials on floors, platforms, or paths where they will obstruct work and make passage difficult (See Fig. 2). Take time to keep the steps and platforms you have to use free from ice, and to knock down overhanging icicles. Take care of the odds and ends of lumber, scrap, brickbats, coke, limestone, and ore you find about the yard. The majority of falls are on the ground level and are largely caused by rubbish underfoot. Watch where you step. Do no walk through steamy places unless it is necessary; if you must go, walk slowly. Don't work where your material or tools can drop without being sure that the space below is guarded by danger signs. On the other hand, don't walk where you know that material may fall on you; remedy the condition if possible.

FIG. 9 MAN FALLS FROM LADDER

FIG. 8—TAKING CHANCES ON A LADDER

In handling material such as ties, lumber, brick, bronze, castings, molds, plates, manhole covers, pipe, barrels, boxes, scrap, and pig iron, watch that nothing falls on your foot and be careful that your fingers are not caught. A large percentage of the accidents in blast-furnace plants happen in handling material. In using bars, sledges, wrenches, picks, and other tools, remember that many accidents occur by men being struck with them. Glancing, slipping, and falling tools cause still more accidents. In using common hand tools more skill and care is required to avoid accidents than with many kinds of machines.

Keep away from tracks if possible. If it be necessary to cross a track look both ways before starting across. If you must cross near a train, keep at least a car length from the end of the train, as it may start quickly, or there may be cars coming on the next track. Do not cross through a broken train unless the trainman motions you to come ahead or unless you are sure that there is no engine at either end. Take time to go around a train or to wait until it passes rather than to climb through (Fig. 3). Never crawl under a car. Avoid stepping on frogs, switches, or guard rails, as your foot may be caught. Don't move material with push cars unless guarded by a flag, and when working where a car might be shoved on to you, have a flag guarding the track approach. Don't ride on engines, cars (Figs. 4 and 5), or locomotive cranes, unless your job requires you to do so.

Shoes should fit snugly about the ankle and leg, and the soles should be thick and free from holes that will allow the sole of the foot to be cut by sharp objects and protruding nails. (See Fig. 6). Whenever you see protruding nails stop and hammer them flat. In handling rough lumber, sheet tin, or material having sharp edges, it is best to wear stout gloves. For handling rough scrap wear safety hand leathers (Fig. 7), not gloves, because in throwing the scrap down the rough edges may catch in your gloves and cause a bad wrench or fall.

Ladders should be provided with spikes or nonslipping pads and when in use should rest squarely on a level surface. Grasp the sides, not the rungs, of the ladder and face the ladder in going up or coming down. Don't attempt to slide down a ladder or to use one hand to carry tools, either ascending or descending. (See Figs. 8 to 10.) Defective ladders should be taken to the carpenter shop at once.

Defective tools should be taken to the shop as soon as the defect is noticed. Do not use a sledge, hammer, pick, or hatchet that is loose on the handle, has a mushroomed head, or a split or splintered handle. Bars and wedges should also be watched, and, if any defect be noticed, be laid aside for repairs. When sledging stand on the opposite side from the man holding the bar, so as to avoid hitting him. (See Figs. 31 and 32 in following issues).

Do not meddle with electric switches, water or steam valves, or gas connections; it may cause delays and even a bad accident. Do not touch any electric line or dangling or broken wires; you may get a severe electric shock. Wear gloves when changing or cleaning electric-light bulbs. Never turn on gas, steam, electricity, or water, or set machinery in motion with which you have no regular business unless you are specifically directed to do so.

Be watchful about the furnace. Gas may be escaping in many places and may

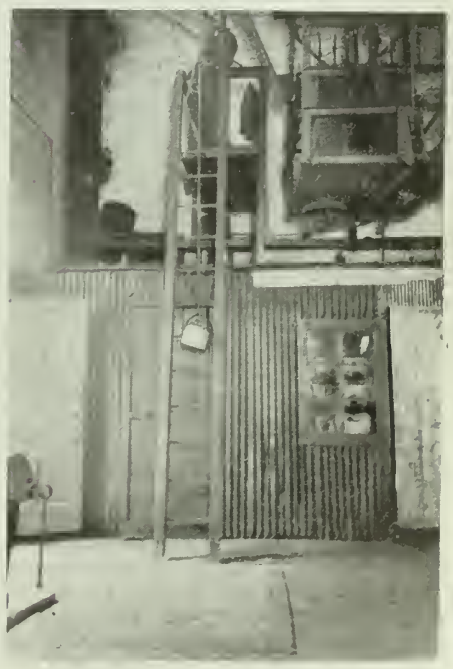


FIG. 10 THE SAFE WAY

kill you before you know it is present. the furnace may slip, the bosh or hearth of the furnace may break out, a tuyere may burst, or a blow pipe burn through, or there may be an explosion. Keep out of the cast house except when your work calls you there. The furnace crew can sometimes tell when these things are about to happen by signs with which they are familiar; at times they happen without warning. Stay at your own work and be safe. Keep away from the bottom of the dust catchers, from under the downlegs of gas mains, and off of manhole covers of gas flues. Avoid iron and cinder ladles while they are being filled, shifted, or poured. Do not go near a cinder granulating pit while it is in use and do not stand about gas burners or air doors of stoves. Never go on top of a furnace or gas washer unless under the direction of the foreman, or accompanied by some one. The tops of boiler settings, gas-engine basements, skip pits, and ore bins should be avoided unless your work take you there. Before you begin work in such places, or in any place where there is a possibility of danger, wait until the foreman has told you that it is safe to go. Satisfy yourself that the place has been made as safe as possible. Never look in the peep holes of the tuyere stocks unless it is part of your duty. Always be on watch when passing near the furnace. Remember that frequently it is impossible for the furnace men to tell when the furnace is going to slip.

Do not refuse safeguards, do not ignore rules and orders, or disregard danger signs. There is a reason for each and every one. Be sure to report every accident, even the slightest burn, cut, bruise, puncture, or substance in the eye, as this may prevent a trivial hurt from becoming a serious injury. Do not set bad examples by bravado, thoughtlessness, or negligence, for less experienced men to follow. Use common sense, foresight, and watchfulness. Those who cannot read and speak English should be urged to acquire a working knowledge of the language at the earliest opportunity. By so doing they will be in a better position to heed warnings and become acquainted with dangerous practices.

CENSUS OF MANUFACTURES

THE total census of manufactures in Canada during 1915 shows that the number of establishments has increased during the last decade from 15,796 to 21,291. The census was taken during 1914.

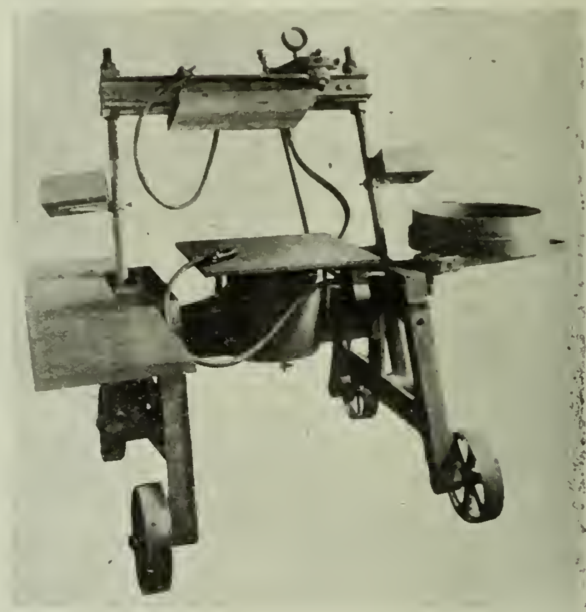
The total capital (including value of land, buildings, machinery, materials and stocks on hand and operating capital, owned or borrowed) has advanced from $846,585,023 to $1,984,991,427, or 134.47 per cent.

The total wages bill has likewise increased from $134,375,925 to $227,508,800, or 69.31 per cent., and the salaries bill from $30,724,086 to $60,143,704, an increase of 95.75 per cent. The value of products in 1915 was $1,393,516,953, an increase of $674,164,350 over 1905, or 93.85 per cent.

The total value of goods manufactured for war purposes actually completed and delivered during 1915 amounted to $130,466,307, a total which it is expected will be increased by several millions in the final return.

PNEUMATIC POWER SQUEEZER MOLDING MACHINE

A POWER squeezer of simple construction and efficient operation, designated as model "D," has been placed on the market by the J. F. Webb Mfg. & Supply Co., Davenport, Ia. It is designed to meet the high-speed requirements of present-day foundry operation, being so simplified that risks of breakdown are reduced to a minimum.

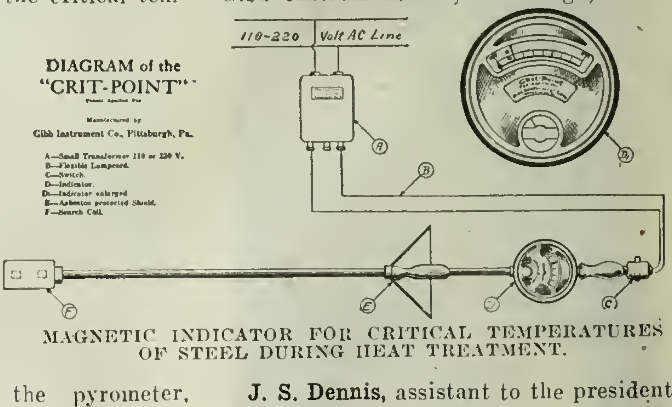

PNEUMATIC POWER SQUEEZER MOLDING MACHINE.

The main frame is formed of two side members connected by the cylinder casting, the strain rods which support the upper cross-arm being hinged to the lower part of the side members. The cross-arm carries the operating valve and control apparatus, these being clear of sand and convenient of operation. The maximum air pressure is controlled by an automatic valve which shuts off the air at any required pressure, adjustment being made immediately to any desired pressure.

Five sizes of this machine are built with cylinder diameters ranging from 8 in. to 16 in., and tables 16 in. x 16 in. to 24 in. x 36 in., all of the machines operating with air at 80 lbs. pressure per sq. in., giving total pressures of from 3,800 to 15,360 lbs.

MAGNETIC INDICATOR FOR CRITICAL TEMPERATURES

THE fact that steel loses its magnetic properties on attaining the critical temperature forms the basis on which has been designed the "Crit-Point," an instrument which infallibly indicates the instant when a body of steel has attained the decalescent or hardening point.



MAGNETIC INDICATOR FOR CRITICAL TEMPERATURES OF STEEL DURING HEAT TREATMENT.

In heat treating installations of the usual type, entire reliance is frequently placed on the permanent accuracy of the pyrometer, which is subject to variation through deterioration of the thermo-elements; the element of time demands consideration so that the steel may assume a uniform condition at the required temperature; the personal factor appears in determining whether the two foregoing conditions have yielded the result desired.

Trouble due to misapplication in any of these respects is entirely eliminated by the instrument referred to, which indicates the critical point, not as a degree of temperature, but as a non-magnetic state. The instrument consists of a contact box containing magnet and coils, mounted on one end of a rod provided with handles and heat shield. The other end of the rod carries a magnetic flux meter, the needle of which indicates the gradual approach of the steel to the non-magnetic, or critical point. Immediately contact is made with the steel in the furnace through the medium of the magnetic coils, the needle indicates the degree of magnetism in the metal, all knowledge of the actual temperature being irrelevant, so far as the indication of the critical temperature is concerned.

The makers of this instrument are the Gibb Instrument Co., Pittsburgh, Pa.

J. S. Dennis, assistant to the president of the C.P.R. has ben elected president of the Canadian Society of Civil Engineers, succeeding G. Herrick Duggan.

Specification Requirements of Munitions Material

By F. C. H.

One of the many beneficial results derived from the manufacture of munitions is the greatly increased appreciation, by engineering firms generally, of the benefits to be derived from judicious heat treatment of metals. In the automobile and steel making industries such procedure had been highly developed, but the applications of scientific thermal manipulations to every-day work had been more or less neglected. Future conditions may largely alter this state of affairs, so that heat-treating will ultimately assume its true position.

TO many of those engaged in the manufacture of munitions the reasons for accurate specifications with relation to metallurgy is not apparent. The common principles of heat treatment of carbon and alloy steels and non-ferrous metals are generally understood, yet there are many little points of interest and importance.

Large guns are made up of concentric wire-wound tubes of steel having the following composition:—

Condition of steel	El. limit lbs. per sq. in.	Tensile strength lbs. per sq. in.	Elongation in 2 in.	Carbon	Manganese	Chrome	Vanadium
Soft	35,400	78,800	24%	.40	.80	...	...
Hardened in oil	......	118,500	14%	...	...	...	...
1450° F. drawn 800	66,900	102,040	....	...	...	...	...
Soft	61,000	83,700	35%	.30	.50	.90	.20
Hardened	99,020	132,000	30%	...	...	...	...
Soft	63,660	103,440	26%	.50	.90	1.00	.20
Hardened	170,000	190,000	15%	...	...	...	...

These tubes are necessarily put under compression so that when the cartridge is exploded, with subsequent stresses, the elastic limit will not be exceeded and a reasonable factor of safety allowed.

The chamber pressure on the 18-pdr., 3 in., 6 in., 8 in., and 9.2 in. guns is from 26,880 lbs. per sq. in. to 33,600 lbs. per sq. in., and on rifles it is a little higher, possibly 45,000 lbs. per sq. in.

On this necessary chamber pressure is based the calculations which determine the requirements of the specifications. In the case of high explosive shells at the moment of explosion of propelling charge, the inertia of shell results in a sudden compressive force being applied through the base and this force tends to bulge the walls of shell which will occur if the shells are soft. For this reason, after high explosive shells are forged they should be stood on end to cool and a reasonable distance apart instead of being piled. This piling of hot shells would cause them to be softened by annealing. As there is no subsequent heat treating for high explosive as compared with shrapnel, defects are not developed as when grinding the latter.

Base plates have a test piece taken across the grain as well as one with the grain. The piece taken across is a check to be sure the material is not piped or seamy, as these defects occur principally at the centre. These plates are subjected to the same strain as the shell and specifications are similar.

Shrapnel Design

The shrapnel shell, while opposing the bursting charge due to its own inertia and being subjected to compressive stress, is also subject to tensile stress, due to the shrapnel bullets inside. In order that these bullets may be thrown forward the shell is designed with a thick wall at the base and this wall gradually tapers off to a thin point near the socket in nose. When the fuse explodes the charge, this thin wall bursts or spreads open, or the fuse threads are stripped. If the steel is too hard the shock of the explosion in the cartridge case will cause fracture with damage to the gun, and if the cartridge case is too hard, due to excessive zinc, permanent deformation will cause it to stick in the gun and prohibit its use over again after being refilled.

While specifications for shell steel have close limits, it should be possible to use steel of higher tensile strength but having good elongation. In this way it would be possible to use almost any analysis, getting the physical properties by heat treatment.

If the steel is hard and brittle, when the shell bursts the pieces break into many small parts, whereas, if the steel is tough, the pieces are larger and the edges are rougher, tending to tear instead of cut, thereby doing more damage.

Cartridge Case Requirements

If the brass cartridge cases vary much in the zinc content from 70 copper, 30 zinc, difficulties will be experienced in manufacture and the product will not permit of being loaded three times as specified.

Formerly, the French military specifications considered uniformity so important that they went so far as to specify where the spelter and copper should come from. The reason for this is doubtless the fact that the analysis must be correct to give a minimum of scrap during manufacture. The great loads to which this material is put during manufacture under 500 and 800-ton presses, for indenting and heading, necessitates punches made of the best of steel, capable of withstanding approximately 160,000 lbs. per sq. in. Carbon steel of about 1.25 per cent. carbon was used for the first two sections, as the punches were built up of water quenched sections, heating to 1475 deg. F. and drawing at 430 deg., F. The remaining portion of punches was .90 to .95 per cent. carbon steel.

In determining the capacity of presses required, crushers of brass were made and tested on a Riehle 100-ton testing machine and from these results the power of presses required was calculated.

The pressures required for operations were:—

Cupping and drawing about	15,000 to 40,000 lbs.
Tapering, 1st operation	8,000 lbs.
Tapering, 2nd operation	20,000 lbs.
Stripping after 1st oper.	3,000 lbs.
Strippin after 2nd oper.	11,000 lbs.
Stripping after heading	16,000 lbs.

Scleroscope Tests

Sclerescope tests were made from day to day on the material, and the results compared with analyses, the result being that only the raw material which came within the scleroscope hardness numbers of 20 and 25, was accepted and readings of either 15 or 30 caused rejections.

A test made on a cartridge case during and after every operation in manufacturing gave:—

Operation	Base	At ¼"	At 2"	At 5"	At 10"
Disc	16				
Cup—					
B	20—27	51—55			
A	19—21	21—23			
1st Draw:					
B	20—22	52—55	55—60		
A	19—20	19—23	19—23		
2nd Draw:					
B	19—20	52—55	55—60		
1st Indent:					
B	42—47	54—58	55—60		
A	18—20	18—20	18—20		
3rd Draw:					
B	20—24	51—55	60—65		
A	18—19	18—19	18—19		
4th Draw:					
B	18—20	43—50	55—60	55—62	
2nd Indent:					
B	33—40	50—57	55—60	55—62	
A	19—20	20—22	20—23	20—25	
5th Draw:					
B	20—22	47—52	53—58	55—65	
A	18—19	20—22	25—30	27—32	
6th Draw:					
B	18—20	50—55	55—65	60—67	65—70
Heading operation:					
1	50—55				
2	54—58	52—58	55—65	60—67	65—70
3	50—58				
Semi-annealing		52—58	45—55	45—50	55—63
Fin. Base:					
1	45—55	52—58	55—60	55—65	55—65
2	52—55				
3	48—55				

B = before annealing.
A = after annealing.

It is interesting to note the effect of annealing which is done at 1,200 deg. F. for 30 minutes, and to note how the hardness increases as the thickness of metal decreases.

If tensile test pieces are examined after being annealed at a high temperature, the surface is rough, showing the grain is too large and that there are cleavage cracks. Annealing at 750 deg. F. gives enlarged grain, and at 1380 deg. F. the grain size is about at the maximum allowable if the brass is to be of any commercial use.

The following table shows the physical properties for different annealing temperatures:—

Annealing temp. degs. Fahr.	Maximum stress tons per sq. in.	Elongation in 2 in.
As rolled	25.00	15.5
545	28.50	20.0
662	26.20	30.0
932	18.20	51.0
1166	17.00	58.0
1256	16.50	58.0
1382	16.00	63.0
1475	15.00	59.0
1500	15.00	59.0
1650	14.00	53.0
1690	13.00	25.0

If brass is held too long at a temperature above 1,300 deg. F., the metal will be greatly weakened. The most important factor is to anneal at the lowest possible temperature necessary to get the desired results.

The fuse material required is most interesting, as the manufacture and loading of this piece is difficult and exacting. There are several grades of brass, each of which is to be used for specified purposes.

Metal and Purpose.	Yield lbs. per sq. inch	Breaking Load, lbs. per sq. inch	Elongation in 2 inches and ½ inch dia.	Copper	Zinc	Lead
Delta Metal—Time and percussion, pellets and screw plugs	44,800	67,200	20	64.74	24.11	1.00
Hard Rolled Brass — Stirrup springs	13,440	26,880	10	60.00	38.0	2.0
Class A Metal—Ferrule and setting pin	44,800	67,200	20	70.00	30.00	....
Class B Metal—Rings	26,880	44,800	30	65.00	35.00	....
Class C Metal—Rings (alternative)	13,440	26,880	10	60.00	38.00	2.0
Class G Metal—Percussion pellets (alternative bodies)	17,920	44,800	20	65.00	35.00	....

Pellets and Other Details

The stirrup springs are stampings and hold the time and percussion pellets from arming on the time needle and ferrule respectively. The time pellet should arm at from 125 to 165 lbs. and the percussion from 77 to 99 lbs., while the ferrule arms at from 200 to 300 lbs.

The ferrule must be accurately made to give the correct weight, the analysis of the metal must be right, and the annealing accurately done for that analysis. The annealing, of course, varies as the analysis. If the zinc contents is high the metal will be harder and the temperature proportionately higher. This temperature varies from 890 deg. Fahr. to 1,200 deg. Fahr. and 15 to 20 minutes is allowed in the furnace, after which a water quenching bath is used.

Some manufacturers make these ferrules from brass tubing, some use bar stock, and some use sheet metal; cupping or drawing them out, chucking, cutting off the blind end, boring, putting on a mandrel and turning the outside. The last method is very slow and in this country possesses no advantage over the other two, which permit of an output of approximately 6,000 per day on one automatic machine. The other two methods are simply matters of cost as to which is the cheaper. In all three methods of manufacture the product is afterwards sized with a broach, and the percussion pellet which is also part of this arrangement is given the same treatment.

SECTION OF TYPICAL FUSE SHOWING PARTS REFERRED TO

These pellets are made of hard metal so that they will not deform on the explosion of detonator, thus causing the full force of explosion to be in the desired direction; recently they have been made of inferior metal, as the percussion pellets are reinforced by the ferrule which is in reality a band around it.

Action of Fuse

It may be of interest to know what happens in the fuse when the gun is fired. The time pellet by reason of its own weight straightens out the stirrup spring and the detonator is pierced, the flash igniting the powder in the flash hole in stem and carrying it to the powder train in top ring. The ferrule due to its own inertia straightens out the percussion stirrup spring and arms itself on the percussion pellet, the whole arrangement being kept from creeping onto the percussion needle by a spiral spring. When the shell strikes, if the time element has not previously taken effect, the resistance of the spiral spring is overcome and the detonator is punctured, the flash extending through the pellet plug, which has a hole bored through it, and the base charge ignited, causing the shell to explode.

On the American fuses there are no ferrules or stirrup springs. The time pellet has a groove left where the pellet plug is screwed in, and into this groove is placed a split brass ring, which must slip over the edge of groove before the detonator can be pierced. The percussion element has a small pendulum, which is thrown out by centrifugal force due to shell rotating; as this pendulum swings out, a needle, which is formed on the other end, is lined up to strike a detonator when the resistance of two small spiral springs is overcome.

Arming Resistance of Pellets

The theory on which the arming resistance is figured is on the maximum allowable chamber pressure and the weight of ferrules.

Suppose:—

The area of gun equals 8½ sq. inches; the chamber pressure equals about 15 tons.

Thrust of explosion in this area is against an 18-lb. shell.

If we find the amount of resistance of each grain of weight and multiply by weight of ferrule, we know what the set back of ferrule will be. The same argument holds good for the time pellet. Some specifications allow for a factor of safety to insure of the parts working, others do not.

The fuse bodies are cast in permanent moulds or chills, which give a closer, finer grained casting, free from gas holes and the increase in breaking strength is from 10 to 15 per cent., with 20 to 25 per cent. increase in elongation.

Sometimes the bodies are cast in green sand moulds and sized afterwards in a die, which gives a similar result to die casting, this alternative, however, being practiced with less success.

UNPREPAREDNESS

O'Flaherty: "Mister O'Sullivan, will ye stop and have a friendly discussion on the matter of Home Rule?"

O'Sullivan: "It's sorry I am, but it's not convenient just now."

"O'Flaherty: "And why not?"

O'Sullivan: "Why, to tell ye the truth, O'Flaherty, I haven't got me shtick handy."

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

RE-BUSHING GRINDING WHEELS

By F. B. Jacobs.

MANY large manufacturing concerns use a number of grinding wheels in various departments for rough grinding of castings and general purpose work. As the stands upon which these wheels are used are generally of different makes and sizes, it is not uncommon for the diameters of the wheel ends of the spindles to vary from 1-16 inch to ¼ inch or more. Thus, while 16-inch wheels might be used in several departments, it is necessary to carry a superfluous stock to accommodate the various size spindles. To overcome this difficulty many manufacturers make a practice of re-bushing their grinding wheels as occasion requires, thereby eliminating the necessity of carrying individual wheels for each department where the sizes of the wheel spindles vary. The wheels are ordered with the correct sized arbor hole to fit the largest spindle, and with proper facilities they can be readily re-bushed to fit the other sizes of spindles at slight expense.

The following method for performing the work in question calls for but a slight outlay for equipment, and the results will be found to be very satisfactory. The necessary tools are a cast iron disk or plate as shown in Fig. 1, and several plugs of the same diameter as the various arbors on which the wheels are mounted. The plate should be as large in diameter as the largest wheels used, and, for the sake of illustration, the plate shown is 20 inches in diameter, having three feet cast on it which allows setting level on an uneven surface should occasion require. The rough casting is mounted in a large lathe chuck and the face trued off, after which a ¾-inch hole is bored and reamed in the centre. The next step is to turn several grooves ¼ inch apart. These can be cut with an ordinary threading tool, and are used to set the grinding wheel central while re-bushing its hole. Two heavy lines are next scribed on the disk 90 degs. apart, and near these lines the circles are stamped 1, 2, 3, etc. Several plugs are now made with one end to fit the hole in the disk, while the diameters of the large ends should be 0.002 larger than the arbors on the grinding stands. This slight clearance is sufficient to allow the wheels to slip on freely. The large portion of the plugs should be one inch longer than the thickness of the grinding wheels. Thus, if wheels with 2-inch face are used, the plugs should be 3 inches as shown in the illustration.

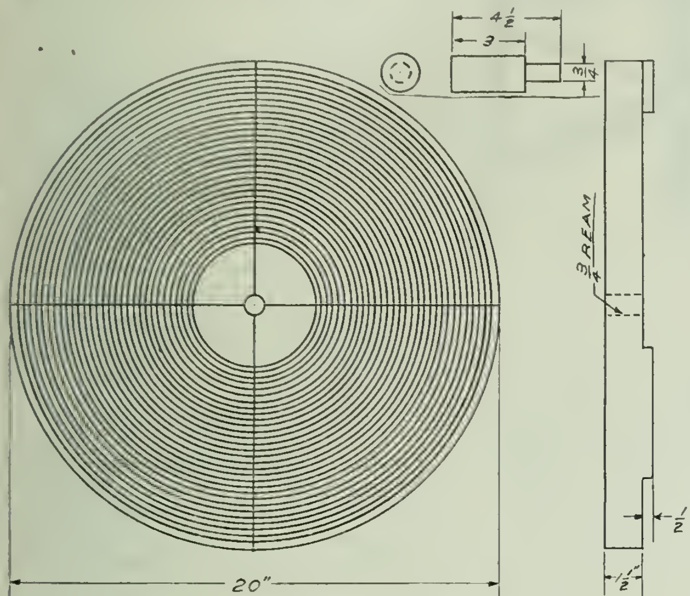


FIG. 1. REBUSHING GRINDING WHEELS.

FIG. 2. REBUSHING GRINDING WHEELS.

In re-bushing a grinding wheel, the first step is to cut out the present lead bushing with a compass saw as shown in Fig. 2. By making two cuts diametrically opposite, the bushing is easily removed by a few light taps with a hammer. The wheel is now laid on the disk and carefully set central by means of the nearest circle to its periphery. A plug of the correct size is next inserted and the new bushing cast in place. Lead is the best material for this purpose although any scrap stock of low melting point such as solder, die casting metal, etc., will answer the purpose equally well. The operation of re-bushing grinding wheels is so simple that any boy or handy man can do the work in a satisfactory manner, while the cost of the whole outfit should not exceed twenty dollars at the most.

CANADIAN IRON AND STEEL PRODUCTION

THE Dominion Department of Mines has received from the producers a record of the production of pig iron and of steel ingots and castings during the first eleven months of the year 1916, which, together with the estimates for December, show a probable production of pig iron in Canada during the twelve months ending December 31, 1916, of 1,171,727 short tons (1,046,185 gross tons), and a probable production of steel ingots and direct steel castings of 1,454,124 short tons (1,298,325 gross tons), of which 1,423,485 short tons were steel ingots, and 30,639 short tons were direct castings.

The production of pig iron in 1915 was 913,775 short tons and of steel ingots and castings 1,020,896 short tons, showing an increase in the production of pig iron in 1916 of about 28 per cent., and an increase in production of steel ingots and castings of over 42 per cent. The 1916 production is greater than that of any previous year, the second largest production of pig iron having been 1,128,967 short tons in 1913, and of steel ingots and castings 1,168,993 short tons, also in 1913. The production in 1916 during the first six months and monthly during the last six months was as follows in gross tons:—

6 months ending	Pig Iron	Steel Ingots	Direct Castings	Total
June	501,577	577,999	11,715	589,714
July	82,154	101,178	2,284	103,462
Aug.	78,450	108,889	2,299	111,188
Sept.	91,736	116,828	2,524	119,352
Oct.	101,436	126,577	2,924	129,601
Nov., partly est.	95,237	119,468	2,745	122,213
Dec. est.	95,300	119,930	2,865	122,795
Six mons. end. Dec.	544,313	692,970	15,641	708,611
Twelve mons. end. Dec.	1,046,185	1,270,969	27,356	1,298,325

TWIN MUFFLE FURNACE FOR HARDENING HIGH SPEED STEEL.

ONE result of the advent of munitions manufacture has been a very complet realization of the value of high speed steel not only economically when performing its duties as a manufacturing accessory material, but also intrinsically when values are increased and wastage prevails through defective treatment and careless usage.

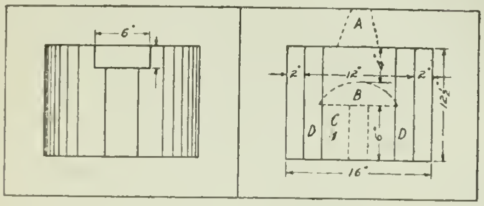
It is an actual fact that the shortage of this material which was threatened some time ago was in part due to carelessness and lack of facilities for proper hardening and in the course of events it was but natural that the onus of the situation would gravitate towards the makers as the source of the material. As the leading makers of high speed steel in this country, Armstrong Whitworth, Ltd., Montreal, were in a unique position to appreciate the factors of the situation, the result being that they have developed, and are now marketing a hardening furnace for high speed steel which enables the full benefits of this material to be obtained by the average user.

The furnace is of the twin muffle type and oil-fired, the appearance and construction being clearly indicated in the accompanying illustrations. Fig. 1 is a front view, the two chambers being of solid fire brick construction, built into an angle iron frame work, the whole being carried on a braced frame of the same material. The internal design is shown in Fig. 2. An opening A is provided at the back of each chamber, through which the oil and air mixture enters, the flame impinging on the curved surface of baffle brick B whence it proceeds around each side of the chamber and underneath the hearth C, finally

FIG. 1—FRONT VIEW OF TWIN MUFFLE FURNACE FOR HARDENING HIGH-SPPED STEEL

ascending past the semi-muffle walls D to the rectangular exit in the arched roof. This arrangement prevents the products of combustion from coming in contact with the work and insures a very even degree of heat throughout the chamber.

The twin chamber arrangement provides ideal conditions for the hardening of high speed steel. The left hand chamber is used for preheating purposes only, the steel being slowly and evenly heated to about 1400 deg. F. when it is transferred to the right hand chamber which heats it quickly to 2,200 deg. F., or over if necessary, to be followed by such quenching as is required by the material.



Individual control is provided for each chamber, and low pressures are employed, the air being at 2 lbs. per sq. in. and the oil at 10 lbs. per sq. in., so that gravity feed can be used in the majority of installations.

FOUNDRYMEN'S CONVENTION AND EXHIBITION

THE Annual Convention of the American Foundrymen's Association will be held at Boston, Mass., during the week of Sept. 24. Concurrent with this meeting will be conducted the exhibition of foundry equipment and supplies, machine tools and accessories in the Mechanic's building, which affords a display floor area of approximately 80,000 square feet.

This is the second time in the history of the American Foundrymen's Association that it has selected New England for its meeting place, the previous Convention having been held at Boston in 1902. At that time, the membership of the American Foundrymen's Association was only a few hundred, whereas at present the enrolment is considerably over 1,000. In addition to the meeting of the American Institute of Metals will hold its Annual Convention at the same time and place.

Electric Drive in Steelworks.—The progress made by electric driving in steelworks in the United States has been remarkable during the last ten years. In an article in the "Electric Journal" Brent Wiley points out that for a period of eight years prior to 1914 the number of installations in American steelworks averaged 25 per year, totaling 33,750 horse-power, including 300 horse-power motors and larger. During the last two years the number of installations has increased very rapidly, including approximately 125 units, totalling 200,000 horse-power, which represents an addition of more than 65 per cent. of the drives installed from 1906 to 1914.

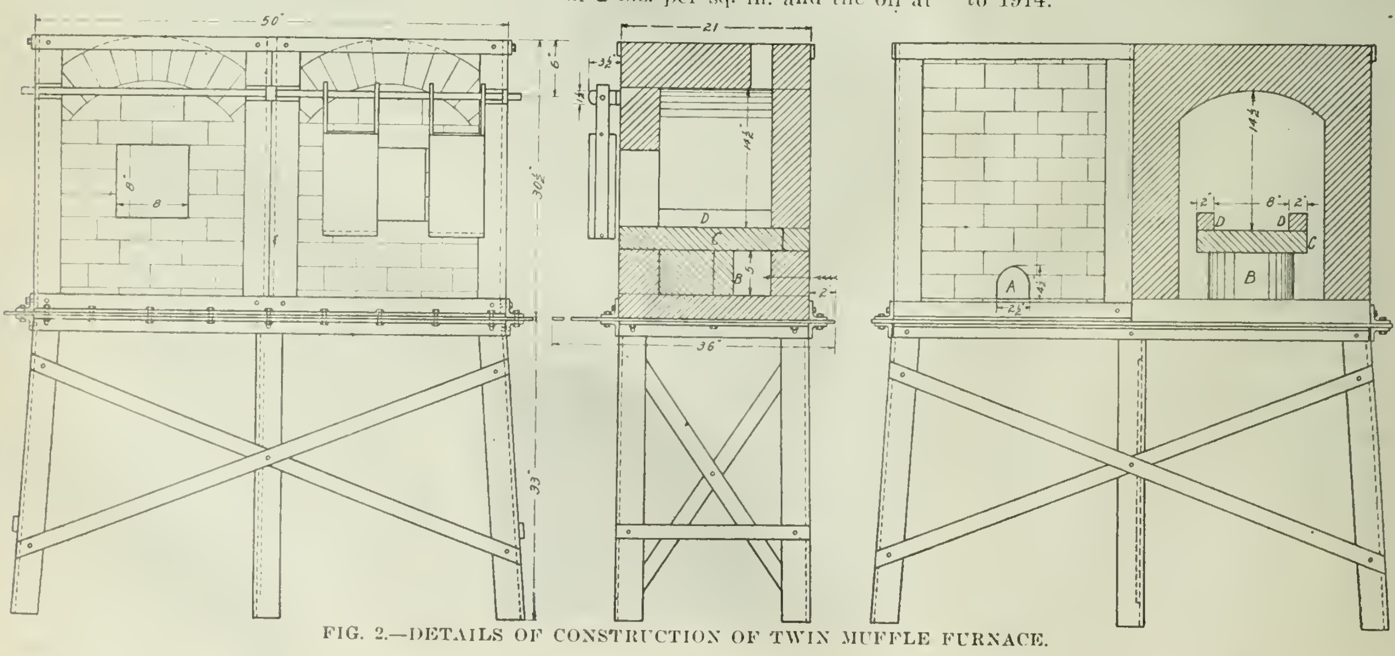


FIG. 2.—DETAILS OF CONSTRUCTION OF TWIN MUFFLE FURNACE.

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PRINCIPAL CONTENTS

IMPAIRED STEEL PRODUCTION

ASIDE from the war news of the past month, steel, whether relative to its commercial importance or stock market standing, continues to play fast and loose with both reason and calculation. Germany's note of "frightfulness" has naturally had some effect on a situation already sufficiently acute; at the same time, we may not lose sight of the fact of its being but an incident in a day's happenings. The output of steel, both for munitions and commercial requirements, tends toward further restriction, and indications are that still lower records are in sight in the immediate future. Coke, a front rank essential in the production of steel, is both high in price and scarce, the two being interdependent. The scarcity is, however, largely due to congested transportation facilities, which appear to be growing steadily, although perhaps imperceptibly worse. What is true of the steel situation as a whole on the North American continent is equally so of that more specifically Canadian, although such concerns as the Steel Company of Canada and Algoma Steel Corporation are perhaps most directly affected in the matter of fuel for metallurgical purposes. It should, of course, be borne in mind that no small contributory to the railroad congestion prevailing is the circumstance of our being meantime in the grip of mid-winter storms and frosts, each of which contributes its quota to the magnification of other disabilities incidental to an altogether abnormal time.

Steel for shells may be said to still constitute by far the major portion, if not practically the total output of more than one of our four big steel plants. It is understood, however, that neither of them are producing the scheduled quantity, largely because of the highly abnormal transportation situation which has been allowed to develop and become a menace to our metal-working industries generally, whether munitions-engaged or otherwise. We are, of course, importing steel from the United States, but, even from that source, transportation troubles militate against even moderately prompt receipts. Our finishing plants, as a result, are in many cases operating below their rated capacity.

As an example of the extreme acuteness of the steel situation, particularly as regards munitions requirements, it may be stated that considerable credence was placed in an early month report of action taken by the Imperial Munitions Board relative to modification of the urgency of the steel requirements—shapes, for the $90,000,000, one-time known "mystery block" at corner of Yonge and College Streets, Toronto. The action taken was imaginary, just as is the "mystery" regarding the concern about to erect the "block" or departmental store. This latter, we might state, will be both costly and pretentious when wholly complete as planned, involving as it does a capital outlay of $90,000,000, covering an area bounded north and south by College and Hayter Sts., and east and west by Yonge and Terauley Streets, and rising to a height of 15 storeys. One unit only of 9 storeys, constituting about one-sixth of the structure at that height, and involving an expenditure of $10,000,000, is meantime to be erected, and for this the steel is on order. Actual construction is not being pushed, however, a circumstance amply borne out, when it is known that delivery of steel (Bethelehem) is entirely at mill convenience; that rolling is not expected to begin until July of this year, and erection under the most favorable general conditions until July, 1918.

Steel is, nevertheless, scarce, and as an instance of how imperative are the requirements for munitions, it may be stated that two Canadian corporations specializing in both heavy, medium and light forgings, in addition to other products, finished and semi-finished, have had to decline tenders for the supply of forgings incidental to the requirements of our marine engineering and shipbuilding plants. The forgings in question have had, as a result, to be imported from the United States.

The downward trend in market values of Canadian steel stocks may be reckoned as healthful, whether "Peace with Victory" for Britain and her Allies be imminent or otherwise. Profits on munitions production are comparatively lean, whatever the particular line or lines being manufactured, and we look to see the price recession reach rock-bottom foundation well in advance of a cessation of hostilities. Under such circumstances, and only so, will the peace time readjustment period be brief, and abnormal dislocation of industrial enterprise in Canada be avoided.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

PROTECTION OF IRON BY ELECTRO-PLATING—II.*

By O. P. Watts and P. L. Deverter.

In addition to the quotation already cited in favor of a coating of zinc under brass or copper plating on iron, the same journal contains the following:—"Neither copper, brass or nickel gives a successful coating upon steel that will resist atmospheric influence and prevent the formation of rust. The large hardware manufacturing companies have realized these facts and are at the present time giving their product a preliminary coating of zinc from an alkaline cyanide zinc solution which is followed by direct deposition of copper, brass or nickel, or coating the zinc with copper or brass and then nickel plating. This method is the most effective for all purposes of plating upon steel when exposed to dampness or the action of salt air."

In view of such favorable reports from practical platers concerning the protective effect of a deposit of zinc beneath copper or brass plate, it was deemed advisable to test such double plating. Specimens were therefore prepared as shown in Table IX.

Table IX—Double Plating on Iron.

No.	Metal	Time Min.	Temp.	Amp./dm.2	Thickness Inches	m.m.	Amp. Hr./dm.2	Cur. Eff.
15	Zinc	3	Cold	14.35	0.00041	0.0104	0.72	70.2
	Copper	15	Hot	7.18	0.00107	0.0272	1.79	47.3
16	Zinc	1	Cold	12.95	0.00012	0.0034	0.21	86.3
	Copper	20	Hot	5.95	0.00145	0.0368	1.98	70.0
20	Zinc	3	Hot	4.88	0.00018	0.0045	0.24	87.3
	Copper	15	Hot	7.32	0.00119	0.0304	1.83	50.5
17	Zinc	1	Cold	13.85	0.000157	0.0040	0.23	85.8
	Brass	25	Hot	12.15	0.00327	0.0832	5.5	58.3
18	Zinc	3	Cold	12.27	0.00040	0.0102	0.61	85.6
	Brass	20	Hot	11.7	0.00186	0.0473	3.9	48.4

The results of weathering in Table X show slightly better protection by double plating than with the same total thickness of brass or copper alone. Had the zinc deposits been free from blisters, it is probable that the results would have been still more favorable to the double deposit. The final rusting of every sample of double coating is in marked contrast to the complete protection afforded by zinc alone.

The zinc in No. 17 is nearly as thick as in Nos. 19 and 21, which gave perfect protection. The result of covering the zinc in No. 17 with 0.003 inch of brass has been to nullify the protective action of the zinc and to induce rusting at nearly the same rate as Nos. 6 and 7, which were without the coating of zinc.

A detailed comparison of the other double deposits with the single coatings leads to a similar conclusion. The protective effect of the zinc coating is almost, if not completely, nullified by plating it over with brass or copper. The reason for this is easily seen. Zinc protects by galvanic action at the expense of being itself corroded. It should be noted that the relative size of the surfaces of the two metals is a factor of tremendous importance in determining the extent of the corrosion or protection of one metal by contact with another.

In No. 19 the surface is zinc, with here and there a pin-hole exposing a minute bit of iron. The corrosion of zinc necessary to protect these microscopic surfaces of iron is so small in amount, and is applied to so large a surface of zinc, that a deposit of the latter only 0.0002 in. (0.005 mm.) thick can protect the iron for months, if not years, against ordinary atmospheric corrosion.

In No. 20 such a deposit of zinc has been copper plated, with here and there a pin-hole through which the zinc is exposed. (The iron may or may not be exposed—the results as regards rusting will be the same). Each pin-point of exposed zinc plate is surrounded by a relatively enormous surface of copper cathode, and, in its endeavor to protect the copper against corrosion and tarnish, the zinc is soon entirely dissolved, exposing the iron beneath it. This, like the zinc, acts as anode toward copper, and rusting is the result.

Such a sub-coating of zinc can at best only slightly delay the rusting of iron plated with brass, copper, nickel, etc. If this practice is to be followed the zinc deposit should be made as thick as possible, in order to lengthen its life when once it is exposed and begins to act as anode. What is needed is a non-porous coating of nickel, brass or copper. Whether or not this can be obtained without going to extreme thickness found necessary in these experiments is for someone of wider experience than the writers to say.

Porosity of Electro-Deposits

The prompt rusting of the iron beneath the thinner deposits of all the metals except zinc seemed to indicate either that such deposits are porous in structure, or that there are small holes at certain points which leave the iron exposed. To study this question use was made of an ingenious yet simple method employed by W. H. Walker for detecting holes in tin plate.

A one and a half per cent. solution of agar was prepared, and to each hundred cubic centimeters of this, 7 c.c. of a one per cent. solution of potassium ferrocyanide was added. The samples of plated iron were placed in a shallow glass dish and covered with the hot solution, which quickly set to a stiff jelly. In a short time numerous blue spots appeared on the thinner deposits.

With copper-plated iron the action is as follows: Whenever there is a crack or hole in the plating a galvanic cell is formed in which the exposed iron as anode goes into solution in the ferrous state, and is precipitated as Turnbull's blue, just as when a solution of potassium ferrocyanide is added to the solution of a ferrous salt in a test tube. The results of this test are shown in Table XI. As these deposits were not weigh-

Table X—Results of Weathering on Double Plating.

No.	Amp.	Hrs./dm.2	Inches	Days required for rusting.
17	0.22	Zinc	0.000157	53, slight; 70, six rust spots on one side.
	5.5	Brass	0.00327	
18	0.61	Zinc	0.00040	40, slight; 70, shows 25 rust spots.
	3.9	Brass	0.00186	
15	0.72	Zinc	0.00041	14, slight; 70, much rusted.
	1.79	Copper	0.00107	
16	0.21	Zinc	0.00013	20, slight; zinc blistered and broken in 70 days, rusted in such spots.
	1.98	Copper	0.00145	
20	0.20	Zinc	0.00018	14, slight; 70, many blisters and rust spots.
	1.83	Copper	0.00012	
35	0.33	Zinc	0.00019	72, slight; 122, eight rust spots.
	0.92	Copper	0.00062	
35a	0.33	Zinc	0.00019	53, slight.
	0.92	Copper	0.00062	

*From a paper presented before the annual meeting of the American Electro-Chemical Society.

ed their thickness can only be estimated by a comparison of the ampere hours per square decimeter with those of Tables I, II, and IV.

All of the deposits were found to contain pin-holes with the exception of the brasses, but unfortunately no deposits of brass less than 0.55 ampere hours per square decimeter were prepared for this test. Copper coatings up to 0.47, and nickel up to 1.81 ampere hours per square decimeter, contained pin-holes, but thicker deposits were free from them.

Table XI—Ferroxyl Test for Porosity.

Deposit	Time, min.	Temp.	Amp. dm.2	Amp. Hrs. dm.2	Blue-spots
Copper	1	Hot	5.5	0.09	Several
Copper	3	Hot	4.8	0.24	Few
Copper	5	Hot	5.6	0.47	None
Copper	10	Hot	5.6	0.94	None
Copper	20	Hot	5.9	1.99	None
Copper	40	Hot	5.9	3.91	None
Nickel	3	Hot	5.0	0.25	Many
Nickel	5	Hot	5.0	0.41	Many
Nickel	10	Hot	5.3	0.90	Many
Nickel	20	Hot	5.4	1.81	None
Nickel	40	Hot	5.1	3.4	None
Brass	3	Hot	11.1	0.55	None
Brass	5	Hot	10.4	0.87	None
Brass	10	Hot	11.8	1.96	None
Brass	20	Hot	11.8	3.93	None
Brass	40	Hot	11.3	5.65	None

The remarkable protection afforded by very thin deposits of zinc must be due entirely to galvanic action, unless zinc coatings are free from the holes which have been shown to exist in thin deposits of all other metals tried in these experiments. The ferro-cyanide test cannot be applied to zinc coatings, however, since any exposed iron would be cathode, therefore would not dissolve, and so would not make its presence known by the blue precipitate. A test for the detection of pin-holes in electro-galvanizing, for which we are indebted to Prof. Walker, consists in immersing the strips of galvanized iron in a hot, strong solution of sodium hydroxide. Wherever a bit of iron is exposed it becomes the cathode of a voltaic cell, and hydrogen is evolved from it. The results of these tests are given in Table XII.

Table XII—Porosity of Zinc Deposits by Sodium Hydroxide.

Deposit	Time, Min.	Temp.	Amp. dm.2	Amp. Hrs. dm.2	Bubbles showing porosity
Zinc	1	Cold	12.1	0.20	Many
Zinc	3	Cold	16.6	0.83	Many
Zinc	5	Cold	11.8	0.98	Few
Zinc	10	Cold	9.1	1.52	None
Zinc	20	Cold	10.0	2.33	None

Table XIII—Porosity of Zinc Deposited on Aluminum.

Questions and Answers

Question.—When nickel-plating medium-sized articles which are placed on holders made of brass wire, we notice that the pieces on the lower arms of the holder receive a heavier deposit in a given time than the piece upon the upper arms. We have tried several methods of preventing this result, but all have proved of little value. Can you suggest a remedy which would be practical for general commercial purposes?—C. B.

Answer.—In a nickel bath, as the metal passes into the solution, the layer of liquid around the soluble anode becomes gradually heavier. Electrolysis is accompanied by a tendency to the separation of the liquid into more or less definite layers. This condition becomes particularly evident in continuous runs. The heavier solution surrounding the lower portion of the anode is, therefore, a better conductor than the lighter layer surrounding the upper portion of the anode. An excess, or rather undue proportion of the electrical current, is thus conducted through the lower strata of solution to that portion of the cathode which is immersed sufficiently deep to enter it, and in this manner uneven deposits are produced. If the electrolyte be occasionally stirred, this stratified condition is removed temporarily, but for commercial plating this means of dealing with the condition is impractical. You will, however, find the following method quite satisfactory and inexpensive:—Drill a three-eighth inch hole, one inch deep, in the centre of the lower end of every alternate anode in the bath. Bend a piece of three-sixteenth inch soft iron wire in the centre, and place the portion of wire which has thus been doubled in the drilled hole. Solder the wire securely to the anode. Bend the wire in such a manner as to clear the anode and carry the two ends upward to the negative rod of the tank and form a hook over the rod with a V-shaped bend. Allow wire enough to raise the hook at upper end of anode free from the negative tank rod. Insulate the upper hook with a piece of rubber hose, also insulate the iron wire over its entire length except where in contact with tank rod, using asphalt enamel, or a bitumastic solution similar to ordinary nickel tank lining. The ends of iron wire may be either copper, brass, or nickel-plated to prevent corrosion. The nickel bath being equipped with anodes, as described above, you will have less annoyance from uneven deposits. The anodes will require overhauling occasionally, but the improved results will warrant the attention necessary.

* * *

Question.—I have seen a turkey's foot metalized and used as an umbrella handle. Can you tell me the process by which this kind of work is accomplished?—S. M.

Answer.—Prepare a solution of nitrate of silver, 1 oz., in 12 oz. of denatured alcohol. Warm the solution slightly and dip the article to be treated; then allow to dry in the air at ordinary room temperature. When dry, apply a solution composed of 1 oz. yellow phosphorus and 12 oz. carbon bisulphide by spraying or dipping; then allow to dry. The latter solution will reduce the metallic silver, and when well dried, the article may be placed in the copper bath and a shell of copper deposited upon it. Coloring in silver or gold bath, as desired, follows. We would advise experimenting upon a few pieces before attempting to metalize anything of sentimental value.

* * *

Question.—Please inform me of the cause of "pitting" of nickel-plate, and a practical remedy for the trouble.

Answer.—There is a great diversity of opinion regarding the caused of pitted nickel deposits, and we firmly believe there are at least several causes, but the more common sources of the trouble appear to be either a deficiency of metal in solution or an excess of acid. Either causes an excess of hydrogen gas upon the surface of the cathode, which results in numerous spots or holes; the deposit is, therefore, actually perforated. The remedies are also numerous, some being really absurd. The writer has met with excellent satisfaction by treating the difficulty in the following manner:—First, test the solution for acidity. If it shows excess of acid, remove a barrelful and inject clean live steam into it until temperature is raised to at least 180 degs. Fah. Next add 1 oz. of nickel carbonate for each gallon of solution contained in both the tank and barrel. Stir the solution in the barrel for several minutes after adding the nickel carbonate, and then return the warm solution to the tank, after which the whole should be well stirred and electrolyzed with full strength of current available for at least two hours. Allow solution to remain undisturbed overnight and proceed as usual in the morning. If the metallic content of the bath is poor, add 3 oz. of nickel sulphate to each gallon and test for acidity after the addition is made. Before making any alterations to the nickel solution, assure yourself that the metal being plated is not imperfect. Very often the minute holes are scarcely discernible, and require a strong glass to reveal them. A second polishing operation usually removes them unless they penetrate the metal very deeply.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey Forge, Pittsburg	$29 95	
Lake Superior, charcoal, Chicago	33 75	
Standard law phos., Philadelphia	53 00	
Bessemer, Pittsburgh	35 95	
Basic, Valley, furnace	33 00	
	Montreal	Toronto
Middlesboro, No. 3	.....	.....
Cleveland, No. 3	.....	.....
Clarence, No. 3	.....	.....
Victoria	.....	.....
Hamilton	.....	.....

FINISHED IRON AND STEEL

Per Lb. to Large Buyers.	Cents
Iron bars, base	$4 00
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 25
Small shapes, base	4 75

METALS

Aluminum	68
Antimony	35
Cobalt, 97% pure	1 50
Copper lake	38 00
Copper, electrolytic	38 00
Copper, casting	38 00
Lead	11 00
Mercury	100 00
Nickel	50 00
Silver, per oz.	79
Tin	58 00
Zinc	13 50

Prices Per Lb.

OLD MATERIAL.

Dealers' Buying Prices

	Montreal.	Toronto
Copper, light	$22 00	$21 75
Copper, crucible	26 00	25 25
Copper, heavy	26 00	24 50
Copper, wire	26 00	25 00
No. 1 mach. comp'n	21 50	20 50
No. 1 comp'n turn's	18 50	17 00
Heavy melting steel	13 50	15 00
No. 1 mach'y cast iron	21 00	16 00
New brass clippings	17 50	17 00
New brass turnings	15 00	15 00
Heavy lead	8 00	8 50
Tea lead	6 00	6 50
Scrap zinc	8 50	8 50
Aluminum	36 00	35 00

COKE AND COAL.

Solvay foundry coke, on application	
Connellsville foundry coke.	
Yough steam lump coal	8 50
Pittsburg steam lump coal	8 50
Best slack	9 00

Net ton f.o.b. Toronto.

BILLETS.

	Per Gross Ton
Bessemer billets	$65 00
Open hearth billets	65 00
Forging billets	85 00
Wire rods	70 00

F.o.b. Pittsburgh.

PROOF COIL CHAIN.

¼ inch	$9 45
5-16 inch	9 10
⅜ inch	8 35
7-16 inch	7 15
½ inch	6 95
9-16 inch	6 95
⅝ inch	6 80
¾ inch	6 70
⅞ inch	6 55
1 inch	6 40

Above quotations are per 100 lbs.

MISCELLANEOUS.

Solder, guaranteed	0.35
Babbitt metals	.11 to .60
Putty, 100-lb. drums	3.35
Red dry lead, 100-lb. kegs, per cwt.	13.87
Glue, French medal, per lb.	.25
Gasoline, per gal, bulk	0.29½
Benzine, per gal., bulk	0.28½
Pure turpentine, single bbls.	.71
Linseed oil, boiled, single bbls.	1.15
Linseed oil, raw, single bbls.	1.12
Plaster of Paris, per bbl.	2.50
Plumbers' oakum, per 100 lbs.	8.00
Lead wool, per lb.	.13
Pure Manila rope	.29½
Transmission rope, Manila	.37½
Drilling cables, Manila	.32½
Lard oil, per gal.	1.35

SHEETS.

	Montreal.	Toronto
Sheets, black, No. 10	$5 50	$6 00
Sheets, black, No. 28	4 50	6 15
Canada plates, dull, 52 sheets	5 75	5 75
Canada plates, all bright	7 50	7 50
Apollo brand, 10¾ oz. (galvanized)	7 25	7 25
Queen's Head, 28, B.W.G.	7 75	7 75
Fleur-de-Lis, 28, B.W.G.	7 45	7 35
Gorbal's best, No. 28	8 25	7 50
Colborne Crown, No. 28	8 00	6 75
Premier, No. 28, U.S.	7 75	7 20
Premier, 10¾ oz.	8 00	7 50

ELECTRIC WELD COIL CHAIN B.B.

3-16 inch	$11 70
¼ inch	8 40
5-16 inch	7 40
⅜ inch	6 35
7-16 inch	6 35
½ inch	6 35
⅝ inch	6 35
¾ inch	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, net; B and C, 20 and 5 per cent.; east iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples 72½; malleable, lipped union 60.

ANODES.

Nickel	$0.50 to	$0.54
Cobalt	1.75 to	2.00
Copper	.44 to	.46
Tin	.62 to	.64
Silver, per oz.	.82 to	.84
Zinc	.18 to	.20

Prices per lb.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper carbonate, anhy.	.35
Copper, sulphate	.17½
Cobalt, sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate ....(per oz.)	.55
Silver nitrate ....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130 per cent.	.41
Sodium cyanide, 98-100 per cent.	.32
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$2.25
Polishing wheels, bullneck		1.35
Emery composition	$0.12 to	.14
Pumice ground		.04
Emery composition.	.08 to	.09
Tripoli composition	.04 to	.06
Crocus composition.	.07 to	.08
Rouge, powder	.30 to	.35
Rouge, silver	.35 to	.50

Prices per lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Toronto, Ont., Feb. 1.—The outstanding feature is the railroad situation. It is undoubtedly more serious, as the shortage of transportation facilities is hampering manufacturing operations to a greater extent on account of the difficulty in obtaining raw materials and coal. Cars continue to be held up and shipments delayed, notwithstanding the efforts that are being made to secure relief. The railways are handicapped by a shortage of cars and labor, while the severe weather has made operating conditions more difficult to control. Passenger schedules have been reduced to provide additional motive power, and a strong effort is being made to cope with the situation.

Steel

An acute situation has developed in the iron and steel trade on account of the transportation difficulties and consequent scarcity of coke. Supplies of coke are so difficult to obtain that furnaces cannot be operated at capacity, and the output of steel is, therefore, restricted. Practically the entire output of the mills is required for munitions, and wire and wire products for export, thus leaving a very small tonnage to meet the domestic demand. In this respect the situation is getting worse owing to the reduced production, causing considerable inconvenience to domestic consumers. This, however, is unavoidable, as war requirements have first call on the mills. All the steel companies have heavy commitments for this year, and have also considerable tonnage on their books for 1918. The situation is, therefore, very strong, and there is no indication at present of any weakness. Although steel prices are at a high point, there is every possibility of further advances, particularly in some lines, if they are to reach levels in keeping with the cost of raw materials. Prospects of an early peace having been dissipated, the steel market has assumed renewed strength, which will no doubt be maintained until final peace suggestions are renewed. When this desirable condition materializes, negotiations will doubtless cover an extended period during which time the market will become to some extent adjusted in accordance with the new conditions, and prices will probably be more or less stationary for a time before any pronounced weakness develops in the way of lower values. In the meantime, export demand continues good, but the steel companies are experiencing much difficulty in filling orders owing to the scarcity of raw materials. Deliveries are more backward than ever, for the reasons stated above, particularly on plates and wire rods, for which there is a heavy demand.

The meantime developments in the steel market in the United States tend to a belief that capacity production is

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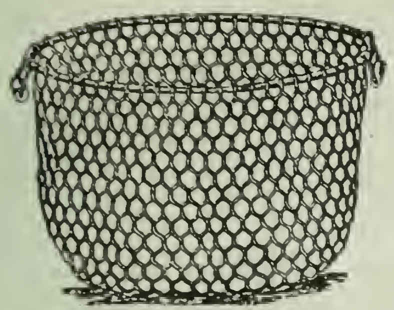

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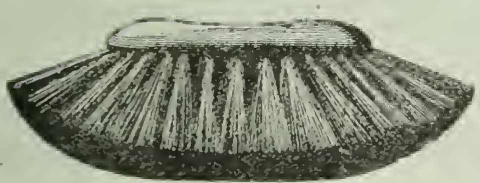

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HAMILTON ONTARIO CANADA

unlikely, at least for several months. Railway embargoes have resulted in a curtailment of steel production, and the mills are falling behind on deliveries. Shortage of cars has resulted in supplies of coke being cut off, seriously affecting the mills by lowering production and restricting the shipment of finished steel. Prices of raw materials, such as ferro-manganese, speigeleisen and ferro-silicon, are advancing, while coke and labor costs are also higher.

Pig Iron

The pig iron situation is getting more acute owing to the shortage of coke, which is affecting furnaces both in Canada and the United States. The Steel Company of Canada have let one furnace down, while the other is only operating at about two-thirds capacity. As the furnace which is not in operation was producing foundry iron, there is practically no domestic pig iron of this grade to be obtained. The furnace which is in operation is producing basic pig iron for steel-making. Grey iron foundries are also suffering from the shortage of coke, and some plants have been obliged to shut down. It is reported that over twenty furnaces in the Pittsburgh district have shut down owing to the coke situation. Canadian consumers are buying considerable tonnages of pig iron from United States' furnaces. No quotations are obtainable on Canadian pig iron, and United States grades are unchanged.

Scrap

The market for scrap is firm and steady, with prices unchanged. The embargo on the export of steel turnings has been lifted again, but is still in force on other steel scraps. Stocks of steel turnings have accumulated, and there is a greater supply than can be used. There is a continued heavy demand for heavy steel scrap, and prices are holding very firm. Ingot metals are firmer, with a fair demand.

Metals

The elimination of peace talk has had a favorable effect on the metal market, and the situation generally has improved. There is a firmer undertone throughout, and advances have been registered in tin, lead, antimony and solders. Business locally continues very good, and the trade is in a prosperous condition.

Copper.—There has been very little copper offered for sale lately, and second-hand metal is off the market. The position of copper continues to be a very strong one, and higher prices appear to be likely. Quotations are still nominal, and are unchanged at 36c per pound.

Tin.—The advance in London has been reflected in higher prices here, although New York is unchanged. Tin is now quoted locally at 47½c per pound.

Spelter.—There is an improved sentiment in the market, and a better demand for spelter. The outlook, however, is unsettled, as spelter would be adversely affected by further peace proposals. Local price unchanged at 13½c per pound.

Lead.—The market is strong and quotations nominal. The "Trust" is holding the price at 7.50c New York, but the "Independents" are quoting 8c to 8¼c New York. Quotations locally have advanced ½c, and lead is now 10c per pound.

Antimony.—Quotations are higher, but nominal with a strong market, due to improved demand. Antimony is now quoted at 20c per pound.

Aluminum.—The market is dull and easy, with quotations unchanged at 68c per pound.

Solders.—The advance in tin and lead has been followed by higher prices on solders. The new quotations are ¼c per pound higher.

TRADE GOSSIP

Wingham, Ont.—The Western Foundry Co. contemplate an addition to their foundry here.

Brantford, Ont.—The City Council are in the market for special castings required during 1917.

Toronto, Ont.—The Consolidated Steel Co. will build an addition to their plant at 1154 Dundas street.

W. S. Atwood, chief engineer of the Canadian Car & Foundry Co., Montreal, has been appointed operating manager.

Montreal, Que.—The Canada Stove & Foundry Co. contemplate building an extension to their plant at St. Laurent, near here.

The Atlas Crucible Steel Co., of Dunkirk, N.Y., have opened an office in Montreal at 405 Dominion Express Building with J. A. Disney as manager.

Longueuil, Que. — The Standard Foundry on St. Elizabeth street, Longueuil, was the scene of a fire on Jan. 23. Most of the damage to the building and plant was due to water, and was estimated at about $1,000.

Orillia, Ont.—A new company known as Electro-Foundries, Ltd., has been formed to take over the smelter and install an electric furnace. Capitalists connected with the International Molybdenum Co. are interested in the new venture.

A. C. Leslie & Co., Montreal announce the completion of 50 years in business. Present officers of the company are as follows: President, William S. Leslie; vice-president, Thomas H. Jordan; director and secretary Edward H. Copland.

George T. Douglas, of Amherst, N.S., until recently manager of the Amherst plant of the Canadian Car & Foundry Co., Ltd., has been appointed assistant to the vice-president and managing director of that company, and left last week for England and France in connection with the company's export orders.

Kingston, Ont.—The Kingston Smelting Co., will shortly be running to capacity. The lead that will be smelted in this plant is to be obtained from British Columbia, the United States, and also from mines in this district. At the present time there is an embargo on crude lead from the United States, but the management hopes to have this removed.

Canadian Steel Corporation.—It is reported from Youngstown, Ohio, that the Canadian Steel Corporation, will not go forward at once with its proposed big plant at Ojibway, Ont., opposite Detroit, owing to high prices of materials, and other conditions. The corporation has a layout for 16 blast furnaces and had planned to build four this year.

London, Ont.—Beatty Bros., of Fergus, will establish a foundry at Chelsea Green, along the London & Port Stanley Railway tracks. The building to be erected will cost $28,000 or $30,000. The company will manufacture iron pumps, barrel churns, grain grinders and hand and power washing machines. Beatty Bros. have hitherto bought their castings.

Steel Plant for Toronto.—The Toronto Harbor Commissioners have completed arrangements with the Imperial Munitions Board, through the chairman, J. W. Flavelle and Col. Carnegie, whereby the Munitions Board will have erected for them an electric steel and forging plant with an initial capacity of 300 tons per day. Ten six-ton, three-phase 25-cycle Heroult type electric furnaces will be installed.

E. P. Mathewson, of Montreal, was awarded the coveted gold medal of the Metallurgical Society of America for his achievements in metallurgy during the past year, when the annual meeting of America's leading mining organization convened in Montreal recently. The medal is awarded annually to the member performing the most valuable service in the metallurgical development.

Hyde & Sons Ltd., Montreal have recently added a new department to their business to include foundry supplies and equipment. The company at a later date contemplate taking up the manufacture of certain lines that are at present being imported into Canada. **Frank M. Meyers**, who has had extensive experience in foundry practice-construction and production will be in charge of the new department.

Will Assist Refineries.—It is announced in Ottawa that the business of refining lead, copper and zinc is to be encouraged by the Canadian Government. Finance Minister White recently intimated that a Government bill would be presented providing aid by bounty or tariff for the refining of these metals. This is another step in the process of transferring from the United States to Canada the entire North American business of munition making. Canada has great supplies of the metals required for shells but up to the present most of the refining of Canadian matte — lead, copper, zinc and nickel—has been done in the United States. The Canadian munition business is growing to such a volume that the Government has decided that the whole process of producing proper metals for shells shall be carried on in Canada.

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Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Manufacturers' Brush Co., Cleveland, Ohio.
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Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
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CORE BOX MACHINES
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Hyde & Sons, Ltd., Montreal, Que.
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CORE MACHINES, HAMMER
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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Brown Specialty Machy. Co., Chicago, Ill.
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Tabor Mfg. Co., Philadelphia, Pa.
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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
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W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Woodison, E. J., Co., Toronto, Ont.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
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McCulloch-Dalzell Crucible Company, Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hyde & Sons, Ltd., Montreal, Que.
Toronto Testing Laboratories, Toronto.

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Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodisou, E. J., Co., Toronto, Ont.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg.

TRIPOLI
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRACK, OVERHEAD

TROLLEYS AND TROLLEY SYSTEMS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Steel Co. of Canada, Hamilton, Ont.
Woodison E. J., Co., Toronto, Ont.

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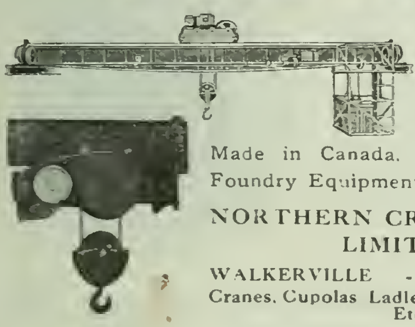
CRANES



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Cranes, Cupolas Ladles, Hoists, Tumblers Etc.

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Any style or shape
Quality Guaranteed

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W. W. WELLS, Toronto

In Brass Bronze Copper Nickel Tin & Zinc

Let us assist you in "Grinding Down Costs".

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Gresolite
for Grey and Chilled Iron.

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Write for booklet "Safety as Applied to Grinding Wheels."

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LIMITED
Manufacturers Grinding Wheels and Machinery
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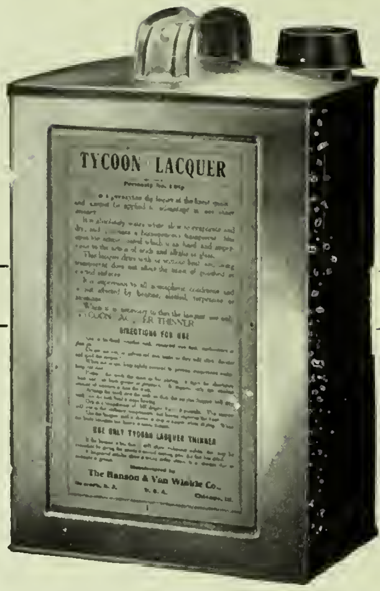
HAMILTON, CANADA

ADVERTISING INDEX

LACQUERS



For All **Metals**

Made in Canada

OUR PRODUCT—About twenty-five years ago we began the manufacture of all kinds of lacquers for metals. We have always employed high-priced, skilled experts, who exercise every precaution in all branches of the manufacture. During these years our experts have been constantly experimenting, sparing neither labor nor expense, which has been the means of bringing our product to its present high standard.

We do not recommend the use of cheap lacquers, but can furnish them when required. Cheap lacquers are for cheap work only. It has always been our aim to maintain the highest possible standard in the quality of all our lacquers. We are manufacturing the full line of high-class material as made by the Hanson-Van Winkle Co., Newark, N.J., and as we carry a complete stock of all grades, can assure the Canadian trade of prompt shipment from Toronto, thus saving custom duty and avoiding long delay in transit.

Submit your proposition and secure our advice.

Our men will gladly call at your plant and make a personal study of your requirements.

Ask us to send you samples.

The Canadian Hanson & Van Winkle Company

15-25 Morrow Avenue, West Toronto, Canada

CANADIAN FOUNDRYMAN
AND
METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, MARCH, 1917 No. 3

IN these extraordinary, busy times, the law of supply and demand is being applied in an inverse ratio. On that account foundrymen often have to accept goods that under other conditions they would refuse. It is really gratifying to you to know that you are obtaining the very best that can be made when you buy

WOODISON "QUALITY" WAX VENT

It is easily handled in all kinds of weather, does not contain string to hold it up, and leaves a clear, unobstructed vent. Best of all, it is uniform at all times. Put up in spools of convenient size and carried in stock at all of our branches. Send in your orders, we'll ship promptly!

We have been able to purchase, at a very reasonable price, a large stock of PLUMBAGO of high quality. It will pay you to investigate this material.

In connection with our manufacture of **Perfect Perforated Chaplets**, we are turning out as a specialty for brass foundry work, a **Perforated Aluminum Chaplet** of superior quality. These chaplets are light, and made with absolute accuracy. They obviate all the difficulties you have had to contend with when forming chaplets by hand from thin metal strips. We make them in our own factory in all styles and sizes, and will be pleased to have you send us your orders--large or small.

The E. J. Woodison Company, Limited

Montreal TORONTO, ONT. Windsor

Foundry Facings, Fire Brick, Woodseed Liquid Core Compound, Polishers' and Platers' Supplies, Compounds and Equipment, Cupola Blocks, Foundry Supplies and Equipment

The Publisher's Page

TORONTO March, 1917

Link-Belt's Tribute to Trade Papers

By JULIUS S. HOLL,*

Extract from an interesting article appearing in "Class."

[Editor's Note:—The conclusions of the head of the promotion department of one of the most consistent trade and technical journal advertisers in the country on the subject of the value of this advertising is not "snap judgment," but is based on experience obtained through the expenditure of approximately $100,000 a year. The appropriation, be it noted, has been increased only as results have justified it, and the company is now using bigger space, more mediums and more trade paper advertising generally than ever before.]

THE trade paper is the manufacturer's best medium for exploiting his product.

It is the most inexpensive kind of advertising, because it keeps the message of the manufacturer before buyers in his field all the time for a nominal sum, and with comparatively little trouble involved in the preparation of the copy.

We get direct returns, yes—but we do not consider the "inquiry" the real index to the value of the advertising or the trade journal. It is a far bigger, better thing than that.

The big idea back of our advertising is to create confidence in our products, to make the buyer want what we have; to do constructive, educational advertising of Link-Belt products and Link-Belt service.

In our Chain advertising, for instance, our copy is designed to show the many varied uses of this product in the field of power transmission. Our aim is to make the purchaser think of Silent Chain when he connects up new machinery. The point I am trying to make is that we are endeavoring to do a constructive, educational kind of advertising, and that our policy has been successful in bringing results.

We realize that getting results from advertising is not a matter of running one or two or half a dozen ads. Constructive advertising takes time. Any man who starts advertising in a trade journal a staple product which does not possess startlingly new or sensational features, should realize that it will take time to get the desired results; but these results are worth waiting for. As John Wanamaker says, "Advertising doesn't jerk, it pulls."

It begins very gently at first, but the pull is steady. It increases day by day and year by year, until it exerts an irresistible force. This is particularly true of trade journal advertising.

Our sales forces are in absolute harmony with our advertising policy, a vital asset to any advertising department. One of our salesmen, who handles the clayworking trade, which is a big user of Link-Belt Silent chains, declared at a recent sales conference that the effect of our advertising in *Brick and Clay Record* in popularizing Link-Belt Silent Chains with the brick manufacturers has been largely responsible for our success in this field, and declared further that if trade papers in other fields were giving similar results, then the trade journal method of advertising was a great success.

Because we have more and more realized what the trade journals can do for us, the tendency has been definitely in the direction of large space. We formerly used comparatively small space, quarter and half pages, but now we seldom run anything less than a full page. Each ad. is carefully built, the foundation usually being a photograph of an installation in the field to which we are advertising, so that every picture tells a story of interest to the readers in that particular industry. It keeps us hustling to dig up these pictures, and to get photos of the right kind, but that makes the sort of publicity that gets the interest of the reader, because the ad. talks to him in his own language.

Our advertising is adapted to meet the condition of each industry. Our products also are too varied to permit of comment upon each; but the value of the trade journal is clearly illustrated again in our advertising in the coal mining industry. Seven years ago we used card space, with an occasional half-page "splurge," yet the volume of business received was satisfactory to our house.

* Advertising Manager, The Link-Belt Company, Chicago

Canadian Foundryman and Metal Industry News

143-153 UNIVERSITY AVENUE - - - TORONTO, CANADA

Also at Montreal, Winnipeg, New York, Chicago, Boston, Cleveland and London

Safe Practice at Blast Furnaces and Its Development---II.

By Frederick H. Willcox

In its efforts to increase safety in the metallurgical industries, the Bureau of Mines, Washington, D.C., has been studying the causes of accidents at blast furnace plants also methods for their prevention. This article describes the known dangers and makes suggestion of means whereby the risk of accident may be lessened or, better still, wholly avoided.

THE CAST-HOUSE CREW

LABORERS and new men should be made acquainted with the possibilities of slips, gas, breakouts, and bursting tuyeres. If you can show them how to be less clumsy in handling tools do so, because awkward men may injure others as well as themselves. If you see anyone doing something that is dangerous or standing in some place where he might get hurt, tell him of the danger. If a man's clothes catch on fire, do not let him run. Put the fire out with a hose, or roll him in sand and smother the fire by throwing sand on it, or wrap him in a blanket or coat. If a man is gassed or receives an electric shock get him into fresh air, notify the foreman, and give him artificial respiration at once; loosen his clothing, take any tobacco out of his mouth, and keep him warm.

Operators' Clothing

Always wear clothes made of wool or hard jean cloth if possible, and especially avoid greasy clothes, as they will readily catch fire. Wear stout shoes, having thick soles, and without cracks or holes, that are not too low, and fit tightly about the leg (see Fig. 12). Congress shoes and leggings are advisable. Wear goggles or a mask to prevent injury when handling hot metal or cinder, breaking scrap with sledges, or turning hose on hot material. Never wear ordinary gloves or hand-made hand leathers in handling jagged pieces of scrap. Leathers or gloves with a safety spring in the back are the only safe ones, as the scrap will frequently catch the glove or leather and may cause a serious sprain or fall.

When breaking runner scrap, slag, lumber, test pieces, etc., with sledges or a "Mulligan," use judgment in blocking up the pieces before breaking them. The closer the material is to the floor, the less probability there is that it will fly in breaking. When barring scrap, plates, or other objects, be sure that the point of the bar is firmly engaged, or that the bar will not slip off the block, before you lift or put your weight on the bar. Keep your working place cleaned up. Bars, drills, and long-handled tools should be kept where they will not fall and injure anyone, by preference in a tool rack. If they are leaned against the wall, place them so they can not easily be knocked over or fall down. Don't leave tools where men can stumble over them. Remove burned drills and bars promptly. Watch out for hot bars and don't throw bars without looking to see whether some one may be hurt by their rebounding. Be careful when the cast house is full of steam; feel your way, do not attempt to go quickly.

When a blast furnace is being blown in or blown out, banked, stopped for a time, or started up, it is more dangerous than in regular running. At such times do not rely upon your own knowledge of furnaces, but follow every direction of the foreman strictly. Do not do any of the routine duties about the stoves, dust

FIG. 12. CAST HOUSE MAN WEARING LEGGINGS, GOGGLES, FELT HAT, AND WOOLLEN SHIRT.

catcher, bleeder, cinder notch, tapping hole, or tuyeres except by direction of the foreman or blower. Don't go on the bustle pipe unless you notify the stove tender, keeper, or blower. When you have to work where you can smell gas, take frequent spells in fresh air and work with another man. Do not stay where there is gas unless your foreman knows conditions and that you are there.

Miscellaneous Precautions

Do not rest or stand under, near, or in front of blowpipes or tuyères, as they may burst or burn through, and throw metal, cinder, coke, or gas over you. When you know that the furnace is hanging, keep under cover and warn others. Keep away from the bottom of dust catchers, stove burners, downlegs, and manholes of underground flues at such times. In going to and from work avoid going under cranes carrying loads or under skip inclines, or through stock houses, boiler rooms, or places where you are unfamiliar with the work done there.

Do not try to do work other than your own about the furnace unless you are familiar with the work or have been ordered to do it. Especially do not try to help the hot-blast man on shutdowns or on work with the bleeder, mixer valve, or any regulating part of gas or blast mains unless everything you do is specifically directed by him. Many accidents have been caused by misunderstanding what some one else was doing.

Avoid Foolhardiness

Always use every safeguard provided—goggles, masks, shields, safety hand leathers, tongs, and gloves. (See January 25 issue, Figs. 6, 7, and 12.) They are provided to prevent injury to yourself, and men at other plants use them. Refusing to use them is not a sign of bravery or of familiarity with your work, but rather of foolhardiness and ignorance of the danger.

Do not drive the tapping bar through the skull in the tapping hole, or go on the last spell on the drill before you have placed the splasher and put a shield in front of the tapping hole, or a cover plate or sheets over the trough, in front of the splasher. (See Figs. 13 and 14), except under unusual circumstances. When it is necessary to pull the tapping bar out don't hold on to the "welshman." Lay a bar across the runner to support the tapping bar while driving it out; the molten iron may rush out unexpectedly and burn you.

Do not stand in front of the iron notch when opening it; work from the side as much as possible, even on the first spell, and keep your feet out of the trough. Be especially careful when working on a short, green, hard or an unusually long hole. On changing turn, the keeper going off duty should inform the one coming on as to the condition of the tapping hole. If the hole has been working short or badly, and has not been taking the clay, the keeper should inform the other keeper and tell him how much clay was used on the last stop.

FIG. 13. UNSAFE METHOD OF DRILLING A TAPPING HOLE.
Men standing over open trough on planks, no shield used at tapping hole, men wearing loose, baggy clothing.

Do not cast until the skimmer, trough, runners, shutters, and spouts are dry and warm. Clay, sand, loam, or coke dust in the runners must be dry to avoid "boils" of molten iron. Do not leave pieces of cold scrap in the runners or place damp sand against the shutters or gates. Don't let pieces of wood get under the skimmer dam or drain gates, and bank up the drain or "punch-out" gates on the outside with dry sand. In filling the mud gun before a cast, only one man should do the work if the clay is being fed at the funnel, because if two men are used, one to operate the plunger and one to feed the clay, one of them may be caught by the plunger.

Loading Clay

In loading clay at the funnel do not push it down with your foot; use a stick. However, the gun can be loaded as well and more safely by putting the clay in at the nose of the gun with a rammer. When the gun is loaded, put about 3 inches of dry sand or ground ganister mixed with tar or black oil in the nose, removing enough clay to give room. Wet or sloppy clay may cause an explosion when it comes in contact with hot iron. Do not wet the nozzle of the mud gun. Daub it with black oil after casting, while it is still warm, and again just at cast time. This will keep it from getting wet, and will prevent a "shot" if the nose of the gun is placed in the hole against a stream of molten iron. Oiling the nose of the gun is better than warming it, because if the nose is heated too much or too long the clay will become dry and stiff, and may cause a short hole. If heating the nose is preferred, pouring one or two hand ladles of cinder over it should be sufficient.

When casting do not use cold or wet bars to poke out sand, clay, or loam in the runners or gates or to break a path for the iron. Lift the punch-out or drain gate (Fig. 15) slowly, to avoid a rush of iron, which may cause boiling, and be sure the punch-out bar is warm. Before turning the iron into a ladle see that the ladle is spotted and is all right. Do not fill the ladle within more than 8 or 9 inches of the top, as the iron may be spilled in shifting it. Do not throw large pieces of cold scrap into the ladle before or during the cast, as it may cause boiling or an explosion of the hot metal. It is safer to fill the ladle nearest the furnace first and finish the cast in the ladles at the lower end, for several reasons. One reason is that the gates may be lifted quickly and the operator go away instantly. (See Fig. 16.)

If the iron is run to the bottom ladle first, be sure that all shutters are dry; if to the top ladle first, be especially sure the sand at the gates is dry. When using the pricking rod on an obstruction in the tapping hole, do not throw too much weight on the rod if standing close to the trough. Be sure that the hand ladles and chills for samples or pig-machine wheels are dry. Do not cross iron or cinder runners during a cast except when necessary, and watch your step very carefully; if you have to go in front of the iron notch, get across quickly. Do not step on the crust of hot cinder. Do not flip wet clay into hot iron to annoy or tease a fellow-workman—it is too dangerous.

Stopping the Tapping Hole

In stopping the tapping hole, be cautious when placing the mud gun in the hole. Unless the cinder and iron in the trough lays away from the hole, drain the trough before putting the gun in. Do not put the gun in the hole against a stream of iron unless the nose is warm and dry, as the iron may explode. After the gun is clamped, turn the steam on by the valve at the column, or by means of a long hook open the three-way cock on the gun. There is danger of gas bursting out or cinder being thrown back when the first clay is shot in. Care must be exercised in stopping the hole after the first shot, as the pressure in the furnace and the suction of the plunger may throw the clay back in the barrel of the gun and a burst of gas or slag follow.

It is safer to feed the clay into the gun with a shovel rather than to stand close to the hole and trough, unless one is expert at throwing the balled clay into the funnel from a safe distance. (See Figs. 17 and 18.) As stated before, use a stick—not your foot—to poke clay down into the funnel. While stopping the hole do not stand so that all your weight is on the sheets covering the trough, and watch for the exhaust steam. Do not put the wind on until the hole has stopped taking clay freely, and after

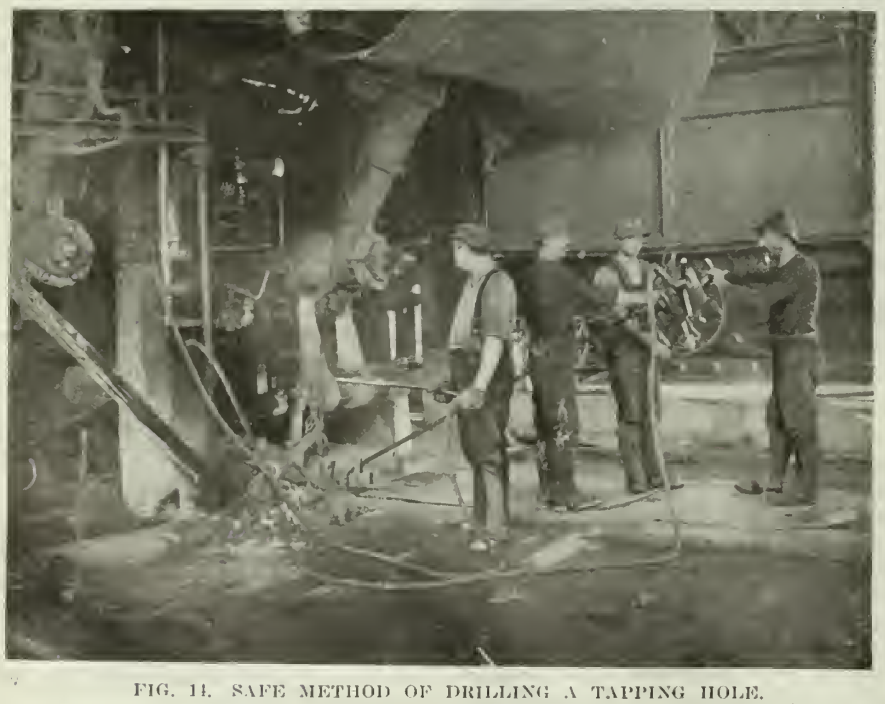


FIG. 14. SAFE METHOD OF DRILLING A TAPPING HOLE.
Steel plate over runner, shield in point of tapping hole, men wearing proper clothing, air jet used to clean tapping hole.

the hole is stopped leave the gun in it with steam on until the clay has set; this may prevent a breakout at the tapping hole between casts. If men are changing tuyères or plates, never throw or turn water into the funnel of the mud gun or use wet clay before the hole is entirely stopped, as gas may blow out on the tuyère men. Step away from the gun for a moment when shooting water into the hole.

In putting water in the skimmer trough at "rid-up," do not stand near by with a short nozzle to turn the water in (Fig. 19). If the water strikes hot slag, the steam may scald you, and if it strikes a pocket of hot molten iron there may be an explosion. It is safer and just as effective to use a pipe, 15 feet or more long, turned down at the end (Fig. 20). If it is necessary to break up crusts or skulls in the trough before turning water on, don't use a cold or wet bar. When handling hot scrap or slag use tongs or a hook whenever possible, and be careful in breaking or barring slag and scrap to avoid flying pieces, falls, or dropping material on to your feet. Before throwing scrap or cinder into a car, be sure there is no one in it and that the pieces do not project over the end or sides of the car where they may fall or be pushed off.

Under Blast Precautions

Never tighten the keys on the tuyère stocks or caps, or take up slack on the bridles when the blast is on unless you are directed to do so by the foreman. Watch for tight bridle springs or split stock hangers, and don't screw up the nut on the bridle until the spring is tight. Do not start to loosen the monkey or stock bridles, hangers, keys or caps until the blast if off and the gas is drafted back. Wear goggles when watching the peep sights during a cast or check, and do not open the peep-sight plug until you are sure no one is in line with it. Don't try to blow coke out of the eyesights until the blow pipes have had time to cool. Know where the hose and water valves are situated in the cast house, as they are needed quickly at times. When playing the hose-on tuyères, blowpipes, or the furnace jacket, stand behind a column as much as possible, or to one side, as they may burst or burn through.

In case a tuyère bursts or a blowpipe burns out, do not work about them unless thoroughly familiar with the danger. Work to one side as much as possible when dropping blowpipes, claying up, and changing tuyères, as cinder, coke or gas may blow out. The tuyère opening should always be firmly plugged with clay as soon as the blowpipe is dropped. Never work about an open tuyère or plate when water or wet clay is being put in the tapping hole. Watch for hot bars, blowpipes, and scalding water or steam. Do not put up the blowpipes after a shut down until the foreman orders you to, for unless the blowing engine is turning over it might cause an explosion. Don't look into a blowpipe when cutting out clay after a stop.

When "botting up the monkey," or plugging the cinder notch, wear goggles or a mask and long leather gloves; be sure of your footing, and always use the shields provided. Work from the side of the cinder notch as much as possible when opening it, and, when breaking cinder in the runner during a flush, keep out of line with the cinder notch and be careful the cinder does not splash on your feet. Cinder will splash farther than iron. Keep as far away as possible when throwing coal in the cinder runners. It is just as well not to throw coal into stiff cinder, as it does not greatly help matters.

Do not throw damp or wet rubbish in the cinder ladles, and always examine them for water or dampness and dry them out with cinder before flushing or casting, because a damp ladle may boil or explode when being filled. Keep away from the granulating pit when the skimmer trough is being drained or when you think iron is coming over the cinder dam. If it is necessary to plug a cinder ladle with clay, always place a sign, or station a watcher before going into the ladle. Be sure there is no one in a car or ladle before throwing rubbish into it.

Reporting Abnormal Conditions

Be prompt to report anything abnormal or unusual about the furnace—for instance, the blast pressure becoming

KILLED AT BLAST FURNACE

Sault Ste. Marie, Ont., Jan. 24. —While engaged at his work at the blast furnace of the Algoma Steel Corporation yesterday Emil Provost, an unmarried Frenchman, twenty-four years old, whose home is in Ottawa, met his death while tightening up a door of one of the furnaces while the pressure was on. He had resided in the Soo only about one month.

FIG. 16. MODERN RUNNER GATE OPERATED BY A CABLE AT A SAFE DISTANCE FROM THE RUNNER. ONLY A PART OF THE CABLE IS SHOWN.

FIG. 15. SAFE METHOD OF OPERATING PUNCH-OUT GATE.
Note the mask worn to protect man from splashes.

high or low; hanging, tightness, or slipping of the burden, cold or dirty cinder; sloppy, dead, or leaking tuyère; gas lighting on the bosh or about the mantle; hot spots on the shell; delays in filling the furnace or in spotting iron or cinder ladles; wind and gas leaks; or signs of a break out, such as steam or gas coming from about the jacket, columns, or pavement, the water getting hot or steamy in the discharge from the hearth or bosh jacket or on the jackets, or the pavement or columns getting unusually hot. Especially, report promptly any signs of the cooling water supply becoming slack. Neglect of these points oftentimes leads to unnecessary hard work and danger from "messes," breakouts, slips, burned tuyères and blowpipes, or explosions. The foremen are looking for these signs also, but one man may not see all of them.

FIG. 17. UNSAFE WAY TO STOP TAPPING HOLE.
Helper is using his hands and standing too near tapping hole.

The Hot-blast Men

Be careful that the gas or blast is not turned into or gas drafted back through a stove that is being cleaned. Do not open or close any doors or valves or remove any signs or locks on such stoves until the foreman has told you to do so. Before turning gas into a stove, warn any well-bottom cleaners working about the doors, as it may flash back when it ignites; and be sure that the chimney valve is open. If you think that the stove is not hot enough to light the gas, put a large bunch of burning waste at the gas door or provide other means to ignite the gas. Don't stand by the burner after turning gas into the stove: step away quickly. At times the gas will not light until it reaches the top of the well or combustion chamber, and it is then likely to light explosively and puff out through the burner and air doors. Be especially careful when you are turning on gas from a furnace just blown in or from one shut down on account of leaky "bronze" (tuyères, coolers, bosh plates, cinder monkey, etc.). In case of doubt always use burning waste; don't let the stove fill with gas and then try to light it. If the stove does not light, shut the gas off and start over again, using burning waste.

Before you blow off a stove, warn men to keep away from the blow-off valve, and especially warn them away from the blow-off door if the stove is being shut down for a leaky tuyère, as the gas may be very explosive. Be sure that the blast is on the new stove before shutting the cold-blast valve of the stove being taken off. Don't let the hot-blast valve drop sharply on to its seat, and don't let the blast slam the chimney valve into place; set the valves easily by hand. Open the cold-blast valve slowly to avoid racing the blowing engines.

In case of the blast stopping unexpectedly from any cause shut the mixer valve on the by-pass at once, then close the cold-blast and hot-blast valves as soon as possible. Never forget to close the mixer valve before checking or shutting down the furnace, beginning a cast, or stopping the blowing engine. To forget to do this may cause an explosion that will wreck the mains and engines. When it is necessary to take the stoves off during a shut-down to "change bronze," or for a short stop, be sure the burners are closed tightly. When ready to start the furnace and bring the gas down, never turn the gas into the stove until the blower has given the signal. Be sure that the explosion doors or bleeders on the gas mains or dust catcher are closed during a shut down; if any air gets into the mains there is always a chance of an explosion. Whatever way the blower tells you to handle the top bleeder, whether to keep it open or shut during a shutdown, always follow his order to the word. Many serious furnace accidents are caused by operating bleeders and gas valves other than in the way ordered. The least change from orders may cause a terrific explosion. If the gas is "wild" in drafting it back in one stove at a shutdown, draft back through an additional stove at once.

Keep away from the dust legs and manhole covers on gas mains, from gas burners and air inlet doors, when the furnace is sticking and liable to slip. Be careful when you open an air door to see how the gas is burning; if too much gas is turned on, or if the checkerwork is dirty, the gas may flash back into your face. Keep and warn others away from these places; no one should handle burners, doors, or valves unless directed by the stove tender. Do not tighten any thumb or other nuts on doors or blow-off valves when the stove is on blast; you may be killed or injured by the bolt breaking. Watch the water on the hot-blast valve and seat, because water leak-

FIG. 18. SAFE WAY TO STOP TAPPING HOLE.
Helper is using shovel and standing away from the trough and the tapping hole.

ing into the stove may cause the furnace to slip or get cold: it will then be more dangerous. Report any gas leaks about the burners or mains; do not let them leak unnecessarily. When the millwright is examining the chimney valve for leaks do not change the stove from blast to gas. When the hot-blast valve and seat are being inspected be sure the chimney valve is kept open and the gas turned off.

The Stove Cleaners

Before entering a stove to clean it, lock the cold-blast valve and gas burner shut, fasten the chimney valve open, and either block the hot-blast valve in its seat or disconnect the cable from the stem, or lock the windlass, and attach danger tags; be sure these things are done. Stop any leaks about the burner with clay, as even a small leak may allow considerable gas to drift into the stove. It is always safest to close the burner door, but if this can not be done for any reason, turn the burner on its seat, away from the door or seal it off with a blank. When ladders must be used to get into a stove through the dome manhole do not try to carry tools up or down the ladder, use a hand line. (See January 25 issue, Figs. 8 to 10.) Keep away from the well of the combustion chamber, and do not sit on the bridge wall between the well and the checkerwork; the wall may give way. Boatswain's chairs for cleaning, tearing out, or repairing the well lining should be supported by tackle attached to the top of the stove shell when possible, and the chair, rope and tackle tested to double a man's weight before use. Anyone working in a boatswain's chair should wear a life belt attached to the chair-sling block. Do not use a torch inside a stove; use an electric light on a standard insulated extension cord and have an electrician make all connections.

When it is necessary to clean checkerwork from the bottom or to clean out under the arches, keep under the arches as much as possible to avoid bruises from falling brickbats, clinkers, or tools. It is best never to enter the bottom until everyone is out of the top. Always wear goggles when inside a stove and do not remove the locks from the valves until everyone is out and the manholes are closed. In cleaning flue dust from the bottom of a stove be careful to avoid burns; the dust is usually hot and easily runs into one's shoes. Notify the stove tender before opening the cleaning, air-inlet or blow-off door to clean the well from the outside, and have him turn the gas off enough to avoid any danger of flame puffing back through the door at which you are going to work. In case the furnace is hanging, stop work until it slips, and keep away from the cleaning door. In loading barrows with hot cinder or dust do not fill them so full that they will run over; handle them carefully, and warn others to keep out of the way. Bars and cutters used in cleaning wells should be handled with crossbars when withdrawing them from the stove. Keep away from the doors when gas is being turned in the stove.

FIG. 19. UNSAFE WAY OF WETTING DOWN TROUGH AT "RID-UP." Short nozzle on the hose, man standing close to trough where he is exposed to an explosion of hot metal or steam.

The Dust-catcher men

Empty the dust catcher regularly; if you let it get filled and the furnace slips, there may be an accident. Notify the foreman when the car is full and if the car is not moved promptly and an empty one spotted. Never dump the dust catcher when the wind is off the furnace or when the furnace is hanging or liable to slip unless you are doing it under the orders and directions of the foreman or superintendent. In dumping dust legs, dust pockets, or dust catchers be sure there is no one underneath to get burned, and warn men against approaching, as the dust may fly and burn them. Be careful in cleaning up dust and never step on it, because it will run like water when hot, and burn you severely if it gets in your shoes. Be cautious in playing a hose on hot dust, as it sometimes explodes or flies. Do not clean up under the dust catcher unless you have notified the foreman and he has told you to go ahead; the bell may be forced open by a slip or by being overweighted and the dust may burn you. For the same reason never go into a dust car after it is spotted under the dust catcher; pack the doors before the car is placed. Turn the water on full before you open the bell, and water the dust thoroughly when dumping the dust catcher. Don't fill the car with hot dry dust and then turn the water on; it will soak down slowly, and the contents may explode. Always place a card on the car so that the unloaders will know they are handling flue dust.

In a recent issue of *The Electrician* some new facts which illustrate the great impetus given to the construction of electric steel furnaces are reported. Since the outbreak of war over 100 installations are known to have been put in, and the total number in the world now approaches 300, which is about twice the number existing in 1913. The United States is credited with constructing 50 last year and Great Britain with 30 since the war began.

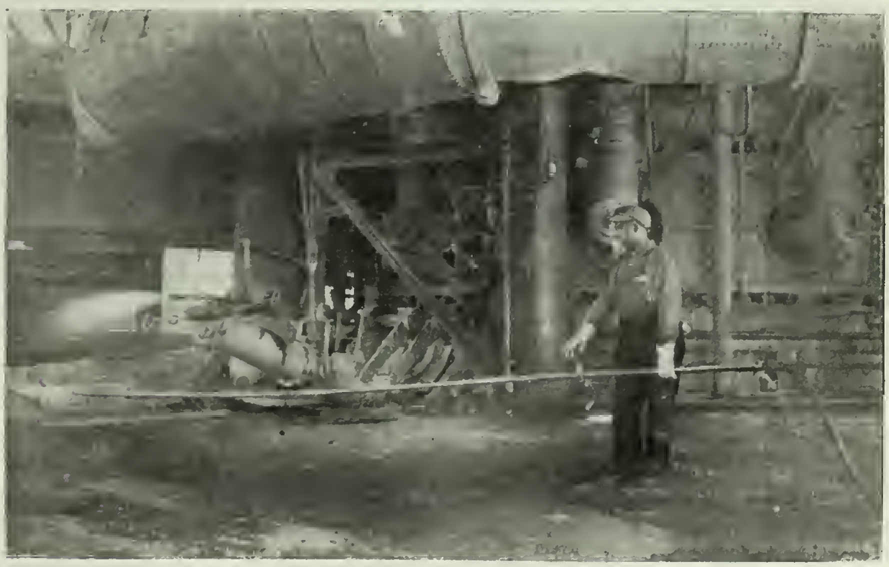


FIG. 20. SAFE WAY OF WETTING DOWN HOT TROUGH. EXTENSION NOZZLE ON HOSE. MAN STANDING AWAY FROM TROUGH.

A BELGIAN BALL-TEST MACHINE

By J. W. G.

THAT increasing recognition is being given to that quality in metals generally termed hardness is evidenced by the number of machines which are now available for testing purposes. Among the different methods in use, the ball test has always occupied a prominent place, the Brinnell system being a standard for certain classes of work. This fact, together with the present terrible tragedy in Belgium, imparts a peculiar, almost a morbid interest to the device illustrated herewith.

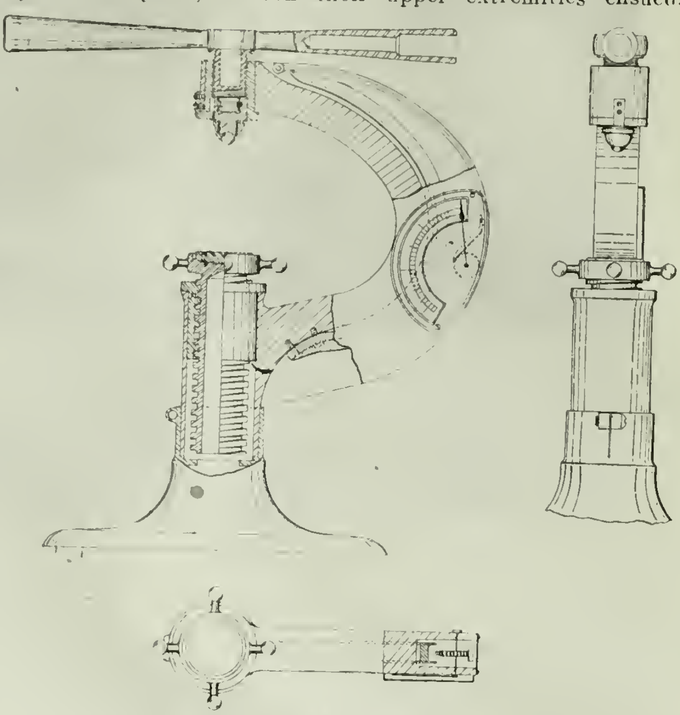
In pre-war days an international reputation as a producer of the highest grade of forgings was enjoyed by the Usines G. Derihon Societe Anonyme, Loncin (Lez-Liege), and the ball testing machine illustrated herewith was developed in the Derihon shops and used in their work regularly. The writer first saw this machine about seven years ago and feels that the peculiar features of the machine, coupled with changed conditions, make it of special interest to your readers at this time.

Method of Operation

The method of operation consisted in pressing a 10 mm. hardened steel ball into a specimen of the material, and measuring the diameter of the impression on different specimens of the same material. The frame of the machine was a hook-shaped forging of narrow channel section, the lower end terminating in a large boss containing an elevating screw for the table, while the upper end carried a pressure screw and testing ball. When pressure was applied to the ball, through the double-ended wrench on top of pressure screw, the resultant stress caused the gap in the frame to open, the frame being so designed and proportioned that regular increments in load were accompanied by equal amounts of distension in the frame without the stresses being near enough the elastic limit to affect its permanent resistance. In other words the frame acted as a very strong spring.

Indicating the Deformation

The amount of deformation imparted to the frame was indicated by a simple lever and pinion arrangement shown clearly in the illustration. A small channel section member was fastened to the base of frame, fitting the curve to a point near the pressure screw. Here the member terminated, a knife edge being formed on the end to support a hinged member which carried a rack at its lower end, this rack engaging with a pinion on the indicator spindle. As the bending of the frame took place above the point where the small channel member was attached, relative movement between their upper extremities ensued, so that the hinged member descended as its hinged end was raised, allowing the rack to travel across the pinion and revolve the indicator.



BELGIAN BALL TEST MACHINE.

The diameters of impressions were measured by a glass gauge similar to a wire gauge. By carefully observing the contact of the tapered lines with the edge of impression, an empirical number was obtained which could be referred to any other specimen provided the same pressure was used in making the test. The maximum pressure applied varied with different materials, the chief point being to get a medium sized impression where possible without injuring the work unnecessarily. Where standard grades of material were in constant use, suitable pressures were specified so that measurements with the scale were then comparable.

To the writer's knowledge, these machines were at one time on the market in the United States. Many dark days have passed over its land of origin since then, the Derihon factory at one time being reported in operation under German control; recent developments, however, create considerable misapprehension regarding the men and plant who were responsible for the development of the machine.

The shrinkage of manganese steel amounts to 5-16 in. per foot as against 3-16 in. to 1/4 in. in ordinary steel foundry practice.

HEROULT FURNACE INSTALLATIONS

AMONG recent installations of Heroult furnaces in Canada, the following are to be noted:—

The Dominion Steel Foundry Co., Hamilton, Ont., are installing four 6-ton furnaces for making war material. After the war, metal from these furnaces will be used to make wheels, tires and axles.

Armstrong, Whitworth, of Canada, Ltd., are installing one more 6-ton furnace, making three of this type and capacity, at their plant, Longueuil, Que. War material, as well as tires, wheels and axles constitute the product.

The Imperial Munitions Board will install ten 6-ton furnaces in their new plant at Toronto. The steel will be used for making war material.

CANADIAN NICKEL REFINERY

THE British American Nickel Corporation are having plans prepared for the first unit of a large nickel refinery to be built at Murray Mine about three miles from Sudbury, Ont. The initial unit will cost approximately $1,500,000 and will consist of two blast furnaces, three converters and power plant. There will be buildings comprising the smelter building, machine and blacksmith shops, power house, etc. The buildings will be of brick and steel construction requiring about 2500 tons of steel. The company propose using about 5000 h.p. hydro-electric power, and all the machinery will be driven by electric motors. The power plant equipment will consist of two 30,000 cub. ft. 12 lbs. pressure air compressors for the convertors, two blowers, of 30,000 cub. ft. capacity at 40 ounces pressure, for the blast furnaces, motor generators, switchboard, 1000 h.p. water tube boilers, pumps, etc. The construction plant is being assembled, and building will start in the early spring. F. T. Brule, Royal Bank Building, Toronto, is the engineer, for the company and is preparing the plans.

B. C. Lead Production.—The lead production of Canada is almost wholly derived from British Columbia, the production of which is about 65,000,000 pounds a year. This metal is at present produced almost entirely from the mines of East and West Kootenay. The ores are smelted at Trail smelter, and the lead is refined there. On the coast and along the route of the G. T. P. are important deposits of lead ores which cannot be economically treated for want of smelting accommodation on the coast. The establishment of a lead smelter and refinery on the coast is, therefore, a necessity to the development of ore deposits tributary thereto.

A stitch in time saves nine. It takes a longer time, and costs much more to replace a broken grinding wheel than it does to move the tool rest close to the wheel.

The Chilled Iron Car Wheel in Steam Railroad Service--I*

By G. W. Lyndon**

The chilled iron car wheel has been, since its introduction in the year 1850, the standard accessory of transportation, carrying as it does the car and its contents to every nook and corner of this continent traversed and served by steam railroads. In the accompanying paper an interesting description is given of its development towards meeting the increased rolling stock weight and capacity that have been found indispensable to a continued industrial expansion.

THE subject of the Chilled Iron Car Wheel is one of vast magnitude, comprehending as it does the vehicle by which the commerce of this continent is moved; at the same time its importance to the transportation world is not as fully recognised as might be, either by the public generally or our industrial community particularly. Statistics which will indicate the extent of the car wheel industry are shown in the U.S. Interstate Commerce Report for the year ended 1914 as follows:—

Total number of freight cars in commercial service	2,325,647
Total number of freight cars in company service	124,709
Total	2,450,356
Add—Private car lines (approximately) ...	225,000
	2,675,356
Number of tons of freight carried, year ended 1914	1,109,271,040
Tons of freight carried one mile, 54% of car capacity, exclusive of private car lines ...	288,318,890,210
Tons of car structure (estimated 18 tons per car)	363,402,465,012
Total wheel burden carried one mile....	651,722,355,222 tons.

An analysis of the rolling stock will show that 95 per cent. of all freight cars are equipped with the chilled iron wheel, therefore, we have, in commercial freight car service and company service, and private car lines in the United States alone, 20,332,687 chilled iron wheels. To this we must add the chilled iron wheels serving under passenger cars, engine tenders and street car lines, and we can safely and conservatively estimate the number of chilled iron wheels running to-day as about 25,000,000, taking into consideration those used in the Dominion of Canada, and the hundreds of thousands which have been shipped abroad and to Mexico and South America. 25,000,000 chilled iron wheels represent 8,000,000 tons of metal.

Initial cost at $25.00 per ton	$200,000,000.00
Scrap value at $15.00 per ton	120,000,000.00

25,000,000 wheels placed on a single track would make a solid line of wheels 13,000 miles in length, over one-half of the circumference of the earth. If they were placed on a single track with treads 2.3 feet apart they would encircle the globe. If they could be piled on top of each other, hub to hub, they would reach a height of 2,760 miles. To replace 25,000,000 chilled iron wheels upon the basis of 2,500,000 annual renewals requires ten years. 800,000 tons of metal are used annually to provide for 2,500,000 wheel renewals. From the receipt of the metal to the finished wheel ready for shipment, the metal must be handled about twelve times, so that to produce 2,500,000 wheels annually 800,000 tons of metal are required and 9,600,000 tons of metal must be handled.

I speak for twenty-five manufacturers operating fifty foundries scattered from the Atlantic to the Pacific Oceans, located throughout the United States and Canada, representing millions of invested capital, and having a combined capacity of 20,000 car wheels per day, and having in mind the statistics to which I have just called attention, we must remember that the history of the development of the resources of North America is a history of the development of the chilled iron car wheel, because the railways could not have reached their present unparaleled development without the chilled iron car wheel, and it would require years and years of preparation to replace them with any other substitute.

What Chilled Iron Is

Chilled iron means what the name implies and is the result of the chilling or sudden cooling of molten cast iron when poured against an iron ring, which is part of the mould. Its discovery is said to have been accidental. In an English foundry, in the 18th century, the slopping over of a ladle of cast iron caused part of its contents to come in contact with cold iron lying on the floor of foundry. In breaking up this scrap it was discovered that the iron was white and much harder than that secured from the ordinary foundry process of pouring the metal into a sand mould. The result of this discovery was the introduction of chilled iron for plow points, faces of forge hammers, punches for punching holes in wagon tires, and rolls for rolling materials.

Chilled Iron for Car Wheels

During the first half of the nineteenth century, a number of attempts were made to introduce chilled iron for car wheel purposes, and many different designs were patented and introduced, with only meagre results. In the primitive days the form of the wheel was the ordinary flat spoke pattern with the hub split longitudinally in three places. The separation of the hub was for the purpose of relieving shrinkage strains

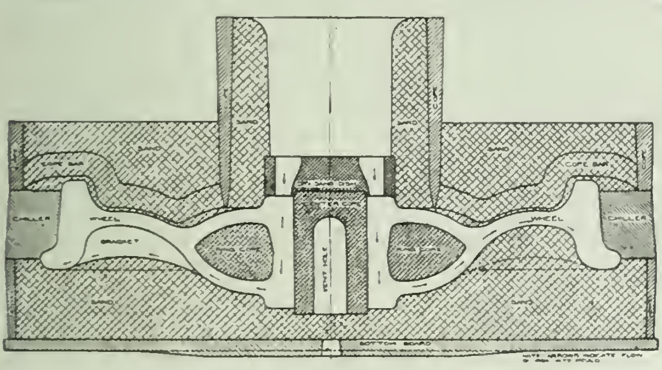


FIG. 1. CROSS SECTION OF CAR WHEEL MOLD SHOWING DIRECTION OF FLOW OF METAL.

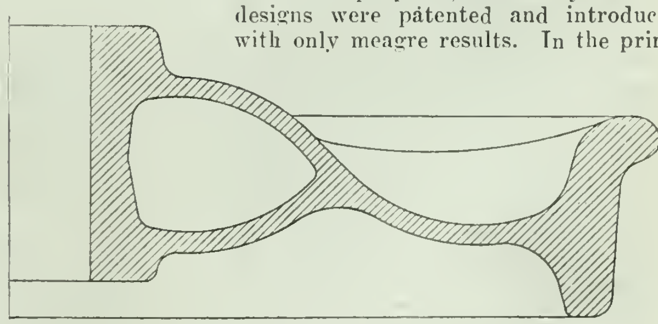


FIG. 2. WASHBURN PATTERN 525-LB. WHEEL FOR CARS OF 10 TONS CAPACITY.

*From a paper read, Feb. 13, at the Canadian Railway Club, Montreal.

**President, Association of Manufacturers of Chilled Car Wheels, Chicago, Ill.

in cooling and preventing the arms and spokes from breaking. The hub was banded together with a wrought iron band and keyed onto the axle. In the year 1838, Geo. G. Lobdell invented a double plate wheel, the front and back plates extending from the hub to the rim, which subsequently evolved into the present pattern.

In the year 1850, a man arose to the situation and developed an idea, the im-

dangerous to use. Anyone by the use of the Scleroscope or Brinell methods can determine the relative hardness of the chilled iron wheel tread, as compared with other types.

The M.C.B. standard 725 lbs. wheel is poured in about twelve seconds. The balance of the mould consists of green sand and dry sand cores, all so scientifically arranged that the finished wheel possesses a gradual hardness of struc-

countered which must be relieved before the wheels are placed in service. During the earlier periods of manufacture, after the wheel was set, it was covered with ashes or hot sand and allowed to remain several days until nearly cold. Another method was to lay the wheel on the floor and apply heat to the tread, so that the temperature of the tread would be brought back to that of the plates and hub.

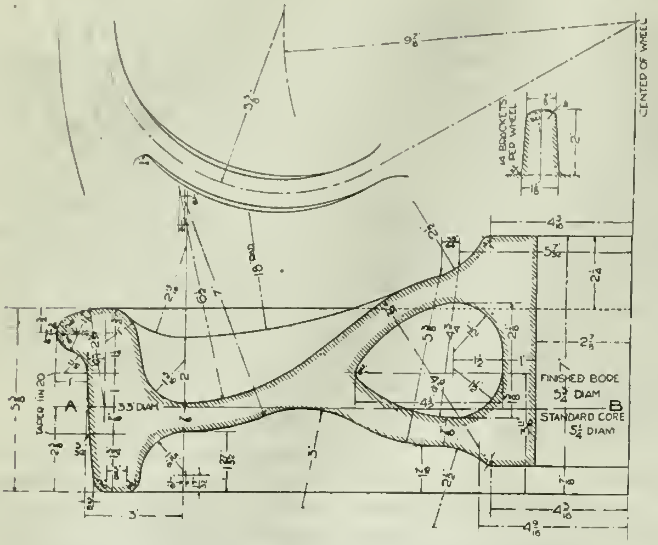


FIG. 3. M.C.B. STANDARD 625 LBS., 33-INCH C.I. WHEEL FOR CARS OF MAXIMUM GROSS WEIGHT, AND NOT EXCEEDING 95,000 LBS.

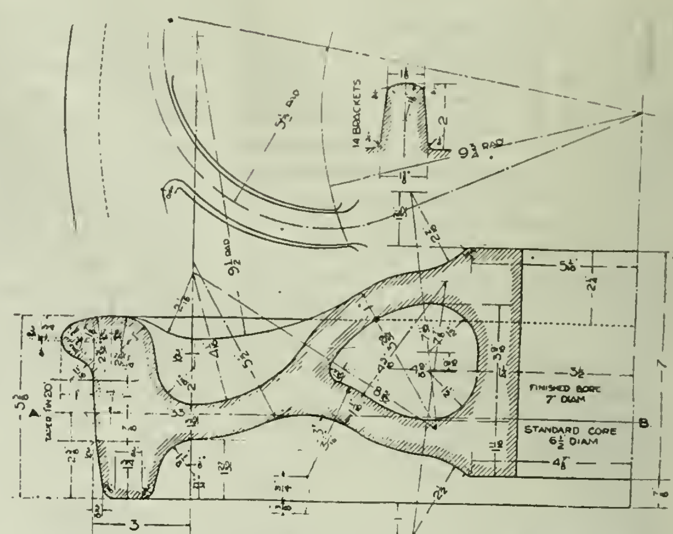


FIG. 4. STANDARD 725 LBS., 33-INCH C.I. WHEEL FOR CARS OF MAXIMUM GROSS WEIGHT, AND NOT EXCEEDING 161,000 LBS.

mensity of which was not dreamed of by him, but has since evolved into one of the most far reaching and important commercial industries in the country. From 1849 to 1860 there were eighty-eight patents granted for alleged improvements in the form of pattern. It was N. Washburn's belief that a solid casting weighing about 500 pounds could be produced that would serve as a car wheel which would require no machining, except as to axle fit and which could be placed into service under the then ten ton car and run on an iron rail for the life of the car.

Method of Manufacture—Pouring

The method of manufacture in so far as the formation of the wheel is concerned, is practically the same to-day as when first introduced, and consists of pouring the iron into a mould, part of which is sand and part iron. The tread or running surface of the wheel is formed by an iron ring or chiller against which is poured the molten metal, and the sudden cooling of molten metal transforms the soft gray colored metal to a metal white in color and harder than tempered steel. This white, hard iron which extends all around the tread of the wheel to a depth of one-half to three-quarters of an inch, yields more mileage per unit of metal worn than any other metal. There is no other metal known that produces so hard a tread that can be operated with safety, because if other metals can produce a tread as hard as the chilled iron wheel this same hardness will be apparent in the plates and the hub, and, therefore, brittle and

ture which is ideally adapted to service conditions, namely hard tread, soft plates and soft hub. Figure No. 1 shows a section of the mould in which the chilled iron wheel is cast, and the same principle of moulding has been in use ever since its introduction.

Annealing

We have found that a 725 lbs. M.C.B. wheel is poured in about twelve seconds. The molten metal is then subjected to different cooling conditions due to the complexity of the mould, which is made up partly of iron, partly of dry sand, and partly of green sand. That part of the mould which consists of iron is the best conductor of heat, therefore, the tread or running surface is cooled almost instantaneously, whereas the plates and the hub, having been formed by dry and green sand, cool slowly. In consequence, shrinkage strains are en-

These crude methods were later displaced with the introduction of cooling pits lined with fire brick, each pit holding from ten to fifteen wheels. Just as soon as the wheel is solidified, it is removed from the mould red hot and placed in a pit maintained at the proper temperature, and by this process the tread and the plates and the hub resume an equilibrium of temperature and the wheels remain in the pits for several days until the shrinkage strains are finally removed by the gradual and uniform cooling process.

The pouring and annealing are important parts of the method by which the wheel is made, but they are only two of the multitudinous processes required.

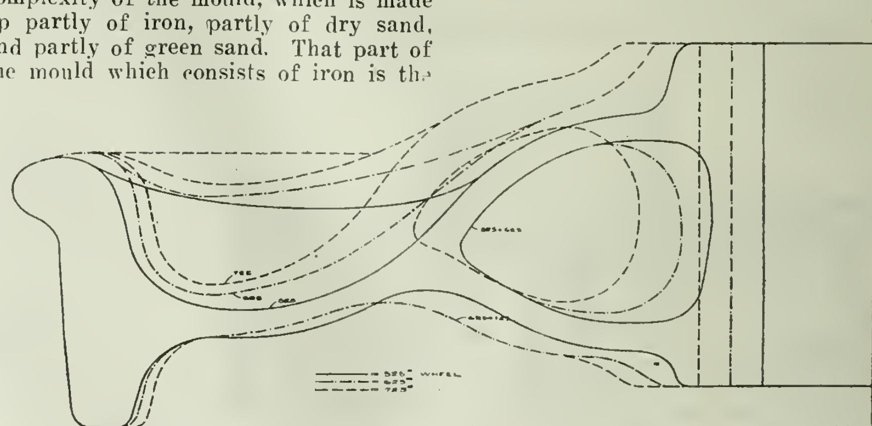


FIG. 5. COMPOSITE OF 525 LBS. WHEEL FOR CARS OF 10 TONS CAPACITY; 625 LBS. M.C.B. DESIGN FOR 30 TONS CAPACITY; M.C.B. DESIGN FOR 50 TONS CAPACITY CARS.

The intricacies of manufacture are only recognized by those who have actually engaged in the business, and complex problems are continually confronting the manufacturer from the assembling of the material to the finished wheel.

We have found the method of manufacture as to pouring has not been materially changed, and we have also found that the pattern introduced in 1850 by Washburn is the same in outline practically as that in use to-day. It will, therefore, be my purpose to show what has been done, and it will be found that the only thing that stands out prominently is that a little metal has been added to the wheel as the capacity of the car has been increased, but the increase in metal has been "grudgingly made," and never proportionate to the increase of duty required. Nevertheless, the wheel manufacturers, in the face of restrictions in weight and flange dimensions, have been successful in maintaining the chilled iron wheel up to a high standard. The chilled iron wheel is like Topsy in Uncle Tom's Cabin. It just grew, and we all realize the fact that the wheel is the most important part of the car structure.

DOMINION STEEL CORPORATION YEAR

THE changed character of Canadian steel production is shown strikingly in the Dominion Steel Corporation output figures for 1916. In the calendar year of 1914 the rail output amounted to 176,505 tons. It was 174,802 tons in the fiscal year 1912-13. In 1915 the output fell to 57,500 tons, and last year it was 17,495 tons. On the other hand, the output of wire rods has risen successively from 30,778 in 1914, to 73,500 in 1915, and now to 112,400 tons for 1916, while sales of wire products, which were less than 11,000 tons in the fiscal year 1912-13, have jumped to 47,500 tons.

These increases are a direct reflection of the export demand created by war conditions, and have resulted from the corporation's ability to diversify its output. Last summer, President Workman noted that the mills were then turning out twice as much barbed wire as six months previously, and the production at the end of 1915 had been about double the capacity at the outbreak of the war. The rail production, now little more than nominal, suggests post-war developments for the life of a rail is only so long, and annual replacement demands alone, deferred to the fullest possible extent since the war, should furnish substantial business when urgent war requirements cease.

An official statement of the corporation's output for the calendar year 1916, shows a new record in tonnage of ingots, the figures being about 8 per cent. higher than in 1915. Pig iron production was more than 12 per cent. in excess of the previous year's showing. Coal output was lower at about 4,500,000 tons, against 5,000,000 in 1915, recruiting and the shortage of shipping facilities entering as adverse factors. The approximate output of the various products is given as follows:—

..	1916.	1915.	1914.
Pig iron	348,000	309,800	334,101
Steel ingots .	376,000	349,000	331,000
Rails	17,495	57,500	176,505
Wire rods ..	112,400	73,500	30,778
Wire products	47,500	34,000	32,414
Blooms, billets, etc. ..	150,000	....	....
Merch. bars .	9,950	....	....

Large expenditures were made during the year for improvements and extensions to the plant, as well as for renewals. The statement adds: "The tonnage of steel on order is sufficient to keep the works actively employed for several months, and, so far, there is no indication of any slackening in the demand for all the materials that the company can produce.

CANADA'S MINERAL PRODUCTS

AN authority on such matters is quoted as saying that of the traffic provided for all railroads in Canada in the year 1913, the mines were responsible for 38 per cent., as compared with 16 per cent. credited to products of agriculture. Similar ratios govern in other years, and from such figures it is deduced that mining is the basic industry of the Dominion. He goes further by accentuating the part mining plays in providing the first essentials in national defence. From this viewpoint the position of Canada looms to proportions of international significance. The following word picture is drawn:—

"Our coal resources are among the greatest in the world.

"Our asbestos deposits in Quebec supply most of the asbestos of commerce.

"The greatest nickel deposits in the world are located at Sudbury.

"Ontario has the largest body of high-grade talc on the continent at Madoc; the largest body of high-grade feldspar on the continent in the Richardson mine, near Verona; the greatest mica mine on the continent at Sydenham, and the greatest graphite mine at Calabogie, and a recent molybdenite find within thirty miles of Ottawa may soon outstrip all rivals.

"We also have one of the richest silver camps in the world at Cobalt, and the most promising of the younger gold camps on the continent at Porcupine. Our smelters produce more refined cobalt than all other refineries in the world put together.

"With such a magnificent heritage we would be very delinquent in our duty if we did not give the mineral industry the careful attention it deserves."

Of the production of steel ingots and castings in 1916, about 43,790 short tons (39,098 gross tons) were made in electric furnaces. In 1915 only 61 short tons were reported as having been made in electric furnaces in Canada.

STEEL PLANT EXTENSIONS IN 1916.

FROM statistics compiled by a U.S. contemporary covering steel plant improvement and extension, during last year, the following data pertaining to Canadian establishments is available:

The Algoma Steel Corporation, Sault Ste. Marie, Ont., added a 32-in. billet mill. In the duplex plant, two 75-ton stationary open-hearth furnaces were also built. This year a 75-ton stationary open-hearth furnace will be constructed and also a heavy structural mill.

The Dominion Iron & Steel Co., Sydney, N.S., has under construction a new 400-ton blast furnace. Contracts have been awarded for 120 Koppers by-product coke ovens with a capacity of 11.2 tons of coke each in 24 hours.

The Steel Company of Canada, Hamilton, Ont., completed and put in operation three 75-ton open-hearth furnaces and doubled its soaking pit capacity. It also made large additions to its shell-forging plant. At its Montreal plant a large addition was made to the shell-finishing plant. A new 75-ton open-hearth furnace is under construction.

The Canadian Car & Foundry Co., Montreal, Canada, made such additions to construction and equipment as were necessary for the furtherance of munition work, but the company does not consider this as capital expenditure. Over $1,000,000 has been spent or authorized on this line of work, although it is not considered as of a permanent character.

The Canadian Car & Foundries, Montreal, built at its Welland, Ont plant two new 25-ton basic open-hearth furnaces, making a total of four, and is now building two more to be completed next month. It has also installed a 1,000,000-gallon oil storage tank and built a new forge shop for forging 5000-4½-in. shells per day. At the company's Longue Pointe works, Montreal, one 25-ton acid open-hearth furnace was built, making a total of four. Another furnace of the same type is under construction to be completed this year. At the Point St. Charles plant, Montreal, one more furnace is contemplated. The company is installing there a forge shop for making 6-in. shell forgings at the rate of 4000 per day, commencing March 1.

The Nova Scotia Steel & Coal Co., New Glasgow, N.S., is erecting a new blast furnace Sydney Mines, N.S.

The Manitoba Steel Foundries, Winnipeg, Man., has practically completed its new foundry. It will make electric steel both in the form of castings and ingots for rolling and will have a capacity of 8000 to 10,000 tons per year.

The Pacific Steel Products, Ltd., Bridgeport, B.C., is constructing a new open-hearth steel furnace and installing machines for turning out railroad spikes, bolts and nuts.

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PRINCIPAL CONTENTS

OUR PRESENT EFFORTS A FUTURE ASSET

HISTORY has been made in more ways than by feats of arms since the memorable appeal for shells was made by Sir John French when in command of the British forces in France. Not the least notable of developments incident to the then crisis has been the steady increase of munitions output by Canada, with its resulting influence on our future status in the manufacturing world, and which, is yet, possible of little more than approximate estimation. One fact, however, stands out in strong relief amid the meantime din of industrial effort, viz., our reserve strength in men, money and material wealth.

In pre-war days the productive capacity of the Dominion, in strictly mechanical fields, was of a very limited nature, due in part to the fiscal policy which seems to be indispensable to young industrial nations during the embryonic stages of developing their natural resources and consolidating their commercial and manufacturing enterprises. Had times such as these been foretold in all their present reality, their improbability would have been readily admitted rather than otherwise.

With reference to our munitions manufacture, it may be said that this in itself is ample evidence of the first item of reserve strength, i.e., men. The use of the word "men" is, of course, somewhat ambiguous now, in view of the successful and increasing employment of women, and when we say successful, we mean more than getting out shells or fuses on time. By successful, we mean the utilization of women help in such a manner that mutual satisfaction with the results obtained will insure a future continuance whenever and wherever opportunity offers. Among the contributing factors may be mentioned equitable remuneration, facilities enabling their arrival and departure from work to be made in a manner consistent with reasonably refined custom, and the shortest hours possible that the nature of the work permits.

The successful utilization of labor from so many previously unsuspected directions is one feature however, which is destined to have a lasting influence on future industrial conditions, not only in Canada, but elsewhere. Abnormal effects are usually the result of abnormal causes, which, if maintained long enough, come to be regarded as normal. While many of the present abnormalities will disappear in due course—even now the adjustment process is abundantly evident—they will be replaced by others of a more stable, permanently, beneficial nature, for which the present period of strenuous effort will have provided the preliminary preparation.

Another noteworthy and intensely personal factor, and perhaps more important than that of actual service, is the mechanical resourcefulness which has been displayed by the staffs of hundreds of factories from ocean to ocean. In the ordinary course of events, thousands of mechanics would never have had occasion to worry about methods and devices of production to the extent at least that these latter have had to be applied in solving satisfactorily munitions manufacturing problems. Their experience with products of their own brains and hands in competition with those of erstwhile competitors and foreign specialists has given them a confidence in their own ability and a capacity for estimating and appreciating at their true value the products of others, a circumstance in itself that cannot help but have a great, though indirect bearing on our future industrial activities.

It has enabled them and others to judge our engineering products from every angle, and, while the ultimate growth of the country precludes the possibility of being entirely independent of foreign machinery builders, conditions during the last two years have been such that a fuller, stronger, wider, and more distinctively Canadian metal-working industry can be confidently looked forward to.

Vast though our expenditure on war has been, it must not be forgotten that our ability to meet this is due to national credit, which in turn is founded on national resources. Without the first and last of these—men and materials—our credit might long ago have ceased to exist. The recognition by the Government of the necessity for scientific research, and subsequent industrial development, will result in an ever-increasing appreciation of Canada's natural wealth. The extent of our dependence on the United States for essential materials would be brought home to us, perhaps more vividly, if the entrance of that nation into the European conflict resulted in prohibition or even restriction of much meantime exported material. It would, however, be ultimately beneficial so far as it stimulated the development of our own resources—mineral and manufacturing.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

PROTECTION OF IRON BY ELECTROPLATING—III.*

By O. P. Watts and P. L. Deverter

ANOTHER method of testing for porosity consisted in examining the electro-deposits by transmitting light. To secure zinc deposits, advantage was taken of the poor adhesion of electro-plating on aluminum. Sheets of aluminum were polished, immersed for a few seconds in the electric cleaner, rinsed, and plated with zinc. The edges of the sheet were then cut away, and the deposit was stripped off and examined. The results are given in Table XIII.

Porosity of Zinc Deposits on Aluminum.

Time, Min.	Temp.	Amp./dm.2	Amp. Hrs./dm.2	Holes
5	Cold	6.32	0.52	Many
10	Cold	6.57	1.09	Few
20	Cold	5.55	1.85	None
30	Cold	5.12	2.56	None

At and above 1.8 ampere hours per square decimeter no holes were found—a good agreement with the previous test.

The lack of adhesion of electroplating on aluminum is due, in part at least, to an invisible film of oxide on the surface of the metal, and in spite of the good agreement seen in the last two sets of tests, there remained a suspicion that this film of oxide might cause electroplating on aluminum to be less uniform than on other metals. It was therefore decided to avoid the use of aluminum for receiving the deposit, wherever possible. Nickel, copper, and brass deposits were obtained by plating on zinc, and dissolving this in dilute sulphuric acid. A description of the deposits and the results of inspection are shown in Table XIV.

Table XIV—Porosity of Metal Deposits on Zinc.

Deposit	Time, Min.	Temp.	Amp./dm.2	Amp. Hrs./dm.2	Holes
Copper	3	Hot	8.2	0.41	Few
Copper	6	Hot	6.1	0.61	None
Copper	6	Hot	6.8	1.14	Few
Copper	10	Hot	7.5	1.20	None
Copper	20	Hot	6.5	2.18	Few—6 per square inch
Copper	40	Hot	7.8	3.12	Few—4 per square inch
Brass	3	Hot	12.0	0.60	None
Brass	5	Hot	12.0	1.0	None
Brass	10	Hot	12.0	2.0	None
Brass	20	Hot	12.0	4.0	None
Nickel	3	Hot	9.2	0.46	Many
Nickel	5	Hot	9.5	0.79	Many
Nickel	10	Hot	9.0	1.50	Several
Nickel	20	Hot	12.9	4.30	None
Nickel	40	Hot	12.9	8.60	None

This study of the porosity of electroplating seems to show that brass 0.000154 in. (0.0039 mm.) thick and copper 0.000347 in. (0.0087 mm.) thick, deposits from the cyanide solution up to 0.5 ampere hours per square decimeter (4.6 amp. hrs. / ft^2) contain pin-holes, and that nickel plating requires 1.5 ampere hours per square decimeter (14 amp. hrs. / ft.^{2}, 0.00102 in. thick) before pin-holes disappear.

In weathering tests of two to four months' duration, rusting occurred on brass and copper plate many times thicker than the minimum for the disappearance of pin-holes. In case of the heavier deposits, rusting was confined to spots a millimeter or less in diameter, the spaces between spots giving perfect protection to the iron beneath. For nickel plate there was good agreement between the disappearance of holes and freedom from rust. The divergence shown in this respect by copper and brass plating may possibly be due to the greater difference of potential between these metals and iron than that which exists between nickel and iron. The greater the difference of potential or corrosive force, the more difficult will it be to prevent rusting.

For copper deposits there were no holes at 4.4 ampere hours per square ft. (0.000347 in., 0.0087 mm., thick) and no rusting at 60.4 ampere hours per square foot (0.00248 in., 0.062 mm., thick). Similar vaules for brass plate are 5.1 amp. hrs / ft.^{2} (0.000154 in., 0.0039 mm.) for no holes, and 20 amp. hrs. / ft.^{2} (0.00607 in., 0.152 mm.) for no rusting. Nickel required 16.8 amp. hrs. / ft.^{2} (0.00108 in., 0.027 mm.) for the absence of holes, and 25.4 amp. hrs. / ft.^{2} (0.00146 in., 0.37 mm.) for freedom from rust.

The only hope of a general use of copper and brass plate on iron exposed to the weather seems to lie in securing a uniform deposit, free from pin-holes. In special cases it may be feasible to employ the extremely thick deposits of these metals which have been shown to be necessary to protect iron from the weather, but unless the plated article is fairly rigid there is danger of cracking and peeling of such heavy deposits, and the time and expense of producing them will prevent their general employment.

Conclusions

1.—The experiments confirm the orthodox view that the superiority of electro-galvanizing over deposits of other metals for the protection of iron is due to voltaic action.

2.—It has been shown that thin electro-deposits of zinc, copper, nickel and brass are full of holes, and therefore only the first may be relied on to prevent rusting, unless deposits are made much heavier than is at present the rule.

3.—Deposits of nickel should exceed 0.0015 in. (0.038 mm.) in thickness in order to protect iron out of doors, and copper or brass plate should have three times this thickness. Even then it is a question how long such coatings will afford protection.

4.—For the protection by electroplating of iron which is to be exposed to the weather, zinc (or cadmium) is the only metal worthy of consideration.

5.—The foregoing experiments do not show that double coatings—zinc followed by copper or brass—are distinctly superior to a single heavy coating of the latter metals. If zinc is to be used advantageously, it should form the outer coating.

6.—It is very desirable that some method be found for producing a uniform electroplate, free from the holes which were responsible for rusting in these experiments. Could such plating be done, deposits of nickel, copper and brass would form a far more effective protection to iron than at present.

*From a paper presented before the annual meeting of the American Electro-Chemical Society.

Silvering Brass for Lacquering.—It often happens, in finishing ornamental work, that silver bands or reliefs are needed, the thickness of the silver, of course, being a minimum. To make a good and efficient solution for the purpose, dissolve 1 oz. of good nitrate of silver in a quart of distilled water, and in a separate vessel make a semi-saturated solution of hyposulphite of soda. Add sufficient of the hyposulphite solution to the nitrate of silver solution to throw down the silver as a brownish precipitate, agitating the liquid; then add, drop by drop, sufficient of the hyposulphite to re-dissolve the precipitate, and after this is secured add a slight excess of hyposulphite. Store in black or other non-actinic glass bottles, well corked. To use, apply to the clean metal with a sponge or brush, and rinse off with clean water, and dry thoroughly before lacquering.

Questions and Answers

Question.—In the manufacture of tools for munition factories we desire to obtain a black non-oxidizable surface upon the steel. Kindly suggest a formula which we could use for this purpose.—S. P.

Answer.—Prepare a solution of the following chemicals:—Bismuth chloride, 1 oz.; copper chloride, 1 oz.; hydrochloric acid, 6 oz.; mercuric chloride, 2 oz.; denatured alcohol, 5 oz., and water, 1 gallon. Mix thoroughly and immerse the cleaned tools in solution while the latter is maintained at a temperature of about 120° Fahr. If blacker tones are desired, redip the steel. Remove and place in boiling water, and allow the steel to remain in the boiling water for at least ten minutes; then remove and wipe dry with clean cloths. A few trials will suffice to enable inexperienced labor to produce splendid black color, which will prove both pleasing and effective.

* * *

Question.—In the manufacture of patented fasteners for ladies' dresses we have experienced difficulty in obtaining a clean yellow brass surface on the parts. The sheet brass from which the fasteners are punched is streaked with reddish color. A large percentage of the pieces have red spots on them after treatment in the bright acid dip, and these spots do not finish black in the copper carbonate and ammonia oxidizing solution which we use. Our acid dip consists of 2 parts sulphuric acid, 1 part nitric acid, and a small quantity of common salt. Do you think the brass is at fault, or can the red spots be removed by chemical or mechanical treatment? We submit a sample of the unfinished article.—P. H.

Answer.—The discoloration is merely superficial, and may easily be removed by the acid dip if the acids are in proper proportions for this particular purpose, and if the pieces are quickly and vigorously subjected to the acids. The samples were cleaned to a bright yellow brass color by immersion in a solution consisting of equal parts sulphuric acid and nitric acid, no salt or muriatic acid being employed. We would suggest that the acid container be set in a tank, and cold running water be allowed to surround it, thus aiding in maintaining a cool solution throughout the day. When treating large quantities of these small parts, it is essential that the quantity immersed be small in proportion to the volume of acids used. Again, the manipulation of the basket or perforated container, while in the acid, must be such as to cause the entire surface of each piece to become acted upon by the acid. Vigorous shaking will expel the air from the pockets, and experience will quickly enlighten you as to length of time it is safe to allow for each immersion. Rinse in cold running water, the rinsing process being a very important part of the treatment. The basket must be moved rapidly through the water in a manner to wash off the acid in the quickest possible time. When the basket containing the pieces is immersed in the oxidizing solution the same motion should be practised, the object being to present all portions of the brass surface to the solution in order to obtain a uniform finish. If the pieces are not agitated while immersed in the dips, the pockets containing air do not receive the solution, and, therefore, remain red or become stained, depending on character of solution. The brass is of good quality, and if you will apply a piece of it to a buff or polishing wheel, you may quickly satisfy yourself as to the depth of discoloration. To protect the black finish obtained with the copper carbonate and ammonia, use a very thin transparent lacquer; a water lacquer would be preferable owing to the extreme lightness of the parts, and the necessity of treating in very large quantities.

* * *

Question.—Please explain why a solution of common yellow soap containing small percentage of sodium cyanide will not prove efficient as an electric cleaning bath in the preparation of steel which has been polished with emery cake before reaching the plating department.—C. M.

Answer.—Because yellow soap and cyanide solution will not saponify the tallow and greases which are attached to the steel when received in the plating department. The caustics, such as soda or potash, saponify or reduce such matter as may be on the surface of the metal under treatment, and which is susceptible to the action of these caustics. The action of the hydrogen is purely mechanical in loosening the solidified matter from the metal and floating it to the surface of the solution. It is not essential to use caustic for electric cleaners, as there are now on the market several very good mild compounds which are proving eminently satisfactory in the preparation of cleaning solutions for all classes of metals and methods of cleaning. When attempting to clean metals for plating, adapt the solution to suit the conditions of the metallic surface to be cleaned. It is useless to try reversing this procedure.

* * *

Question.—How can I produce a simple verde green on large copper-plated objects?—M. E.

Answer.—Dissolve 1 lb. of copper sulphate and 1 lb. of ammonium chloride in 1 gallon of water. Also dissolve 1 oz. of ammonium sulphate in 1 pint of water. Deaden the surface of the object with brass wire scratch brush and pumice, wash the object and immerse in the first mentioned solution, which may be called the verde solution. Remove and allow to dry. Green color will not be perceptible. Next stipple the surface with solution No. 2 applied with an ordinary painter's sash tool, allow to dry for about fifteen or twenty minutes, and then immerse in clear cold water, moving the object rapidly while immersed. The green tones will then appear over the entire stippled surface. Remove and dry without heat. Lacquer by dipping or spraying, or finish with wax dissolved in turpentine and polish with Canton flannel buff.

* * *

Question.—Our nickel deposits stain very easily. Please inform us of the cause and a remedy.—C. G.

Answer.—Your nickel solution is probably alkaline; deposits from alkaline solutions stain very readily. Add sulphuric acid to the bath in small quantities until the trouble is corrected, or add sulphate of nickel if the metal strength of the bath will allow.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers 1916-1917.

President—Wm. J. Salmon, 104 Lake Front, Kew Beach, Toronto.
Vice-President — John Acheson, 1065 Dundas Street, Toronto.
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Librarian — John A. Magill 591 St. Clarens Ave., Toronto.

PLACE AND DATES OF MEETING.

The Occident Hall, corner of Queen and Bathurst Streets. Fourth Thursday of each month, at 8 p.m.

MANGANESE IN COPPER-NICKEL ALLOYS

MANGANESE is largely used as a deoxidiser for copper-nickel alloys. The best method of using is to introduce it as manganese-copper, as that method renders the introduction of the manganese positive. Unless the pure manganese is added in the right manner, the results are uncertain, and lack uniformity. Pure manganese melts at a temperature very much higher than German-silver or other nickel alloys, and when it is added to the molten metal it does not melt, but remains on the melted mass in its original condition, being removed when the crucible is skimmed. The best method is to first make a rich copper and manganese alloy, and then use this for adding to the German-silver or other alloy to be treated. The copper and manganese alloy melts at about the temperature of the German-silver and then diffuses through the metal shortly after it melts. A method which gives satisfactory results is first to make 70 per cent. copper and 30 per cent. manganese alloy. The manganese and copper are melted together in a crucible at a heat sufficiently high to melt the manganese, after which the mass is stirred and poured into small bars that can readily be cut into pieces. The resulting cupro-manganese is added to the metal or alloy in the proportion of about 5 oz. to 100 lbs. of the molten metal. The best results are obtained if it is added when the metal is put into the crucible and it is allowed to melt with the other metals.

Best in Foundry Equipment at Lowest Cost

Advice well-timed is a money-saver and a money-earner. Take this timely advice—GIVE US A TRIAL. Our lines include everything in foundry, Facings, Equipment and Supplies and the quality and the price of our goods are certainly without parallel.

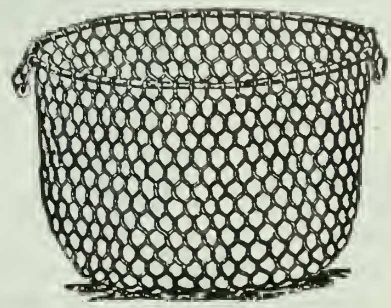
WE HAVE A FULL LINE OF FOUNDRY EQUIPMENT FACINGS AND SUPPLIES

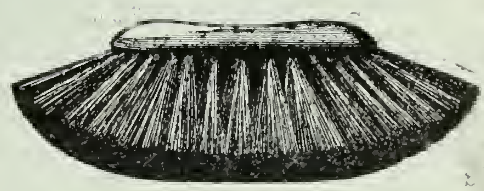
When you buy from the Hamilton Facing Mill Co., you are buying direct from the manufacturer, who has studied and practised economy in production and who in consequence is producing at a right price. We keep a strict eye to—QUALITY—we stand behind each line we manufacture as to quality, and no inferior article is allowed to leave our factory. We sell the best foundry equipment at lowest cost.

TWO OF OUR SPECIALS

Our pure Ceylon Plumbago Facing has made its mark — it is much in favor in foundries everywhere for dry and green sand work. Why not test it?

We have the distinction of being the distributors for Ontario for the Harbison Walker Refractories Celebrated Fire Brick. This well-known Brick has no superior.





The Hamilton Facing Mill Company, Limited

HAMILTON ONTARIO CANADA

Quality and satisfaction is our aim

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey Forge, Pittsburg	$31 95	
Lake Superior, charcoal, Chicago	35.75	
Standard low phos., Philadelphia	53 00	
Bessemer, Pittsburgh	35 95	
Basic, Valley, furnace	33 00	
	Montreal	Toronto
Middlesboro, No. 3	.....	.....
Cleveland, No. 3	.....	.....
Clarence, No. 3	.....	.....
Victoria	.....	.....
Hamilton	.....	.....

FINISHED IRON AND STEEL

Per Lb. to Large Buyers. Cents

Iron bars, base	$4 00
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 25
Small shapes, base	4 75

METALS

Aluminum	68
Antimony	35
Cobalt, 97% pure	1 50
Copper lake	39 00
Copper, electrolytic	39 00
Copper, casting	39 00
Lead	12 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	79
Tin	56 00
Zinc	14 00

Prices Per Lb.

OLD MATERIAL.

Dealers' Buying Prices

	Montreal.	Toronto
Copper, light	$23 00	$24 00
Copper, crucible	27 00	28 00
Copper, heavy	27 00	24 50
Copper, wire	27 00	25 00
No. 1 mach. comp'n	23 00	22 00
No. 1 comp'n tur's	19 00	20 00
Heavy melting steel	13 50	15 00
No. 1 mach'y cast iron	21 00	16 00
New brass clippings	18 00	18 00
New brass turnings	15 00	16 00
Heavy lead	8 00	8 50
Tea lead	6 00	6 50
Scrap zinc	8 50	9 50
Aluminum	36 00	35 00

COKE AND COAL.

Solvay foundry coke, on application	....
Connellsville foundry coke.	
Yough steam lump coal	8 50
Pittsburg steam lump coal	8 50
Best slack	9 00

Net ton f.o.b. Toronto.

BILLETS.

Per Gross Ton

Bessemer billets	$65 00
Open hearth billets	65 00
Forging billets	90 00
Wire rods	80 00

F.o.b. Pittsburgh.

PROOF COIL CHAIN.

1/4 inch	$9 45
5-16 inch	9 10
3/8 inch	8 35
7-16 inch	7 15
1/2 inch	6 95
9-16 inch	6 95
5/8 inch	6 80
3/4 inch	6 70
7/8 inch	6 55
1 inch	6 40

Above quotations are per 100 lbs.

MISCELLANEOUS.

Solder, guaranteed	0.35
Babbitt metals	.13 to .60
Putty, 100-lb. drums	3.85
Red dry lead, 100-lb. kegs, per cwt.	13.87
Glue, French medal, per lb.	.25
Gasoline, per gal. bulk	0.29½
Benzine, per gal., bulk	0.28½
Pure turpentine, single bbls.	.71
Linseed oil, boiled, single bbls.	1.40
Linseed oil, raw, single bbls.	1.43
Plaster of Paris, per bbl.	2.50
Plumbers' oakum, per 100 lbs.	8.00
Lead wool, per lb.	.15
Pure Manila rope	.29½
Transmission rope, Manila	.37½
Drilling cables, Manila	.32½
Lard oil, per gal.	1.35

SHEETS.

	Montreal.	Toronto
Sheets, black, No. 10	$5 50	$6 00
Sheets, black, No. 28	4 50	6 15
Canada plates, dull, 52 sheets	5 75	5 75
Canada plates, all bright	7 50	7 50
Apollo brand, 10¾ oz. (galvanized)	7 25	7 25
Queen's Head, 28, B.W.G.	7 75	7 75
Fleur-de-Lis, 28, B. W.G.	7 45	7 35
Gorbal's best, No. 28	8 25	7 50
Colborne Crown, No. 28	8 00	6 75
Premier, No. 28, U.S.	7 75	7 70
Premier, 10¾ oz.	8 00	8 00

ELECTRIC WELD COIL CHAIN B.B.

3-16 inch	$11 70
1/4 inch	8 40
5-16 inch	7 40
3/8 inch	6 35
7-16 inch	6 35
1/2 inch	6 35
5/8 inch	6 35
3/4 inch	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A. net; B and C, 20 and 5 per cent.; cast iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples 72½; malleable, lipped union 60.

ANODES.

Nickel	$0.50 to $0.54
Cobalt	1.75 to 2.00
Copper	.44 to .46
Tin	.62 to .64
Silver, per oz.	.82 to .84
Zinc	.18 to .20

Prices per lb.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper carbonate, anhy.	.35
Copper, sulphate	.14
Cobalt, sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate ....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130 per cent.	.46
Sodium cyanide, 98-100 per cent.	.37
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$2.25
Polishing wheels, bullneck		1.35
Pumice ground		.04
Emery composition	.08 to	.09
Tripoli composition	.04 to	.06
Crocus composition	.07 to	.08
Rouge, powder	.30 to	.35
Rouge, silver	.35 to	.50

Prices per lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Toronto, Ont., March 6.—While the fuel situation has been relieved for the time being, little improvement has been noticeable as regards supplies of raw materials. The efforts of the railways were concentrated on moving coal but there still remains a large volume of freight along the frontier that has not been touched. Manufacturers who cannot get their raw materials are seriously handicapped. Machinery houses have the greatest difficulty in getting shipments through, while several cars of steel products have been over three months in transit from Pittsburgh to Toronto.

Steel

The situation in the steel trade has improved during the past week principally because supplies of coke are coming forward in greater volume. It will probably be some weeks before conditions are really satisfactory and production of steel reaches the level which obtained during the latter part of 1916. The return of cold weather will further handicap the railways and cut down supplies of fuel. Notwithstanding adverse conditions however, the steel companies are making a fine showing in regard to the production of steel for munitions. Plant extensions have of course enabled them to increase their output, to mention one concern only as a typical case, the Nova Scotia Steel & Coal Co., whose report for 1916 was recently issued. The output of forged shells in 1916 was 90 per cent. greater in number, and 120 per cent. greater in weight than in the previous year, while the total shipments of finished steel, forgings, etc. showed an increase of as much as 64 per cent.

Prices of iron and steel products continue very firm and further advances in the near future are expected. Plates, particularly, are bound to reach considerably higher levels owing to the large excess of demand over production. The mills are declining large tonnages because their capacity is quite unable to cope with the extraordinary heavy demand. The urgent demand for ships is the principal reason for the unusually tight situation in plates. Higher prices on wrought pipe are likely as skelp has recently advanced. Steel bars and shapes are unchanged, but very firm. A shortage of natural gas at Hamilton is causing considerable inconvenience at the mills.

Sheet mills continue to operate at reduced output, production ranging from about 75 to 85 per cent. of capacity owing to the unsatisfactory traffic conditions. Shut-downs are threatening all the time owing to the shortage and uncertainty of supplies of raw mater-

ials, chemicals, and fuel. Practically all mills are sold up for most of their first and second quarter output, prices are thus very firm and seem certain to avance. Galvanized sheets are already up; Premier No. 28 gauge is quoted at $7.70, and 10¾ oz., at $8.00 per 100 lbs., with higher prices expected.

The fuel situation in the United States is not quite so acute but is still seriously affecting production at a time when even a small falling off in output is severely felt. During February, operations at the mills equalled only 70 per cent. capacity, the falling-off in production being due to the severe cold weather and transportation difficulties. The situation has recently improved to some extent, production now being about 85 per cent. of capacity. Prices of iron and steel products continue very firm, but no important changes have been made during the week.

Pig Iron

With the freight situation improving, shipments of coke and pig iron are moving more freely. If the improvement continues with no set-back, the furnaces and foundries in this district will resume more active operations. The pig iron market is still very firm and prices steadily advancing. Very little foundry iron has been obtainable from Buffalo furnaces, but what can be secured is around $37 at furnace.

Scrap

The improvement in the freight situation is welcomed by scrap dealers and business is more active. Prices continue very firm on all kinds of old material, but there are no important changes to note. There is a heavier demand for low phosphorus steel scrap, and prices are steadily stiffening. Lead scrap is very firm and an advance is looked for shortly. All grades of copper and brass scrap continue very firm at unchanged prices.

General Supplies

The general situation as regards machine shop and mill supplies has not changed materially from last month. Business continues very brisk and prices on all lines are very firm. The high cost of pig lead has naturally resulted in an advance on lead products, including lead sheets which are now 2c higher. Gasoline, benzine and coal oil have each advanced 1c per gallon, and further advances are expected during the year. There appears to be a great scarcity of linseed oil, and prices, therefore, are entirely nominal.

Metals

There is practically no change in the situation in the metal markets, and prices have been maintained at last week's level. The general tendency of the market continues strong, due for the most part to the expectation that the United States will ultimately be drawn into the war. Copper continues strong with prices still nominal. Tin although higher in London is unchanged here. Prices of tin are also nominal, the market being affected by submarine operations. Spelter and lead are firmer at unchanged quotations, while antimony is quiet and easier.

Copper.—There have been no recent developments of importance in the copper market. Spot and nearby demand has not been so active, although a fair volume of business has been done in third quarter copper. Early deliveries continue scarce, and the general aspect of the market continues to be one of waiting developments. Quotations continue nominal and unchanged at 39c per pound.

Tin.—Although the price of tin has advanced in London, local quotations are unchanged, but market is firm. Submarine activities are affecting the market although it is understood that very little tin has as yet been lost. Local quotations are nominal and unchanged at 56c per pound.

Spelter.—Supplies of spelter in the East are more plentiful, and the situation has been relieved to some extent. There is no real shortage of metal, as production is large enough to take care of the present demand. Local quotation unchanged at 14c per pound.

Lead.—The "Trust" price of lead which for some time has been below the outside market has been advanced to 9c New York. Independents, however, are still quoting 10.25c to 10.75c New York for spot metal. There has been a marked falling off in demand, but the advance is expected to stimulate business. Local quotations unchanged at 12½ per pound.

Antimony.—The market is quieter though still firm, due to the continued scarcity of antimony. Local price 35c per pound.

Aluminum.—The market is firm with a slight upward trend but local quotations are unchanged at 68c per pound.

Foundry Supplies and Chemicals

Business has been good lately and all indications point to a continuance of the present activity. Prices of foundry supplies are holding very firm with an upward tendency due to the steady increase in cost of raw materials. Although there have been few price changes lately, advances in some lines may be looked for. The chemical market continues very firm, but prices on most chemicals are unchanged. Copper sulphate, however, has declined slightly to 15c, while sodium cyanide has advanced to 38c per pound. There is still a shortage of some chemicals, but the situation in this respect is not any worse than it was.

TRADE GOSSIP

St. Catharines, Ont.—The St. Catharines Brass Works, Ltd., is building a foundry.

Hull, Que.—The Hull Iron & Steel Foundries, Ltd., propose to make additions to its plant which it is reported will cost $500,000.

D. Walter Munn, of the Montreal Rolling Mills Branch of the Steel Company of Canada, has joined the engineering department of the Algoma Steel Corporation, Sault Ste. Marie, Ont.

The Canada Metal Co. held their annual convention at Toronto on Feb. 12 and 13. Salesmen from all over Canada attended the sessions which were presided over by W. G. Harris Jun.

Sherbrooke, Que.—Fire on Feb. 8, damaged the plant of the Mackinnon, Holmes Co., steel manufacturers, here, to the extent of about $30,000. The loss is covered by insurance.

Thorold, Ont.—The Exolon Co., manufacturer of abrasive refractory materials, has commenced the erection of an addition to its plant, and will instal equipment so as to increase the production by 100 per cent.

Montreal, Que.—Canada Stove and Foundry Co. plans to build a concrete, brick and mill construction pipe foundry at St. Laurent. Estimated cost, $36,000. W. A. Mahoney, 78 Quebec Avenue, Guelph, Ont., architect.

St. Thomas, Ont.—The plant of the C. Norsworthy Co., known as the Red Foundry, was badly damaged by fire on Feb. 28. The origin of the fire is unknown. The loss, $20,000, is partly covered by insurance. The company will rebuild at once.

Hull, Que.—Fire which broke out in the plant of the Hull Steel and Iron Foundries, Ltd., on Sunday, March 4, caused damage to the extent of between $4,000 and $5,000 to the building and its contents. The loss is fully covered by insurance.

Toronto, Ont.—The Queen City Foundry Co. plant on Cherry street, was gutted by fire on Monday morning. All the equipment was destroyed and also the patterns. The loss is estimated at $60,000 which is only partially covered by insurance.

Ralph D. Norton, Craig Street, Montreal has secured an exclusive agency for Canada for the John Illingworth, Steel Co., of Frankfort, Pa. This concern has been established since 1855 and they make high grade crucible steel and also special open hearth steel.

London, Ont.—The London Smelting & Refining Co., have purchased the old power house of the London and Lake Erie Railway at Chelsea Green, London, and has converted this into a plant for the smelting and refining of metal under the management of Geo. Trudell.

Standard Steel & Tempering Co., has been incorporated at Ottawa with a capital of $50,000 to construct and operate steel, iron, and brass plants, foundries and furnaces etc. The head office is at Montreal and the incorporators are S. H. R. Bush, B. Robinson and T. E. Durocher all of Montreal.

George Dawson, who has been master mechanic of the Canada Stove & Foundry Co., St. Laurent, Montreal, and who is leaving to accept a position in Campbellford, Ont., was given a farewell supper and presented with a quarter-oak cabinet and a silver tea service at the factory on Feb. 26, by his fellow-workers.


Pattern
Making
Illustrated

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Tilghman-Brooksbank Sand Blast Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Hyde & Sons, Ltd., Montreal, Que.
Standard Equipment Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE MACHINES, HAMMER
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Demmler & Bros., Wm., Kewanee, Ill.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hyde & Sons, Ltd., Montreal, Que.
Toronto Testing Laboratories, Toronto.

MIXERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
W. S. Hill Co., 323 Fourth Ave., Pittsburgh, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TEEMING CRUCIBLES AND FUNNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg.

TRIPOLI

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS

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ADVERTISING INDEX

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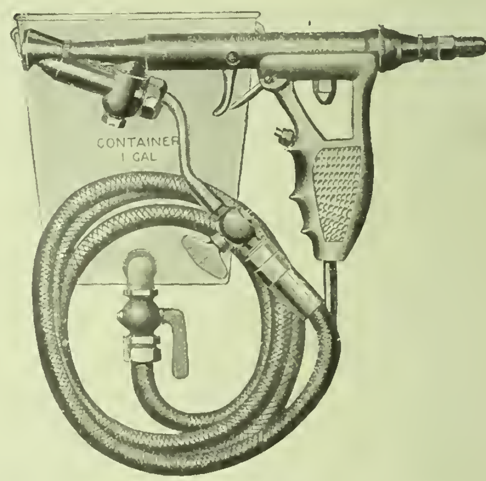

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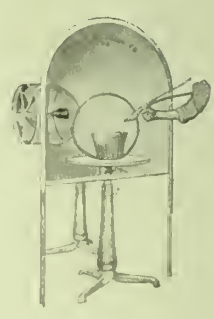


CANADIAN HANSON & VAN WINKLE COMPANY, Limited

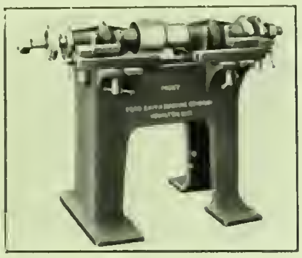
TORONTO - CANADA

Canadian Foundryman and Metal Industry News

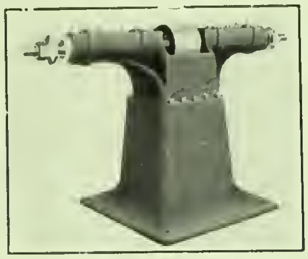
A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, APRIL, 1917 No. 4

Light Type Floor Grinders

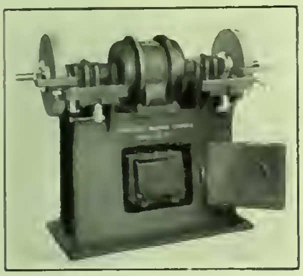


Heavy Type Floor Grinders



Plow Grinders

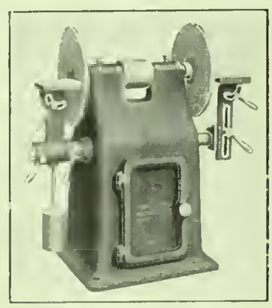
Water Tool Grinders



Motor-Driven Grinders

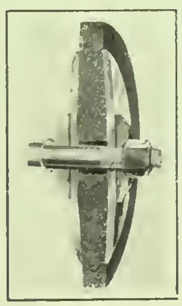
Bench Water Tool Grinders

Heavy Type Polishers



Disc Grinders

6" and 30" Double End Grinders.



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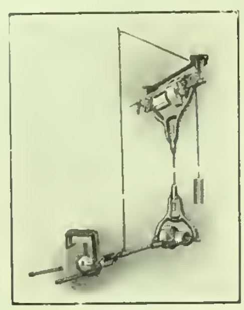
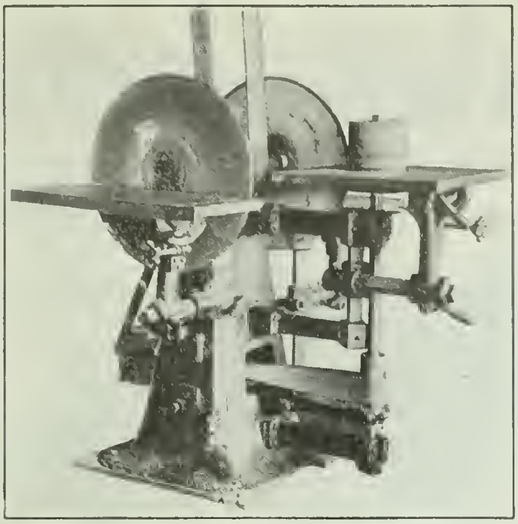


Swing Grinders



IN THE PATTERN SHOP

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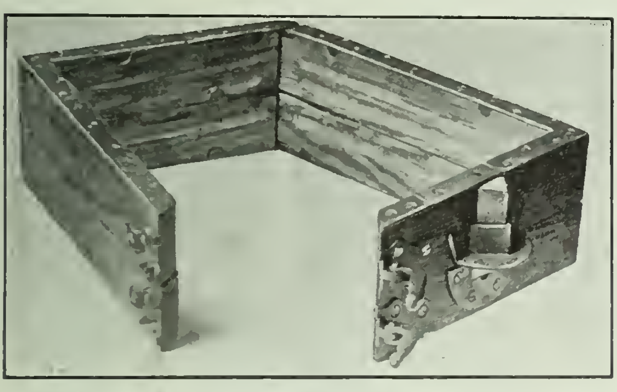

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We are now manufacturing in our own factory a snap flask of superior quality.

The cut at the left gives a very good idea of its general construction. It is made of the highest grade of Maple, and the fittings are of malleable iron, giving the maximum strength and rigidity to the flask, thus fitting it particularly for use on molding machines.

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The Publisher's Page

TORONTO April, 1917

An Address before the Technical Publicity Association in New York

By Mr. Geo. H. Gibson

THE application of science proceeds at an acelerated pace. The days have about gone by when one good idea would keep a family in business for several generations. No one dare rest content, for as Solomon remarks, "Yet a little sleep, a little slumber, a little folding of the hands to sleep, so shall thy poverty come." Every manufacturer, and particuarly manufacturers of engineering appliances and products, must maintain a constant output of improvements and new developments in order to protect his investment in plant, organization, and good will, and indeed, to stay in business. As has justly been said, the invention of a new machine or process—by some one else—may be as disastrous as a fire, and far more likely to occur.

Moreover, the more progressive, the more advanced, a concern is, the greater will be its volume of new developments and improvements. Inventions breed inventions.

At the same time, the investment of time and money in research and development is a capital risk, that is, the preliminary investigation upon which the design of improved apparatus is based and the provision of manufacturing equipment and organization for turning it out must largely be paid for before the market for it can be developed. It is only by the prompt enlightenment of the prospective consumer, in other words, by educational advertising regarding the applications and advantages of the new article that the loss of time and the waste which always intervene between the perfection of a device or process and its general use, can be reduced.

The introduction of new things is a speculative venture which bars the timid—but for that very reason is highly profitable. Patents more or less effectively insure to the originator a safety zone, protecting him from competition for a limited period that he may have the opportunity to recover his great initial outlay. Advertising, however, is equally useful, since it can shorten the period of loss, conserving for profit-making a greater portion of the 17 years' monopoly conferred by the patent and increasing the volume of profit. *Advertising itself exerts an accelerating influence on technical development, for before advertising, one should have something worth advertising.* Much of the strategy in the competitive selling of engineering appliances consists in originating better methods or designs, or new and improved products.

Good business has been defined as the art of selecting probabilities, and it is certainly true that the greatest successes in the engineering business have come to men who had the ability to do the following things:

(1) Foresee the need or opportunity,
(2) Develop the solution, and
(3) Focus the attention of the public upon the problem and its solution.

AS EXAMPLES, I might mention Edison with the incandescent lamp, Westinghouse with the air brake and alternating current transmission, Hunt with rope transmission, Sturtevant with fans and blowers, De Laval and Parsons with the steam turbine, Babcock and Neier with the water-tube boiler, Diesel with the oil engine, the Wheelers with surface condensers, Hill with technical journalism, Thurston with technical schools, Patterson with the cash register, Herschel with water meters, Kent with his handbook, and many others.

The inertia and prejudice which must be overcome in the introduction of a new device may be illustrated by the experience of Corliss with his variable cut-off, four-valve steam engine. After he had perfected and demonstrated the remarkable savings of his engine as compared with the engines then common in this country, he was still compelled to give the engines away and to take his payment in the fuel saved during the first year's operation in order to make headway.

Many people have the idea that the invention is the important thing. Very few engineering businesses, however, are founded altogether on exclusive and basic patents. They are based rather on a combination of scientific knowledge and business sagacity, with the help of such protection, monopoly or trading advantage as can be obtained from the detail patents which it may be possible to secure as the development of the art unfolds itself. A man may have the germ of a good idea for a successful business, but still nothing that can be protected by a patent, even though patentable improvements will doubtless be discovered upon developing the idea. Nevertheless, the essential factor is the broad judgment or foresight which leads him to take up certain matters at a particular juncture, and not the specific mechanical contrivances by which he may carry out his ideas. *In such cases, the best protection to the idea is advertising by means of which he can promptly get the full benefit of the potential demand for his product before competitors have had time to imitate and develop. Once he has his organization and business well under way, competition will be at a disadvantage.*

ENGINEERING PRODUCTS are purchased almost solely for their utilitarian value. Their usefulness can be weighed, measured or computed in some way, and they are usually purchased with much deliberation, for the reasoning faculties of the people who buy them have been emphasized by technical and business training.

The advertising should arise from and carry forward the general ideas and beliefs of the guiding mind of the business. It finds inspiration in new products and the exploitation of new fields. As compared with this broad purpose, the means and methods discussed in books on advertising, such as typography and display, color of ink, quality of paper, etc., are to a degree only incidental—all that is asked of them is that they should do their part in transferring ideas efficiently and not get in the way of the main motive, which is the making use of the spectacular qualities of advancement and improvement and the doing or saying of things interestingly.

The world is run largely on ideas and the dissemination of ideas is the business of the advertising engineer.

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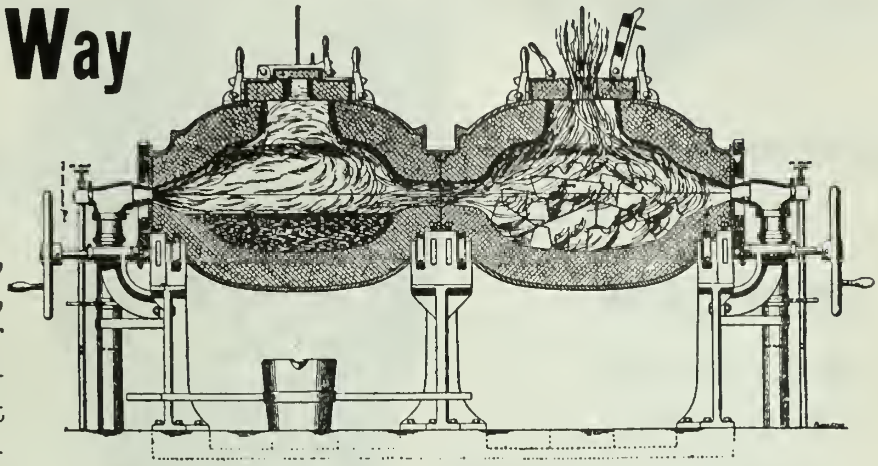
Used by Federation of ALLIES and "Uncle Sam"

Copper, Brass, Bronze, Aluminum, Iron, Steel, Gold, Silver and other similar metals can be melted at a reduction in cost that is worthy of your instant attention by the use of the —



ACTION OF HEAT
Double Chamber Melting Furnace—Oil and Gas

Monarch Double and Single Chamber Melting Furnace

Reference to the illustration will show at a glance the Monarch Double-Chamber Furnace at its cost-cutting work—Melting is practically continuous, permitting melts of various metals to follow one another in rapid succession. Two chambers can be used alternately. Melts in one chamber and heats to near melting point in the other. Flame is not directed against metal, therefore there is no oxidation.

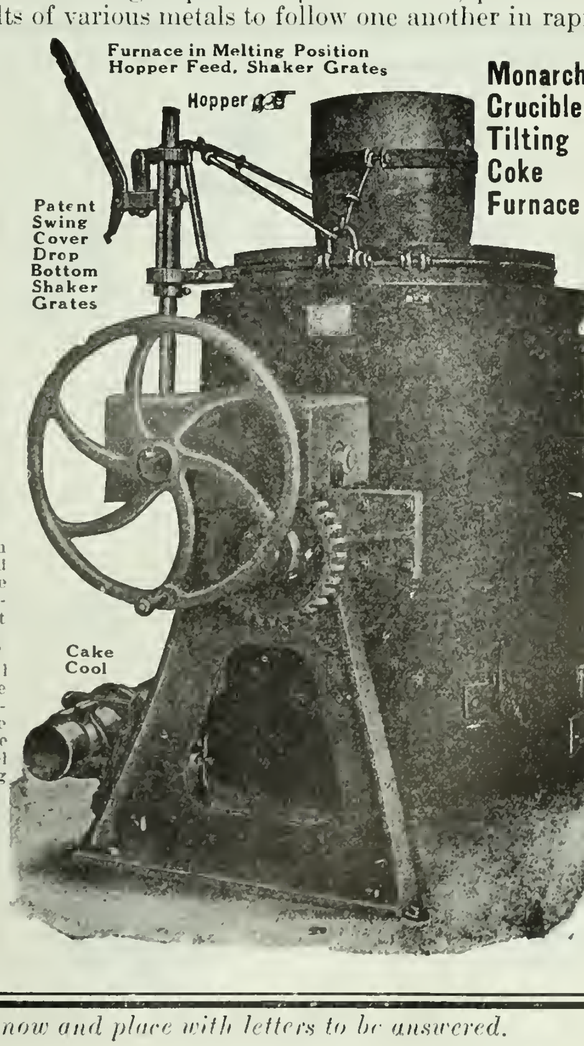
The Monarch-Rockwell Simplex or Single Chamber Furnace produces a quality of metal equal to that melted in crucibles in greater quantities in less melting time, without preparation, at a greatly reduced cost, both in fuel and labor, and entirely eliminating expensive crucibles.

Core Ovens, Crucible Furnaces, Portable Heaters, Mold Dryers, Cupola Lighters, Pumps, Blowers, Motors, Complete Foundry Equipment, Reverberatory Furnaces, all capacities, Stationary and Tilting. Our Specialty is the Specialization of the Melting of all Metals.

Foremost industries in Canada and the United States have found the Monarch Lines satisfactory to the highest degree.

Send for catalog C.F. 4, 1917. It gives full information about the excellence of our Crucible Tilting Coke Drop Front Core Furnaces, Arundel Ovens and our Melting Furnaces.

ARUNDEL Drop Front Core Oven



Monarch Crucible Tilting Coke Furnace

The Monarch Engineering & Manufacturing Co.

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Shops—Curtis Bay, Md.

Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
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Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

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For lining and patching the Cupola or Open-Hearth Furnace, Lining Ladles, Clay Wash, etc.

It will save your fire brick and the time of your men.

Whitehead Bros. Co.

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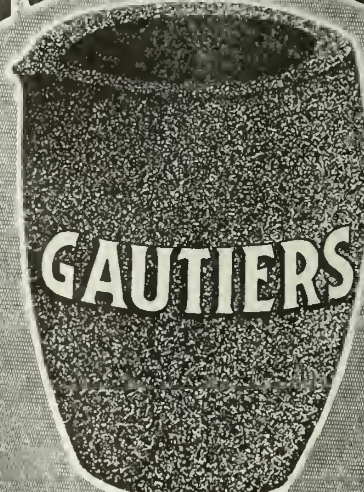

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Safe Practice at Blast Furnaces and Its Development--III.

By Frederick H. Willcox

In its efforts to increase safety in the metallurgical industries, the Bureau of Mines, Washington, D.C., has been studying the causes of accidents at blast furnace plants also methods for their prevention. This article describes the known dangers and makes suggestion of means whereby the risk of accident may be lessened or, better still, wholly avoided.

THE STOCK-HOUSE CREW

ROD the furnace regularly, and, in, case it is hanging or stiff, report to the foreman promptly. If anyone is working in the skip pit, or the skip incline, hoist, or skip, don't move the skip, except under direction and after giving warning. If an oiler or "handy man" is working on the sheave wheels, bell rods, hoppers, distributor mechanism, or bell-rod cylinders, do not lower the bells except on signal from those on top. Never start the skip or hoist cage until you receive the proper signal, unless you have all regular charging operations in sight, and then signals are not required. When the blast is off, or when the furnace is shut down and men are working about the top or bottom, do not fill the furnace or lower the bells without warning the men away from the tuyères and hoppers on top, and then only under the direction of the foreman. If the furnace is being shut down or if it is working irregularly and stops taking charges on account of hanging and slipping, do not put wet ore on the bell; at many plants it is considered dangerous to dump wet ore when the furnace is low. Report anything about the skips, bells, or indicators that does not seem right, such as skips striking the bumper blocks too hard, or frayed cables. irregular, slow. or quick movement of the bells, or water in steam lines. By early notice an accident or possibly a hazardous delay may be avoided. Never let anyone go up the skip incline to the top alone.

Scale Car Operators

Scale-car operators should watch for stock-house cleaners or others crossing the track and should always have the car under control. Watch out for overhead obstructions. Let the furnace millwright or electrician do all repair work on the car. Be careful not to leave ore or stone on the edges of the chutes; many accidents are caused by stock falling from the chutes. When barring or punching at the chutes or doors of the bins be careful to avoid a rush of ore or stone falling on your foot. Do not open the door of a nearly empty bin or get under it just as the car doors are dropped on the trestle; the material may easily fall through and bruise you. or if it is flue dust or sinter, burn you. Wear goggles when the coke is very dusty or when breaking ore or limestone. If steam is used to thaw ore in the bins or piles be sure that the hose is strong and in good condition. See that no one is in line with the nozzle when you turn the steam on. If gas is used see that it stays lit and that a pocket of gas does not accumulate. Do not light gas by hand with a match, use burning waste, placed on the floor or in the chute.

Ore Buggie Accidents

Most accidents with ore buggies happen from catching the fingers between the buggy handle and a column, wall, or other obstruction. Watch out for this and use safety handles. Be careful not to let the buggy leg come down on your heel, or to run the wheel over someone's foot. Never race with a buggy, you may easily lose control of it and receive a wrench, strain, or bruise. Watch that your fingers or feet do not get caught between a lump of stone or ore from the chute and the buggy or floor. Don't undercut an ore or stone pile, or let the stock lodge above you, keep it knocked down with a bar. Never stand close to the elevator pit as the cage comes down, ready to take the buggy off the instant the cage comes to rest, as many men have had their feet crushed in this way by getting them caught between the cage and the floor sill. Don't try to get on the cage before it has come to rest, or after the signal for hoisting has been given.

When it is necessary to clean the skip pit, notify the skip operator and do not go into the pit until he tells you to. Avoid walking under bin doors and chutes. Keep off the scale-car track and watch for the car when crossing the track. Don't stand on the track when signaling the car operator. Be careful that your bar does not touch a third rail or trolley wire. It is best not to ride on the scale car, and you should never jump on or off the car when it is moving.

When you enter the motor house or hoist-engine room notify the skip operator, both on entering and leaving. Stay at your own place of duty, even when you are "spelled off." Keep away from the cast house and stoves unless you are required to go there to help. Report all bad places to the foreman, such as dark corners, overhead obstructions, poor track, holes, and unsatisfactory bin doors. Be sure to report every injury, as even a slight injury if neglected may have serious or fatal results. Even a bit of coke dust may seriously injure the eye if not taken out right away. If a man receives an electric shock free him from the source of current, being careful not to get a shock yourself, give him artificial respiration at once, and send for the foreman. Similar first aid is needed if anyone becomes gassed while working on top.

Hand Filled Furnaces

On hand-filled furnaces, top fillers should remember not to step over trap or lift doors at the top of elevator shafts while the elevator is running. The safety of many men about a furnace plant depends indirectly on the care and interest the stock-house crew take in their work. Careful weighing, regular charging, reporting any difference in appearance or quality of coke or limestone, and constant watching of the movement of the charge in the furnace will prevent many slips, "messes," and dangerous work at the tuyères, tapping hole, and furnace top.

FIG. 21. SAFEST WAY OF USING POLE TO PLACE CARS.

Trestle Gang and Yardmen

Watch for the lorry car, locomotives, and cranes, and do not go under the ore bridge just before ore is dumped into the bins. Do not jump on or off moving cars; many men are hurt that way every year. Never sit on or near the track or bridge rails to rest; find a safe place. When you hear the warning whistle at the furnace get out of the car at once and under shelter as it means the furnace is hanging and may slip. When ore is being dynamited and a warning is shouted, get under cover and stay there until material has stopped falling. Do not try to jump across the bins from rail to rail; use the crossovers. They were put there to use, and the minute saved by not using them is worth less than the good example set by using them.

Do not use a pole in spotting cars with a transfer car or locomotive on an adjoining track, use a cable with safety hand locks. If there is no cable and a pole must be used, stand on the same side of the pole that the coupler of the car is on (Fig. 21). Be careful in pinching cars on the trestle, you may fall and receive a severe injury. Pinch a car the way the foreman has shown you, and report pinch bars with smooth heels or dull points to the toolman or foreman. The safest pinch bar (Fig. 22) is one fitted with a disk and tool-steel heel. When turning on a steam jet to thaw ore see that no one is in line with the jet; use a clamp to hold the nozzle, and avoid working with worn hose. Watch that cinders from trestle locomotives, or hot coke, do not start fires in the coke bins or walks. A safety car wrench for opening drop doors on cars is shown in Fig. 23.

FIG. 23. TRESTLE LABORER USING SAFETY CAR WRENCH. WHEN THE SHAFT BEGINS TO REVOLVE, THE HINGED JAW RELEASES. DISC IS TO PREVENT MAN'S HAND STRIKING CAR, AND SHORT BEND ON END OF HANDLE PREVENTS USE OF PIPE EXTENSION.

Loaded Car Drop Doors

It is dangerous to open drop doors on loaded cars unless you know how. Do not try to do it until you have been shown and, if possible, have watched for a day men who knew how. Before getting into a car to unload it, or crawling under a car to work on the drop doors, make sure, by asking the foreman or "straw boss," that the car will not be moved. Wait until the doors are dropped before going on top of material in cars to be unloaded. When unloading hopper cars, do not stand over doors or on the edge of the material; it may slip and carry you down into the bin, where you may be suffocated or severely injured. Obtain a firm footing in the bottom of the car between the doors, or be sure of a firm hold on the side of the car. By all means wear a belt and safety line if these are provided. Do not undercut material any more than is necessary and watch that the lumps do not catch you. Be very cautious in opening the doors of cars loaded with flue dust; if dry, it will fly out. Avoid stepping on flue dust in cars, for even apparently wet dust may be dry and hot beneath and cave when you step on it. Always get out of a car the same way you get in; do not crawl through the doors in the bottom of the car (Fig. 24).

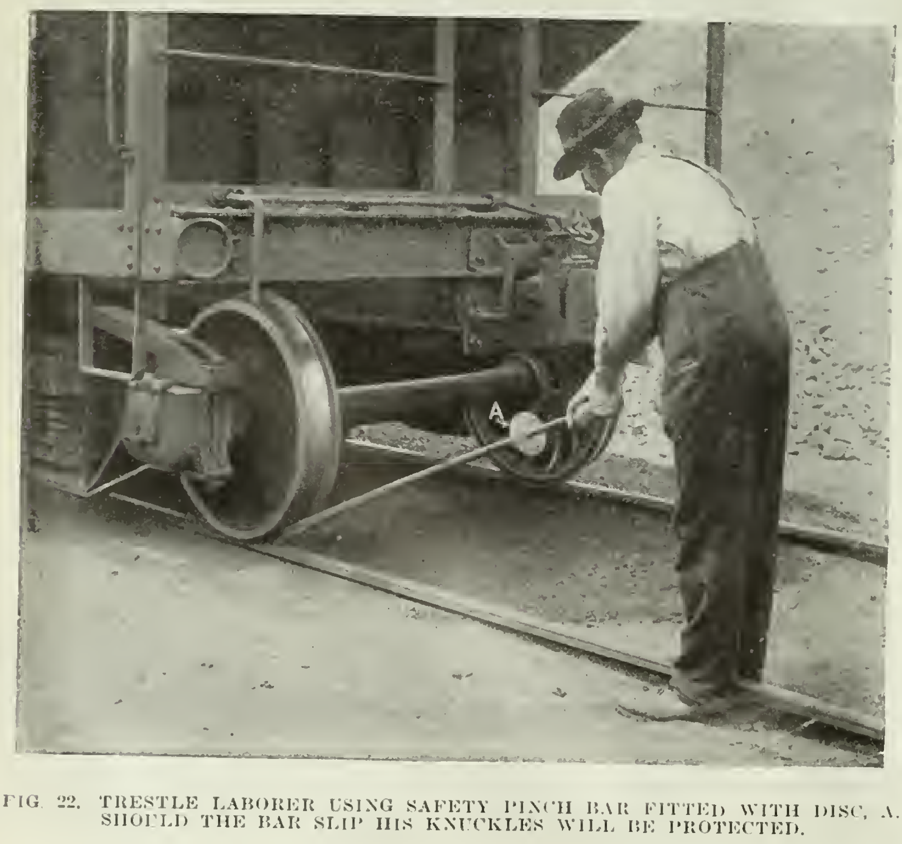

FIG. 22. TRESTLE LABORER USING SAFETY PINCH BAR FITTED WITH DISC, A. SHOULD THE BAR SLIP HIS KNUCKLES WILL BE PROTECTED.

Miscellaneous Precautions

Before you drop material into empty or nearly empty bins, notify the stockhouse crew so they can keep clear of falling material, and be sure that the bin doors are closed. In poking ore in bins and chutes see that you will not get caught in case a fall of ore catches the bar. Never go into any bin to shove material or to clean the bin unless you have a belt with a life line attached to a girder or tie (see Fig. 25). Use a flag or track torpedo to protect the bin you are working in, or ask the foreman for a watcher to hold the line and warn men not to dump material in the bin or run cars over it.

Do not work with a pick or sledge if the handle is cracked or the head loose. Do not use a bar, wedge, or sledge having burrs or splinters; give it to the toolman. Watch that your tools do not touch electric conductors. When carrying bars, pipes, or other material through doors be careful so as not to strike persons passing by (see Fig. 26).

Avoid leaving tools, scrap, boards, lumps of ore or stone, or sheet iron, on the walks where they may cause some one to stumble, or fall into a bin or into the stock house. Coke forks or shovels should be placed with the edges or prongs pointing to the floor. Report to your foreman any rotten, loose, or burned planks in the walks, or defective lights. When you are set at new work be sure to ask about the work, the way to do it, and the dangers connected with it. Do not ignore danger signs; they mean what they say. Do not wrestle or play when at the plant, especially when on the trestle, where you may fall into a bin or the yard.

FIG. 24. UNSAFE PRACTICE: CRAWLING OUT OF HOPPER CAR THROUGH HOPPER OPENING.

Men working in ditches and excavations should work far enough apart to avoid any risk of striking one another with picks or other tools. (See Fig. 27.) Before leaving an excavation for the night or for other work cover the hole with planks. Manhole covers should always be replaced when a job is done, or even when leaving the job for a short time. (See Figs. 28 and 29.) If you are chipping concrete, wear goggles, as chips frequently fly in the eye. Don't undercut piles of ore or stone, or piles of frozen earth, sand, or other material. Don't undercut banks when excavating; keep them knocked down; test the edges with a bar and knock or pry any loose earth down (Fig. 30). Frozen ground is especially dangerous.

Stay out of cast houses, pig machines, boiler houses, and other places where your work does not require you to go, and keep away from iron and cinder ladles when they are being shifted. Whenever possible, keep from under cranes in operation. Always warn the crane man before beginning to clean the tracks about the granulating pit, as he may accidentally drop some hot slag over the sides of the car unless he knows you are beneath, or scalding water may run from the grab bucket as it is carried over your head. Be careful in cleaning up about a loaded cinder car, as steam and scalding water may escape suddenly from a drop door. Don't throw wet or damp rubbish into cinder ladles, as it may cause an explosion, and in turning a hose on a leaking cinder or iron ladle stand as far away as possible, as you may be scalded by steam or burned by an explosion or "shot" if the water hits molten iron. Avoid walking on ash piles; they may be hot underneath and burn your feet if you break through. Keep your feet out of flue dust when cleaning it up. In loading or unloading

FIG. 25. PROPER EQUIPMENT FOR MAN WORKING IN ORE BIN. NOTE LIFE LINE ATTACHED TO HIS BODY AND TO CROSS BEAM OF BIN.

FIG. 26. SHOWING DANGER TO PASSERS-BY WHEN CARRYING BARS, PIPES AND SIMILAR MATERIAL THROUGH DOORWAYS.

cars, see that the gang planks or runways are in good condition and are properly placed and secured.

Be careful when handling heavy material or using tools (see Figs. 31 and 32), as most accidents about blast-furnace plants are caused in such work. When necessary to go on a roof or window ledge to clean windows always use a safety belt and a life line. When cleaning windows from a ladder do not overreach; go down and move the ladder if necessary. Be sure that the ladder is resting squarely at the bottom so that it can not slip. If the ladder is a long one have some one steady it. Always have at the top a cross piece long enough to span the entire window. The cleaner you keep the yard the better and more safely everyone can do his work. Don't let piles of rubbish accumulate, or pieces of lumber, brickbats, scrap, and other material lay around, or leave tools about; some one may stumble over them. Fill up small holes and depressions and report promptly any steam or hot-water puddles caused by leaky lines.

Pig-machine Men

Always wear goggles or a mask when working about the troughs while iron is being poured; be cautious when the molds are cold or if they have ice, snow, or water in them, and, especially when cinder is coming over, keep away as much as possible. When it is necessary to work under the strands to knock out the "stickers," keep from directly under the strand as much as possible, both the one you are working on and the adjoining strands. Men tending the lime vats and sprays should watch for stickers when it is necessary to go under the strands to adjust the sprays or to feed lime, while the machine is running. Aim to do such work between casts and shut off the steam when working about the sprays or vats. Before pouring, examine the top of the ladle to see that there is no solid crust of cinder or iron frozen over the hot metal. Such crusts should be broken with a warm, dry bar, as otherwise the metal will splash badly when it breaks through the crust. Never operate the motors, clutches, or hoists for pouring ladles or running the strands unless it is your job, or unless you are told to do so by the foreman. Keep away from around the sprocket wheels. Remove the scrap and clean the rails between pouring ladles or casts. Don't try to save a few seconds by stepping on or across molds in motion or containing hot metal; use the walks or go around if necessary. Be sure that the bars you use with which to bar scrap out of the troughs are dry and warm, and avoid using short poling sticks. Before releasing the ladle after pouring, replace all safety dogs or legs in position.

When you are working about the rear of the machine, wear goggles to protect the eyes from flying chips of iron or lime dust. Use care in loading cars to prevent side loading, overloading an,d loading directly upon drop doors, and see that no pigs are left on the end frames where they may fall off.

When working on the pig-machine strands, or changing molds, see that motor switches are locked open, tagged with a danger sign, or that the clutch is fastened open. Avoid touching electric lines, motors, or light sockets, for where there is so much steam and metal floors as are about pig machines, you may get a severe electric shock or burn. Keep sledges, cutters, and other tools in good condition, be careful in using them and watch your hands and feet when handling molds or pigs. Report cuts, burns, or bruises promptly.

FIG. 28 WORKMAN LEAVING MANHOLE UNCOVERED

FIG. 27. EXCAVATION OR DITCHING, SHOWING LIABILITY TO SERIOUS ACCIDENT IF MEN WORK TOO CLOSE TOGETHER.

Ladle-House Men

Don't leave large pieces of scrap on the ladle spouts, they may cause accidents in shifting or pouring, and in removing them use a long bar and keep away from in front of the ladle; work from the side. Before trying to remove a bottom skull, clear away all overhanging rim or side skulls and knock out any loose bricks. The bottom skull will then come out more easily and safely. Before removing a skull or cleaning a ladle, be sure the ladle is securely blocked or propped. When trying to lift a rim skull out of a ladle with the crane, don't stand on the rim of the ladle, the hook may slip and strike you or cause you to fall. Watch all ladles for iron frozen on the rim or spouts, skulls, and "hot spots," or signs of failure on the lining whereby hot metal might break through. A thin place in the lining is usually shown by the ladle shell becoming rusty red.

Do not clean hot kish or metal from ladles onto damp ground; to do so may cause an explosion. When cleaning a ladle into the quenching pit use a long-handled scraper and keep as far back as possible. Take time to pull the cleanings out slowly and keep them from running out suddenly if they start to slide. There is no danger of an explosion if the cleanings are fed into the water intermittently and in small quantities and not too fast. An accumulation of unquenched ladle cleanings beneath the water or a rush of cleanings may explode. To guard against sparks or small splashes wear goggles or a mask. When playing a hose on hot scrap or ladle cleanings, stand as far away as possible to avoid steam or small explosions. If you dry ladles with gas, do not try to light the gas with a torch; kindle a small wood fire or throw burning waste on the ladle before turning the gas on. Always examine a relined

FIG. 29—PASSER-BY FALLS IN MANHOLE LEFT OPEN BY OPERATOR

and dried ladle that has been standing about before using it; if it seems to be damp inside, build a fire in it or dry it again. A damp lining will probably cause boiling, leaks, or explosions of hot metal. Always report water in cinder ladles.

Do not work inside of a ladle without notifying the crane man or placing a sign to show him you are inside, so that he will not carry loaded buckets over you. Use hooks or tongs in handling heavy pieces of scrap. Gloves or hand leathers, except safety hand leathers, should not be used, as they may catch and cause you to fall. In hooking on scrap to be lifted with the crane see that you do not catch your hand. When breaking scrap with a steel drop ball get behind shelter and place danger signs to warn others from flying pieces. In steadying heavy crane buckets use a hook or a long-handled shovel. Do not stand close where you may be crushed or caught between the bucket and some other object.

FIG. 31. UNSAFE WAY OF HOLDING BAR FOR A SLEDGE. MAN HOLDING BAR IS ON SAME SIDE AS STRIKER.

Slag-dump Men

When dumping cinder ladles at dumps, pits, or conveyors, keep away from the front, as the cinder will splash to a great distance. Never pour cinder on flue dust or refuse coal; to do so may cause a great burst of flame or an explosion. Never try to remove a "sticker" or apparently solid skull from a cinder buggy or ladle that has just been brought from the furnace to the dump; the sticker is probably molten inside, and if it does not fall out itself when the ladle is tilted and you try to pry it out, it may burst and splash hot cinder on you. Before working on such a ladle report the sticker to the foreman. He will, if necessary, set the ladle aside long enough for the slag to harden, when it can be pried loose without danger from burns.

Engine Room Force

Before changing blowing engines on a furnace first notify the furnace blower unless it is an emergency change on account of a breakdown. In case of a stop at the furnace keep at least one engine turning over at sufficient speed to avoid any chance of its being stalled. Watch that the flywheel does not turn backward owing to the back pressure of the blast; few blowing engines will do this, however. By keeping an engine turning over against the butterfly valve in the cold-blast main with the snort valve open, there is the least chance for an explosion or fire in the cold-blast main and air tubs.

In case two or more furnaces are blown from one room, attach a number to each engine showing the furnace it is blowing to avoid any possibility of confusion in checking the furnaces. When the furnace whistle is blown for a check, observe the signal light or number as well as the whistle before checking the furnace. In case of a shutdown when the engines are stopped, close the stop valves between the air tubs and the cold-blast main. In case there is a steam connection to the cold-blast main, examine the connections at the beginning of each turn or shift to see that both air and steam connections are in working order and that no steam is leaking into the main. Always be ready to turn steam into the blast main if the signal or word is given. Place numbers at each steam inlet to correspond to the furnace number. Always be ready to check the engines promptly; at times, conditions at the furnace demand throwing the snort valve open very quickly and getting the wind off as fast as possible.

Before entering a cylinder to make repairs, lock the steam throttle and the vacuum stop valves, place blocking in the cylinder, and block the flywheel fast. The drain valves should be opened prior to taking off the cylinder head. In undertaking repairs to gas engines, be sure that the gas valves and water seals to the engine are closed. It is essential that two men should work together in repairing gas-engine parts that are inside the cylinder, are near gas or inlet valves, exhaust lines, or are in enclosed places, such as basements and tunnels. Be prompt in shutting down gas engines when the signal is given, as there is even more danger involved in delay with gas engines than with steam engines.

Oilers and wipers should wear closely fitting clothing that can not be easily caught in the moving parts. In wiping and inspecting the engine, watch that you do not get caught by rocker arms.

FIG 30—MAN CUTTING TOO FAR BENEATH BANK OF EARTH; A DANGEROUS PRACTICE

wrist plates, eccentric rods, and Corliss or other valve mechanisms. Be careful that you do not slip on oily platforms and steps, and be prompt to report equipment out of order or in a condition dangerous to employees or the plant, such as valve wheels without lock nuts, steam leaks, worn or oil-soaked governor belts, broken steps or railings, defective indicators or gauges.

Remember that uniform and correct speed of the blowing engine has much to do with the regularity of the furnaces. Irregular speed causes slips and other serious troubles. Report immediately to the blower any trouble with the pumps and tuyere-water supply so that he may be prepared to take care of the furnace in case the flow of water becomes slack or fails.

Do not put any engine or machinery in motion without seeing whether anyone is in a position to get caught or struck. Do not work on electrical equipment or touch wires unless advised by the electrician. Let the electrician fix the lights. In working above, be careful not to drop tools or leave them where they may fall on someone below. Keep from under loads carried by cranes. When the crane is being used, one man only should have authority to signal the crane man to hoist. The crane man should try to hoist straight, but, as the crane is usually high, heavy loads may swing, so it is best to keep at a safe distance when he starts to hoist. Do not tighten bolts in leaking flanges on live steam lines except under the direction of the master mechanic. Be careful in placing a ladder before using it, and if there is any danger of its slipping have someone hold it. Do not carry tools or material up or down a ladder; use a hand-line. (See Figs. 8 to 10). Return mushroomed or burred chisels and other defective tools; report or remove rounded nuts and be careful not to use too large a wrench or one with spread jaws. Don't pull on a wrench when you are in such a position that you may lose your balance and fall if the wrench slips.

FIG. 32. SAFEST METHOD OF HOLDING A BAR.

SEASONING OF CASTINGS*

By Richard Moldenke.**

ONE of the little-known characteristics of cast iron, which nevertheless has an important bearing on results where accuracy in machining is essential, is the ability of this adjust their relative positions to an extent sufficient to overcome some of the existing stresses.

The following instance will perhaps give a fair idea of the condition a casting may be in when just shaken out of the sand: A very large sheave-wheel. after shaking out, was taken outdoors to be cleaned and made ready for turning up. It was leaned against the side of the building, but before much could be done an arm tore apart with a loud report. Investigation showed that the sun had been shining on the upper rim, thus adding a slight strain to those already existing within the arm and thus overbalancing the strength of the metal in tension. Had this sheave been kept under cover for a while, or at least until machined, the strains would have eased off sufficiently and allowed the sun to look upon it without disaster.

It will not be necessary to multiply examples. Every engineer knows the danger of water-hammer in pipe lines, particularly if the latter are of cast iron. Every mechanic knows, or should know, that it is not good to strike a fitting that is under steam pressure.

Shrinkage and Contraction—A Distinction

It will be necessary to write a few words about the internal strains in castings—the so-called casting strains we hear so much about. It is generally known that to get a casting reasonably true to the dimensions wanted requires a slightly larger pattern. The usual allowance for grey iron is ⅛ inch to the foot, and ¼ inch to the foot for white iron. This reduction in length, breadth and thickness in a casting is erroneously called shrinkage. It should be called contraction, as for practical purposes it is simply the difference in dimensions of the casting red-hot and cold. In fact, it is really a volumnar contraction, and takes place after the metal has set

The real shrinkage covers an entirely different situation. When a casting is poorly designed, it is impossible to feed the mold properly when pouring. The thinner sections set more quickly than the thick ones and may leave the latter without means of drawing in liquid metal to compensate for the reduction in volume in the act of setting. As the metal sets against the mold walls first, and gradually thickens from the surface inward, when the influx of fresh supplies is stopped there results a void in the centre, or at least a spongy portion. This is shrinkage, and can be seen more particularly in white iron, by reason of its greater reduction in volume from liquid to solid form, apart from the final contraction from red heat to ordinary temperatures. Such shrinkage usually takes place at abrupt angles, in thick parts adjoining thin ones, in the rims of flywheels, hubs of pulleys, at the flanges of cylinders, etc.

Dual Volume Reduction

It will be seen from the above that there are really two kinds of reduction in volume to be reckoned with: First, that due to the change from the liquid to the solid state; second, the reduction in volume after setting until ordinary temperatures have been reached. The first, often called interior shrinkage, is a rather serious occurrence. The specific gravity of molten iron is about 6.65: it does not vary widely from this figure whether the metal on setting is grey or white in fracture—all the carbon being combined when in the molten state. On setting, however, if grey iron results, the specific gravity will be over 6.8, and if white iron, up to 7.8. The formation of graphite in the structure accounts for the comparatively moderate increase in the case of grey iron. In average cast iron with 7.3 specific gravity, the increase in density is 0.65, or 9 per cent., which means a very big decrease in volume for equal weights of molten and solid metal. This situation accounts for the quantities of molten metal that have to be added to a mold after pouring it full in the first place, and in the case of small castings, particularly when of white iron, for the funnel-shaped sprue left in the pouring basis or gate.

Contrast this with the eventual reduction in volume after setting. Here we have a linear reduction of about 1 per cent. in every direction, which is an infinitesimal amount when compared with the real metal shrinkage.

It stands to reason, that, if the metal in setting has the power to pull apart, whatever liquid material may remain

*From a paper presented at the American Institute of Mining Engineers, New York, Feb., 1917.

**Consulting Metallurgist, Watchung, N.J.

after feeding has stopped, thus causing large spongy parts in the interior of a casting; powerful strains which affect the strength injuriously must have occurred. This is apart from the reduction of strength in the material for the section itself. In other words, not only will the metal have a lower tensile strength because of the spongy nature of part of the section, but the interior strains counterbalance part of the tensile strength that is available.

This situation is intensified by the fact that the metal in setting does so far more quickly at the mold surface than in the interior—the cold sand walls drawing away the heat from the molten iron more quickly at the beginning of the setting process than later when this heat has to travel through a more or less thick shell of metal already set. The consequence is a higher percentage of combined carbon at the surface than in the interior of the casting. In chilling the surface, we have a white iron surface and a grey iron interior. The relative change in the specific gravities of the same molten iron turned into two extreme forms of iron as cast will indicate what strains there must be within the casting due to the differences in volume which the two metals want to occupy when set, but cannot properly occupy on account of the quickness of the setting action.

Contraction of Set Metal

Finally come the strains due to the contraction in the set material until ordinary temperatures have been reached. This has been stated as ⅛ inch to the foot in grey iron and ¼ inch to the foot in white iron. In large castings this is very serious. Suppose, in the case of a big flywheel, the rim sets fast enough to hold the much cooler arm as in one set of jaws of a testing machine, the huo, held by the arms on the other side of the wheel, being the other set of jaws. Surely the arm in wanting to reduce in length ⅛ inch to the foot must be under a terrific strain if not allowed to do so. In the case of white iron the situation is much worse. Such castings as hand-brake wheels (subsequently annealed for malleable castings), snap apart when allowed to cool in the sand in the ordinary way. Work of this kind must be shaken out as quickly as set, taken to special ovens and allowed to cool down very gradually.

Overcoming Injurious Strains

Sufficient has been said to make the case of cast iron look very weak. Fortunately, there are two phenomena which help to overcome some of the injurious strains set up. The first is the fact that cast iron in the act of setting (between liquid and solid), can be stretched. The second is the seasoning or easing up of the remaining strains after the final contraction through the mobility of the molecules. It is the stretching of grey iron during the set ting that saves the flywheel arm from rupture before the new strains due to final contraction are introduced. It is the inability of white iron to stretch very much, which causes so many cracked castings in the malleable process which would not be seriously affected by the final contraction.

Castings Test

This discussion of the actual situation in making castings has another bearing. Purchasers of castings may wonder why foundry men who really know something about their basic material are so uncompromisingly opposed to test coupons on their product. The man who is at least somewhat familiar with cast iron should realize that it is unfair to the maker of the casting to judge its value by a test piece subject to a variety of strains introduced as the result of position, manner of attachment, method of pouring of the metal, etc. It is further unfair to the purchaser to judge by coupons, as there are many ways of artificially strengthening such test pieces There is only one way of testing a casting properly, and that is to break it. Obviously this will not do, and hence for repetition work a given percentage of castings can be thus tested. For all other cases the only method of obtaining reasonable assurance on the subject is to make standard test bars, entirely apart from the castings, but of the same iron. These test bars should be made under conditions giving the iron the best possible chance to show just what it is, neither artificially strengthened, nor filled with strains and thus deliberately weakened.

Every mechanic knows that, in planing up a slab of cast iron on both sides to get a true job, it is necessary to take a light cut, reverse, and take a cut on the other side, then reverse again for the finishing cut, finally reversing for the last cut. If this is not done, there will be warped surfaces to deal with on account of the internal strains. Again, it is well known that a true piston is rather difficult to produce. Even after grinding to a finish, it is apt to get out of true. It is not so generally known, however, that if such a cast iron plate or piston is allowed to remain in storage for a long period, the results will be much more satisfactory. The castings have seasoned. Where establishments are familiar with future production demands, orders for castings are placed far ahead of requirements. Since, however, on getting to the bottom of a big pile the difficulty of tracing defective work becomes correspondingly harder, only shops having their own foundries are likely to do much storing.

The present demand for very high-class machined castings, as evinced by automobile cylinders, pistons, engine and compressor cylinders, etc., should bring this question of seasoning out very prominently. Inquiry by the writer has shown but little knowledge on the subject in the trade generally, though first-class foundrymen were very much alive to the matter. In general, the difficulty seems to be the inability of storing up ahead, or, if this is done, of discovering defective product when least expected.

Increasing Strength by Tumbling

We are indebted to the well-known metallurgist, A. E. Outerbridge, Jr., for what seems to be the best indirect explanation of seasoning. In his famous experiments on tumbling castings to increase their strength, he found that by the action of light blows, often repeated, the internal strains were relieved to such an extent that the real value of the metal came into play. The mobility of the molecules was aided by artificial means. Incidentally, however, the tests establish the mobility of the molecules in cast iron very satisfactorily. Replace half-an-hour's tumbling by six months' quiescence and the molecules will have done their work with somewhat the same results.

In view of the possible depression scheduled for us on the close of hostilities in Europe, would it not be well to ease up operations slowly instead of shutting down tight? This would help the industrial situation adjust itself more safely and at the same time permit supplies of castings to accumulate, which will be all the better for having seasoned.

CORES, THEIR CONSTITUENTS AND COMPARATIVE COSTS

IN a paper read before the Scottish Branch of the British Foundrymen's Association on January 13, Arthur Naylor read a Paper on "Cores, and their Material Constituent, and Comparative Costs." Mr. Naylor remarked that it is now considered an established practice to separate coremaking from the trade of moulding, and very few foundries are now to be found where there is not a core-making department. This is not only a more economical arrangement but it is an arrangement by which greater efficiency is obtained. The question of materials used in core-making varies to some extent with local conditions. The price charged for carriage of new sand has also an important bearing upon the subject, in determining the proportion of new and old sand to be used.

Oil-Bonded Cores

With inexperienced foundrymen, the question of comparative costs, with regard to ordinary sand cores and oil-bonded cores is a debatable matter. At a glance it seems a costly procedure to use oil at say, $8.50 to $10 per 100 lbs. compared with using ordinary sand. However, as a result of actual practice there is no doubt that the use of oil-bonded cores is more economical. For ordinary work, sea sand bonded with linseed oil serves admirably for cores. It is not always advantageous to use oil-bonded cores in every instance, but for work such as steam-chest cores, cylinder-port cores, cores for water-jacketed cylinders, compressors, etc., and in all cases where the extraction of the core after casting presents a difficulty, nothing could be more suitable or more economical than oil-bonded cores.

The amount saved in dressing such castings more than pays for the oil also any extra work involved in the production of the cores. In the majority of cases an oil-bonded core does not take any longer to produce than a similar core made in ordinary sand; it has also these further advantages, that fewer core irons are required and less venting is necesary than with similar cores in ordinary sand. The question of drying is slightly against the oil-bonded core, but a little experience soon overcomes any difficulty met with in this respect. The temperature of the stove for drying such cores should not exceed 500 deg. Fah. Oil bonded cores are much easier to handle and less liable to break when placing in position, and they may be left any length of time in the mould before casting as they do not absorb moisture.

An example from personal experience was given to show the comparative costs of the two systems of producing cores. That selected was the cores of a water-cooled gas-engine cylinder. At first these cores were produced in the ordinary way by grinding a quantity of loam taken from a used mould; this powder was again dried in the stove and then milled with an equal proportion of new sand, and a liberal proportion of horse-dung and clay-water. The production of these cores, including the necessary core irons, took from four to five days, and after the castings were made it took 1½ to 2 days to remove the cores. When the system of oil-bonded cores was adopted the cores were extracted from the castings in 15 minutes. The cost of each system is shown in the following tables:

Ordinary Sand Cores

Sand and mixing	00.75
Core Irons	3.75
Making Cores	11.00
Dressing and blackwashing cores	2.50
Dressing castings	5.00
Total	$23.00

Oil Bonded Cores

Sand and mixing	.75
2 gallons oil at 4s. per gallon	2.00
Making cores	7.50
Dressing and blackwashing cores	2.50
Dressing casting	1.75
Total	$14.50

The core irons for oil-bonded cores, where these are necessary, may be wrought iron, and re-used from time to time; the ends of these irons should be arranged to project into the print of the core, and when this precaution is observed the irons can be easily removed from the casting. Any vertical recesses left by the removal of loose pieces in the core-box should be filled with dry or wet parting sand, and removed after the core is dried. Should these recesses be in a horizontal position the spaces must be formed by rubbing down a small piece of dried core to the shape of the recess; this should be covered with paper and rammed up with the core, the paper forming a parting substance to facilitate the withdrawal of the small core after the main core has been dried.

If any part of the main core is to come into contact with the plate for supporting the core while drying, the part coming in contact should be separated by a piece of paper, otherwise it may adhere to the plate. Should any sharp edges be exposed to the heat they are liable to burn. This may be avoided by spreading a little oil from an ordinary oil-can over the exposed part. Oil-bonded cores contract about one-eighth of an inch per foot, and provision for this has to be made in the core-box.

Scabbing is practically an unknown factor with oil-bonded cores, provided a clean open silica sand is used. The boxes in which the cores are made should be well oiled to prevent the sand adhering to the sides of the box. We are indebted to the *Foundry Trade Journal* for the foregoing synopsis of the paper.

DEMONSTRATION OF METAL SPRAYING PROCESS.

CONSIDERABLE interest was manfested by manufacturers in Toronto and Western Ontario in a recent demonstration of the Schoop Process of Metal Spraying by the Metals Coating Co., of Canada, Ltd., at the plant of the Dominion Bridge Co., Toronto. Although, a comparatively recent accomplishment, the Schoop process, which takes its name from one of its prominent sponsors, a Swiss engineer, has been for several years in successful operation in many European countries, and is now being adopted by progressive Canadian and American manufacturers.

In the Schoop process, the coating adheres to the object chiefly by mechanical union. The apparatus is so designed that either hydrogen, Blau, or acetylene gas are used in conjunction with oxygen, the reducing gas being always in excess so that oxidization of the metals is prevented. Compressed air discharges the products of combustion at a high velocity so that the molecular spray by penetration secures a perfect adherence to the surface being coated, and rapidly builds up to the depth required.

All kinds of protective metals and their alloys can be utilized and applied to metals, wood, paper, stone, clay, cement, cotton and silk fabrics, and glass.

DEVELOPMENT OF STEEL CASTINGS MANUFACTURE

AT a recent meeting of the Manchester Association of Engineers, the first part of a paper—on the "Development of the Manufacture of Steel Castings," was read by Ernest F. Lange, M.I. Mech.E., A.M.Inst. C.E. A two-section sub-division was made, namely—1, Crucible steel processes, and 2, Bessemer steel processes. In the first, the author traced the history of the crucible processes of manufacture from Reaumur's early writings and experiments up to the present, dealing incidentally with Huntsman's discovery of cast steel, the Siemens regenerative crucible steel furnace, "Mitis" steel castings, the modern coke-fired furnace, and Krupp's steel foundry. In the second section the author traced the development of the Bessemer steel processes. The Walrand and Robert converters were described, and the author compared the features of the former with the Tropenas converter, which to-day is the most extensively used.

Referring to the Walrand-Légenisel process, it was stated that the most important claim on its behalf was that it enabled the production of hot fluid metal to be achieved on a smaller scale than any known method, other than by crucibles. It was mentioned in this respect that there is in use in Paris a ½-ton converter giving a perfectly hot fluid steel with the Walrand method of ferro-silicon superheating. The author concluded this section of the paper with a description of the Stock oil-fired converter. He said that in no country had the small converter process for the manufacture of steel castings had a greater development than in Belgium, although at first glance there were no obvious reasons why that should be so. The fact remained that, before the war, the Belgian foundries were able to import hematite from Great Britain, convert it into steel castings, and undersell the British foundries in their own markets.

As a result of careful study of the Belgian steel casting industry, by personal observation and inquiries in that country itself, Mr. Lange came to the following conclusions as regards the causes that led to its success:

1—The excellent organization and equipment of the steel foundries.

2—The suitability of the small converter for making small and medium weight castings, as shown by the fact that the output of steel castings in Belgium has quadrupled itself in the last twelve years.

3—The advantage of no artificial restraint of the production on the part of the trade unions, i.e., the advantage of working piecework instead of day work.

4—The fact that small converter castings require smaller casting heads and runners than with the open-hearth process.

5—The castings require less annealing.

6—The Belgians have an abundance of cheap natural moulding sand, particularly suitable for the small converter process.

The James McKay Co., Pittsburgh, maintains an office in charge of John A. Buchanan in the King Edward Hotel in Toronto, Ont. The company is selling a large part of its output in Canada, comprising mechanical, marine and stud-link marine chain, anchor shackles, hooks, etc., and commercial and special forgings.

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PRINCIPAL CONTENTS

FUTURE ASPECTS OF SKILLED LABOR

ONE of the principal handicaps which manufacturers are likely to encounter in this country, in the generally expected struggle for after-war trade, will be the obtaining of a supply of suitably trained labor. References to the lack of graduate apprentices recur at increasingly frequent intervals, generally accompanied by expressions of disappointment regarding the incompetence of such help as offers itself where trained journeymen were formerly available. Observers, both in Britain and America are noting closely the present tendencies of the situation, and where possible are exerting personal influence to the end that the employee's interests in obtaining a proper training are too closely identified with the employer's to permit the latter to ignore the facts of the case indefinitely.

A few mechanics are born, some are trained, but a large proportion are the creatures of circumstances, who started in a machine shop as boys glad to get rid of school studies and brain work of any description. Perhaps the machine shop was the only local opportunity; had it been a packing-house or a cheese factory, they would have started there for just the same reasons. Such youths seldom remain long enough or work seriously enough to imbibe any ideas of the trade's requirements; they may ultimately manage to read a micrometer and yet be unable to work a problem in decimal fractions, and no one cares, at the time. In after years the same youth may make costly errors in his work through careless reading of dimensions on drawings while his employer anathematizes mechanics generally.

These conditions have been common in the past—most of our readers are probably able to recall such individuals and occurrences—and all of them have doubtless agreed that when all was said and done, the employers have themselves to blame, because they don't want to spend their own time or money training help for the ultimate benefit of other firms, and when the majority of employers view the situation thus, no remedy seems applicable.

At the present moment, too much importance is attached to the seeming ease with which munition workers have adapted themselves to work altogether foreign to many of them. The success attending the employment of women operators in several instances has also helped in developing a deprecatory attitude toward the trade of the mechanic. Such views are, however, based on temporary conditions, and are more frequently off-hand and superficial rather than the mature verdict of extended observations.

Nothing but a return to ordinary commercial work will bring about the previous state of affairs. The repetitive feature of shell production will not be present, and the efforts of this country to build up a foreign trade will involve for some time a variety of manufacture, throughout the country generally, and in many shops in particular, which will create a real demand for the all-round machinist, and it is in their efforts to anticipate this demand that manufacturers, who are laying plans for the science indicative of their ability to play a larger part science, indicative of their ability to play a larger part in the future upbuilding of our industries.

Very few of our firms are in a position to operate training schools for apprentices, and the feasibility of co-operation among employers is suggested thus by a writer in a contemporary: "Why not get together within the industry and organize what will be frankly trade schools, owned and operated by the manufacturers through the medium of stock companies where boys shall be offered opportunities that they cannot afford to pass by?" This remark is quoted without any disparagement of the work being done in technical schools; attendance at such institutions does not always mean that the student will join the ranks of skilled mechanics—frequently he is induced to leave and enter the employ of some firm which fails to realize that it is to his own and the industry's ultimate loss.

The equipment and instruction given in a jointly owned school could be of a varied yet thorough nature which while in line with the general requirements of the student's employers would insure his ability to tackle any work not absolutely specialized.

Out of the large number of present operators, quite a few bright individuals are available who might well form the nucleus of a later addition to the ranks of trained mechanics, an asset of considerable value to the trade, employers, and nation.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

PLATING AND POLISHING MATERIAL

By Abe Winters

THE war time prices of chemicals used in electro-plating and the increasing of nearly all materials required in the processes of plating and polishing are of special interest to the manufacturer of metal goods. The influence of these materials on the resultant effects in connection with the above named operations is a matter of great importance to both the manufacturer and the foremen in charge of these departments, and should be given special consideration during these strenuous times. When dealing with the more important items used in the operations mentioned. It is necessary to include the practical, commercial and technical aspects in order to appreciate fully the relationship between these three particular points and their respective significance to the trade. Technical references when made will be for the purpose of showing their effects on the commercial results, which we must admit is the chief ruling factor in any operation conducted for business purposes.

The subject of materials is almost without limits, therefore only a very small portion will be covered by this article.

Cleaning Materials

These include caustic salts and carbonates, caustic potash being entitled to first place, owing to its prominence in the composition of many cleaning compounds, and when obtainable, to its value in various branches of the industries, but as caustic soda is now the leading caustic we will dispense with potash for the present. Caustic soda, or Sodium Hydroxide, (NaOH) is prepared for commercial purposes at strengths of from 70 per cent. to 74 per cent. Na_2O (Sodium Oxide). Considerable quantities of sodium hydroxide are to-day obtained electrolytically, starting from solutions of sodium chloride or from fused sodium chloride. The sodium is obtained in the form of sodium hydroxide and all the chloride is absorbed by slaked lime and goes into commerce as chloride of lime (bleaching powder) containing 35 to 37 per cent. of chlorine.

Caustic soda has been adopted as a substitute for caustic potash in many branches of the industries and its use in the process of plating forms but a very small portion of the consumption. It is used in the manufacture of soap, paper, cotton fabrics, dyestuffs, and for purifying mineral oils etc. Germany exported approximately 10,000 tons annually, while England exported over 80,000 tons annually before the war. Concentrated solutions of caustic soda are shipped in iron drums and tanks. Caustic soda is decomposed by electrolysis, separating sodium at the negative pole. It is very soluble in water with evolution of heat, and is deliquescent in the air, from which is rapidly absorbs carhon dioxide.

Function of Caustic Soda

The function of caustic soda, is to transform the insoluble oils and grease present upon the surface of the articles treated, into what we may term soft soap, which is soluble. If mineral oils are present, the soda does not combine with them, in such cases, benzine, gasoline or slaked lime should be employed, if the condition is only occasional, but if mineral oil is present upon all articles treated an electric cleaning outfit for the purpose is advisable. Any article coated with mineral oils, when immersed in a caustic soda solution, will, by virtue of the law of gravity become cleaned to a certain extent. The oil rises to the surface of the solution, and when the article is removed from the solution, the article again becomes coated with an oily film, picked off the surface of the solution.

Carbonates of soda act too slowly to be of any great value in the cleaning processes preceding electro-plating. Additions of sodium cyanide in small quantities are sometimes permissible, especially where brass goods are treated. The percentage of acual caustic soda is very important, and should be known. A simple test to ascertain, roughly, the quality of the soda consists of adding sulphuric acid to a given weight of caustic soda, dissolved in any quantity of water, 80 parts, by weight, of caustic soda, is neutralized by 98 parts, by weight, of sulphuric acid, which reduced, is approximately 1 to 1¼ or 1 oz. of caustic soda should neutralize 1¼ oz. sulphuric acid. The reaction in the form of an equation is—

$$2\ NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O$$

Substituting their respective atomic weights we have

$$2\ (23 + 16 + 1) + (2 + 32 + 64) =$$

$$2 \times 40 + 98 =$$

80 + 98 which is the proportion of the substances mentioned. As is assumed in the equation, allowance must be made if the percentage is not 100 per cent. If the commercial sample of caustic soda contains, say, 90 per cent.. only, then an additional 10 per cent. of the soda must be used to neutralize the 98 per cent. of sulphuric acid.

These figures are only approximate, and actual figures must be worked out by the plater using the test, this being merely a rough guide—for instance, the present of 10 per cent of sodium carbonate must be allowed for. But even a crude test will often suffice for cleaning materials or indicate whether the substance should be properly analyzed.

The introduction of carbonates for ordinary, or electrolytic cleaning may be regarded as the result of an eccentricity on the part of the operator, except when used in solutions prepared from compounds containing certain forms of aluminum. Soda crystals contain 63 per cent. of water. Caustic potash is usually preferred to caustic soda where brass goods are treated, owing to the very pronounced action of the latter on polished brass surfaces. In normal times caustic potash is more economical than caustic soda, as the cleansing properties remain from two to three times as long.

Copper Salts

Copper carbonate is extensively employed for both copper and brass plating solutions. Very few platers now make their own carbonates. In fact there appears to be a constantly increasing tendency on the part of platers, to dispense with copper carbonate to a great extent in the maintenance of cyanide copper and brass baths. Baths prepared from copper oxide are seldom found in operation, yet the native oxide of copper contains 89 per cent. of copper, but is not employed in preparing the baths. The double cyanide of copper and potassium contains 24 per cent. copper; according to its formula the percentage of metal should equal 41 per cent., but when made from solutions containing free potassium cyanide (KCN) crystals of KCN come down with the double salt.

Sulphate of copper is one of the essential salts used in most plating plants. It is made largely from yellow copper pyrites (a double sulphide of copper and iron). The ores are roasted, or calcinated and afterwards heated in leaden vats with sulphuric acid and steam. The copper crystallises out, and is purified by recrystalising. On account of its manufacture from pyrites, containing a large percentage of iron, it is evident that the ordinary commercial qualities may contain iron in appreciable quantities.

To test for this impurity—dissolve a portion of the sulphate in liquid ammonia—just adding sufficient to redissolve the precipitate formed. Let it stand for thirty minutes or an hour, and any iron present will settle at the bottom of the container in the form of an insoluble brown deposit.

For use in cyanide solutions it should be more carefully tested; but for ordinary acid baths, unless unusual current densities are employed, the iron remains in solution. There are other tests, but the above may be utilized by those who do not possess the facilities to make absolute investigations, and may prevent unnecessary trouble by the exercise of caution.

Cyanide

Several years ago the potassium cyanide obtainable in this country was quite free from adulterations, gradually the percentage of sodium cyanide in the potassium salt increased, until practically pure sodium cyanide was substituted for the potassium salt. For all electro-plating purposes the sodium cyanide is equally as effective as the potassium cyanide, in fact 49 parts of sodium cyanide will do the same work, chemically, as 65 parts of potassium cyanide. A mixture of sodium cyanide with low-grade potassium cyanide will increase the percentage of cyanide in the compound, the 98 per cent. to 100 per cent. variety is obviously a mixture of potassium and sodium cyanides. Hundreds of platers used sodium cyanide for many months before becoming aware of the substitution, the supply houses having quietly taken advantage of the lack of attention to details on the part of the plater, who because of peculiar prejudices would, in many cases object strongly to the change. The only difference between the practical economy of sodium cyanide and potassium cyanide, as used by the electro-plater lies in the fact that potassium cyanide does not decompose as rapidly as the sodium cyanide. At the present time this point is of absolutely no significance. As only the sodium cyanide is obtainable and its price is such as to merit the exercise of unusual economy in its use.

Emery

This well known abrasive is a very important compound and is used for a great many purposes, where polishing or grinding operations are conducted.

Its use dates back to the time of the ancient Greeks, who called it Smyris. The principle source of supply is and has been Naxos, an island in the Grecian Archipelago, large deposits are also worked in Asia Minor.

It is found in large and small nuggets, embedded in red soil, and it is also found in crystalline limestone, some nuggets weighing approximately forty tons. These large nuggets are broken with hammers, and when necessary are roasted and cooled in order to render disintegration possible. In nature its distribution is quite peculiar, sometimes it is found on mountain tops and sometimes low in valleys. Emery is a mixture of magnetite, hematite and corundum (oxide of alumina) and other less important substances. It sometimes contains 70 per cent. of corundum and the iron oxides may run from 9 to 24 per cent. Native corundum is called adamantine spar, has a specific gravity of from 3.8 to 4.0 and contains about 90 per cent. alumina. It is second only to the diamond in hardness and its formula is $Al_2 O_3$. Broadly speaking, corundum may include the ruby, sapphire, adamantine spar and emery. Emery is a dull, opaque form of corundum and the latter constituent does not crystallize in the same shapes as characterize the other varieties. When in the form of sapphire corundum is blue and transparent, when red it is the ruby, and when of proper tints it is known as amethyst, topaz or emerald.

The best grades of emery are manufactured from Naxos brands and an analysis of this emery will show ferric oxide, 15.3; alumina, 68.4; silica, 2.7; calcium oxide 2; titanium oxide, 3.5; magnetic, iron 9.6. A very appreciable quantity of commercial emery is artificially colored and some is adulterated with iron, slag, garnet and is very inferior rubbish.

The practical value of emery lies in its abrasive qualities, and to test this quality it is tested by its action on plate glass. By this test it is possible to arrive at a standard of comparison. Its quality varies with its source and ranges from "good grade" with a durability of 60 per cent., to "high-grade" with a durability of 97 per cent, the latter being very well adapted to heavy grinding. Emery or any abrasive, to be efficient must be free from dirt and dust, these latter serving mainly to create heat and cause glazing, resulting in the unnecessary expenditure of labor and power to accomplish a given amount of work, a condition unprofitable to both employer and employee. In purchasing emery it is therefore well to consider the percentage as compared to the cost, although the proportion of corundum need not be particularly high, as often the actual economical employment of the abrasive may depend upon its state of mechanical union with its other components.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.
Officers 1916-1917.

President—Wm. J. Salmon, 104 Lake Frout, Kew Beach, Toronto.
Vice-President — John Acheson, 1065 Dundas Street, Toronto.
Sec.-Treasurer—Ernest Coles, P.O. Box 5, Coleman, Ontario.
Librarian — John A. Magill 591 St. Clarens Ave., Toronto.

PLACE AND DATES OF MEETING.
The Occident Hall, corner of Queen and Bathurst Streets. Fourth Thursday of each month, at 8 p.m.

Plating Salts

Prior to 1910 there were very few nickel solutions prepared from other than the double nickel salt, nickel-ammonium suphate, $NiSO_4 (NH_4)_2 SO_4 6H_2O$. Importations of special brands of nickel salts from European markets, were sold to Canadian and American consumers at prices greatly in advance of prices paid for ordinary nickel salts. The imported salts proved to be a "bee in the bonnet" of every plater who used them, as has been demonstrated by the large number of formulas which have been prepared by our more progressive platers. The result as seen to-day is truly remarkable, there being very few double salt solutions in operations among the up-to-date shops.

The salts manufactured to-day are practically pure. The percentage of nickel in the single salt $NisO_4$ 7 H_2O is, approximately 21 per cent. while the double salt contains approximately 15 per cent. The single salt is formed on dissolving nickel or its hydroxide in H_2SO_4. It crystallises at 15 to 20 deg. F. with $7H_2O$ in bright emerald-green crystals, isomorphous with Mg SO_4, while at higher temperatures it crystallises with $6H_2O$ in bluish-green crystals. At 280 deg. it loses all its water and becomes yellow. It dissolves in 3 parts of water. If a solution of Ammonium sulphate is added to a solution of NISO in water acidified with H_2SO_4, then on concentration green crystals of this double salt separate. It is only slightly soluble in water (2:17).

One of the disadvantages encountered in the use of the double salt is the accumulation, in the solution, of the ammonium sulphate residues from the nickel salts. These residues are, so far as actual practice is concerned, inert and harmless salts, and they serve no useful purpose. This is frequently demonstrated by the nickel hydrometer which possibly shows a specific gravity of 6 deg. Beaume, and yet the solution does not contain one half ounce of metallic nickel per gallon. A new solution prepared from 12 oz. of nickel-ammonium sulphate per gallon would give approximately 2 oz. of metallic nickel per gallon. A solution of this concentration has the further disadvantage of producing the peculiar effect of precipitating the nickel from the solution in the form of double salt. If we take advantage of this property of sulphate of ammonia, it is quite easy to determine roughly the amount of metallic nickel per gallon of solution. Prepare a strong solution of ammonium sulphate and add this to at least one quart of the nickel solution, stirring vigorously until the solution is colorless. Set aside for a few hours, siphon the liquid off, and weigh the precipitate of double salt. At 15 per cent. nickel, one seventh of the weight of the salt thrown down, will be about the amount of actual nickel in the solution. If both nickel-ammonium sulphate and the nickel sulphate are used to maintain the efficiency of the nickel bath, and we desire to ascertain the proportion of each salt present in the bath before replenishing, we would first determine the amount of ammonia present and calculate the number of grams of nickel sulphate required to combine with the determined amount of ammonia, the remainder would be recognized as the nickel sulphate salt. Double salts form a solution with water which is a comparatively poor solvent for nickel anodes, particularly those of high percentage of nickel, the solution also loses it original metallic strength quite rapidly when subjected to constant use at maximum current density permissible.

High Speed Solutions

Single salt solutions, otherwise known as "high-speed" or "rapid" solutions are more nearly ideal because of their high solvent powers. Various salts are employed as conducting salts, the true function of these salts being to aid the corrosion of the anode. After exhaustive tests and continued use of several chlorides for this purpose, leading authorities still differ as to the more desirable chloride, although the writer has repeatedly demonstrated the superior merits of nickel chloride for the purpose in question. And in practice has discarded all other chlorides. He maintains that if a chloride must be employed, the least harmful one should be chosen, if it is equally as efficient as others; nickel chloride fulfils every requirement and produces the least objectionable results.

Some of the impurities found in the nickel salts of commerce are very harmful to a nickel solution prepared for high-grade plating and it is necessary to determine the character and quantities of these enemies before intelligent action may be taken to remove them or prevent their injurious effect at the cathode. The presence of iron may be detected by dissolving a small quantity of the salts in water and adding a solution of ammonium chloride and liquid ammonia, with ammonia in excess. Any iron present will be precipitated as a bulky brown flocculent mass.

Copper Detection

Copper in the salts or solution is frequently the source of serious trouble, and is possibly the most harmful foreign substance encountered in nickel plating solutions. The presence of copper may be detected by passing sulphuretted hydrogen gas into a portion of the solution, when a black precipitate, or a cloudy, dark solution indicates presence of copper. To be certain the copper is introduced into the solution as an impurity in the salts, a solution of the salts should be tested. Dark nickel deposits often are the result of copper contamination. When the percentage of copper is very great, copper is deposited out by simple immersion.

If the copper contamination originates in the anode, the condition is indicated by a reddish coating on the anodes when at rest. This reddish discoloration may also be caused by the electro-chemical action between other impurities in the anode, and therefore it is wise to know the actual composition of the anode, in order to deal with the aforesaid conditions in a proper manner. Ninety-five per cent. of the difficulties arising during the electro deposition of nickel, brass, copper, cobalt and zinc have their origin in impurities in the salts or anodes, or the improper preparation of these two materials. The judicious use of boric acid and citric acid in the nickel bath, potassium hydrate in the brass bath and zinc bath are to be encouraged, but some rather annoying conditions arise from excessive or haphazard employment of these chemicals as additions to plating baths.

Several of the materials of minor consequence in normal times are now, by reason of advanced prices, worthy of special attention when considering the economic utilization of plating room supplies. As an example we will take copper carbonate. Any intelligent plater will admit that the cheapest source of metal is the anode and if this is true, we can eliminate considerable expense by operating the hot cyanide copper bath without the customary frequent additions of copper carbonate.

See that the grade of pumice used is such as to produce the greatest efficiency per pound, install a settling basin and collect the pumice used in scouring, and use dried material in various tumbling operations. Do not raise the temperature of solutions containing cyanide to 200 deg., the cyanogen content rapidly diminishes and wasteful renewals are required. Cyanide copper and brass baths will work sufficiently rapid at a temperature approximately 100 deg. Shut off the steam before the actual maximum degree of heat is obtained. Watch the supplies coming into the plating department and the product going out will be less faulty.

Questions and Answers

Question.—In the manufacture of brass fuse protectors we have experienced considerable difficulty in producing a clean finished article without resorting to scratch-brushing. The strip of tin used as a releasing band prevents the employment of the customary bright acid dip, owing to blackening effect on the tin. Scratch-brushing produces a very satisfactory finish but is too expensive and a very slow process. We shall greatly appreciate any information which will enable us to clean 20,000 protectors per day at moderate cost.

Answer.—Prepare a solution of New England cleaner, 4 to 6 oz. per gallon of hot water. Use an electric current of 6 volts tension and as strong current as possible to pass through the work. By making holders of soft brass stock of at least 3/8-in. dia. and arranging the protectors so that the solution may be easily and quickly expelled when removing from the solution, and using a solution of 200 to 300 gallons, one man could easily treat your daily output by this method. A boy or girl would be required to place the parts on the holders and another boy to dry the pieces by compressed air or heated chamber. If the protectors have become badly stained before reaching the cleaning tank, they may require an addition of 1 oz. to 2 oz. of liquid ammonia per gallon of the New England cleaner. The holders used must not cover the open end of the protectors if a clean interior is expected. Maintain the cleaning solution at about 150 deg. F.

* * *

Question.—I have undertaken to electro plate various pieces of munitions which have been machined too small and have been rejected by the inspectors. By copper-plating these pieces I am able to finish them to proper size and weight. I employ an acid copper solution for the purpose and have succeeded splendidly except in the matter of time. I desire to increase the speed of deposition, can you suggest a method.

Answer.—You do not state your present rate of deposition therefore we can but generalize in our reply. If you use a sulphate solution containing 2 lbs. of copper sulphate, and from 10 oz. to 12 oz. free sulphuric acid per gallon, and operate at as high a temperature as you find possible without disturbing results when combined with suitable agitation, you will no doubt obtain increased output. You may obtain still greater output by arranging perpendicular shafts over the plating tank and suspending the shells in the solution from these shafts which are rotated at from 500 to 1,000 revolutions per minute. In the latter case, agitation should be facilitated by actually pumping the solution from the tank directly upon the shell while rotating. By this method there is practically no limit to the rate of deposition possible, if the velocity of the shell is properly increased with the increase of current supplied. If rough deposits annoy you, use small additions of alum or black molasses, and clean the sediment from the tank at frequent intervals.

* * *

Questions.—We have been engaged for many years in the manufacture of various sheet brass novelties. Since the price of brass has advanced to a figure which makes its use impossible for the manufacture of popular priced novelties we have resorted to a composition sheet which consists of a large percentage of tin. In finishing this metal after forming, we experience much trouble in producing an adherent deposit of nickel or silver. We have been advised to copper-plate the surface previous to nickeling but owing to increased cost of production by so doing, we desire to avoid the coppering operation, if possible. We therefore appeal to you for assistance.

Answer.—Your difficulty in plating the composition metal which contains a large percentage of tin is probably due to improper methods used in preparing the surface for plating and possibly to the use of improper cleaning materials. Do not employ caustics in the cleaning solution and even when using mild alkalies, the tin articles must not remain in the solution until discolored if the process is to be rapidly and successfully performed. After removal from the hot cleaning solution rinse in clean hot water, then in cold water and scour with very fine lime or whiting. The scouring must be thorough and quickly performed. Rinse in clean, cold running water, immerse momentarily in a 20 per cent. sulphuric acid solution, and place at once in the nickel solution. Plate for 10 to 20 minutes, with moderate current; silver may be depopsited upon the nickel.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey Forge, Pittsburgh		$35 95
Lake Superior, charcoal, Chicago		38 75
Standard low phos., Philadelphia		70 00
Messemer, Pittsburgh		38 95
Basic, Valley, furnace		35 00
	Montreal	Toronto
Middlesboro, No. 3	.....	.....
Cleveland, No. 3	.....	.....
Clarence, No. 3	.....	.....
Victoria	.....	$43 00
Hamilton	.....	.....

FINISHED IRON AND STEEL

Per Lb. to Large Buyers. Cents

Iron bars, base	$4 25
Steel bars, base	4 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 00

METALS

Aluminum	68
Antimony	36
Cobalt, 97% pure	1 50
Copper lake	40 00
Copper, electrolytic	40 50
Copper, casting	39 00
Lead	12 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	79
Tin	56 00
Zinc	14 00

Prices Per Lb.

OLD MATERIAL.

Dealers' Buying Prices

	Montreal	Toronto
Copper, lghti	$24.00	$24 00
Copper, crucible	28 00	28 00
Copper, heavy	28 00	27 50
Copper, wire	28 00	28 00
No. 1 mach. comp'n	23 00	22 00
No. 1 comp'n tur's	19 00	20 00
Heavy melting steel	17 00	16 00
No. 1 mach'y cast iron	21 00	16 00
New brass clippings	19 00	18 00
New brass turnings	16 00	17 00
Heavy lead	9 00	10 00
Tea lead	7 50	6 50
Scrap zinc	9 00	10 00
Aluminum	36 00	35 00

COKE AND COAL.

Solvay foundry coke, on application	
Connellsville foundry coke.	
Yough steam lump coal	8 50
Pittsburg steam lump coal	8 50
Best slack	9 00

Net ton f.o.b. Toronto.

BILLETS.

Per Gross Ton

Bessemer billets	$65 00
Open hearth billets	65 00
Forging billets	90 00
Wire rods	85 00

F.o.b. Pittsburgh.

PROOF COIL CHAIN.

1/4 inch	$9 45
5-16 inch	9 10
3/8 inch	8 35
7-16 inch	7 15
1/2 inch	6 95
9-16 nch	6 95
5/8 inch	6 80
3/4 inch	6 70
7/8 inch	6 55
1 inch	6 40

Above quotations are per 100 lbs.

MISCELLANEOUS.

Solder, guaranteed	0.35
Babbitt metals	.14 to .60
Putty, 100-lb. drums	4 00
Red dry lead, 100-lb. kegs, per cwt.	13.87
Glue, French medal, per lb.	.25
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	.69
Linseed oil, boiled, single bbls.	1.40
linseed oil, raw, single bbls.	1.43
Plaster of Paris, per bbl.	2.50
Plumbers' oakum, per 100 lbs.	8.00
Lead wool, per lb.	.15
Pure Manila rope	.29½
Transmission rope, Manila	.37½
Drilling cables, Manila	.32½
Lard oil, per gal.	1.35

SHEETS.

	Montreal	Toronto
Sheets, black, No. 10	$6 50	$6 50
Sheets, black, No. 28	6 50	6.50
Canada plates, dull, 52 sheets	7 00	7 00
Canada plates, all bright	8 00	8 00
Apollo brand, 10¾ oz. (galvanized)	7 25	7 25
Queen's Head, 28, B.W.G.	7 75	7 75
Fleur-de-Lis, 28, B. W.G.	7 45	7 35
Gorbal's best, No. 28	8 25	7 50
Colborne Crown, No. 28	8 00	6 75
Premeri, No. 28, U.S.	7 75	7 95
Premier, 10¾ oz.	8 00	8 25

ELECTRIC WELD COIL CHAIN B.B.

3-16 inch	$11 70
1/4 inch	8 40
5-16 inch	7 40
3/8 inch	6 35
7-16 inch	6 35
1/2 inch	6 35
5/8 inch	6 35
3/4 inch	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, net; B and C, 20 and 5 per cent.; cast iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples 72½; malleable, lipped union 60.

ANODES.

Nickel	$0.50 to $0.51
Cobalt	1.75 to 2.00
Copper	.44 to .46
Tin	.62 to .64
Silver, per oz.	.82 to .84
Zinc	.18 to .20

Prices per lb.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper carbonate, anhy.	.35
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate ....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130 per cent.	.46
Sodium cyanide, 98-100 per cent.	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheel,...2 felt, per lb.		$2.35
Polishing wheels, bullneck		1.35
Pumice ground		.04
Emery composition	.08 to	.09
Tripoli composition	.04 to	.06
Crocus composition	.07 to	.08
Rouge, powder	.30 to	.35
Rouge, silver	.35 to	.50

Prices per lb.

TRADE GOSSIP

James P. Wood, a member of the firm of Wood Bros., foundry, died at Chatham, Ont., on March 16, aged 45.

The Hull Iron & Steel Foundries, Ltd., of Hull, Que., have opened a sales office at 165 Broadway, New York City, to take care of their export business.

The E. J. Woodison Co., foundry outfitters have moved from 340 Dufferin street to more commodious premises at 858 Dupont street, Toronto.

Toronto, Ont.—Plans have been prepared for a new foundry to be erected on Cherry Street by the Queen City Foundry Co., at a cost of $12,000.

Three Rivers, Que.—The Quebec Steel Foundries, Ltd., are building a plant here. Messrs. Massicotte and Gagnon, of Ste. Anne de la Perade, are interested in the company.

George Forest McKay died at New Glasgow, N.S., on March 13, at the age of 82 years. Mr. McKay assisted in the founding of the Nova Scotia Steel & Coal Co., and was its oldest director.

Eburne, B.C.—The British Pacific Iron & Steel Co. has placed an order for open-hearth furnaces for the steel plant they will erect on the Fraser River, near Eburne. A site of 10 acres has been secured.

Guelph, Ont.—In a few weeks the International Malleable Iron Co., expects to proceed with the erection of a large addition to their plant. The new building will be 216 feet long, one storey high. Tenders are now being received for the construction.

The Ætna Iron & Steel Co. has moved its offices from Victoria, B.C., to 916 Standard Bank Bldg., Vancouver. The company has leased with option of purchase the Port Moody Steel Works. The entire plant is being rearranged and a new open-hearth furnace is being constructed. David Milne is the managing director.

Charles H. Easson, vice-president of Brown's Copper and Brass Rolling Mills, Ltd., formerly manager of the Toronto branch of the Bank of Nova Scotia has been appointed general manager of the Standard Bank of Canada, to fill the vacancy caused by the death of the late George P. Scholfield. Mr. Easson will assume his duties on April 2.

Toronto, Ont.—Good progress is being made on the new steel plant at Ashbridge's Bay. The pile drivers are preparing the site and the Hamilton Bridge Works have started erecting one of the buildings.

Windsor, Ont.—Preparations for the development of the quarries at Amherstburg by the Solvay Process Co. are already under way. Gordon S. Rutherford, newly appointed general resident manager of the company, has already taken charge and has planned his campaign.

Hull, Que.—The Hull Iron & Steel Foundries are making considerable extensions to their plant, including a machine shop extension, 40 ft. by 90 ft.; office building to cost $20,000; two 20-ton, open-hearth furnaces, approximate cost $50,000. New equipment to be installed will consist of one 30-ton overhead traveling crane for the main foundry; one 10-ton crane, 40 ft. span, with 300 ft. runway, into the yard. Three heavy duty engine lathes will also be required.

Halifax, N.S.—A new company has been formed which will be known as the Halifax Steel Co., to take over the Nova Scotia Car Works. Louis X. Fuller of Halifax is the moving spirit in the new enterprise.

Windsor, Ont. — Goldman & Harris who proposed to establish a brass foundry here may build the plant in some other town as the City Council has raised the price of the site from $850 to $1150 per acre.

The London Smelting & Refining Co. has been incorporated at Toronto, with a capital of $45,000, to carry on the business of refiners and smelters of all kinds at London, Ont. The incorporators are: Jacob Harris, Samuel Harris, and Louis Harris, all of London, Ont.

Midland, Ont.—It is understood that the Port Arthur Copper Co. will install a reverberatory furnace at the reduction plant at Midland for smelting copper ores. This furnace will be operated in combination with the company's blast furnace, and will be ready, it is stated, for ore by May 1 next.

Hugh Russel, a life-long resident of Montreal, died on March 22 at his residence, 423 Guy street. Mr. Russel was president of Hugh Russel & Sons, Ltd., iron and steel merchants, Place d'Armes, and had been in business for himself in this city since 1868. He was born in Montreal on August 17, 1844.

Mineral Resources Near Kingston.—Mineral resources of the Kingston district in Ontario are attracting increased attention, according to United States Consul Felix S. S. Johnson. The iron mine near Trenton, closed for many years, has been reopened and large shipments of ore made to the United States. This ore is mixed with other ore in the manufacture of steel. Export figures for the district show several thousand tons shipped. Large bodies of mica have been discovered north of Kingston recently. American capital is interested in several properties in the Sydenham district. Since the war began there has been a greater demand for Canadian mica than heretofore.

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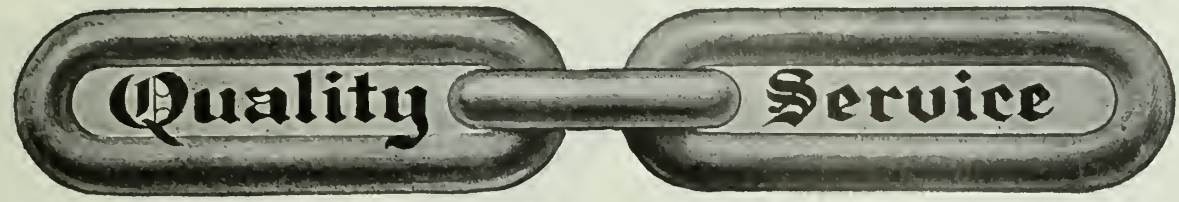

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Jonathan Bartley Crucible Co., Trenton, N.J.
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Stevens, Frederic B., Detroit, Mich.
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Hyde & Sons, Ltd., Montreal, Que.
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Woodison, E. J., Co., Toronto, Ont.

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W. W. Wells, Toronto.
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SAND BLAST ACCESSORIES
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Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT
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Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
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SAND SIFTERS
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SILICA ROCK, GROUND AND PULVERIZED
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Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
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SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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Can. Hart Wheels, Hamilton, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Hamilton, Ont.
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Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
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Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

ADVERTIS NG INDEX

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company Limited, Toronto, Montreal, Winnipeg, and London, England

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The Publisher's Page

TORONTO May, 1917

What Gives Value to Trade Names

IN these days when a trade name may be made to be worth a million dollars or so a letter, the desire of manufacturers to find the proper trade name can well be understood.

To all manufacturers there is a valuable suggestion in what the American Ever Ready Works says about its new trade name, "Daylo," as reported in *Printers' Ink* last week. This name was selected on the basis of a referendum to the public. It was chosen by competent judges as the best of the thousands of names submitted, and yet the company confesses itself somewhat disappointed in the results.

"We had hoped," it said, "perhaps to obtain a word that would satisfactorily combine in a suggestive way both what Eveready is (powerful, portable electric light) and the variety of service it renders. We are now convinced that no usable protectable word could cover so broad a field."

But every manufacturer who has developed a successful trade name knows that if the company advertises persistently some day the word "Daylo" can be made to mean just what the company wishes it to mean. "Kodak" in the beginning had no meaning whatever. It was an arbitrary collection of five letters. But to-day consumers know what Kodak means because the company has given it a precise meaning through its years of intelligent advertising.

The American Ever Ready Works need not feel disappointed: but *its work is just begun. It must now give a meaning to "Daylo" which everybody will understand, and that means advertising. "Daylo" can be made to mean as much or as little as the company will. If the company depends upon the word alone to do the educational pioneering for the company's goods, it will mean little. If a strong volume of educational advertising is put behind the name, in time it can well prove its value to be worth a million or even two million dollars a letter.*

This is good philosophy, gentlemen, be it applied to flashlights or to files; to furnaces or forging presses or any other product.

Good advertising will give a name a value and a significance which it could not otherwise possess. Yes, advertising goes even further than that, because it creates in the buyer a sense of security and a feeling that there is something in the advertised product besides mere material, brains and skilled labor.

CANADIAN FOUNDRYMAN
AND METAL INDUSTRY NEWS
143-153 University Avenue Toronto, Canada

Everything for the Foundry

WE are in a position to supply you with the following high grade materials, at the lowest cost, from our stock, mines, and manufactures.

High grade clay, silica, chrome and magnesite bricks of all shapes, chrome ore, mica schist, silica grit, ganister, fire clays, etc., for lining converters, openhearth, basic and acid, electric or other furnaces. Steel molding, core furnace bottom, and all kinds of iron molding sands to the very finest grades. Best grades of plumbagos, crucibles, core wash, silica mold wash, sea coal facing, core compound, talc, partamold, and liquid core compound to take the place of oil at one-third the cost.

We are also in position to quote you on **foundry equipment,** such as ladles, cupola, converters, openhearth furnaces, core ovens, sand mixing machines, pneumatic rammers, chisels, riddles, etc.

We are the selling agents for Canada of the famous **Rennerfelt Electric Arc Furnace.** The most efficient, modern, and economical furnace in the market for melting steel, iron, brass, copper, nickel, monell, or any metal from five hundred pounds to seventy-five ton capacity.

In connection with our supply and foundry equipment department, we are in a position to give expert advice on brass, cupola, converter, openhearth, and electric furnaces, also on foundry construction, foundry efficiency, mixing of metals. Molding in iron, steel, brass and monell, as well as acting in an advisory capacity in regard to the purchase of raw materials so as to secure you the most suitable materials at most reasonable prices.

We will be pleased to have you call upon us at any time regarding your problems, as our services are gratis. Write us.

HYDE & SONS, LIMITED

New Birks Building

MONTREAL QUEBEC

Crucibles of Quality

UNIFORM

Service and Durability Ensure Economy.

Tilting Furnace

CRUCIBLES

Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

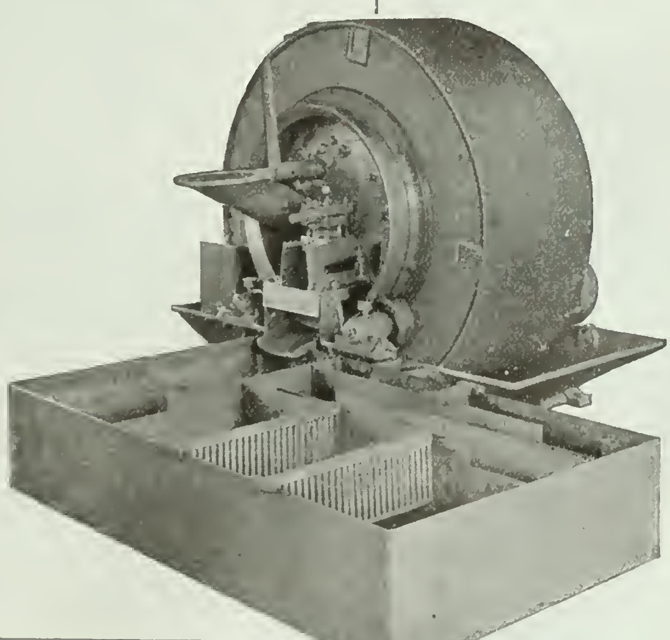
TRENTON, N. J., U. S. A.

Don't wait for an expert to tell you

WE can tell you now—and prove it if you wish—that you can effect wonderful savings by reclaiming your waste material, and that by the use of the Standard Cinder Crushing Mill you can reclaim from 98 to 99% of all metal contained in cinders, slag, skimmings, old crucibles, etc.

And in the Standard you get not merely an improvement of an old process, but something entirely different from anything you have used heretofore. Its new features make possible a decided increase in efficiency and have in every installation greatly reduced the cost of maintenance.

Further particulars ought to interest you. A post card will bring them to you.



THE STANDARD EQUIPMENT CO.

47 Orange St., New Haven, Conn.

Safe Practice at Blast Furnaces and Its Development--IV.

By Frederick H. Willcox

In its efforts to increase safety in the metallurgical industries, the Bureau of Mines, Washington, D.C., has been studying the causes of accidents at blast furnace plants also methods for their prevention. This article describes the known dangers and makes suggestion of means whereby the risk of accident may be lessened or, better still, wholly avoided.

BOILER-HOUSE FORCE

ALWAYS pay attention to furnace signals for checks, slips, and shoutdowns, and be sure to follow the plant rules for taking boilers off when the furnace is shut down; failure to do so may cause an explosion. When the furnace is hanging and liable to slip, and especially when one or more checks have been blown to slip the furnace, keep away from gas burners, firing and ash-pit doors, and explosion doors; the gas may flare out and burn you when the furnace slips. Do not sit on or near dust boxes, burners, or gas mains; a very small leak will let enough gas escape to "gas" you. Do not stay in any place where you can smell gas. If your work requires you to do so, have a helper with you, and be sure that your foreman knows what you are doing.

Boiler Repair Precautions

Do not go inside a boiler setting to make repairs or clean it until you have stopped with clay all gas leaks about the burners and mains near openings into the setting. If the burner or burner valve leaks and the burner can be pulled back, put a piece of sheet iron between the nose of the burner and the setting. If the burner cannot be pulled back, put a blank flange in the downleg or other feasible place, unless the valve is absolutely tight. Do not enter the setting, boiler, or work on the tubes until the foreman has either locked or placed danger signs at the gas burners, blow-off valves, and stop valves at the steam leader and feed lines. Wait until the clinker and dust has been cooled off, and have someone to watch you while inside, and "spell" you off, before entering the combustion chamber. Don't stay inside when turning a hose on the walls to cool them, as the clinker is likely to spall off and expose red-hot brick dust or brick, which may make the water boil and spit and scald you. Before opening manhole covers or tubes the safety valve should be lifted; be sure the steam is entirely exhausted from the boiler.

FIG. 33. WORKMAN PLACES WRENCH CARELESSLY ON LADDER PLATFORM.

FIG. 34. WRENCH FALLS AND INJURES HELPER.

Unless it is your work and you are familiar with it, do not turn gas into the boilers after a shutdown unless the foreman is present. It may explode and burn you if it is not lighted properly. Similarly, do not turn steam into a cold line or put the boiler on the main steam line unless the foreman, water tender, or head fireman is present. Never open a burner or valve with a danger sign on it. If it appears that someone has forgotten to remove danger signs when through work, report to the foreman. Don't remove the signs yourself unless directed to do so.

Opening Cold Steam Line

To open a cold-steam line proceed as follows:—First, open the valve drips; second, open the by-pass or open the stop-valve enough to warm the line slowly; third, do not open the main-line valve until you are certain the line is heated. To turn the boiler into the main steam line:—First, bring the boiler pressure to within 5 pounds of the main-line pressure; second, open the valve next to the boiler slowly; third, open the valve next to the main steam line slowly. To clean boilers:—First, close all stop valves on the steam main (do not depend upon any automatic stop or non-return valve); second, close all valves between the mud drum and the blow-off main; third, if there is but one valve, put a blank flange between the valve and the boiler; fourth, close the stop valves on the feed water next the main line; fifth, close the stop valves on feed line next the boiler; sixth, place danger signs at the valves and lock them; finally, be sure the steam is entirely out of the boiler.

Gauge Glass Removal

In removing and replacing gauge glasses wear heavy goggles. When turning water into a gauge glass place a shield in front of the glass to protect yourself from glass or steam should the glass break, and turn the steam in slowly. Leaks in pipe flanges and gasket or valves should be promptly reported. Never use a hammer, chisel, or wrench on live-steam lines in an attempt to

FIG. 35. CARELESS WORKMAN STANDING INSIDE OF A CABLE BENT AROUND SNATCH BLOCK.

temporarily stop leaks. Watch your steam hose and replace it when it shows weakness. In blowing off boilers open and close the blow-off valve slowly.

In unloading ashes be sure that they are wet down, and in turning water on them do not get close enough to be burned by steam. When unloading coal, wet it down if very dry or dusty. Never use any kind of light other than an elec-

FIG. 36. WORKMAN WEARING GOGGLES WHEN GRINDING TOOL. NOTE GUARDED EMERY WHEEL.

tric light when working about dusty coal, and do not smoke. Neglect of this precaution may cause a violent dust explosion.

Riggers, Millwrights, and Handymen

Don't go on top of the furnace unless you notify the furnace foreman, so that you will not be on top when the furnace is liable to slip. Also notify your foreman so that he can send someone with you. One man should always stay where there is no gas, but in a position to watch the other man while he is inspecting or oiling. If the latter appears to be getting "gassed," the alarm should be given the stock-house or cast-house crew, and every effort made by the watcher to get the exposed man out of the gaseous place, or to keep him from falling while the crews are coming up. Do not go over the receiving hopper unless you notify the skip or bell operator not to operate the bells. Avoid making even routine examinations of hoppers and bells unless the furnace foreman knows that you are doing it and upon what particular top or furnace you are working. Repairs to explosion doors or bleeders or work inside of hoppers should never be undertaken when the wind is on. At shutdown, don't light the gas on top of the furnace until you have received the signal from the blower.

Gas Container Precautions

Before going into gas mains, scrubbers, or any enclosed gas-containing or gas-using place to make repairs or inspections, be sure that every gas connection is closed and the place cleared of gas. Familiarize yourself with the layout of gas valves, water stops, and gas mains, so that you may know where all gas connections are. Always wait until your foreman and the furnace foreman say it is safe to go in. In closing and opening sand, goggles, or slide valves watch for gas. When it is necessary to work in gaseous air, as it often is, to make some other place safe, to shut down or start up a furnace, or other reason, work in "spells," and if you feel sick or dizzy go into fresh air at once. When possible, always wear breathing apparatus or a belt and life line, both in enclosed and unenclosed gaseous places. Avoid smoking in such places.

When it is necessary to examine a chimney valve on a stove, notify the stove tender not to shut the blast off or turn the gas on. Before examining hot-blast valve slots or valves see that the gas is shut off and the chimney valve is open. Do not go inside of a hoist drum to replace or take up the hoisting cable until you have seen for yourself that the steam-stop valve is shut and the pinion blocked in the gear, or, if it is an electric hoist, that the motor switch is locked open and the gears blocked. Avoid trying to adjust the feeding or running on of cables on wrenches or hoist drums while they are in motion. Do not work on cranes, hoists, skip inclines, skip pits, and scale or lorry cars unless you know that the motor switches are locked open. When on crane runways be sure the main-line switch is open, or if the crane must be used protect yourself with track torpedoes. When pouring hot babbitt or lead warm the sockets or molds, and wear goggles to protect your eyes from splashes.

Scaffolding Precautions

Before going on scaffolding, inspect it and satisfy yourself that it is safe. Don't lean castings against scaffold uprights or pile material against them. When placing material upon scaffolds let it down carefully, don't throw it down or let it drop quickly, especially if lowering it with a winch or hoist. Place material evenly and look out for overloading. On coming down from scaffolds or platforms don't slide down ropes; use the ladders or steps provided. Never throw tools or other materials down from scaffolds unless the space below is protected with danger signs or a watcher. Do not leave bolts, rivets, tools, etc., on platforms when through work or lay them during the work where they may fall through holes or from the edge of the platform. (See Figs. 33 and 34.) Remember to use care when on ladders.

Do not attempt to tighten or adjust doors, nuts, valves, or packing glands while the blast is on, and avoid rushing repair jobs by loosening too many nuts or keybolts on blast mains, hot-blast valve seats, or heads before the blast is off. Ascertain the correct number to loosen and do not exceed that number.

Hoisting Tackle

Where hoisting tackle is used, the danger of practices such as walking near taut hoist lines, getting foul of guy lines, standing in front of snatch blocks (Fig. 35), etc., may not be apparent to laborers or members of the furnace crew who are helping. You can prevent accident by warning the men of these obscure dangers. Be sure that all hoist lines, cables, chains, tackles, and boatswain's chairs are in good shape before using them. Care should be taken in slinging a load to see that the slings are properly arranged and the load balanced and securely fastened to prevent slipping. The

FIG. 37. WORKMEN CUTTING OUT RIVETS AND USING SHIELD. NOTE THAT GOGGLES ARE BEING WORN.

part of the sling from the hook to the load should be long enough so that it makes an angle of more than 45° with the ground. Very short and flat slings are under much greater stress than ones arranged as above. In hooking on the load, watch that your hand does not get caught, and don't grab the cable above the lower sheave block.

Be sure to replace all belt, gear, machine, and engine guards, shields, and railings; they prevent accidents. Do not try to do work on electrical wires or to connect temporary lights. Defective insulation may cause a severe shock or burn, especially if you should be standing on an iron plate. Keep your tools in good shape and return all tools with burrs or mushroomed heads, cracked handles, or other defects for redressing and repairs. Avoid using pipe wrenches, defective wrenches, or a wrench that is too large for the bolt head or nut to be removed. The wrench may either slip or round off the nut. Be especially careful in working on rounded nuts and replace them with new ones at the first chance. Don't cut rivets, bolt heads, or nuts off until you have placed a shield to prevent them from flying, or have a sign or a watcher to warn men of the danger. When chipping or cleaning castings always wear goggles. (See Figs. 36 and 37.)

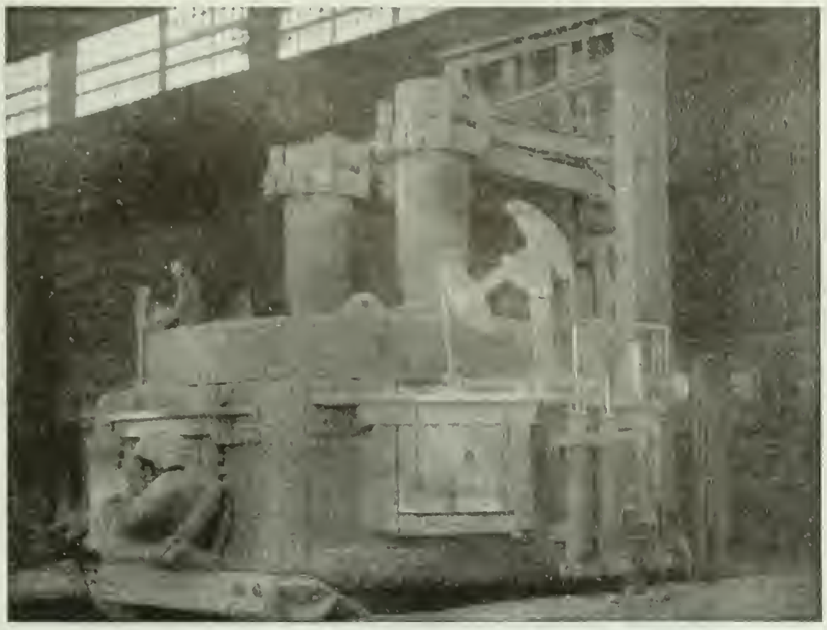
Regular inspection of hoists and skips, brasses, bells, sheaves, hoppers, and valves, may prevent sudden shutdowns and extra hazardous work. Members of rigging and millwright gangs, being in every part of the plant in their regular work, should know more about many obscure and not readily apparent dangers than most of the furnace force. It should be a part of their duty to report any dangerous practice or condition. There are many trivial sources of accidents, so many that no one man or committee can see them all, or, in some cases, even know that they exist until injury results.

ELECTRIC FURNACE EQUIPMENT

THE constant broadening of the commercial field of the electric furnace is due largely to the perfecting of furnace design and reduction in cost of power. Whereas their former use was principally in the refining of high grade alloy and tool steels, they are now being more widely used for the refining of common grades of steel. Improved devices for charging and tilting, larger electrodes, and automatic regulation all tend to greater economy.

While many different designs of furnace are in existence, they can be grouped in two general classes, the induction furnace and the arc furnace; the latter, in sizes from one-half to 20-tons having been adopted almost exclusively in American practice.

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed complete electrical equipments for all classes of furnace, that for the arc type of furnace, assuming high tension alternating current is available, including line protective equipment, switchboard, step down transformers, furnace tilting motors, motors for adjusting position of electrodes, and a regulating system for the control of the electrode motors.

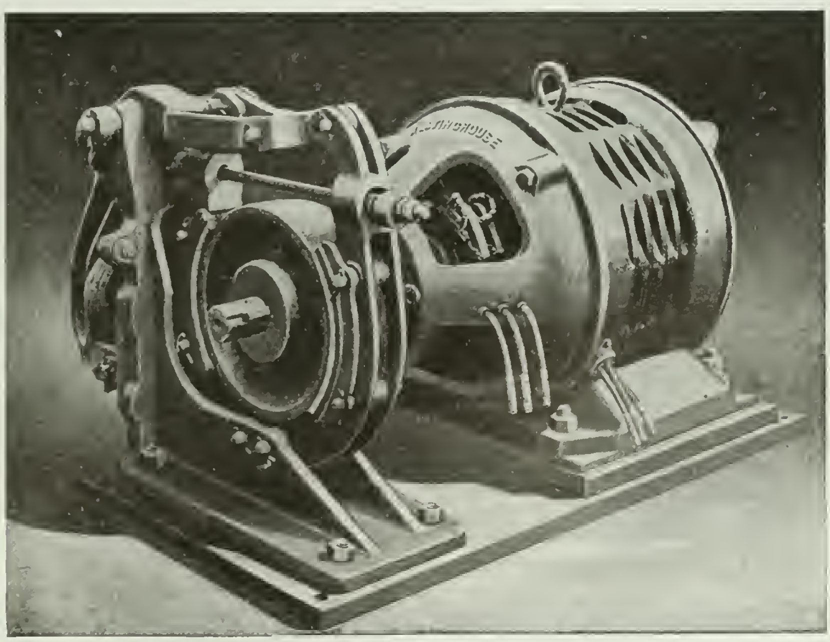


ARC TYPE ELECTRIC FURNACE SHOWING ELECTRODES, CHARGING AND POURING DOORS.

The type of motor employed for operating the tilting mechanism is shown in one of the accompanying illustrations. Either a.c. or d.c. motors are suitable, having characteristics similar to those used for hoisting work. The controller is of the reversing type and a motor brake is used to prevent over-travel of the furnace and hold it in any desired position, a complete line of motors from 15 to 150 horse-power being available for this work.

Where automatic control of the electrode is desired, a motor operated hoisting mechanism is provided for each electrode. As the motors are mounted on the furnace which tilts, the bearings are built with special lubricating features. Shunt-wound direct current motors are selected for this service, enabling a more simple and positive system of control to be used than when alternating current is used.

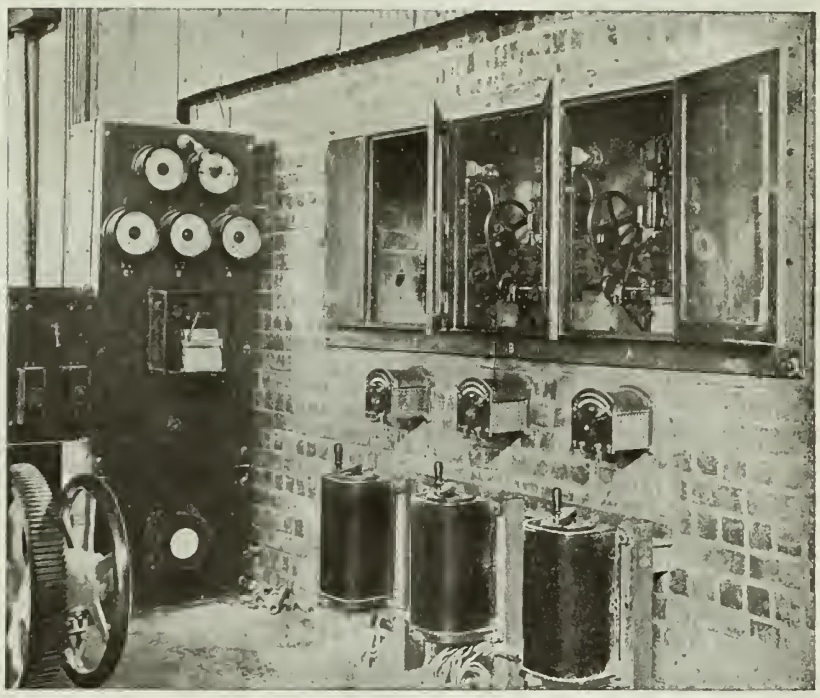
Automatic regulation has as its object the maintaining of a constant current at the furnace resulting in higher furnace efficiency and increased output of higher and more uniform quality. The Thury system has been adopted for a large percentage of the furnaces in use, and can also be adapted for maintaining a constant potential when desired. A three phase furnace equipment is illustrated herewith and consists of three regulating drum controllers; three field regulators; three resistances, two series transformers, and one motor with shafting etc.



TILTING MOTOR WITH BRAKE GEAR AS USED ON ELECTRIC FURNACE.

Damping devices permit the regulator to act only when necessary, and sudden changes and peaks of short duration do not put the regulator in action. This in itself is very important, as there is not only a great saving in the wear and tear of the electrodes hoisting mechanism, motors for driving same, etc., but the current is kept more uniform by avoiding unnecessary regulation.

Each regulator controls one electrode. The regulator is controlled by a solenoid energized by means of current from series transformers in the main high tension circuit. The regulator in turn controls the armature circuit of the electrode motor to give it motion in either direction, or stop it, as required. This electrode motor operates a hoisting mechanism, which in turn raises or lowers the electrodes. The regulator can handle any amount of power for regulating purposes without impeding the free play of the controlling mechanism, which is only in contact with the power mechanism for exceedingly short periods of time and is otherwise perfectly free. Intermittent action of a contact making arm prevents the regulation from being carried too far in one direction. Thus a high load power factor and a uniform current on the furnace is assured at all times.



VIEW OF AUTOMATIC REGULATOR EQUIPMENT FOR CONTROLLING ACTION OF FURNACE ELECTRODES.

ELECTRIC STEELS

THE war has speeded up in a remarkable degree innumerable developments which were previously hanging fire or proceeding at a leisurely pace. Among these the electric furnace is noteworthy. In the first half of 1914 electric furnaces were certainly being installed here and there in steel works, but in an experimental or very tentative way. The war brought an increased need for alloy and special steels, for steel castings, and also for means of extracting chromium and nickel from the vast quantities of steel turnings containing these alloys, which are being made in the munition shops. For all these purposes the electric furnace has proved itself particularly valuable, and in the last three years the number of electric furnaces in use in the world has increased with rapid strides. According to a recent computation there were on January 1st, 1917, in the United States, 136 such furnaces, in Great Britain 88, in Germany 52, in Sweden 40, in Italy 29, in France 20, in Canada 19, in Austria Hungary 18, in Russia 16, and in other countries 44. In this computation, figures for belligerent countries are probably underestimated, but accepting the list as given, there are now at work in the world 471 electric furnaces producing steel of one kind and another.

The capacity of the furnaces varies greatly, and no precise figures are available for the total rate of output at the present time, but it is estimated on sufficiently good grounds that within a year or two the world's output will reach 1,000,000 tons per annum. This estimate is for special steels and castings only, melted up from cold charges, but the electric furnace is also being extensively used for the refining of steel charged into the furnace in a molten state, and if this process should prove generally advantageous, the installation of electric furnaces may be very greatly accelerated. The comparatively large number of furnaces in use in Sweden is, of course, accounted for by the fact that the generation of electricity by water power is proceeding rapidly in Scandinavia, a development highly favorable to the use of electric furnaces. This fact has promoted in Sweden the use of electric furnaces for quite another order of metallurgical work—smelting of pig iron direct from the ore. At least seventeen furnaces, with capacities ranging from 3,000 to 6,000 h.p. are at present at work under construction in Sweden in this connection.

An important feature of the electric steel process is that, by means of it, high quality steel can be produced from materials of a much lower grade than is possible by any other process, so that even though the cost of current exceeds the cost of fuel, it is still possible for the product of the electric furnace to be sold at a competitive price. It remains to be seen how far the electric furnace will be able to hold its own when normal conditions return, but there is every indication that it has taken a permanent place in the process of steel manufacture.

BRITAIN'S ORE AND PIG IRON SUPPLY

DISCUSSING Great Britain's supplies of iron ore and pig iron, also the shipping situation in general, Premier Lloyd George said:—"We are melting millions of tons every year of iron ore, and we cannot cut down the supply by a single ton. It is essential for the munitions of war, essential for shipbuilding, and essential for the machinery required in agricultural work. Therefore, we must find ships for this work at all costs. There is plenty of ore in the country, but its quality is not too good, and it has not paid to dig it. It has been cheaper to get the better class of ore from Spain.

"This, however, is not a commercial question. It is a question of getting ore, and getting it without using up our shipping tonnage. It involves, unfortunately, the increasing of our number of blast furnaces. That means more labor for building and carrying on the work, and there is a very limited supply; in fact, there is no margin of supply of highly skilled men to work these blast furnaces. We have protected them against recruiting for months, but in spite of that fact, we are short of the necessary supply of labor for our blast furnaces.

"There are mines in Lincolnshire, in Cumberland, and there are the famous Cleveland mines, all producing excellent ore; and if we could increase the labor in those mines we could augment by millions of tons a year the quantity of ore which can be produced at home. Here, again, you require skilled as well as unskilled labor. I want to make a special appeal to both classes. There are a certain number of mines which might be able to spare a few miners for this purpose. In those two directions we might be able to secure the necessary number of skilled men, and for the unskilled men we must trust the people to place their services at the disposal of Neville Chamberlain for the purpose of assisting in this all-important task."

As to the supply of pig iron, the secretary of the Cleveland Blastfurnacemen's Association stated some time ago that during the past six months six additional furnaces have been put into operation in the Cleveland district.

The Chilled Iron Car Wheel in Steam Railroad Service--II*

By G. W. Lyndon**

The chilled iron car wheel has been, since its introduction in the year 1850, the standard accessory of transportation, carrying as it does the car and its contents to every nook and corner of this continent traversed and served by steam railroads. In the accompanying paper an interesting description is given of its development towards meeting the increased rolling stock weight and capacity that have been found indispensable to a continued industrial expansion.

INCREASES IN CAR CAPACITY AND WHEEL WEIGHTS

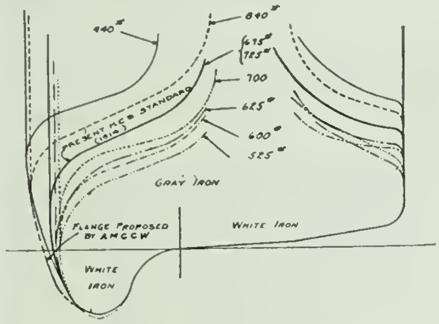
A 33 in., 525 lbs., chilled iron wheel, of the Washburn type, as shown in Fig. 2, became standard soon after the year 1850 for 10-ton freight cars, and also for passenger cars. Cars of this capacity remained standard for about thirty years. As late as 1875 there were only occasional cars having a capacity as high as 12 tons. The heaviest capacity passenger coaches weighed 18 tons. Sleeping and drawing room cars of twelve sections weighed 30 tons. The operation of railroads then was very different than at present. Interchange of traffic as we now know it did not exist. An official of a great railroad charged another with running freight trains as fast as twelve miles an hour. "The wear and tear is something terrible," said he. "It is pounding the track to pieces. Every ton of freight handled at that speed is carried at a loss. The reduction of speed to eight miles an hour will lessen the cost more than $1,000 per day."

Such were the ideas of the foremost men in charge of transportation in the days of iron rails, hand brakes, link and pin couplers, fragile cars, etc. Under such conditions of light wheel loads, small flange pressures, slow speeds, low annual mileage, the wheels would last the entire life of the car. Wheel mileage obtained under such circumstances is sometimes erroneously used to indicate the superior service of wheels manufactured at that time. The ton mileage, which is the true basis for comparison, was extremely low as compared with wheel performance at the present time.

The introduction of the air brake, the automatic safety coupler, heavy steel rails, more rigid cars and interchange of traffic have permitted an era of rapid transit of heavy capacity freight cars with time schedules almost equal to that of express trains. Daily runs averaging thirty miles per hour, including stops, with an occasional burst of speed as high as fifty to sixty miles per hour, to maintain the high average rate is not uncommon.

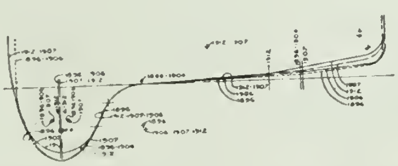
The thirty ton car, introduced in 1885, was the heaviest capacity car on any railroad during the time of the World's Columbian Exposition at Chicago, in 1892. It was strongly argued at that time that the wheel load of 11,000 lbs., which was required under cars of 30 ton capacity was the maximum that could be carried on a 33 ins. diameter wheel, because the area contact between the wheel and rail being so small, any greater load would cause a permanent injury to both wheel and rail by reason of the fact that the elastic limit in the metal would be exceeded, resulting in dents in the rail and flat spots in the wheel tread.

Not only was 11,000 lbs. per wheel considered the maximum wheel load, but there was a good deal of doubt expressed by the foremost engineers as to whether this load was not in excess of good practice. The introduction of the 30-ton car was very rapid on all railroads.



DEVELOPMENT OF FLANGE AND TREAD OF THE CHILLED IRON WHEEL UNDER GROWING REQUIREMENTS.

A chilled iron wheel weighing 600 lbs. was used under cars of this capacity and was recommended as standard in 1904 by the Master Car Builders' Association. It was later modified and the weight increased to 625 lbs. in the year 1909, upon the recommendation of our association. This standard is shown in Fig. 3, which represents the present M. C. B. standard.



CHANGES THAT HAVE BEEN MADE IN THE M.C.B. CONTOUR OF FLANGE AND TREAD, FIG. 6.

Notwithstanding the doubt expressed regarding the maximum wheel load, cars of 40 ton capacity were soon tried out and found to be satisfactory and almost immediately thereafter the 50 ton car was developed for the coal carrying trade and found to be so satisfactory that cars of lighter capacity ceased to be built for this service. The 700 lbs. wheel was used under 50 ton cars and recommended as standard in 1904, by the M. C. B. Assn., but afterwards, upon the recommendation of our association, was modified to 725 lbs., and made standard in the year 1909. This design is shown in Fig. 4.

It will be noticed that in 1904, the first wheel made standard for the 50 ton cars weighed 700 lbs. In 1909 we succeeded in getting the weight increased 25 lbs. During the time intervening, a new wheel was introduced of the rolled steel type, and notwithstanding the alleged superiority of metal, the steel wheel substituted for the 700 lb. chilled iron wheel, weighed a minimum of 750 lbs. Fig. 5 is a composite drawing showing the contours of the early 525 lbs. wheel, and the present standard 625 lbs. and 725 lbs. wheels.

The present indications are that the 50 ton car is likely to be superseded in the very near future by the 70-ton car for carrying such commodities as coal, iron ore, etc. Cars of 70 ton capacity have already proven successful from every standpoint, and are being made in comparatively large numbers at the present time. The wheel proposed for this service by the Association of Manufacturers of Chilled Car Wheels is shown in Fig. 10.

The marvellous increase since the year 1875 in the capacity of cars and the tremendous tonnage hauled has called for an increase in the weight of the car structure, from 18,000 lbs. to 65,000 lbs. or 260 per cent. increase. There has also been an increase in the weight of rail from 50 lbs. to 125 lbs., or 150 per cent. increase. The axle has increased from 350 lbs. to 1,070 lbs., or 200 per cent. increase; and the weight of the wheel from 525 lbs. to 850 lbs., or 60 per cent. increase. All of these increases are shown in the following table:

Capacity, lbs.	20,000	60,000	100,000	140,000
Per cent. of increase	....	200	400	600
Average wt. of cars, lbs.	18,000	30,000	42,000	50,000
Per cent. of increase	....	66	133	178
Weight of b'y. cars, lbs.	18,000	48,000	64,000	65,000
Per cent. of increase	....	166	255	261
Weight of axle, lbs.	350	550	870	1,060
Per cent. of increase	....	57	149	203
Weight of b'y. of car, lbs.	12,400	23,000	32,900	39,000
Per cent. of increase	....	86	165	215
Weight of wheel, lbs.	525	625	725	850
Per cent. of increase	....	19	38	62

It will be noted that the percentage of increase in the wheel is much less than for any other part of the car, and while the carrying capacity has increased from 10 to 70 tons, or 600 per cent. the weight of the heaviest M. C. B.

*From a paper read Feb. 13 at the Canadian Railway Club, Montreal.

**President, Association of Manufacturers of Chilled Car Wheels, Chicago, Ill.

standard wheel has increased only 38 per cent. This is a wonderful record for the performance of the wheel under adverse circumstances, when it is considered that not only has the capacity been increased but the speeds at which trains are operated have been increased 500 per cent. The ton miles per annum of the present 70 ton car is approximately twenty times that of the 10 ton car, which indicates the greater service given by the present wheel than was secured from any wheel during the pioneer days. It also plainly shows that the mere comparison of mileage is of no value whatever unless the load carried is taken into consideration.

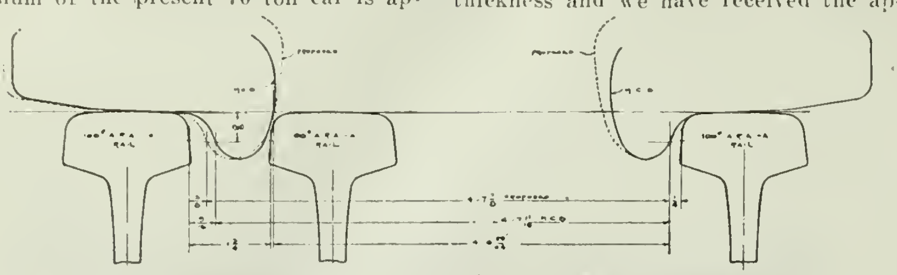


FIG. 7. RELATIVE POSITIONS OF M.C.B. AND PROPOSED FLANGES WITH REFERENCE TO GUARD RAIL WHEN ONE FLANGE IS AGAINST THE RUNNING RAIL.

The Flange

While the chilled iron wheel has always met increased requirements by reason of the rapid increases in the capacity of the cars, there is one part of the wheel that has received scant consideration, and that is the flange. The drawing, Fig. 6, will indicate all the changes that have been made since the wheel was first introduced, in the year 1850.

During all the remarkable railroad development, one dimension in track structure has remained constant. The space between the running rail and guard rail has remained fixed as one and three-quarter inches.

Chilled iron wheel manufacturers have ben trying for years to secure a stronger flange and have demonstrated the fact that three-sixteenths of an inch can be added to the thickness of the present M. C. B. flange, compensation for the increase being made in mounting each wheel three-thirty-seconds of an inch closer to the rail and still maintain the Master Car Builders' standard throat to back the flange dimension of 4 ft. 6 29-64 ins. This insures that the relation of the back of the flange to guard rail remains the same as at present and no change in track clearance is required. There can, therefore, be no objection from a track standpoint of making a liberal increase in the present flange thickness and we have received the approval of our plan from a special committee, who were appointed for the purpose of investigation through the American Railway Engineering Association.

Under the 10 ton car, whose weight was about equal to its capacity, the load carried per wheel was approximately 5,000 lbs., which would require about 4,000 lbs. flange pressure to change the direction of the truck in engaging curves.

Under the 70 ton car, the load per wheel has increased to 25,000 lbs., which requires almost 20,000 lbs. flange pressure to change the direction of the truck, therefore the flange thrust has increased 400 per cent. on account of the increased load, which is further augmented by the high speed of modern freight trains Under present conditions of operation, considering the increased load and speed the thrust on the flange, including impact, is at least ten times greater than under the old 10 ton car, and by consulting the chart showing the changes that have been made in the flange, it must be apparent that the increased duty has not been provided for.

Figure 7 shows the relative position of the M. C. B. flange and the proposed flange, recommended by our association with reference to guard rail, and it will be seen that the flange can be increased three-sixteenths of an inch when mounted as proposed, and there can be no greater impact blow against the guard rail than with the present M. C. B. flange. There are approximately one-half million wheels running to-day with flanges increased one-eighth inch. in thickness, and which have a throat to throat dimension of 4 ft. 7⅞ ins.

Relation of Wheel to Service Conditions

In the year of 1909, the Association of Manufacturers of Chilled Car Wheels made a study of the heat stresses developed in the wheel through brake application, and issued a pamphlet which was widely circulated, entitled the "Relation of Cast Iron Wheels to Service Conditions." It was our purpose to call the attention of the railroads to the fact that under present conditions of operation in some classes of service where high braking power is encountered, that the wheel was being subjected to uses for which it was not designed. This was particularly noticeable in cars of heavy tare weight. Under the thirty ton class of cars, one wheel weighing 625 pounds was introduced, in the year 1909, for use under any car whose gross load was 112,000 lbs., and the variation in the light weight of the cars in the thirty ton class is to-day from 23,000 lbs. to 53,000 lbs., approximately.

Inasmuch as the cars are braked at 60 per cent. of their light weight it was shown that one car of 46,000 lbs. light weight was subjected to twice the brake pressure of other cars weighing 23,000 lbs. in the same class of thirty ton cars and in the same train, and in consequence many wheels were subjected to heat stresses in excess of that for which they were originally designed. The result was that many wheels were removed on account of cracked plates, due to the excessive heating of the wheel on account of the strain in the plates, because the plates of the wheel were not designed or intended for one hundred per cent. increased duty. A cracked plate wheel should be rare if the plates of the wheel are designed for the maximum condition of service.

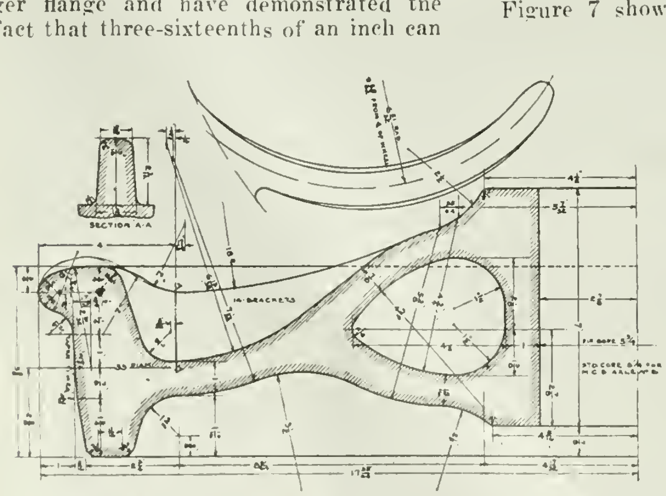


FIG. 8. WHEEL OF 675 LBS. PROPOSED BY THE A.M.C.C.W. FOR ALL CARS OF LESS THAN 40 TONS CAPACITY.

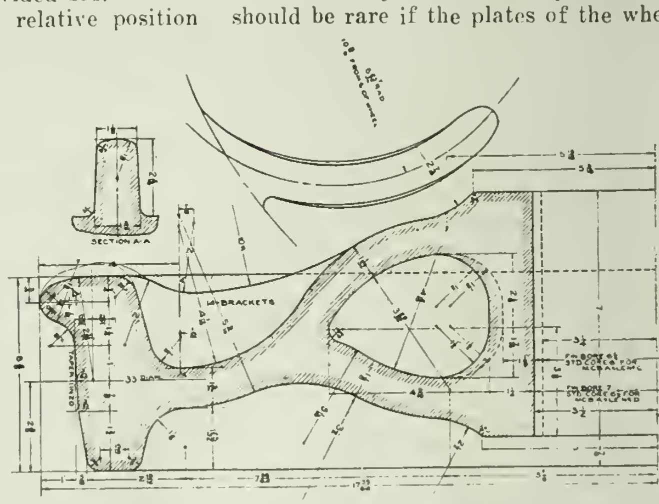


FIG. 9. WHEEL OF 750 LBS. PROPOSED BY THE A.M.C.C.W. FOR ALL CARS OF 40 TO 55 TONS CAPACITY.

The following table will explain the recommendation of the manufacturers with reference to plate thickness, and while these recommendations were made in the year of 1909, and based on 70 per cent. of the light weight of the car, the conditions confronting the manufacturers have not yet been changed.

THICKNESS OF PLATES REQUIRED IN RAILROAD CAST IRON WHEELS TO TO WHICH BRAKES ARE APPLIED

Maximum Gross Load on 8 wheels	Thickness of plates required in each wheel to safely carry the load	Total breaking power of car	Thickness of plate to be added to take care of temp stresses.	Required Thickness of Thread
Pounds	Inches	Pounds	Inches	Inches
40,000	.36	12,500	.16	
50,000	.41	15,000	.19	
60,000	.45	17,500	.22	1.50
70,000	.48	20,000	.25	
80,000	.52	22,500	.28	1.62
90,000	.55	25,000	.31	
100,000	.58	27,500	.34	1.75
110,000	.60	30,000	.37	
120,000	.63	32,500	.41	1.87
130,000	.65	35,000	.44	
140,000	.68	37,500	.47	2.00
150,000	.71	40,000	.50	
160,000	.73	42,500	.53	2.12
170,000	.75	45,000	.55	
180,000	.77	47,500	.59	2.25
190,000	.79	50,000	.62	
200,000	.81	52,500	.66	2.37
210,000	.84	55,000	.69	
220,000	.86	57,500	.72	2.50
230,000	.87	60,000	.75	
240,000	.89	62,500	.78	
250,000	.91	65,000	.81	2.50

WEIGHTS OF VARIOUS DIAMETER OF WHEELS WITH GIVEN THICKNESS OF PLATES.

Thickness of plates in inches	Weight of Wheels 36" diam.	33" diam.	30" diam.	28" diam.	26" diam.	24" diam
.62	640	550	480	440	390	350
.68	665	575	500	455	405	360
.75	690	600	525	470	420	375
.81	715	625	550	485	435	390
.87	740	650	575	500	450	405
.93	770	675	600	520	465	420
1.00	800	700	620	540	480	435
1.06	830	725	640	560	495	450
1.12	860	750	660	580	510	460
1.18	890	775	680	600	525	470
1.25	920	800	700	620	540	
1.31	950	825	720	640		
1.37	980	850	740	660		
1.43	1010	875	760			
1.50	1040	900				

Stress Tests

The University of Illinois, under the direction of our consulting engineer, F. K. Vial, have been conducting a series of tests for the purpose of ascertaining the magnitude of stresses to which the wheel is subjected in pressing it on to the axle and under various service conditions. These are enumerated as follows:

First—When a wheel is pressed on an axle, a compressive stress is developed radially and a tensile stress circumferentially. These stresses are of large proportion and extend all the way from the hub to the tread.

Second—The plate must carry the load, which produces a combination of stresses resulting in a wheel slightly elliptical.

Third—On descending grades the heat generated by the brake shoe, which is a factor of load, grade and speed, causes a tensile stress in a radial direction in opposition to the compressive stress which was developed while pressing the wheel on the axle.

Fourth—The heavy flange thrust causes a bending action in the plate which intensifies the tensile stress developed by the heat in the front plate and the compressive stress in the back plate developed while pressing on the axle. The ratio between these stresses developed in the seventy-ton car, as compared to the ten-ton car, is much greater than that indicated by the mere increase in carrying capacity. The heaviest stress developed is probably that caused by the sudden rise in the temperature of the tread of the wheel from brake shoe application on descending grades. If we assume that trains are now operated at double the velocity they were forty years ago and the load on the wheels five times as great, there will be ten times the heat generated per unit of time on the tread of the present wheel, as compared to the wheel under the ten-ton car. Also the flange thrust being from five to ten times greater indicates that we have ten times the force to contend with that we formerly had.

Chilled Car Wheel Manufacturers' Recommendations

The information obtained would indicate that in order to design a wheel that will fit a given condition of service, it requires a thorough understanding of the intensity of the stress in each part of the wheel and the relation of the stresses to service conditions. Our association believes that due to the general conditions confronting us today, and considering the safety factor of operation, that three designs of wheels of 675 lbs., 750 lbs., and 850 lbs. respectively, with flange reinforcement of 3-16 in. for 30, 50, and 70-ton cars, would in a great measure solve our present troubles and our recommendations would be:

675 lb. wheel for cars having a maximum gross load of. 112,000 lbs.
750 lb. wheel for cars having a maximum gross load of. 161,000 lbs.
850 lb. wheel for cars having a maximum gross load of. 210,000 lbs.

drawings of which are shown in Figs. 8, 9 and 10 respectively.

Cost

I know of no railway material sold that is so necessary for operation, that comprehends so low an initial investment to the railway, as the chilled iron wheel. The eight million tons of chilled iron wheels running to-day possess a higher relative market value when worn out, based upon their first cost, than is usual with other commodities purchased by the railroads. Worn out chilled iron wheels are as staple as sugar, and are worth about sixty per cent. of the original selling price; therefore, if you purchase wheels at $25 per ton, the manufacturers will immediately accept in part payment for the new wheels, old worn out wheels at approximately $15 per ton.

Hundreds of thousands of chilled iron wheels have been sold at a differential of $10 per ton, which represents the difference between the original selling price and the scrap value of the old worn out wheels, and this $10 per ton differential represents the cost of reconverting the old wheel into a new one, plus the necessary labor, plus the price of the

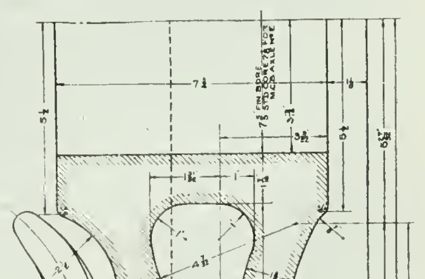


FIG. 10. WHEEL OF 850 LBS. PROPOSED BY THE A.M.C.C.W. FOR ALL CARS OF 60 TO 70 TONS CAPACITY.

new material and the profit of the manufacturer. Special wheels are purchased by many railroads at a higher differential than $10 per ton, and some foundries located in remote parts of thcountry far from the raw materials, such as coke and pig iron, must receive a higher price. The profit on a chilled iron wheel is so low that a fifteen cent freight rate will often absorb the profit on the wheel.

Contracts with railways provide for an equal exchange of tonnage of old wheels, and it is not necessary to exchange the identical worn out wheels to the manufacturer. Any chilled iron wheel, no matter where or by whom made, is accepted in part payment for the new wheels, and wheels made in Canada may find their way into the exchange market of Texas, and wheels made in California are exchanged in Massachusetts or vice versa, and as there are fifty foundries conveniently located throughout the United States and Canada which are accepting all makes of wheels in exchange, a ready and economical solution of teh old wheel problem is provided. The commonest kind of castings, such as sash weights, which require no skill to manufacture, and which have no duty to perform except as counterweights, cannot be purchased as cheaply as chilled iron wheels.

About thirty per cent. of all wheels sold are removed by foreign lines and the price paid for these removals is fixed by the printed interchange rules of the Master Car Builders' Association, as follows:

	Chilled iron.	Steel.
New value, each	$9.00	$19.50
Scrap value, each	4.75	4.50
Net cost	$4.25	$15.00
Cost of removing from and replacing in trucks, per pair $2.25, each ..	1.12	1.12
Cost under car, each..	$5.37	$16.12
Cost of two turnings..		3.25
Total cost of wheel service, each	$5.37	$19.37

It will be observed that the total cost for wheel service for other types of wheels is about four times that of the chilled iron wheels, and upon this basis of comparison any substitute must yield four times the mileage or time service in order to equalize the cost. As the Master Car Builders fix the price of removals on 30 per cent. of your equipment, it must follow that the same relative basis of cost must apply on the 70 per cent. of removals on your own lines.

Chilled iron wheels sold at a differential of $10 per ton makes the net cost of the three Master Car Builders' standards as follows:

625 pounds M.C.B. wheel for 30-ton cars $3.12
675 pounds M.C.B. wheel for 40-ton cars 3.37
725 pounds M.C.B. wheel for 50-ton cars 3.62

All chilled iron wheels, unlike other types, are guaranteed for a minimum service, and the usual guarantee in the States is:

625 pounds M.C.B. wheel for 30-ton cars .... 6 years
675 pounds M.C.B. wheel for 40-ton cars .... 5 „
725 pounds M.C.B. wheel for 50-ton cars .... 4 „

Should any of these wheels fail in service through the fault of the manufacturer a new wheel is supplied without any cost to the user.

Maximum net cost of 625 lb.
M.C.B. wheel gtd. 6 yrs...52c per year
Maximum net cost of 675 lb.
M.C.B. wheel gtd. 5 yrs...67c „ „
Maximum net cost of 725 lb.
M.C.B. wheel gtd. 4 yrs...90c „ „

Any wheel that is sold for $20 will cost the railroad, in interest charges alone (figured at 5 per cent. per annum), more than the renewal charges of the chilled iron wheel, because while the guaranteed net cost to the railroads is based upon six, five and four years' service respectively, the actual service is often twice as much. During the two years last past, the price of all commodities have reached their highest figures. Nevertheless, the price of the chilled iron car wheel has practically remained constant. Based upon the annual renewals of 2,500,000 wheels any other substitute at a price of $20 per wheel will cost the railroads $50,000,000 initial investment the first year.

FOUNDRY TUMBLING BARREL

SOME time ago, having a very large quantity of small castings to supply, says a writer in the *Foundry Trade Journal,* we decided to build a small rattler or tumbling barrel, as the large

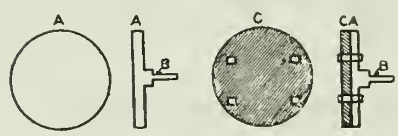


FIG. 1. FIG. 2.

iron ones caused a great deal of breakage. The measurements of the new one were 15 ins. inside and 3 ft. long, this holding a barrow-full at a time. The

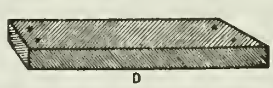
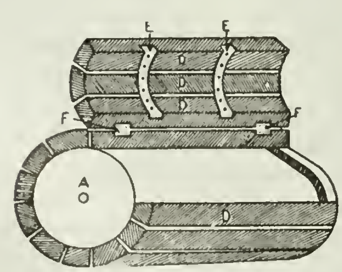


FIG. 3.

method was as follows: Cast two discs 15 ins. dia. and 1 in. thick, with a spindle as shown at B, Fig. 1. Make two



FIGS. 4 AND 5.

wood discs and bolt on to face at CA, Fig. 2. This method saves drilling and machining, for the wooden bars, D, Fig. 3, can be screwed on to the disc. The lid, Fig. 4, is of three bars screwed on to sections of wrought iron bent to cor-

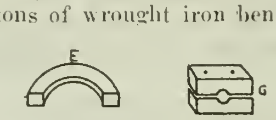


FIG. 6. FIG. 7.

rect angle at E and D, Figs. 4 and 6, and mounted as shown in Fig. 5 by hinges F. Next cast two blocks for bearings, and drill through as shown at G,

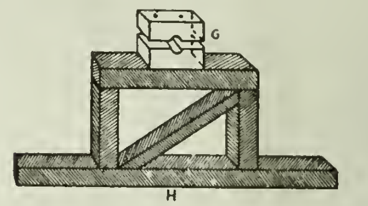


FIG. 8.

Fig. 7. The standards, H, Fig. 8, are of timber, 3 ft. by 4 ft.; these can be bolted to the floor.

The whole thing was put together by

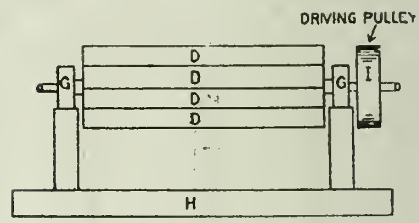


FIG. 9.

a carpenter, and cost about $15. It can be attended by any lad, and proves a most serviceable and cheap tool for very light and small castings.

ONTARIO NICKEL DEPOSITS

THE report of the Province of Ontario Royal Commission on nickel was brought down in the House on March 26. It is a complete history of the nickel industry done up in a neat volume of 600 pages. Its cost is estimated at $60,000. It tells of the difficulties to be overcome before the metal could be refined in Canada, and of the triumph of science over sulphur fumes. The amount of nickel in sight in Ontario is given as about 70 million tons, but it is estimated that the total deposits amount to about double that amount.

Taxation of minerals is discussed at length, but a hasty examination of the volume does not reveal any concrete recommendation as to what the Ontario tax should be. The evidence taken before the commission is given in an appendix. Through the report runs a seam of warning as to the dangers of confiscation, and of the evils that may arise should capital be intimidated.

The only reference to Ontario nickel reaching the Germans is contained in a short paragraph which deals with conferences held with the Imperial Government. The only comment is that for obvious reasons these conferences were secret, and what transpired could not be divulged.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

WHY A PATTERN IS DIVIDED

By D. A. Hampson.

IT IS very hard to get designers and patternmakers to divide their patterns profitably because few of them take the trouble to obtain the moulders' viewpoint. A mould is made in a box called a "flask," that is split horizontally, and in which the pattern has been placed ond the sand packed around it. Now note, to get that pattern out, the halves of the mould have to be lifted off the pattern, or the pattern has to be lifted out of the mould; there is a vast difference, and on this difference hinges the reason for divided patterns.

As an example, consider the pattern in Fig. 1, which has a deep lug extending on opposite sides of the hub, and core prints at the ends. Assuming that this pattern were made solid, and that we could look into the mould before the pattern was "drawn" (out), we would see something like Fig. 2. The parting line is marked; it is the line between the up-

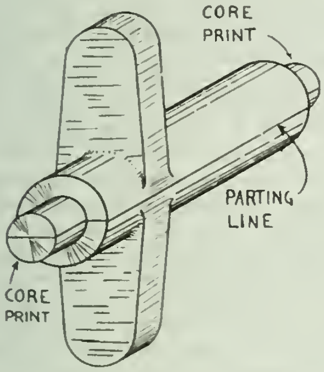


FIG. 1.

per and lower halves of the mould, known respectively as the "cope" and the "drag." In order to get the pattern out of the mould, the cope has to be lifted off the pattern, the latter remaining in the drag if the moulder has good luck. The pattern has in all six vertical faces, and the trick is to lift the cope off so that none of them knock off any sand—a practical impossibility. The rounded hubs and the tapering sides of the lug draw without any trouble, but the vertical faces, even though made with the usual "draft," are sure to catch portions of sand and spoil the mould so that patching up is required. When it is considered that this cope may be a box 18 or 20 inches square, and 8 or 10 inches deep, and weighing up to a hundred pounds, the proposition of a man lifting it 5 or 6 inches in a perfectly straight line, never raising one corner ahead of another, is a formidable one. And while he is doing this, he cannot possibly see underneath to gain an idea as to "how she is coming."

If the pattern be made divided, the patternmaker predetermines the parting line of the mould when he splits his pattern. The pattern in Fig. 1 is split along

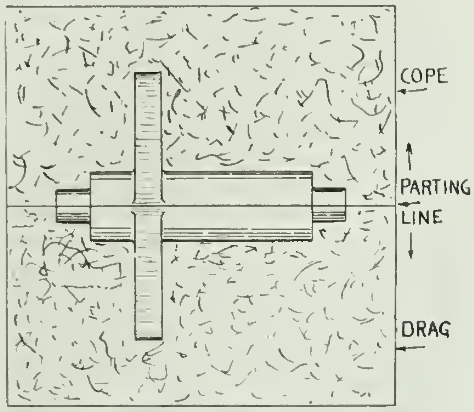


FIG. 2.

the horizontal centre line, as noted. To keep the halves in relation, two dowels are put in, one flat face, and enter holes in the other. To facilitate the moulder's work the dowels are made with a good deal of taper, and only fit the holes exactly when the two halves are in actual contact.

Now the divided pattern is put in the flask and has the sand packed around it, just as does the solid pattern shown in Fig. 2, but here the similarity ends, for to get the pattern out of the sand the cope is lifted off and carries with it one-half of the pattern, as shown by Fig. 3. The dowels offer no resistance, and there is no sand to disturb. Then this part of the mould is inverted and becomes for the time being just as the other half. It is a comparatively simple matter to draw the pattern out of the sand when only the pattern has to be lifted; it of itself is light, and the whole operation can be seen. Hence, easier work and quicker, and no patching up to be done. The half pattern can be jarred in the

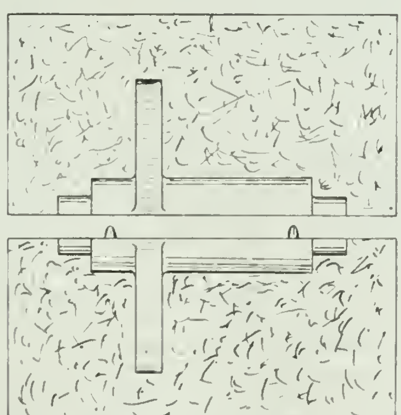


FIG. 3.

sand ("rapped" it is called), making the space in the sand the least bit larger than itself and removal is a simple operation. In Fig. 4 the half pattern is partly withdrawn.

If the work is rightly planned, divided patterns are as quickly made as solid ones. Because the work is arranged so he can see it, the moulder needs less draft than with solid patterns, and this is a point appreciated by the men in the machine shop who have to work up the castings. When there is a doubt as to where or how to divide a pattern, the moulder should be consulted.

COATINGS FOR WOOD PATTERNS

By D. A. Middleton.

SOME plants have specified colors for different parts of their patterns. The ground work is natural wood finish, core prints are black, and surfaces that are to be machined are red. While this is only a typical color scheme, it serves for an example, and the moulder knows at a glance just what the casting will be and how it will be worked up in the shop. But whatever the color scheme, shellac is the basis of the coating, and the various colors are obtained by mixing powders in the clear shellac. Many plants paint their patterns black, and to get that, mix lampblack in the shellac and thin with denatured alcohol.

The present high cost of shellac has brought into prominence one or two very good shellac substitutes, which fill the purpose well, but take a longer time to harden than shellac. It should be borne in mind that the purpose of the coating is primarily to protect the wood from the destructive effects of the damp moulding sand. Holes and imperfections in the wood surface are commonly filled

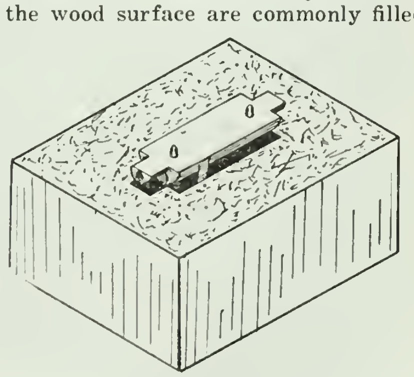


FIG. 4.

with beeswax; small fillets and corners are formed from it. Paraffine wax is much cheaper and just as good, but patternmakers have trouble in making it stick to the wood. If the pattern is given one coating of shellac first and then the paraffine applied hot, it will stick as well as beeswax.

FOUNDRYMEN AND PRICE CUTTING

By "Cupola."

IF there is one question more vital to the foundryman than another it is the question of price-cutting. Other trades are beginning to see that the evil of price-cutting is ruinous to the foundryman. No less than any other line, and particularly to the jobbing foundryman. The manager of a large foundry, in speaking upon this subject, stated: "It just amounted to this. We had to buy over several specialties and acquire the sole manufacture of them, or close down. This expenditure meant thousands of dollars of new capital, scrapping a whole lot of accumulated equipment, of which there is no end in a jobbing shop."

There's no reason in the world why a jobbing foundry should not be a paying venture, and it is only a matter of time when such will be the case. All over the country foundries are doing as this manager stated, and if the jobbing foundryman will take advantage of the situation and demand a living price this evil of price-cutting will soon be a thing of the past.

Effect on the Moulder.

The evil of price-cutting has an effect upon the moulder which is detrimental. He hears that the boss took such a job at so much per lb. He figures it out in his own crude way something like this: "'Well, wouldn't that skin yer! The boss has taken this job at so much per lb. Iron costs so much. It takes ten of us two hours to take off a cast. It takes Jimmy six hours a day to get the cupola and ladles ready, then he has coke, cores and losses. The castings have got to be rumbled, bagged and shipped. It will take us fellows all our time to put up so many boxes a day, because the castings only weigh so much a piece. That don't allow a cent for profit. I'll be darn'd if I know what he's thinking about. I'm not going to work like Sam Hill to make him money at that price."

The boss says: "But look here, chaps. I simply had to take the job to keep you fellows going. So & So offered to take it at ¼ of a cent less, but Brown's a friend of mine and I got the ¼ of a cent more."

The writer has been up against this "Friend of Mine," and is very pleased to say, has lost a lot of friends. Job said, "Lord preserve me from my friends." The moulder who knows that the boss is price-cutting is like the sailor who finds the captain boring a hole in the bottom of the ship to let the water out, and beginning to see that all the pumping in the world won't save the ship, he refuses to pump any faster.

Back-Bone Wanted.

What is needed is better business methods, more back-bone ,"less friends," less of the "well if Smith can let you have them at 3 cents I can" kind of methods. There's not a foundryman on this earth that can give a price on a line of castings unless he has moulded the job before. Every casting has some peculiarity of its own. It depends upon how they're gated, or whether the castings have to be machined or not, and a thousand and one little things to be considered.

Before a price is given there should be a test made if there is any quantity; for a few tons, however, there should be no juggling of prices, but a straight time and material invoice rendered. There are buyers of castings to-day that do nothing but peddle their castings all over the country and pose as "friends of mine" to the limit, simply because they know that on an average the jobbing foundryman is a poor business man.

In this way foundrymen who, in actual fact, are the beginning of the mechanical world, are the poorest financially, of any of the allied craftsmen.

Can Buy Castings Cheaper.

It's a very common thing to hear the head of a large machinery company, when asked why they buy their castings instead of running a foundry to reply, "Run a foundry? Not on your life. We can buy castings cheaper than mould them and have no worry. If we get bad castings it's not our loss; it's the other fellow's."

There are various reasons for this state of affairs. For instance, a contract has been taken to turn out castings at a certain price, and there is scarcely enough weight in a day's moulding to to take off a melt. The foundryman thinks, "Now, if I could only get another job with a bit more weight in it, I could make good on this job." So out he goes looking for a bit more weight, and he's so anxious to get weight that price is a secondary consideration; thus possibly spoiling a customer and lowering a fair price, with the result that some day he'll be handicapped with "more weight" than price. Buyers of castings begin to play upon the foundryman in more ways than one.

What Is Wanted.

Now, what is wanted is this. The foundryman should find out what it costs him to do business. He should say to himself, "Well, if I was working for So & So, he'd give me $150 a month," and begin like this:

Overhead Expenses For One Year.

Own salary, $150 a month	$1,800.00
Rent of foundry, $25 a month	300.00
Telephone	45.00
Stationery and postage	25.00
Bookkeeper	600.00
Fire insurance	50.00
Laborer at $2.50 a day, 300 days	750.00
Cupola man, $3 a day	900.00
	$4,470.00

An average of $14.90 per day for 300 working days. And there are other little incidentals which creep in.

It may be stated that a laborer and cupola man need not be classed as an overhead expense, but both these men are just as indispensable as the boss. The writer was in a foundry not long ago and asked for the manager. He was told to go into the foundry. And there was the boss with his sleeves rolled up, working at a job which the laborer should have been doing. That was all that boss was worth, but he may have been drawing a couple of thousand dollars a year. This particular foundry was employing, on an average, 25 men all the year round, and not paying a dividend, just holding its own, and lucky at that.

EMBARGO ON STEEL TURNINGS EXPORT

THE Canadian Government placed without warning, effective Saturday afternoon, April 21, an embargo against the shipment of steel shell turnings into the United States. Very considerable amounts had been purchased by consumers in the States, and large tonnages are still due on contracts which cannot now be filled. This scrap is very desirable on account of the analysis and is used in open-hearth practice. For some time an embargo had been in effect against the exportation to the United States, of heavy shell crop ends. The mills of the latter which are shipping billets into Canada for the manufacture of shells and which are large consumers of steel turnings will no doubt insist that the clause in their contracts which provides for the return of the scrap crop ends and turnings to them be complied with.

Production of shell turnings in Canada, it is believed, far exceeds Canadian consumption, and it is known that electric furnaces are being provided at Toronto under Canadian Government auspices, for the conversion of turnings into steel. A similar embargo placed about six months ago was shortly afterward lifted by reason of the inability of the Canadian consumers to take care of their production. The embargo at that time immediately brought the price of turnings down $5 or $6 per ton below what could be obtained on this side. Much adverse criticism is heard on the action in placing this latest embargo, as consumers in Canada have the same opportunity to buy the scrap as American consumers and have generally been given preference at equal figures.

DOMINION BRIDGE GET STRUCTURAL STEEL CONTRACT

THE Department of Railways and Canals of the Canadian Government has placed a contract with the Dominion Bridge Co. of Montreal for 2,500 tons of structural steel for two piers and pier heads to be constructed in the harbor of Halifax, N.S. The steel will be furnished by the Bethlehem Steel Co. Bids have also been asked on 3,000 tons of structural steel for pier sheds at Quebec, but no award has meantime been announced.

Recent bids on the construction of the second unit of the Eaton department store at Toronto, requiring 12,000 tons of steel, were so high that it was decided to postpone the placing of the contract at this time. It will be recalled that the contract for the first unit was placed in February with the Dominion Bridge Co., and that the steel was ordered from the Bethlehem Steel Co. at $100 per ton f.o.b., Toronto.

STEEL INDUSTRY DEVELOPMENTS

The War-Created Stimulus given the Steel Industry is Reflected alike in the Nature and Application of New and Improved Equipment being Installed and Developed.

CLEANING BLAST FURNACE GAS*

MARKED differences in opinion have been expressed by engineers interested in cleaning iron blast furnace gases for use in hot-blast stoves and under boilers, with reference to the advantages of a hot-dry method compared with a cold-wet method.

One point at issue involves the sensible heat energy in the moisture contained in the gas. Some advocates of the cold-wet methods claim that the condensation and resultant removal of the greater portion of this contained moisture by wet scrubbing, spraying or similar method, results in a saving of some of this sensible heat energy, because water vapor has a high capacity for sensible heat energy and may carry from the exit of a hot-blast stove, for example, more heat units than are sacrificed or lost when the gas is cleaned by this cold-wet method.

Other advantages claimed for the latter method are: That gas burns more readily when it is free from moisture in any form; that, because gas is made denser by cooling and removing the moisture, it has a higher calorific value than hot gas carrying moisture; and that higher flame temperatures are obtained when the gas is cleaned by the cold-wet method.

Gas Heat Energy

The total heat energy in a gas includes the heat which may be developed by combustion (chemical energy), the heat due to the temperature of the gas (sensible heat), and the latent heat vaporization. The first type of energy may be called "the heat energy of combustion" and the second type "the sensible heat energy" of the gas. The heat energy of combustion is a function of the composition of the gases. For a definite composition of gases it is practically constant and can be readily calculated. The sensible heat energy of a gas depends upon the quantity of gas, the volume and temperature of the gas and the mean specific heat of the gas. The specific heat of a gas in turn depends upon the temperature of the gas and its chemical composition.

In this discussion one pound of a typical dry, clean top blast furnace gas is taken as the unit. It is assumed to have the following percentage composition by weight: CO_2, 21.00; CO, 24.00; H_2, 0.25; CH_4, 0.25; N_2, 54.50. The presence of moisture, dust and excess air is measured in terms of the quantity of this foreign material per pound of such dry, clean top gas. The sensible heat energy of moist, top gas is, therefore, according to our method of calculation, the sensible heat energy of one pound of dry top gas plus the heat energy of the moisture which accompanies, and is in addition to one pound of the gases which constitute the dry top gas; that is, the heat energies are added together.

Moisture Measurement

In practice, the amount of moisture or dust in a gas is frequently measured in grains per cubic foot of gas. This method of measuring the moisture or dust content of a gas usually assumes that the moisture or dust is computed at a certain temperature of the gas such as 32 degrees Fah. Thus, taking one pound of dry top gas with 20 grains of dust per cubic foot of gas calculated at 32 degrees Fah. and 50 grains of moisture per cubic foot of gas calculated at 32 degrees Fah., the unit of gas would contain 0.034994 pound of dust and 0.087485 pound of moisture. The unit of gas considered would consist of a total of 1.122479 pounds of matter, and a calculation of the sensible heat energy of one pound of dry, clean top gas with the above moisture and dust content would involve the calculation of the sensible heat energy of 1.122479 pounds of matter.

This article, however, compares two methods of cleaning, the dry-hot and the cold-wet methods. Since both methods presuppose the removal of dust, it is not necessary to consider the sensible heat energy of the dust. In the example just cited the sensible heat energy would be calculated for 1.0487485 pounds of matter, the dust being excluded.

In the example given in the preceding paragraph the amount of dust and moisture per actual cubic foot of gas decreases with rise in temperature, because the gas expands. At atmospheric pressure one cubic foot of gas at 32 degrees Fah. will become two cubic feet at 523 degrees Fah., and in the example of moist, dusty gas, the dust content of 20 grains per cubic foot of gas calculated at 32 degrees Fah. will fall to 10 grains per actual cubic foot of gas at 523 degrees Fah., while the moisture content will fall from 50 grains per cubic foot, calculated at 32 degrees Fah., to 25 grains per actual cubic foot at 523 degrees Fah., though the percentage of dust and moisture per pound of dry, clean, top gas has remained the same. The measurement of the density of dust and moisture in a gas is, therefore, made by calculating how many grains of each a cubic foot of gas would contain if reduced in temperature to 320 degrees Fah., the pressure being standard at 760 millimeters of mercury.

Air Addition for Combustion

For purposes of combustion it is necessary to add a certain minimum weight of air per pound of the clean, dry top gas. After combustion the chemical composition and the specific heats of the gases have been completely changed. The datum point will be taken as 60 degrees Fah., and the sensible heat energy of the exit stove gases will be the amount of heat energy that the products of combustion of one pound of dry top gas plus the specified excess air plus the specified moisture entering the stove with the gas and air would emit when cooled from the specified temperature of the exit gases down to 60 degrees Fah. In these calculations it will be assumed that the moisture content of the stove exit gases is not great enough at any time to result in condensation of any of the water vapor at the temperature at which the mixed gases actually leave the stoves. In practice, the moisture content would seldom if ever reach such an amount.

Latent Heat of Water Vapor

The latent heat of the water vapor need not be considered because it is lost in any cleaning method which can be adopted. In the cold-wet method the latent heat of the water vapor is absorbed by the water used during the washing process, and is thus carried away by it; in the dry-hot method the latent heat of the water vapor is carried out with the stove exit gases and thereby lost.

Further, in using 60 degrees Fah. as the datum point for calculations of the sensible heat energy of the exit stove gases or of the blast furnace top gas after coming from the cleaner, it will be assumed the gas contains 5 grains of moisture per cubic foot of gas calculated at 32 degrees Fah. This means that the sensible heat energy is referred to that of the same gas practically saturated with moisture at 60 degrees Fah. Such a datum point is convenient because any kind of a gas cleaned by the cold-wet method usually comes out at about 60 degrees Fah. and is practically saturated with moisture. As our comparison is made between a dry-hot and a cold-wet method of cleaning, it is natural to assume conditions prevalent in the cold-wet method as the datum point.

Consider one pound of dry, clean, top gas at 700 degrees Fah., containing 20 grains of dust and 25 grains of moisture, both calculated per cubic foot of gas at 32 degrees Fah. Our unit of dusty and moist gas weighs 1.078736 pounds. It is found that the sensible heat energy in the one pound of top gas and that in the moisture (which would be lost if the gas passed through a cold-wet cleaning apparatus, thus reducing its temperature to 60 degrees Fah.) would be 174.69 B.t.u.—Qt. By the cold-wet method of cleaning that cools the gas to 60 degrees Fah., the above Qt units of heat energy are lost for every pound of dry top gas, plus a specified moisture density.

*From a paper presented at the meetings of the American Institute of Mining Engineers, New York, Feb., 1917, by L. Bradley, H. D. Egbert and W. W. Strong.

In the dry-hot method of cleaning, no material lowering of temperature of the combustible gases for the stoves need take place. This condition is practically feasible when the electrical method of cleaning is used because the electrical precipitators need not be more than 15 or 20 feet in length. The length of the gas mains and connections need not, therefore, be greatly increased, and, furthermore, they may be insulated so as to conserve the heat energy of the gases.

In the dry-hot method of cleaning the 25 grains of moisture per cubic foot of gas remain in the gas and are carried into the stoves and then out with the products of combustion. The only difference between the exit gases from dry-hot cleaning and cold-wet cleaning is that in the one case there are 20 grains of moisture per cubic foot of gas standard more than in the other case. Let us assume that the exit gases leave the hot-blast stoves at 600 degrees Fah., which is a fair average. With the hot-dry method of cleaning these gases will carry away 8.83 B.t.u. of sensible heat energy for every pound of dry top gas over and above what the same gases would have carried out had they been cleaned by a cold-wet method, due to the greater amount of moisture left in the gas when cleaned by the hot-dry method. Let this energy be Qe. The saving in sensible heat energy by the hot-dry method of cleaning as compared to the cold-wet method is: $Qt - Qe = 174.6 - 8.83 = 165.86$ B.t.u. per pound of dry top gas.

In the above comparison any energy changes due to expansion or contraction of the gases can be neglected because the exit gases are under practically the same condition of pressure and temperature for both methods of cleaning.

Assuming a ton of iron to represent a production of 12,000 pounds of such typical top gas, a hot-dry method of cleaning the gases would conserve: $12{,}000\ (Qt - Qe) = 1{,}990{,}320$ B.t.u. per ton of iron.

In some ores a considerable amount of compounds of potash, zinc, lead, arsenic, antimony, etc., may accompany the compounds of iron, copper, etc., for which the ore is being smelted. Under present conditions this more volatile part of the ore may be carried away in the top gas. A dry method of cleaning may allow the recovery of certain of these volatile compounds, thus making commercially possible the treatment of a greater variety of ores. At the present time the application of the electrical method of cleaning blast furnace gas from iron ore containing zinc is being developed and other problems similar to this are also under consideration.

Under practical operating conditions, many factors relating to the cleaning process must be considered. A few of these may be briefly discussed. The cold-wet process of cleaning is usually more or less automatic in operation and requires comparatively little attention. Rather large quantities of water are used and considerable power is consumed in handling this water, and in forcing the gases through the system. The washers are comparatively large and the initial expense of installation is also large. In some instances, a problem arises as to the disposal of the muddy water, it often being illegal to allow this contaminated water to run into the streams, while in other instances water is not abundant and its use for gas cleaning may be prohibitive.

Electrical Method of Cleaning

There is a hot-dry method of cleaning that promises to be very advantageous for the purpose of cleaning these gases. The electrical precipitation processes make use of a high-tension electrical discharge which sweeps out the suspended matter from the surrounding gas. The electrical method does not cool the gas, it precipitates the suspended dust in a dry state, thus making it easy to reclaim this material. The operation is practically automatic and the energy consumption is small.

The cleaning power of the electrical method is said to be practically complete, in many instances being as high as 99 to 100 per cent. The degree of cleaning is greater than that usually obtained by wet methods in general, and is ample for stoves and boilers. Indeed, the results of recent tests have indicated the probability that, even with a single pass precipitator, the gases would be cleaned to the degree required by internal-combustion engines.

Uniform System of Foundry Cost Accounting

To promote the adoption of a uniform system of foundry cost accounting among its members, the American Foundrymen's Association has outlined a plan of procedure which represents the most comprehensive effort in this line of endeavor that has ever been undertaken.

FOR some years the American Foundrymen's Association has had had cost committees at work which have presented valuable reports at the annual meetings of this society, but unfortunately a large part of this work has been without practical results owing to the fact that the members, in only a few instances, have followed the recommendations made.

To make this work more practical and to facilitate the installation of uniform cost-keeping methods in the plants of the members of this association, it has been decided to provide them with the personal service of a cost expert whose duty it will be to make the existing cost systems conform to the one that is to be adopted. Without the services of a cost accountant to introduce the system, no headway can be made toward uniformity of practice, which is the underlying basis for intelligent estimating among competitors.

Since the American Foundrymen's Association, due to its low cost of membership, is without means to carry on this special work, it was decided to raise a fund by subscription among those who desire to participate in the benefits to be derived from this undertaking. The plan will enable foundrymen to obtain a cost accounting system at a nominal cost, which will be representative of the latest and best practice in cost-keeping methods.

Productive labor is a good measure of the value of the business transacted by a foundry and, therefore, the expense of this undertaking will be prorated on the basis of the number of molders and coremakers employed. The schedule of charges that will apply, follow: Foundries employing up to 40 molders and coremakers, $50; from 40 to 200 molders and coremakers, $1.25 for each molder and coremaker employed; for plants employing more than 200 molders and coremakers a flat charge of $250 will be made. Since additional traveling expenses will be involved in the installation of the system outside of the industrial centers of the United States and Canada, an extra charge will be made for this service west of the Mississippi river, south of the Ohio river, and outside of the Province of Ontario, in Canada.

Payments are to be made on the following basis: Twenty-five per cent. when subscribing to this special fund; 25 per cent. upon the receipt of the book containing the uniform cost system; 25 per cent. after the system has been installed by the cost expert and the remaining 25 per cent. after the subscriber has received from the cost accountant a written report covering the system in use with suggestions to make it conform to the uniform method to be adopted.

To carry on this work, the Cost Committee of the American Foundrymen's Association has engaged the services of C. E. Knoeppel & Co., New York, industrial engineers and cost accountants. Data are now being gathered preparatory to the compilation of a uniform system of cost-keeping for foundries, which can be adopted to shops specializing in the manufacture of gray or malleable iron, or steel castings. The problems of the foundry which is a department of a manufacturing plant and produces no castings for the trade will be considered and provision also will be made for specialty, light and heavy work shops.

When the uniform system has been ratified by the Cost Committee, it will be printed in pamphlet form and will be distributed among all of the subscribers. As soon as possible thereafter, cost experts in the employ of C. E. Knoeppel & Co., will visit each one of the plants of the subscribers and will point out the features of the cost system and will aid in its installation.

This personal visit will be followed by a written report by the cost expert who will detail every step to be followed in the introduction and use of this system. For a reasonable time thereafter, the advice of C. E. Knoeppel & Co., can be had by correspondence without additional cost to the subscriber.

Subscribers to this fund are limited to the membership of the American Foundrymen's Association, but foundries not so enrolled can derive the benefit of this great work by becoming members of this organization.

Furthermore, only subscribers to this special fund will receive a copy of the uniform cost system and the services of C. E. Knoeppel & Co., membership in the American Foundrymen's Association alone not entitling those so enrolled to participate.

Favorable replies already have been received from 217 members of this organization in the United States and Canada, and 51 have forwarded their subscriptions. This is sufficient assurance that the plan can be carried to a successful conclusion, and it marks the beginning of the greatest uniform cost campaign ever undertaken in a single industry.

The members of the Cost Committee, who conceived this undertaking, follows: B. D. Fuller, chairman, Westinghouse Electric Mfg. Co.. Cleveland; H. J. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa.; J. Roy Tanner, Pittsburgh Valve Foundry & Construction Co., Pittsburg; C. R. Messinger, Sivyer difficulties confronting the Western pub-Steel Coating Co., Milwaukee, and A. O. Backert, secretary Twelfth and Chestnut Streets Cleveland.

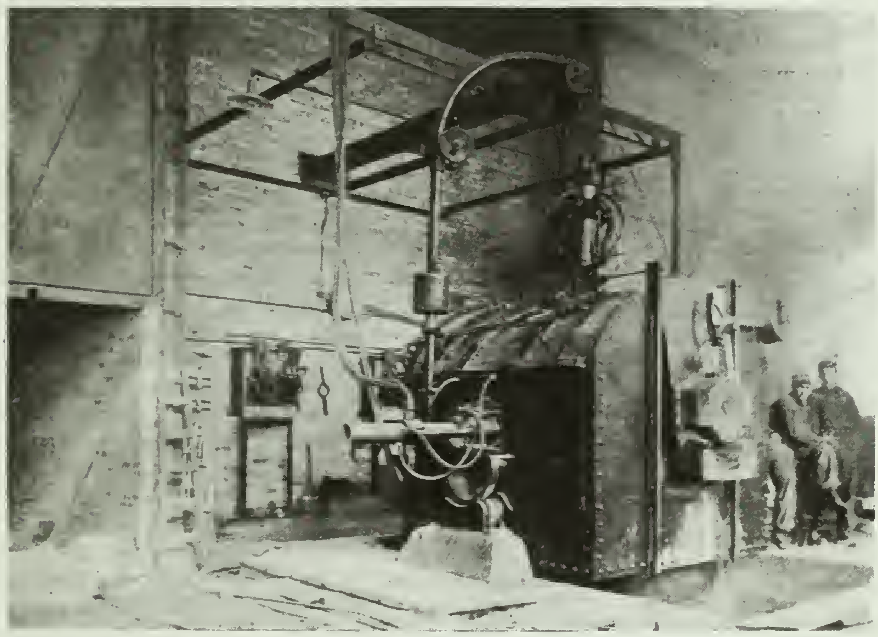
RENNERFELT ELECTRIC ARC FURNACE

DURING the past two and a half years, or since the inception of the shell industry, the utilization of the electric furnace for the production of steel has made rapid and remarkable progress, and the knowledge acquired during this period of activity will, in all probability, open a still wider field for this process of manufacturing steel and other metals on a commercial basis for many domestic requirements.

Electric furnaces are not only finding a place in the foundries of the steel industry, but are proving themselves to be an essential factor in the evolution of this branch of engineering practice. While the principle of all electric furnaces is similar, the method adopted by the different manufacturers of applying electric current for the dissolution of metal provides a means of comparison for the various makes of furnaces. The outstanding features of the Rennerfelt electric arc furnace, illustrated herewith, are the location of the three electrodes, their position in the furnace and the action of the arc upon the bath of the metal.

The 3-phase current enters the transformers, and is changed by means of a Scott connection to 2-phase, 3-wire system. The middle or combined conductor carries about 40 per cent. more current in the vertical than does either of the side electrodes, and this forces the entire radiating arc, by the resolution of forces and electro-magnetic action, down on the bath. The horizontal electrodes are about 15 inches above the bath or slag in some of the larger size furnaces, and the operating distance from tip to tip of the horizontal electrodes is usually from 18 to 22 inches or more. These dimensions give an idea of the size of the flame, which, striking the bath, mushrooms to the side and ends of the furnace. The heat reaching the roof is consequently very indirect, thus favoring low roof-maintenance costs.

On account of the peculiar characteristics of the Rennerfelt arc, it is very steady with hand regulation, and the furnace operation is electrically simplified to a marked degree, by avoiding all automatic electrode regulation, although motors with push button control are contemplated. As only 4 or 6 pounds of Acheson graphite are burned away per ton of cold steel scrap or pig iron, melted and treated, it is evident that the electrode regulation with such a steady arc, made between three points of stability, that is, the tips of three electrodes, is a minimum. Light metal scrap or turnings can be heaped in the furnace with the electrodes touching the charge, and yet before many minutes the free burning arc between the electrode tips has established itself. The majority of these furnaces are operating with basic bottoms; but in the case of a few, where high-class raw material is available at reasonable prices, the acid bottom has been adopted.



"RENNERFELT" ELECTRIC ARC FURNACE INSTALLATION.

The wear of the electrodes seems to depend upon three things—first, the density of the current; second, the circular area and length exposed inside the furnace; and third, the amount of air leaking into the furnace. The latter cause seems to have the most deleterious effect, and hence doors are fewer now than formerly. Up to the three-ton size there is only one door, and the larger sizes have but two doors, and are made to fit as close as possible. The clearance of the cooling boxes is also made less. Only $\frac{1}{8}$-inch clearance is allowed, which is just enough room to compensate for the slight irregularity in the manufacture of what are ordinarily perfectly round electrodes.

Probably the greatest advantage that can be accorded to this type of furnace is its adaptability to the satisfactory dissolution of all kinds of metal, such as copper, bronze, red brass, nickel, aluminum, and such mixtures where zinc does not predominate, or where the percentage is low. The quiet state in which the metal is retained during the melting process is one of the chief reasons why the oxidation and volatilization is kept very low, thus preventing the escape of poisonous gases from copper charges. This may also explain in a measure why the burn-off in ordinary miscellaneous steel scrap is only about 3 per cent. in the Rennerfelt furnaces. These furnaces are being placed on the Canadian market by the firm of Hyde & Sons, 12 Bleury Street, Montreal.

THE industrial importance of the aluminium-zinc alloys is gradually being more fully recognized. With regard to zinc in alloys for bearings, it may be stated that at least 75 per cent. of the car journals bearings in use on United States railways contain upwards of 2 per cent. of zinc. In recent investigation on the effect of zinc on the mechanical properties of copper-tin-lead bearing alloys, Clamer concluded that alloys containing not less than 65 per cent. of copper, and approximately 5 per cent. of tin, up to 20 per cent. of lead, and up to 5 per cent. of zinc, should be satisfactory for all classes of car journal bearings. With an increase in the amount of lead, the zinc content should be correspondingly diminished.

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A Monthly Technical Journal devoted to the Foundry and Metal Industries

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PRINCIPAL CONTENTS

OBJECTIVE OF MUNITIONS SCRAP CONSERVATION

As a result of the demand for munitions steel, the rolling of rails for either domestic or export purposes has now been at a standstill for many months in each of our two steel mills specially equipped for same. The need of steel rails is only less urgent than that of munitions steel, and just here there exists ample evidence that as shell requirements become less pressing, and cease ultimately, a period of more or less abnormal activity will continue to mark steel plant operation on rail production.

It may readily be taken for granted that the initiation of the big electric steel plant now under construction in Toronto for the Imperial Munitions Board was inspired with the idea of relieving one or both of our rail mills of their munitions steel burden, and while the electric steel plant referred to will not produce from the raw materials—the latter as commonly understood, in another sense, the material from which its product output will be derived, may readily be classed as essentially raw. In a word, our quite enormous tonnage of scrap shell ends, shell crop ends, shell machining turnings and borings, defective billets and forgings are going to be conserved, instead of shipped out of the country as scrap, and will be reproduced in shell billet size and quantity to conform with immediate requirement.

The needs of our railroads become daily more pressing, steel for almost any one of their departments being quite as urgent as that relative to rails. The Imperial Munitions Board is alike in intimate touch with Empire and our own specially national needs, and as we have on former occasions voiced a word of appreciation of their efforts in directing our munitions and shipbuilding industries, it seems fitting that the highly important matter of our railroad maintenance should also be mentioned as coming within the scope of their vision and activities.

COAL WILL CONTINUE SCARCE AND DEAR

With the advent of spring weather and the near approach of the good old summer time, there is already evident a disposition to forget our past winter troubles and inconveniences, due to lack of coal for manufacturing and domestic services in both quantity and quality, the latter probably more aggravated than the former. Even now, when to all appearances, we are still well removed from the firing of the last shot in this apparently cruel war, a powerful public opinion—essentially scientific and moral perhaps, deems the conflict to have been worth while and altogether necessary to our future well being. The reason is not far to seek, and need not be looked for en masse; it being as a matter of fact a more or less individually determined conclusion arising from personal experience. We have come to appreciate things more in keeping with their proper value and in so doing to extract from them the commensurate return. It is hard, however, to get away altogether from the idea that the war in much of its detail has been other than tyrannical, and so far as we on this North American continent are concerned, the coal situation during the past winter on many occasions by its maintaining a generally threatening aspect and seriously affecting industrial enterprise and domestic comfort, contributed its quota to such a condition of mind. From well authenticated sources, our information is that not only may little price relief be expected—if any, but much below normal supplies of coal are also likely to be received. The 1917 season of navigation on our lakes and rivers is going to be less effective in accumulating coal supplies than ever before, due not only to the shortage of "bottoms," but to such other causes as the shortage of labor at the mines, and the reduction in railroad rolling stock available for such service. The foregoing applies to coal receipts from within our own borders, as well as those from beyond. It seems in order to impress our readers — executive and operative, with the quite remote prospect of lower coal prices during the summer season than those now prevailing, and to advise that not only will they be higher during next winter than last, but the higher levels will be reached much earlier than usual. Something like $5 per ton for bituminous coal at pit mouth, in Pennsylvania is now quoted, and anticipations are that $7 per ton at pit mouth will be the price ruling before the summer is over. Such coal in pre-war days ranged from $1.50 to $2 per ton at pit mouth.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

THE ENAMELLED-WARE INDUSTRY

THE products of this industry may be divided roughly into two classes, the first of which comprises articles that are stamped or pressed from sheet metal and are subsequently coated with an enamel solution, while the second consists of larger and heavier objects of cast iron, which are similarly coated. Kitchen utensils, such as kettles, pails, and pans, are familiar examples of the first class, and bat tubs and lavatories of the second class. Although these objects are in common use, it is doubtful if the methods and processes employed in manufacturing them are generally known, says the *Travelers' Standard*. It may, therefore be of interest to describe the various operations, and to refer to some of the dangers that are associated with the work.

In manufacturing kitchen utensils and other similar articles, plates of sheet iron or steel of the proper thickness are shaped by means of pressing or stamping machines provided with dies of appropriate forms. All excess metal is trimmed off by power-operated shears, and the edges are turned or rolled by beading machines. When openings are required—such, for example, as those for the spouts in tea-kettles and coffee pots—these are punched or drilled by machines. Handles, spouts,and other small parts are also shaped by machinery and are then secured in position by riveting, or by the electric welding method.

Forming and Shaping Machines

The machines used for forming and shaping the various objects include power-driven presses, foot presses, drop hammers, power shears, beading and forming machines, and spinning lathes. The majority of the accidents that occur in connection with these machines consist in injuries to the fingers and hands of the operators, from the rapidly-moving dies. Many fingers are cut off in this way, or crushed so badly as to require amputation. The mechanical action of all pressing and forming machines is quite similar, and guards for finger-protection have been devised, which, when properly installed and used, greatly promote the safety of the operators.

In addition to the finger hazard, there are possibilities of accidents in connection with unguarded belts, exposed gears, projecting set-screws, and various other familiar mechanical elements. Improper adjustment of machines, insufficient lubrication, and neglect of other obvious precautions, also lead to serious consequences. The remedies for these troubles have been reiterated so often that no managr or foreman can fairly plead ignorance of them as an excuse for continued accidents.

After the forming and shaping operations have been completed and the spouts, handles, or other small parts have been secured in position, all oxide, grease, and dirt must be removed from the metal so that the enamel solution will adhere properly, when applied. This is usually accomplished by treating the objects with acids and strong alkalis. For this purpose large wooden tanks are provided, containing potash, or sulphuric or muriatic acid, mixed with water in solutions of varying strength. The articles to be pickled are placed in wire baskets or trays which are hoisted over the vats by cranes, and then dipped into the solution. The potash and acid "cut" and remove the grease and dirt, and clean the metal very thoroughly. In order to neutralize the acid the objects are usually dipped into vats containing a soda solution and are then washed with clean hot water, and dried; but in some cases the soda bath is omitted, and reliance is placed upon hot water alone.

Pickling tanks should extend to a height of at least 36 inches above the floor or platform upon which the men stand. If this is not practicable (and especially if the tanks are flush with the floor, or nearly so), they should be rail-guarded in a safe and substantial way, to prevent persons from falling into them. The men working in the pickling rooms should wear stout, well-made shoes, with heavy wooden soles; and whenever necessary they should also wear rubber gloves. A bucket containing a solution of soda ash (or washing soda) should be kept in a convenient and accessible place, so that the men may thrust their hands into it in case of emergency. Particular care should be taken to keep the acid solution out of the eyes and mouth, and it is often advisable for the men to wear goggles.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

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PLACE AND DATES OF MEETING.

The Occident Hall, corner of Queen and Bathurst Streets. Fourth Thursday of each month, at 8 p.m.

Pickling Tank Fumes and Vapors

The fumes and vapors from the pickling tanks are harmful, and the inhalation of them may give rise to bronchitis, rhinitis, pneumonia, and other respiratory troubles. Gastritis and anaemia are also common. Erosion of the teeth occasionally results from long continued exposure to the acid fumes, as well as ulcers of the nose and mouth, and other troubles.

It should be remembered that the danger from these fumes is not due solely to the acids that are used in the pickling solutions—that is, it should not be forgotten that the actual danger is greater than it would be if the acids and the metal that is acted upon by them were chemically pure. Phosphorus and various other substances are always present in iron and steel, and arsenic is quite likely to be present in the acid. Certain of these substances combine with the hydrogen that is liberated from the pickling solution, and form poisonous gaseous compounds, of which phosphoretted hydrogen and arseniuretted hydrogen are the most notable examples.

The pickling rooms should, therefore, be well ventilated by natural means, and. in addition, exhaust hoods should be installed to draw off the acid fumes and vapors, and respirators should be worn when ever the conditions make the use of such apparatus advisable. As the fumes from the pickling tanks are usually somewhat heavier than air, exhaust ducts should be installed at or near the floor level, as well as directly over the tanks. Open-flame lights of all kinds should be excluded from pickling rooms, because otherwise the hydrogen that is liberated by the various acids may become ignited and cause an explosion; and incandescent electric lamps located in such rooms should be incased by vapor-proof globes.

Plant Deterioration

Wooden platforms, floors, and gratings about the pickling tanks, as well as the supports beneath them, deteriorate rapidly on account of the action of the acid that is spilled upon them. For this reason they should be inspected frequently and with the greatest care, and if found to be defective they should be renewed at once. Furthermore, the acid fumes cause metal objects to corrode rapidly, and, hooks, chains, and other parts of cranes that may be used to hoist heavy objects from the tanks should therefore be examined frequently and carefully. Metal railings and all metal work that enters into the construction of the building should receive similar attention, and particularly the rivets, bolts, and nuts that are used to fasten the various parts together.

Acids for use in pickling departments are often bought in carload lots, and in such case it is important to consider the problem of safely storing and handling such large quantities. When possible, the main supply should be kept in large storage tanks from which the acid may be piped directly to the pickling vats. (Special acid-proof pipes are made for this purpose.) In this way the handling of carboys and other vessels will be eliminated, there will be less danger of burns from spilled acids, and the ill effects from inhaling the fumes will be greatly reduced. When carboys are used they should be mounted on "rocking chairs," or inclinators, so that they may be tipped easily and be held in position without effort when pouring out the acid. Goggles, rubber gloves, and wooden-soled shoes should always be worn by the men when working with strong acid.

After the metal objects have been thoroughly cleaned and dried they are ready to be coated with enamel. Various materials are employed in the manufacture of enamels, including borates, fluorides, and silicates, oxides of lead, tin, zinc, and alkalies such as potash and soda. These are mixed together in varying proportions, either by shovelling them over upon the floor, or by shaking them about in a mechanically-operated mixers. Good results in the use of the enamel depend upon the purity of the raw materials and upon the care with which the materials are compounded. The formulas that are used are guarded with great care to prevent them from becoming generally known, and, as a rule, the secret is intrusted to but one or two persons in the plant.

Enamelling Process

After the materials have been thoroughly mixed, the compound is introduced into a furnace or smelter, where it is melted. The molten mass is then drawn off through a tapping hole into a tank of cold water—the sudden change in temperature causing the enamel to become granulated or pulverized. The resulting substance is called "frit," and this is ground, either by millstones or in tumbling barrels containing extremely hard pebbles, to a degree of fineness comparable with that of talcum powder. As sheet metal objects are almost universally coated by the "wet process" (in which the enamel is applied in a liquid state), a certain quantity of white clay is placed in the mill to be ground with the frit, and the coloring matter is incorporated at the same time. The clay is used for the purpose of holding the particles of enamel in suspension in the distilled water used in making the solution.

Dust Hazard

Considerable dust is raised during the mixing process, particularly when this work is done by hand. The dust is likely to be injurious to the workmen because it is composed of minute particles having the general characteristics of pulverized glass, and these are likely to irritate the respiratory passages, and they may even enter the lungs and cause serious harm. Moreover, although the enamel that is used on cooking utensils does not contain lead, it may contain antimony or some other substance that will cause symptoms similar to those of lead poisoning. The men engaged in mixing (and also in grinding, when dry grinding is done), should therefore be provided with respirators, and should be required to wear them faithfully. The mechanical hazards in connection with the grinding and mixing processes are not very important; but the usual protection for belts and pulleys should be provided, each machine should have a well designed belt-shifter or clutch, and all dangerous moving parts should be thoroughly guarded.

The usual method employed in enameling cooking utensils and small sheet-metal objects in general, is that of dipping. The liquid enamel is poured into tanks, and the metal objects are dipped into the enamel by hand (usually by women), and the excess solution is shaken off. Instead of using the dipping process, the enamel is sometimes applied by compressed-air sprayers, atomizers, or air brushes, and it is by this means that the mottled effect on some wares is obtained. A third method consists in simply pouring the enamel over the object and allowing the excess to drain off.

This process is sometimes called "slushing," and is used mainly in connection with large objects. When an air-brush is used in an open room, the operator is constantly surrounded by a cloud of fine enamel spray, and cannot avoid inhaling more or less of it. Every such operator should therefore have a suitable respirator, and should be required to wear it. It is much better, however, to inclose the ware in a glass box, provided at the top with an exhaust outlet—the air-brush being operated through an opening in the front of the box. This procedure has been proved, by experience, to be quite practicable, and it is recommended most particularly in connection with enamels containing lead or other poisonous constituents.

The first coating of enamel is called the "ground coat," and after it has been applied the objects are placed in special furnaces heated to a temperature of about 1,800 degs. Fah., to dry and harden, or "burn" the enamel. These furnaces are usually heated by gas, but sometimes coal or other fuel is employed. The small objects are placed in the

COATING IRON AND STEEL WITH ZINC—GALVANIZING

WHEN iron or steel, having been coated with zinc, is exposed to the atmosphere, a galvanic action is set up, although extremely slight. Any two dissimilar metals form a galvanic couple, but zinc being "electro-positive," the zinc suffers corrosion at the expense of the iron, which is the "electro-negative" metal. The effect is that, providing there is any zinc left upon the iron, the corrosion goes on exclusively with the zinc, the iron or steel not being corroded at all.

The oldest galvanizing process and the one most generally used is the hot or dipping process. The cold or electro and the Sherardizing processes are also used to a considerable extent, and they have gained ground in the last few years. The hot or dipping process is used exclusively for the coating of sheets, and consequently it will perhaps be well to deal with this branch of the galvanizing industry first. An idea of the immensity of this branch of the industry may be gathered when we consider that the production of this commodity, which in the year 1895 was two hundred and four thousand tons (204,000), by the year 1907 had grown to a production of four hundred and ninety-seven thousand tons (497,000). The chief consumers of this commodity are Australia, South Africa, Argentine and India.

The term galvanized iron is one which for many years has been given to articles of iron coated with zinc, for the purpose of preserving the iron from oxidization by the atmosphere. When iron is thoroughly cleaned and freed from scale, it will, upon being dipped into molten zinc, become perfectly coated. If the iron is perfectly coated the atmosphere has no direct action upon it, but a thin film of oxide is formed upon the zinc coating.

Quality Feature

The quality of the galvanized sheet depends chiefly upon three things. Primarily, on the quality of black sheet iron—that is the sheet iron as it comes from the rolling mills—and upon the care exercised during the process of galvanizing. If the quality of sheet iron is poor, even a heavy coating of zinc will not produce a good sheet. It is essential that the sheet iron be absolutely clean and free from scale and cinder, otherwise it will not hold the zinc coating for long, and after a short time of exposure to the atmosphere spots of rust will appear, which eating into the surface expose the iron to rapid oxidization and corrosion. Secondly, the quality of the iron as regards ductility and toughness must be studied, for, if it is not sufficiently so it will, on being corrugated, crack, and although the fissures may perhaps be so small as to escape a cursory examination, they will, on being exposed to the action of the atmosphere quickly corrode and render the sheet practically worthless. Thirdly, the quality of the finished iron depends to a very large extent upon the purity of the spelter used—spelter is the name given in commerce to the zinc blocks before being made into zinc sheets.

Questions and Answers

Question—We have a large aluminum casting which we desire to use as a pattern. The present dimensions of the casting are slightly larger than those which the proper pattern for the desired casting should have. In order to utilize this casting as a pattern we must reduce its size by about 1-32 in. all over. Owing to size of the casting and its very irregular surface it is not practicable to attempt this reduction in size by mechanical means. Can you furnish us with a practical suggestion which may accomplish the desired reduction by chemical means.

Answer.—To reduce the size of the aluminum casting by chemical treatment you will require the use of an iron tank sufficiently large to contain the casting easily. Prepare a solution of sodium hydrate by dissolving from 8 oz. to 10 oz. of caustic soda in each gallon of water necessary to cover the casting. Heat the solution to 200 deg. F., immerse the casting and slowly agitate while immersed. The action will appear very violent but is really not as rapid as the evolution of gases would indicate. Frequent inspection is advisable, however. This treatment will reduce the size of the casting uniformly if the latter is moved reguarly, and the composition of the casting is uniform. We would advise treating a small casting previous to the large one, in order to test the merits of the treatment and become familiar with the operation.

* * *

Question.—In pickling brass castings, what should be the proportions of acid used and what temperatures should be maintained for rapid treatment.

Answer.—If you have a constant and large quantity of castings to clean, it would be economy to install a small sand blast for the purpose. If however, you insist on pickling, use a 10 per cent. solution of commercial sulphuric acid to which add 1 oz. of hydro-fluoric acid per gallon. Heat the solution to at least 100° F. by means of lead coils. the tank containing the solution must be lined with sheet lead with burned joints. If the castings are placed in the pickle before they have cooled from the mould the pickling is more rapid as the sudden cooling in the acid assists in cracking the skin and allows the acid to penetrate beneath. If after a time you find the solution becomes fouled, it is advisable to save the pickling solution for the purpose of recovering the metal (copper) which it contains. The latter is precipitated by placing iron or tin plate scrap in the solution, when the copper is thrown down in small flakes or grains. The liquid should be carefully drained off, leaving a slime containing the metal, dirt, etc. Wash the slime, and remove the iron by a magnetic separating machine, and the copper is ready for the crucible .

* * *

Question.—I shall appreciate any information which will assist me in economizing in the use of potassium sulphurette which has become so scarce as to make its use very expensive.

Answer.—The following will be found a very cheap solution for oxidizing silver, etc. It produces a fine blue-black finish and will permit scratch-brushing. To one gallon of water add 2 oz. of sodium thiosulphate, 4 oz. of nickel-ammonium sulphate and 4 oz. sodium sulphurette. The sulphurette does not lose its effectiveness as readily in this mixture as when used alone.

* * *

Question.—I wish a formula for a tin solution, which may be operated cold, for plating cheap articles with a thin coating of tin.

Answer.—To each gallon of water required to make a bath of the size desired, add 4 oz. of fused tin chloride, 2 oz. of ammonium chloride. Use a moderate current; a strong current will cause a pulverulent deposit to form. Anodes of pure tin are necessary.

* * *

Question.—I have recently begun to operate a cyanide copper solution for the first time in my experience. I was told to add carbonate of soda and bisulphite of soda to the solution for best results. The results of my efforts have been very unsatisfactory owing to defective deposits being repeatedly produced. What is the object of adding bisulphite of soda to the cyanide copper solution; I believe it is injurious in my case?

Answer.—The purpose of adding sodium bisulphite to copper, brass or gold solutions is to prevent the formation of so-called basic compounds upon the deposit. When the bisulphite is used the deposit is cleaner, brighter and quite uniform. The foregoing applies particularly to copper solutions in which the metallic strength is maintained by regular additions of copper carbonate. If the metallic content of the solution is maintained by increased corrosion of the anode by means of an excess of cyanide, there is no necessity for additions of sodium bisulphite, as the deposit will be uniform, bright and clean, and less liable to prove faulty than when soda is used. We do not advise the use of soda in any form for cyanide copper solutions, except where used to minimize the amount of cyanide necessary to yield a correct deposit.

* * *

Question.—A black nickel solution, which I have operated for over a year, has become practically useless; the color produced is only a dirty grey. What shall I do to restore the solution to correct working condition.

Answer.—If you are sure you have not introduced injurious foreign substances into the solution, add from 1½ oz. to 2 oz. of potassium sulphocyanate. This will give you a brilliant black. If the deposit streaks, add a little nickel carbonate to neutralize the excess acid present. Operate the bath at about 100 degs. F.

* * *

Question.—I have a quantity of old copper wire and copper anode waste. Would it pay me to dissolve this and make copper salts for plating purposes?

Answer. — Considering the present price of copper scrap and of sulphuric acid and soda, we think it would be better to sell the scrap. Following figures may assist you in deciding:—40 lbs. of sheet copper dissolved in sulphuric acid will yield 98.8 lbs. of copper sulphate, or 40.46 per cent. of sulphate. The sulphate precipitated with sodium carbonate gives 57.35 per cent. copper carbonate, or 40 lbs. of metallic copper will make 69.7 lbs. of copper carbonate.

* * *

Question.—My nickel solution plates very dark on dead or unpolished surfaces, and peeling is more noticeable than usual. Kindly tell be how to whiten the deposit and prevent the peeling.

Answer.—As your solution plates dark-colored nickel, and the latter is non-adherent, we believe your solution is deficient in metal, unless copper has entered the solution accidentally. A deficiency of metal may be corrected by additions of from 2 oz. to 5 oz. of nickel sulphate. The peeling is probably due to poor conductivity or poor anode corrosion, in which case add either ammonium sulphate or magnesium sulphate, about 2 or 3 oz. per gallon. Make a special inspection of your cleaning solutions and methods before making additions to the nickel bath for correction of peeling deposits. Very often platers become so proficient (?) in the preparation of work for plating that they overlook minor details, and in time these oversights become apparent in the form of defective deposits or equally as serious results elsewhere. Contaminated rinse water will produce dark, stained nickel. Excessive use of sodium chloride will cause a dark grey matte deposit. Small quantities of zinc in the solution will produce similar dark tones. Exercise care in the introduction of hollow articles which may contain alkalies.

* * *

Question.—I am employed by a corporation as caretaker of a large office building. The entrance to the building is placarded with several large brass signs which I am supposed to keep polished and clean. During a recent illness the plates have been neglected by the temporary caretaker, and as I have often found the cleaning operation a severe task, I wish to inquire if you are aware of any method which would be practical for keeping these plates bright throughout the year with little manual labor.

Answer.—The solution of your problem will be comparatively simple if you are in possession of a vacuum cleaner of the type which has a separate motor. Secure a flexible shaft of sufficient length and attach a 4-in. cotton buff on the end. Connect to the motor shaft by a threaded socket and use the buffing wheel with small applications of ordinary grade B Ideal white polishing compound, which may be procured from reliable platers' supply house in tin containers. This method will be found rapid, easy, and the finished plate will have a lustre far more brilliant than any finish produced by hand. The lustre and cleanliness will last longer and the cost of operation will be exceedingly small.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey Forge, Pittsburgh	$39 95	
Lake Superior, charcoal, Chicago	46 75	
Standard low phos., Philadelphia	75 00	
Bessemer, Pittsburgh	43 95	
Basic, Valley, furnace	40 00	
	Montreal	Toronto
Middlesboro, No. 3	.....	.....
Cleveland, No. 3	.....	.....
Clarence, No. 3	.....	.....
Victoria	.....	.....
Hamilton	.....	.....

FINISHED IRON AND STEEL

Per Lb. to Large Buyers.	Cents
Iron bars, base	$4 75
Steel bars, base	5 00
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 25

METALS

Aluminum	68 00
Antimony	30 00
Copper lake	37 00
Copper, electrolytic	37 00
Copper, casting	36 00
Lead	12 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	79
Tin	59 00
Zinc	12 00

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices

	Montreal.	Toronto
Copper, light	$22 00	$20 00
Copper, crucible	26 50	25 00
Copper, heavy	26 50	24 50
Copper, wire	26 50	24 50
No. 1 mach. comp'n.	22 50	20 00
No. 1 brass tur's	16 00	16 00
New brass clippings	18 00	17 00
Heavy melting steel	19 00	17 00
No. 1 mach'y cast iron	21 00	21 00
Malleable scrap	15 00	14 00
Steel turnings	8 00	8 00
Heavy lead	9 00	10 00
Tea lead	7 50	7 00
Scrap zinc	9 00	10 00
Aluminum	36 00	35 00

COKE AND COAL.

Solvay foundry coke, on application	
Connellsville foundry coke	
Yough steam lump coal	
Pittsburg steam lump coal	
Best slack	

Net ton f.o.b. Toronto.

BILLETS.

	Per Gross Ton
Bessemer billets	$80 00
Open hearth billets	80 00
Forging billets	105 00
Wire rods	85 00

F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

¼ in.	$ 9 75
5-16 in.	9 40
⅜ in.	8 65
7-16 in.	7 45
½ in.	7 25
9-16 in.	7 25
⅝ in.	7 15
¾ in.	7 05
⅞ in.	7 00
1 inch	6 90
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, guaranteed	0.35
Babbitt metals	.14 to .60
Putty, 100-lb. drums	4 00
Red dry lead, 100-lb. kegs, per cwt.	13.87
Glue, French medal, per lb.	.25
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	.69
Linseed oil, boiled, single bbls.	1.40
Linseed oil, raw, single bbls.	1.43
Plaster of Paris, per bbl.	2.50
Plumbers' oakum, per 100 lbs.	9.00
Lead wool, per lb.	.15
Pure Manila rope	.29½
Transmission rope, Manila	.37½
Drilling cables, Manila	.32½
Lard oil, per gal.	1.45

SHEETS.

	Montreal.	Toronto
Sheets, black, No. 10	$7 75	$7 85
Sheets, black, No. 28	7 50	7 50
Canada plates, dull, 52 sheets	7 00	7 00
Canada plates, all bright	8 00	8 00
Apollo brand, 10¾ oz. (galvanized)	7 25	7 25
Queen's Head, 28, B.W.G.	7 75	7 75
Fleur-de-Lis, 28, B.W.G.	7 45	7 35
Gorbal's best, No. 28	8 25	7 50
Colborne Crown, No. 28	8 00	6 75
Premier, No. 28, U.S.	8 30	8 70
Premier, 10¾ oz.	8 60	9 00

ELECTRIC WELD COIL CHAIN B.B.

3-16 inch	$10 20
¼ inch	7 80
5-16 inch	6 90
⅜ inch	6 00
7-16 inch	7 65
½ inch	7 45
⅝ inch	7 25
¾ inch	7 15
⅞ inch	7 00
1 inch	6 85

Prices per 100 lbs.

IRON PIPE FITTINGS.

Cauadian malleable, A, net; B and C, 20 and 5 per cent.; cast iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples 72½; malleable, lipped union 60.

ANODES.

Nickel	$0.50	to	$0.54
Cobalt	1.75	to	2.00
Copper	.42	to	.41
Tin	.62	to	.64
Silver, per oz.	.82	to	.84
Zinc	.16	to	.18

Prices per lb.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper carbonate, anhy.	.35
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate ....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130 per cent.	.46
Sodium cyanide, 98-100 per cent.	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheels felt, per lb.			$2.50
Polishing wheels, bullneck			1.33
Pumice ground			.04
Emery composition	.08	to	.09
Tripoli composition	.04	to	.06
Crocus composition	.07	to	.08
Rouge, powder	.30	to	.35
Rouge, silver	.50	to	.55

Prices per lb.

The General Market Conditions and Tendencies

Toronto, Ont., May 5.—The new tax on war profits, while more drastic than was expected, has been received philosophically in business circles, and manufacturers are to be commended for the spirit in which they have accepted the taxation. There are not many industrial concerns who will be seriously affected, and the arrangement of the schedule is such that the heavy assessment falls largely on those who are able to pay. General business conditions show no important change, although the scarcity of raw materials continues to handicap manufacturers and is restricting production. The coal situation is perhaps the most serious, for, not only is there a scarcity, but prices are going up, notwithstanding the season of the year when coal is usually cheaper. The outlook for next winter is not at all hopeful, unless some drastic steps are taken this summer to prevent another famine. In any event, it seems that high prices are inevitable, owing to increase in miners' wages and higher cost of transportation.

Steel

Recent developments in the steel market seem to indicate that prices will continue to advance indefinitely. The fixing of prices on steel products for the American Government has not caused any cessation in the upward movement; in fact the tendency is all the other way now that Government's purchases of steel are becoming more clearly defined. The expectation that the Government will ultimately require considerable tonnages of steel at a time when the mills are in a sold-up condition is giving a fresh impetus to the market and forcing prices up. Generally speaking, the extraordinary high prices on steel products are not curtailing the demand as much as might be expected, due principally to the fact that a large proportion of the tonnage is required, either directly or indirectly, for war purposes. Consumers who can wait for their material are staying out of the market until conditions become more favorable, both as to price and delivery. In regard to deliveries, the situation is becoming worse, especially on steel imported from the States, where congestion at the mills is getting more acute as the demand becomes more insistent. The Canadian mills have all the business they can take care of for several months, and as practically their entire output is bespoken for the Imperial Munitions Board, steel for ordinary purposes is very scarce. Although price changes are not so numerous this week, it is no indication of a weakness in the market. Further advances are looked for in the near future, which will affect black sheets, plate, wire products, and possibly bolts and nuts, chain, and tubes. Ship plates have recently sold at 10c base, Pittsburgh. Although business has been done at a lower figure, it is an indication of what may develop over here. Smooth steel wire recently advanced to 6c base for Nos. 0 to 9 gauge, which will doubtless be reflected in prices of wire products. Quotations on hoops and bands are nominal, as most manufacturers have withdrawn from the market until Nov. 1. Bolt and nut prices advanced 10 per cent. in the States, which may result in higher prices here.

Prices of black sheets continue to advance, and the demand in the primary market is getting heavier. The latest advance on sheets is equivalent to $10 per ton, which brings No. 28 gauge to $7.85, and No. 10 to $7.50 per 100 lbs. The United States War Department has purchased a large tonnage of sheets at what is practically the market price. In view of further Government requirements, sheet makers have practically withdrawn from the market. Prices of galvanized sheets have not advanced, but may do so in the near future, although costs are getting almost prohibitive for consumers.

Government requirements in the United States feature the steel market there, and are helping materially to force prices up. Prices of finished steel are advancing, bars being now quoted at 3.50c, and structural shapes 4c, Pittsburgh. Sheet bars have been quoted at $82.50 mill to domestic consumers, while it is reported that 1,000 tons of open-hearth sheet bars have been sold to Canadian interests at $90 mill. Structural shapes, Chicago warehouse, are now quoted at 4.75c. Iron bars have advanced to 3.75c Pittsburgh.

Pig Iron

The situation in the pig iron market remains unchanged. No prices on domestic iron are obtainable, and available supplies are light. At Buffalo practically the same prices as prevailed last week are still current, ranging from $42 to $45, according to the ability of the furnace to supply material, and without much difference as to grade.

Scrap

The scrap market is weaker for red and yellow metals, but firmer as regards heavy melting and similar materials. Copper prices have declined practically 2½c, and brass 1½c. Heavy melting is up 1c, No. 1 machinery cast iron 1c, and malleable scrap 3c. Steel turnings have recovered from the slump last week, and are now quoted at $8. A market for this material will open up probably in July, when the electric furnace plant at Ashbridge's Bay starts operating. In the meantime supplies will accumulate.

Supplies

Prices of machine shop supplies continue firm with advances on some lines. A sharp advance of 75c has been made on white lead in oil, bringing the price up to $15.75 per 100 lbs. in ton lots. This is a phenomenal price, and is due to the high cost of pig lead and linseed oil. Gasoline is firm and unchanged, but fuel oil is down to 11¼c in gallon lots. Plumbers' oakum has advanced to 9c per lb.

Metals

Considerable activity has developed in the metal markets, being featured by declines in copper and spelter, and an advance in tin. The market in New York has been unsettled owing to the uncertainty as to the U. S. Government's requirements for war purposes, and the low prices originally fixed on copper. More recently the price of copper to the Government was raised to 25c, which helped to improve the situation. The expectation of a low price being fixed on spelter has unsettled the market for this metal. Tin has advanced, following a higher price in London. Lead continues very firm, but is unchanged in the meantime. Antimony is in good demand, although quotations continue nominal. Aluminum is unchanged.

Copper.—The market is very irregular and prices have declined, but are still nominal. The knowledge that the U. S. Government's requirements for copper are to be heavy, and that a 25c price has been fixed, and that the Allies will soon be in the market is having much to do in strengthening the position of copper. Notwithstanding this and the continued heavy demand, it is likely that prices will decline further. Local quotations have declined 2c, and are as follows: Lake and electrolytic 37c, and castings 36c per pound.

Tin.—The market is stronger and higher both in London and New York. The advance in New York is due to the present limitations on imports and higher cost of freight and insurance. There is also some fear of a scarcity of tin on account of the growing demand. Tin has advanced 2c, and is now quoted at 59c per pound.

Spelter.—The possibility of a low price being fixed on Government purchases has unsettled the market in New York. Early in the week it was reported that the price of spelter had been fixed at 5.85c, but this was later denied. Spelter has declined 1c locally, and is now quoted at 12½c per pound.

Lead.—The market continues very firm on good demand. The position of lead is strong, and the expectation of increase in demand is tending to advance prices. Local quotation unchanged at 12¼c per pound.

Antimony.—The demand for spot antimony has fallen off, but futures are more active. The market is strong and prices continue nominal at 30c per pound.

Aluminum.—The situation is unchanged, although an increase in demand is anticipated. Local quotations are unchanged at 68c per pound.

Foundry Supplies and Chemicals

Continued high prices and shortage of raw materials are the principal features to note. As result there is a scarcity of foundry supplies and prospect of further price advances. There is a good demand for general lines but business is being somewhat restricted owing to the inability of dealers to keep their customers supplied to the full extent of their requirements. The abnormal high cost of pig iron is causing manufacturers of foundry machinery to raise prices, while foundry equipment generally is also advancing. Felt polishing wheels have advanced and are now quoted at $2.50, while higher prices on bullneck wheels are looked for. American emery is not proving a very satisfactory substitute for the Turkish product which is off the market. An advance in many lines of chemicals is expected owing to the increase in demand caused by the United States entering the war. Soda products particularly will be affected and higher prices are looked for. In the meantime there are no price changes to note, the market is however, very firm.

BIG INCREASE IN DOMINION TRADE

CANADA'S total trade during the fiscal year ended March 31 last exceeded that of the previous financial year by over eight hundred million dollars. Hon. J. D. Reid, Minister of Customs, announced on April 24 that the trade for the year recently terminated amounted to $2,249,170,171, of which $225,000,000 was in coin and bullion, as compared with $1,424,916,665, of which $140,000,000 was in coin and bullion in 1915-16.

The exports for the year 1916-17 aggregated $1,151,375,768, as against $741,610,653 in the previous twelve months. Indeed, the great growth in trade was largely due to the expansion in exports of manufactured and agricultural products.

The exports of domestic manufactures increased from $242,034,998 in the fiscal year of 1915-16 to $477,399,676 in 1916-17; agricultural products increased from $249,661,194 to $373,413,701; export of animals and their produce from $102,882,276 to $127,795,468; products of the mines from $66,589,861 to $85,616,907.

Imports grew from $507,783,361 in 1915-16 to $845,330,903. Of the imports the dutiable goods accounted for $461,708,206 and free goods for $383,622,697. The Customs revenue was $147,623,230 in 1916-17, as compared with $103,929,126 in the previous fiscal year.

TRADE GOSSIP

Hamilton, Ont.—The Dominion Steel Foundry are building an addition to their plant.

Oshawa, Ont.—An extension to the McCullough Brass Foundry is contemplated this summer. A site has been purchased adjoining the plant on the Ritson road.

Hamilton, Ont.—The Steel Company of Canada has decided to erect a by-product coke plant. Plans are being prepared, and it is understood construction will start at an early date.

Sudbury, Ont.—The British American Nickel Co. will build two complete units of the plant near here, and will produce 10,000 tons of nickel a year instead of 5,000, as originally intended.

Galt, Ont.—The Canadian Brass Mfg. Co., has acquired the B.O.T. Mfg. Co. of Toronto, established in 1910. The head office will be at Galt and the Toronto office becomes a branch. G. A. Dobbie, of Galt, is president.

The Dominion Steel Foundry Co., and its subsidiary, the Hamilton Steel Wheel Co., are to be amalgamated and incorporated under the name of the Dominion Foundries & Steel Ltd. Both plants are located at Hamilton, Ont.

Copper Mine Reopened.—The copper mine at Red Head, Charlotte county, N.B., formerly operated by James McLean of Letete, has been reopened by a New York syndicate. A quantity of ore has been taken out and shipped to the United States for testing.

Ontario Molybdenum Co., has been incorporated at Toronto with a capital of $40,000 to carry on the business of mining, smelting and refining metals. The head office is at Toronto and the incorporators are Theodore Burrel, Irene O. Allan and Lily Guylar all of Toronto.

Copper Mining in Newfoundland.—The Colonial Government is assisting in the work of developing copper mining activities on the northeast coast of Newfoundland, in the expectation of providing additional supplies of the metal for the Allies. Three large mines in the vicinity of Notre Dame Bay were worked profitably by old methods forty years ago. It is estimated that many million tons can be recovered under modern means.

Embargo on Tin Plate Likely.—Tin plate users and canners in Canada are much perturbed over the possibility of the American tin manufacturers placing an embargo on tin plates and cans. The shortage there is such that canners have been urged to can only perishable fruits, so as to conserve as far as possible supplies. Most of the tin supplied Canada comes from the States, and the proposed embargo would be a serious thing for consumers here.

Lieut.-Col. T. C. Irving, was recently gazetted as colonel in the 4th Canadian Division. Col. Irving left Toronto with the First Canadian Contingent as a captain in charge of the 2nd Field Company of the Engineers. Capt. Irving received the D.S.O. at the Battle of Langemarck, and shortly afterwards obtained his majority, while the latest gazette raises him to the rank of lieutenant-colonel. Lieut-Col. Irving was formerly vice-president of the C. W. Hunt Co., engineers and the Moffat-Irving Steel Works, Toronto.

John J. Drummond, of Midland, Ont., died at the home of his brother, George E. Drummond, in Montreal, on Saturday, April 7. Mr. Drummond was long identified with the development of the iron and steel industry in Canada. In association with his brothers, George E. and the late T. J. Drummond, he established iron furnaces at Radnor, Quebec, and opened up large iron properties in the Maritime Provinces. He was president of the Zenith Machine Co., Midland, Ont. The deceased was born in the North of Ireland in 1856 and came to Canada at an early age.

Hamilton, Ont.—The National Abrasive Co. of Boston and Amesbury, Mass., manufacturers of carbolon an abrasive material for grinding and polishing purposes, have decided to locate in Hamilton and have bought an acre and a half of land on Biggar ave. near Lottridge street. They will start erecting a factory immediately and expect to start operations in 90 days. The equipment and material is being ordered through the Ritchey Supply Co. of Toronto, who are the selling agents for this concern in Canada. Nathan C. Harrison is persident of the National Abrasive Co. and he has connected with him, J. T. Johnston, who is looking after the erecting and equipping of the Hamilton factory.

The Carbon & Alloy Steels Co., Ltd., has obtained a Dominion charter, with an authorized capital of $1,500,000, and will erect furnaces and a foundry plant in Hamilton, Ont., for the manufacture of steel castings, ingots, etc., by the Moffat electric process. The company will also take over the Moffat-Irving Steel Works of Toronto, which will be moved to Hamilton and added to the new plant. Plans have been prepared by Prack & Perrine for buildings that will cost about $100,000. The main building will be 60 ft. wide and 400 ft. long, while subsidiary buildings will cover an equal area. Another $200,000 will be spent on furnaces, electrical equipment, conveyors, cranes, compressors, and general machinery. The plant when fully equipped will give employment to about 250 men, and will have a gross capacity of 32 tons of molten steel per 24 hours. The incorporators are: J. B. O'Brien, K.C., president, Moffat-Irving Steel Works, Toronto; H. J. Waddie, Esq., President, Canadian Drawn Steel Co., Hamilton; J. W. Moffat, Esq., vice-president, Moffat-Irving Steel Works, Toronto; John G. Gauld, K.C., Gauld, Langs & Crosthwaite, Hamilton; W. E. Vallance, Esq., late of Wood, Vallance & Co., Hamilton.

CATALOGUES

Safety Glasses.—Bulletin issued by T. A. Willson & Co., Inc., Reading, Pa., dealing with various styles of safety glasses for industrial uses. Each style is illustrated and described together with price lists of the glasses and extra parts.

The Britannia Foundry Co., Coventry, England, have issued a series of leaflets dealing with an interesting line of foundry equipment, including the "Britannia" and "Coventry" molding machines, the "Git" sprue cutter, sand mixers and drying stoves. Each machine is illustrated and described, while a specification is also included, giving the principal dimensions and other data.

Whiting Cranes.—Of all types and for every service are described and illustrated in catalogue 127 recently issued by the Whiting Foundry Equipment Co., Harvey, Ill. The opening pages of the catalogue deal with electric traveling cranes illustrating and describing the latest features in Whiting crane construction. Following are brief descriptions of hand power, locomotive and cranes accompanied by illustrations showing the various types. The second half of the catalogue shows several typical illustrations of Whiting cranes of various sizes and capacities in different classes of service. These views represent a wide field of service covered and are shown with the object of assisting purchasers to select the proper types.

Bellevue Furnaces.—The Bellevue Industrial Furnace Co., Detroit, Mich., have issued an attractive catalogue No. 3, describing and illustrating an interesting line of stock sizes of "Bellevue" furnaces and accessories designed to supply standard equipment for all methods of metal heat treating. The principal features of the various types of furnace, which are adapted for use with oil or gas, are dealt with and the essential dimensions given for each size. Some of the uses to which these furnaces can be put include, melting all kinds of metals, brazing, case-hardening, forging, heat-treating tempering, rivet heating, tilting and tool furnaces, etc. The catalogue contains 68 pages with index and is fully illustrated.

Black Sheets.—An interesting booklet has recently been published by the American Sheet & Tin Plate Co., Pittsburgh, Pa., entitled "Black Sheets and Special Sheets." The several products are briefly described in conjunction with the trade designations, covering numerous grades of varying degrees of finish, tenacity and other distinctive qualities. For the convenience of the trade, such finishes as are of special qualifications have been grouped under the industry responsible for their origin. The booklet contains some useful tables, including weights of painted roofing and siding, U. S. standard gauge, thicknesses of steel sheets, and a bundling table of black sheets, etc. An interesting feature of the booklet is a diagram of the manufacture of steel as used for sheet and tin mill products.

Abrasive Grinding Wheels is the title of an attractive new catalogue No. 6, issued by Abrasive Company, Philadelphia, Pa. The catalogue contains an extensive list of special shaped abrasive grinding wheels for miscellaneous grinding machines. The wheels are classified and illustrated with principal dimensions and price given for each size. Straight, cup and cylinder wheels are also listed, accompanied by rules for calculating list prices. A chapter is devoted to the use and care of wheels, followed by a set of rules for calculating speeds. The principal points involved in the process of manufacture of these wheels, which are made of boro-carbone and electrolon, are briefly described. A table for selection of grain and grade for various classes of work is a useful feature of the catalogue and one of considerable help when ordering. The catalogue contains telegraph and cable codes and general index. Copies may be obtained from the Canadian distributors, the Canadian B. K. Morton Co., Toronto and Montreal.

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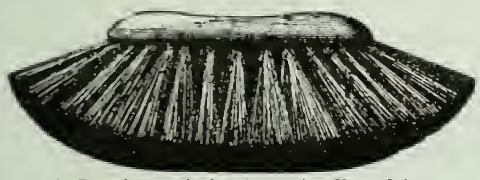

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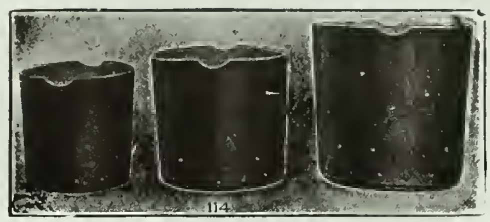

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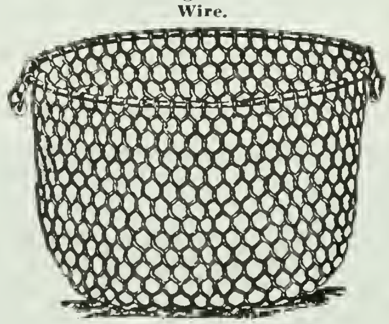

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Hyde & Sons, Ltd., Montreal, Que.
Standard Equipment Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE MACHINES, HAMMER
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Demmler & Bros., Wm., Kewanee, Ill.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hyde & Sons, Ltd., Montreal, Que.
Toronto Testing Laboratories, Toronto.

MIXERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Harrison Supply Co., Boston, Mass.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont
Woodison, E. J., Co., Toronto, Ont.

SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TEEMING CRUCIBLES AND FUNNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg

TRIPOLI

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont

VIBRATORS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

ADVERTISING INDEX

Elliptic ANODES

MADE IN CANADA

We are in a position to give you

Nickel Anodes of Established Purity

made from Canadian Grain Nickel and cast in Canada under conditions that ensure a plate of the proper structure as regards hardness and crystaline formation of the molecules of metal.

H. & V. W. Patented Elliptical Anodes save loss of metal and electrical energy, and they give uniform, smooth and quicker deposits with best possible distribution of metal and circulation of solution. They are not porous or spongy.

A great advantage in the use of these Patent Elliptic Anodes is the uniformity of deposit as disintegration takes place from all sides of the anode, consequently the molecules are distributed uniformly throughout the solution, and not only hasten the deposit, but give a heavier deposit in a given time. Another important feature in these anodes is the fact that they wear down evenly to a small narrow strip, and when worn down to such a point that it seems desirable to put in more nickel, the old ones, which take up practically no room in the tank, can remain until entirely consumed, and as a result there is practically no scrap nickel to dispose of at half price. The waste averages but 5% of the original weight, while a flat plate shows a loss of from 14% to 27%.

Having just completed a large addition to our foundry, which enables us to very materially increase our daily output of castings, we are now in a position to offer the trade prompt delivery, and solicit inquiries for anything in nickel, brass, bronze, zinc, or other metals.

Curved Elliptic ANODES

for Plating Barrel Solutions

We show herewith a curved Elliptic Anode which we use with our patent mechanical plating apparatus. These anodes are curved to fit the periphery of the revolving barrel, and when the anodes are hung at each side of the tank, the barrel holding the work is equidistant at all times from the anodes, hence a regular and even deposit is obtained.

Canadian Hanson & Van Winkle Co., Limited

TORONTO, CANADA

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, JUNE, 1917 No. 6

Every Minute Counts

The sooner you let Kawin Service show you what great savings it can effect in your plant the sooner you will be adding dollars to your capital.

"KAWIN SERVICE"

—is the result of a thorough, practical foundry training, plus the knowledge gained by our association with hundreds of foundries throughout Canada and United States.

"Kawin Service" sends an expert, practical foundryman to your plant to suggest in molding and cupola practice, advising in the most economical manner the purchase of raw materials, and to see that everything is up to specification.

Let us demonstrate at once what Kawin Service will do for you—THERE IS POSITIVELY NO CHARGE IF IT DOES NOT SAVE YOU 100% OVER AND ABOVE ITS COST.

We'll gladly call at your request and explain our proposition thoroughly without the slightest expense to you and with no obligation whatsoever.

Charles C. KAWIN Co., Limited

CHEMISTS *FOUNDRY ADVISERS* *METALLURGISTS*

Chicago, Ill. **307 KENT BUILDING, TORONTO** **Dayton, Ohio**

San Francisco, California

The Publisher's Page

TORONTO June, 1917

Advertising That Reached Unrelated Industries*

How the Ford Chain Block Took Each Field in Turn and Thus Made a Small Appropriation Serve Till Demand Became Larger

WHERE the consumer is an individual and where each consumer uses the product in about the same way or for much the same purpose, the advertising problem is comparatively simple. But when the chief consumers of a product group themselves into various unrelated industries, to advertise to them economically and effectively is not an easy task. One industry may use a product in one way or for a reason peculiar to itself. Another industry may employ the identical product, but for an entirely different purpose. Take steel, as an example. In what a large number of industries it is used, but also for what a wide variety of purposes! Hence the commodity would have to be advertised to each industry as though it were another product that each of them were interested in.

This is THE problem that advertisers to industries have to contend with, and yet many striking successes in mechanical and technical fields have been achieved in solving it. One of the most recent and also most conspicuous examples is the Ford Chain Block and Manufacturing Company, of Philadelphia. Starting to advertise but four and a half years ago, this company was then undoubtedly the smallest concern in the chain-hoist field. It has now become one of the large producers in the industry. The achievement of the company is all the more noteworthy because it started with a very small amount of money, and succeeded on its insignificant initial appropriation, despite the fact that it had a large field to cover.

The success of this advertiser is due to a plan which was based on a thorough market analysis and which was stuck to unflinchingly and carried out systematically, despite all temptations that came along, promising a short cut to success.

For years Ford was a very successful salesman for one of the older companies in the chain-hoist field. One day he decided that he could sell the product for himself just as well as for the other fellow. Accordingly, eight years ago he opened up his own plant and started to build the Ford Tribloc. He incorporated some mechanical features in the device, which enabled him to go to the trade with strong selling arguments.

The new concern made satisfactory progress right from the start, but for the first three years or so not much advertising had been attempted. Cards had been carried in the trade press, but this was little more than directory advertising, which justified itself but did not accomplish anything sensational. About this time Mr. Ford began to have visions of a much bigger business, which he believed could be developed through the right sort of advertising. Competent advertising counsel was called in and the proposition analyzed for its possibilities.

Right here is where the crux was reached. The appropriation offered was only $2,000! What could be done with that? How easy it would have been to fritter it away! How could a possible market that embraced thousands of shops and plants in dozens of unconnected industries be reached with a paltry $2,000? While the Tribloc is a machine, it is virtually a commodity. At least it is distributed and sold in the way that commodities are. Hence direct advertising would have been neither economical nor practical.

A study of the market showed that chain hoists were already widely used. The demand for them existed and did not have to be created. Creative advertising, undoubtedly, would have developed some new demand, but under the circumstances it would have been wasteful. Obviously the thing to do was to direct the appeal to the user of hoists, so that the next time he was out to buy he would give some consideration to the Ford. It was seen that the quickest and easiest way to reach this trade was through the trade and technical press. But arriving at this conclusion did not solve the problem. Neither flash nor intermittent advertising could be expected to get the Ford message to the prospect in a way that would impress him and make him remember the name and the advantageous features of the device. Steady advertising that kept pounding away at the proposition was necessary, but how could that be done with $2,000?

No one or two publications reach all the different industries in which chain hoists are used. For instance, the mechanical shops of railroads could not be advertised to through the same medium that reaches the sugar industry. To get the message to all the buyers that should be interested in it would take quite a large group of publications. Obviously this was impossible on the small appropriation available. This problem was overcome by tackling one industry at a time.

Extension of Advertising Was Gradual

It was decided to strike out for the machinery field first. Advertisements of various sizes were put in the journals of this trade. Occasionally the space was large, but more often it was small. The constant repetition of the message was regarded as more important than the making of a tremendous impression all at once. The advertising had to pay its own way as it went along. It had to increase sales in the industry to which it was appealing before additional money was appropriated for the extensions of the list of mediums.

In this way the publications of other industries were gradually gone into. Now those reaching the electric railway field, the makers of mechanical rubber goods, the mechanical shops of railroads, the sugar business, the boiler-making field, steel mills and foundries are used, as well as periodicals in the Spanish language, going to South and Central American countries. The industries are approached in the order of their importance as users of chain hoists. The advertising was increased as sales justified it, and now the appropriation is a very tidy one. In the meantime, as already intimated, the concern has climbed from near the bottom of the industry almost to the top.

The general character of the copy is changed about every six months. At first most of the emphasis was placed on the mechanical features of the Tribloc, although the name was never subordinated. The five-year guarantee which the company offers has always been played up. This guarantee has figured considerably in the development of the business. In living up to it, the customer is always regarded as right.

Most of the advertisements are signed "Ford of Philadelphia" in script. This stunt has given them an individuality and has also led people to understand that the Ford who makes chain hoists is not the other Ford that hails from a place in Michigan.

*Reprinted from Printers' Ink.

English Moulding Machines

"Jarr" Ramming
"Head" Ramming
"Hand" Ramming

The most efficient on the market.
Well built to suit rough usage.

Write for particulars to the makers.

Britannia Foundry Company

Coventry, England

Every Up-to-Date Foundryman

whether OWNER, FOREMAN or MOLDER, should learn to make steel castings, as there is an EVER-INCREASING DEMAND for more steel castings, and for men who KNOW HOW to make them.

McLAIN'S SYSTEM OF STEEL FOUNDRY PRACTICE covers the field thoroughly, as McLain's experience dates back to the FIRST SUCCESSFUL CRUCIBLE STEEL FOUNDRY in America.

Then the CONVERTER and a 20-TON OPEN-HEARTH FURNACE WAS INSTALLED, each of which McLain had charge of in Pittsburgh, Pennsylvania.

Write for free information.

McLAIN'S SYSTEM, INC.

STEEL FOUNDRY DEPARTMENT

700 Goldsmith Bldg. - MILWAUKEE, WIS.

Please send me full particulars of your steel lessons.

Name ....

Address ....

Firm ....

City ....

Position ....

Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
CRUCIBLES
Our Specialty.

Catalogue on request

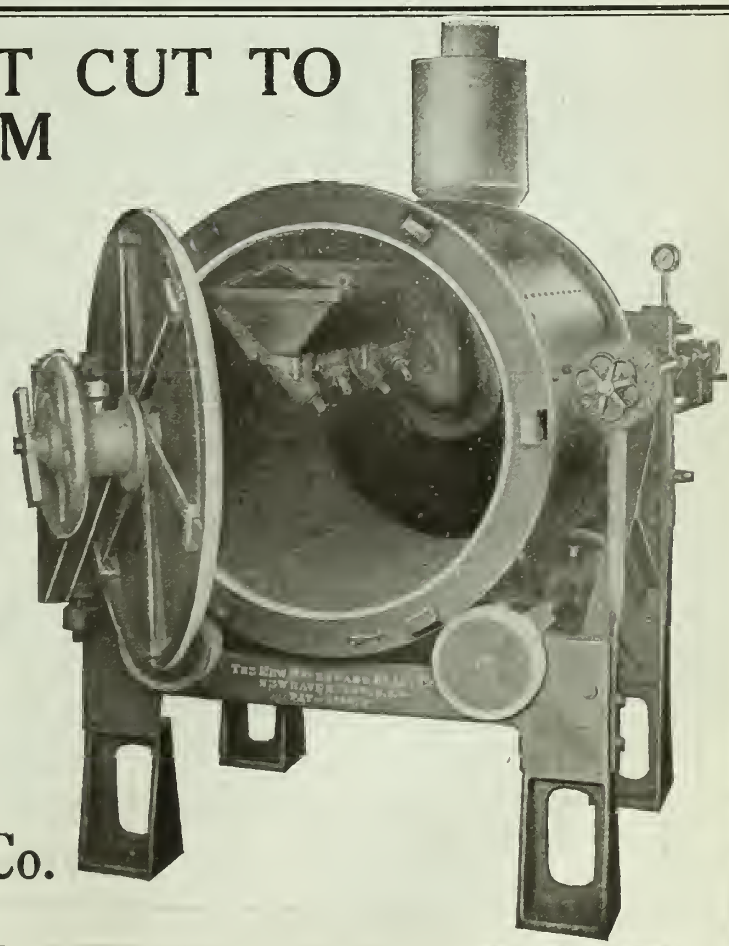
A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

PRODUCTION COST CUT TO A MINIMUM

Cost of production is going up with the cost of living, but there are cases where the cost of production can be given a death blow. Here is one: A Modern Foundry utility that is guaranteed to cut operating expenses—and at the same time give increased cleaning capacity and do the highest quality of work.



NEW HAVEN
Sand Blast Machines

They are the ONLY genuine, self-contained sand blast barrels where the cleaning material does not leave the inside, but is used over and over on the work. The accumulation of dust and dirt is confined inside and removed by direct exhaust.

Write for particulars.

The New Haven Sand Blast Co.

NEW HAVEN, CONN.

If any advertisement interests you, tear it out now and place with letters to be answered.

Safe Practice at Blast Furnaces and Its Development--V.

By Frederick H. Willcox

In its efforts to increase safety in the metallurgical industries, the Bureau of Mines, Washington, D.C., has been studying the causes of accidents at blast furnace plants also methods for their prevention. This article describes the known dangers and makes suggestion of means whereby the risk of accident may be lessened or, better still, wholly avoided.

PIPE FITTERS AND TUYERE GANG

Do not go up on the bustle pipe or stack platforms until you have notified the blower, keeper, or stove tender. When going above the bustle pipe it is safest to have a watcher. Before repairing sprays on dust catchers or on skips, skip-pit siphons, steam, air, or oil lines on top of the furnace, or sprays on the furnace jacket, notify the furnace foreman as it may be necessary to stop charging or to check the furnace.

FIG. 38. WORKMAN THROWS DOWN BOARD WITH NAILS IN IT.

Leaking steam, where the men have to work, is always annoying and is frequently a menace on account of the noise and the mist, and the possibility of scalds. You can do much to prevent the danger from this cause by promptly attending to the leaks. Warn other men of the danger of attempting to stop steam leaks on pipes under pressure by tightening flanges.

A blast-furnace plant is different from other plants in that, if an emergency requires a quick shutdown, the operation may be very hazardous, unless everyone knows what to do and does the work assigned to him promptly and accurately. Make it your first duty to learn the layout of the water and the steam lines leading to the gas mains, and the water lines leading to the water-seal valves. It is up to you to see that these lines are always in working order. Try them frequently by testing the steam line to the main for gas, and, if the line is plugged, clean it. Try the lines from the water and also from the steam supply for delivery; keep them drained to prevent freezing, and be sure the valves are not stuck. Do not let the water collect in the water-seal valves.

Successful and safe furnace operation depends in part upon the cooling-water system being kept in proper condition. Careful testing of tuyeres, coolers, plates, regularity in flushing the mud and sediment out, and regular inspection of the strainers, will do away with much of the disagreeable, difficult, and, at times, dangerous work caused by chilled or slipping furnaces, "messes," and bursting tuyeres due to water leaks.

Bricklayers

Inspect a scaffold before going up on it, and do not let your helpers or laborers go up unless you are satisfied that the scaffold is safe; many of them probably do not know whether it is safe or not, and must rely upon your judgement. In piling brick on a scaffold be careful not to overload it. Don't permit your helpers to drop the bricks on the flooring; make them set the bricks down carefully, and don't let buckets of clay or loads of bricks down heavily. Avoid overloading the hoist buckets, so that the material can not fall off; use safety hooks for hoisting buckets and pails. Don't throw brickbats down promiscuously when you are on a repair job; rope off a danger place, and place a danger sign to warm the men. Be careful not to leave your tools or bricks where they can be easily dislodged and fall, whether there are men below or not.

Before going into inclosed places where gas has been used or contained satisfy yourself that the gas valves are tightly shut. Remember that in such places there is always an odor of gas unless ventilation is very ample and pronounced. It is sometimes necessary to go into these places, and although you may feel assured that there is no gas leak, come out at once if you begin to feel dizzy or ill. Gas may come from old brickwork, flue dust, bulkheads, or wet surfaces in amount sufficient to overcome you, and when ventilation is difficult the slightest odor of gas is a warning for you to exercise the greatest caution. Always wear a belt and life line and a breathing apparatus where ventilation is weak or lacking and there is reason to expect gas. Use electric lights when working inside gas mains; torches make the air unfit to breathe. Use goggles when you are cutting brick, and if you get a bruise, abrasion, laceration report it at once.

Carpenters

It is your duty to use sufficient and strong enough lumber to make every scaffold, staging, railing, gangway, and ladder safe. The men may not know whether they are safe or unsafe; but whether they are competent or incompetent to judge, you can not evade responsibility for unsafe construction. Temporary ladders, runways, and other wooden constructions not intended for permanent use often are used when they have become unsafe. Make it your duty to condemn any unsafe equipment of this kind and to promptly remove temporary scaffolds or ladders when the need for them has passed.

Avoid leaving lumber with projecting nails about the plant, and hammer flat or remove all projecting nails that you notice on scrap lumber or lumber used in construction. (See Figs. 38 and 39). In laying planks for temporary floors, walks, or runways place the ends so that men in stepping on them will not tip the planks up.

Most of the accidents that happen to men doing carpenter work are caused by their hitting themselves with hammers and hatchets, from saws slipping, and in handling lumber. In working on lumber piles watch that you do not fall. In handling rough, heavy, or splintered lumber be careful not to drop it on your

FIG. 39. RESULT OF LEAVING BOARD LYING ABOUT WITH NAILS IN IT.

hands or foot or lacerate your hands. Be watchful and careful in the use of hand tools, and observe danger signs and the directions and warnings of foremen acquainted with the dangers at the different parts of the plant. By so doing a large proportion of the injuries commonly encountered will be avoided.

FIG. 40. SAFE WAY TO OPEN A SWITCH. USE ONE HAND AND KEEP OTHER BEHIND BACK.

Electricians

The insulation on electric wires and on tools and rubber gloves can not be depended on to prevent shock, as the insulation may not be in good condition. Do not work on live circuits unless absolutely necessary, and if necessary and you are in doubt as to the voltage of the circuit, consult the foreman and obtain his permission.

Try to observe the following precautions: Use only one hand if possible (Figs. 40 and 43); work on only one wire at a time and insulate it before starting on the next one; insulate parts of opposite polarity within reach of tools; do not touch electric conductors when you are standing on iron plates, structural iron, wet ground, or pavement—get a dry board or rubber mat to stand on; use tools with the handles adequately wound with tape, and wear rubber gloves without cracks or holes. Take the same precautions with supposedly dead circuits, as there is always a chance of such circuits being crossed with a live circuit. Low-voltage system, telephone wires, and signal wires may similarly be crossed with high-voltage lines.

When power has been cut off by opening a switch place a danger sign bearing your name on the switch and lock it open. Do not remove the sign and lock unless the work is completed, everybody and everything clear of the circuit, and no one in a position to be injured by the machinery starting up. Do not attach wire or cord for lights to iron pipes or structural parts. Neglect of this precaution may lead to charging of equipment or parts so that a man may receive a shock when least expected. Make frequent inspection of flexible cord for hand lights, portable clusters, or electric drills. The various crews frequently handle them when standing on wet places where, should the insulation be defective, a serious burn or shock might result.

Remove all dead circuits not likely to be used. Avoid installing temporary wires in a slipshod manner. Do not let inexperienced men handle electrical equipment, and do not set bad examples of careless familiarity with electrical equipment for inexperienced men to follow. Always attend immediately to an electric burn. Such burns are often misleading; a third-degree burn which may not be immediately painful may later result in gangrene.

Cranemen

Never carry a load over a workman's head. If men are working in the path of a load, run the trolley out to avoid them, or give them warning. Before moving a crane be sure that no one is in a position to be injured. Open the main switch before leaving the cab, and do not go or allow another to go on top of the crane runaway without opening the main-line switch and attaching to the switch a notice bearing his name. If the switch is found open and no notice on it, notify the foreman instead of shutting it yourself; there may be a reason for its being open.

Do not hoist without a signal when men are hooking on or slinging material. If possible be sure that their hands are not inside the hook or sling. Place the trolley directly over the load to avoid swinging it against the workmen. In hoisting heavy loads test the brake when the load is a few inches clear of the floor.

After a repair job is finished go over the crane carefully and pick up any tools, bolts, or parts left behind. Watch for loose parts; see that the brakes, warning bells, and switches work properly and report at once insecure or dangerous parts or places. Don't leave chains, hooks, or buckets hanging at heights that do not clear a man's head.

Notes on First Aid

In plants where the continual presence of a doctor or nurse is not feasible it is advisable to have at least one emergency first-aid box. These boxes are furnished by various manufacturers and associations and contain materials designed or recommended by advisory boards of physicians and by the American National Red Cross. They are admirably adapted for use at isolated plants and primarily are for the prevention of infection. A first-aid box in the charge of the chemist, storekeeper, or watchman will encourage the workmen to form the habit of seeking immediate first-aid treatment for slight injuries. Such treatment, if correctly performed, may prevent infection or illness, but further treatment should be by a physician.

When a man is so badly injured that he needs immediate relief before a physician can arrive or before he can be taken to the first-aid room it is essential that some one with a knowledge of first-aid should assume charge, preferably the foreman, first-aid man, member of safety committee, or ranking employee and direct the work of caring for the injured man until the doctor arrives.

Transportation of Injured

Do not move an injured person or move any part of his body until you are sure of the nature of the injury. If the injured man is unable to walk use the greatest care in placing him on the stretcher. Stretchers are now so universally available at plants that mention of other means of carrying men should be unnecessary; however, familiarity with methods of handling injured men is essential.

Eye Injuries

Any object in the eye that irritates the lid or eyeball probably makes a cut which may be infected just as easily as a cut on the hand or foot, and more so if a toothpick, match, knife, or handkerchief is used to remove the object. Moreover, infection of a wound in the eye is a very serious matter, because the eye is the most delicate external organ of the body. If any injury to the eye is neglected or wrongly treated, not only may the eye become inflamed, involving loss of time, but the sight may be lost. If you get something in your eye, do not try to remove it from the eye at your

FIG. 41. ELECTRICIAN REPAIRING WIRES WITH SWITCH IN; A DANGEROUS PRACTICE.

working place; go to the first-aid station and have your eye examined at once. If the object can not be removed by cotton rolled on the end of a match or toothpick or by a loop of sterile horsehair, it is probably imbedded in the eyeball or eyelid, and the injury should be examined by a physician immediately.

FIG. 42. RESULT OF REPAIRING WIRE WITH SWITCHES IN. SHORT CIRCUIT BURNS ELECTRICIAN.

Cuts, Lacerations, and Punctures

Whenever the skin has been cut accidentally, it is safe to assume that germs have been introduced, because tools, clothing, or other material, the dust in the air, or the skin itself may carry disease germs. Every wound should be primarily looked upon as infected and receive immediate attention. A fresh cut should not be washed, even by the first-aid man; leave that for the physician. Unsterilized water is dangerous, for it may contain infectious germs. For the same reason waste, cobwebs, tobacco, or dust should not be put on a wound, nor should the open wound be touched with the fingers.

If a fellow workman gets hurt and the wound bleeds profusely, or in spurts, apply a tourniquet or constrictor and notify the first-aid man. Immediate first aid by fellow employees is imperative in such cases, as the man may bleed to death before the first-aid man can arrive. A belt, suspender, handkerchief, rope, or any immediately available material that can be tied with a knot and twisted will do for a tourniquet. The man should be made to lie down and the injured part be kept elevated as high as possible by some one. If a limb is crushed or badly mangled, the tourniquet should be placed above the knee or elbow, near the crotch or arm pit, and twisted until just enough pressure is obtained to stop the blood. Every 20 or 30 minutes the tourniquet should be loosened a little; if bleeding recommences, it should be tightened again. If the circulation is stopped completely for upwards of three hours gangrene may develop. Many severely bleeding wounds may be stopped simply by pressure in the wound with a clean bandage.

Puncture wounds, such as are caused by nails, slivers, and small sharp objects are perhaps the most dangerous of all small wounds. Such cuts are always larger on the inside than on the outside on account of the elasticity of the skin, and the danger of infection is greater because the puncture closes, little bleeding occurs, and there is less chance of any dirt and germs that may have gotten into the wound being flushed out by the flow of blood. Puncture wounds of the foot, and the palm of the hand, the thumb, and the little finger are especially dangerous.

Burns

A burn is not readily infected when first inflicted unless it has been broken open accidentally or by careless or improper handling. A burn should not be washed by anyone except the physician. For small burns picric-acid gauze or sterile gauze with vaseline spread on it, placed over the burn and fastened with a roll bandage, is efficacious. The use of carron oil, which is a mixture of linseed oil and lime water, is not recommended. Soda and sterilized water may be used, but is not as soothing to burns as picric acid.

FIG. 44. SCHAEFER METHOD OF ARTIFICIAL RESPIRATION—EXPIRATION.

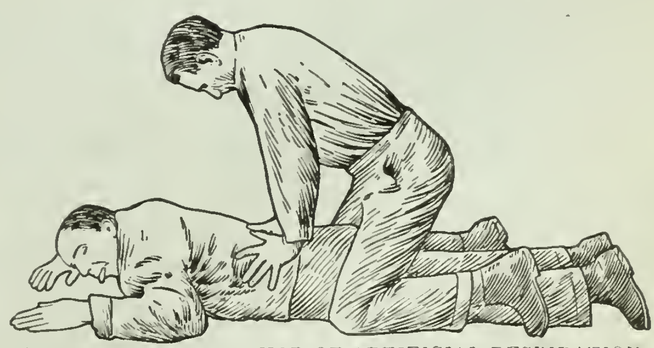


FIG. 45. SCHAEFER METHOD OF ARTIFICIAL RESPIRATION—INSPIRATION.

When a large burn is caused by clothing ignited from hot metal or cinder, or by electric flashes, steam, or boiling water, it is better not to remove any but the outer clothing. The injured man should be handled as little and as carefully as possible. It may be necessary to cut away part of the clothing, such as a sleeve or trouser leg. In case medical or hospital attention is not immediately available, the entire burned area should be covered with picric-acid gauze or vaseline-covered gauze. If a hospital is near, the clothing may be saturated with a soda and water solution (one-fourth pound soda in a half gallon of clean water). After such treatment, the injured person should be wrapped closely in a blanket.

FIG. 43. SAFE WAY TO REPAIR A WIRE; SWITCHES OUT.

All burns should be reported immediately to the foreman or first-aid man. Sometimes a second or third degree burn—that is, one in which the inner and outer skin, or skin and flesh beneath, are destroyed—may not, although a serious burn, be immediately painful, but later may lead to gangrene.

Fractures

For the purposes of first-aid, fractures may be classified as "simple," when the broken bone does not come through the skin, and "compound," when the broken bone sticks through the skin. Unless a broken limb is handled carefully a simple fracture may be converted into a compound fracture; therefore, a man with a fracture should not be moved until a splint has been applied. A compound fracture requires a longer time for recovery than a simple fracture.

A splint is simply a light stick or piece of wood for keeping the injured part in a fixed position by means of bandages. A broken arm or leg can be placed in a straight position, and if no splint material is available, a coat may be rolled from each side toward the center over the sleeves, placed about the broken limb, and tied there. An injured arm may then be tied to the body or a broken leg to the uninjured leg.

In case of a broken back, neck, or severe crushing and internal injury a patient should not be lifted until a physician comes. Unnecessary handling is harmful, causes needless suffering, and as a physician is generally immediately available at furnace plants, first-aid in such cases is, as a rule, of questionable value. The patient may be kept flat on his back and covered with a warm blanket.

Blows on the Head or Abdomen

When a man receives a blow on the head or abdomen, first-aid is not usually possible. Avoid rough handling, loosen the clothing, do not give liquid stimulant, and call a physician at once. Don't let the patient go home alone. After receiving a severe blow on the head men have continued work, or stopped work for the day, and then suddenly became seriously ill or died. Similar developments are possible after a heavy blow on the abdomen.

Bruises and Strains

Such injuries as bruises and strains should always have the attention of a physician rather than first-aid only, for although the injury may at the outset seem very slight, it may develop into a deep-seated injury with permanent total or partial disability.

Asphxiation or Shock

To remove a victim from contact with an electric circuit, cut the current off if there is a switch handy. If not, roll or push the man's body from the circuit with a dry piece of wood or wrap your hands in a dry cloth stand on dry wood, grasp his clothing and lift his body from the wire, or place a loop of dry cloth or rope over the man's head or feet and jerk him from the wire.

In case a man has been asphyxiated or "gassed," or has received an electric shock, carry him into the open air, send for a doctor, and then proceed as follows: Feel with your finger in his mouth and throat and remove any false teeth, tobacco, etc. Lay him face downward, with one arm extended out straight beyond his head. Place his other arm under his head, and turn his face to one side, so that mouth and nose are free for breathing. Have someone draw his tongue forward. Put a folded jumper or coat under the lower part of his chest if he is thin. Straddle him on your knees, facing his head (see Fig. 44), with your knees a little below his hips; then with fingers outstretched place your hands at the lower part of his ribs with your thumbs nearly joining.

Hold your arms straight and rigid, swing forward slowly so that the weight of your body is gradually brought to bear on the subject's body; then swing back, removing the pressure, but keep your hands in place; repeat 16 to 20 times every minute. (See Figs. 44 and 45). If you have not a watch, follow the rate of your own deep breathing. Keep it up for 3 hours unless natural breathing is resumed. Keep the man warm and do not try to give liquid stimulant until he is conscious and able to talk and drink. Do not hold ammonia bottles under his nose or mouth. It is important that every foreman and every member of a safety committee in the plant should understand this method of resuscitation.

MINERAL PRODUCTION FOR THREE MONTHS

THE quarterly report of the Ontario Bureau of Mines covering the records of Ontario's mineral production for the first three months of this year, shows that copper and nickel are running at smelter capacity; gold is being mined in increasing quantity, but silver has dropped in production below the totals for the same period in 1916. Iron ore shows a remarkable increase and considerable increases are also reported in all other items of metalliferous production within the province.

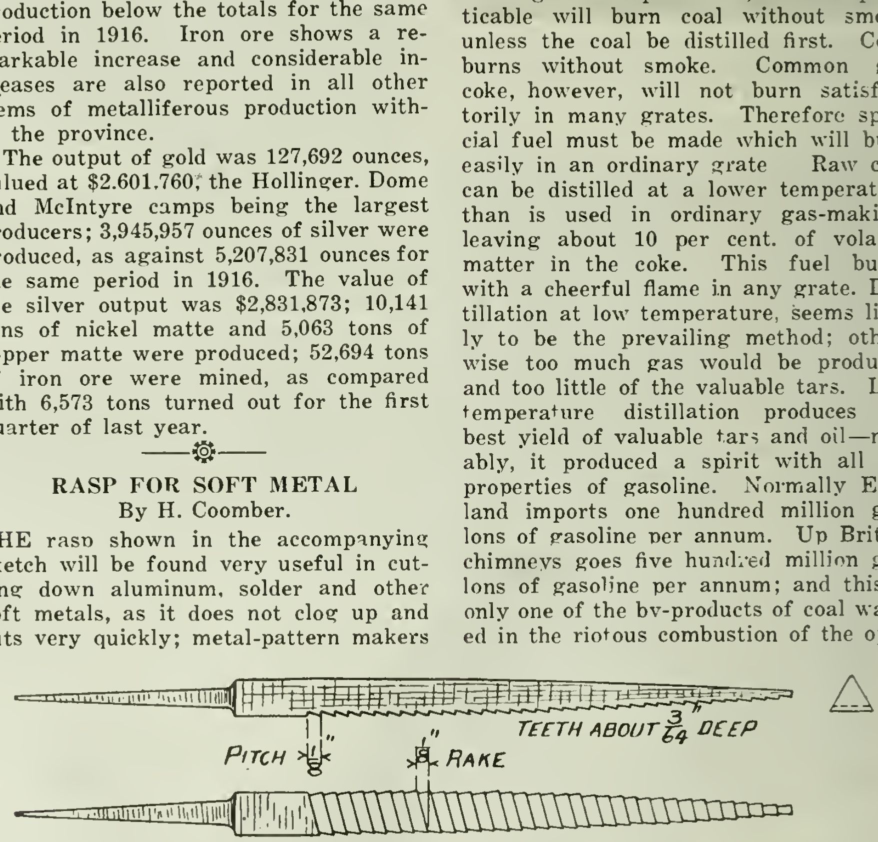
The output of gold was 127,692 ounces, valued at $2.601.760; the Hollinger. Dome and McIntyre camps being the largest producers; 3,945,957 ounces of silver were produced, as against 5,207,831 ounces for the same period in 1916. The value of the silver output was $2,831,873; 10,141 tons of nickel matte and 5,063 tons of copper matte were produced; 52,694 tons of iron ore were mined, as compared with 6,573 tons turned out for the first quarter of last year.

RASP FOR SOFT METAL

By H. Coomber.

THE rasp shown in the accompanying sketch will be found very useful in cutting down aluminum, solder and other soft metals, as it does not clog up and cuts very quickly; metal-pattern makers will find it very handy in trimming of solder on gated work. It is easily made; a file of suitable shape is softened, and then the teeth are filed to the dimensions given, a six-inch half-round file being used for this purpose. It is best to leave the rasp soft, as it keeps the edge for quite a satisfactory length of time, and can be quickly filed up sharp again.

This tool is best made from three-cornered, square and half-round files; the half-round and round will be found very useful in getting around a radius. The file may be bent, if desired, about two inches from the point, which facilitates getting at sunken portions of the work.



RASP FOR SOFT METAL.

BY-PRODUCTS OF COAL DISTILLATION

By C. T.

THE abolition of smoke should be brought about simply and solely by distilling all coal before burning it. Everything at this moment combines to make this reform practicable, and it would effect a saving for the whole country of a hundred million pounds a year. First the increase of the price of raw fuel, quite apart from the war, has induced more care and thought as to its consumption. Next the advent of the internal combustion engine, by far the most simple, convenient, and economical prime mover so far discovered, has created an increasing demand with higher prices for benzol, gasoline and fuel oil. The passing of the horse and the gradual exhaustion of the nitrate beds of South America had led to higher prices for ammonia sulphate, which is one of the other valuable by-products of the distillation of coal.

No grate simple enough to be practicable will burn coal without smoke unless the coal be distilled first. Coke burns without smoke. Common gas coke, however, will not burn satisfactorily in many grates. Therefore specicial fuel must be made which will burn easily in an ordinary grate Raw coal can be distilled at a lower temperature than is used in ordinary gas-making, leaving about 10 per cent. of volatile matter in the coke. This fuel burns with a cheerful flame in any grate. Distillation at low temperature, seems likely to be the prevailing method; otherwise too much gas would be produced and too little of the valuable tars. Low temperature distillation produces the best yield of valuable tars and oil—notably, it produced a spirit with all the properties of gasoline. Normally England imports one hundred million gallons of gasoline per annum. Up British chimneys goes five hundred million gallons of gasoline per annum; and this is only one of the by-products of coal wasted in the riotous combustion of the open fire. The ammonia waste is still worse, for ammonia, if burnt, gives out no heat. It is a vital necessity in farming. Every ton of coal burnt might yield 50 cents worth of ammonia if distilled. From 200 to 250 million dollars worth of recoverable ammonia vanishes up British chimneys every year, with no return at all. A quarter of that could be easily retained by low temperature distillation.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

NOTES ON NON-FERROUS METALS FOR ORDNANCE WORK

By G. C. R.

MUCH has been said about the machines, presses, tools and methods used for producing cartridge cases and copper bands for shells, but little has been said about the metallurgical methods when the trouble experienced in obtaining an adequate supply is considered.

The physical properties govern the methods of manufacture, and in the case of the copper bands the requirements make the difference between cast or rolled material. In the larger sizes of bands these specifications are all the more important, particularly when the lands of the rifling of the gun become worn, and form a small bearing area which, when inferior material is used, tears and rips.

Formerly the French artillery specifications not only specified the analysis of cartridge brass, but the brands of copper and spelter which would be accepted were also named. This was caused to try and prevent the use of spelter containing lead, iron and cadmium. These undesirable elements have various effects, such as reducing the ductility, etc. Cadmium and its effect in small proportions has been investigated very little, but apparently the melting point of brass is so high that the cadmium volatilizes and the remaining percentage has little effect due to the difference in the melting points which seems to be the principal trouble.

Small Bands Cast

In the case of the smaller sizes of copper bands, the specifications can be met with cast copper, while the larger sizes must be subjected to rolling or other treatment. The smaller bands are top poured and cast in steel tubes with hay loam cores. The hay is not twisted into a rope, but is picked out from the bin and laid in place covered with loam.

The cylinders are turned on the outside and cut to lengths, after which the bands are chucked and a cleaning cut made on the inside. The larger sizes must be rolled or worked, and in some cases the method of procedure is to cut out the blanks, which are about 36 in. dia. cup and draw similar to cartridge case work, care being taken to anneal between operations at 1,500 degs. F. A noticeable feature in the drawing operation is the amount of play on the cross-head or ram supporting the punch. Lubrication is used, as in brass drawing.

Melting the Copper

The copper for these purposes is produced in an oil furnace, pure scrap, as near as possible to obtain, being used, including cuttings. The refining is done by covering the surface of molten copper with charcoal and by rabbling or puddling with a green pine pole, possibly 5 inches in dia. and 15 ft. long. This poling causes steam and gases to form from the green wood, reducing the oxides and impurities. The slag which forms on the surface, and which contains the impurities, is taken off and test buttons are taken to see if the process has been carried far enough. These buttons are about 1⅛ in. in diameter. The condition is judged by fracture, which should be pink, and not red, and by the shrinkage or lack of it. The latter is termed pitch, which means the shape of the top of sample, i.e., convex, straight or concave. What is required is a slightly concave surface, and if it is not as desired, poling must be continued, and if too concave, oxygen must be added and the process repeated, but this requires considerable mechanical skill to restore this overpoled copper.

The slag obtained from the refining contains good metal, and should be remelted in a cupola with suitable fluxes and the reclaimed copper subsequently refined.

The medium-sized bands are made from castings about 9½ in. dia. x 9½ in. long, which are cast in metal molds on a rotary platform, after which they are annealed at 1,500 degs. F. for half an hour, and the cupping and drawing operations which are performed on horizontal hydraulic presses follow.

The brass for cartridge cases is composed of from 15 per cent. to 40 per cent. scrap, depending on the available supply, but no fine cuttings or dross are included. Melting is done in crucibles heated by coal in open pit types of furnace.

Pouring Billets

The molds, which are cast iron, hinged at bottom, with clamps at top, which are part of the pouring basin, make a billet about 1⅜ x 9 x 30 in. Pouring is from the top through gates about ⅝ in. dia., and the temperature and process is watched so carefully that there is very little discard, if any. The billets are now taken to a high-speed machine, which cleans off all dirt or dross which may have gathered on the sides during the casting operation.

The rolling operation consists of eight passes, with a reduction of ⅛ in. per pass. After passing the first three passes a lubricant is applied.

In blanking the finished sheets a shear is used behind the punch and die; in this manner the trimming permitted handling for further blanking, and the scrap was automatically cut to correct size for subsequent remelting.

SPECIAL ALLOYS AND THEIR COMPOSITION

By L. E.

BY means of the alumino-thermic process, metals are produced from their oxides in a practically pure state, free from carbon. Such metals have proved invaluable for a number of purposes, not the least of which is the making of non-ferrous alloys where iron and other impurities must be excluded, and the manufacture of which would be otherwise impossible. Among the most important of these metals are chromium, 98 to 99 per cent., and manganese, 96 to 97 per cent.; the former being chiefly and very extensively used in the manufacture of special high-grade crucible steels. The latter is mainly employed for making non-ferrous alloys, and one of the special features of this metal is the ease with which it alloys with copper, zinc, tin, aluminum, nickel, etc. Amongst other metals may be mentioned 75 per cent. ferro-chromium and 60 per cent. ferro-chrome-cobalt.

Improves Nickel Alloys

A small addition of manganese to nickel alloys has been found most beneficial, and gives a bright color resembling silver. For nickel castings manganese is used as a deoxidizing agent to produce greater density. In this case about 2 per cent. manganese is added to the molten nickel. In mints, manganese is added to copper-nickel alloys (25 to 7) to the extent of about 2 per cent. Manganese-copper, with 30 per cent. manganese, technically free from iron is now very largely used for a variety of purposes, such as in cupro-nickel, brass, and aluminum alloys, with far better results than an alloy containing iron. In aluminum alloys an addition of about 1 per cent. manganese in the form of 30 per cent. manganese copper is a good substitute for nickel or zinc. Such an addition increases the tensile strength, and gives a casting which can be more easily machined.

Copper and bronze castings lose their brittleness if manganese is added instead of phosphorus. Compared with other deoxidizing agents, such as phosphorus, manganese has the advantage that an excess will tend to improve the quality of the bath, whereas the excess of phosphorus would impair the quality. All castings with manganese alloys should be made under exclusion of air as far as possible. Generally speaking, it is better to add manganese in the form of a high percentage manganese-copper, tin or zinc alloy as the case may be. Alloys of manganese-bronze, manganese-tin, and manganese-titanium, among others, are also made. The latter is said to be probably the best deoxidizing agent for brass and bronze alloys, only about one-third the quantity being necessary, compared with manganese-copper.

Recent Special Alloys

An alloy of ferro-copper 50 per cent. has recently been placed on the market. The alloy is absolutely uniform, in which state it can only be produced by the alumino-thermic process, and is supplied in thin notched plates. For introducing vanadium and chromium into special mixtures, alloys of vanadium-copper 8 to 9 per cent. Va., and chromium-copper 10 per cent Cr. are supplied. A special alloy for brass has also been recently introduced known as "SAB" alloy, which overcomes the difficulty experienced in getting manganese, tin, aluminum, iron, etc., to alloy by themselves with brass. The difficulty is generally got over by means of an intermediate alloy, such as ferro-zinc, for the purpose of introducing iron. These intermediate alloys, however, necessitate heating the brass to a high temperature which, in addition to causing a loss of zinc, has also the disadvantage of the alloy deteriorating in quality by absorbing oxygen in the form of zinc oxide. By means of the special brass addition, various elements in a definite percentage can be introduced into the copper and zinc bath. If 8 per cent. of the alloy is added to the brass containing 60 per cent. copper and 40 per cent. zinc, a brass will be obtained having a tensile strength of 33 tons per in. and elongation of 30 per cent. The product has a golden yellow color, and is distinguished by its resistance to atmospheric influences, to acid and alkaline solutions, as also to sea and mine water. It can be easily worked, forged and pressed. In order to make the special brass an alloy of 60 per cent. copper and 40 per cent. zinc is made from the purest copper and zinc, free from lead, and 16.5 pounds of the special alloy is added to every 204.6 pounds of brass; in doing this, the temperature must be kept so low that the brass bath only smokes.

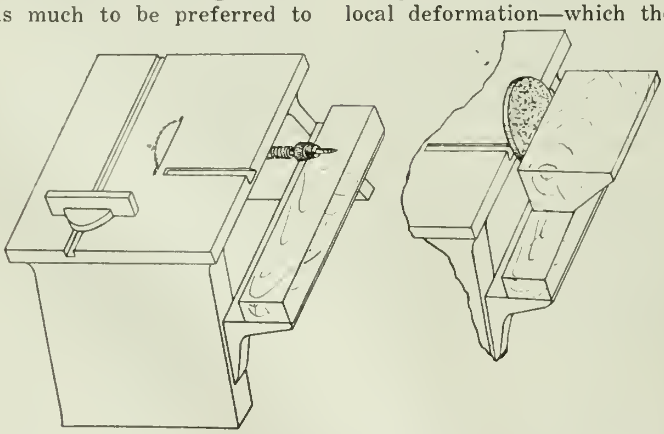
GETTING THE MOST OUT OF A SAW

By H. Middleton.

A PATTERNMAKER can get along very nicely with no machinery other than a good saw bench if it is rigged up like the one in the illustration. A good all-metal saw is much to be preferred to one with a wooden frame. A new spindle, or saw arbor, is made with a projecting end that is externally threaded and is bored to take the taper shank of a drill chuck.

The external thread is left hand and on it screws a light cast iron disc, 8 in. in diameter, to which sand paper is glued. By means of an auxiliary table on the shelf at the side, support for the work is provided across the centre of the wheel. Having no nut at the centre, the entire face is available for sanding patterns, rounding corners, putting on "draft," etc. The uses of a sand wheel are legion and new ones are constantly presenting themselves.

When it is desired to drill holes, the disc is taken off and the drill chuck put in the spindle. Various face plates, side and angle gauges for odd drilling, are made of wood. This makes a low-priced, good, all-round outfit for a patternmaker. Complete with ¾ horse-power motor it should cost less than $200, and is all any man with a small business needs.



GETTING THE MOST OUT OF A SAW.

WHAT IS "HARDNESS"?

By L. Street.

THE word "hardness," as loosely used in everyday engineering talks, has no precise meaning. It calls up in the mind a complex image of a substance which is not easily scatched or dented, is liable to snap rather than bend, and will be likely to give trouble in machining and resist wear. "Hardness" is a utility word that carries all these associations. One can, however, use the word in a more definite sense, and speak of the hardness of a substance as determined by one or other of the hardness tests.

Such tests fall into two categories: (1) Abrasion or scratch tests, in which particles of the material whose hardness is to be determined are torn away from its surface by sliding contact with some other substance, whose corresponding resistance is so high that its surface remains unimpaired by the action! (2) indentation tests, in which the surface of the material under test is permanently distorted by the pressure of a hard steel ball, cone, or knife edge. Of these, the indentation tests are the simplest, and give very reliable indications of one of the component qualities of hardness—resistance by local deformation—which the method is best suited to determine; Brinell and scleroscope figures are, therefore, accordingly more often quoted as measure of hardness than any other test result. For this reason engineers have rather fallen into the way of regarding indentation figures as an accurate index of hardness in general, including the kind of hardness which ensures resistance to wear. As a matter of fact it does not by any means follow in practice that a metal which resists indentation will in the same measure resist abrasion.

A Complex Characteristic

Hardness is not a specific property, like elasticity or tensile strength, but a complex of many characteristics which, so far as present knowledge goes, cannot be determined by any single test. The indentation test informs us of resistance to deformation; any one of the many possible abrasion tests will indicate resistance to wear under conditions similar to those obtaining at the test; but it is not possible to argue from one kind of the test what the qualities of the material will be under any other.

The Committee appointed by the Institutional Engineers in 1914 "to report on a hardness test for hardened journals and pins," describes in its report an ingeniously contrived series of tests to determine resistance to rolling abrasion with a view of comparing the results of such tests with the Brineli and scleroscope hardness numbers. The conclusions reached, while distinctly informative in many ways, make it clear that the Brinell hardness numbers of a miscellaneous selection of steel are not a safe guide in predicting their relative resistance to wear.

Results Not Interchangeable

As an example of the difficulties that surround the task of finding a law whereby the results of hardness tests of various kinds might be interchangeable, the process of skin-hardening which goes on under wear with some grades of steel, more particularly manganese steel, is especially noteworthy. Manganese steel, though it cannot be tooled, is really quite "soft" material. Its prime quality is toughness; its hardness is only about 200 Brinell. As soon, however, as it is subjected to a crushing or rolling action, producing deformation, the skin of the surface takes on quite another structure, passing from 200 Brinell hardness to 300, or even 500. This is a peculiar property, and explains why it is so difficult to tool a steel of such comparative softness, the reason being that the material hardens to the pressure of the tool. For this reason alone hardness cannot be expressed in terms of single value. It can only be expressed, by a complete stress strain curve.

THE wood mostly used for making pencils is the red cedar, grown in Florida, Alabama, and Tennessee, on account of its soft character and straightness of grain. With the demand for pencils steadily increasing, and the supply of suitable cedar becoming quickly exhausted, manufacturers will be obliged to use other woods, or users must be content with mechanical pencils.

PROCESSES IN MANUFACTURE

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

METAL MELTING IN A SIMPLE CRUDE OIL FURNACE*

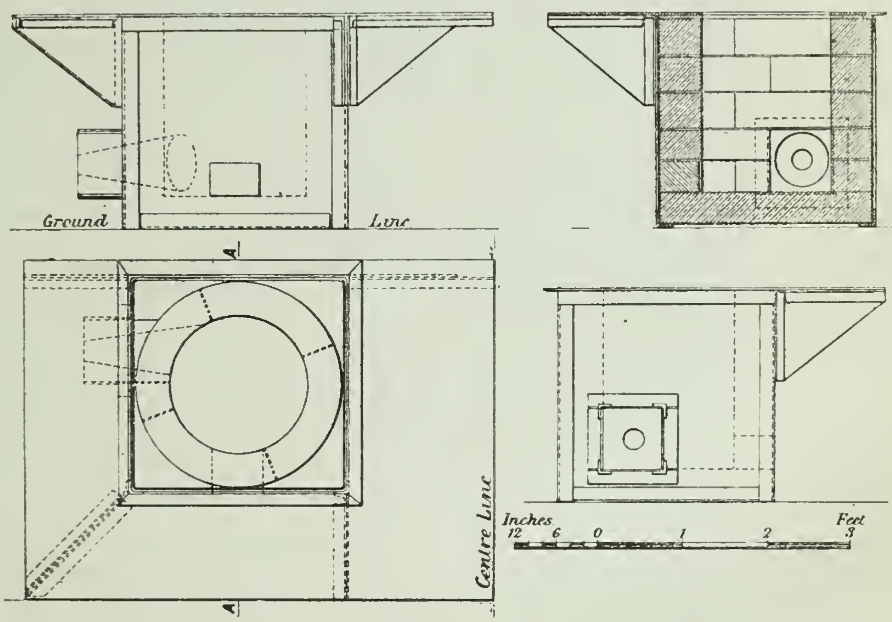
By H. S. Primrose

NOT every locality which has been selected for the large-scale melting and production of non-ferrous metals and alloys has been favoured with the possession of a high-pressure or cheap gas supply to facilitate operations. Many firms have therefore been content to purchase various forms of fixed or tilting furnaces of the oil-fired type and found them satisfactory. The chief difficulty with the majority of these, however, has been to retain or obtain the services of sufficiently skilled workers to operate the larger sizes so as to maintain uniformly good results both in the composition and strength of the castings and billets produced. The writer has been privileged to assist in the evolution of a very simple and efficient type of fixed oil furnace introduced by the Crittall Mfg. Co. for Government work, chiefly in connection with the rapid production of various grades of brass. The design is exceedingly simple, and permits of the use of unskilled labour throughout in its operation. The working drawings are reproduced to scale, and show the plan and several elevations of a single furnace, which is the left-hand unit of a pair of similar furnaces.

Construction

The furnace proper is constructed of the simplest engineering materials. The outer shell or casing is made of mild steel plates bolted together to form a rectangular box, the height of which may be varied to take large or small-sized crucibles. The one illustrated is capable of holding 100 up to 200 lb. pots, their elevation in the furnace being governed by the thickness of stool employed to raise them from the floor brick. The lining is of ordinary firebrick set in ganister to leave a circular opening, the corners between the lining and casing being packed with sand as an insulating material. The top of the furnace consists of two cast-iron plates resting on the top ring of firebrick and leaving a circular opening over which the furnace cover is placed during melting. The platform for the workmen is conveniently made of chequer plates, carried round all four sides of the furnace on channel or angle bars. This top also serves as a runway on which to move about the two-wheeled lifter for the furnace cover, which consists of a circular flat firebrick with a conveniently small aperture in the centre. The cover is bound round with a stout band of iron which serves to hold it together, and to enable it to be moved aside by the prongs of the lifting carriage.

*From a paper read before the Institute of Metals, March, 1917.



ELEVATIONS AND PLAN OF SIMPLE CRUDE OIL FURNACE.

It has been found that the best arrangement is to have the whole furnace above the floor-level, so that no pit or special foundation is necessary, and the construction and keeping clean of flues are completely done away with. In the event of a crucible cracking in the furnace whilst full of molten metal, there is no difficulty in removing the spilled metal through the frontal opening, which is usually, in working, kept closed by luting in a firebrick.

Air Supply

The space between each pair of furnaces can be utilised in conveying the necessary pipe-lines for the air and oil supply close up to the opening of the burner brick. Valves are, of course, required to regulate the inlet of each, so that the correct pulverising of the oil into a suitable spray is effected to give the right flame to envelop completely the crucible and have a small flame protruding from the cover opening.

The shape of the special burner brick allows the oil spray to spread out in a conical fashion, and, igniting on entering the furnace with a tangential motion, it causes the flame to sweep round in the annular space between the furnace walls and the crucible before passing out at the central opening in the firebrick cover. By using a single burner brick of the required shape, and also by having the firebrick slab for the floor of the furnace in one piece, there is no chance of leakage or escape of unconsumed oil, and as it is thus all burned inside the furnace, great economy in the heating power results, and uniform time of melting may be relied upon.

The form of oil-burner depends upon what type of air-pressure plant is installed in the works. Where compressed air is already in use it must be reduced in the foundry to not more than 25 lb. per square inch effective pressure at the burner valve. The burner must then be of the special high-pressure design, which is found to be exceedingly effective in producing the necessary pulverising action on the heaviest types of crude oil employment, and in this way high economy in melting may be secured. Such low figures as 1.5 gals. consumption for each hundred pounds of brass melted can be consistently maintained. The slightly increased cutting action of the high-pressure burner flame, both on the furnace lining, where carbonisation is likely to result, and on the crucibles themselves, makes this extreme saving of oil a questionable advantage in view of the short life of the crucibles and the more frequent patching required for the furnace lining.

Most satisfactory results have been obtained with the use of low-pressure burners, which can be used in cases where no high-pressure air system is in vogue. Small high-speed electric fans capable of producing about 12 oz. air pressure (i.e., from 20 to 22 in. of water gauge) can be readily employed to work four furnaces simultaneously. The only precaution to be taken in such a case is that the furnaces should be started up from cold not more than two at a time, and those which are not immediately in use at any period can have the air supply cut off separately. The consumption in this method of working is slightly more than two gallons per 100 lb. of metal melted, but against that must be offset the advantage of being able to melt with perfect regularity against time, as not more than 35 minutes are required to melt completely and pour 100 lb. of brass. 200-lb charges require only 50 to 55 minutes.

Advantages

In addition to the advantage of being completely operated by unskilled labour, these furnaces have the obvious advantage of being easily removable, as they can be set down anywhere on a reasonably smooth floor. Besides being exceedingly easy to repair, they are constantly under the most complete control, simply by regulating the air and oil inlet valves. Their first cost is not great, and repairs are a very small item in their running. A large number have been in continuous operation night and day for over a year without any necessity for relining, and only slight attention to the walls in the way of patching with ganister has been needed. They are not nearly so destructive on crucibles as the various forms of gas flame employed in melting furnaces, and the ever-present trouble of clinkering, as with coke-firing, is completely done away with. The only resemblance to cleaning which must be attended to and that only on occasion when the correct air quantity has not been maintained during a run with very heavy or viscous fuel oil, is the deposition on the furnace wall opposite the burner of small accretions of solid carbon. It should never be allowed to interfere with the proper circulation of the heating flame, and the deposit must be barred off and removed when the crucible is withdrawn for pouring.

With 100-lb. pots there is no difficulty in withdrawing the crucible full of molten metal by hand, but when 200-lb. pots are used it is advisable to resort to a mechanical aid such as the quadrant lifting arm, with a chain to hook on to the basket lifting tongs. This very much lessens the chances of accident and minimises the effect of unsteady lifting out when manual labor alone is employed.

Melting Results

In a properly organized brass foundry all mixtures are controlled by analyses, and the charges accurately weighed out, after briquetting, if necessary. In this way it is quite feasible to do without any fresh copper. Complete returns are kept of the work and output of each shift and these may be abstracted for each grade of metal made. The following table represents one month's output of "G" metal only:—

Metals melted:	lb.
Zinc	65,920
Cartridge cases	349,813
Swarf	709,218
Scrap	357,549
Total	1,482,500

Flux used, 7,312 lbs.
Aluminum deoxidiser, 820 lbs.

Foundry Production: Number of melts 14,825 of 100 lbs.

Billets produced, 124,855 =	1,312,225
Scrap and spilled metal ..	26,539
Metallic shot recovered from foundry dross	73,920
Total	1,412,684

Melting loss = 1,482,500 — 1,412,684 = 69,816 lbs. = 4.7 per cent.*

Number of furnaces working, 18 to 22. Total oil consumed, 32,599 gallons.

Oil consumed per 100 lbs. of metal melted, 2.2 gallons.

*The amount returned as loss is somewhat in excess of its actual value, as the weight of metallic shot recovered (33 tons) represents an average of only 60 per cent. of the total dross produced and treated by simple washing. Further treatment by concentrator revealed nearly 30 per cent. more metal to be got out.

PYROMETER DEVELOPMENT*

By Richard P. Brown**

AS FAR as we know the ancients who baked excellent bricks and forged iron in their crude way made use of a form of pyrometer used to-day with ever diminishing success—the eye.

The operation of the first mechanical pyrometers depended upon the difference in expansion of iron and brass. An iron tube containing a brass rod projected into a furnace, and these were mechanically connected to a multiplying movement which caused a pointer to pass around a dial. The difference in expansion of about 1/8-inch was sufficient to move the pointer up to 800 degs. Fah.

Siemen's Water Pyrometer

An instrument used quite largely 30 or 40 years ago was the Siemens water pyrometer. A copper ball weighing exactly 137 grams was placed on a piece of steel in the furnace, and after it had fully attained the temperature, it was quickly removed from the furnace and dropped into a vessel containing a thermometer and exactly one pint of clean water. The rise in temperature of the thermometer in the water could be read off in actual temperature degrees on a corresponding scale. The accuracy of this instrument necessarily depended upon exact measurement of the quantity of water in the vessel and the weight of the copper ball which scales away slowly under heat. The time taken to remove the ball from the furnace and drop it into the water must necessarily vary slightly. An accuracy within about 25 degs. Fah. was, however, usually attained with this instrument. The Siemens water pyrometer is still used by armor plate manufacturers as they can readily place a number of copper balls on a piece of armor plate which cannot be easily reached by more improved pyrometers. These instruments are in use in the armor plate department of the Bethlehem Steel Co., South Bethlehem, Pa.

*From a paper before the Steel Treating Research Club, Detroit.
**President, the Brown Instrument Co., Philadelphia.

Principle of Resistance Thermometers

The principle on which resistance thermometers operate is the change in resistance of metals due to change in temperature. A coil of platinum or pure nickel wire protected with a suitable tube is inserted at a point where the temperature is to be measured, and with a constant source of current passing through the coil of wire, the resistance increases or decreases, depending on the temperature. This change in resistance can be easily measured as an adjustable resistance is used to balance the resistance of the bulb, and a galvanometer shows when the balance is reached. The adjustable resistance with sliding contact arm can have a temperature scale for direct reading. This instrument is an exceedingly accurate one for measuring low temperatures, but is hardly to be recommended for high temperature service.

Thermo-Electric Methods

For measuring temperatures above 1,000 degs. Fah., the thermo-electric method has come to be by far the most largely used. A thermo-electric pyrometer consists of a thermo-couple, a measuring device, and wires connecting the thermo-couple and the measuring device. Experience has taught us that for measuring temperatures up to 200 degs. Fah. a thermo-couple of bismuth and antimony is best. For temperature to 1,000 degs. Fah., a satisfactory thermo-couple consists of one wire of iron the other 60 per cent. nickel and 40 per cent. copper. For the measurement of temperatures as high as 1,800 degs. Fah., a very satisfactory base metal thermo-couple consists of one wire of 90 per cent. nickel and 10 per cent. chromium, the other wire 98 per cent. nickel and 2 per cent. aluminum. The General Motors Co., Detroit, has developed a base consisting of silica, manganese, nickel and aluminum.

For a long time pyrometer builders attempted to duplicate the wire in order to procure thermo-couples which would reproduce the voltage of the previous thermo-couples, but this gave large amount of trouble and no great precision could be secured. Several years ago the policy was adopted of shunting each thermo-couple with manganin wire, reducing the voltage at the terminals of the thermo-couple about two millivolts. Each thermo-couple is adjusted in an electric furnace to a standard, and a maximum error of one-tenth of a millivolt or 4 degs. is permitted. In this way a thermo-couple as sent out produces a definite voltage within 4 degs. Fah. This method of shunting the thermo-couple also permits of the customer re-standardizing his instrument at intervals.

Wire Insulation

The wires forming a thermo-couple must be insulated from each other throughout their length. This insulation must withstand high temperature, must be a good insulator, and must withstand reasonably severe handling. A common method of insulating base metal thermo-couples is to wrap them with asbestos, and paint the asbestos winding with a solution of sodium silicate. Another method is to fit lava or porcelain beads over the thermo-couple wire. For the platinum thermo-couple the insulation must be of porcelain or high grade fire clay, free from impurities.

The life which will be obtained from any thermo-couple installed in a furnace will very largely depend on the protecting tube over the thermo-couple. For temperatures up to 1,200 degs. Fah., a high grade wrought iron tube gives satisfactory results. The life of this tube can be increased by calorizing, a process which impregnates the pipe with an aluminum oxide recently developed by the General Electric Co. This will increase the life of the pipe about three times where used at temperatures around 1,400 degs. Fah.

Compensating Box

Until a few years ago, no particular attention was given to caring for the source of error caused by changes in temperature at the cold junction of the thermo-couple. Recently, however, it has been customary to run compensating leads of the same material as the thermo-couple to a distant point, preferably under ground, where the temperature is uniform, instead of having the cold junction just outside the furnace wall, where it might vary several hundred degrees. Where it is not possible to place the cold junction in the ground, on account of the furnaces being on an upper floor of a building, a compensating box can be used. This device consists of a lamp and thermostat which will maintain the temperature constant within two degrees. These compensating boxes can be supplied to maintain the cold junction constant for any temperature from 50 to 150 degs. Fah. The temperature for which the compensating box is set must necessarily be higher than the atmospheric temperature of the room in which it is located.

Thermo-Couple Voltage Measurement

There are two distinct methods of measuring the voltage produced by a thermo-couple—the millivoltmeter method, and the potentiometer method. The millivoltmeter consists of a permanent magnet with its pole pieces, in the field of which a copper wound coil swings in jeweled bearings. Instruments of the millivoltmeter type were in extensive use commercially abroad, and to some extent here as long as 20 years ago, but the instruments were of such delicate construction as to be hardly suitable for general commercial use. Usually they were supplied with the moving coil hung between fine wire suspensions, and were easily broken through jars or handling in transit. These instruments were of high resistance, approximately 300 ohms.

On account of the delicate construction of this type of imported instrument, a standard form of switchboard millivoltmeter, frequently used as an ammeter, came into extensive use about 1905, and is still in use. It has a resistance of about 5 ohms, and each individual instrument must be calibrated for a thermo-couple of a certain length and for use with leads or wiring of a definite length. Slight changes in resistance, due to changes in the length of the thermo-couple, or length of the wiring, naturally effect the indication, as the internal resistance of this type of millivoltmeter is so low.

In the potentiometer method of temporary measurement, the electromotive force produced by the thermo-couple is measured by opposing to it a known variable electro-motive force, usually that of a dry cell contained in the instrument, so that when a balance is reached, no current flows. A galvanometer is used to indicate the point at which no current is flowing, and the pointer on the galvanometer then indicates zero, the voltage of the thermo-couple being opposed to the dry cell. The advantage of the potentiometer method of measuring temperature lies in its extreme precision, and its independence of resistance changes throughout the thermo-couple circuit. It has the disadvatage compared with the millivoltmeter method in that it is not direct reading, and that some outside source of current, a dry cell for example, is necessary as a source of current to oppose the thermo-couple.

Radiation Pyrometers

The radiation pyrometer is a development of the thermo-electric pyrometer. Instead of placing the thermo-couple inside the furnace, where the temperature would be so high as to destroy it, it is placed in the back of a tube in front of a mirror. The rays of heat from the furnace enter the tube and strike the mirror and are brought to a focus on the thermo-couple junction. This instrument has a particular field where temperatures must be measured from 2,800 degrees Fahr. up, and it is possible to secure an accuracy within 1 or 2 per cent. with this type instrument, if the instructions as to its use are properly carried out. It is not recommended for service where a thermo-electric pyrometer with base metal or platinum thermo-couple can be used.

It is very essential if accurate results are to be secured from pyrometers that they be re-standardized at frequent intervals. The freezing point of pure salt is an excellent method of testing thermo-couples, or of the complete pyrometer consisting of the thermo-couple, leads and instrument. Insert a thermo-couple in a small crucible containing pure salt; ordinary table salt is satisfactory and heat the salt to about 1600 degs. Fah. Remove the crucible from the heat and allow it to cool off. At the freezing point of the salt which will be indicated by the temperature remaining reasonably constant for four or five minutes, the pyrometer should read 800 degs. Cent., or 1,472 degs. Fah. The melting point of a number of different metals is quite satisfactory for checking purposes.

The metals most generally used for this purpose, and their melting points follow: Tin, 450; zinc, 787; silver, 1,761, and gold, 1,945; copper, 1,929; aluminum, 1,157, and platinum, 3,227 degs. Fah. The Bureau of Standards at Washington tests pyrometers and thermo-couples for manufacturers in the United States, and it is a good plan to have a standard platinum or base metal thermo-couple tested at the Bureau since its laboratories can furnish the millivolt values for the thermo-couple. This data can be retained as a primary standard to test the secondary thermo-couple. The cost of such a test is usually about $10.

Automatic Temperature Control

The greatest future in pyrometry undoubtedly is along the line of automatic temperature control. Instruments which automatically control the temperature of electric furnaces have already been designed. By means of solenoid operated switches the circuit is opened and closed through the rheostat, maintaining the temperature constant within 10 degs. Fah.

It may be suggested that the various steel manufacturers who are interested in the improvement of heat treating methods can be of great assistance to pyrometer manufacturers in co-operating with them to test out new devices in an endeavor to improve on present methods.

COOLING IRON CASTINGS

WHERE soft castings are wanted, the rate of cooling has very much to do with the matter. Assuming that the silicon and carbon content are properly proportioned, slow cooling gives the desired results owing to the fact that the carbon very largely separates as graphitic carbon. To secure the best results the sand should be used as dry as is possible to produce a good mould, and there should be a good body of sand of a porous character to back up that forming the actual mould. There is an advantage also in facing the moulds with plumbago, or very finely ground charcoal. This prevents the formation of a siliceous skin on the casting, although the carbonaceous coating to the mould is practically a mere film. Allowed to become practically cold in such moulds, castings should be as soft as the character of the iron will permit. Cast iron is not appreciably amenable to annealing after it has cooled, but during solidification and cooling down to about 300 degs. C., the rate of cooling exerts much influence.

Comparative Mechanisms—

The Master—You look worried. What's the matter?

The Housekeeper—The nurse has just left, and there is nobody to wash the baby.

Master—Have the chauffeur do it. There isn't as much mechanism about a baby as there is about a car anyway.

FOUNDRYMEN'S CONVENTION AND EQUIPMENT EXHIBITION

NEW ENGLAND foundrymen already are making extensive preparations for the reception and entertainment of the members of the American Foundrymen's Association and the American Institute of Metals, who will meet in annual convention at Boston during the week of Sept. 24. Concurrent with this great gathering of foundrymen will be held the yearly exhibition of foundry equipment and supplies, machine tools and accessories. in Mechanics' Building, which affords 80,000 square feet of floor space.

Never before in the history of these organizations has as much interest been manifested in this event, so far in advance of the opening date, as this year. Space reservations for exhibits already have been made by 80 manufacturers, and last year's total of 150 at Cleveland, promises to be greatly exceeded. The average space per exhibitor also shows a big increase over previous years and the indications are that Mechanics' Building will be crowded to capacity. A prominent feature of the Boston show will be the extensive display of machine tools. New England builders promise to be unusually well represented and numerous reservations also have been made by machine tool builders in the central west.

The Boston exhibition will be a great patriotic demonstration of the preparedness of equipment builders to meet the most exacting needs of foundrymen and machine shop operators in this great crisis. The labor-saving tools that will be displayed will demonstrate how operations can be speeded-up to meet the demands of the Government, and, in addition, engineers will be in attendance who will explain the intricacies of munitions manufacture.

The programme for the technical sessions of the American Foundrymen's Association is unusually complete, and provides for separate sessions for the discussion of grey iron, steel, and malleable iron topics. Three symposiums have been scheduled, namely, "Military Stores," "After-treatment of Castings to Improve Their Physical Characteristics." and "Refractories." The opening meeting on Monday afternoon, Sept. 24, will be a joint session of the American Foundrymen's Association and the American Institute of Metals. Throughout the remainder of the week, ending with Friday, Sept. 28, only morning sessions will be held and the same plan will be followed, which proved so satisfactory at Cleveland last year. It is probable that simultaneous sessions of the malleable and grey iron and steel sections will be held Wednesday, Thursday and Friday. The exhibition will be formally opened Tuesday morning, Sept. 25, and will close Friday evening.

Headquarters for the American Foundrymen's Association will be at the Copley-Plaza Hotel, although the meetings will be held in the Mechanics' Building. The American Institute of Metals will have its headquarters at the Hotel Somerset and its meetings will be held at this hotel or in the exhibition building.

The foundrymen of New England have completed a strong organization to provide for the reception and entertainment of the visitors. While their plans have been outlined only tentatively, the programme includes a boat trip around Boston harbor, theatre party, a visit to one of the big league parks to witness a professional ball game, ladies' luncheon and plant visitation. The complete list of committees appointed by the New England Foundrymen, follows:—

EXECUTIVE COMMITTEE.

W. J. Lavelle, chairman, New England Coal & Coke Co., Everett, Mass.
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C. A. Reed, Reed, Fears & Miller, Boston.
R. D. Walker, Walker & Pratt Mfg. Co., Boston.
W. E. Freeland, The Iron Age, Worcester.
A. R. Plant, Blackstone National Bank, Providence, R.I.
W. A. Viall, Brown & Sharpe Mfg. Co., Providence, R.I.
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MECHANICS BUILDING, BOSTON, MASS., WHERE THE EXHIBITION OF FOUNDRY EQUIPMENT AND SUPPLIES WILL BE HOUSED.

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J. F. Lanigan, Davis Foundry Co., Lawrence, Mass.
W. M. Saunders, Saunders & Franklin, Providence, R.I.

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G. P. Aborn, Blake & Knowles Steam Pump Works, Cambridge, Mass.
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B. S. Leslie, United Shoe Machinery Co., Beverly, Mass.
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A. O. Backert, Cleveland.

PRESS FOR STAMPING WASHERS FROM SCRAP PLATES

SCRAP sheets and plates bring a small price when sold as scrap, but when punched into washers realize a much higher figure. The press shown in the illustration herewith is specially adapted for making washers and other stamped specialties from scrap plates and sheets or from new material, its most useful field being in the utilization of waste material by converting it into standard or special washers, large quantities of which are always used around railroad and industrial plants.

The frames are one solid casting of the open gap type, on which is mounted the gearing (a single reduction except in case of motor drive) plunger, cam shaft, dies, etc. The plunger has broad wearing surfaces and is equipped with a bronze taper gib to take up any wear. Fastened at the bottom is the die and piercer, the former for cutting the outside of the washer, and the latter for punching simultaneously the centre hole. The punch is on the bottom and is held in a substantial punch holder block on the lower jaw of the frame.

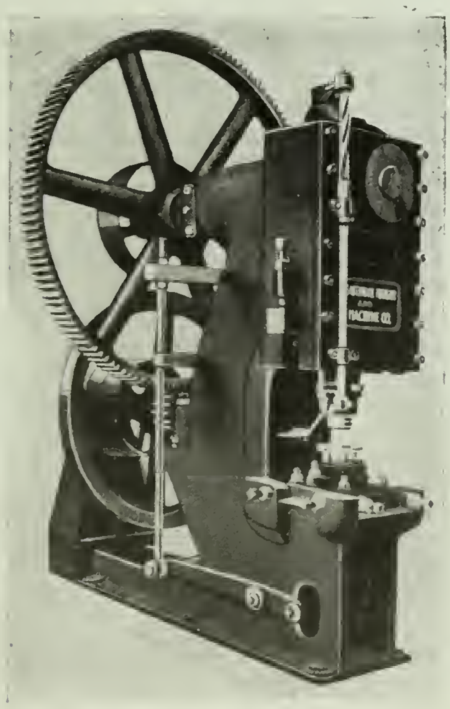
Surrounding this punch is the stripper ring, operated through connecting rods and lever from a cam on the back of the main shaft. In an annular space between the piercer and die are a series of knockout pins for knocking down the washer which sticks in the upper part of the die mechanism and goes up with the upward stroke of the plunger. These pins are operated by a bar passing crosswise through the ram and, at the top of the stroke, stopping against a pair of set screws in lugs cast on the frame.

At the left front side of the machine is a vertical shaft which is splined at the top with a steep pitch thread. This passes through a nut which is fast to the top of the plunger. The up-and-down stroke of the ram imparts a rotary motion to the shaft. On the bottom of the shaft is the hand or cup which receives the knocked out washer and throws it into a pile or suitable receptacle.

The back of the main shaft is equipped with a tight pulley as is also the fly wheel shaft. This pulley drives the machine on light work when operated the same as a fly-wheel non-geared press. In this case the fly-wheel, pinion and shaft are removed. Operating without gears makes the machine a rapidly acting press the speed being limited only by the skill of the operator handling the material.

The machine may be used for various forms of stamping, punching, shearing, etc. Where used for scrap reclaiming only, it may be placed at the scrap bins. Only one man is required to operate it, he using both hands to hold the material as the ram operates continuously. By a special die construction, the press makes a complete washer at each stroke of the ram, insuring the concentricity of hole with the outer circumference. It leaves the washer perfectly flat and with clean-cut edges. The punched washer is thrown out automatically into a box or to a pile by a mechanical hand operated from the slide.

The machine is equipped with a pulley for belt drive or, when specified, motor bracket and suitable gearing for electric motor drive and one set of punches and dies for any size within range of the capacity. Five sizes of this machine are built by the Southwark Foundry & Machine Co., Philadelphia, Pa.



WASHER STAMPING PRESS.

POWER FOR STEEL MILLS

FROM a report of the central station power committee of the Association of Iron and Steel Electrical Engineers, submitted at the recent meeting in Chicago, the following has been taken, and for which we are indebted to the *Iron Age*.

The rate schedule of 20 power companies furnishing power to steel mills has been obtained. To permit comparisons the net resultant rates for 1000-kw. and 5000-kw. loads at 50 per cent. load factor were calculated, which calculations gave the following results:

NET RATES PER KW.-HR., 50 PER CENT. LOAD FACTOR.

	Maximum	Minimum	Average
1000-kw. demand	1.246c	0.700c	0.9417c
5000-kw. demand	1.060c	0.667c	0.8464c

The demand, including the effect of power factor upon it, is just as important a part of a proper rate schedule as is the energy charge. A mill with a load factor of 70 per cent. and a power factor of 80 per cent. or better can be served at much less cost than a mill having a load factor of 35 per cent. and a power factor of 50 to 70 per cent.

Rate Schedule

Rate schedules should be as simple as possible and avoid complicated systems of rates and discounts for varied load factors and consumptions. Where the mill can so adjust its operations as to permit keeping off the central station peak there should be a lower rate than for peak service. Some of the power companies reporting charge only 50 per cent. of the peak demand rates for off-peak service only.

We recommend that in negotiations for central station power service, and in order to obtain most favorable rates to the purchaser, it be insisted that the rate schedule be divided into demand charges and energy charges; that the demand be the average or integrated peak of 15 to 30 min. duration; that the power factor be 80 per cent., with decrease or increase in the demand to be charged for accordingly as the power factor is above or below 80 per cent.; that the demand charges per kilowatt be in two or more steps; that the energy charges per kilowatt-hour be in two or more steps; that any excess demand occurring at other than the peak period of the power company's plant be charged at only one-half the demand charge normally applying for such excess if occurring on the power company's peak period. With rate schedules on the basis recommended, the mill engineer will obtain the benefits due to good operating conditions and not be obliged to pay for the poor conditions of another consumer's load.

The user of electric power is enabled to collect engineering data, such as capacity of machines, load curves, power requirements, maximum demands and power consumption, and, in addition, to provide a means of analyzing the cycles of operation throughout the plant. With such records, the central station can accurately determine the requirements of steel mills and negotiations for the sale of power are greatly facilitated.

The power requirements in steel mills range from 1000 to 10,000 kw. or more. A fair average is about 4000 kw. The load is characterized by large peaks. Where alternating-current service is used the power factor will vary from approximately 65 to 80 per cent. Large generating capacity is required to provide service of the proper regulation.

Application of Central-Station Power

In all large modern central stations, the power is generated and transmitted as alternating current at a voltage considerably higher than is permissible for use around a plant. At the receiving end of the transmission line this power must be retransformed to at least two and generally three lower alternating-current voltages, namely; 6600 or 2200, 440 or 220, and 110; and, where direct-current power is used, further transformation is required from alternating current to direct current.

The 6600-volt or 2200-volt current is used for driving the synchronous motor of motor-generator sets, the large motors driving the mills and some of the larger auxiliaries, say from 100 hp. up for the 6600-volt and 50 hp. up for the 2200-volt for driving pumps, fans, blowers, etc., in those locations where these voltages can be used without endangering life and property.

For the remaining auxiliaries the alternating-current voltage is further reduced to 440 or 220 volts. Motors wound for these voltages have a wide range of application, covering almost all classes of service in the mill, especially where constant-speed characteristics are required.

For lighting 110-volt is generally used and transformed from either of the above voltages. In all of the above transformations a certain percentage of the initial purchased power is lost, the magnitude of the losses being in the order of the motor-generator sets first, the rotary converter second, and transformers third and least.

In some contracts for central-station power the power paid for is that which is delivered to the high-tension side of the transformers connected to the transmission lines, the power being measured on the low side of the transformers, the wattmeter readings on the low side being multiplied by a constant or multiplier which takes into account the transformer losses. In contracts of this class the purchaser pays for transformation losses. In other contracts the power paid for is that which is delivered on the low side of the stepdown transformers, the power company paying the losses of the first transformation, the purchaser paying for all others.

A study of percentage losses incurred in distributing central station power from receiving station to plant feeder station busbars would indicate that in deciding on the other equipment that that equipment should be selected which would entail the least losses to the power delivered to the motors. If this was conditions we would select 6600 or 2200 volt apparatus; but physical and safety considerations limit the use of those voltages, and consequently only a relatively small number of the total motor equipment can use them.

Our next choice, so far as efficiency goes, would be for the 440 or 220 volt alternating-current auxiliaries. These can be used in almost all applications where direct-current power is used, the exceptions being where variable speed and dynamic braking are required. The direct-current motors are so much better adapted for this class of service that the disadvantage of greater conversion loss is more than compensated for by their flexibility and adaptability.

The ratio of alternating current to direct current used will vary greatly in different plants, depending on so many factors that no standard can be set. In general, in those plants where power is purchased and where there are many cranes and variable speed drives direct current will probably predominate for auxiliaries about in the ratio of 60 per cent. direct current to 40 per cent. alternating current for voltages of 440 alternating current or less and 250 direct current.

The alternating current is suitable for driving fans, pumps, hot saws, cold saws, conveyors, straightners, drill presses and possibly some mill tables. Alternating-current motors are not favored for table drives, for the majority of them require a wound rotor type of motor, which, as a rule, is more difficult to repair than a direct-current armature, and the direct current is better adapted to heavy table work. Direct current will be used for cranes, tables, charging storage batteries, electrolytic work and variable speed motors, especially those used for driving machine tools. The type of winding to use will depend on the nature of the load and the results sought.

In general, the use of alternating-current motors is recommended where constant-speed, non-reversing conditions obtain, and the direct current where large starting torque, quick-reversing and acceleration, variable speed or dynamic braking are required.

THE ELECTRIC FURNACE

THE use of the electric iron and steel furnace has made exceptional progress under war conditions. When the demand for steel exceeds the supply, and junk piles are searched for available metal, the electric steel furnace experiences a boom because it is capable of making an excellent quality of steel from a comparatively poor quality of iron and steel scrap. As more and more careful conservation of natural resources becomes necessary, electrical processes steadily gain ground because of their greater economy in the use of raw materials.

At the beginning of 1916 there were 73 electric steel furnaces in the United States producing 100,000 tons per year; to-day there are over double this number with a yearly production exceeding 1,000,000 tons. These furnaces require in the neighborhood of 150,000 h.p., one of the largest single installations having a total capacity of 70 tons in units of 15 and 20 tons.

The relative growth in Canada is even greater; electric furnace steel production has increased from 61 tons in 1915 to 43,790 tons in 1916. In Montreal alone, according to figures supplied by the Civic Investment and Industrial Co., there are in operation, or being installed, 11 electric furnaces requiring a total of 17,000 h.p. The larger furnaces, when fed from high tension lines and properly controlled, offer no serious disturbances to their circuits, but a plant of less than 5,000 h.p. capacity should not attempt to carry single phase furnaces of 400 k.w. or over. The possibilities as an off-peak load are good as the usual length of heat is only about three hours, which condition would adapt itself excellently to a limited service operation. The furnaces can be operated economically at from 1c. to 1½c. per k.w.h., and such rates are now in force in many Canadian centres for ordinary service such as house lighting.

AUTOGRAPHIC TEST INDICATOR

A DEVICE termed an autographic load extension optical indicator has been designed by Professor W. E. Dalby, of London, in the course of efforts to improve existing mechanical devices for getting load extension diagrams of metals. The extension of the steel bar is measured by the movement of a spot of light focused on the camera screen, and the inertia of the heavy steelyard and jockey weight is eliminated. Light mechanical linkage is used to convert the extension of the specimen into the small angular movement of a light mirror within the instrument.

The instrument is self-contained and its principal element is a hollow bar of fine steel about a foot long. This bar, called the weigh bar, hangs by one end from the upper shackle of a vertical testing machine. The other end is coupled to the specimen bar to be broken, and the lower end of the specimen bar is secured in the lower shackle of the testing machine. Weigh bar and specimen bar are like two links of a chain stretched between the shackles of a testing machine, so that the pull through the shackles is applied equally to each of the bars. The cross sections of the bars are so proportioned that the pull applied through them is ultimately able to break the specimen bar without loading the weigh bar beyond its elastic limit. The stretch of the weigh bar is used to determine the load passing equally through it and the specimen bar.

The novel feature of the instrument lies in the optical method of measuring the extension of the weigh bar and the extension of the specimen bar, and in recording both photographically. The instrument is described as "autographic," because the record of load on. and extension of the specimen bar, is made by the movement of a spot of light over a photographic plate held in a camera attached to the weigh bar itself.

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PRINCIPAL CONTENTS

INDUSTRY AND CONSCRIPTION

THE announcement by Sir Robert Borden soon after his return from England that conscription would be resorted to at an early date to maintain the forces of the Dominion at the required strength was not unexpected by observers of events. Chief among such are the manufacturers, especially those in the metal-working industries, and their reception of the announcement has not been such as to occasion grave fears of industrial dislocation and its attendant results. Conscription is far more likely to affect those strata of society which are unconnected with foundry and machine shop enterprises. The call for labor to carry out the shipbuilding program alone and into which a variety of foundry product enters, will place a considerable number of manual workers outside the scope of any enactment. The availability of numbers of women operators due to recent decrease of shell production will in some measure make good the possible drafting of operators from a number of non-essential trades. The conscription proposition should be accepted by the country as final evidence of the seriousness of the war, and if accompanied by reduction of extravagance, and increased production of necessities, with proper control of same, the future results of the present step can be but for the best, industrially, financially and politically.

CANADIAN STEEL CORPORATION ACTIVITY

THE decision of the Canadian Steel Corporation—United States Steel Corporation subsidiary, to go ahead with a nine million dollar section of the big plant projected and provided for at Ojibway, Ont., is of more than passing interest, and may be taken as not only justifiable from an emergency viewpoint, but as an indication that post-war opportunities, arising in and to be developed abroad from this Dominion, are of the most assured and substantial nature. All of our steel mills are booked far ahead with orders for munitions steel, even to a degree involving further extension of plant and increasing existing equipment. The rolling of steel rails for which two of our mills are fully equipped is a matter of considerable urgency, and equally so is that of the rolling of ship plates and shapes to meet our shipyard needs.

MODIFICATION OF WAR TAXATION IN ORDER

JUDGING by the urgent need of ships to replace those sunk and being sunk by enemy submarines and mines, there is great opportunity for the establishment of additional shipbuilding plants in Canada, more especially on her ocean and ocean waterway shores. Quite a number of shipyards have been projected and a good deal of preliminary work done with reference to them, but there is an apparent tendency for all of them to more or less "hang fire." Lack of Government support, lack of equipment and structural material readily available, and the recent War Tax announcement, are individually and collectively responsible for the hesitancy to take definite action, and on the latter of the three deterrents—the War Tax business profits, there is good reason to believe that considerable onus lies. Shipbuilding development means material enlargement of the scope of iron and steel foundry practice.

The enormous tax which is proposed upon the profits of some incorporated companies, acts as the greatest discouragement to initiative and to production that could well be devised. Business men to-day are prepared to assume heavy burdens and to pay large taxes. Men, however, who are responsible for the industrial investment of money cannot assume a responsibility which places upon them the possibility of large losses on the one hand, if unsuccessful, and on the other hand, of only a fraction of the profits gained if the operations succeed. We want to encourage production on the farm to-day. We want to encourage production in the factory. We want to encourage the reinvestment in improved plant by manufacturers. We want also to encourage the introduction of fresh capital into Canada and the conservation of her resources.

In this tax on profits the Minister of Finance has gone too far in one direction. He must modify it before it is too late, and if he finds it necessary to replace some revenue which he thinks is going to be lost thereby, then put some tax upon those articles, the consumption of which should be restricted in Canada to-day. Until some material modification of the War Taxation as it applies to business enterprise, established or projected, is made effective, we may look to see not only initiative chilled as regards shipbuilding, but relative to all forms of industry, manufacture, and resources development.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

USE OF GLUE IN STEEL POLISHING INDUSTRY

By H. O. Anderson.

THERE are a great many varieties of glue upon the market, but the glue used in the polishing trade is a product of the action of heat and water on nitrogenous animal tissues. This is known as animal glue and more often simply as ground glue. Glue is made from the by-products of the packing houses by boiling the animal tissues with water. From the fact that there are so many materials from which glue is made and for the fact that it is only a water solution, various lots of the same kind of glue can very considerably. Too much care, therefore, connot be exercised in becoming familiar with each shipment before putting it into actual use.

There are many reasons why two lots of glue from the same dealer and of the same kind might vary considerably as made, but aside from these, from the time a lot of glue has been received into the polishing room to the time it has been incorporated with the abrasive upon the polishing wheels, there are fully as many causes for variations. The use of glue in a polishing room is, therefore, a most important operations, not only from the point of economy but also for good results, and elimination of complaints on abrasive grain and on glue.

Some may think that to prepare a solution of glue, all that is required is to throw a small amount of the ground glue in with any portion of water, heat up to boiling and the glue is ready for use. Glue prepared in this manner would cause complaints against the glue dealer on the very first day of its use, or. on the other hand, the dealer of the abrasive grain would receive a complaint that the glue does not hold the abrasive to the wheel.

Pulverized Sheet Glue

If glue is received in the sheet form, it is always well to pulverize it. Ground glue absorbs water and melts in the heating so much sooner that the time spent pulverizing is well paid for. The amount of water to be added to any portion of glue should be determined in the cold water soak, and this is very important, because the water absorption, the tenacity of the belly and the viscosity of the solution are very important factors in obtaining the best holding power with the least amount of glue. If the flake or sheet glue is not powdered, it requires a longer soak. The same consistency of a glue solution cannot be expected to work properly with coarse abrasive grain and with the finer sizes. The finer the abrasive grain the thinner should be the glue solution.

It is a well known fact that the weight of ground glue varies considerably, which is a very good reason why the glue and water to be mixed should be carefully weighed. Some glue mixers fail to weigh these materials, believing that by measuring the glue and water the same consistency can be obtained which, of course, is not true. It is very important that the proportion or weight of glue and water be correct in the cold soak, because, after heating, if the solution is found too thin and more glue is added, or, if on the other hand, the solution is thick and more hot water added, very unfavorable results must be expected.

Soaking and Heating

The best time to make the cold water soak is at night, then allow to stand in a fairly cool place until morning, when it is ready for the heating process. Care must be taken that this solution does not freeze during the night soaking. The glue pot should be thoroughly cleaned out in the evening, scoured if possible, so that no dried or overheated glue remains in it to contaminate the fresh solution. This pot should be made of copper, brass or aluminum. Under no circumstances should iron glue pots be used, as these corrode considerably, due to the action of the water, and the acid in the glue, so that in the long run the iron pot, although cheaper at first cost, will be the most expensive.

The most expensive glues can very easily be so spoiled that they would not be as satisfactory as the very cheapest glue upon the market. The greatest care in glue preparation should be during the heating operation. Never allow direct heat to come in contact with the glue pot, either as a coal fire or live steam. The proper way of heating a glue solution when glue converters are not in use is to have the glue pot surrounded by a water jacket, then either heating the water with live steam or an electric coil. If an automatic temperature controller is not used, a thermometer is recommended in the glue solution and under no circumstances should the temperature exceed 160 degs. Fah. The heating should be conducted so that the glue solution averages from 150 degs. to 160 degs. Fah., for 1½ to 2 hours, after which it can be cooled down to 130 degs. to 140 degs., and allowed to remain in this condition while being used.

If it is not necessary to continue the heating of the glue all day, a better method is to make up only such amount as is to be used immediately. Under no circumstances should more glue be made up than can be used in one day. A glue that has been allowed to stand for 10 hours. then cooled over night and reheated in the morning is absolutely of no value. If a glue is allowed to heat at the higher temperature, that is from 160 degs. to 170 degs. Fah., the value of this glue is reduced about one-third to one-half cent per pound per hour. Therefore, if conditions are such that the glue must be kept warm during the entire day is should not be at the upper temperatures. Then, too, glue is one form of gelatine and gelatine is the medium in which germs are multiplied very rapidly. Deterioration of glue for this reason will result from prolonged heating. Where the glue dissolvers are at hand it is always recommended that these be used so that fresh solutions of glues can be quickly made up.

Another factor which enters into the preparation of glue in open glue pots is the evaporation of water. If a great deal of the water has evaporated so that the glue solution has become thicker, after several hours of heating, it is a very simple matter and a custom in some polishing rooms to add water. This is detrimental to the entire solution and it is also very unsatisfactory to use the thickened solution. Therefore all glue pots should be covered.

After the glue has been applied to the polishing wheels, which should have been heated before the application, the coating of abrasive, which has also been heated, is to be applied. If a warm solution of glue is applied to a cold polishing wheel, the chilling effect of this wheel will cause the glue to partially set or harden and thereby not hold the abrasive. If, on the other hand, the abrasive is in the cold state, this will also have a chilling effect upon the glue, and before a proper combination between the two is effected, the glue is so partly hardened that the abrasive will very easily fall off in the polishing operation.

After the wheels have received the applications of glue and abrasive, they should be dried for at least ten hours before using. This drying must not necessarily be conducted in a very hot room but, if fairly warm, they can be allowed to lay around in the polishing room. The temperature and humidity of a polishing room will change the action of the polishing wheels considerably, therefore the condition of the atmosphere in the polishing room should be kept as constant as possible so that like polishing conditions can always be expected.

Glue Pot Cleanliness

The most important things in a polishing room are cleanliness of the glue pot, accurate weight of glue and water in a mixture and exceedingly careful consideration in the heating of the glue solution.

Do not expect to get good results from a glue which has been mixed in any proportion with water heated up rapidly to very high temperature, or by using a glue which was used a day or two before.

Do not expect to use glues that have been heated with water less than one to two hours unless glue converters and dissolvers are in use.—Grits and Grinds.

THE ENAMEL WARE INDUSTRY II*

THE processes and methods that have been described up to this point are those commonly used in applying liquid enamel to sheet metal cooking utensils and other similar objects. Liquid enamel is also used on various other objects, however, some of which are made of cast iron. These include bedsteads, gas ranges, and refrigerators; hospital equipment, such as tables, chairs, trays, and surgical instrument cases; also tanks of various kinds, and other articles. These are enameled by the dipping, slushing, or spraying methods, and also, in some cases, by painting with hand brushes. The enamel is baked on in every case, however, and the dangers are practically the same as those described above, except that they are somewhat increased by reason of the greater weight and bulk of the objects. Except for the first coat, a process entirely different from any of those previously described is used for enameling cast iron bath tubs, lavatories, sinks, and other similar pieces of sanitary ware. This is a "dry" process, in which powdered enamel is sprinkled or sifted upon the ware while it is red hot.

Preparing Castings For Enameling

Castings that are to be enameled are not cleaned by pickling, in the way that sheet-metal is cleaned. After removing the sand that adheres when the ware is taken from the mold, the castings are gone over with an emery wheel mounted on a flexible shaft, which grinds off all fins and small protuberances. The ware is then finally cleaned by means of a sand blast. The men should wear eye protectors while grinding, and it is advisable for them to wear respirators also. The sand-blasting operations should be carried on in the most approved manner. Special dust-proof rooms should be provided for this work, having gratings in the floor through which the used sand may be drawn off by exhaust fans into suitable collectors, and recirculated. The operators should wear special dust-proof helmets or hoods, into which a plentiful supply of air is introduced from the outside, by means of hose.

After being thoroughly cleaned by the sand blast, the ware receives its first coat of enamel, which is applied wet, and while the ware is cold, by the slushing process or by means of a compressed-air atomizer. After the enamel has become thoroughly dry the object that is being treated is placed in a furnace or oven heated to a temperature of approximately 1,800 degs. Fah., where it remains for about fifteen minutes, or until the enamel is thoroughly baked on. It is then removed from the furnace, and while it is still at a red heat, dry, powdered enamel is sifted or dredged over its surface, after which it is returned to the oven and baked again for fifteen or twenty minutes. This process is repeated until three coats have been applied, or until the desired finish is obtained. A more detailed description of these processes is given in a subsequent paragraph.

Method Dangerous

This method of applying enamel is far more dangerous than the other methods that have been described. The mixing, grinding, and applying processes all cause a great deal of dust, which in itself is harmful. The principal objection, however, is that the enamel usually contains a large amount of lead, which is one of the most important of the industrial poisons. It is difficult to determine just how much lead is used in enamel, because of the secrecy maintained by the manufacturers in connection with their formulas; but it may be said that the amount varies from a minimum of about five per cent. to a maximum of about twenty-five per cent. It can easily be seen that the health of the men is seriously menaced when they are obliged to work constantly in an atmosphere loaded with dust of this nature.

In some foreign countries leadless enamels are used, but these have not been extensively adopted in the United States. Most of the lead poisoning in our factories is due to lax methods, however, and it might be greatly reduced by taking suitable precautions to prevent the dissemination of the lead-bearing dust. The ingredients should not be mixed by shoveling them from the various bins and re-shoveling them upon the floor. This method is responisble for many cases of lead poisoning, and it should be discarded and dust-proof mechanical mixers substituted. The storage bins should also be located on the floor above the mixing room, and dust-proof chutes should lead from them to the bin in the mixing room. A properly designed exhaust hood over this latter bin, with a strong draft, would then dispose of the greater part of the dust that is produced.

Mixer Discharge

The mixer should discharge into a suitable dust-proof cabinet containing a truck which can be transferred to the fritting oven, after the dust caused by emptying the mixer has settled. Similar precautions to keep the dust at a minimum should be observed in connection with the grinding operations.

In the enameling room of a modern plant, large ware first receives a "ground" or "slush" coat of enamel, and is then put into an oven where the enamel is baked on. The doors to the furnace or oven are raised or lowered (usually by compressed-air arrangements), and the ware is inserted and withdrawn by means of a strong iron fork about 25 feet long, which is suspended, at about the centre of its length from a trolley running on an overhead rail. After being properly baked, the ware is withdrawn from the oven, and is usually placed in a cradle which is provided with an ingeniously-arranged system of compressed air cylinders so that it can be revolved and tilted to any desired position. In some of the older plants, however, this modern method has not been adopted and in place of the cradle just described a sort of turntable is used, the operation of which is much more laborious.

While the ware is still at a dull, cherry-red heat, the enameler shakes or sifts the powdered glaze over it, the helper meanwhile turning the piece about so that all parts will be coated. The powder fuses immediately upon striking the hot metal, and adheres to it. Sometimes small hand-sifters or dredges are used, and sometimes larger ones are employed, having plungers or hammers operated by compressed air or electricity, to cause a free and constant flow of the powder. The men engaged in this work are exposed to the intense heat from the furnaces and the red-hot ware under treatment, as well as to the dust hazard, and they should therefore wear suitable masks or shields to protect their faces and eyes. A large, sheet-iron shield is sometimes suspended from the trolley by which the fork for holding the ware is supported, and arranged in such a way that it can be shifted about by the enameler, to protect him from the heat. The problem of disposing safely of the dust is a serious one when large, massive ware is being treated. Great volumes of heated air rise from objects of this kind, carrying considerable quantities of dust with them; and when the heated air cools in the upper part of the room and loses its velocity, the dust that it carried up falls again, everywhere, like fine snow.

Exhaust Hood Feature

An exhaust hood, to deal with a dust problem of this kind at all adequately, must have an outlet pipe of extra large size, and must be served by a fan of unusual capacity, capable of carrying away all the heated air that rises from the object being treated. Even with an apparatus of this kind it is hard to remove the dust with any approach to completeness, when working upon a piece of ware as large as a bathtub, because the hood, unless it is of prohibitive size with a draft of corresponding magnitude can hardly take care of all parts of the object effectively. The safest and best procedure is to enclose the ware in a metal cabinet, the front of which is p—

*From the Travellers' Standard.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers 1916-1917.

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PLACE AND DATES OF MEETING.

The Occident Hall, corner of Queen and Bathurst Streets. Fourth Thursday of each month, at 8 p.m.

vided with openings for the operator's arms, and with a large pane of glass through which he can look. An exhaust pipe for removing the dust is attached at the top or back of the cabinet, and at te side of it there is a slot through which tongs can be introduced for moving the red-hot ware, which rests upon a turntable inside.

Another exceedingly disagreeable and harmful operation is that of removing the dust that accumulates on the walls, ceilings, and beams of the enameling room, and, in fact, all parts of the plant. In many cases the dust is blown down by compressed air, and is swept up with brooms after it has settled on the floor. When this method is followed, the air sometimes becomes so filled with dust that it is almost impossible to breathe. Such conditions may be eliminated by removing the dust by means of a vacuum apparatus, or washing it off with a hose; and there appears to be no sufficient reason why one of these methods cannot be adopted in almost every place.

A great deal remains to be done in the way of safeguarding the men employed in the enameled-ware industry, and particularly in branches of it in which the dry-powder method is employed. Most essential of all is adequate protection against lead poisoning. There appears to be no insuperable necessity for using lead in enamel, in poisonous forms or quantities. Various foreign countries have legislated poisonous lead-enamel formulas practically out of existence, and satisfactory substitutes have been found. In fact, the claim is made in Germany that leadless enamel is superior. Strict regulation of the industry is maintained in Great Britain as well as in Germany and the lead hazard is considered negligible in both of these countres.

"THRIFT" IN THE PLATING DEPARTMENT

By Abe Winters

PROCURING the best grade of supplies for the plating room is not only advisable but often essential, if satisfactory results are expected. There are, however, many opportunities for the practice of economy in the use of these supplies which are thoughtlessly ignored by many men in charge of plating departments. There has never been a time in the history of commercial electro-plating when careful attention to needless waste of money in the utilization of plating room supplies was more necessary than now. The uncertainty of future conditions relating to raw materials and the possibility of a still greater uncertainty with reference to labor, makes the subject of particular interest to manufacturers of plated metal goods.

Recent visits by the writer to various plants engaged in nickel, copper, brass, and silver plating, have revealed some very startling facts. Plants engaged in finishing various parts of munitions which require an electro deposit are easily in the lead in the heedless waste of materials. No one seems to be responsible, no one seems to care, the cry is for output and the cost is of minor consequence. The indirect result of this extravagance is a higher price to the manufacturer of ordinary ware, who cannot afford to purchase his supplies in large quantities. The market is short and the plater has done his share to make it so. Now this waste is uncalled for, and it does not hasten or improve the output. Munition plants are not the only ones heedless in the use of plating materials, for a very large percentage of the firms doing general plating could reduce operating expenses to a much lower figure by the application of a little thought and attention.

Stringing and Cleaning the Work

In small shops where an electric cleaning tank has not been instituted, owing to cost of tank and fixtures, a very handy substitute may be made from a good barrel or old steel drum. A negative rod and a piece of sheet iron in case a wooden barrel is used, are the only requisites aside from a few feet of connecting wire to reach the dynamo mains. This apparatus will prove very useful for cleaning all such work as usually requires a vigorous scouring, and the use of pumice and brushes.

An acid dip used on small iron and steel parts direct from the still cleaning solution is a labor saver, and eliminates considerable expense in brushes and scouring materials, besides doing the work quicker and more efficiently than the average plating room helper who scours a string of parts in a careless, mechanical manner while carelessly carrying on a conversation with a fellow workman regarding the hair-breadth escape of the latest moving picture heroine, or the respective ability of a members of a local baseball club.

The use of copper wire for stringing has been considerably reduced by the use of suitably formed holders made of brass wire. These holders may be kept in good shape for an indefinite period by stripping in a solution consisting of equal parts hydrochloric acid and water, and by having broken parts replaced as soon as noticed. Nearly every plant doing sheet metal stamping can supply their plating department with all the necessary materials for making holders without other expense than soldering the pieces into proper form. Sheet steel stamping scrap may be used as well as brass, and if the distance from cathode rod to surface of solution does not exceed five inches, the extra power required to plate a hundred square feet of surface will not amount to enough to warrant the use of brass in preference to steel of ample cross sectional area.

Nickel Plating

In the operation of either nickel, copper, brass, zinc, or tin plating solutions, the cheapest source of metal is the anode, and probably the more prominent metal in the list when referring to replenishment of the bath by metallic salts, is the nickel salt. The maintenance of proper metallic content in the solution by almost daily additions of nickel salts is a fine source of revenue for the supply house, but a costly method of getting results in the plating department. A nickel solution operated at 6 degrees Beaume, with a current density of from 4 to 6 amperes per sq. foot, and an average duration of plating approximating 1 hour to 1½ hours is a slow process of coating metal for any purpose, not to speak of labor required to actually keep things moving. A slow process in plating is necessarily a costly process, therefore if we increase the rate of deposition in the baths we decrease the expense of the operation in a very noticeable manner, and increase the necessity for greater activity on the part of the employees directly or indirectly concerned. By increasing the rate of deposition merely 50 per cent., we double the output in a given time with practically no increase in the cost of labor, as the same staff can handle twice the ordinary amount of work if a systematic method of receiving and delivering the work to and from the department is established.

Furthermore, if we increase the current density to ten times the original figure and produce in 5 or 6 minutes a nickel deposit which is superior in many ways to the slowly formed deposit, we can reduce the quantity of solution in operation, also reduce the number of anodes required for a given amount of work by the slow method. Certainly we will use practically the same weight of metal in a year as by the slower method, but the expense of placing it where it will yield a profit is reduced. Stock required for actual operation is often less than 25 per cent. of that required in process by slower method.

For example, if five tanks amply equipped with anodes, are in constant use by a slow process and the rate of deposition is increased to five times the former rate, the number of tanks required for same volume of work in same period of time could be reduced to one. The ampere consumption would not necessarily be greater in the one tank operated at high current densities than in the five tanks as originally employed, for the current would be regulated by the load treated at one time.

In order to economize on copper bus bars, the old bars would be arranged in parallel. If we place a lead steam coil about six inches from the bottom of the nickel tank, and along the sides, and raise the temperature of the solution from room temperature to 80 or 100 degrees, we can increase our output from the one tank at least 100 per cent. more than by merely increasing the concentration of the solution. Nickel deposits of any appreciable thickness obtained from cold solutions of ordinary density are much more liable to fail or prove defective than a ten or even twenty minute deposit obtained from a concentrated nickel solution operated hot. Any increase in the cost of labor when changing from cold to hot solution would be consequent upon the shape or size of the article being plated. If the nickle tank is lined with good asphaltum there will be very little expense attached to the change. If lead lining is required, the initial cost will naturally be greater, but even at present prices the adoption of hot nickeling will be found to be an economical move. One hour nickel deposits often prove non-adherent owing to the absorption of hydrogen during deposition, which in turn is the result of the passive condition of the anode. A twenty-minute deposit from a hot nickel solution is not as liable to prove non-adherent because of decreased absorption of hydrogen resulting from increased anode corrosion. We mention a twenty-minute deposit because there are very few requirements which are not adequately met by a twenty-minute deposit from a hot nickel solution operated at permissab'e current densities.

If nickel sulphate is added to a good working double sulphate nickel solution until the density is approximately 13 degrees Beaume, and 4 oz. of magnesia sulphate and 4 oz. boracic acid be added for each gallon of solution, the whole being stirred thoroughly, allowed to settle, and then be heated by means of a lead coil, as mentioned, to a temperature of 80 degrees Fah., and the solution operated with a current of 50 amperes per square foot, fine adherent deposits of good color which will finish easily to a beautiful luster, may be produced in five minutes. This five-minute deposit will prove equal to the average one-hour nickel deposit obtained in the double sulphate nickel solution operated cold, when subjected to corrosion, friction or acid tests. It will prove superior to the average one-hour nickel deposit from double sulphate solution operated cold, when subjected to bending, hammering or twisting tests. With lead lined tanks and ample bus bar equipment , current densities between 200 and 300 amperes per square foot can be used at temperatures ranging from 125 to 150 degrees Fah. To prepare a new bath for hot nickeling we recommend the following:—

In each gallon of water dissolve 2 pounds of nickel sulphate, and 2 oz. of nickel chloride. Stir well and neutralize with nickel carbonate then add 4 oz. of boric acid per gallon of solution. In lead-lined tanks this solution is capable of producing splendid white, firm, adherent deposits on copper, brass, iron or steel articles of uniform shape, with current densities approaching 1,000 amperes per square foot. Anode containers of coarse canvas are advisable when this rate of deposition is employed.

Now the point we wish to impress upon the reader is the excessive cost of operating cold nickel solutions with low current densities. If you find it impossible to adopt a hot nickel solution at this time, there is much to be gained by increasing the concentration of your present solutions by the addition of nickel sulphate as heretofore mentioned, and operating the solution cold with an increased current. The maintenance cost will be no more than with a bath of lower concentration, and the output will surprise you. Try it in a small way at first, if you are skeptical. Naturally there are a few details relating to hot nickeling which will require special attention.

Do not use ammonium salts in the solution, they increase the liability of crystallization.

Do not attempt to plate five square feet of surface with 200 amperes per square foot in a tank which is connected to the dynamo mains by a one half inch rod. Be sure your bus bars and tank fixtures are of sufficient cross sectional area to conduct the necessary current.

Do not permit the solution to become heated above a reasonable temperature. Turn the steam off a little early rather than a little late. One tank efficiently operated as we describe may often do the work formerly plated in three to five tanks and in such cases the bath is placed closer to the source of current, and the resistence of the external circuit greatly lessened.

Copper and Brass

Copper and brass solutions may be managed in very similar manner with a corresponding increase in output. The maintenance cost is greater for hot cyanide baths than for cold baths owing to more rapid decomposition of the salts and less by evaporation. If a cold cyanide copper solution is used for deposits thicker than a mere film, it is economy in time and supplies to install an acid copper bath to produce the heavier deposits; the upkeep of acid copper solutions is small compared to cyanide copper solutions. Brass baths should not be loaded with metallic salts in excess of actual requirements. Keep the cyanide content sufficient to maintain clean working anodes and a uniformly colored deposits, and the metallic supply will automatically regulate itself to a great extent. Care in adding zinc salts is specially to be borne in mind. By using two-thirds copper anodes and one-third zinc anodes, alternately arranged in the solution, and an occasional addition of one-half oz. of white stick caustic potash per gallon, and operating the solution at about 80 or 100 degrees Fah., the deposits will form rapidly and be of good yellow color, firm, adherent and hard, yet smooth and easily finished by buffing. By using copper and brass sheet scrap, scrap wire, punchings, trimmings from castings, etc., suspended from the anode rod in the copper and brass solution, either in thin sheet lead containers or riveted in convenient form, a very large amount of metal can be saved from the scrap heap.

The adoption of several of the ideas mentioned in this paper will never be consummated by the average man in charge of plating departments unless he is prompted to a certain extent by the superintendent or manager. With all due credit to the few progressive platers who are conscientiously doing all they can to economize, we feel justified in saying that the majority of men actually responsible for any innovation in plating practice as found to-day among the industries are the officials of the respective concerns. The plater does not trouble himself to investigate economic ideas, particularly if the process is liable to incur additional responsibilities. Any approaches made by the management should be conducted in an encouraging rather than in a fault-finding manner, as the latter will be strongly resented by men whose intelligence is sufficient to enable them to efficiently carry out any radical changes in the administration of plating-room affairs. The use of hot plating solutions or any increase in the rate of depositions of the metals frequently makes it possible to reduce the working hours of the department and the pay-roll without interfering with the output. A reduction of one hour per day will often mean a considerable saving in a year, and ways and means to effect these reductions in operating costs are incorporated in the one word—"thrift."

Questions and Answers

Question.—I am operating an arsenic black nickel solution. The work comes out of the bath with a smoky surface. At times I cannot get a color beyond a mere smudge. Please let me know what you think is wrong with the solution.—E.V.A.

Answer.—No doubt you have some good reason for maintaining an arsenic black nickel, but possible you do not know that you can duplicate the product of your arsenic bath with one more easily controlled. When your arsenic black nickel solution begins to plate smoky, it indicates that it has become depleted of arsenic by continual use. The remedy is as follows: Dissolve from two to three pounds of white arsenic in a gallon of chemically pure hydrochloric acid. This operation will require heating the acid over a sand or hot water bath. Add the solution of arsenic in acid to the black nickel solution—a small quantity at one time, stir well and remove a portion in a glass beaker or jar to note turbidity. Continue the addition of arsenic solution until the black nickel solution becomes clear. After becoming properly balanced, the bath requires no additions other than arsenic prepared as above; the additions may be required very frequently dependent on volume of work.

* * *

Question.—What are the proper proportions for an ammonia copper dip.—M.A.B.

Answer.—Carbonate of copper-8 oz., 26 per cent. ammonia—1 gallon. Stir thoroughly, add ½ gallon warm water and 8 oz. carbonate of soda. Clean the brass as for plating a high luster gives best results. Rinse, dry, lacquer.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON

Grey Forge, Pittsburgh		$40 95
Lake Superior, charcoal, Chicago		50 25
Standard low phos., Philadelphia		75 00
Bessemer, Pittsburgh		45 95
Basic, Valley, furnace		42 00
	Montreal	Toronto
Victoria	.....	50 00
Hamilton	.....	.....

FINISHED IRON AND STEEL

Iron bars, base	$5 00
Steel bars, base	5 25
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 50

METALS

Aluminum	$68 00
Antimony	30 00
Copper, lake	37 00
Copper, electrolytic	37 00
Copper, casting	36 00
Lead	13 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	79
Tin	66 00
Zinc	12 00

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$22 00	$22 00
Copper, crucible	26 00	27 00
Copper, heavy	26 00	26 50
Copper wire	26 00	26 50
No. 1 machine composition	21 50	22 00
New brass clippings	18 00	19 00
No. 1 brass turnings	16 00	16 00
Heavy melting steel	19 00	17 00
Steel turnings	8 00	8 00
Shell turnings	12 00	12 00
No. 1 machinery cast iron	22 00	25 00
Malleable scrap	17 00	20 00
Pipe, wrought	14 00	9 00
Scrap zinc	8 00	9 50
Heavy lead	10 50	19 75
Tea lead	7 50	7 00

COKE AND COAL

Solvay foundry coke	$10 90
Connelsville foundry coke	....
Steam lump coal	8 50
Best slack	8 05

Net ton f.o.b. Toronto

BILLETS

	Per Gross Ton
Bessemer billets	$90 00
Open hearth billets	90 00
Forging billets	110 00
Wire rods	85 00

F.o.b. Pittsburgh

PROOF COIL CHAIN

B

1/4 in.	$9 75
5-16 in.	9 40
3/8 in.	8 65
7-16 in	7 45
1/2 in.	7 25
9-16 in.	7 25
5/8 in.	7 15
3/4 in.	7 05
7/8 in.	7 00
1 in.	6 90
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS

Solder, guaranteed	0.41
Babbitt metals	16 to 65
Putty, 100-lb drums	4 35
Red dry lead, 100-lb. kegs, per cwt.	13 87
Glue, English, per lb.	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	69
Linseed oil, boiled, single bbls.	1 40
Linseed oil, raw, single bbls.	1 43
Plaster of Paris, per bbl.	2 50
Plumbers' oakum, per 100 lbs.	9 00
Lead wool, per lb.	15
Pure Manila rope	33½
Transmission rope, Manila	43½
Drilling cables, Manila	38½
Lard oil, per gal.	1 45

SHEETS

	Montreal	Toronto
Sheets, black, No. 10	$7 75	$8 60
Sheets, black, No. 28	7 50	8 15
Canada plates, dull, 52 sheets	8 50	8 50
Canada plates, all bgt.	9 50	9 50
Apollo brand, 10¾ oz. (galvanized)	7 25	7 25
Queen's Head, 28, B.W.G.	7 75	7 75
Fleur-de-Lis, 28, B.W.G.	7 45	7 35
Gorbal's best, No. 28	8 25	7 50
Colborne Crown, No. 28	8 00	6 75
Premier, No. 28, U.S.	8 30	9 70
Premier, 10¾ oz.	8 60	10 00

ELECTRIC WELD COIL CHAIN B.B.

3-16 inch	$10 20
1/4 inch	7 80
5-16 inch	6 90
3/8 inch	6 00
7-16 inch	7 65
1/2 inch	7 45
5/8 inch	7 25
3/4 inch	7 15
7/8 inch	7 00
1 inch	6 85

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, net; B and C, 20 and 5%; cast iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples, 72½; malleable, lipped union, 60.

ANODES.

Nickel	$0.50	to	$0.54
Cobalt	1.75	to	2.00
Copper	.42	to	.44
Tin	.73	to	.75
Silver, per oz.	.82	to	.84
Zinc	.16	to	.18

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 00	$4 95
Cut nails	5 00	5 00
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.11½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, acqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper carbonate, anhy	.35
Copper, sulphate	.16
Cobalt sulphase	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheels, felt, per lb.			$2.50
Polishing wheels, bullneck			1.35
Pumice, ground			.04
Emery composition	.08	to	.09
Tripoli composition	.04	to	06
Crocus composition	.07	to	.08
Rouge, powder	.30	to	.35
Rouge, silver	.50	to	.55

Prices per lb.

Toronto, Ont., May 29.—Manufacturers are feeling more than ever the shortage and high cost of raw materials while it is likely that a scarcity of labor will become more pronounced if conscription is enforced. As this is practically assured, measures will have to be adopted to relieve the situation. In regard to the shortage of raw materials there appears little possibility of any betterment in the outlook. This is particularly true of iron and steel, as the demand for these materials is increasing out of proportion to the supply. The congestion at the mills is getting more acute with no prospects of production overtaking the demand. In spite of all these handicaps, trade was perhaps never better as shown in company reports and Government returns.

Steel

War requirements dominate the steel market to such an extent that every other consideration is relegated to the background and private consumers are in a worse position than at any time since the beginning of hostilities. The congested condition of the mills in the States is getting worse and the shortage of steel is thus becoming more acute. The constantly increasing demands of the American Government are making it increasingly difficult for private consumers of iron and steel to cover their requirements. Some of the larger makers of finished products have practically had to withdraw from the market owing to the fact that Government demands have to be met first. There is no let-up in the demand for steel products. Some concerns are said to be refusing business because of the crowded condition of the mills. Premiums are being paid for good deliveries and several steel concerns who can take contracts for comparatively nearby deliveries are receiving fancy prices from consumers who are in urgent need of material. Some consumers are sending in orders for steel without any reference to price. So urgent is the need that price is a secondary consideration. Warehouse stocks are also low, being in some cases depleted of certain sizes. Dealers are substituting sizes in order to meet customers' requirements. The situation is such that higher prices on steel products are inevitable. This week prices of iron and steel bars and small shapes have advanced 25c. per 100 lbs.; these materials being now quoted as follows: Iron bars 5c., steel bars 5.25c., and shapes 5.50c base. Steel plates have also advanced, but quotations are practically nominal. Plates, ¼-in. and larger, are now 9c., heads and tank plates, 9.10c. base. The situation as regards the supply of plates is getting tighter right along and prices continue to advance rapidly. Canadian shipbuilding interests who are in the market for plates are having the greatest difficulty in obtaining material even at the fancy prices now current. It is understood that approximately 75 per cent. of the plate mill capacity in the States is being used for shipbuilding. Wrought pipe is very firm at the last advance and higher prices are likely. Prices of boiler tubes continue very firm and heavy premiums are being paid to any makers of iron or steel tubes who can ship out fairly promptly.

Prices of black and galvanized sheets have again advanced and the market is very firm. Black sheets are now quoted at $8.60 for No. 20 gauge and blue annealed $8.15 for No. 10 gauge. Galvanized sheets have advance $1, Premier No. 28 being quoted at $9.70 and 10¾ oz. at

$10. Canada plates bright are now $9.50 and dull $8.50. One reason for the advance in sheets is the high cost of sheet bars which have recently jumped up to $90 Pittsburgh. There is also a great scarcity of sheets as the American Government have taken over considerable tonnage. It is not unlikely that black sheets will be selling at $10 before the end of the year.

Arrangements are being made for the united buying of steel for the American and Allied Governments. By co-ordination in this way it is hoped that all available resources will be utilized to the best advantage. No prices have been as yet announced under the new arrangement. but it is believed that nearer current prices will be paid that were originally fixed. Prices continue to advance and it is evident that the market is still far from the turning point and that still higher prices may be expected. The chief problem for the steel mills to solve is the question of satisfying the enormous demands now being made upon them. The unfilled tonnage is piling up every day with no apparent possibility of overtaking the business. The shortage of steel is so great that consumers cannot obtain the required material and private enterprise is being interfered with. The principal price advances this week include semi-finished material. Bessemer and O.-H. billets and O. H. sheet bars are now quoted at $90 and forging billets $110 Pittsburgh.

Pig Iron

A leading domestic producer is practically sold up for this year and has booked considerable tonnage for delivery during the first half of 1918. Quotations are unchanged but firm at $50. The demand for pig iron continues heavy, but the furnaces, although operating at capacity, cannot cope with the situation. At Buffalo the market continues very strong with prices advancing. On foundry grades prices now range from $45 to $48 furnace for shipment over the remainder of the year; from $42 to $45 for shipment during the first quarter of 1918 and from $40 to $42 for shipment during second quarter.

Scrap

The scrap market is firmer with higher prices on some old materials. Consumers who had been holding off buying owing to prevailing conditions have now come into the market to replenish stocks. This situation was expected and although as a result the market is firmer, it is still unsettled. Coppers. No. 1. composition and new brass clippings have all advanced, ranging from 1½ to 2c. Heavy melting steel is strong but unchanged. No. 1 machinery cast iron and malleable scrap have advanced $3 a ton.

Machine Tools

There is no change in the situation in regard to machine tools. Local machinery houses report fair business general on lines of machine tools, but no outstanding feature. Developments in the States, however, are being closely followed as the increased activity in the trade there will affect deliveries on imported equipment. Reports from machine tool centres in the States indicate that the trade is entering another period of great prosperity.

Miscellaneous Supplies

Although there are no important price changes to note this week some advances may be looked for in the near future on account of the steady increase in cost of practically all raw materials. Current quotations are all very firm and business continues good. White lead has advanced and is now quoted at $17.50 per 100 lbs., in ton lots, with 30c. extra for less than ton lots.

Metals

While the non-ferrous metal markets are firm, the situation continues unsettled owing to the lack of definite information with regard to the American Government's requirements. On this account buying is not particularly active, the general disposition being to await developments. The American Government has appointed a sub-committee on pig tin, thus bringing it in line with other non-ferrous metals. This should do much to improve the situation in regard to this metal. Copper continues quiet, but prices are firm in expectation of heavy demand. Spelter is unchanged, but lead has advanced owing to scarcity of spot metal. The antimony situation is unchanged, but a decline in aluminum may take place as the American Government has fixed a price of 27½c. a pound as compared with 62c. prevailing in the outside market. Prices of solders have advanced due to the high cost of lead and tin. Business locally continues good with an upward tendency in prices.

Copper.—There has been no change in the copper situation and prices are firm at last week's level. It is not expected that there will be much change in the market until the American Government requirements are made known as to quantity and price agreement arrived at. It is, however, well understood that the Government needs will be heavy and also that the price will be pretty near the current outside market. The nearest copper which can be had just now from the leading producers is for July delivery, and there is very little of this now offering. Local prices are firm, lake and electrolytic being quoted at 37c. and castings at 36c. per pound.

Tin.—Although the market is a shade easier, prices are firm and underlying conditions point to renewed strength before long. The easier position in New York was due to freer arrivals of tin lately and a fair amount of metal on the way. Business has of late been quiet, there being a disposition to await developments following appointment of a sub-committee on pig tin by the American Government. Local price, 68c. per pound.

Spelter.—The market in New York is dull and unchanged. The trade is waiting to see what action the American Government may take in regard to their spelter requirements. The local situation is unchanged, spelter being quoted at 12c. per pound.

Lead.—The market is quiet but prices continue very firm. There is very little business passing on account of the scarcity of lead. The principal producers are out of the market and only lead that can be had is held by dealers who ask from 1c. to 1½c above the "trust" price; consumers are holding off as long as they can. Lead has advanced ¾c. locally and is now quoted at 14c. per pound.

Antimony.—There is no change in the antimony situation. Arrivals have been absorbed and prices are firm on the basis of current quotations, that is, 30c. per pound.

Aluminum.—There is no change in the price of aluminum, although it is understood that the American Government have fixed a price of 27½c. per pound as against 62c. prevailing on the outside market. Local price unchanged at 68c. per pound.

Solders.—The high cost of lead and tin is forcing up prices of solder. Strictly is now quoted at 38c. and guaranteed at 41c. per pound, being an advance of 2c. Prices of Babbitt metals now range from 16c. to 65c. per pound.

Foundry Supplies and Chemicals

Although there are no price changes of particular importance to note this week, there is every indication that another upward movement is getting under way. As all raw materials are getting more costly, finished goods are likewise bound to advance. The scarcity of raw materials is also affecting the price situation and is already causing considerable inconvenience to manufacturers and dealers. In this regard the outlook is not very promising and there is no sign of any relief in sight. The demand for foundry supplies continues good, but deliveries on many lines are slow. Prices of chemicals are firmly held at current quotations.

TRADE GOSSIP

Welland, Ont.—Electro-Metals, Ltd., will build additions to their plant, costing $50,000.

Three Rivers, Que.—The Three Rivers Casting Co. are building a foundry and forging plant here.

Thorold, Ont.—The Exolon Co., manufacturers of artificial abrasives, contemplate adding another unit to their plant here.

Vancouver, B.C.—Plans for the construction of a $10,000,000 iron and steel plant in the vicinity of Vancouver are being made by a group of financiers.

Port Arthur, Ont.—The Hennepin Mining Co., which was recently incorporated, will likely establish a smelter here. W. F. Langworthy is interested in the project.

Sidney, C.B.—It is understood that the Dominion Steel Corporation will start operations again at their rail mill. A considerable tonnage of rails is required for renewals for the Intercolonial Railway.

A. McL. Seeley, for several years general storekeeper of the Nova Scotia Steel & Coal Co., at Sidney Mines, has been appointed to the position of general purchasing agent, with headquarters at New Glasgow, N.S.

St. Thomas, Ont. — The Dominion Brakeshoe & Foundry Co., whose plant is being finished expects to commence operations within the next thre weeks. The local branch is the first foundry of the American Brakeshoe Co. to be started in Canada.

Canadian Des Moines Steel Co., has been incorporated at Ottawa with a capital of $100,000 to acquire and take over the Chatham Bridge Co., of Chatham, Ont. The incorporators are R. L. Brackin, B. L. Bedford and E. W. Reeve all of Chatham, Ont.

The Wheel & Foundry Co., has been incorporated at Ottawa with a capital of $25,000 to carry on the business of iron and steel founders, engineers etc. The head offices are at Toronto, and the incorporators are A. T. Thomson, W. S. Morlock and R. H. Parmenter all of Toronto.

Dominion Molybdenites Ltd., has been incorporated with a capital of $1,000,000 at Toronto to acquire and develop mineral lands and deposits. The head office is at Toronto and the incorporators are Kenneth A. McRae, William J. Lockwood and Kenneth McKay all of Toronto.

Collingwood, Ont.—William Kennedy & Sons, steel plant, is now in full operation, an important contract for their product having recently been secured. A contract has been signed by the company with the Hydro-Electric Commission for an additional 1000 h.p. for the new electric furnaces.

M. J. Butler, managing director of Armstrong Whitworth Ltd., Montreal and **D. H. McDougall**, general manager of the Dominion Steel Corporation Sidney, N.S. have had conferred upon them the honorary degree of L.L.D., at St. Francois Xavier University, Antigonish, N.S.

Dominion Foundries & Steel, Ltd., has been incorporated at Ottawa, with a capital of $6,000,000, to acquire and take over as a going concern the Dominion Steel Foundry Co., and the Hamilton Steel Wheel Co., both of Hamilton, Ont. Incorporators are, Edward H. Ambrose, Henry A. Burbidge, and John R. Marshall, all of Hamilton, Ont.

Chatham, Ont.—The foundry at the old Defiance Iron Works, which is now the Canadian-American Pump & Well Machinery Co., located on Lacroix Street. and which has been idle for several years, is again under operation under the management of Woods Bros., who for several years have operated the Ideal Foundry on Princess Street.

Almond Penfield Turner, formerly president of the Canadian Copper Co., a subsidiary of the International Nickel Co., died last month in Oakville, Ont., at the age of fifty-two, from Bright's disease. The late Mr. Turner spent most of his life in Cleveland, but was in Copper Cliff, Ont., for ten years, with the Canadian Copper Co., joining the company in a junior position and rising to the presidency. He retired five years ago on account of ill-health.

Russian Platinum Production.—According to the British Consul at Ekaterinburg, Russia, the 1916 output of platinum in the Urals amounted to 86,500 troy ounces, only about three-fourths of the output in 1915. The chief causes of the decline in the production of platinum are the shortage of labor, the difficulty in obtaining spare parts for dredges, and the exhaustion of the richer alluvial deposits. New alluvia will undoubtedly be found when extensive prospecting is resumed.

Thomas J. Dillon, whose appointment as general manager of Canada Foundries and Forgings, Ltd., is announced, has heretofore had jurisdiction only over the western plants at Welland, Ont., the Canada Forgings and Billings and Spencer. This now extends to the James Smart Manufacturing plant at Brockville. Mr. Dillon, who is also one of the directors of the company, is one of the most successful forge managers in Canada, having been associated with the business for many years and virtually brought up in it.

W. D. Jacoway has been appointed superintendent of the open-hearth and electric furnace departments at the new plant of Armstrong, Whitworth of Canada, Ltd., at Longueuil, near Montreal. He was connected with the open-hearth department of the Dominion Iron & Steel Co., Sydney, N.S., and later was with the Bethlehem Steel Co. at South Bethlehem. More recently he has been associated with C. H. Macmillan in installing and operating an electric furnace and open-hearth plant for the Canada Cement Co. at Longue Point, Que. The new plant at Montreal consists of four Heroult furnaces and two open-hearth furnaces.

Shortage of Tin Plate Affects Canneries.—Canadian canning factories are concerned over the fact that they have to depend on American companies to furnish the cans, and that this year the supply of cans in the conservation of tin, is much less than usual. American canneries are able to obtain only 40 per cent. of their usual requirements, and are intending to can only perishable goods. Where the Canadian factories will come off is not yet known exactly, but they, too, will probably be able to use tins only for exceedingly perishable products. Cardboard paper machine and other manufactured containers are being suggested for some lines.

Record Zinc Output by Smelters.—Advices have been received in Toronto from the Trail Smelter of the Consolidated Mining & Smelting Co. of Canada that the zinc refinery output has risen within the past month to a new high record at 89,000 pounds, or equivalent to about 44½ tons. Previously, a new record was created with an output of 83,000 pounds which has now been displaced. This development which is highly satisfactory to the board of directors, and should be to the shareholders, compares with a contemplated maximum output of 25 to 30 tons per day when the company undertook the production of zinc by electrolytic process.

Metal Market in New Zealand.—According to the latest published report, the metal market in New Zealand is very greatly restricted for lack of supplies, although there is not the demand for metals in general that obtained before the outbreak of the war. Building and public improvements have been curtailed materially during the past three years. There has been a fair demand for fencing and barbed wire, however, and the supply has become almost entirely exhausted. One firm reported late sales amounting to 180 tons of fencing and barbed wire received from manufacturers in the United States. This demand is liable to continue until the close of the war.

Record Demand for Steel Predicted.—Manufacturers who were present at the meeting of the American Iron & Steel Institute recently in New York were all of one opinion—that while capacity was larger than ever before, the demand was also record-breaking, and that the wants of consumers this year could not be satisfied. One of the largest subsidiaries of the U.S. Steel Corporation has notified consumers that it can make no further contracts until 50 per cent. of the orders now on the books are worked off. Many consumers want to buy steel for delivery as far forward as 1919. The steel companies will be the heaviest war tax payers this year, and the incomes of shareholders will be greatly increased. This will mean additional revenue for the Government. Steel manufacturers have been assured that nothing will be done in the way of price fixing for Government needs that will disturb their business in the least.

To Develop Canada's Fuel Supplies.—A resolution was adopted in the House at Ottawa recently reading as follows: "That in the opinion of this House, it is of great importance that the increasing demand for fuel for manufacturing and residential purposes be supplied in larger quantities and at cheaper rates than are now possible; that the deposits of bituminous and anthracite coal in Canada, located in the extreme eastern and western portions thereof, be more fully and thoroughly utilized for the benefit of the residents of the central Provinces; that the enormous peat and lignite deposits so widely distributed through all portions of the Dominion be also scientifically made use of for the same purpose, and further, that the Government of Canada make a special effort, through legislation and otherwise, to have these valuable deposits more fully and rapidly developed, to the end, that the people of Canada may be adequately provided with these fuels for industrial and residential purposes."

CATALOGUES

Buffing Machinery.—The Chase Turbine Mfg. Co., Orange, Mass., have issued a bulletin describing and illustratin describing and illustrating two styles of buffing and polishing machines. A specification is included covering the principal features.

CHILLED SHOT DIAMOND GRIT

The two best Metallic Abrasives
manufactured for SAND BLAST purposes

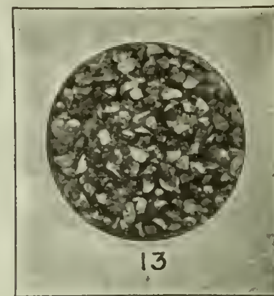
12

Actual Size

Since 1887 we have been continually manufacturing our abrasives—which are used the world over.

Use the dustless and economical metallic abrasives for cleaning iron, steel, malleable brass and aluminum castings.

Send for FREE SAMPLES and our LOW PRICES
PROMPT SHIPMENTS ALWAYS!



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Actual Size

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To do this simply give us an outline of your grinding operation and we will furnish the **best possible wheel** for the purpose.

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for Grey and Chilled Iron.

Emery
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Write for booklet "Safety as Applied to Grinding Wheels."

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LIMITED
Manufacturers Grinding Wheels and Machinery
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For lining and patching the Cupola or Open-Hearth Furnace, Lining Ladles, Clay Wash, etc.

It will save your fire brick and the time of your men.

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Providence
New York
Buffalo

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Tilghman-Brooksbank Sand Blast Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J. Co., Toronto, Ont.

CINDER MILLS
Hyde & Sons, Ltd., Montreal, Que.
Standard Equipment Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE MACHINES, HAMMER
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Demmler & Bros., Wm., Kewanee, Ill.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

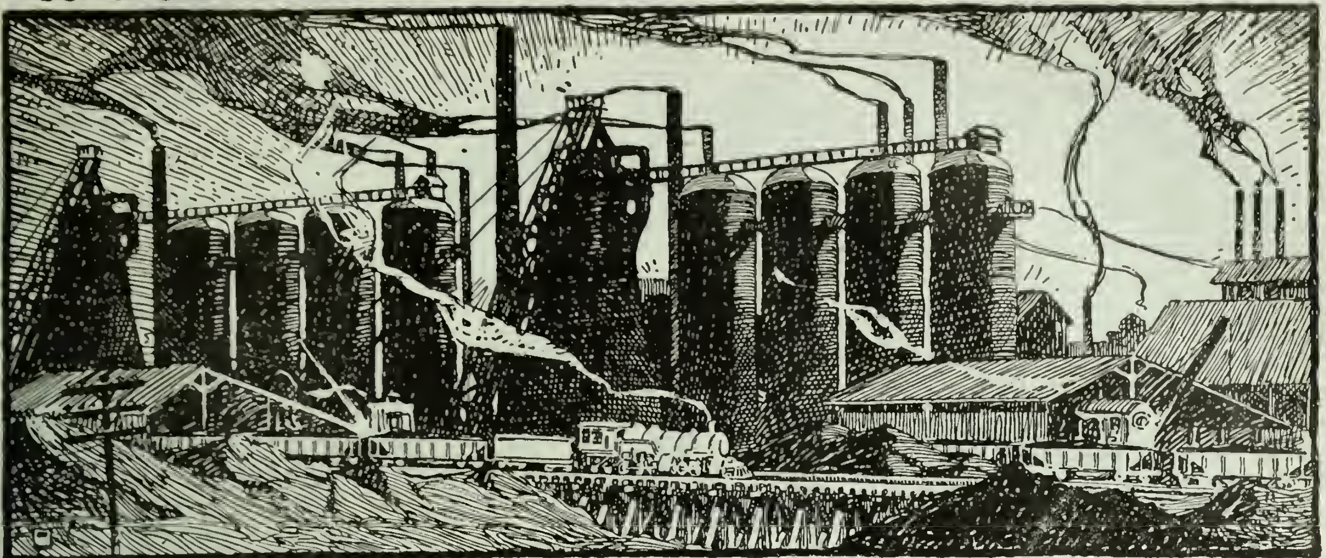
FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.



FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MAGNETS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hyde & Sons, Ltd., Montreal, Que.
Toronto Testing Laboratories, Toronto.

MIXERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

PULLEYS, MAGNETIC
Ding's Magnetic Separator Co., Milwaukee, Wis.

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Harrison Supply Co., Boston, Mass.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont
Woodison, E. J., Co., Toronto, Ont.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.

SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Hanson & Van Winkle Co., Toronto, Ont
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TEEMING CRUCIBLES AND FUNNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg

TRIPOLI

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS

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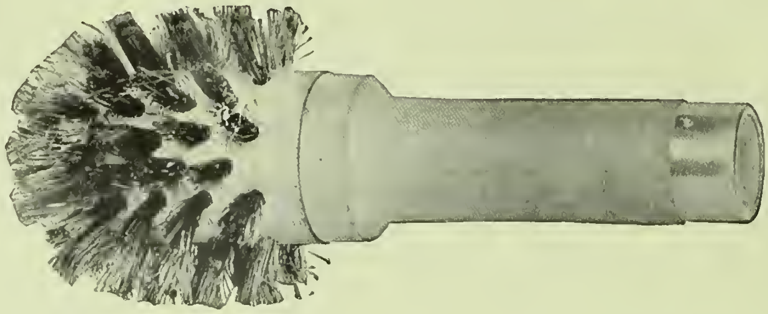

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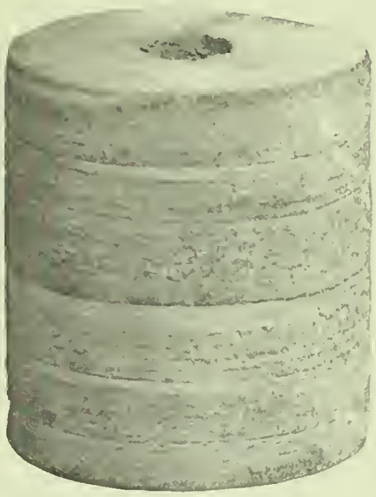

Leather Wheels, size 1¾" x 2"

We manufacture all kinds of polishing wheels for cleaning both inside and outside of shells.

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We manufacture in Canada a full line of caustics for removing grease.

Kostico, Essex Cleaner, XXX Lye, New England Cleaner, Acme Mineral Cleaner.

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CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, JULY, 1917 No. 7

The Publisher's Page

TORONTO July, 1917

Extract from a Manufacturer's Letter to His Salesmen and Jobbers

A DEALER in Toronto recently received a letter from a manufacturer calling attention to the fact that it is easier to sell advertised products than goods which are not advertised.

The dealer thought the letter a very good one and so passed it on to us. It ***is*** a good letter and so we in turn pass it on to our readers that the usefulness of its message may be multiplied.

"The salesman who sells advertised goods is the man who gets the interview always.

"That's why the salesman of advertised goods can get a good hearing—can get to the order point quickly—why the buyer wastes no time when he talks to representatives of manufacturers who advertise their products.

"You know advertising helps you salesmen. Are you letting our advertising pages help you sell our line?

"Trade paper advertising educates the reader on the worth-while products and puts the manufacturer's claims in black and white—shows why the advertised goods should be used.

"Readers of advertising are informed of the reliable goods in their field—for only reliable products can be continuously advertised. We have been advertising for twenty years.

"We trust you are letting our trade paper advertising help you."

MORGAN CRUCIBLES

English Manufacture

We have a large stock in both warehouses for immediate shipment. More arriving weekly.

The Dominion Foundry Supply Co., Ltd.

MONTREAL, QUE. TORONTO, ONT.

Are You Melting Sand

"WABANA"

Machine Cast Pig Iron

Cast in specially shaped moulds to permit of easy Handling, Piling and Breaking.

Chill Cast—*"SANDLESS"*—Pig Iron melts quicker or with lower fuel consumption than Sand Cast Iron. Machine Cast Iron is shipped 2240 pounds to the ton and it is *ALL METAL*—no sand.

We grade this iron according to the Silicon, as follows:

No. 1 Soft	Silicon	3.25% and over
1	"	2.50 to 3.24
2	"	2.00 to 2.49
3	"	1.75 to 1.99
4	"	1.30 to 1.74

An iron therefore for every Foundry purpose. Enquiries solicited. May we have the pleasure of quoting on your next requirements?

Dominion Iron & Steel Co., Limited

Head Office and Works, Sydney, N.S.

SALES OFFICES:

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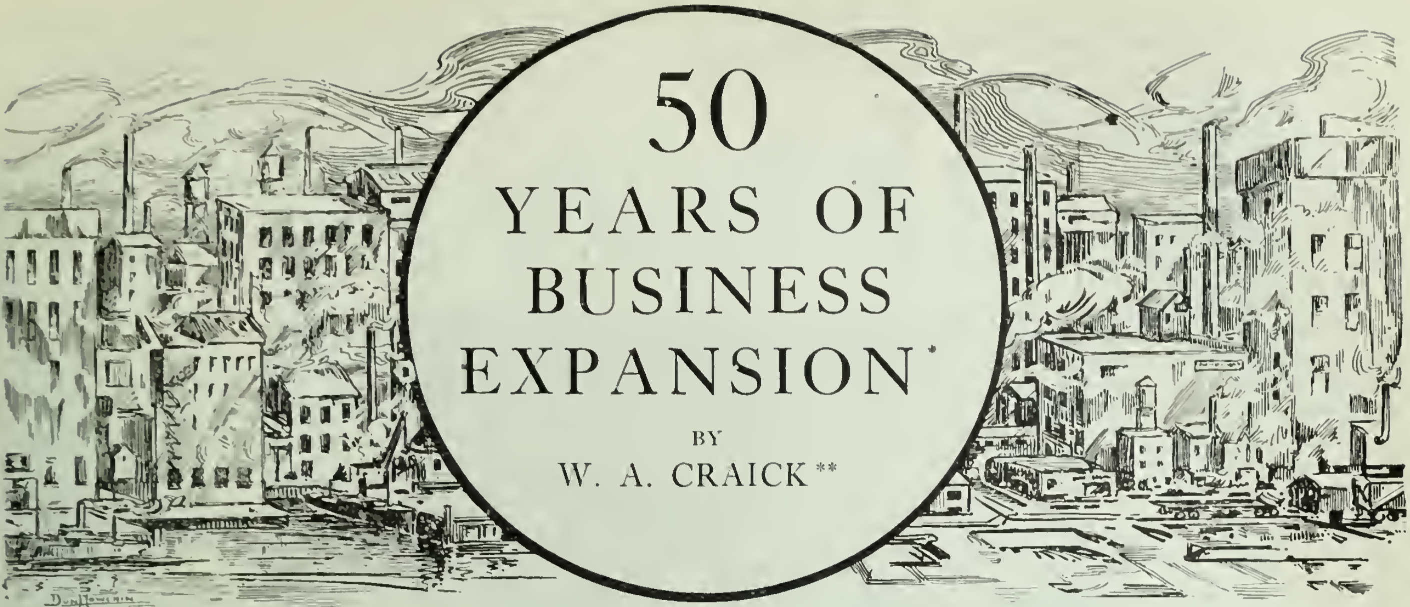

50 YEARS OF BUSINESS EXPANSION*

BY

W. A. CRAICK**

There is here given in racy fashion, yet evidencing in the variety detail discussed considerable painstaking and scrupulous regard for developments in the period under review, to the end that as far as possible everything embraced by the article title, wide in scope as it happens to be, should get at least a passing reference. Speaking generally, the advances made in the spheres of Industry, Finance, Transportation and Insurance are prominently featured.

CANADA'S position at the close of the fiftieth year of Confederation is imposing only in so far as present day conditions are placed in contrast with those prevailing at the dawn of the Confederation era. Progress is at best a relative term, and to appreciate to the full the extent of this country's development, one must visualize the setting in which that development was commenced.

To all intents and purposes, the whole of Western Canada, with its far-flung population, its many fine cities, its thousands of miles of railway and its enormous agricultural production, must be eliminated from the canvas. It is true that by 1867 some ten thousand people had settled in the Red River Valley; that stragglers had penetrated even farther west. It is also true that the gold rush of the late fifties had poured population into the Fraser River Valley and that Victoria was already a fair-sized town. But these widely-separated settlements, on the prairies and at the Coast, were almost as distant from Eastern Canada in those days as Australia is to-day, and further, their business associations were entirely with the neighboring sections of the United States.

Canada in 1867

The picture of Canada in 1867 narrows, therefore, to the comparatively restricted limits to the older settled portions of the country—the narrow fringe of clearing along the St. Lawrence; the lake front counties of Ontario; the coast and river settlements of New Brunswick and the scattered towns and fishing villages of Nova Scotia. The wider vision of a great and prosperous West had not yet seized upon the minds of the people and their field of possible endeavor lay no further off than the thickly wooded concessions of the back counties.

Though fairly well populated and supplied with the modern means of communication, the older sections of Quebec and Ontario were still in a comparatively crude and undeveloped condition. Even between Montreal and Toronto, then as now, the two foremost centres of population in Canada, the appearance of the country was anything but prepossessing. There remained much uncleared land. Many of the homes of the inhabitants were at best but miserable shanties. The people were poor; the children dirty and ragged; the cattle lean. Towns, which were quite as numerous as they are today, and in several cases nearly as large, were suffering from the after-effects of the Grand Trunk boom, and exhibited numerous unoccupied and delapidated buildings.

From Prescott to Ottawa, then the customary route to the Capital, the railway traversed what appeared to be a continuous pine swamp, wet, dismal and depressing. The Capital itself lay hidden away in the midst of green, unbroken forests, which closed in on the log houses and small villas lying on the outskirts of the embryo city.

To the rear of the counties fronting on the St. Lawrence and Lake Ontario, settlement was just getting under way at the time Confederation came into being. Railways were being promoted to tap the resources of Peterboro, Victoria, Simcoe, Grey and Bruce Counties, and settlers were arriving from the Old Country to people their solitudes. In fact, this particular section of Canada was going through an experience which has since been duplicated many times in the West.

The Government was devoting special attention to the settlement of the free grant lands in the Muskoka District. Advertising matter of the same brand as that which later lured thousands of immigrants to the prairies, told of the prospective wealth to be derived from the cutivation of the soil in this remote part of the province. In response to the appeal, population was penetrating as far north as Parry Sound on the shore of the Georgian Bay, while Bracebridge was thronged with newcomers.

Oil and Gold Booms

It was about this period, too, that the oil boom in Enniskillen Township and the gold boom at Madoc were absorbing public attention. The former attracted the curious from all parts of the country. To reach the oil fields, visitors had to leave the Sarnia branch of the Great Western at Wyoming and drive through the woods to Oil Springs. It was a trip, as described by travelers, full of spectacular interest. The great dark forest, traversed by a narrow plank road; the constant succession of carts coming and going with their barrels of oil; the derricks, oil tanks and engines scattered through the clearings, all presented a scene of strange and outlandish character. Oil Springs itself was a village of wooden hotels, thronged with speculators and hangers-on, who by their frenzied efforts to secure paying properties increased the popular interest in the district.

The Madoc gold finds were made in the year before Confederation and the rush to the mines in the spring of 1867 was one of the events of that momentous year. Prospectors in lare numbers thronged to the new gold fields, from which so much was expected, and many miners, who had participated in the California and British Columbia rushes, made their way to the new Eldorado. Five lines of stages from Belleville to Madoc

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*Also in MacLean's Magazine.

**Of MacLean Publishing Co. Staff.

were for a time insufficient to accommodate the crowd who sought access to the scene of the discovery.

These events, bulking largely in the popular imagination at the time, have long since dwindled into their proper proportions. The oil wells of Enniskillen have become a commonplace; the gold strikes at Madoc have sunk into insignificance. Reference has been made to them merely to illustrate how places which fifty years ago were on the very fringe of settlement and to reach which tedious journeys had to be made, are now left far in the rear by the tide of progress. The gold of Porcupine has long since eclipsed the gold of Madoc, and in Southern Alberta the oil prospector has been finding new fields for his investigations.

Lumbering

In various other respects conditions have changed in old Ontario and Quebec. Lumbering was a far more important industry fifty years ago than it is to-day. The Great Western Railway brought down from its Sarnia branch annually large quantities of oak timber. This wood was rafted at Hamilton and towed to Quebec for export to the Old Country. The Northern Railway carried to Toronto, and the Port Hope, Lindsay and Beaverton Railway hauled to Port Hope trainload after trainload of lumber for shipment by schooner across the lake. Cordwood was one of the commonest commodities of the day, and trainloads of it were a common sight on the railroads fifty years ago. It was used not only for heating and cooking, but it formed the universal fuel for locomotives, and from the back settlements thousands of cords were shipped annually to the United States.

LUMBERING ON THE UPPER OTTAWA. A FLOURISHING INDUSTRY AT THE TIME OF CONFEDERATION.

Early City Settlements

The extent of settlement in 1867 was reflected in the cities. To-day there are in the Dominion six cities with populations in excess of 100,000 — Montreal, Toronto, Winnipeg, Ottawa, Hamilton, and Quebec—while a seventh, Vancouver, falls little short of that figure. In the year of Confederation, however, Montreal was the only urban centre that came within 50,000 of reaching the 100,000 mark. Toronto could not boast 50,000 inhabitants. Winnipeg was a mere hamlet. Ottawa contained but 15,000 people. Hamilton just exceeded 20,000 by a narrow margin. As for those flourishing Western cities—Calgary, Edmonton, Regina, Saskatoon, Brandon, Moose Jaw, and Vancouver—they were practically all non-existent. Only conservative old burgs like Quebec, Halifax, and St. John, had populations in any way commensurable with present figures.

Our Capital City

The beautiful capital city of the Dominion, whose natural charms have been greatly enhanced by the work of the Ottawa Improvement Commission, has developed during the fifty years of Confederation from a crude backwoods settlement into one of the finest cities in America. So unprepossessing was its appearance when it was selected by Queen Victoria to be the seat of government, that it was described as the Cinderella of Canadian Cities. Its intrinsic beauty was recognized, but that beauty was so hidden by uncouth and dirty surroundings that the comparison was by no means inapt.

Curious visitors who went to view the new capital during the early sixties, came away with mixed impressions. It was admitted that the site of the Parliament Buildings was a lovely one; that the surrounding forests had a wild impressiveness, and that the clear air, everlasting resounding with the noise of falling water, was exhilarating, but what were these natural attractions when everyday living conditions were so bad? The streets were rough, the houses mean and squalid, the hotel accommodation wretched, and the food poor. Lumber and sawdust littered the place until it looked like one vast timber yard.

A sister of Lord Monck, who visited the town shortly before the Governor-General moved there from Quebec, groaned over the prospects of life in such a place, describing it as "t'other end of nowhere." And it is known that civil service employees, who had to forsake the comparative loveliness of Toronto, Montreal, or Quebec, for its early crudities, bemoaned their fate, while Ministers of the Crown took the earliest opportunity to escape from its impenetrable dulldullness.

Of course, all this has changed. Ottawa to-day boasts the possession of every modern facility, not only for the enjoyment, but for the improvement of life. Its beautiful streets and parks, its splendid public buildings, its superior hotels—all these combine to render the contrast with the miserable, down-at-the-heel settlement of fifty years ago most striking and complete.

And what of other cities? Montreal,

the foremost city of the Dominion with its more than 600,000 people could, in 1867, muster barely one-sixth of that number. In extent it was very considerably smaller. Its principal business thoroughfare of to-day, St. Catherine Street, lay on the outskirts of the city. Even lordly St. James Street, with its splendid financial institutions, was only just in course of construction. Business centred in Notre Dame Street; McGill College stood out in the suburbs, and it was a mile walk from the edge of the city to the mountain.

In several respects, Montreal, fifty years ago, was greatly inferior to the present city. Its streets were notoriously filthy, especially along the docks where the mud frequently lay knee-deep. The lighting even of the main thoroughfares was inadequate, gas being then the universal illuminant. The drainage was bad, and in this connection one visitor tells of having to leave the Theatre Royal one night in the middle of an amusing comedy on account of the vile odors that were wafted in through the windows. Apart from these deficiencies, however, the city seems to have been an imposing place with its solid-looking buildings, its many fine churches and its active commerce.

Our Queen City

Toronto's expansion during the fifty years has been equally, even if not more, phenomenal. When it is recalled that in 1867 Queen's Park, now in the heart of the city, was on its extreme northern edge, Trinity College was situated a mile beyond the western limits and that troops were able to go through extensive evolutions on a great common that lay between the city and Spadina Avenue, some faint conception of the physical growth of the place can be obtained. In population it has increased twelve-fold, or roughly from 40,000 to 480,000.

The cities in the east, Halifax and St. John, have probably exhibited fewer changes than their western sisters. Halifax, which has now about 50,000 inhabitants, had a population of 30,000 at the time of Confederation. St. John, which to-day contains approximately 54,000 people, was then a place of 35,000 inhabitants. In Halifax the lives of the citizens revolved around the garrison of British regulars which manned its forts and citadel. Some trading, it is true, went on with the West Indies. Fish was exported; sugar and other tropical products imported. But the military and naval interests of the place predominated and trade and commerce, while a necessary evil, were not allowed to thrust themselves too far into the foreground.

The commercial spirit was more in evidence in St. John, a city which then as now regarded its Nova Scotia contemporary with a feeling of suspicion and rivalry. St. John had been a notable shipbuilding centre for years and, not only was many a stout vessel built each year in its shipyards, but its merchants owned and outfitted numerous deep sea craft for service on the seven seas. The docks of St. John were a busy spot in those days, for ships and sailors were numerous and there was a constant coming and going of vessels from distant ports.

Industries Feature

If cities were small fifty years ago, so also were the industries that flourished in them. Industrially, there has been a remarkable change in Canada during the past half-century. When Confederation came into being the settled sections of the country were plentifully supplied with an immense number of small steel industries. Each town, each village, had its little group of manufacturing establishments which produced the essentials of life for the people of the immediate neighborhood. A flour and grist mill, a sawmill, a tannery, a carding and fulling mill, a carriage factory and not infrequently a brewery or distillery were the possession of practically every centre of population.

The census of 1861 showed that in Ontario alone there were in operation 501 flour and grist mills, 1,164 sawmills, 271 tanneries, 185 carriage factories, and 143 breweries and distilleries. In Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island combined, there were 8,503 industries, of which 1,785 were flour and grist mills, 4,240 sawmille, and 710 tanneries. By 1867 all these figures had probably been considerably increased.

Few of these primitive local industries have survived the evolution of the centralized factory system. Here and there through the country there may remain some pathetic examples of these once important institutions. But, generally speaking, the economies introduced in the operation of the large factories of to-day have made it quite impossible for the small industry to exist.

Lachine Canal an Industrial Factor

Even in the sixties there were evidences of the development of large-scale manufacturing. The building of the Lachine Canal seems to have produced a considerable industrial boom in Montreal. The canal furnished four million horsepower of hydraulic energy per annum, a huge figure for those days, and, as practically all manufacturing was done by waterpower, manufacturers naturally flocked to this new source of energy.

The extent and importance of the factories along the canal filled visitors with astonishment. There were huge iron works, employing no fewer than 120 men and producing 12 tons of nail plates per day! There was a wonderful new flour mill, which could grind 500 bbls. of flour in twenty-four hours. There was a sugar refinery with a capacity adequate to manufacture seven-eighths of the sugar consumed in Canada and there was a marine works, which could produce several ships for river and lake service each season.

One may smile at the expressions of amazement with which the citizens of 1867 regarded these examples of industrial enterprise, the size and output of which have long since been eclipsed by immensely larger establishments, but, after all, there were some industries in operation fifty years ago which would astonish even the wonder-sated folk of the twentieth century. The sawmills at Ottawa, for instance, were undoubtedly marvels. There were ten of them running night and day in an endeavor to keep pace with the efforts of the ten thousand lumbermen who were busy felling the forests along the river. One of these mills boasted eighty saws and the others were very little smaller. The ten mills together turned out 180,000,000 feet of lumber a year, while 16,000,000 cubic feet of square timber was rafted to Quebec each season for shipment across the Atlantic. In that golden age of the lumber trade, it took 800 ships, manned by 25,000 men, to carry the harvest of the Ottawa from Quebec to England.

Wood Shipbuilding

These were great and picturesque enterprises and so, too, was the wooden shipbuilding industry, which was in its heyday of prosperity when Confederation came into being. At Quebec and at many a harbor and port on the coasts of New Brunswick and Nova Scotia, fine, large wooden vessels were built and launched annually in considerable numbers. There were fifteen shipyards at Quebec alone, in which from 25 to 50 ships were turned out each year. Unfortunately, except for a forced revival of the industry at the present time, wooden shipbuilding is dead and thus an interesting chapter in Canadian industrial history is closed.

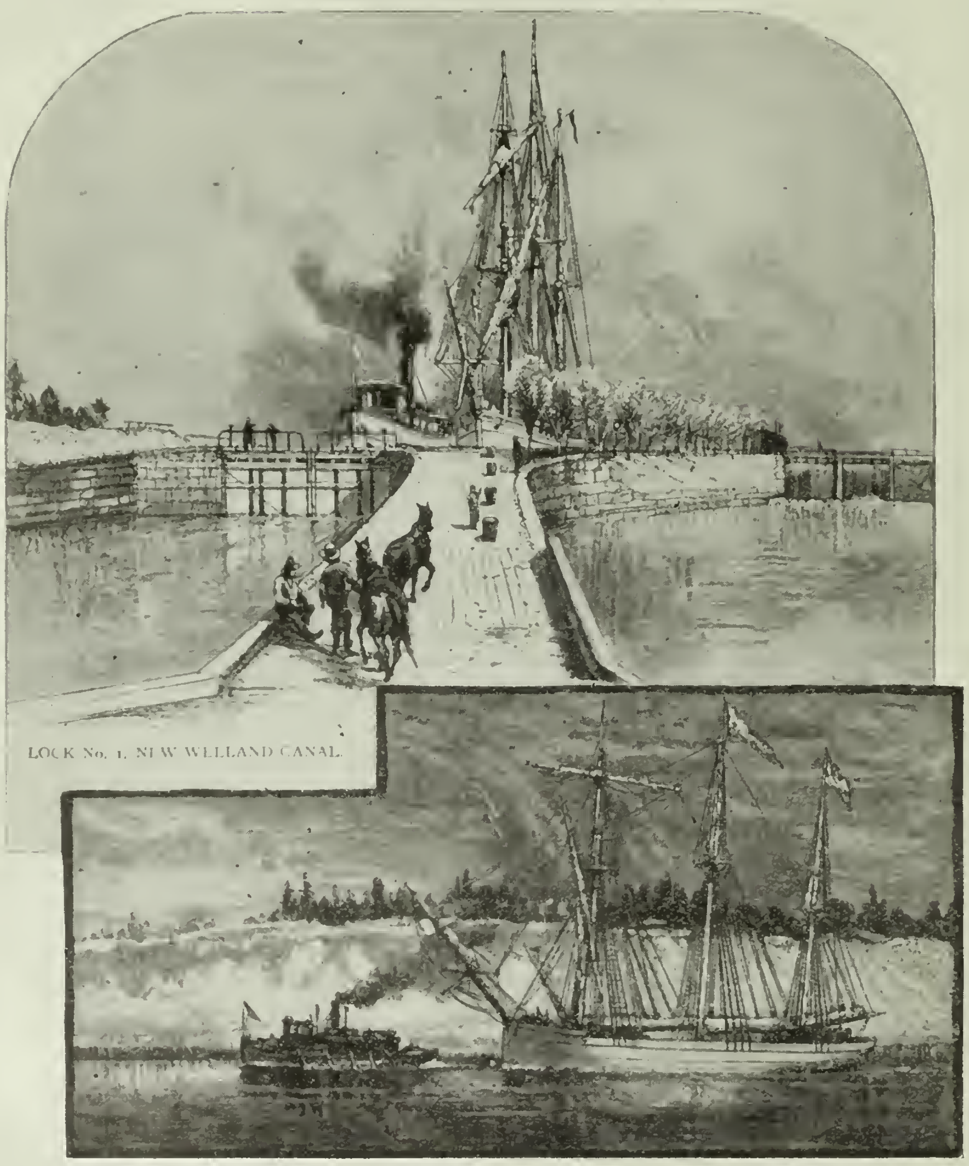
However, all industry in Canada in and about the year of Confederation was not so spectacular, though to the people of the time many of the developments seemed very wonderful. In Hamilton, for instance, where foundations for future industrial greatness were even then being laid, it was deemed a remarkable feat on the part of the local manufacturers to have installed $100,000 worth of new machinery in a single year. The production of locomotives at Kingston was considered a work little short of marvellous. The erection in Sherbrooke in 1866 of a woollen factory five stories high was heralded as a most important event, while Victor Cote's new tannery at St. Hyacinthe, which gave employment to 90 hands, was regarded as a mammoth plant.

But if industries were small and scattered, the products of industry were by no means inferior. At the great Paris Exhibition in 1867, the goods of Canadian manufacturers showed to advantage. Furniture made by Jacques and Hay in Toronto was declared to be superior to anything on display. The wall hangings of the Stauntons compared favorably with the product of the English makers. The Barbers, of Streetsville, showed cloths and woolens of most creditable quality. Implements from the Jones plant at Gananoque and the Whiting plant at Oshawa, were highly commended, as were also the cigars exhibited by Davis, of Montreal.

Transportation Developments

Industrially, Canada has traveled far since those far-away days. All the marvelous expansion which the introduction of electricity has facilitated has come since then. The mammoth textile works with their electric drives; the great steel plants; the huge paper mills; all these and many more have sprung into being since 1867, and in no respect has the progress of Canada been more marked than in this department of national life.

Hand in hand with the growth of industry has gone the extension of transportation facilities and rapid means of communication. In 1867 the railway systems of the country, since expanded into transcontinental proportions, were limited in scope. This was especially true of the Maritime Provinces, where the stage coach was still an established and very necessary institution when the Confederation era dawned. Nova Scotia was served by two short lines of road, running from Halifax to Truro and from Halifax to Windsor respectively, a matter of some hundred miles of track in all. New Brunswick likewise had but two railways, one connecting St. John and Shediac and the other St. Andrew's and Woodstock. Prince Edward Island, which has now a system of 275 miles, was without any railway at all. In short, the three Maritime Provinces among them had only about 300 miles of road in operation, whereas to-day their mileage extends to 3,668 miles.


LOCK No. 1, NEW WELLAND CANAL.

THE DEEP CUT, A VIEW OF THE WELLAND CANAL IN THE EARLY DAYS.

The Upper Provinces were somewhat better served. The Grand Trunk, then the longest railway in the world under one management, ran from Portland, in Maine, to Sarnia, in Ontario, and from Riviere du Loup, on the Lower St. Lawrence, to Richmond, P.Q. Its most formidable rival was the Great Western, running from Niagara Falls through Hamilton, to Windsor, with a branch from Hamilton to Toronto. Northward stretched lines from Prescott and Brockville to Ottawa, from Port Hope to Beaverton, and from Toronto to Collingwood. All the rest of the network of roads now traversing both old and New Ontario were non-existent.

Railroad Through Traffic

The idea of through traffic was only just being evolved in 1867. The Great Western, then a wide-gauge road, as were most of the railways in Canada, had laid a third rail from Windsor to Niagara Falls and built a car ferry for service across the Detroit River, in order to secure a slice of the business between the newly developed settlements in the Middle West and the seaboard. The Northern Railway from Toronto to Collingwood was paying so much attention to the traffic it was receiving from the upper lakes and trans-shipping at Toronto for lower lake ports, that settlers along the line complained of the difficulty of getting their cordwood shipped to Toronto. In fact, the promoters of the Toronto & Nipissing and the Toronto, Grey & Bruce made it a point in soliciting financial aid from the municipalities that they would serve the settlers better in this regard that they were receiving.

Communication between the Maritime Provinces and the Upper Provinces in those days was usually by coasting vessel from Halifax or St. John to Portland and thence by Grand Trunk to Montreal. The extension of the Halifax-Truro road to Pictou, completed in the Confederation year, gave a new summer route up the St. Lawrence to Quebec, while one of the fruits of the new political arrangements between the provinces was the establishment of a line of steamers to run from Montreal and Quebec to Maritime Province ports. Otherwise it was possible to take a longer stage journey up the St. John valley from the railway terminus at Woodstock to Edmundston and across the height of land to Riviere du Loup, where the Grand Trunk terminated. This was the route by which the British regulars journeyed to Upper Canada at the time of the Fenian scare.

Victoria Tubular Bridge

The recent completion of the Victoria tubular bridge at Montreal was then filling the minds of visitors with awe and astonishment. It was hailed as one of the wonders of the world, a scientific achievement without a peer in the history of construction. Its three million cubic feet of masonary, its eight thousand tons of iron, its enormous length, its great cost, were dilated upon in unmeasured terms of admiration. For the times it was indeed a remarkable engineering feat, but since then many a far more wonderful undertaking has been completed in Canada, which illustrates still further how the country has progressed.

Canada's canal system had by 1867 reached considerable proportions and comparatively speaking, traffic by water was of more importance than that it is to-day. The lakes were covered with sailing craft, while steamboats were far more numerous than they are now. Of course, all these vessels were so much smaller than the big freighters of the twentieth century that mere numbers were insignificant. At the same time they provided a most picturesque element in the picture of Canada in 1867. The passage of fifty schooners a day through the Welland Canal was by no means an unusual experience in the year of Confederation.

The canals were much smaller than they are to-day. Those on the St. Lawrence, by means of which ships passed up from Montreal to Lake Ontario, contained but nine feet of water, while the locks were limited to 200 feet in length. Notwithstanding this, records of vessels are not uncommon which had sailed down from the upper lakes and, passing through these canals, had later crossed the Atlantic.

Conditions of Travel

Traveling conditions in the year of Confederation were none too satisfactory. As compared with the luxury of the present day, a journey even for a short distance was an arduous and uncomfortable undertaking. In the Maritime Provinces, if a traveler preferred an overland journey instead of a trip by coasting vessel, he would have to put up with the inconvenience of a wearisome ride in a big, lumbering, springless stage over rough roads, his only solace the occasional pauses for rest and refreshment at old-fashioned change houses. In the Upper Provinces, he would have to contend with the wretched service of what were referred to at the time as the most poorly conducted railways in the world.

Two trains a day in each direction were sufficient to accommodate the traffic between the two largest Canadian cities. One made the journey by day, the other by night, and the run was scheduled for something like fourteen hours. The locomotives burned wood and there were frequent stops en route to re-load the tenders. Cars were small and light, the track poorly laid and the bumping and jolting terrific. One wretched tourist who endeavored to beguile the telium of the journey by a game of draughts found to his disgust that it was quite impossible to keep the men on the board.

Postal System

The postal system in Canada fifty years ago differed very little from the present system except that very much higher rates of postage had to be paid, and it took much longer for letters to reach their destination. The rate to points in Canada, that is, Ontario and Quebec, was five cents; to the United States, 10 cents, and to England, 12½ cents. A special weekly service to Halifax, via Portland, having been arranged, a business man in Toronto or Montreal could send a communication to Nova Scotion for the sum of 12½ cents. As for British Columbia, it cost 25 cents to forward a letter to the Pacific Coast.

Statistics for the year 1863 show that there were in the Upper Provinces, 1,974 post offices in that year and that the number of letters carried was 11,000,000. New Brunswick had 375 post offices, in which 833,625 letters were handled, and Nova Scotia 493 post offices, with 1,467,726 letters. The year's revenue for the three provinces was $853,778, and the expenditure, $896,303. As an indication of the extent to which the postal service has since expanded, it may be said that in 1915, the revenue for all Canada was over thirteen million dollars and the expenditure nearly sixteen millions.

Telephones

While the telephone was unknown in 1867, the telegraph and the Atlantic cable were both in existence, and so far as telegraphic communication was concerned, Canada was well served. Indeed, in Nova Scotia the boast was made that they had more lines of telegraph per inhabitant than in any other country in the world and, what is even better, lower rates. In Ontario and Quebec, the Montreal Telegraph Company, with over 3,000 miles of wire, controlled the situation, while in the Maritime Provinces the lines, about 2,000 miles in extent, were controlled by the American Telegraph Co. As there are to-day over 200,000 miles of wire in the telegraph systems of the country, it is obvious that here again there has been vast development.

The story of the telephone is all contained within the limits of the Confederation era. There were no telephones when Confederation was born. To-day there are between six and seven hundred thousand instruments in use, with over a million and a half miles of wire connecting them.

Electrical Street Railways

Electric street railways have been another modern development. In fact, in the year of Confederation, horse cars had only just come into use. Toronto's system had been opened in 1861. It consisted of six miles of track on Queen and Yonge streets, with eleven cars and 70 horses, a total investment of only $175,000. Montreal had also about six miles of track with similarly small equipment. Halifax was a third city with a system of horse cars at that time. The innovation was not welcomed. One critic complained that "the street railway is an institution for the benefit of those who ride, at the expense of those who drive, and is a flagrant violation of the rights of the majority. The horse railway is a permanent obstruction; it practically divides a wide street into two narrow ones and a narrow one into two lanes. It is questionable whether it will be found profitable in Canada."

In the light of this hostile attitude, it is interesting to note that the tiny systems in the three leading cities of 1867 have since developed into a vastly important series of electric lines, located in practically every city in Canada, operating upwards of 1,700 miles of track and carrying annually six hundred million passengers. The capital invested in them amounts to over $150,000,000.

Trade and Finance

Trade and finance have shown marvelous expansion in the fifty years of Confederation. When it is considered that in 1868 the country's total trade only amounted to a little over $131,000,000, of which $57,500,000 represented exports; that the export of manufactured products in that year scarcely amounted to $2,000,000 and agricultural products exported were under $13,000,000 in value, then the growth becomes all the more remarkable, for, in 1916, Canada's trade amounted to nearly a billion and a half dollars; her exports of manufactured products to $242,000,000, and her exports of agricultural products to $250,000,000. Her mineral exports in the same period jumped from $1,800,000 to nearly $67,000,000, and the products of her fisheries from $3,500,000 to over $22,000,000.

The development of trade has been graphically reflected in the expansion of the financial institutions of the country, notably the chartered banks and the insurance companies. There were as a matter of fact, more banks doing business in 1867 than there are to-day, but the banks of the Confederation year were very much smaller and, in several cases, they were in a notoriously shaky condition. In all, there were twenty-six of them in existence, with a paid-up capital among them of approximately thirty millions, or about a quarter of the paid-up capital of the twenty-one institutions now operating under Dominion charters. There were about 120 branches doing business, the large majority of which were located in the Upper Provinces.

Since 1867, sixteen of the twenty-six chartered banks on the list in that year have disappeared, either through failure or amalgamation, leaving but ten of their number to carry on the traditions of the pre-Confederation days. The survivors, in point of age, are the Bank of Montreal, Bank of Nova Scotia, Bank of British North America, Bank of Toronto, Molson's Bank, Bank Nationale, Merchants Bank, Banque Provinciale, Union Bank, and Canadian Bank of Commerce. Eleven new banks have been established, bringing the present total up to twenty-one.

To-day Canadian banks have over 3000 branches in Canada alone, not to mention agencies in the United States, the West Indies, and elsewhere. Their assets have grown since 1867 from seventy-five millions to well over two billions; their liabilities from forty millions to over eighteen hundred millions. They have deposits of over fifteen hundred millions as compared with twenty-five millions fifty years ago, and their circulation has expanded in the half-century from nine millions to over $132,000,000.

Insurance

Life insurance was the smallest of Canada's financial institutions in 1867. Only one Canadian company—the Canada Life, which had been organized in 1847—was operating, and the total insurance in force of all companies, including British and American, did not exceed $30,000,000. Progress in this one business alone has been little short of phenomenal. Company after company has been organized until to-day no fewer than twenty-six domestic companies are reporting annually to the Dominion Department of Insurance, not to speak of fifteen British and sixteen American companies.

By the end of 1916, the insurance in force on the lives of Canadians amounted to nearly a billion and a half dollars, of which nine hundred millions was carried by our own Canadian institutions. The latter, whose assets in the year of Confederation were a mere bagatelle, now show accumulated wealth approximating three hundred million dollars; their annual income runs to over sixty million dollars; while they disbursed last year to policyholders or to their beneficiaries nearly twenty-five million dollars in cash.

The business of fire insurance has enjoyed a similar expansion. Our Canadian companies, then few in number and uninfluential, had at risk in 1867 about fifty million dollars, on which they were receiving premiums of somewhat less than half a million dollars and paying losses of from a quarter to half a million dollars a year. Last year, the domestic fire companies had $663,758,129 at risk, on which they were receiving premiums of nearly five million dollars, while they met losses during the year of over half that amount.

One might proceed and produce figures bewildering in their detail to demonstrate how far Canada has progressed in every department of business activity since 1867. The tremendous expansion of agriculture due to the opening up and settlement of the West; the development of mining, which is placing Canada in the forefront of the mineral-producing countries of the world; the growth of the fisheries; the extension of hydro-electric power in industry; these and a hundred other matters might easily be referred to as affording means of gauging the country's fifty years of progress. However, enough has been written to give a faint idea of the Canada of fifty years ago and with this in mind it is not difficult to picture mentally the extent of development.

DOMINION STEEL CORPORATION OUTPUT

THE Dominion Steel Corporation report shows that new records were made in steel products, but that coal production was less than in recent years owing to difficulties of transportation. Steel production for two years compares as follows:

	Mar., 1917	Mar., 1916
Pig iron	346,926	329,664
Steel ingots	377,079	371,086
Bloom and billets for sale	144,051	142,252
Rails	17,495	35,197
Wire rods for sale	67,492	55,106
Bars	5,259	8,017
*Wire	35,142	36,058
Nails	20,175	19,262

*This includes wire used in manufacture of nails shown in next line.

"The distribution of shipments continues to follow the lines indicated in last year's report," comments the president. "The production of steel for munitions in the form of blanks, barbed wire, etc., has, however, advanced to the first place in importance, and preference is given to this over all other forms of steel. The next element in order of importance is the material furnished to manufacturers in Great Britain, France and Canada, engaged in the production of war materials, for which a strong demand still continues."

The total production of all the collieries was considerably below that of recent years, amounting to 4,279,772 tons, against 5,261,198 in 1916, 4,550,512 in 1915, 5,047,683 in 1914, and 5,051,603 in 1913. "The causes of this falling off," says Mr. Workman, "were beyond the control of your directors, arising for the most part from the scarcity of men consequent upon enlistment for service overseas, and also to a considerable extent from the lack of adequate transportation facilities."

BY-PRODUCT COKING

By T. J.

AMONG many branches of development in modern scientific industry there is probably none of which less is known to the general public than that of by-product coking—that is to say, of the manufacture of coke on a large scale for use in the blast furnace and the foundry, and of the contingent recovery of valuable by-products from the coal used. Formerly all coke for use in the metallurgical industries was made in "beehive" ovens—a considerable portion of it being yet made by this primitive process, in which a considerable portion of the carbon, as well as the volatile elements given off under the influence of heat are consumed to keep up the temperature of the oven. The only product of this system, therefore, is a remainder in the form of coke, amounting usually to about 60 per cent. by weight of the coal put into the oven.

About thirty years ago the by-product oven was introduced, and more recently it has made such progress concurrently with improved methods of recovering and treating the by-products that at the present time the larger proportion of the coke production of Britain is made under by-product recovery conditions. The essential difference between the two systems is that while the older one is a burning process (with necessary limitations as to the amount of air admitted to the oven), the newer one is purely a distillation process involving external heating and the total absence of air; and whereas the product of the one consists of coke only, that of the other, besides a larger quantity of coke from a given weight of coal, includes also, in some cases, a large volume of surplus gas, in all cases valuable residuals in the form of coal tar and ammonia, or ammonia compounds, and in may cases benzol which is the principal "intermediate" of some of our most powerful high explosives, and of many varieties of coal tar dyes.

Among other things, little known to the public, is the large part which is being played by the by-product coking industry both in helping the Allied nations to win the war and in keeping going many of our most important industries under war conditions.

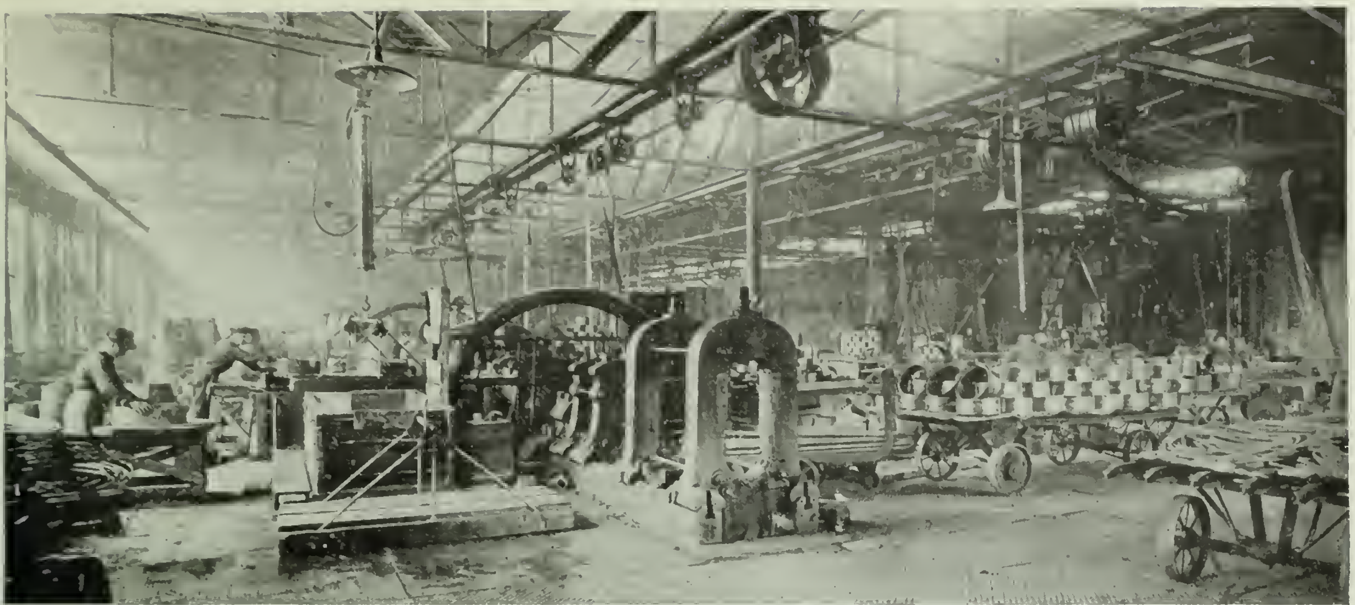
By-Product Ovens Surpass Gas Works

The popular idea is that the principal source of ammonia and toluol, for example is the gas works of the country. In point of fact, the by-product of coke ovens, and certain closely allied processes yield more both of coal tar and ammonia than all the gas works of the country combined, and much more of benzol and toluol, which they are able to recover from their gas more systematically and thoroughly than the gas works can from theirs. Altogether, there are now about 120 by-product coking plants in Great Britain, comprising about 8,000 ovens, each carbonizing a coal charge of from eight to ten tons in from 30 to 36 hours, or approximately five charges per week. As the operation of the plants is continuous the potential yield of metallurgical coke per oven per year, allowing liberally for all contingencies, and for occasional repairs, may be taken at from 1,200 to 1,500 tons, so that the aggregate output may be put at approximately 10,000,000 tons.

In some cases the ovens have regenerators; in some they have not. In the latter case the greater part of the gas given off in the process of carbonization is used for heating the oven flues—in the former only about half is required for this purpose, so that there is a large volume of gas available for consumption under steam boilers (thus again saving coal), for use in gas engines, or for sale. In several cases the surplus gas is cheaply sold to power companies, and raises steam for the generation of electricity; in others it is transmitted to iron and steel works for heating purposes, in others, again, it is sold to the statutory gas authority of the locality for the town lighting.

The town of Middlesbrough is now wholly lit by gas from the coke ovens of Messrs. Samuelson & Son, Port Clarence Works, and the supply of the City of Leeds is partly derived from the coke ovens at Middleton Colliery some miles away. Generally speaking also, each ton of coal distilled in the by-product oven yields from 7 to 9 gallons of tar, from 24 to 32 lbs. of sulphate of ammonia, and in the majority of cases now, from 1½ to 2½ gallons of benzol, which is sometimes sold to chemical works in crude form, and sometimes fractionated on the spot to commercial benzol, toluol, xylol, and solvent naphtha. Some of the plants have also their own distillery, and some recover naphthalene or ammonium chloride.

No actual figures can be readily given, but it may be affirmed with confidence that the by-products thus recovered on modern coking plants in England, Wales and Scotland, represent an annual value of $10,000,000 (all of which would have been lost in the "Beehive" oven process). There is also the consideration that to produce the same weight of coke under the old system at least a million tons of coal would have been required, an important consideration at this time, when the supply of coal is unequal to the demand.



ROLLING BRASS SHEETS IN A LARGE CANADIAN METAL WORKING PLANT.

Present Day Production of Metals and Minerals in Canada

By J. M. Wilson*

Despite restrictions of output and reductions in operating efficiency the mining industry of Canada has maintained its position well and in some respects where subject to war stimulation, its efforts have been greatly extended and widened. Metallic magnesium, metallic arsenic, ferro-molybdenum, Cobalt alloys, nickel refineries, all testify to the capacity and ability of the mining industry, presaging a future continuance of its present prosperity.

ABOUT a century and a half before Confederation, early French settlers carried on the mining and smelting of iron ore near Three Rivers in Quebec Province under a grant from Louis XIV. In 1915, there were 22 blast furnaces located in 12 separate plants, which in 1916 produced 1,169,257 short tons of pig iron valued at $16,750,903 the previous highest production having been in 1913, when 1,128,967 short tons were produced.

Despite its antiquity, and its present important dimensions, the growth of the iron and coal industry in Canada has been of comparatively recent date, the third quarter of the last century having seen numerous vicissitudes and successes in various parts of the country. The present day, however, sees the sister industries supporting the country in time of stress and. with numerous dependent activities, achieving an undreamed of development when compared with the proportions existing at Confederation.

Relative Importance

While the present state of activity will be subject to modification when normal conditions return, the mineral and manufacturing resources of the Dominion have greatly altered their relative positions in the country's trade, and in so doing have betrayed a welcome wealth of material which under other circumstances might easily have remained more or less dormant. A glance at the accompanying table shows that manufactures have advanced from fifth place to second place, increasing thirty-eight fold, and mineral produce now occupies fourth place instead of sixth, its increase being twenty-nine fold.

VALUE OF CANADIAN EXPORTS.

	1868-70 $	1915 $	Ratio
Agricul. produce, millions..	12¾	134¾	10.5
Animals and their produce.	9¼	74¼	8
Fisheries produce	3½	19½	5.5
Forest products	20¼	42½	1.9
Manufactured products	2¼	85½	38
Mineral products	1¾	51¾	29

The extent to which nearly all manufacturing industries are dependent on iron and coal for their existence lends additional interest to the value of manufactured exports, a value which reflects itself back through machines, chemicals, equipment, and power, to the earthly twins, iron and coal.

While not of such great value, the mineral produce is of particular interest, in that rare and commonly occurring materials are here found in more or less abundance, the variety being profuse indeed, and, with the exception of radium, vanadium, uranium, and platinum, including nearly every other mineral and metal found in any other country. Many of the products mined to-day were comparatively unknown to the world of science in 1867, yet at this moment are produced in large quantities, to play their part as essential substances in the world war, and later as mainstays of the Dominion's commercial life—nickel, copper, silver, gold, asbestos, and aluminum to mention a few only.

Coal and Iron Inseparable

Apart from their individual values to civilization, the interdependence of iron and coal is such that a review of either without the other would be incomplete, yet it is a peculiar feature that the greater part of the raw material used is imported; for instance, in 1914, 94 per cent. of ore, 50 per cent. of coke and 56 per cent. of limestone necessary for pig iron production was imported. In the early days, however, both ore and fuel were produced at or near the scene of operations, largely because of the undeveloped state of transportation, and for this reason we find the province of Nova Scotia early occupying the premier place amongst Canadian provinces as a producer of iron and coal.

As far back as the year 1604, the discovery of iron ore in Nova Scotia by one of the French governors of Acadia is recorded, but no real development took place until during the first half of the nineteenth century, during which several discoveries of ore were made until in 1880, iron ores were known to occur in fifteen of the eighteen counties of the province. The earliest record of coal in Nova Scotia is said to be in 1672, but apart from sundry efforts, no organized development took place until the year 1825, when a company known as the

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General Mining Association, Ltd., of London, Eng., acquired all known and unknown minerals, except those previously granted. Circumstances subsequently enabled the company to secure control of all mines and minerals and insured the continuance of coal mining at the well known seams of Stellarton, on the mainland, and Sydney Mines, in Cape Breton.

Nova Scotia Districts

Mineralogical features and transportation facilities early combined to divide the Province of Nova Scotia into three districts known as Pictou, Cumberland, and Cape Breton, and up till the decade preceding Confederation, more or less intermittent efforts were made with varying success. In 1825 the Annapolis Iron & Mining Co. erected a 35 ft. stack at Clementsport, but after two years' operation closed down due to political influences, being stopped till 1860. Again in 1862, it shut down for ten years, resuming operations in 1872, when 600 tons of ore from a local mine were smelted, the resulting yield of 163 tons of pig iron going to Boston. White birch charcoal made locally, was the fuel, and fluxes were imported from St. John, N.B. This last effort only extended six weeks.

In 1828 an abortive effort was made by the General Mining Association to manufacture pig iron in Pictou county, but the first attempt which accomplished really tangible results over a term of years was that which resulted in the formation in 1874 of the Steel Company of Canada, with a capital of £500,000. This was one of the high water marks of a business which had its inception in a Catalan forge in 1850, followed by a smelting furnace with water power and charcoal fuel, producing seven tons of pig iron per day. The year 1860 saw a rolling mill added to the plant on the west branch of Great Village River; in 1862, a puddling furnace was added, the bars from which were shipped to Sheffield, and in 1867 a wheel foundry was installed. A subsequent reorganization, in 1887, due to market conditions, saw a million dollar company, the Londonderry Iron and Mining Co., to take control, but the depression of the early "nineties" was the beginning of the end, and only a pipe foundry remains of this extended but fruitless effort.

Concerns of To-day

The two concerns which now represent the iron and coal industry in Nova Scotia are the Nova Scotia Steel & Coal Co., and the Dominion Iron & Steel Co., the former operating plants at Sydney Mines and New Glasgow, and the latter at Sydney. The success of both concerns is largely due to one fact, viz., the availability of high grade ore from the Wabana mine in Newfoundland, but their histories vary much. In 1872, the town of New Glasgow saw the start of the Hope Iron Works near the scene of an unsuccessful attempt by the General Mining Association to smelt pig iron in 1828. By 1885 the business had developed to a point where the Nova Scotia Steel Co. was formed by the principal shareholders, with $160,000 capital and a 15-ton acid line open hearth furnace installed along with a 26 in. cogging mill and a 16 in. merchant bar mill. Here the first steel ingots in Canada were produced on a commercial basis, although basic open-hearth practice was adopted five years later, and the Duplex process more recently.

Up to 1889 imported pig iron had been used, but the formation of the New Glasgow Iron, Coal and Railway Co., in 1890 gave access to ore properties which were successfully utilized. In 1894, the Wabana ore fields of Bell Island, Newfoundland, were acquired, and since then the record has been one of continued progress, the present name of the company being assumed in 1900 after purchasing the coal and other properties of the General Mining Association in Cape Breton. Thus one of the most successful of the pioneer bodies was finally taken up by a later and much vaster organization, forming an interesting link with early times and imparting that touch of struggle and failure combined with ultimate success, which adds so indefinably to the prestige of old established yet modern concerns.

The production of coal from Sydney mines is an important feature, the annual production rising from 250,000 tons in 1900 to 840,000 tons in 1912, one third of this being used in iron and steel manufacture.

From Coal to Steel

The earliest development in this field however, was by the Dominion Coal Co., which in 1893 began active development of the most important coal areas here. It was due to a peculiar combination of circumstances that it was compelled to enter the iron and steel industry, the Dominion Iron and Steel, with a capital of $30,000,000 being formed in 1899.

The original plant was laid down for the production of blooms, billets and slabs, but was subsequently extended to produce steel in more finished forms. The Co. secured by purchase a portion of the Wabana ore deposits, this material when used with Sydney coal yielding satisfactory results.

Subsidiary enterprises utilize the byproducts, over 5,000,000 gallons of tar from the six hundred odd coke ovens being handled, together with cement and fertilizer products from slag. From a production of 950,000 tons of coal in 1893, the output has risen to 4,500,000 in 1912.

Quebec Efforts

In Quebec province the blast furnace industry is almost extinct although intermittent efforts were made dating from the year 1737 mentioned at the beginning of this article. In 1867, Moise was the scene of an attempt to smelt iron on a commercial scale, likewise St. Urhan in 1873 and Hull in 1872 and 1887, all of which were unsuccessful. At Radnor and Drummondville, however, furnaces were operated continuously from 1887 to 1912 on local ore, with locally-made charcoal as fuel, an average output of 8,000 tons per annum being maintained. The present industry consists of steel production in small open-hearth furnaces and electric furnaces, also the manufacture of special steels the tonnage of which is relatively small.

Ontario a Success

Operations in the Ontario iron and steel industry are unique in the fact that all fuel used together with the greater part of the ore used is imported. Geographical features have divided the plants into two groups the Ontario, and the Lake Superior. Numerous deposits of ore have been found in Eastern Ontario and many of these in Mayo township are shippers.

The early efforts to establish the iron industry date from 1800 when an attempt was made in Leeds county. Normandale was also the scene of a failure a few years later which, however, was more or less redeemed between the years 1832 and 1847 during which time it was successfully operated on bog ores of the vicinity with charcoal fuel. Other efforts were the Marmora furnace 1820-1875, Madoc, Houghton and Burnt River being also the scenes of ultimately abandoned efforts.

In 1892 the province of Ontario was without a single blast furnace, but from 1894 when smelting was started in Hamilton, followed later by the Lake Superior activities, the growth of the industry has been steady. The Ontario district now contains seven blast furnaces, the Steel Company of Canada, in 1913 producing 180,000 tons of pig iron, 157,000 tons of steel ingots, and 192,000 tons of finished merchant bar.

Western Developments

The Lake Superior district contains four blast furnaces, three of which are operated by the Algoma Steel Corporation, Sault Ste. Marie. An idea of the extent of the development at this point will be gathered from its output figures for 1913, pig iron made, 308,000 tons; coke made from American coal, 411,000 tons; steel ingots made, 438,000 tons; steel billets made, 20,000 tons; rails made, 320,000 tons; merchant mill product, 19,000 tons. A considerable amount of native ore is mined in this district, the Helen mine in the Michipicoten range being the largest producer in Canada, with 1,000 tons per day, other shippers are the Helen and Magpie mines, northwest of Sault Ste. Marie, while the Moose Mountain range contains an important deposit of magnetite.

The amount of iron ore mined in Canada in 1913 is not insignificant despite the troubles of pioneer efforts. In that year, 307,000 tons were produced but since then, New Brunswick and Nova Scotia have ceased. Ontario produced 195,000 tons of that amount, Helen and Magpie mines shipping 22,000 tons and Moose Mountain 3,300 tons. In 1914, 244,000 tons were produced in Ontario of which 184,000 tons were shipped to Canadian furnaces and 60,000 tons to the United States.

Mineral Developments

Canada was a gold producer of some

importance at the time of Confederation, the output for the five preceding years being 882,947 ozs., valued at $18,252,143. British Columbia produced more than seven-eighths of this amount, Nova Scotia suplying the balance. Quebec became a producer in 1877, Yukon in 1885, Alberta in 1886 and Ontario in 1891. In these the Yukon has the record for any one year, 1,077,553 oz. in 1900, valued at $22,275,000. By 1914, Ontario had secured premier annual place with 268,305 oz. valued at $5,546,356.

Ontario has a well established lead in silver since 1906, till now she is seven times as productive as British Columbia the figures in 1914 being 24,215,926 oz. and 3,212,111 oz. respectively. in copper, the positions are reversed, British Columbia producing 41,221,628 lb. against Ontario's 28,948,211 lb.

The history of nickel has been recapitulated so frequently of late that further emphasis on its value as a national asset seems impossible in these columns.

Unique Source

Talc, graphite, gypsum, feldspar, mica, corundum, molybdenite, asbestos, and manganite are some of the minerals now produced commercially throughout the Dominion. The world's chief source of asbestos is in Quebec, and with the exception of Ceylon, Canada is the only source of supply of amber mica, the United States securing its supply of this very necessary material for electrical work almost wholly from the Dominion.

Adding to these the existance of petroleum and natural gas on a considerable scale in certain localities, the variety of our natural resources becomes more evident, and when modern developments is water power utilization are taken in consideration, the whole industrial complexion assumes a wonderful aspect in comparison with fifty years ago, a surpassing roseateness dimmed only by the world cloud of struggle but ever holding forth promise of future brightness and greatness which in other fifty years may well outshine the present, even as the present outshines the past.

FIRE LOSSES IN MAY

LOSSES by fire in the United States and Canada during May reached the stupendous total of $24,968,000 just $9,000,000 more than the corresponding month of last year.

In these figures are included the values of many expensive Canadian factories and industrial concerns. The rapid growth of the monthly fire loss is causing grave concern. In these days when the country is straining every effort to reach a maximum production, the loss of a single factory is felt, and it is urged that a campaign for great fire prevention be immediately launched.

Losses So Far

The losses in the United States and Canada, according to The New York Journal of Commerce, for the first five months of 1917 reach the unusually large aggregate of $129,108,455, as compared with 113,528,920 for the same months in 1916. The following table gives a comparison of the losses for May of this year with those of the two preceeding years, together with the losses by months for the balance of 1916 and 1915:

	1915	1916	1917
Jan.	$20,060,600	$ 21,423,350	$ 36,431,770
Feb.	13,081,250	24,770,770	29,587,660
March	18,786,400	38,680,250	17,523,000
April	18,180,350	12,681,050	18,597,225
May	11,388,450	15,973,500	24,968,800
Total 5 mo.	$81,497,050	$113,528,920	$129,108,455
June	$ 10,893,950	12,247,500	....
July	9,006,800	23,013,800	....
Aug.	10,067,100	10,745,000	....
Sept.	14,823,500	12,244,625	....
Oct.	14,465,850	17,701,375	....
Nov.	21,204,850	19,898,450	....
Dec.	20 877,100	22,063,325	....
Ttl. for yr.	$182.836,200	$231,442,995	....

Big Fires in May

There were some 261 fires during May each of which caused an estimated property damage of $10,000 or over. This compares with 244 such fires in April, 270 in March, 381 in February and 303 in January, making a total of 1,459 fires since the first of the year, which caused a loss of $10,000 or over. The May fires classified according to their destructiveness, show the following results:

Estimated Loss—	No. of Fires
$ 10.000 to $ 20.000	71
20,000 to 30.000	53
30,000 to 50.000	41
50,000 to 75,000	31
75.000 to 100.000	19
100,000 to 200.000	26
200,000 and over	20
Total	261

Of the twenty large fires during Mav which each caused a loss of $200,000 or over, the following are worthy of special notice:

Location—Description—	Amount.
Columbus, Ohio, department store	$ 300,000
Pocatello, Idaho, garage and 200 autos	340,000
Toronto, Ont., ammunition factory	350,000
Sioux Falls, S. D., grain warehouse	1,000,000
Macon, Mo., railroad station, etc.	550,000
Lexington, Ky., several business houses	600,000
Atlantic, Ga., dwelling section of city	5,000,000
Fort William, Ont., stove Works	500,000
Bowie, La., lumber yards and dwellings	1,000,000
Greenwich, Conn., dwelling	300,000

Practically all of the important fires in May involved well insured property, and the fire underwriters, who had suffered severely in the first quarter of 1917, are now much worse off.

Ontario Figures

The summary of fire losses in Ontario during the first four months of the year is as follows:

	No. of Fires	Loss	Insurance Loss	Loss not covered by Insur.
Jan.	798	$ 808,419	$ 566,589	$241,830
Feb.	1,020	1,369,139	1,105,039	264,100
March	765	1,144,373	886,126	258,247
April	666	1,201,361	998,384	202,977
Total	3,249	$4,523,292	$3,556,138	$967,164

While the aggregate amount of the April loss ($1,201,361) is in excess, it is gratifying that the number of fires in the province in the mosth of April is less by nearly one hundred than in the preceding month, declares the report of the Ontario Fire Marshal. Unfortunately, the aggregate of the fire loss is due almost entirely to two large fires, both of which are under investigation. In Hastings county, Graham & Company's evaporator at Belleville was burned, involving a loss of about $185,000. In Norfolk county, the loss is almost exclusively caused by the fire in the premises of the Dominion Canners at Simcoe. It has not yet been ascertained what the exact amount of the loss by this fire is, and we are consequently estimating it at the figures furnished in the official Fire Chief's report, namely, $23,000 on the building and $500,000 on the contents. This may be very far astray, but it is the official estimate and when the loss is determined, it will be adjusted in the subsequent month's return.

CAR SHORTAGE SERIOUS

REPRESENTATIVES of various Boards of Trade and the railway companies are to meet in Ottawa on July 3rd, to outline a plan for revising the existing car demurrage rules. If an agreement can be reached the Railway Commission will be asked to ratify the new regulations immediately. It is felt that if the present rules are not changed car shortage will become more acute month by month.

"The public should have a clear realization of what is aimed at in the revision of these demurrage rules," said J. E. Dalrymple, vice-president of the Grand Trunk, recently.

"The situation is unprecedented. In every territory on the continent there is a demand for cars that cannot be fully met. It is useless to look to the car builders for relief. They have more work now than they can handle. If the situation is to be improved, or at least prevented from becoming more serious, there must be the greatest possible cooperation betwen the shippers, the consignees and the railways. Every car available must be kept moving and every car must be loaded to its capacity. That is without doubt the only way out of the present difficulties. Any measures that may be adopted to prevent the undue holding of cars for loading and unloading will, therefore, be of national advantage. Rules that were probably equitable under normal conditions are to-day hampering the efficiency of transportation."

FOUNDRYMEN'S CONVENTION AND EXHIBITION

WITH the total number of applications for space in the Mechanics' Building already in excess of the number of exhibitors at Atlantic City two years ago, and with the approximate floor area reserved considerably in excess of that occupied during that show, the success of the exhibition of foundry equipment, machine tools and accessories, to be held at Boston, September 25 to 28, is assured. Indications now point to the greatest show of this kind ever held, and it is probable that in number of exhibitors all records will be broken.

Manufacturers who have reserved space now are making preparations to ship their exhibits at an early date to avoid delays in delivery due to the congested condition of the railroads. As soon as delivered, all equipment will be stored in Mechanics' Building until the date of the opening of the show. An added feature of the exhibit will be the display of motor trucks. Manufacturers of these vehicles have been extended an invitation by the exhibition committee of the American Foundrymen's Association to display their products and a representative number of types undoubtedly will be displayed.

Technical Programme

That the technical features of this great gathering of foundrymen have not been neglected is reflected by the 44 papers that already have been secured, and to these must be added a large number of committee reports. The Boston meeting will be opened on Tuesday morning, September 25, in place of Monday afternoon, as at Cleveland last year, and morning sessions only will be held, closing Friday, September 28. Simultaneous sessions for the consideration of papers on gray iron, steel and malleable iron will be necessary to dispose of the lengthy programme that has been prepared. Registration will open at the Copley-Plaza on Monday morning, but on Tuesday the headquarters will be transferred to Mechanics' Building, where they will be continued throughout the remainder of the week.

General Topics

Symposium on "Military Stores":

"Making Shells in Permanent Molds," by Edgar A. Custer, Philadelphia.

Paper on Military Stores, by Dr. F. C. Langenberg, Watertown Arsenal, Watertown, Mass.

"Small Steel Castings for Ordnance Purposes," by Major C. M. Wesson, Watertown Arsenal, Watertown, Mass.

Symposium on "Refractories":

"Refractory Materials Employed in the Metallurgical Industries," by H. C. Arnold, University of Illinois, Urbana, Ill.

"Cupola Refractories," by G. E. Jones, Whiting Foundry Equipment Co., Harvey, Ill.

"Factors Contributing to the Economical Use of Grinding Wheels in the Foundry," by Wallace T. Montague, Norton Co., Worcester, Mass.

"Results of Tests in Blending and Mixing Sand by Means of Mullers," by R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston.

"Experiences with Sand Mullers from their Conception to their Final Application to the Foundry Industry," by P. L. Simpson, National Engineering Co., Chicago.

"Fillet-Sizes," by Frank R. Jones, University of Kansas, Lawrence, Kans.

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HOT-BLAST STOVES

OF the cold-wet and hot-dry methods of cleaning blast-furnace gases for use in hot-blast stoves, the latter is preferable for many reasons, according to a paper read before the American Institute of Mining Engineers. With this method, no material lowering of temperature of the combustible gases for the stoves need take place. This condition is feasible when the electrical method of cleaning is used, because the electrical precipitators need not be more than 15 ft. or 20 ft. long. The sensible heat energy of the top gas from blast furnaces above 60 deg. Fah., is much greater than that of the moisture carried away from the stoves.

Therefore a hot-dry method of cleaning the gases that conserves the heat energy of the top gases is more efficient as an energy saver than is a wet method of cleaning that reduces the moisture content, and thus decreases the sensible heat energy carried out by the moisture leaving the stoves. The dry-hot method also permits of the collection of such volatile constituents of the ore as potash, zinc, lead, tin, mercury, arsenic, and antimony compounds. The electrical method of cleaning removes 98 to 99 per cent. of the suspended matter in ore operation, and the use of such a clean gas makes feasible a different type of hot-blast stone construction from that now used.

It seems advisable, therefore, to design the stoves with a view to getting the maximum amount of heat energy into the products of combustion. The checker openings should be small, so as to bring the brick surfaces into intimate contact with the hot gases, and in the absence of necessity for removing dust, the present size of openings may be reduced materially. It might even pay to have the bricks so close together as to require the placing of a fan above the stove to compensate for the additional friction of the gases in passing through the brickwork.

WOMEN WELDERS USE OXY-ACETYLENE APPARATUS

CURRENT developments all tend to show that when the interests of their country demand it, Canadian women will be found willing and able to help in any possible manner. Among the many industrial occupations which have been invaded so successfully by women in Britain is that of blow-pipe operation involving the use of oxy-acetylene apparatus for welding and cutting. It is a peculiar fact that, while the physical effort required in this work is small, every aspirant to the occupation does not always turn out successfully. Skill, concentration of mind, lightness of touch and deftness of hand and eye are necessary factors of success, and that the female temperament contains these qualifications is evidenced by the number of women operators who have recently acquired a high degree of proficiency in this work.

CANADIAN GIRLS WHO HAVE QUALIFIED AS WOMEN WELDERS IN THE USE OF OXY-ACETYLENE APPARATUS.

The rapid development of aeroplane construction in this country opened up much work in the welding and cutting line which was particularly suited to the employment of women workers. Of comparatively small dimensions, and light weight, and, from their very nature, necessitating the utmost reliability of manufacture, the parts required are now being satisfactorily made by locally trained female operators. For some considerable time now, selected pupils have been receiving instruction in the shops of the Carter Welding Co., Toronto, and the high percentage of these who make successful operators has been a most pleasing feature of this interesting industrial development.

GROUP OF PUPILS RECEIVING PRACTICAL TRAINING IN CUTTING, WELDING AND BUILDING UP AEROPLANE PARTS.

STEEL INDUSTRY DEVELOPMENTS

The War-Created Stimulus given the Steel Industry is Reflected alike in the Nature and Application of New and Improved Equipment being Installed and Developed.

SULPHUR IN STEEL

By L. E.

THE long established belief that the effect of sulphur in steel is to make it unreliable has frequently been questioned in recent years. It has come to be generally recognized that high sulphur in pig iron is caused by poor furnace conditions, and that the sulphur is merely one indication of an iron that has not been properly produced. When this is the case, no amount of subsequent treatment under oxidising conditions in the open-hearth furnace can remedy the trouble, although the percentage of sulphur may be considerably reduced. The effects are carried forward into the finished steel, and there are good reasons for supposing that here also high sulphur is not so much the cause of unreliability as a symptom, and it might very well follow that a high sulphur is not harmful, provided the steel is not otherwise poor, due to insufficient reduction in the blast furnace. The question is receiving attention in many quarters.

In a recent American investigation tests have been carried out upon three steels having sulphur contents of 0.04, 0.09 and 0.16 per cent., the other elements remaining for all practical purposes the same. All the specimens were heated just above the critical range, quenched in water, and various sets of specimens were reheated to different temperatures ranging from 300 to 600 deg. C., and again cooled in various ways. After heat treatment the specimens were tested for tensile strength and for resistance to repeated shock,—the Charpy pendulum machine being used for the latter test. This machine consists of a heavy pendulum, which drops from a fixed height and strikes the specimen which is supported from each end, and breaks it at notch. The pendulum then continues its swing and the height it reaches is registered. Knowing the weight of the pendulum, the height it falls, and the height it rises, a simple calculation gives the energy consumed in breaking the specimen.

The results of the tensile tests showed that sulphur does not lower the tensile strength. The figures obtained for elongation and reduction of area show that there was little difference in ductility between the low and medium sulphur steels, but the ductility of the high sulphur steels was slightly lower than the other two for most of the treatment. The average figures for the shock tests, except for the air and furnace cooled specimens, were highest for each treatment in the case of the low sulphur steels and lowest for each treatment of the high-sulphur steels. The widest difference appeared in steels which were quenched and reheated.

It is difficult to draw definite conclusions from the results, because of the newness of the shock tests and the difference of opinion among engineers regarding its value. The tensile tests were not favorable to steels with a moderate percentage of sulphur, while the shock tests showed a decided falling off in strength as the sulphur increases. Until the interpretation of the results from the Charpy machine is more fully understood, it is impossible to say to which set of tests the most importance should be attached. It is important that the question of sulphur in steel should be settled, not only because the elimination of sulphur entails much trouble and expense, but also because a moderate percentage of sulphur is an aid to machining. The low sulphur material drags, and the production of a smooth surface is very difficult.

DOMINION STEEL CORPORATION ANNUAL MEETING

"WE are booked up in steel products to the end of the calendar year," President Workman told the shareholders of the Dominion Steel Corporation at the annual meeting last month, "and in addition to that our shell steel output for the first six months of 1918 has been disposed of." This was supplemented later on by the president's statement that unfilled orders at the present time were double those of a year ago and further that the business was not subject to cancellation.

Mr. Workman reviewed in some detail the improvement in the financial position of the corporation effected in the past year by the retirement of notes, etc., and the elimination from the balance sheet of the item of $2,000,000 "discounts and premiums on securities" which involved a recurring annual charge of about $225,000. For the current fiscal year he estimated that the annual interest charges would be about $500,000 less than two years ago—this in addition to interest on bank loans which have been eliminated.

Plant Improvement

As to physical improvements at the plants the remodeling of the blast furnace department was making progress and two batteries of new by-product coke ovens were being installed which would result in lower coke costs, while permitting of the utilization of the company's total blast furnace capacity which is now greater than can be taken care of owing to the limited coke production. Difficulties in the coal department due to scarcity of labor and ships were dealt with in some detail, but the president indicated that the outlook for the current year was fairly satisfactory. In a general review of the present position and the after-the-war outlook, Mr. Workman had this to say:—

"While the statements now before us indicate a greatly improved condition as compared with the previous history of the corporation, it must not be forgotten that lean years have been the rule rather than the exception, and it must therefore, be my policy to exercise conservation in ail our undertakings. I feel particularly committed to this course, having in view the keen competition that will undoubtedly arise after the war.

"Many corporations engaged in the steel industry across the border, have been able, partly through exemption until a comparatively recent date from taxation, and partly by reason of other advantages resulting from the attitude of neutrality long maintained by their Government, to accumulate large surpluses, and to practically amortize their plants. We, in Canada, have borne responsibilities of this nature for a much greater period, and it must not be lost sight of, that however gladly and willingly we have shouldered the burdens which have fallen upon us as our share in the prosecution of the war, none the less does this condition demand careful study and the exercise of rigid economy, in order that we may not be placed in a position of disadvantage os regards our competitors.

When Peace Comes

"Our chief problem, therefore, lies in the meeting of the conditions which may arise after peace terms have been signed, and I consider it good business to fortify ourselves in every possible way, so that when the time comes, we will be in such a position that the problem of meeting competition will not be insurmountable. Following out this policy, as I have stated already, our annual interest charges have been greatly reduced, and I might say that these charges for the current fiscal year will be more than half a million dollars under the figures of two years ago—this in addition to interest on bank loans, which have been eliminated.

"Many expressions of opinion have been presented at one time and another with regard to conditions which may prevail after the war, and while it is given to no man to definitely foretell the course of events, I feel, as far as the demand for materials such as we manufacture is concerned, that we may look to the future with confidence. It is inevitable that replacements and renewals, and replenishments of stocks throughout this country and abroad, which have been given second place during the urgent call for war materials, must, when conditions again become normal, culminate in a strong demand for products of all kinds. We should, however, be prepared for adjustments immediately following the declaration of peace, which may possibly result in a period of lessened industrial activity more or less extended. Nevertheless, the underlying need will seek to assert itself at the first favorable opportunity, and will sooner or later force merchants and consumers into the market.

"These problems, as I have said before, belong to the future. As for the present, I am happy to report that we are booked up in steel products to the end of the calendar year, in addition to which our shell steel output for the first six months of 1918 has been disposed of."

After the presenting of the president's address, H. Gordon Strathy asked if it were not possible for the shareholders to have more than one statement a year. To this the president replied that he could promise a statement of the output of steel each month, but that it was rather difficult, owing to the fact that a varying amount of business was done during the different seasons of the year, to issue satisfactory quarterly or half yearly reports of earnings.

Asked if it would not be possible to pay a quarterly dividend on the subsidiaries' preferred stocks, instead of half yearly, the president replied that the right to do that would have to come from the shareholders. That and the question of earning statements would not be lost sight of, and he personally would give them serious consideration.

Most of the Montreal directors were present and among the out of town directors were Hector McGinnis, K.C., M.P., Halifax; Brig.-Gen. Sir Henry Pellatt, Toronto; Lt.-Col. the Hon. F. Nicholls, Toronto; W. D. Matthews, Toronto, and Brig.-Gen. the Hon. James Mason. Other shareholders present were: M. E. Williams, F. W. McAnulty, A. Michaud, S. L. Herman, Geo. H. Bishop, W. R. Miller, C. W. Lindsey, P. E. Brown, Thos. Tate, F. J. Lewis, A. P. Frigon, R. B. Verner, A. LaRose, J. B. Clearihue, J. J. M. Pangman, L. McIsaac Sprackman, Dr. E. E. Simard, G. D. C. Dobbin, Dr. E. M. Hill, J. Gow, J. N. Cote.

IRON AND STEEL IN CANADA, 1917

THE Mines Branch of the Department of Mines has received from the producers complete returns of the production of pig iron in Canada, and with the exception of three small plants, complete return of the production of steel ingots and castings during the first three months of 1917.

The total production of pig iron during the three months was 276,777 short tons, or an average monthly production of 92,259 tons, as against an average monthly production throughout 1916 of 97,438 tons.

Furnaces were in blast at Sydney, and North Sydney, Nova Scotia; Hamilton, Port Colborne, and Sault Ste. Marie, Ontario, and a small electric furnace was operated at Orillia, producing pig iron from scrap steel. The blast furnace at Deseronto was idle throughout the period.

The total production of steel ingots and castings during the three months was 403,880 short tons, or an average monthly production of 134,627 tons, as against an average monthly production of 106,268 tons during 1916.

The monthly production, exports and imports, 1916 and 1917, are shown in the accompanying tables:—

Steel and Iron.—Reaumur discovered the direct process of making steel in 1722 or thereabouts by immersing malleable iron in a bath of cast iron. A steel manufactory is said to have been set up by Benjamin Huntsman near Sheffield in 1740. It was about 1800, however, before steel fairly became the fashion.

Pig Iron in Canada

	Production		Exports		Imports	
	Tons 1916	Tons 1917	Tons 1916	Tons 1917	Tons 1916	Tons 1917
January	562,097	89,187	1,635	106	4,456	5,473
February	or	83,801	1,393	732	4,101	3,502
March	monthly	103,789	2,725	1,394	5,602	7,442
April	average		80		5,963	
May	of		30		6,489	
June	93,683		221		3,190	
July	92,012		394		3,773	
August	87,864		3,902		3,961	
September	102,744		1,534		5,001	
October	113,608		4,344		5,933	
November	104,436		4,055		3,310	
December	106,496		2,991		6,351	
Total	1,169,257		23,304		58,130	
Monthly average	97,438		1,942		4,919	

Steel in Canada

	Production of Steel ingots and direct steel castings		Imports*	
January	589,553	130,944	4,212	13,322
February	or	120,568	7,288	15,213
March	monthly	152,368	5,206	32,590
April	average		10,877	
May	of		8,542	
June	98,259		11,368	
July	100,817		10,742	
August	107,273		13,412	
September	113,411		10,433	
October	123,469		12,958	
November	124,431		12,723	
December	116,265		10,309	
	1,275,219		118,070	
Monthly average	106,268		9,839	

*The figures given hereunder represent the exports of steel ingots and billets from the United States to Canada and are compiled from the monthly reports of "Foreign Commerce and Navigation of the United States," Washington, D.C.

Iron and Steel in Canada, 1916

	1915 Short Tons	1918 Short Tons
Iron Ore—Shipments:		
Hematite	205,989	45,541
Magnetite	59,217	19,113
Roasted siderite and hematite	132,906	210,522
Total shipments	398,112	275,176
Sold for export	89,730	140,608
Imports (Customs record)	1,504,113	2,339,677
Charged to blast furnaces, Canadian ore	293,305	221,733
Charged to blast furnaces, imported ore	1,463,488	1,964,598
Charged to steel furnaces	74,872	55,059
Shipment from Wabana, Nfld.	868,451	1,012,060
Pig Iron—Production by Provinces:		
Nova Scotia	420,275	470,055
Ontario	493,500	699,202
Production by grades:		
Basic	739,613	953,627
Bessemer	29,052	31,388
Foundry and malleable	145,110	184,242
Total production	913,775	1,169,257
Exports of pig iron	17,307	23,304
Exports of ferro-alloys	9,238	22,802
Imports of pig iron	47,482	58,130
Imports of ferro-alloys	13,758	14,777
Steel:		
Production of ingots and castings	1,020,896	1,428,249
Production of ingots by classes:		
Open hearth	962,411	1,377,387
Bessemer	19,448	1,416
Other steels	7,970	961
Electric steel	.....	17,939
Direct castings by classes:		
Open hearth	28,384	23,496
Other castings	2,683	5,350
Electric	.....	1,700
Electric steel, total production	5,625	5,350
Imports of steel ingots, billets and blooms from United States	58,486	118,070
Production of steel rails	232,411	90,123
Production of wire rods	124,381	179,226
Imports of tin plate	45,165	57,543
Value of total exports of iron and steel good	$48,268,148	$63,837,681
Value of total imports of iron and steel goods	74,308,983	129,090,168

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PRINCIPAL CONTENTS

EFFICIENCY THROUGH CO-OPERATION

APPARENTLY, the keynote of successful manufacture of the present day is based on the principle of efficiency, yet the fact that this efficiency must vary to a great extent in every individual and likewise every industry, makes it the more difficult to understand and also to define. From the dictionary we learn that the meaning is resolved into the ratio of the work performed to the energy expended, and while this applies more in the terms of mechanical work, the same is applicable to achievement of any or every kind. Individual efficiency, however, is the striving to accomplish what is required of you with the least expenditure of energy in the least possible time and with the most satisfactory results; and while this is true in the case of personal ability, the effect is the same in all lines of industrial activity, for the entire problem is mainly one where the human factor is the chief essential. With the individual, this trait of utilizing the full power to produce can only be acquired by stirring up the latent energies of the mind and body—the latter, in many instances, does not respond readily to the activities of the former, and adapting these energies to the best possible accomplishment of the desired objective. In the case of industries, great or small, maximum efficiency is only possible by the development and maintenance of this important factor in every individual workman.

Many manufacturing plants in the past have been impressed with the idea that their efficiency has been the result of adopting certain methods in the manufacture of their product, the secret of which they have been able to withhold from others in the same business, thus being able to advance more rapidly than the other. While this may be true in some cases, such an idea of efficiency is becoming exploded by the more broad-minded one of mutual co-operation and the interchange of ideas. If the old order of things had prevailed during the past three years of abnormal activity, every manufacturer relying on his or their own ability and resources for the development of the shell industry, the success of this industry would undoubtedly have been far below what actual results have proved.

The magnitude of recent munitions activity throughout the entire Dominion has clearly shown that to attain maximum efficiency both in the individual and in the operation of the plant, it was most essential that every facility be provided for maintaining production at the highest possible figure, and in order to do this it was found advisable, in fact necessary, to have a free and unrestrained exchange of thought and ideas regarding the best methods of achieving a certain end. It therefore follows that the highest efficiency in any line of endeavor can only be attained and maintained by the mutual co-operation of every one connected with the origination, progress and achievement, of every line of thought and action.

We speak of a machine in terms of efficiency, yet it depends almost entirely upon the operator what this term really implies. When a man is kept employed on a certain machine for any length of time, his effectiveness will naturally increase in proportion to the interest he takes in his work and also the nature of that work. If, however, the nature of the work is such that monotony is a feature of its continual operation, the efficiency of the machine may remain constant, but the actual production may be lessened, due to the laxity of the man working it. This has been offset to some extent by the introduction of the piece-work system, whereby a workman is encouraged by possible additional remuneration for greater production. On the other hand, where the nature of the work calls for the closest concentration in the accomplishment of same, and where the accuracy of the work depends more on the operator than on the machine, the individual workman and eventually the shop in which he is employed, may find themselves traveling in a rut with their relative efficiency unchanged, but at the same time falling below that of the other plant which has brought itself to recognize the increased possibilities by adopting methods whereby certain operations can be improved or production increased.

Efficiency is a flexible term when applied to production; its value may change from day to day as a result of many causes or a combination of several, but it is safe to say that the chief essential in maintaining a constant and gradual increase in operating efficiency is the closer co-operation of individual activity and the freer interchange of ideas between the men in each shop and with those of other shops, the latter being made more effective through publication in the editorial columns of their trade and technical journals.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

COATING IRON AND STEEL WITH ZINC—GALVANIZING*

By W. Ellison Sharples

Dipping Only

WHEN the trade was first established, the process universally adopted was that of dipping, no machinery being used. The bath employed was about 9 ft. long by 3 ft. 6 ins. wide by 4 ft. deep. A bar of "T" iron upon which was riveted an iron plate, just deep enough to go into the molten metal when the bath was at its lowest working level, was placed across the middle of the bath. The object of this was to divide the flux and keep the exit side in the best condition. A dipper and his mate were employed at the entrance side, and they together plunged the sheet into the molten metal, and by means of rods passed it under the iron plate before mentioned, bringing it up on the other side of the same through the flux. The sheet was then seized by "takers out"—two being employed—who gradually drew it out by means of tongs, and when the surface was sufficiently set plunged it into a tank of clean water. Afterwards the sheet was passed to the sawdust boxes, where it was dried. If it was desired to have a bright sheet, it was plunged into water before the surface was set—that is, before crystallization had begun. It was tried, with a view to economy in flux—that is, sal ammoniac, or muriate of ammonia as it is generally known in the trade—to utilize black foundry sand. It is apparent to anyone conversant with the process of galvanizing what a terrible practice this was, seeing that sand is not a fluxing agent for zinc. Its only economy, and that an imaginary one, was that due to the sand dragging on the surface of the sheet it would act as a flux. It created a large quantity of sand skimmings and oxide, besides the difficulty of separating the spelter and the sand when in a fine state. Several patent processes were introduced, among them being Heathfield's, Baylis's, and Carasco's.

Heathfield's Process

In this process a machine having several pairs of rolls was employed, the last pair being just above the surface of the metal, the object being to squeeze the surplus zinc off the sheets and give a uniform coating.

Baylis's Process

In this process the sheets after being pickled were passed through a pair of cold rollers upon which flowed a continual stream of water. From these rollers the sheet passed on to a bath which it entered by means of a pair of rollers fixed on the bath frame. It then passed by means of guides through the metal and emerged through the flux, which in this process was sand. They were then seized by a pair of studded rollers, passing onwards by means of an endless chain to a set of revolving brushes which brushed off the adhering particles of sand.

Carasco's Process

In this process the sheets passed through a pair of rollers on the bath and were conducted by means of guides into the flux box. From the flux box they passed by means of other guides through the metal and emerged through a pair of V-shaped wheels which gripped the sheets on the edges.

We now come to the process as carried out to-day and will deal with the machinery more fully.

*From a paper read before Institute of Metals.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

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President—Wm. J. Salmon, 104 Lake Front, Kew Beach, Toronto.
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PLACE AND DATES OF MEETING.

The Occident Hall, corner of Queen and Bathurst Streets. Fourth Thursday of each month, at 8 p.m.

Buildings

A building with a framework of light sectional iron and covered in either with asbestos, slates or corrugated iron sheeting serves the purpose equally as well as costly wood or brick buildings. Care must be taken to have a periodical inspection of the ironwork, and it should also frequently be coated with some good anti-corrosive paint, of which there are several upon the market. In arranging the buildings, the fact should not be overlooked that it is better to have the sheds used for corrugating, sorting and packing separate and detached from the galvanizing and pickling sheds. Attention also should be given to the ventilation of the buildings, especially in the case of the corrugating, sorting and packing sheds, and they should also be heated to obtain a dry atmosphere. This can be done by means of hot air heated by a steam heater, or a waste-coke heater, of which there are plenty in works of this kind.

Pickling

This is the first stage of the process after receiving the sheets from the annealing furnaces. There are two classes of acid used in this work, either sulphuric or commercial hydrochloric. If the former, the specific gravity used is 1.8 or 1.9 and mixed in the proportion of five parts of water to one of acid. In using this acid it is necessary to quicken its action upon the sheets by warming it to a temperature of about 90° to 95° F. by means of a steam jet, which conveys the steam to about 2 ins. from the bottom of the vat by means of a lead pipe of about ½-in. bore.

If hydrochloric acid is used as the pickling agent a "Twaddell" of about 35 is employed and the proportions are one of water to one of acid. By using this acid, it is, as a rule, unnecessary to warm it up by means of steam except in cold weather.

Of course, the adoption of acid used for pickling depends to a certain extent upon local conditions, but, speaking generally, it is preferable to use hydrochloric acid, since the sheets do not require soaking after pickling, although a water vat is often provided so that when the sheets are taken out of the pickling vat, to await being dipped by the dipper, they may be put in the water vat to await dipping, thus ensuring that they are kept perfectly clean. The fumes generated by the hydrochloric acid pickle are not so annoying as those generated by the sulphuric pickle. The working cost of both pickles is approximately the same due to the different quantities of acid used. The time occupied in pickling a batch of sheets is approximately the same under both systems and varies from 15 to 20 minutes, according to the condition of the iron and also of the pickle.

Pickling Vats

These vats are best constructed of good York stone, the vertical joints being joined together by means of solid round indiarubber pulled tightly together by means of clamps and rods. In the opinion of the author, clamps are better dispensed with. It is only necessary to drill the flags and pass the tie-rods through them direct. The horizontal joints are best made with flannel well smeared and kneaded with a paste of white lead and boiled oil. This prepared flannel is then evenly laid upon the portion of the stone which has already been truly dressed for the purpose. The side flags are then laid upon this flannel, their weight being found sufficient to close the joints securely. If care is taken in the building up of these tanks, they will last for many years with very little attention. Owing to the continual charging and discharging of the vats with sheets some protection is necessary for the tops of the vats. A cheap and efficient method of overcoming this difficulty is to protect them by means of channel iron, the wear being taken by this iron. This will be found to well repay the extra outlay, as the renewal of a stone side is a somewhat costly job. The bottom of the vat is protected by blue bricks set in china clay and pitch, about two courses deep. A hole about 3 ins. diameter for emptying the vat is provided at one end of the vat, being plugged up by means of a wooden taper plug covered with flannel. A cheaper vat can be made of pitch pine lined with lead and its bottom protected by means of elm or pitch pine planks wedged in to prevent the sharp edges of the sheets cutting the lining.

Although the initial cost of the stone vats is far in excess of the wooden ones, their life is considerably longer and the maintenance is not so high. All tie rods and clamps should be regularly and frequently coated with a mixture of equal parts of lime and tar, when it will be found that they will last a considerable time, although often being splashed with acid.

The second or intermediate vat is generally constructed of pitch pine planks whose top sides are likewise protected with channel iron to prevent wear due to the rubbing action of the sheets. The sheets after being fed into this vat from the pickling vat by manual labor are, in some cases, fed into rollers fixed on the side of this vat, and thus conveyed into the dipping machine; but it is, in the author's opinion, better that the sheets be taken by hand from this vat and fed into the dipping machine by the dipper, thus ensuring a square start and a safer passage of the sheet through the galvanizing bath.

Bath and Bath Frame

The bath is made of the best quality mild steel plates 1 in. to 1¼ ins. thick, being either riveted or welded, a convenient size being 5 ft. 9 ins. by 5 ft. 9 ins. by 3 ft. 6 ins. deep. This is set upon a foundation of brickwork covering the whole of the bottom, rising about 9 ins. round the sides, so as to prevent, as far as possible, the bath being burnt when the dross accumulates at the bottom.

These baths are fired by various means, generally open coke fires, or the bath may be surrounded by means of cast iron covering plates over the fires, with suitable firing holes cast in them, and having lids so that the intensity of the fire may be regulated. These plates are best cast in angle form and bolted together in such a manner that they may form a fixing or stay for the brickwork, at the same time being easily removable in the event of the bath becoming leaky, necessitating immediate and quick repair. Great care is needed in the firing of the bath, as upon this depends to a very large extent the life of the same. For successful working it is necessary to maintain an even heat in the bath so as to prevent undue formation of oxide caused by overheating of the metal on the one hand, and excessive deposit of metal on the sheets caused by too low a heat on the other hand. The temperature to aim for is from 830° to 850° F., which will give a satisfactory result. Care should be taken to instruct the dipper, and likewise to see that the instruction is carried out, that he must clean daily the sides of the bath on the fire side and internally, as far as possible of oxide creepings by means of a scraper bar. This considerably helps in prolonging the life of the bath, preventing overheating of the same—as oxide is an exceptionally bad conductor of heat and when formed and allowed to remain causes burning of the plates and ultimate failure of the bath.

Starting a New Bath

When the galvanizing bath has been properly set, considerable care must be exercised in filling it with spelter to prevent the bath from being ruined when the fires are started. In filling the bath with slabs of spelter, place them on edge in such a way that their flat surface will lie as closely as possible to the sides of the bath. By exercising a little ingenuity the slabs can be so placed as to practically cover the sides of the bath. This method of placing the slabs will lessen the danger of burning the bath on the first firing as there is cold zinc against all the heated surface. The slabs should also be arranged so that as the outside ones melt, those next to them will be forced outward against the side of the bath.

Firing a New Bath

In heating up the bath for the first time, one should take care that the work is not hurried. Under no circumstance attempt to melt out a bath for the first time in less than 36 hours. Until spelter begins to melt the fuel should not be allowed to attain a depth of more than 12 or 15 ins. in the fire spaces, and the air holes should be regulated so that the fires will not burn so strongly. As the metal melts the depth of fuel may be increased, but it should never be more than 3 or 4 ins. above the surface of the metal in the bath. Of course, it is rather difficult to determine just the depth of the molten metal, but it is easy to be on the safe side even if a longer time is taken in melting out.

Leaky Baths

It often happens that a bath is worn more in one particular place than another. This is often caused by extreme draughts forcing the fire in that particular spot, but by careful stopping it is possibly to considerably lengthen the life of a bath. All repairs should be carried out in a careful manner, and as quickly as possible consistent with first-class repairs.

The location of a leak soon makes itself apparent by excessive fumes due to oxidization of the metal. The first operation is to remove the fire and ashes from the vicinity of the leakage when the size of the same can be observed. No attempt should be made to stop the leak by thrusting the point of a poker in the hole, as this may cause the hole to become larger, especially if the plate has become very thin in this particular place. If the hole is very small it can be stopped, but if the molten spelter flows in a continuous stream it is necessary to lower the level of the metal below the level of the hole. If the hole is large the metal can be caught in moulds while the operation of lowering is going on.

The next step is to build up from the bottom of the fire space a column of firebrick to within a foot of the hole. A piece of R.S. channel about 5 ins. by 3 ins. is then put in an upright position and tightly wedged to the bath from the brickwork and the brick column is built up to the level of the surrounding brickwork. In the intervening space, formed by the channel, some fireclay, made into a stiff paste, is put and well rammed, so as to form a good foundation, which should reach to within 5 ins. of the hole. A mixture of iron filings and sal-ammoniac is then put in on the top of the fireclay and also well rammed until it is a few inches above the aperture. The remainder of the space so formed is then filled in with fireclay and well rammed. This should be allowed to remain a couple of hours to set, when the bath may again be put in service.

Questions and Answers

Question.—I have recently added some alum to my acid copper solution and find that instead of an improved condition the bath has become rapidly deficient in acid. Will you please explain why such a change should take place.—J.E.C.

Answer.—Alum is a double salt composed of sulphate of potash and sulphate of alumina. The addition of alum to acid copper baths is common practice and unless used in excessive quantities will not neutralize sufficient free sulphuric acid to interfere with the proper working of the bath. It is possible that the free sulphuric acid in the bath was very low at the time alum was added. If so, the alum would hasten the depletion. Acid copper baths do not require frequent additions of acid after being once prepared; free sulphuric acid is being constantly formed in the solution while deposition is going on. The alum could do no further damage when neutralization was effected and aluminum sulphate formed. This substance has been found beneficial in the acid copper bath. You may use dextrine in place of alum, or black molasses. In using dextrine, make certain of the purity of the chemical, as commercial dextrine contains gluten which invariably causes streaking of deposits.

* * *

Question.—Please publish a formula for a good yellow green verde. I want to use the method for finishing a variety of electric parts.—A.M.Y.

Answer.—Dissolve 5 oz. of nitrate of copper, 5 oz. of ammonium chloride, 5 oz. of chloride of lime in 1 gallon of water. Use the solution warm, copper plate iron, steel and brass articles and pass them through an oxidizing solution for light tones. For dark tones, oxidize black. If a trial indicates that the verde solution absorbs the oxidizing solution, reduce the density of the verde solution by diluting with water to about $1\frac{1}{2}$ or 2gallons. Permit the verde to form slowly, and when of satisfactory tone, rinse rapidly in clean cold water. This improves the depth of color and richness of tone. Dry and lacquer, or wax as is usual.

* * *

Question.—We intend to electro-galvanize a portion of our product hereafter, and would appreciate some information from you regarding a good formula for the purpose, also a memo of the usual procedure in the management and operation of the solution.—F. L. F.

Answer.—If you have never operated a zinc plating solution you will find plenty to occupy your attention as soon as you prepare one for commercial purposes. After mastering the peculiarities of the bath you will have no further trouble. For each gallon of water dissolve 2 pounds of zinc sulphate, 4 oz. aluminum sulphate, and 3 oz. sodium chloride. The solution should be effected by warming the water. After the above solution is transferred to the plating tank and well stirred, add about 1 oz. of of black molasses for each 10 gallons of zinc solution. Place anodes cast from pure zinc in the solution, and allow the solution to remain idle for from 12 to 15 hours. In the interval, the free acid remaining in the solution attacks the anodes and the solution becomes neutralized to a proper working condition. An electromotive force of about 6 volts, and a current density ranging from 20 to 30 amperes per square foot will be found adequate for ordinary purposes. As a general rule, zinc plating solutions should be kept strong in metallic content. A solution containing less than 4 or 5 oz. of zinc per gallon does not yield as good deposits as one richer in metal and operated with higher current densities. This is probably due to the electro-positive nature of the metal zinc. Hydrogen being electro-negative is more readily set free, and with low currents the proportion of hydrogen gas to metal would be unusually high. Zinc plating solutions require a higher current density per square foot of surface than is usual for other electro-deposited metals. Iron and steel require same care in cleaning as is necessary for nickel plating. Iron or steel may be zinc plated direct, but it is customary to first copper plate the surface; brass or nickel may be used if preferred. As is the case with all other metals, the thickness of deposit depends not only upon the current density employed, but also upon the time allowed for deposition. This point you will be obliged to settle to your own satisfaction. A deposit obtained in 15 minutes will prove sufficient for many cheap articles, while 1 to 2 hours may be required to produce a deposit to withstand severe acid tests. The latter you may use to assist in getting an idea of the corrosion resisting qualities of the electro-deposited zinc as compared to hot galvanizing by means of molten baths of metallic zinc.

Question.—Can you assist us to secure some information about plating aluminum. We understand there is a process which includes the use of iron in some form. We wish to copper plate a small aluminum cup used on our machine.—H. C.

Answer.—The method you have reference to originated in France and has been used with more of less success by various firms in this country. The principal objection to this method is same as for all others. The resulting deposit becomes non-adherent after a few months and blisters up. We have seen specimens which were apparently sound and firm after being plated one year, but in commercial practice this is unusual. The process is as follows: Clean the aluminum with gasoline or benzine, then use diluted warm—not hot— soda solution. Rinse well and scour, then immerse in a pickle composed of hydrofluoric or hydrochloric acid, say 3 to 6 oz. of acid per gallon of water. Rinse well and immerse in a solution 8 oz. iron chloride to 1 gallon of water and to which has been added 1 oz. hydrochloric acid. A film of iron is formed on the aluminum surface by this immersion and, after rinsing, the article is transferred directly into the plating solution. Use initial current considerably stronger than for regular plating. The iron chloride may be made by dissolving clean iron in hydrochloric acid until the acid ceases to act.

* * *

Question.—The copper hooks supporting the anodes in our copper bath wear away very rapidly, and as we have consumed all the short pieces of copper and brass wire of sufficient size which we have accumulated for this purpose and will be obliged to buy copper for hooks unless we can devise some substitute, we are writing you to find out whether there is any material which would prove effective as anode hooks in our plating bath as a substitute for copper or brass. —A. C. C.

Answer.—You may avoid a great amount of annoyance, labor and expense by using lead hooks to support your anodes in the copper and brass solutions. Lead hooks are particularly effective in acid copper solutions, as they are not attacked by the solution and conduct sufficient current for all practical purposes. In cyanide solutions, the hooks must be as large as possible and should be protected by several coats of bitumastic enamel. The E.M.F. required to operate the solution will be greater owing to the resistance of the lead, but the difference is not sufficient to give preference to copper. In one establishment the copper hook is encased in a thin sheet lead covering, and the disintegration of the copper is thereby greatly retarded, with little increase in resistance to the current.

* * *

Question.—The firm I am working for have received a large number of castings known as "die cast metal." They are imported in rough and some are required to be plated. I have attempted to plate them, but find the metal somewhat difficult to handle. The deposits invariably blister or peel. Some of the castings have been ruined by repeated treatment. Can you advise me regarding a proper treatment.—A. N.

Answer.—Cleanliness is the prime factor in the plating of die castings. The metal is almost as susceptible to the corrosive action of caustics as is pure aluminum, and this fact must be remembered. Wash the castings with gasoline and avoid touching them with the hands when cleaned. Rinse quickly in a dilute solution of clean caustic sode (about 8 oz. per gallon). Do not use the cleaning solution very hot; a temperature of 125 degrees Fahr. will suffice. Rinse in clean warm water, then in cold water, and swab the surface of the casting with a cotton potash brush charged with whiting and transfer immediately to a double sulphate nickel solution containing not more than 8 oz. of nickel salts per gallon and operated with a voltage of from 1.25 to 3 volts. The current density allowable will depend largely upon the shape of the casting, however; a trial will suggest the correct current. Deposition may continue for fifteen minutes or a half hour. Buff on soft cotton wheel of moderate diameter at about 1,800 r.p.m.

* * *

Question.—Please tell me what material is used for sand buffing brass goods previous to plating, and how it is employed.—L.E.

Answer.—Pulverized pumice stone mixed with oil is generally used by most successful operators. Just enough oil is used to render the pumic more adhesive than the dry material, the fineness of the pumice depends upon the nature of the metal to be treated, and the condition of the surface when received for sand buffing. The material is applied to the wheel with one hand while holding the article to be polished in contact with the lower portion of the wheel with the other. The wheels employed are usually made from Walrus hide, being tough and very durable. The sand or pumice is allowed to flow from the hand onto the wheel as it revolves toward the operator in a downward direction. A large fan or wooden enclosure arranged beneath the wheel catches the sand which is used repeatedly. As it wears too fine for rougher classes of work, it is removed for use on finer grades. Coal oil is sometimes added to the mixture to thin the mixture, while melted tallow may be used to thicken it. Usually a simple mixture of oil and pumice will suffice for general purpose.

* * *

Question.—How can I produce a red mahogany finish on copper.—D.S.

Answer.—Obtain a five or ten minute deposit in the acid copper solution, wash and immerse in weak sulphurette solution used slightly warm, when iridescent colors appear, quickly remove and wash, scratch brush lightly, employing a little ammonia chloride in the water used for brushing. Dry and lacquer, the latter bringing up the tone and lending luster and richness to the finish.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON

Grey Forge, Pittsburgh	$47 95	
Lake Superior, charcoal, Chicago	57 00	
Standard low phos., Philadelphia	82 00	
Bessemer, Pittsburgh	55 95	
Basic Valley, furnace	50 00	
	Montreal	Toronto
Victoria		.....
Hamilton	.....	.....

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$68 00
Antimony	26 00
Copper, lake	37 00
Copper, electrolytic	37 00
Copper, casting	36 00
Lead	14 25
Mercury	100 00
Nickel	50 00
Silver, per oz	0 82
Tin	66 00
Zinc	12 00

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$22 00	$22 00
Copper, crucible	26 00	27 00
Copper, heavy	26 00	26 50
Copper wire	26 00	26 50
No. 1 machine com position	22 50	22 00
New brass clippings	18 00	19 00
No. 1 brass turnings	16 00	16 00
Heavy melting steel	20 00	17 00
Steel turnings	9 00	8 00
Shell turnings	12 00	12 00
No. 1 machinery cast iron	25 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	17 00	14 00
Scrap zinc	8 00	9 50
Heavy lead	11 50	10 75
Tea lead	7 50	7 00

COKE AND COAL

Solvay foundry coke	$10 90
Connelsville foundry coke	....
Steam lump coal	8 50
Best slack	8 05

Net ton f.o.b. Toronto

BILLETS

	Per Gross Ton
Bessemer billets	$100 00
Open hearth billets	100 00
Forging billets	125 00
Wire rods	95 00

F.o.b. Pittsburgh

PROOF COIL CHAIN.
B

1/4 in.	$10 75
5-16 in.	10 40
3/8 in.	10 25
7-16 in.	10 00
1/2 in.	9 90
9-16 in.	9 90
5/8 in.	9 75
3/4 in.	9 50
7/8 in.	9 40
1 inch	9 25
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS

Solder, guaranteed	0.41
Babbitt metals	16 to 65
Putty, 100-lb drums	4 35
Red dry lead, 100-lb. kegs, per cwt.	13 87
Glue, English, per lb.	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls	0 62½
Linseed oil, boiled, single bbls.	1 27
Linseed oil, raw, single bbls.	1 30
Plaster of Paris, per bbl.	2 50
Plumbers' oakum, per 100 lbs.	9 00
Lead wool, per lb.	15
Pure Manila rope	37
Transmission rope, Manila	43
Drilling cables, Manila	39
Lard oil, per gal.	1 50

SHEETS.

	Montreal	Toronto
Sheets, Black, No. 28	$10 00	$10 00
Sheets, Black, No. 10	9 50	10 50
Canada plates, dull, 52 sheets	11 00	11 00
Canada plates, all bright	12 50	12 50
Apollo brand, 10¾ oz. galvanized	9 75	9 75
Queen's Head, 28 B.W.G.	10 75	10 75
Fleur-de-Lis, 2..8 B.W.G.	10 75	10 75
Gorbal's Best, No. 28	10 25	10 25
Colhorne Crown, No. 28	10 00	10 00
Premier, No. 28 U.S.	10 90	11 70
Premier, 10¾ oz.	11 10	12 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$15 50
3-16 in.	11 70
1/4 in.	8 40
5-16 in.	7 40
3/8 in.	6 35
7-16 in.	6 35
1/2 in.	6 35
5/8 in.	6 35
3/4 in.	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, net; B and C, 20 and 5%; cast iron, 50; standard bushings, 60; headers, 60; flanged unions, 55; malleable bushings, 60; nipples, 72½; malleable, lipped union, 60.

ANODES.

Nickel	$0.50 to $0.54
Cobalt	1.75 to 2.00
Copper	.42 to .44
Tin	.73 to .75
Silver, per oz.	.86 to .88
Zinc	.16 to .18

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .20
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, acqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper, carbonate, anhy	.50
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.12
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate .....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3.50
Polishing wheels, bullneck		1.70
Pumice, ground		.05
Emery composition	.08 to	.09
Tripoli composition	.04 to	06
Crocus composition	.07 to	.08
Rouge, powder	.30 to	.35
Rouge, silver	.50 to	.55

Prices per lb.

Toronto, Ont., July 3.—That the trade of Canada continues to expand is shown in the statement recently issued at Ottawa by the Department of Customs. For the month of June the revenue amounted to $15,386,678, compared with $12,030,451 for June, 1916, being an increase of $3,536,226. For the first three months of the present fiscal year the increase in revenue amounted to $11,248,798 over the corresponding period of last year. These figures are very satisfactory in view of the conditions prevailing in regard to shortage and increasing high cost of raw materials and scarcity of labor. A reduction in the price of soft coal ranging from $1 to $1.50 per ton in the United States is welcome news, and will benefit consumers in this section of this country. It is not known as yet if anthracite will be affected, but it appears likely. The important thing now is to get coal moving in sufficient quantities to fully supply the demand.

Steel

Conditions in the market in the U. S. dominate the situation in Canada to a greater extent than at any other period. Canadian mills, by reason of their heavy commitments of steel for war purposes, can only take care of their domestic business to a small extent; the balance must of necessity, as far as possible, be obtained from the States. In that market, however, conditions are such that domestic consumers there cannot obtain a fraction of the steel they require and private enterprise has fallen off in proportion. Canadian consumers are affected in a like manner, and they are suffering serious inconvenience. Not only is the shortage of steel getting more acute, but prices of many products are becoming almost prohibitive for the average manufacturer, whose only hope is to continue in business as long as his old contracts for steel will carry him, and then await a readjustment.

Although there are few price changes to announce this month, a number of advances are in prospect. Iron and steel bars and structural shapes are expected to advance very shortly. Higher prices on wrought pipe are also looked for. The situation in plates is tighter than ever, and higher prices are inevitable. The plate mills are being taxed to the limit to meet the requirements of the American Government and private shipbuilders. Prices of plates are entirely nominal, and no one can tell what the market is. Conditions in the boiler tube trade are unchanged, and prices continue very firm.

The sheet market continues steady, with prices practically nominal. The commercial demand for sheets continues active, but the mills are refusing to quote on new business not coming from regular customers, conserving as much of their output of sheets of all grades for Government needs. The U. S. Government are ordering sheets at the rate of 19,000 tons monthly.

It is expected that the American Government will shortly announce a decision with regard to contract prices for iron and steel products. In the meantime, prices are advancing, due largely to Government orders, with the result that private consumers are holding off from the market wherever possible.

Pig Iron

Domestic foundry pig irons continue off the market, and the situation is generally unchanged. Pig iron prices in the States, however, are still advancing. At

Buffalo, No. 1 foundry, malleable and basic, are now held at $53 to $55. Lake Superior charcoal iron is now $57, Chicago. The coke situation continues to grow serious. Producers are not willing to enter upon contracts at any price, as they say they cannot tell what their production costs will be, nor whether they can secure a sufficient number of cars to make deliveries. Connellsville coke has recently been sold as high as $15.50 ovens, and further advances are expected shortly.

Scrap

The situation in the scrap market is unchanged, and prices are at the same level as quoted last month. Consumers continue to keep out of the market in the expectation of lower prices. Heavy melting steel and machinery cast iron are in good demand and prices are holding firm. Shell turnings are in good supply, and stocks on hand are increasing with a consequent weakening in price. There is a continued scarcity of most old materials which is tending to keep prices up.

Machine Tools

Fair demand for machine tools for general purposes continues to be the feature of market. Prices of practically all lines of tools are very firm, with prospects of advances. In the Chicago district, advances of 5 to 15 per cent. have been made on almost all kinds of machine tools. Radial drills have alvanced 15 per cent., and boring mills 10 per cent. There is increasing activity in the market in the States, which will affect deliveries of machinery imported into Canada.

General Supplies

Business continues active at firm prices, but there are no changes of particular importance to note this month.

Metals

The metal markets have been more or less inactive during the month, but consumers and producers are awaiting further developments in regard to the American Government buying. Last week the Government purchased a quantity of lead at 8c, St. Louis, while more recently it was announced that 60,000,000 pounds of copper had been purchased at 25c, New York. A decision in regard to the other metals has yet to be made, which introduces an element of uncertainty into the market. There are no price changes to note, but quotations generally are holding firm.

Copper.—The purchase of sixty million pounds of copper at 25c by the American Government has created considerable interest in the market, and it is believed to be an indication that the Government consumption for its own use and also that of the Allies is going to be exceptionally heavy. The market is quiet and prices continue more or less nominal for all positions. Lake and electrolytic are quoted at 37c, and castings 36c per pound.

Tin.—The market is dull and featureless, but prices are holding firm. Local quotation, 66c per pound.

Spelter.—The market continues dull, with a continued lack of interest taken in spelter by consumers. It is expected that further U. S. Government orders for spelter will be at prices probably better than were fixed for the previous purchase. Local quotations unchanged at 12c per pound.

Lead.—The tone of the market is easier, and the independents have dropped their price to 11.50c New York, which is now only a shade above the "Trust" quotation. Local quotations unchanged at 14¼c per pound.

Antimony.—Dullness continues to prevail in the market, and prices are unchanged at 26c per pound.

Aluminum.—The market is quiet and demand light, with quotations unchanged at 68c per pound.

Foundry Supplies and Chemicals

The scarcity and high cost of raw materials is the outstanding feature in the market, and the situation is becoming more acute. Foundry equipment is, on this account, advancing in price, while the cost of supplies is also increasing. The demand for most lines of foundry supplies is good, yet business would be a great deal better if materials could be obtained in sufficiently large quantities. Polishing wheels are now $3 and bullneck wheels $1.75. Owing to the scarcity of leather, bullneck wheels are becoming more difficult to obtain. Useable sizes of genuine emery are practically off the market and the substitute materials are not giving the same satisfaction. Ground pumice is now quoted at 5c per pound. There is no improvement in the situation as regards chemicals, prices continue high with a scarcity of some lines. Boracic acid has advanced and is now quoted at 20c. Nickel ammonium sulphate is higher at 12c, and anhydrous copper carbonate is 50c per pound.

TRADE GOSSIP

Elmira, Ont.—The Elmira Transmission Co., propose building a foundry.

Toronto, Ont.—The Hoyt Metal Co., will build an addition to its factory on Eastern Avenue.

The Canadian Furnace Co., Port Colborne, Ont., has increased its capital stock to $1,500,000.

Bracebridge, Ont. — The Muskoka Foundry Co., contemplate making an extension to their plant.

New Toronto, Ont.—Brown's Copper & Brass Rolling Mills, Ltd., have increased their capital stock to $5,000,000.

Copper Cliff, Ont.—The Canadian Copper Co. will build a blast furnace and converter to cost $200,000. The Dominion Bridge Co. will supply and erect the steel work.

Niagara Falls, Ont.—The Norton Co. will build this year another unit to their plant at Chippewa for making abrasives. They have installed a waterworks system recently with a mechanical filtration plant.

St. Catherines, Ont.—The St. Catherines Brass Co. are going to enlarge their plant at a cost of $15,000 and will be exempt from taxes for ten years. This firm will manufacture plumbers supplies and brass fittings.

Col. Thomas Cantley has resigned from the presidency of the Nova Scotia Steel & Coal Co., to assume the position of chairman of the Board of Directors. Col. Cantley has been with the company 32 years, of which 16 were spent as general manager and two as president.

Sidney, N.S.—The Dominion Steel Corporation has started extensive improvements to the Wabana properties which will increase the output of iron ore from 800,000 to 1,600,000 tons. The cost of the work is estimated at $1,500,-000.

The Deloro Smelting and Refining Co., have opened up their own sales offices at 315 Graig St. West, Montreal, with B. Horwood as manager. The product (Stellite) of this firm was formerly handled by the Canadian B. K. Morton Co. of Montreal.

Frank H. Crockard, vice-president and general manager of the Tennessee Coal, Iron & Ry. Co., Birmingham, Ala., has been appointed president of the Nova Scotia Steel & Coal Co., to succeed Col. Thomas Cantley, Chairman of the Board of Directors.

Hamilton, Ont.—The Steel Company of Canada have purchased the steel mill at Morrisburg, Ont., and propose removing the entire plant to Hamilton, if the city will sell some property adjoining the company's works. The Board of Control have the matter under consideration.

Allocate Pig Iron.—The American Iron and Steel Institute has been asked by the Department of Commerce, Washington to name a committee to allocate pig iron in the United States. The British Government has assured the United States that its shippers will observe any regulation by such a committee.

Will Roll Steel Rails.—Owing to the urgent need of the Canadian railroads for steel rails, it is announced that the Imperial Munitions Board has decided to release 25,000 tons of steel which will be manufactured into rails at the Soo plant and so cover immediate needs in this connection. It is understood that 15,000 tons will be supplied by the Algoma Steel Co.

Nova Scotia Steel Output.—The output of the Nova Scotia Steel and Coal Co., for the first quarter of the year was as follows:—Coal mined, 146,525 tons; ore mined, 12,177 tons, limestone quarried, 21,074 tons; coke made, 25,545 tons; iron made, 21,103 tons; steel ingots made, brushed steel and forgings, 28,598 tons.

The International Malleable Iron Co., Guelph, Ont., have about completed an addition to their factory 216 x 100 feet, which will shortly be in operation. Another extension 90 x 60 feet is being built. New smelting furnaces and annealing ovens when installed will increase the output by 50 per cent. or 3000 tons per year. The satisfactory increase in demand for the company's product has made these extensions necessary.

Tungsten More Active.—The demand for tungsten in the primary markets has been quite active recently and considerable business has been done for delivery during the balance of the current year. Beyond this producers are willing to quote. The market in New York is strong on light arrivals. The present market is equivalent to about $2.25 per pound tungsten.

Large Copper Output.—In the first four months of this year the principal copper mines of North and South America produced a total approximating 715,000,000 pounds. Of the 715,000,000 pounds produced to date in 1917, Anaconda was responsible for nearly 114,000,000 pounds, with Phelps-Dodge Corporation properties second with a total of 64,000,000 pounds.

President Mark Workman of the Dominion Steel Corporation has left Montreal for the company's properties in the East. He will be away about two weeks. During that time he will first inspect the new blast furnaces and by-product ovens being installed at Sydney. From Sydney he will cross to Wabana, Nfld., where work has been started on the improvements planned in connection with an increased output of iron ore.

R. H. Parks has been appointed operating manager of the Canadian Car & Foundry Co., Montreal. Mr. Parks who will have charge of the operation of all the car plants has been identified with the car building industry for a great many years, and came to Canada from the Bettendorf Car Co. of Davenport, Ia. Coincident with this appointment, **W. S. Atwood** has been appointed assistant to the vice-president and managing director.

Nickel Refinery Soon to Open.—Ambrose Monell, president of the International Nickel Co., in the annual report, says that construction of the new refinery at Port Colborne, Ont., is proceeding at a rapid pace, in view of the difficulties in securing labor and materials, and it is expected that the plant will be in operation at the beginning of 1918. This property is located at the Lake Erie entrance of the Welland Canal. The cost of the refinery when completed is expected to be $5,000,000. Up to the close of the fiscal year the actual expenditure on construction had been $1,046,740.

Nickel in Ontario.—Nickel mining is of first importance in Ontario. In 1915 the nickel contained in Sudbury matte amounted to 34,039 tons, valued at $17,019,500. In 1915 the output was 42,000 tons, worth $21,000,000. During 1916 both of the operating companies, the Canadian Copper Co. and the Mond Nickel Co., worked to their fullest capacity their mines and smelters in Ontario, as well as their refineries, one of which is in New Jersey, the other in Wales. Other sources of nickel in Canada are the nickel oxide obtained by the refineries from the ore of the Cobalt district and the Alexo mine. A little metallic nickel was obtained elsewhere during the year, but production was relatively unimportant.

Government Ready to Operate Mines.—Replying to a question in the House of Commons, Ottawa, on June 21, about the Western coal mine situation, Hon. T. W. Crothers, Minister of Labor, stated that the mines would be in operation within a few days under the guidance of the Government, unless the operators and miners got together. The only point in dispute was the penalty clause, which the operators insisted upon putting into the contract. Both sides were willing to accept the scale of wages proposed by the Government special commissioner, R. F. Green, M.P.

Port Coquitlam, B.C.—An agreement has been entered into between A. F. Bernstein and the Corporation of Port Coquitlam, B.C., to provide for the erection of an electrical smelting plant here consisting of four 25-tons per day units. The plant is also to be provided with a rolling mill, having an output of 75 tons per day. The company must produce 15,000 tons of pig iron per annum. The plant is designed to treat the magnetite ores of B.C. and construction will commence shortly. A by-law will be submitted to the electors shortly to authorize assistance by way of a bonus of $200,000, payable upon completion of the plant. Manso, Ramsay & Co., of Vancouver, B.C., are the consulting engineers to whom communications may be addressed.

Steel Price Inquiry.—The United States Government inquiry into steel making costs, in the opinion of manufacturers may develop facts likely to reduce the bickering reported from Washington. It will show, for one thing, that one company's expense in making plates, steel bars, structural forms, etc., is by no means the same as the expenses of another concern. It is pointed out that while the Steel Corporation might show good profits on ship plates, say, at a certain price, a competing concern, with a smaller output, would not make any money at all at the same figure. In the steel trade the uncertainty over prices, for Government work is reported to be making the price situation in commercial lines more confused than it has been before in this exceptional year.

Commission Will Fix Steel Prices.—At the request of Secretary Daniels and Chairman Denman of the United States Shipping Board the Federal Trade Commission will undertake an investigation looking to the fixing of an equitable price for steel. The Commission will be aided by James A. Farrell, President of the U.S. Steel Corporation and the Munitions Board of the Council of National Defence. Not only will a price be fixed for steel, but also for all materials, including coal and coke, entering into the manufacture of steel. The prices fixed by the Commission will not be arbitrarily imposed. The manufacturers will be invited to co-operate with the Government to the extent of furnishing the material for food ships and naval construction at a price the Commission considers just. Failing in its efforts at voluntary co-operation, the Commission will make a report to Congress similar to its report on coal and transportation two days ago, in which it will recommend the pooling of the steel interests of the country to be operated by a Government agency on Government account.

CATALOGUES

Service Bureau Bulletin, issued by the National Founders' Association, Chicago, Ill. Bulletin No. 6 deals with various types of hand squeezers, with pattern and flask equipment, etc., particularly as to the attainment of satisfactory results and saving of time. The bulletin is fully illustrated.

The Stroh Steel Hardening Process Co., Pittsburgh, Pa., have issued an attractive-looking catalogue describing the Stroh process for making steel castings. The catalogue states what the Stroh process is and the theory of it. A number of steel castings, made by this process, are illustrated, showing the suitability of this method, particularly for making castings for certain purposes, such as gear wheels, pinions and car wheels, etc., where the service is exceptionally severe. The included pages trace the history of steel castings from pre-historic times until the present day featuring the Stroh process.

CANADA'S COAL OUTPUT

THE Mines Branch of the Department of Mines, at Ottawa, has received from the principal coal mine operators returns of their production during the first three months of 1917, on the basis of which the following estimates have been made of total production during this period.

According to these estimates the total production of coal during the first quarter of 1917, was 3,590,991 short tons, comprising 1,233,934 tons in January; 1,143,956 tons in February, and 1,213,101 tons in March. Corresponding records for the year 1916 are not available for comparison.

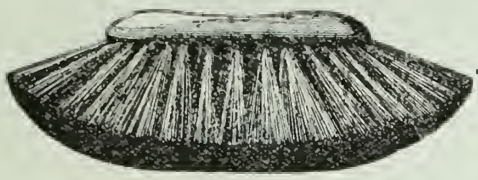
The record would appear to show that the average rate of production in Nova Scotia and British Columbia was less than the average rate of production during 1916, but greater in the provinces of New Brunswick, Saskatchewan and Alberta.

The exports of coal during the three months' were 501,570 tons, as against exports of 737,744 tons during the corresponding period of 1916.

The imports of coal during the three months were 3,921,824 tons, as against imports of 4,002,892 tons during the corresponding period of 1916.

The production of oven coke during the first three months of 1917 was 308,690 tons—the imports during the same period being 207,139 tons, and the exports 5,606 tons.

Revised statistics for 1916, as compiled by the department, show that the total consumption of coal was 29,865,856 short tons, against 23,906,692 in 1915. Production in Canada was 14,483,395 tons, against 13,267,023 in 1915, and imports, 17,850,603 against 12,465,902.



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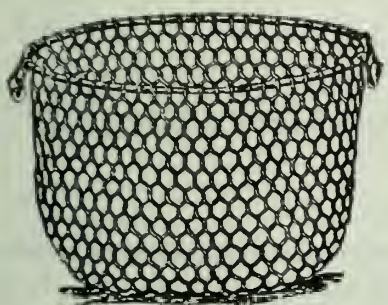

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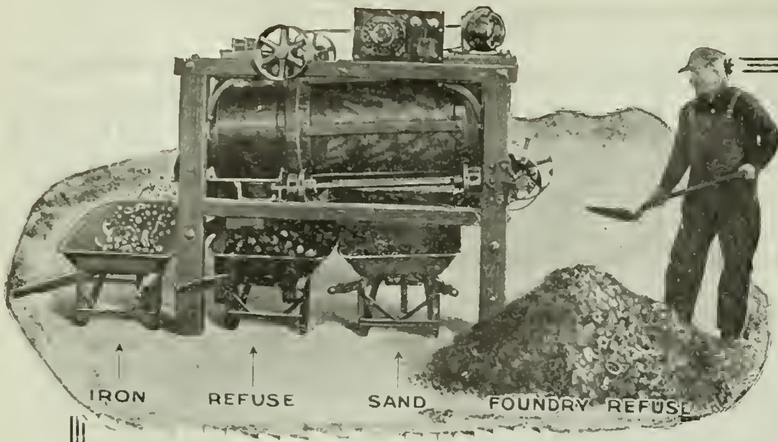

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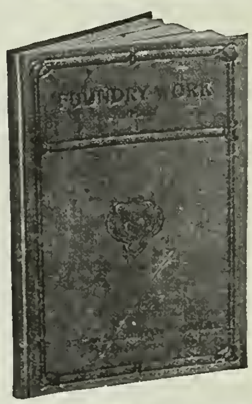

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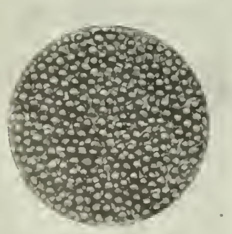

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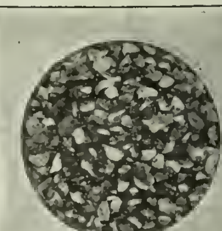

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Actual Size

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CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

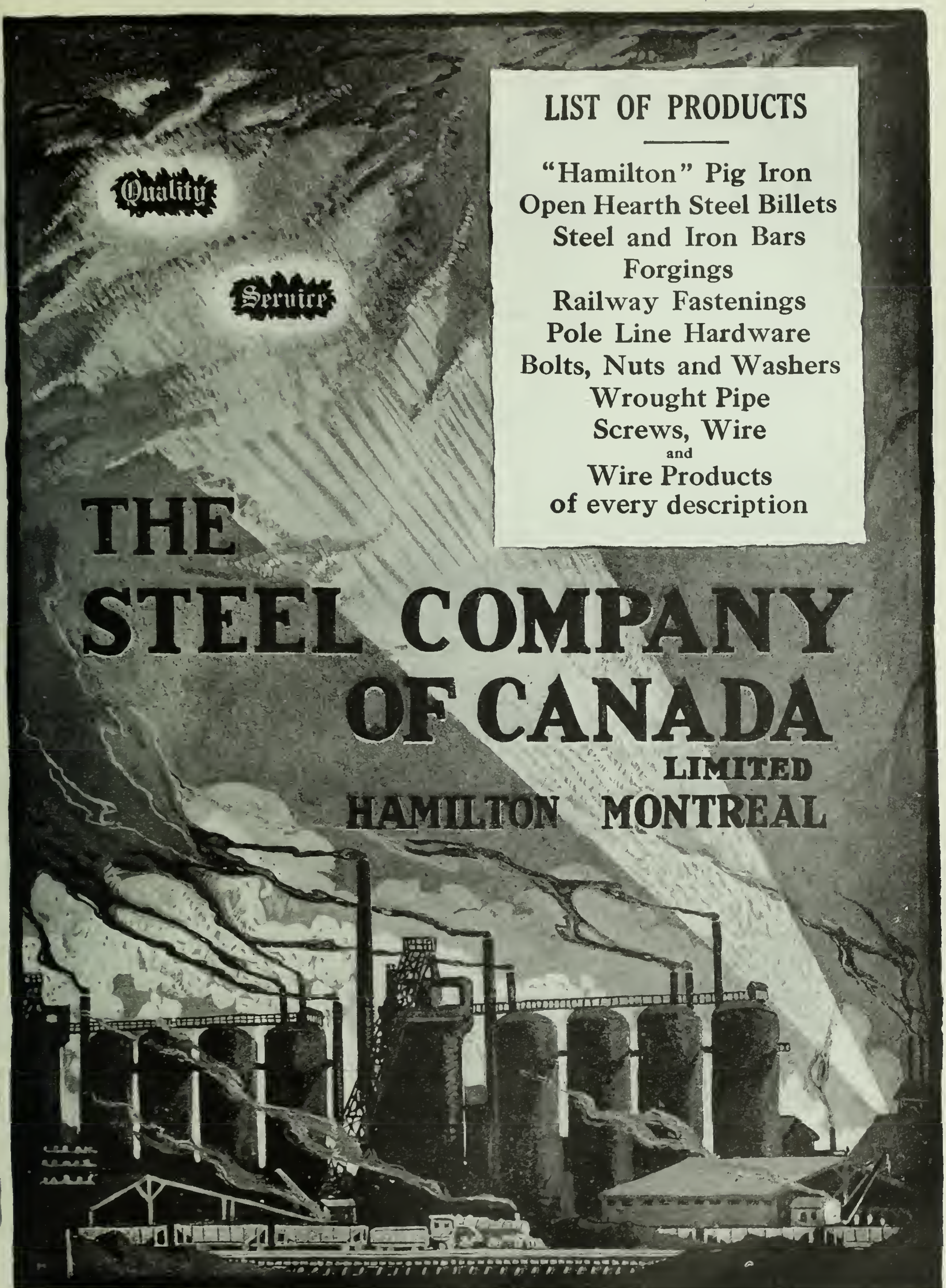
EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.


LIST OF PRODUCTS
"Hamilton" Pig Iron
Open Hearth Steel Billets
Steel and Iron Bars
Forgings
Railway Fastenings
Pole Line Hardware
Bolts, Nuts and Washers
Wrought Pipe
Screws, Wire
and
Wire Products
of every description
Quality
Service
THE STEEL COMPANY OF CANADA
LIMITED
HAMILTON MONTREAL

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MAGNETS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
Hyde & Sons, Ltd., Montreal, Que.
Toronto Testing Laboratories, Toronto.

MIXERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

PULLEYS, MAGNETIC
Ding's Magnetic Separator Co., Milwaukee, Wis.

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT
Globe Steel Co., Mansfield, Ohio
Harrison Supply Co., Boston, Mass.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Harrison Supply Co., Boston, Mass.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont
Woodison, E. J., Co., Toronto, Ont.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion F[illegible]. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Hanson & Van Winkle Co., Toronto, Ont
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

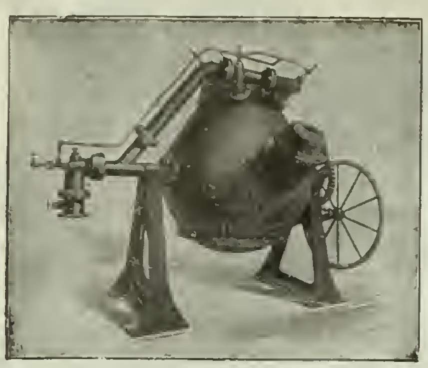
WALL CHANNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Can. Hanson & Van Winkle Co., Toronto, Ont
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.



The Hawley-Schwartz Furnace

The Only Perfect Melter

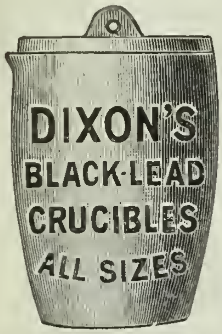
All metal from 50 lbs. to 10,000 lbs.

Is Absolutely Uniform

Write for catalog and complete information.

The Hawley Down Draft Furnace Co.
Easton, Penn., U.S.A.

For melting—from laboratory to furnace.



DIXON'S
Graphite Crucibles

Used the world over since 1827.
Booklet No. 27-A

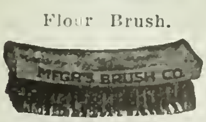
Made in Jersey City, N.J., by the
JOSEPH DIXON CRUCIBLE COMPANY
A-26

DOES MORE WORK ON LESS AIR THAN ANY OTHER SAND SIFTER

Begins to save you time and money as soon as installed, The Battle Creek Sand Sifter. Simple, efficient, economical. Write for full details.

BATTLE CREEK SAND SIFTER CO.
Battle Creek, Michigan, U.S.A.

Floor Brush.



Highest Quality
Foundry Brushes

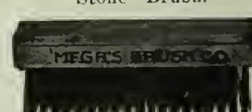
We can meet every foundry brush requirement on the shortest notice. You can rely upon our lines to give the best of satisfaction from every point of view. Get your next supply from us—or give us a trial order.

The Manufacturers Brush Co.
CLEVELAND - OHIO
19 Warren St., New York

Bent Handle Washout.

Shoe Handle Washout.

Stone Brush.



ADVERTISING INDEX

GUARDING THE FOUNDRY TRADE

To protect the trade—against delays — against inferior qualities, I have large stocks of worthy products ready for immediate delivery.

Stevens Superior Supplies do not stop with being merely desirable—they are a positive NECESSITY as a matter of saving-money economy in foundries and plating shops.

Once you buy them you will have naught else.

Pick some of these "good things" and, if you are unacquainted with a matter of saving-money-economy order a barrel on approval, for trial.

Stevens Pure East India Plumbago—direct from the Island of Ceylon.
Stevens No. 2 King Kore Kompound—the one proved perfect production.
Stevens No. 4 Columbia Parting — Cheapest although best.
Stevens Carbon Blacking — Something super-excellent.

Stevens Stopper (Iron Filler) —A wonderful money saver.
Stevens Core Oils—The Oil of oils.
Stevens Core Gum—The climax in core binders.
Fire Sand.
Fire Brick.
Fire Clay.
Cupola Blocks.

Gautier Crucibles.
Hostetter Coke.
Seacoal Facing.
Talc or Soapstone.
Molding Sand.
Foundry Molasses.
Foundry Flour.
Foundry Rosin.
Core Ovens.
Foundry Equipment.

Stevens Tripoli Compositions.
Stevens Buffing Compositions.
Genuine Turkish Emery (some numbers).
Stevens Improved American Emery.

Buffing Wheels.
Emery Glue.
Spanish Felt Wheels.
Canary Yellow Dextrine.
Cyanide of Sodium.

Nickel Anodes.
Nickel Salts.
Chemical Sundries.
Platers' Supplies.
Polishing Room Equipment.

FREDERIC B. STEVENS

Manufacturer Foundry Facings and Supplies, Buffing Compositions and Platers' Supplies

FACING MILL: Corner Isabella Avenue and M.C.R.R.
WAREHOUSE and OFFICE: Corner Larned and Third Street

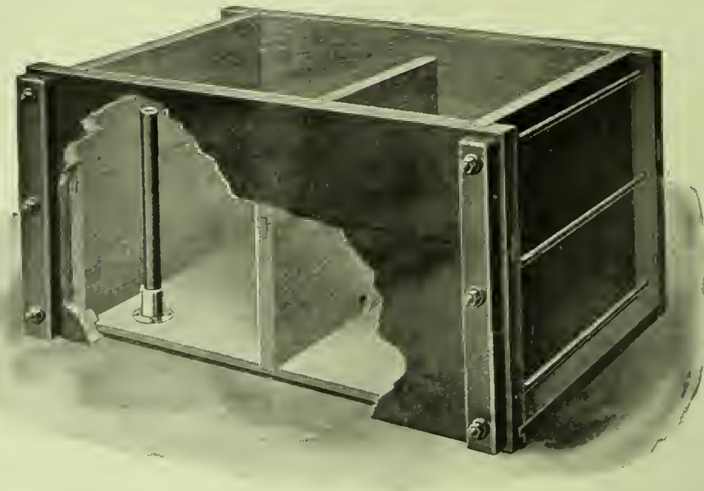
DETROIT, MICHIGAN

EXPORT WAREHOUSE: Windsor, Ontario

BRANCH: Hoosier Supply Co., Indianapolis, Indiana

NEW ENGLAND BRANCH: Frederic B. Stevens, Corner Water and Olive Streets, New Haven, Conn., E. E. Seeley, Manager

WOOD and STEEL TANKS



CYPRESS WOOD TANKS

Plain or Lead Lined

We specialize in making tanks of all kinds, any size to meet requirements. We are prepared to furnish these plain, asphaltum lined or lead lined.

Welded Steel Tanks

Welded or Riveted Steel Tanks all sizes.

Enquiries Solicited.

Canadian Hanson & Van Winkle Co., Ltd.

TORONTO - CANADA

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, AUGUST, 1917 No. 8

The Publisher's Page

TORONTO August, 1917

Dare I Reduce My Advertising During the War?

GEORGE F. TILTON, In 100% Magazine

Advertising is a force that is so stupendous as to be almost immeasurable. Dare I, therefore, underestimate the results of shutting off this wonderful business power at this time in the world's crisis?

"WHY should I advertise when I cannot supply the demand?" a prominent manufacturer wrote the other day. In some of his lines the raw materials positively could not be had. In others the supply was so limited as to make the price almost prohibitive. Then, with next to nothing from which to manufacture his finished product, why should he spend any money advertising a commodity that cannot be bought?

This problem is uppermost in the minds of thousands of manufacturers. We admit that on the surface there seems to be but one answer, and were you running a corner grocery store and were you depending only on the immediate neighborhood for your income, it would be easy to solve your problem.

But how about you big manufacturers, you who realize the gravity of the situation, you who have been spending millions in advertising that has helped to make this country the most wealthy nation in the world; are you willing to trifle with this powerful business agent?

Hasty decisions based on fears and apprehensions often lead to business oblivion.

American business has reached a place in its progress where, if it desires a successful future, it must make haste slowly.

Have you measured and do you know just how much of your success you owe to advertising?

Copy the following questions. They may be worthy of deep consideration:

(1) Have the results of my advertising in the past been only temporary? In other words, have I advertised only for immediate returns or for the accumulation of good-will?

(2) What will I lose in good-will by not being able to supply the goods I advertise?

(3) If I stop advertising for one year how much will it cost me to restore my sales impetus to its normal momentum?

(4) How much will my organization be affected and how long will it take me to build it up after the war?

(5) By shutting off my advertising am I not leaving the way clear for new concerns to be organized that will have an equal chance with me to get my business after the war?

(6) How long will my business run without advertising?

(7) How are my competitors going to meet this crisis?

Some manufacturers believe that business is going to be harder to get after the war and are far-sighted enough to increase their advertising in anticipation of that dull period. If business is going to be harder to get after the war, now is the time to make friends with the public and win a consumer market.

All periods of prosperity are followed by an aftermath of business depression—a time when people not only become frugal—they become niggardly. Is there a business force so well equipped to overcome the bad effects of panics and depressions as advertising?

To some people there seems to be a vast difference between "economy" and "elimination of waste." Economy and frugality mean "management without loss or waste" and have nothing to do with excessive hoarding. Judicious spending is just as important as the elimination of waste. Depressions and panics are not overcome by niggardliness and parsimony.

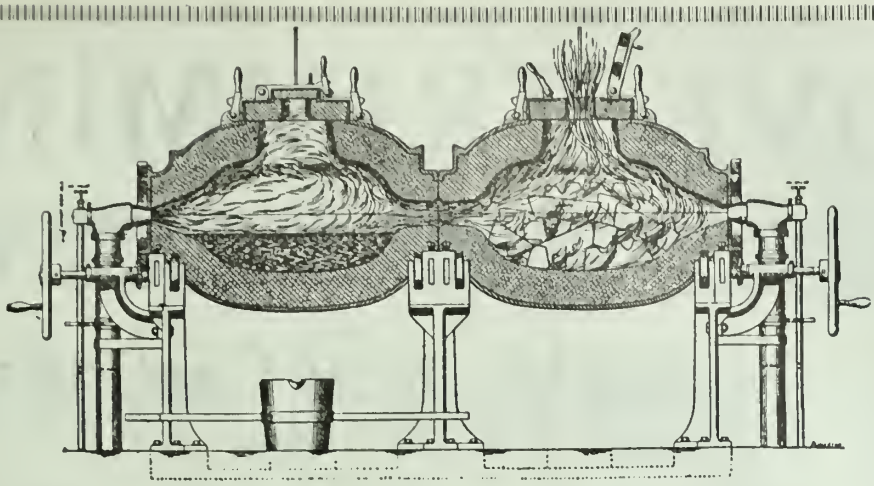
Let us not get these terms confused. Let us economize if we must, but let us start where economy is essential. Let us discriminate in favor of efficiency. Let us study our manufacturing costs; our overhead; our depreciation; our method of manufacture.

The business of the nation is no stronger than its internal business, and the manufacturers who are looking forward to the securing of international markets after the war cannot hope to succeed if the nation is confronted with an internal panic because of lack of foresight at this time in reducing its advertising.

You manufacturers who have been enlarging your plants and increasing your production during the recent time of prosperity had better be making new efforts and building a new consumer demand for the time when business is not going to be easy to get.

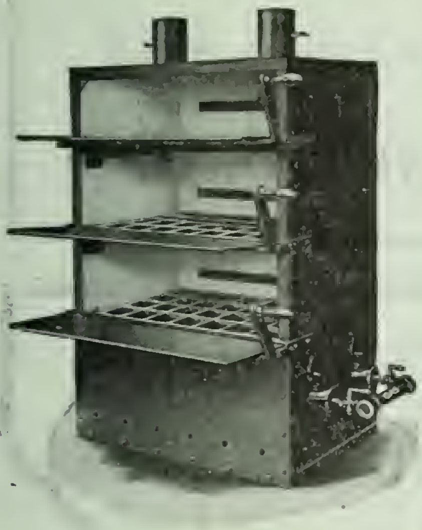
Advertising now will make your future secure.

NO CRUCIBLE

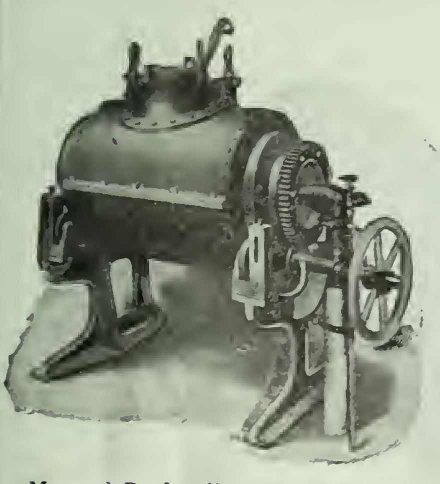


OIL OR GAS

Run This Chamber Off While This Chamber Melts



Arundel Drop Front Core Oven
All fuels



Monarch Rockwell Single Chamber Furnace —' Simplex''

It's Your Loss to Forget

Not only the Point about this Double Chamber Furnace but also the many points of our Equipment

The continuous melting feature of the "Monarch" Double Chamber Furnace is added to by the quality and construction of the furnace. The flame is not directed against the metal, therefore no oxidizing takes place. Copper, brass, aluminum, iron, steel, gold, silver and similar metals are reduced to molten condition with the greatest speed and thoroughness. The Single Chamber "Monarch" Furnace maintains the same inherent qualities as the Double Chamber Furnace, the continuous feature being eliminated.

The Arundel drop front core oven is superior over all other makes of oven of similar size.

Your inquiry regarding any foundry requirements would receive prompt and intelligent attention.

Send for Catalogue D.P.7

The Monarch Engineering & Mfg. Company

1206 American Building, Baltimore, Md., U.S.A.

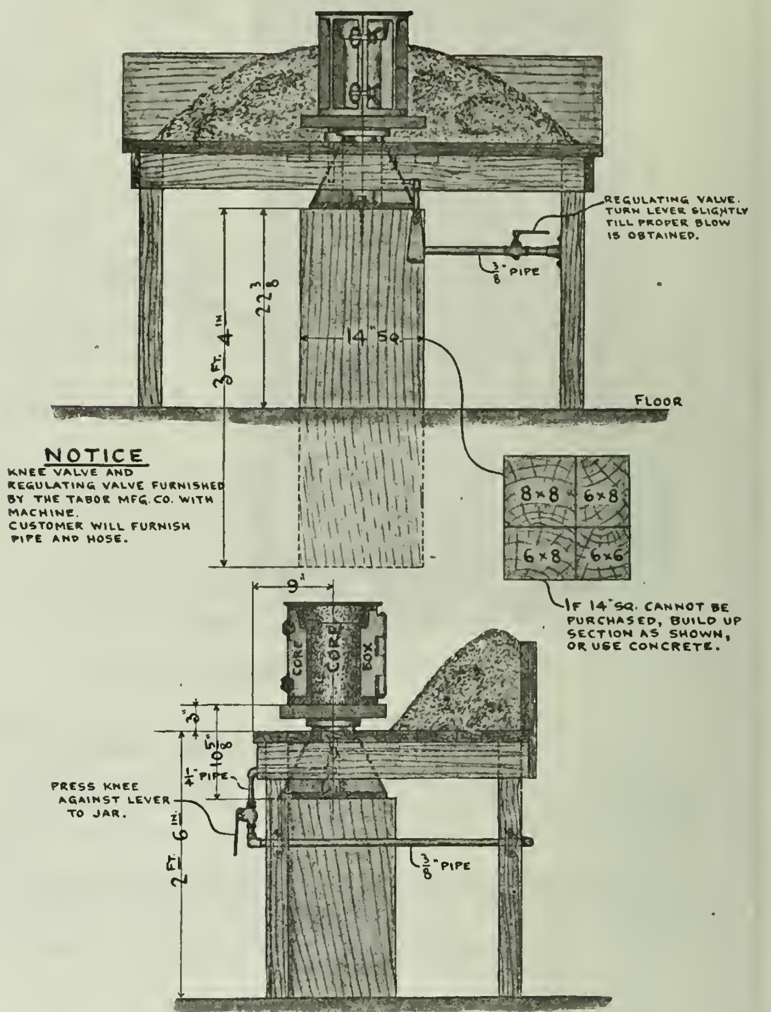
Shops at Curtis Bay, Md.

SEE THEM AT THE CONVENTION — ASK OUR REPRESENTATIVE FOR INFORMATION

If any advertisement interests you, tear it out now and place with letters to be answered.

TABOR

3" Tabor Jarring Machine with 12" x 14" Table.



3" Tabor Jarring Machine set in Core Bench.

FOR SMALL MOLDS AND MEDIUM SIZED CORES

Write for Bulletin M-J-P.

THE TABOR MANUFACTURING CO.

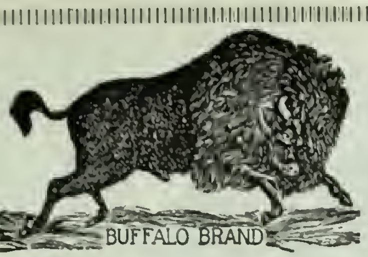
PHILADELPHIA PA.

FOREIGN AGENTS:

Geo. W. Goodchild & Macnab, 56 Eagle St., Southampton Row, London, W. C.; Fenwick, Freres & Co., 8 Rue De Rocroy, Paris, France.

FOREIGN AGENTS:

Mitsui & Co., Ltd., New York, Tokio, Japan; Benson Bros., Sidney and Melbourne, Australia.



Vent Wax

Reliable
Economical
Easy To Use

It has proven to be the easiest and best way to vent any core. Simply bed it in the sand, leading it to the proper outlet, and it will be entirely absorbed by the core when drying, leaving a good, clean vent just the size and shape of the wax used.

Ask your supply house for samples or write us. A trial will be the most positive way to prove its value.

United Compound Company

228 Elk St., Buffalo, N.Y.

Look for the Buffalo on the Octagon cord board spools

THE STANDARD IN

CRUCIBLES

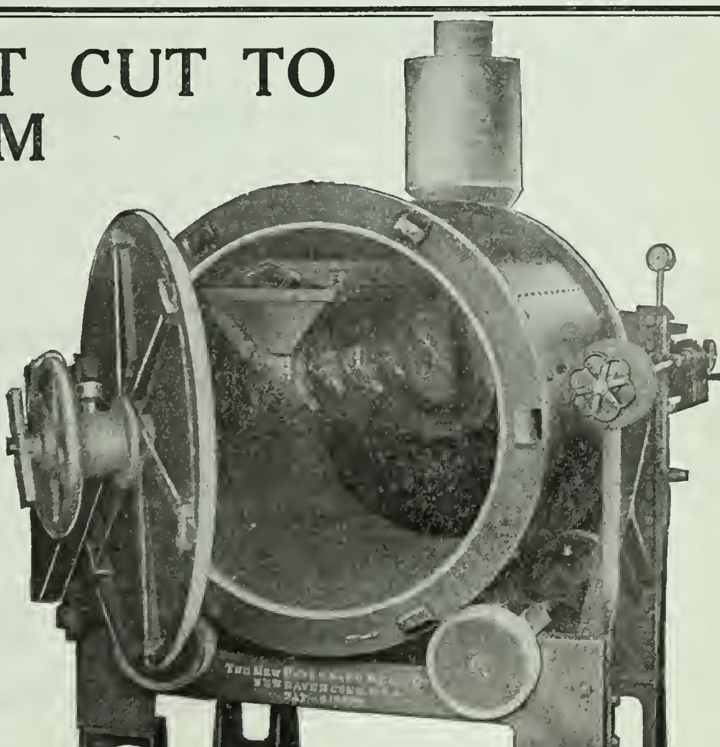
Manufactured For Over [illegible] Years

J. H. Gautier & Co.

JERSEY CITY, N.J., U.S.A.

PRODUCTION COST CUT TO A MINIMUM

Cost of production is going up with the cost of living, but there are cases where the cost of production can be given a death blow. Here is one: A Modern Foundry utility that is guaranteed to cut operating expenses—and at the same time give increased cleaning capacity and do the highest quality of work.



NEW HAVEN

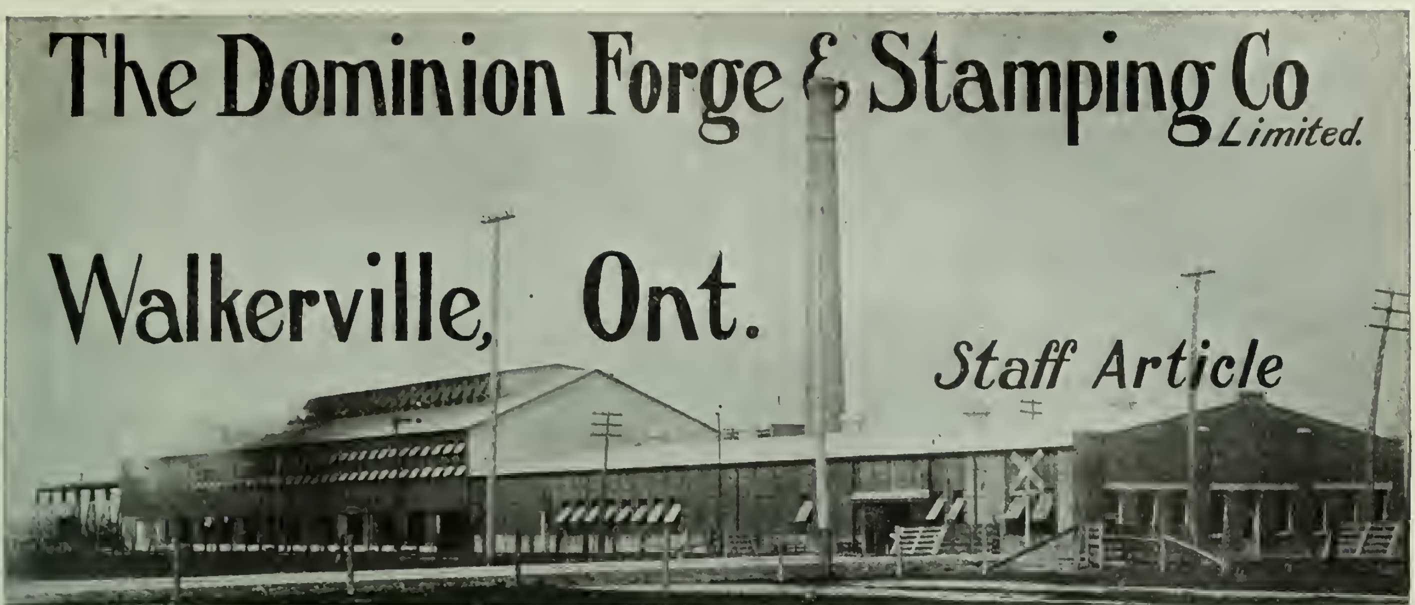
Sand Blast Machines

They are the ONLY genuine, self-contained sand blast barrels where the cleaning material does not leave the inside, but is used over and over on the work. The accumulation of dust and dirt is confined inside and removed by direct exhaust.

Write for particulars.

The New Haven Sand Blast Co.

NEW HAVEN, CONN.



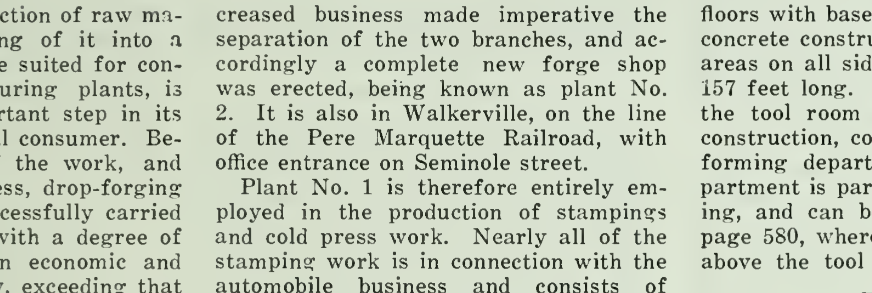
Next to the production of iron and steel from the raw ore, the field of operation covered by stamping and forging is of greatest, though not always most obvious importance. Recent events have tended to thrust machine shop work more into the limelight, but as a basic branch of engineering activity the art of stamping and drop forging may be expected to increase in importance as conditions revert to normal in the hoped-for near future.

NEXT to the production of raw material, the working of it into a semi-finished state suited for consumption by manufacturing plants, is perhaps the most important step in its progress toward the final consumer. Because of the nature of the work, and conditions of the business, drop-forging and stamping, to be successfully carried on, must be conducted with a degree of efficiency, both from an economic and productive point of view, exceeding that which is permissible in ordinary metal-working establishments. Occupying as it does, an intermediate stage between the initial and final stages of manufacture, the functions of a plant such as described in this article, must be discharged systematically and reliably, otherwise the successful operation of other plants dependent on its product may be seriously jeopardized. The growth of drop-forging and stamping work in this country has been steady and continuous over a number of years, and the magnitude of operations and extent of equipment installed serve to convey some idea of the important part played by firms of this type

Plant Locations

The Dominion Forge & Stamp Co., Walkerville, Ont., operates two plants. The original plant, No. 1, adjoins the Grand Trunk Railway near Walkerville station and occupies the entire end of the block between St. Luke's Road and Albert Street. Both forging and stamping operations were carried on here until increased business made imperative the separation of the two branches, and accordingly a complete new forge shop was erected, being known as plant No. 2. It is also in Walkerville, on the line of the Pere Marquette Railroad, with office entrance on Seminole street.

Plant No. 1 is therefore entirely employed in the production of stampings and cold press work. Nearly all of the stamping work is in connection with the automobile business and consists of sheet metal fenders, tanks, mufflers and hoods. Some time ago, operations were extended to include the manufacture of automobile frames, and developments in this line have been such that arrangements are now being made to double the shop capacity for this product. Frame production is carried on in a separate building on the opposite side of Albert street, an interior view of this building forming one of the illustrations. Situated here is also the boiler house which was necessary for the original forge department before removal to plant No. 2, and which is now used for the central heating plant for the stamping division.



PLAN VIEW OF FORGE PLANT SHOWING LAYOUT OF DEPARTMENTS.

Stamping Plant

The main building consists of four floors with basement and is of reinforced concrete construction with large lighting areas on all sides. It is 55 feet wide by 157 feet long. Extending to the rear is the tool room building, of single floor construction, connecting with the fender forming department. This latter department is parallel with the main building, and can be seen in illustration on page 580, where the monitor roof shows above the tool rom.

Press Room

The basement is devoted entirely to storage of raw material, many tons of sheet metal of various sizes and gauges being kept in stock, although present conditions of the steel industry and heavy demands for product have prevented any extensive accumulation of material. The first floor contains the receiving and shipping department with elevator service to all floors. All heavy stamping work such as blanking, flanging, etc., involving the use of large machines is done on this floor, a view of some of the larger presses being given on page 114. Five large double-crank presses are employed for blanking and forming sheets for automobile fenders, of which several types are made; flanging and embossing or doming over large areas is also done in these presses. Two of these large presses are shown toward the right of illustration. Additional equipment on this floor includes medium power presses and shears. Prominent amongst the makers of these machines are noted, the Toledo Machine & Tool Co., and the Consolidated Press & tool Co.

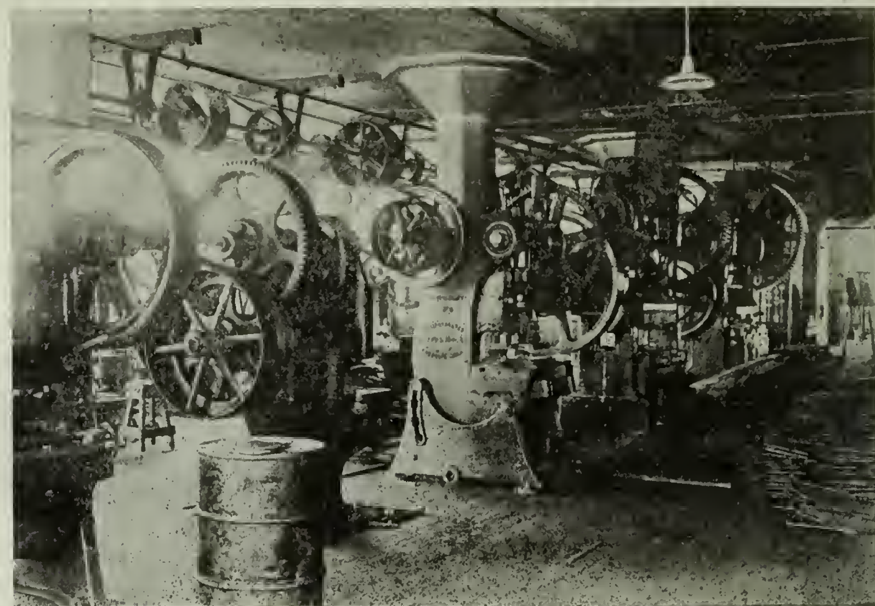
Fender Forming

Following the fender blanks to the forming department, the operations necessary to complete the crowning are done in a large double-crank press, after which the aprons, skirts, or fillers, as they are variously termed, are united with the fender proper by means of rolling and beading, these operations being done on special types of sheet metal working machinery. Some slight amount of hand work is necessary to remove variations in shape and any irregularities which occasionally appear, due to slight variations in the material being operated on.

Miscellaneous Assembly

Returning to the second floor of the main building—this is occupied with the assembling of muffler parts, engine hoods, tanks, etc., the equipment consisting of presses, shears, etc., such as are ordinarily used for such work. The third floor is occupied by the fender finishing department, which includes the fitting of reinforcements at different parts of the fenders, and the securing in place of various details either by beading and rolling or by electric welding. Final fitting by hand to duplicate fixtures representing the parts of the car frame, completes the work of fender making, which is followed by the enameling process before the fenders are complete and ready for shipment.

The locating of the enameling department on the fourth or top floor is desirable because of the freedom from the dust on the sheet, and the absence of annoyance to other floors by the presence of vapors and odors. The fenders are first of all cleaned with emery cloth after which they are washed in gasoline to remove all grease and foreign matter, The enamel is applied by dipping, the fenders being immersed in a large tank of liquid enamel and hung up to drain thoroughly before baking. Several coats are applied according to specification, each coat being baked at a temperature of 350 deg. F., in order to obtain that hard glasslike finish which is such a conspicuous feature of modern automobiles.



VIEW OF PRESS ROOM IN MAIN BUILDING, SHOWING TYPES OF MACHINES USED IN MAKING FENDERS.

Plant Maintenance

The construction and maintenance of stamping machine equipment calls for considerable experience in work of this class. The designing, building, and trying-out of a set of dies for a new design of fender is always a prolonged and expensive job. Methods which have been successfully applied in one shop may, for some unaccountable reason, fail to give satisfactory results in another, and the necessity of meeting the call for deliveries puts the job up to the tool room squad on their own merits, as it is generally preferable to find a way of doing the work in a satisfactory manner, rather than spend the same or longer time finding out why the other fellow's method will not work. It is not surprising, therefore, to note the extent of the tool room equipment, when one considers that, although the types of fenders produced are comparatively few, there are perhaps twelve to sixteen separate and distinct operations in each fender.

Prominent amongst the machines is a No. 6 vertical Becker milling machine, capable of handling a large variety of work in connection with the stamping dies. Three shaping machines are installed—C. M. C., Smith & Mills, and American Tool Works Co. Other machines include a large surface grinder for die-blocks, etc., built by the Safety Emery Wheel Co., a Le Blond tool room grinder, a Gray planer, and a Cataract bench lathe, the equipment being rounded out by such items as two milling machines (plain and universal), two sensitive, drills two vertical drill presses, one radial drill and three tool room lathes.

A blacksmith shop and heat-treating department are also provided, while a 9 x 8 in. motor driven Ingersoll-Rand compressor supplies high pressure air throughout the building.

Frame Manufacture

The frame shop, to which reference has already been made, is single floor brick building equipped for the quantity production of automobile frames. Operations at present are concentrated on two designs, the finished cars of which they are a part being two of the most popular makes in this country. Roughly speaking, the work of making a frame consists of shearing, trimming, punching, forming, assembling. The stock is received in sheets which are cut to the proper outline on a 12 ft. Nia-

MAIN BUILDING OF PLANT NO. 1, WHERE HEAD OFFICE OF COMPANY IS LOCATED.

gara shear. Special trimming work is now done on the ends if necessary, according to the type of frame being made. This work consists of shaping the ends so that projecting lugs may be bent sideways at a later stage to form angle brackets wherewith to facilitate the assembling of the cross members with the sides.

The strip from which the side is formed, still flat, is now taken to a multiple punching machine which punches every hole in the side simultaneously. The machine is of special design and is located in the left background of the frame shop (see photo below). It is of the inverted type, with the lower platen operated by three eccentrics located underneath, the eccentric shaft and driving motor being all below floor level, so that the platen is at a convenient height for the operators to handle material. Eight massive steel columns threaded at their upper ends, support the stationary platen and provide adjustment for the various dies. This press runs approximately 10 strokes per min., and punches from 60 to 80 holes, round, square, or oval, at one stroke.

After a sufficient number of parts have been punched, the machine is changed over to forming work and turns over the top and bottom flanges which impart the familiar U section to the piece. Various other presses to the number of fourteen have meanwhile been engaged in similar work on the cross members, some of which are shown on trucks in the view of the frame room. These are now grouped together and riveted, some of the riveting being done in punch presses cold and some of it by pneumatic hammers hot.

In this building is also located the welding department in which two Prestolite welding outfits are installed. Much of their work consists in welding muffler parts and special exhaust pipe sections. Another 9 x 8 in. Ingersoll-Rand compressor is installed here for the pneumatic apparatus.

Considerable as is the output of this department, the constant growth of demand from the ultimate consumer has rendered necessary the doubling of capacity, and active operations are now in progress to duplicate the department, space being conveniently available at one end.

Forging Plant

The "Forge," as plant No. 2 is familiarly termed, is an excellent example of specialized plant design. While the conditions which prevailed in the original plant before the erection of these works delayed development of this line to some extent, it afforded desirable opportunity for studying the requirements and planning the arrangement of the new plant on the most efficient lines. The straight line design of plant has been adhered to in very complete degree, as with the exception of certain types of forgings which pass through the cold trimming department, the great bulk of the work passes continuously from storage shed into forge shop, thence to inspection, and finally shipping.

LOOKING DOWN THE CENTRE OF FORGE DEPARTMENT, PLANT NO. 2.

A study of the plant lay-out on page 113, combined with the title illustration, conveys a clear idea of the plant. The view forming the title is taken from Seminole street, just above the tracks, the forge shop occupying the main central portion of the building, with the steel storage shed showing at the far end. This shed is approximately 185 ft. long by 66 ft. wide, which is the uniform width of the main building. Both the storage shed and forge shop buildings are of considerable height in order to provide headway for a 5-ton Northern overhead traveling crane of 40 ft. span, which travels the full length of the two departments. A standard gauge spur track from the Essex Terminal Railroad extends the full length of the storage shed, so that incoming cars of raw material can be placed in close proximity to the particular section of storage space devoted to any certain class of material.

Routine of Operations

An industrial track system connects the various parts of the plant. Bundles of bar stock are deposited at the two Bertram bar shears, one on each side of the forge shop, where they are cut to the required length, while if no cutting is required, the traveling crane conveys the stock direct to the particular furnace, where it is to be forged. Passing along the forge shop, as shown in view above, on the right is a battery of Massillon steam hammers, consisting of four 1,500 lbs., and two of 2,500 lbs. capacity. The heavier sizes handle parts for railroad cars, such as draw-hooks, equalizing levers, spring shackles, etc. A number of motor car forgings are also produced at this point, steering knuckles, hand levers, etc., being prominent items.

Immediately across the shop from

COMPONENT PARTS OF AUTOMOBILE FRAMES IN PROCESS OF MANUFACTURE IN FRAME DEPARTMENT.

these is a battery of eight hammers, one 5,000 lbs. Chambersburg, and seven Massillon hammers, 1 of 3,000 lbs., 4 of 1,200 lbs., and 2 of 800 lbs. Crankshafts for motor car engines, front axle forgings, and various pieces of similar proportions, are forged on the larger hammers, while small parts, such as forked rod-ends, steering levers, etc., constitute the bulk of work done on the four smaller hammers.

Beyond the hammers on the right are nine board hammers engaged on munitions stampings and similar work, including one 1,500 lbs. Toledo, and eight Waterburys, from 800 to 1,000 lbs.

Forging Machines

The blocking out of certain types of forgings before going to the hammer is frequently desirable, the ends of front axles being an instance of this work, which is performed on forging machines of the Ajax, Acme and National types, having capacities for handling stock from 1½ in. to 4 in. Individual motor drive is installed on these machines, their location being opposite the board hammers.

Cold Trimming

Where the size and type of forging render it desirable, provision is made for hot trimming in a suitable machine placed next the hammer, but much small work can be trimmed to advantage when cold. The economy of this is apparent when it is considered that cold trimming is limited only by the speed at which the operator can feed the machine, whereas hot trimming is limited to the speed at which the hammer finishes the work; in addition to which the class of help necessary for cold trimming is comparatively unskilled compared with that of a drop-forge operator. The location of the cold trim shop is indicated in the plan and a view of one side is shown below. The bins at left are built with hopper bottoms, which cause the pieces to slide to the opening as quickly as they are withdrawn. An inclined runway extends from the yard to the top of the bins so that forgings can be dropped into the bins by the barrow load. Six Toledo presses are installed in this department, of the type shown in view.

Inspection

Forgings from the cold trim shop are now conveyed to the inspection room, where they rejoin the bulk of the work coming direct from the forge shop. Here the work is gone over carefully, being tumbled in barrels, dressed off in grinders, or otherwise manipulated, according to requirements, before being finally inspected and passed for shipment. Machine equipment in this department includes a set of Massillon shears, and two Newton motor-driven cold sawing machines.

DIE-SINKING DEPARTMENT, SHOWING TYPES OF MACHINES EMPLOYED IN PRODUCING DIES FOR THE HAMMERS.

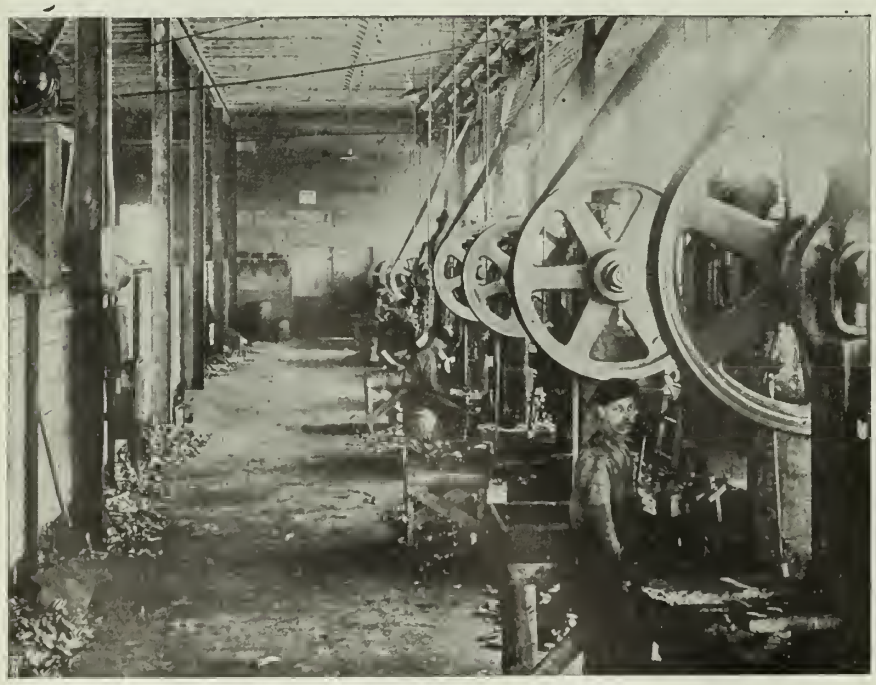
Die-sinking Department

The section of the main building in which the inspection department is located, also includes the die-sinking department and the office, with minor accommodation, such as tool crib, die storage, electrical department, machine repair, and locker space. The die-sinking department occupies almost half of the section which is 200 ft. long by 66 ft. wide. The equipment installed here is typical of modern practice and includes three Becker and four Pratt & Whitney vertical milling machines; one 12 ft. American, and one 10 ft. Pond planing machines; one Safety Emery Wheel Co. surface grinder; one 24 in. LeBlond lathe, one New Haven lathe, drilling machines, and shapers, the latter including four Gould & Eberhardt and one Hamilton.

Power Equipment

The remaining group of buildings contains the blacksmith shop and power department. The former is equipped principally for the work of hardening dies for the hammers and presses, four large furnaces being installed for this purpose. They are equipped to burn both gas and oil. Large quenching tanks containing brine, oil, etc., are provided for cooling purposes. A 1,500 lb. Massillon open frame steam hammer, and two smith's hearths, are installed for taking care of special work outside of the regular run of the work, while the availability of the furnaces enable special heat treating to be done on occasion.

The power department consists of a boiler room 65 ft. x 60 ft., containing a battery of 5 Goldie & McCulloch 150 horse-power return tubular boilers for supplying steam to the steam hammers, and general heating purposes. Hydro-Electric power is employed for the various motors and shaft drives throughout,



COLD TRIMMING DEPARTMENT, WHERE DROP FORGINGS ARE TRIMMED TO SIZE IN PUNCH PRESSES.

also shop lighting. As shown in the view of the boiler room, gas firing is installed throughout; owing, however, to the heavy demands on this source of heat in winter time, combined with a steady decrease in available supply, the installation of mechanical coal stokers is now under way.

An Ideal feed water heater and purifier is used, while the feed pump installation consists of one Darling Brothers 10 x 6 x 12 in. duplex piston pump, and a Goldie & McCulloch outside centre-packed plunger pump of similar size.

Turbine Driven Blower

An interesting item of equipment is a blowing unit composed of a General Electric centrifugal air compressor running at 3,400 revs. per min., direct driven by a 75 horse-power Curtis turbine. Forced lubrication at a pressure of 4 lbs. per sq. in., is supplied to the bearings, while the air is delivered to the main blast pipe at a pressure of 11 oz. per sq. in. The exhaust steam from the turbine is utilized for heating the boiler feed water.

All the forge furnaces are of uniform design, so that gas and oil can be utilized to best advantage according to the class of work being heated. The furnaces are placed between the hammers and the walls of the buildings. They are not opposite the hammers, however, but toward either side, with one end toward the hammer so that the operator is not exposed to excessive heat. In this respect, mention should be made of the large proportion of wall area devoted to lighting space. Steel sash of the Trussed Concrete Co. type has been liberally employed, which, in conjunction with the numerous ventilators in sides and roof insures working conditions of maximum comfort and efficiency.

FUTURE SUPPLIES OF IRON ORE

MANY interesting facts regarding the world's supply of iron ore were mentioned by Prof. W. G. Fearnsides in the second Howard lecture before the Royal Society of Arts, May 7. Not only in Britain but throughout the world, there is, at this time, a shortage of ore for making fine acid steel, there is, however, abundance of material for making basic steel.

English iron masters wanting ore for the acid steel process invested money in the Bilbao district in Spain in the eighties, and soon after, Germany became a competitor for the product of these fields. The hematite ore was obtained in open quarries on the slopes of the hills, and the Germans, being second in the field, took the dump heaps that were first turned over. That material was of poor quality, but by bringing in mechanical processes of dealing with it, they obtained a wealth of valuable material.

Nevertheless, the ore fields in the neighbourhood of Bilbao were within measurable distance of exhaustion, and if the 19 million tons of ore per annum which were taken from these fields were taken for another decade there would not be much left. Hitherto the ore had averaged something like 50 per cent. of metal. Whilst, however, the Bilbao fields were getting near exhaustion, the ore fields of Spain generally most certainly were not. Along the coast from Bilbao to the west there were large masses of ore which would become available as soon as transport facilities existed. That district could undoubtedly continue to supply a good deal of non-phosphoric material for a good many years.

French Ore Fields

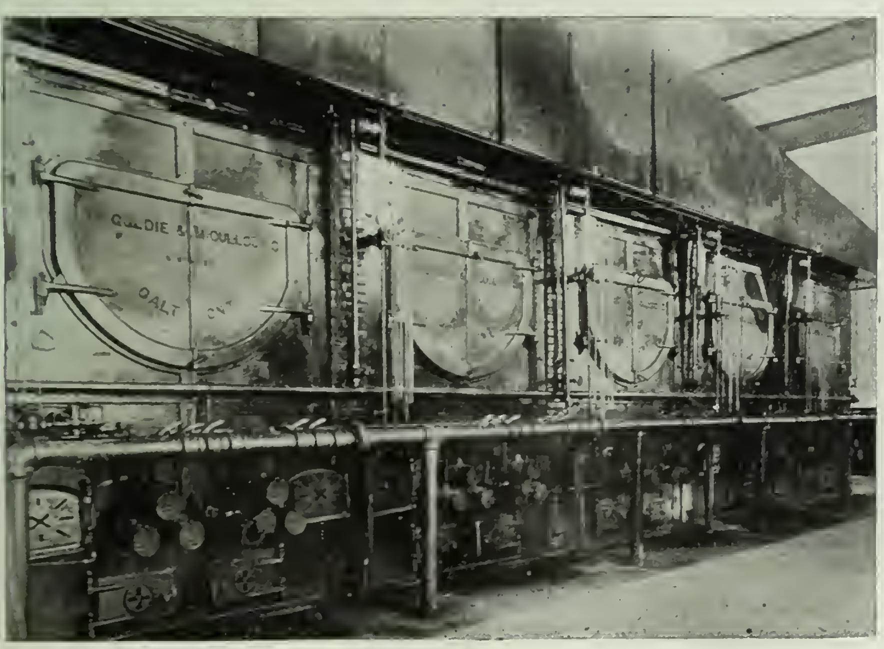
On the borders of France and Germany, around Metz and Verdun, the ores were comparatively near the coal. Briey, Longwy, and Nancy marked the extent of the fields, a distance of 30 miles, and it was there that the great increase of pig iron and steel production, which had been so marked during the present century, had taken place. It had been estimated that, on the German side, there were more than 2,000 million tons of this ore, and on the other side 3,000 million tons. The first thing that the Germans did on the outbreak of war was to advance their armies at all costs to the western side of this ore belt, and since then they had continued to work the mines. But for that source of material the Germans would have found it very hard indeed to maintain their shell supply. The best of the ore was to be found around Briey, where it varied from 6 ft. to 19 ft. in thickness, and contained about 40 per cent. of iron. Briey only became important in the early years of the present century, and whereas in 1900 it only produced 7 per cent. of the total production of the district, in 1913 it produced 70 per cent. The district as a whole accounted, before the war, for nearly 80 per cent. of German iron, and 90 per cent. of the French, and the importance attached to it by the Germans was emphasied inasmuch as all German peace terms insisted that it should all be on the German side.

Sweden and Norway, in addition to sending about a million tons of ore to this country, also sent large quantities to Germany, to which had to be added the output of Swedish pig iron. Most of the ore was obtained from the district to the north-west of Stockholm, and it differed from anything that we had in this country, or that we imported from Spain or North Africa. Much of the material now being made into Swedish iron was raised from the old time workings, the iron ore being picked out magnetically. Even so, the Swedish Government had recognised for the past ten years that there was a shortage, and had prohibited the export of the best material. More important to British, as well as German, ironmasters was the district between Lulea and Narvik. The mass of ore was five miles long and 80 yeards thick. Hitherto we had picked out the less phosphoric material, but the Germans were less particular, and had taken the other, and from it had obtained a production of 5 million tons per annum since the beginning of this century, and they could continue doing so. There were vast resources in the district, and magnificent harbours available, and it seemed exceedingly likely that it would be a valuable source of supply in the future.

American Deposits

Coming to America, Professor Fearnsides said that 80 per cent. of the American ore came from the district of Lake Superior. The bulk of the material contained as much as 50 per cent. of iron. The bulk of the best hematite ore came from the Mesabi Range, where there were between 2,000 and 3,500 million tons waiting to be got. Beyond that there were 70,000 million tons of rather lower grade ore that might at some time be worked.

In Canada it was hardly known how much iron ore would become available. The Lake Superior deposits in the United States continued across the boundary, and were equally productive on the other side. There were also plenty of low



INSTALLATION OF GAS-FIRED BOILERS FOR SUPPLYING STEAM TO THE HAMMERS IN THE FORGE DEPARTMENT.

grade ores available in Canada as well as in Nova Scotia and New Brunswick. Then there were the supplies in Newfoundland, which were worked more under the sea than under land, and produced about 1½ million tons a year, and there was also another great source of supply in Cuba. The latter had been proved to be a quality which was suitable for making pig iron which could be converted direct into alloy steel, as it contained chromium and nickel.

In western France there was a large output which, for want of coal to treat it, had been sent as to two-thirds to Germany and one-third to Great Britain. If Germany could afford to carry that ore to Westphalia, British iron-masters could afford to bring it to England, and larger supplies from that district might be looked for. The ore had been proved to depths as great as 1000 metres.

As to the Colonies, Newfoundland was sending a small quantity to England; there were considerable quantities of ore in Rhodesia, but it was doubtful whether it would pay to bring it to England. There was also plenty in India, as well as in Australia and New Zealand, in each of which countries there was plenty of coal, and in all of them great industries were being set up for the manufacture of steel within their own borders. It was not likely also that South Africa would long be behind.

Reviewing the position, the lecturer said that America, Germany, France and Sweden showed great increase in iron ore output, and all of them were supplying material which required the basic process for its refining. England was comparatively steady, and had not yet adopted that process. The fact was that the supply of hematite ore, and the material suitable for making acid steel, was failing, whilst there was abundance. and no suggestion of a shortage either in Great Britain or elsewhere in the world of the material suitable for the basic process, and it seemed to him that if Britain were to keep pace with the other nations in the race for the world's markets she would have to open out the basic process. It might be said that he who was master of the world's iron was master of the world, and that the question of quality was of more importance than the question of quantity.

CANADA'S 1916 STEEL OUTPUT

THE statistics of production of iron and steel in Canada in 1916 as published by the American Iron and Steel Institute recently show a marked increase over the output of the preceding year. Pig iron production was 1,069,541 gross tons against 825.420 gross tons in 1915. The production of steel ingots and castings last year amounted to 1.286.509 tons against 912,755 tons in 1915. The production of pig iron by grades in 1916 and the four years preceding was as follows, gross tons:

	Basic	Bessemer	Foundry	All Other	Total
1912	489.799	228.742	194.208	129	912.878
1913	558.524	227.662	225 231	3 701	1,015.118
1914	331.456	184.053	174.346	16 117	705.972
1915	660.369	13.714	125.769	25.568	825.420
1916	851,453	12,575	181.748	23,765	1,069,541

The production of steel ingots for last year was 1,255,196 tons and of steel castings 31,313 tons. The production of ingots and castings by processes in the past five years was as follows, gross tons:

	Open-Hearth	Bessemer	Other Kinds	Total
1912	645.062	207,569	400	853,031
1913	768,663	273,391	449	1,042,503
1914	556,910	186.158	284	743,352
1915	884.736	22,521	5,498	912,755
1916	1,245,488	10,968	30,053	1,286,509

The production of finished rolled products in Canada in 1916 was 76,478 tons of iron and 887,332 tons of steel, making a total of 963,810 tons. This compares with the high record of 967,097 tons in 1913. The distribution of finished rolled forms of leading products for the past five years is shown below:

	1912	1913	1914	1915	1916
Rails	423,885	506,709	382,344	209,752	81,497
Structural shapes and wire rods	64,082	68,048	59,050	114,829	174,490
Plates and sheets, nail plate, merchant bars, tie-plate bars, etc.	373,257	392,340	218,125	328,737	707,823
Total, gross tons	861,224	967,097	659,519	653,318	963,810

It will be noticed that rail production last year fell off heavily, due in large part to the extraordinary demand upon steel works for war steel. In the preceding year Canada shipped a considerable quantity of rails into the United States.

The production of iron and steel cut and wire nails in Canada in 1916 amounted to 1,757,000 kegs of 100 lb., as compared with an estimated production in 1915 of 1,636,000 kegs. Cut or wire nails were made last year by nineteen works in five provinces.

The production of finished angle splice bars, tie plates, fish plates and other rail joints and fastenings in Canada by rolling mills and steel works in 1916, all steel. not including spikes, bolts, nuts and similar fastenings, amounted to 6,479 gross tons, as compared with 9,406 tons in 1915, 34,165 tons in 1914, 54,839 tons in 1913 and 52,157 tons in 1912.

The total production of cast-iron gas and water pipe and fittings and cast-iron soil and plumbers' pipe and fittings in Canada in 1916 is estimated at 43.850 net tons of 2,000 lb., as compared with an estimated production in 1915 of 53,700 net tons, a decrease of 9,850 tons.

WATER GAS PRACTICE

By L. E.

THE main problems of carburetted-water gas practice centre around the proper and economical treatment of the oil used for enriching. The tar produced has a lower specific gravity than coal tar, and shows a decided tendency to hold more water in its mass. Occasionally an even worse trouble manifests itself, viz., that a considerable amount of it persists in remaining on top of the water in the tar well and other places. This is caused by incorrect heats and may manifest itself either when the carburetter and the superheater are too cold or too hot.

When the heats are too low a large amount of oil is imperfectly cracked, or not cracked at all, and, passing through the seal-pot, thins the tar and makes a composition that will float. On the other hand, if the heats are too high a large amount of lamp black is made, which will mix with the less amount of tar produced, and the mixed water, tar and lamp black persists in floating.

The oil supplied for use in water gas manufacture is not as a rule quite the same as was delivered in the earlier years of this process of making gas. It very often seems to be a mixture of distillates, for part of which a certain heat is too high, causing stopped pipes and an excess of lamp black, and for the other part the heat is too low, making too much tar, and that of a low specific gravity, and rich in oils somewhat similar to the original oil. Moreover, some American oils reveal a residue that carbonizes on heating and forms deposits on the chequer work in the carburetter, especially troublesome if the air blast enters the vessel rather high up, as a strong flame heats there during the blow, and if much of this carbonaceous deposit collects there it prevents the heats being suitably and regularly maintained.

The oils commonly supplied now often give nearly 50 per cent. more tar than would have been produced under similar conditions some years ago. This indicates the need of higher heat or more heat storage in the chequer work, while a more frequent cleaning of the chequer bricks is also necessary. A little suspected source of tar trouble may be the character of the ash used in the generator, the ash of some coke fuses at the temperature reached during the blow, and is easily removed as clinker. Some of the ash of other cokes does not fuse in this way, and is blown into the carburetber and superheater (in a similar way to the flue dust of ordinary coal gas settings). This ash deposit on the bricks acts as an insulator, and prevents the bricks from being thoroughly heated during the blasting periods. The oil is sprayed onto these insufficiently heated bricks. and the result is the emulsion of tar and water complained of which will not settle in the tar well.

FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

FOUNDRY FACINGS*

By H. Winterton

HOW frequently coal dust has been blamed for many a scabbed casting, when perfectly blameless, will never be known. In too many foundries in past times the question of the admixture of coal dust with sand has been considered of too little importance to warrant either extreme care or even more than cursory attention. In quite a large number of foundries, the "fat" is mixed on scientific lines by experienced hands, whose variations of mixtures are worked out almost to fractions. The functions of coal dust are threefold. In the first place the heat engendered in the mould when in contact with the coal dust forms a gas which gives a lead through the sand to the gases formed by the iron in the mould. Second, the absorption of the coal particles by the heat clears a way for the passage of those gases. Third, and by no means the least important phase, is the formation on the face of the mould of a layer of gas which prevents in a measure the actual contact of the iron with the sand.

Coal Quality

One result of this is that a skin or fine surface is formed on the face of the casting, and, according to the strength of the coal dust, so is the colour of this skin heightened or deepened. If this be the case it follows that great care should be taken to obtain coal dust of a suitable quality, and amongst the points to be noted, it will be necessary to include the bituminous quality of the coal, its comparative freedom from ash, its volatile content, and also its proportion of fixed carbon. I am aware that many differences of opinion exist as to the kind of coal to be used, but for the purposes of this paper, rather than go to extremes, it would be advisable to take a coal of a fairly good quality. Writers on this subject have in the past built their ideals round a coal containing an extremely low percentage of ash, and a high percentage of carbon, forgetting that a coal of this character must necessarily prove low in bituminous qualities, and, in fact, be of too refractory a character altogether to carry out satisfactorily the functions just indicated. On the other hands, there have been tried coals containing as high as 25 per cent. of ash, the results of which when heat is applied can only be to produce a casting with a skin of an extremely grey colour and a rough surface.

A good working coal dust for general foundry use should not exceed 12 per cent. of ash, 37 per cent. of volatiles, and 51 per cent. of fixed carbon. It might be contended that the percentage of ash in this coal is high. But the volatiles have to be taken into consideration, and I know I am right in saying, that with mixtures in which the ash was much lower, castings were scabbed and the skin had a harsh and uneven appearance. Especially was this the case in some experiments made with a good-class anthracite, in which the percentage was under 4. I arrived at the conclusion that the coal dust had resisted the heat so much, owing to the presence of a high percentage of carbon, that it had acted as a refractory, and actually prevented the escape of the gases from the mould by closing up the pores.

As in all matters appertaining to the foundry, however, there is a limit in the direction indicated, and care should be taken, while not exceeding the minimum in one direction, not to approach too closely the maximum in the other. It would never do, of course, to make use of such a coal as was submitted to me recently as suitable for use in the moulds, the analysis of which came out as follows:—Ash, 43.85; volatile matter, 29.80; fixed carbon, 26.35.

Varied Grist of Coal

It is well known that it is very necessary to have various grists of coal dust according to the class of work carried out in each foundry, and according to the grade of sand used. For very light castings a coal dust of exceedingly fine grist is necessary, especially if the sand has an open tendency, while a slightly coarser, yet still fine grist should be used for heavier work. The medium and coarse grades come in for the larger classes of castings, in which it is necessary for the gases engendered to be carried away quickly, while the work of providing a skin to the casting is left to a larger extent for the blackings or facings.

In many instances I have found that where a good superfine coal dust is used a splendid casting with a capital skin has been produced, it necessarily following that on account of the lightness of metal the gases formed in the mould have not been overpowering, while the heat of the smaller body of iron would not have been sufficiently great to fuse any coal particles of more than infinitesimal size. This brings me to a source of frequent complaint which arises when founders are using a coal dust of too coarse a grist. It is then found that small pits are left on the face of a casting when cooled, and these are easily distinguishable by their formation from those indentations caused by particles of sand insufficiently milled. The application of heat from the molten metal to the small particles of coal forms a gas, as has been previously indicated, and in the case of light castings, the effect can usually be seen on the face in the shape of small pits made by that gas taking the line of least resistance into the molten metal in the endeavor to free itself. Where larger castings are concerned, the heavier weight of metal and the consequent increase of temperature prevent such indentations, particularly as the coating of blacking on big moulds is generally more pronounced, and, in fact, is applied with a particular object in view.

Coal Dust and Blemishes

It must not be thought, however, that every blemish on the face of a casting or a great deal of the scabbing is always due to the coal dust. In one splendidly-equipped foundry the presence of small rusty-looking spots was promptly placed to the credit, or discredit, of the coal dust; luckily, after a series of tests, it was definitely established that the fault was due to the presence of lime particles in the sand. Again it has been proved, time after time, that scabs on castings have been due to excessive moisture in the mould, or indifferent ramming. At all events, I think I have said sufficient under this head to show the importance of giving careful consideration to a point which frequently escapes notice. I say nothing upon the question of mixture, though this, too, is a matter of importance, and modern foundry practice tends all in the direction of power mixers.

As to actual mixtures, local circumstances, i.e., class of casting, sand, mixing, quality of coal dust, and the exigencies of the moment, bear largely upon this point. But I may quote two mixtures, the first for heavy castings, and the second for light work, which have been used with good results. One mixture was:—55 parts old sand, 30 parts new, and 15 parts coal dust. The other was: 70 parts old sand, 25 parts new, and 5 parts coal dust. There are, of course, many variations, and I do not for one moment suggest that the above are infallible recipes.

Blackings

There is a divergence of opinion on the use of blacking, whether for loam, dry sand, green sand, or cores. The facings may be divided and sub-divided into various classes, and again into further sections. The old-fashioned ideas of blacking moulds with all and sundry compounds, many of them evil smelling, some of doubtful efficacy, and not a few positively deleterious to the casting, seem to be rapidly passing, and in many foundries today the preparation of cores and moulds is carried out with meticulous care. To-day the foundryman demands various facings suitable for the

*From a paper read before the Birmingham Branch of the British Foundrymen's Association.

particular class of casting upon which he may be engaged, care being taken to bear in mind the thickness of metal, the heat of the molten iron, and the general characteristics of the finished casting.

For light castings, nothing exceeds in efficiency a charcoal blacking of good quality, though expert practical men are not quite in agreement as to whether a pure wood charcoal or one slightly stiffened by a mineral admixture produces the better results. Some foundries go even further. I have in my mind two light-casting foundries in the Black Country, each of which has a special facing to its own formulae, and which in turn differ to a marked degree in essential particulars. Certain it is that both these foundries enjoy a high reputation for the excellence of their castings, while the proprietor of one assured me that since introducing the new method he had experienced far less trouble in his fettling shop, and at considerably reduced outlay under that head.

For ordinary green-sand work, which requires sleeking, there are now prepared many mineral blackings, sometimes called "patent," which gladden the eyes of the moulder, and assist to bring out a casting with that beautiful blue glossy skin so much sought after by founders. The true functions of these facings are reflected by this very anxiety on the part of the founder. He knows that given a good highly-refractory substance, the pores on the face of the casting will be closed, and therefore the utility of the skin before-mentioned does not end with the colour. He knows, too, that with a blacking of the right character the cleaning off or "fettling" of the casting is going to be a matter of comparative simplicity, and this remark applies, not only to green-sand, but also to loam, dry-sand, and core work.

The Refractory Feature

It is of course necessary to have a stronger or, as it is termed, heavier facing for the larger castings, for not only has the weight to be considered, but the casting temperature in large moulds becomes a serious factor. Hence it is necessary to provide a strong refractory in which the percentage of carbon grows higher in accordance with the strain placed upon it. It is on this very point that theory breaks down, and when this happens, as occasionally it may, it becomes necessary to search for the real reason. On the face of the previous remarks it might be thought that to get good results in all cases it would only be necessary to raise the carbon content, but this is not all that is required. Some refractories are of so harsh a character as to preclude all thought of sleeking on a green-sand mould, or mixing with water in a "boss," especially when newly prepared. It is here that the skill of the blender is required, and by his agency devious facings are produced which can be held to cover all classes of moulds. In many instances I have found that the slightest modifications of mixtures have made all the difference between a good-looking casting and one that would be described as something worse than indifferent.

It is only seeking trouble to make use of a facing that does not process refractory characteristics to a high degree to face a mould of considerable size, and which is to be at a high temperature. On the other hand, the presence in the blacking of too great a proportion of silicious matter would cause infinite trouble in the way of scabbing and burning. But, as previously indicated, the use of a high refractory for light castings is not generally advisable.

For cores a sound refractory must be used, but the necessity of providing something that will not easily rub off after baking must be kept clearly in view. Here, again, the task of the expert has been to provide an article which will perform its work perfectly under varying conditions, and, I think I am right in saying that the work in the fettling shop has been very decidedly lessened in the past few years, and on this account. With regard to graphites, graphite facings may be divided into three parts, and roughly classed as plumbago, graphite, and black-lead. There are numerous qualities but it is more or less a matter of carbon content, and those who are satisfied with the poorer kinds must not expect to obtain such good results as other founders who endeavor to obtain the highest grades. Here, again, it is a matter of individual practical test in the various foundries, but to-day the founder who knows what he wants and asks for it is sure to find satisfactory supplies.

Steel Refractories

These are in a class by themselves, and instead of aiming for carbon content the founder looks for materials high in silica. For loam work nothing has been found to exceed in efficiency the silica compositions at present in use. It is not for me to place before experts the various methods of building up the moulds, but I may be permitted to point out the extreme importance of procuring a composition in which, while possessing a high percentage of silicates, is not so closely composed as to interfere with the proposity of the finished mould.

One important factor in these manufacturers is the practical, if not absolute, banishment from the material used of iron oxides. These should be carefully eliminated, for as surely as they enter into the mould in anything like an appreciable proportion so surely will the trouble of the moulder begin. This remark applies with even greater force to the preparation of the facing of "paint," as it is commonly called, with which the mould is finally dressed. The effect of this paint is practically the same as the blacking on an iron mould, and when the high casting temperature of steel is borne in mind it can easily be comprehended how necessary it is to use an article which is above reproach as a refractory.

CASTING TEMPERATURE OF ALUMINUM

THE casting temperature exercises a decided influence on the physical properties of aluminum alloys, according to F. H. Hurren in his summary of a paper read before the Birmingham branch of the British Foundryman's Association. To a certain point, the lower the casting temperature, the better the mechanical properties. At temperatures below 650 deg. C., there appears to be very little change in the tensile tests, and at this temperature almost any properly-gated casting can be run. It is, of course, absurd to dogmatise, and say that no mould must be poured at a temperature exceeding 650 deg. C., as factors may be present which render it desirable or necessary to cast at a higher temperature. For instance, aluminum aeroplane cylinders require a higher temperature to ensure freedom from mis-runs in the very thin cooling fins, and in the remarks on porosity an example being cited where a temperature of 675 deg. gave the best results. Speaking generally, however, most commercial casting can be performed at a temperature of 650 deg. C., or under, by paying proper attention to the method of gating, and obviation of air locks. Pyrometry is just as important when dealing with molten metals as in annealing and hardening processes. Many aluminum castings are poured from two crucibles simultaneously, and it is to court trouble to have the two lots of metal at different temperatures. By "drawn" melting in bulk the risk of this happening is not so great as when melting in small crucibles in coke or oil furnaces. Many of the vexatious cracks and "drawn" places are due to this cause.

Again, the "burnt" metal danger appears to be an imaginery one. By proper attention to casting temperature, it does not matter what temperature the metal has attained, nor how long it has remained in the furnace; results may be obtained equalling those from metal which has been melted with every care. I think that most of the trouble which has been ascribed to "burnt" metal, is really due to crude methods of judging temperature, and could be avoided by the introduction of a pyrometer. It is difficult, if not impossible, to correctly estimate the temperature of a body of molten aluminum, by the eye. A crucible of metal has been heated to, say, 880 deg. C.; it is drawn from the furnace, stirred, pieces of scrap or ingot metal added, stirred again, termed "right" (when perhaps the temperature is still as high as 720 deg. C.), and when a "waster" results, it is credited to "burnt" metal. Actually it is due to a high casting temperature, and had a pyrometer been used and the metal cooled to, say 620 deg. C., no doubt a perfect casting would have resulted.

Aluminum is still sufficiently fluid at 540 deg. C. to run thick castings, and there is no visible difference between metal at that temperature and metal at 700 deg. C. No one would deliberately leave metal in the furnace for a long period after it has melted, owing to the waste of fuel and increased melting loss, but where this is unavoidable figures obtained indicate that the metal does not suffer deterioration. There is no danger in using metal which has been left in the furnace for two hours, provided attention is paid to casting temperature.

BRASS ASHES.

By L. E.

BRASS ashes usually contain from 2 to 8 per cent. of metal. This metallic content is partly due to inefficiency of employees in foundries, but the greater loss, however, is due to the cracking of the crucibles after they have had several heats. There are two methods for recovering the metallic contents in brass ashes, the wet and the dry method. The dry method is not used to any great extent owing to the varying results obtained and this is especially true when the material is damp. The wet method is universally employed in consequence of the accurate and uniform results obtained after the machinery is properly installed. Concentrates from the dry method rarely, if ever, run over 50 per cent. whilst concentrates from the wet method average from 60 per cent. to 65 per cent.

In the wet method treatment of brass ashes, the latter are first run into an elevated revolving screen by means of a cup elevator. If the material can be run direct from the car, the screen can be elevated close to the car, so that the material can be shovelled direct from the car into the revolving screen. The cup elevator at the start should be avoided, as it easily clogs up, owing to large pieces of coke and metal which fall under the pulley at the bottom of the elevator. The screen should be about 6 feet long, tapered from 2 feet to 1½ feet with ¾ inch opening on the screen. The material that is screened drops into a sluice box, which is built with a slope of 45 degrees from each end of the revolving screen. This sluice box is also built up to the centre of the screen with a catch box directly under the middle of the screen meeting the sluice box with a 45 degree slope from each end of the screen.

Running water is introduced into the sluice box by means of two one inch pipes at each end of the screen with ¼ inch holes an inch apart in each pipe. The water running into the sluice box under the revolving screen forces the screened material through the catch box into the sluice box from the catch box to the rolls where the material is finely crushed. The fine material is then run into the sluice box, which is built under the rolls to the cup elevator and into the jig where separation takes place. The rough material that does not go through the screen, goes through a box at the small end of the screen and into a crusher or chaser, where the material is crushed. From there it passes into the rolls, where it is crushed more finely and then goes to the jig with the screened material that is first crushed.

The jig is 16 feet long by 6 feet high, by 4 feet wide, and is separated into four hatches. Each hatch is 6 ft. by 4 ft., by 6 feet high, with the inside built with a 45 degree slope so that the metal falling through the grates at the top of each hatch can roll to 3 inch stop cocks placed outside of the middle hatch. The hatches are not built on a level, but each one is about 2 inches lower than its neighbor, so that the material running over the top is slowly separated, the metal going to the bottom and the coke continuing its journey clear over all the hatches, it being of no further value. Each hatch must be filled with water before the machinery is started. Plungers are attached to each hatch and when the machinery is started, the suction formed by the plungers separates the materials as described. The stop cocks at the bottom of each hatch are opened every few minutes to collect concentrates.

UNMACHINED JOINT FACES.

By D. Street.

CAST iron possesses not only "flow" properties under prolonged stress, but is also much more elastic than is commonly supposed. Indeed, there is a widespread notion among the mechanically educated that cast iron "will break before it will bend." Yet cast iron will spring to a quite appreciable amount, as witness the deflection shown by a cast iron test bar before breaking occurs, or the "wind" of a lathe-bed resting on faulty foundations. Joints in which any kind of sheet jointing material is used have hitherto been rough machined. The machining has been considered necessary in order to true the surfaces, which, at the same time have had to be left rough in order to provide a grip on the packing.

It is now found that, given careful moulding, machining can be eliminated altogether on certain joints, such as those of hydraulic pump-valve covers. The parts are cast with the faces well serrated, and by using stout millboard jointing, the sand finish is entirely successful, and the joint answers satisfactorily all tests. Up to the present it has been found necessary to machine the joint faces of pump bodies and cylinders, but hopes are entertained that in course of time even this will be eliminated for ordinary pump joint faces. The practice is dependent upon the ability of the foundry to turn out surfaces reasonably flat; more studs are required than would otherwise be employed. Joints tight under 500 lbs. hydraulic pressure can be made with 18 in. by 12 in. rectangular covers over 1 in. thick, having a diagonal wind of ⅛ in., using 3 -16 in. millboard, and no trouble whatever is experienced under test.

If special attention is paid to the moulding and casting of the parts, the number of wasters in the foundry can be kept very low. Lumps and bumps of a decided character render jointing impossible, but a surface reasonably level, even if it depart considerably from the straight line, is no barrier under the persuasion of the nuts on bolts or studs. Damp sand and molten metal scarcely seem an ideal combination for finished work possessing relative accuracy, but if the foundry product be examined, it will be realized that the normal deviation from truth can be kept well within the permissible tolerance. It may prove requisite to use an adequately reinforced core, levelled properly after storing, and applied at the point where the jointing face is desired, the latter being poured face downwards. If it becomes clear that the work on one moulder under inspection proves more accurate than the rest, it is safe policy to study his precise methods. The practice of finishing cold-water pump covers without machining is in actual daily operation at the present time.

FIRE LOSSES IN CANADA AND UNITED STATES

LOSSES by fire in the United States and Canada have been steadily increasing during the past three years. In times of commercial crisis the records of fire losses have always been inclined to show large increases. For the first six months of this year, the amount of wealth wasted by fire in America shows an alarming increase over 1915 or 1916.

The losses by fire in the United States and Canada during the month of June, as compiled from the records of "The Journal of Commerce" of New York, reached an aggregate of $15,513,270, as compared with $12,247,500 in 1916, and $10,893,950 in 1915. The losses for the first half of 1917 reach the unusually heavy total of $144,621,725, as compared with $125,776,420 last year, and $92,391,000 the year before. The following table gives a comparison of the losses by months for the first half of this year with those of 1916 and 1915, together with the losses for the balance of those years:

	1915.	1916.	1917.
Jan.	$ 20,060,600	$ 21,423,350	$ 36,431,770
Feb.	13,081,250	24,770,770	29,587,660
March	18,786,400	38,680,250	17,523,000
April	18,180,350	12,681,050	18,597,225
May	11,388,450	15,973,500	24,968,800
June	10,893,950	12,247,500	15,513,270
Total six mos. ...	$ 92,391,000	$125,776,420	$144,621,725
July	9,006,800	23,013,800	....
Aug.	10,067,100	10,745,000	....
Sept.	14,823,500	12,244,625	....
Oct.	14,465,850	17,701,375	....
Nov.	21,204,850	19,898,450	....
Dec.	20,877,100	22,063,325	....
Total for year	$182,836,200	$231,442,995	....

There were some 230 fires during the month of June this year, each of which caused an estimated property damage of $10,000 or over. This compares with 261 such fires in May, 244 in April, 270 in March, 381 in February, and 303 in January, making a total of 1,689 fires of $10,000 or over in the first half of 1917.

"Any rags? Any old iron?" chanted the dealer, as he knocked at the suburban villa. The man of the house himself opened the door.

"No, go away," he snapped, irritably. "There's nothing for you. My wife is away."

The itinerant merchant hesitated a moment, and then inquired: "Any old bottles?"

NEW AND IMPROVED EQUIPMENT

A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

OPTICAL PYROMETER FOR WORKS USE

FOR the measurement of temperatures above say 1400° F., only two methods have been found practicable for works service. One of these is based on the thermocouple, used either with the millivoltmeter or with the more

CASE CONTAINING BATTERY, RHEOSTAT AND MILLI-AMMETER FOR USE WITH OPTICAL PYROMETER.

accurate and reliable potentiometer. The other method is based on the laws of radiation and includes both the radiation pyrometer, which would be more properly named the "total radiation" pyrometer, and the optical pyrometer, which utilizes only that radiant energy visible to the human eye

For many services the inexpensive and sturdy base-metal couple may be used for accurate measurements up to 2000° F., with entire satisfaction; the more fragile and expensive platinum couple may be used up to 2800° F., but, the thermocouple, like thermometers in general, must assume the temperature of the hot object by conviction, conduction, radiation, or all combined. This fact militates against its use for measuring the temperature of molten brass, iron and other metals, or for measuring temperatures in gas producers and other locations where the thermocouple would be subjected to rough mechanical treatment or to contamination by vapors and gases, which would rapidly impair its accuracy. In many industries the temperatures used are far above the range of thermocouples.

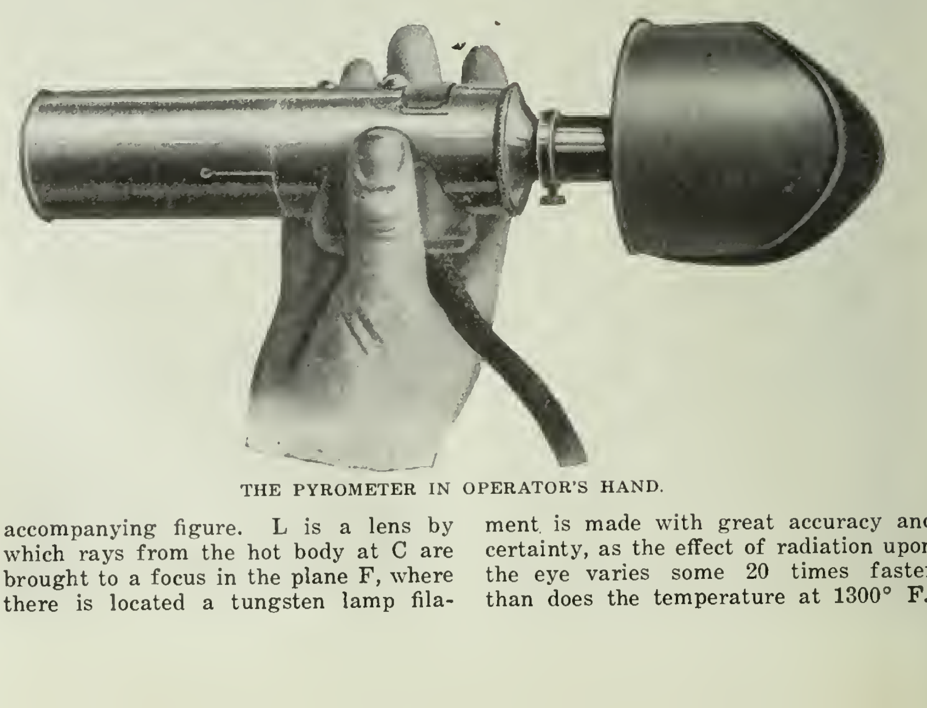
Measurements by radiation can be carried out at a distance, once the laws connecting temperature of radiating body and intensity of radiation have been determined, and the radiation receiving and measuring part need not be heated to the temperature of the radiating body, nor even anywhere near to that temperature. Pyrometers utilizing radiation are divided into two classes, those which measure as heat energy the total radiation falling upon the receiving part of the instrument, and those, known as optical pyrometers, which are based upon the fact that the luminous radiation or light varies in a definite manner as the temperature of the hot body changes.

The greatest success has been attained by separating out one kind or wave length of radiation, usually that which excites the sensation of red, and comparing the intensity of this one-color light with the intensity of the light of the same color emitted by a standard source of light. The eye is very sensitive when comparing the brightness of two surfaces when one is superposed upon the other, and after having arranged to have light from the hot body and light from the standard of comparison viewed in this relation, they can be made equal, either by varying the amount of light received from the incandescent object, or by varying the intensity of the standard of comparison.

The latter method, that is, variation of the intensity of the standard of comparison, is preferred and used by the U.S. Bureau of Standards, also by the Reichsanstalt, of Berlin, where its practical application has been brought to a high degree of perfection by Messrs. Holborn and Kurlbaum. The Leeds & Northrup Co., Philadelphia, working under the fundamental Morse patents, has lately carried on a prolonged investigation and development of this type of optical pyrometer with a view to realizing a high degree of accuracy and reliability in a simple and portable device. The instrument, which is illustrated herewith, is suitable for measuring from dull red (about 1100° F.) up to the highest known temperature.

The manner in which the luminous radiation from the hot body is balanced against that from a standardized source will be understood by reference to the accompanying figure. L is a lens by which rays from the hot body at C are brought to a focus in the plane F, where there is located a tungsten lamp filament. By means of the eye piece E, the observer views the incandescent filament which appears to lie upon the image, just as the cross hairs in a surveyor's telescope appear upon the distant object looked at. By means of a rheostat in a case slung about the neck, the case also containing a storage battery and a milliammeter, the current through which the lamp is adjusted until the brightness of the filament is just equal to the brightness of the image produced by the lens, that is, so that the filament blends with, or becomes indistinguishable upon, the background formed by the hot object. The observer then notes the reading of the milliammeter, which may be provided either with a special scale to read in degrees of temperature, or the temperature corresponding to the current may be read from a calibration curve supplied with the instrument. The adjustment is made with great accuracy and certainty, as the effect of radiation upon the eye varies some 20 times faster than does the temperature at 1300° F.,

OPTICAL PYROMETER IN USE.



THE PYROMETER IN OPERATOR'S HAND.

and some 14 times faster at 3400° F., while as above stated, the eye is very keen in distinguishing differences in brightness between superposed objects.

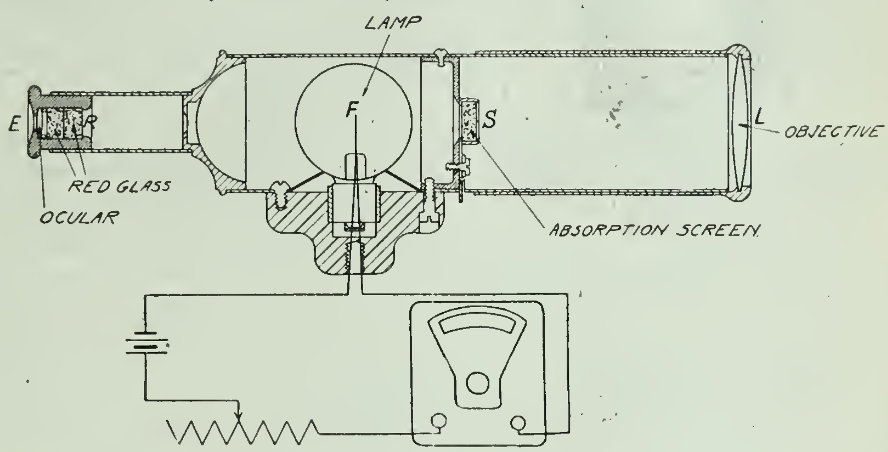
At high temperatures the light emitted by both the hot body and the filament would become dazzling, and comparison would be difficult. For this reason a red glass is placed in the eye piece at R, which has the further advantage that light of only one color then reaches the eye and no difficulty is introduced by lack of color identity between the light emitted by the hot body and that emitted by the filament. The intensity of light radiation of any one color increases progressively in a definite manner as the temperature of the radiating body rises, and nothing is therefore lost by eliminating all other light from the comparison. As only brightness, not color, of light is matched. inability to distinguish colors and color-blindness do not interfere with the use of the instrument. In fact, in the region of temperatures used for hardening steel, for example, different observers using this instrument agree in their readings within 6° F.

The brightness of the image of the hot body produced by the lens L is almost absolutely constant, irrespective of the distance from the hot body, although the size of the image varies with the distance. Since it is the brightness of the image and not the total radiation received through the lens that is measured, it is possible to measure the temperature of a small body or of a body at a distance equally as well as that of a large body or of one near at hand. It is not at all necessary that the hot body should fill the entire field of view of the instrument, as with total radiation pyrometers.

In observing bodies at very high temperatures, as 2,500° to 10,000° F., the light received through the lens would be too blinding for direct observation, even through the red glass of the eye piece, and the intensity of the image might also become greater than that at which it is practicable to burn the tungsten filament, so that a balance would become impossible. Some method for reducing the intensity of the light from the hot body, such as by varying the aperture through which the light is received or by placing a screen to intercept some of the light, is therefore necessary. A screen is used, placed between the lens and the image so that it reduces the light from the hot body, but not that from the filament. With the reducing screen it is possible to make direct observations of the most brilliant light sources, as the electric arc or the surface of the sun.

It is not feasible to calibrate the instrument at such high temperatures by direct comparison, since they are above all known melting points and the ranges of contact thermometers, but fortunately a relation has been found to exist between temperature and intensity of radiation of any one color or wave length of light. By making use of this relation, known as Wien's Law, and reducing the intensity of the image in a known ratio by means of the screen just referred to, it is possible to extend the scale of the instrument to the highest temperature. The scale thus obtained has been found to agree very closely with a scale of temperatures established by known facts about the relation between temperature and total radiation. In other words, this form of optical pyrometer gives the same scale of temperature as do total energy pyrometers used with the precautions necessary to secure accuracy and precision in the measurement of total radiation.

The screen used for cutting off part of the radiation from very hot bodies can be thrown into or out of the field of view by means of a milled disk projecting through an opening in the tube of the instrument. With the absorbing screen in use, a different milliammeter scale or calibration curve is required, but as the range of the instrument without the absorbing screen overlaps many hundred degrees with the range for the absorbing screen, the accuracy of the two scales can always be checked by observing a hot body whose temperature lies within this range.



OPTICAL SYSTEM AND ELECTRICAL CIRCUIT.

The readings obtained with this instrument are always the same for the same temperature, if the body viewed is surrounded by other objects, such as the walls of a furnace at the same temperature. Also no correction is required in the case of so-called "black bodies," such as incandescent carbon, when viewed in the open. For iron and steel in the solid state, the corrections required for readings taken in the open are also negligible.

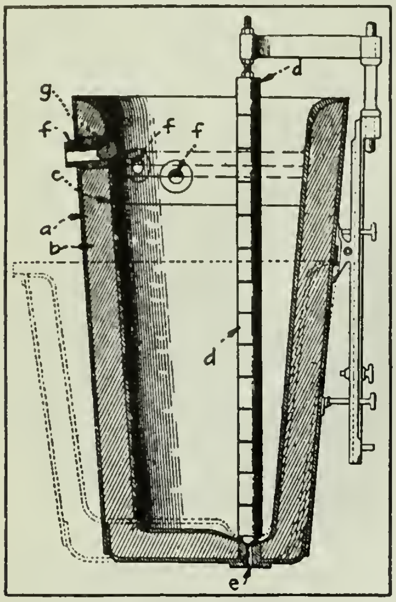
Objects having a metallic sheen, that is, a surface which reflects light freely, as molten metal or polished platinum, do not give the same readings when viewed in the open as when viewed in the furnace, or as a black body would give with this or any other radiation or optical pyrometer. The readings, however, are always consistent for the same material under the same conditions, and by using suitable reduction factors, can be converted to true temperatures. Furthermore, the readings obtained with this type of instrument when sighted upon a body in the open differ less from those given for the same body at the same temperature enclosed in a furnace, or for a black body at the same temperature; than do the readings of instruments which measure the total radiated energy. In other words, the correction where there is a departure from "black body" conditions is smaller than with the total radiation pyrometer.

The instrument can be calibrated by sighting it upon bodies whose temperatures are known, either by means of a thermocouple pyrometer, or by the melting or freezing of various substances. The constancy or reliability depends upon the constancy of the lamp, that is, its ability always to shine with the same intensity when receiving the same current. This matter has been investigated exhaustively by the U.S. Bureau of Standards and by the Nela Park Laboratory of the National Electric Light Association, also in the laboratory of the Leeds & Northrup Co., and it has been found that after a tungsten filament is thoroughly aged, that, is, burned for some time at a temperature higher than that to which it will be subjected in service, no sensible variation thereafter occurs. The instrument is so designed that one lamp can quickly be replaced by another, and by keeping two lamps, their correctness can always be insured by checking one against the other.

The instrument itself is handy and portable, weighting only about a few ounces, and can be sighted as easily as an opera glass. The case, containing the battery, rheostat and milliammeter, is designed to be slung about the neck, and weighs about 10 lb.

SELF-SKIMMING LADLE FOR STEEL FOUNDRIES.

A NEW type of ladle, described in The Iron Age, and known as a self-skimming one, has been invented by J. C. Davis, fourth vice-president of the American Steel Foundries, Chicago. It is especially adapted for pouring steel castings and is claimed as making it possible to expose 45 per cent. less area of steel to the detrimental action of the slag than in the case of the old style ladle where basic slags are obliged to remain for a long time in contact with the metal. This is particularly the case in pouring castings, for the chemical reaction between the slag and the steel tends to lower the silicon content of the steel and to add oxygen and phosphorus to it. The new type of ladle has the further advantage, it is claimed, of imparting a greater hydrostatic head to the metal, which the in-



NEW TYPE OF LADLE WHICH SKIMS ITSELF OF EXCESS SLAG. THE OLD TYPE IS SHOWN RELATIVELY BY THE DOTTED LINES.

ventor claims has the effect of causing the lighter slag to rise to the top of the steel and remain there while the ladle is being emptied.

In making open hearth steel, it is almost impossible to produce an exact quantity of steel of the desired composition at one time because owing to various delays more metal than was contemplated in the original charge has to be added. It is, therefore, necessary that the ladle, which is to hold the steel and its slag, be of such ample proportions as to properly receive and contain the original charge and any such additional amounts which have to be added. Normally, therefore, when a heat of steel is discharged into its ladle, there is so much space between the top of the steel and the top of the ladle that the latter receives an excessive amount of slag, which remains usually in contact with the steel until the ladle is emptied entirely. The greater the volume of slag in the ladle, the greater the hydrostatic head or pressure exerted by the slag, thereby causing the latter to settle more deeply into the steel, increasing the slag's contaminating effect. These conditions are especially true in steel foundries.

As shown in the illustration, the new ladle is of smaller diameter and is much deeper than the type generally employed. It is pierced near the top with several openings which are staggered at different levels, the purpose being to provide outlets for the removal of slag. Before the ladle is filled with steel, the slag openings are closed with a plug, composed mainly of silica sand with a binder of fire clay, and these plugs can be removed as required in order to regulate the height of the slag in the ladle to a proportion just sufficient to serve as a blanket to prevent chilling the steel. The ladle consists of an exterior shell, (a), a brick lining, (b), and a thinner lining(c), of material containing magnesite and dolomite. The stopper is shown at (d), the pouring opening at (e), and the slag holes at (f). How the slag holes are plugged is illustrated at (g).

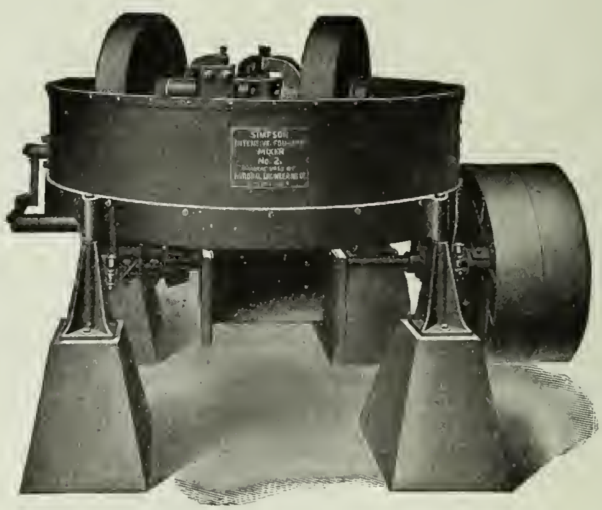
INTENSIVE FOUNDRY MIXER

AN action which squeezes and kneads the grains of each kind of sand through and amongst each other is the underlying principle which is responsible for the efficiency of the foundry mixer illustrated in the accompanying engraving. It is claimed that the squeezing or kneading action imparted by the mechanism gives a degree of mixing impossible to get by hand or from the pugmill type, while the breakage of the sand grains which takes place with excessively heavy mullers is obviated by designing the mullers of just sufficient weight and width of face to mull and knead the sand properly so as to produce the necessary plasticity and toughness without breaking the grain of sand, thereby retaining the original porosity and openness of the mixture.

The illustration shows the exterior view of No. 2 mixer having a pan 6 ft. in diameter, with mullers 30 in. dia. by 6 in. face, set at different radii from the centre so as to cover 10½ in. width of track. The pan is stationary and carries a turret on which are bearings for a central supporting casting in which is fastened a vertical drive shaft from the bevel gearing underneath. The central supporting casting carries the plows and the mullers, the function of the plows being to turn over and move the sand mixture alternately inwards and outwards, the outside plows throwing the mass of sand toward the inner muller and the inside plows doing likewise to the outer muller. The mullers revolve on their own axis as they travel around the pan, their paths being at the points where the mixture is heaped up highest by the movement of the plows. The action of the plows, together with the kneading and squeezing action of the mullers results in a thorough incorporation of all the elements of the mixture regardless of its composition.

The builders of this machine are the National Engineering Co., Chicago, who make it in two sizes, the No. 1, or 4 ft. mixer having a capacity of 3½ to 4 cub. ft. per charge, while the No. 2 machine, illustrated, takes 7 to 10 cub. ft., which includes the quota of coal dust when facing sand is being mixed, or binder when core sand is required.

Moulding Range Top Plate Query — We have experienced considerable trouble in moulding range top plates. The size of these plates is 20 in. by 22 in., weight 47 lbs., thickness of outer edge 3-16 in., inner part ⅜ in., with 1 in. flange on bottom all the way round at about ½ in. from the edge. There are also four braces across the bottom. Our trouble is to get a smooth surface on top for polishing. We have found better satisfaction in moulding it top side down. We pour the metal as hot as possible and at times get a very fair surface. At other times, however, we get a very rough or pebbly surface, and sometimes small slag holes. We are using No. 1 Albany sand and have tried a number of different styles of gates. We have also tried sea coal facing without securing the desired results. Suggestions as to remedy of the trouble are invited.—H. Z. F.



INTENSIVE FOUNDRY MIXER.

Inhabitant—Ain't you t'chap as were singing tenor solos last night at t'town hall?

Tenor (proudly)—I am.

Inhabitant—Well, look 'ere, m'lad, I doan't blame thee so much as I do t'folk as sent ye!

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PRINCIPAL CONTENTS

THE PROJECT TO DEVELOP CANADIAN TRADE

In view of the interest being taken by the business and investing public in the matter of trade after the war, considerable attention has been attracted by the recommendation of the special committee of the Senate on conservation of Canadian trade that there be established in Canada a Canadian Trade Corporation. The idea, follows along the lines of the organization which has been formed in England known as the British Trade Corporation, being the outgrowth of the proposal for the establishment of a British trade bank. According to the report of the Senate Committee, the aim is to secure orders for overseas trade, to replace in part the great volume of orders that during the war have been received for munitions and supplies, and to finance the undertaking of large overseas contracts along the lines of the British organization.

From information available, we find the future outlook very much clouded with regard to trade matters. It is difficult to forecast what conditions may be and, therefore, very hard to organize to meet possibilities. There can be no doubt but that such an organization as proposed might be an important factor in relation to the country's trade in securing information as to foreign markets. This would require a wide service employing practical men and would mean the expenditure of considerable sums in order to give it that effectiveness in securing actual orders which has been lacking in connection with the past service of our Trade and Commerce Department. To provide the necessary funds, a Government subsidy would be almost necessary.

So far as the conditions in England and Canada are concerned, it may be pointed out that there is considerable difference as to the need for such an organization. England is now out to compete more closely with Germany. She is, therefore, adopting some of Germany's methods. In England, up to the present time the banks have been practically nothing more than trust organizations, lending money on good security, but not financing new business with attendant risks. On the other hand, Germany built up her foreign trade through her banking system which was used for the encouragement of industrial expansion. Now England proposes to take a step in the same direction. In Canada the banking system has been considered as being something between the English and German standards. Facilities have been provided for financing foreign trade through exchange and other arrangements for settlement of accounts, but the banks have not themselves taken the actual risks of manufacture.

The project, as it has been launched in the Senate, is evidently an effort to combine the trading and banking ideas so as not only to provide a market, but to aid in supplying the products to meet it. The possibilities presented are both important and interesting and the matter will no doubt receive considerable attention by the business and industrial community. Speaking with regard to the project, Senator Nichols, president of the Canadian General Electric Co., recently said in the Senate:

Great Britain has already taken action, Japan has taken action, and no doubt honorable gentlemen have all read in the despatches what Australia is doing. The Australian Government is now considering the expenditure of $50,000,000 to assist private capital, thus recognizing the pressing necessity of aiding individual enterprise. I am not one of those who believe that the Government should take any large measures of responsibility, but it can do a great deal. We are now employing 300,000 workpeople directly on munitions, and possibly 200,000 more in the production of other war supplies. When the war is over we shall have to provide these men with new employment, and we shall also have to take care of four, five or six hundred thousand returned soldiers. I think I have made that clear. No concerted action has yet been taken, so far as I can see, in an endeavor to grapple with these problems; and I feel that if concerted action is taken there is no better place for the genesis of the movement than in the Upper House of the Parliament of Canada.

During the present month, the committee report comes up in the House for adoption, and doubtless both the essentials to the success of the project and the extent of the support likely to be accorded it will become manifest.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

ELECTRIC JAPANNING*

THE term japanning refers principally to the covering of wood or metal with a coat of black varnish, which is hardened by baking in an oven. The process as used to-day can be regarded as a step between painting and porcelain enameling. Records show that as far back as 392 B.C. the Japanese cultivated a tree belonging to the same family as the sumach, which was tapped when about 10 years old and grayish white juice drawn off that oxidized when applied to pieces of wood and formed a very glossy and smooth black lacquer. It was not until the fifteenth century that any record of this art is to be found in Europe, and in the seventeenth century the English and Dutch had made it into a regular profession, giving it the name "japanning." The early Japanese product was costly and took considerable time, but articles finished this way were found to withstand the elements for years. When Europe took up the work a substitute consisting essentially of the same constituents as our present day japan, usually an asphaltum base combined with oils, dryers and various oxides, gradually came into use.

The action of this japan consists of two operations, one thermal and the other chemical. The solvent keeps the material liquid until it has an opportunity to spread or flow evenly over the surface to be covered, whereupon it evaporates, leaving a smooth viscous covering. This is a physical process and is brought about by the application of heat. The material left after the solvent has evaporated must be changed from a viscous to an elastic solid. This is accomplished by oxidation, the action being speeded up to give the material a more complete solidification by high temperatures. This constitutes the chemical process.

Present-Day Japanning Practice

Some great strides have been made in shortening the time of japanning operations in the last few years. Formerly 5 to 9 hr. were allowed to complete the baking operation which is now being done in from 30 min. to 1 hr. Even better speeds are anticipated, and, in fact, at the present time laboratory tests have produced perfectly baked japan in 10 min. Here the heat is generated electrically within the part to be japanned, which is not the commercial electric japanning. In this case the oven is heated by energy radiated from the metal of the heating units and only to a slight degree by convection. The electric heating units consist in general of a framework of steel or cast iron supporting insulators on which a resistor, made from a flat ribbon of nickel-chrome alloy, is wound continuously. Where a number of these heaters are employed, steel busbars are used, and all connections are mounted on insulators having the same characteristics as those supporting the heating units. The complete heater used in the ovens runs in units of from 2½ to 10 kw. each. They are small and easily movable, thus enabling them to be placed anywhere on the walls or floor until practically a uniform temperature is obtained.

The control of temperatures in japanning is most essential especially where it is desired to secure uniform production of duplicate parts. Electricity can be depended upon to afford a ready, simple and dependable control and takes two distinct forms—hand and automatic control. The first consists of numerous switches connected with the heating elements so that the desired number of heaters to produce or hold a given temperature can be turned on or off. With the second method, a thermostat consisting of a capillary tube thermometer which actuates a contactor through a relay to throw off part or all of the heaters when the oven reaches the desired temperature and again throwing them in when the temperature falls has been found satisfactory. The bulb or sensitive member of the thermometer is usually about 15 ft. long and is placed inside the ovens, an armored connection being run to the indicating portion of the thermometer on the outside of the oven. The actuating fluid is a liquid which vaporizes at a temperature slightly above that of the atmosphere and the instrument has two indicator hands which are set at the maximum and minimum temperatures desired.

Types of Electric Ovens

Oven design is an important feature in all japanning. The less the radiation and ventilation losses from the oven, the greater amount of heat available for actual work. The oven walls, roof and floor should be constructed of a high-grade heat insulating material, and it is also important that the material has little mass to keep its heat absorption as low as possible. Up-to-date practice shows that a 4 to 6 in. wall lined with diatomic earth or similar products seems to meet these requirements. As little metal as possible should run from the inside to the outside of the oven as the thermal conductivity of wrought iron or mild steel is about 1400 times that of a good insulating material, and a ¼-in. bolt will radiate nearly the same amount of heat to the outside air as a 7-in. square of good insulating material. Proper ventilation also requires attention. From both a baking and a safety point it has been found that just enough air must be brought into the oven to reduce the vapors given off by the japan to below a point where it becomes an explosive mixture, but not enough to cool down the oven and retard the baking. The best way to handle this problem is to base the amount of ventilating area upon the amount of japan to be baked, or for every gallon of japan baked within an oven at one time there should be 1200 cu. ft. of free air taken into the oven during the vaporizing period.

Japanning ovens in use to-day can be divided into three types: the box or kiln, the semi-continuous conveyor and the continuous conveyor. In the first the heaters are usually placed on the side walls or floor to give the proper distribution of heat. The semi-continuous conveyor oven is made as a rotary oven and also in a box type with a conveyor which is moved as the operator desires. The former is cylindrical in shape with a heat insulating partition through the center, thus enabling the operator to be loading one-half of the oven while the other half is baking. This oven is very convenient where many pieces of different sizes and shapes are to be japanned.

The semi-continuous conveyor box type has doors placed at both ends. A conveyor, from which the work is hung, runs through the upper part and is of sufficient length to extend the same distance beyond each end of the oven as its length within. With this type one charge is baking in the oven while a second is being loaded. When the first japan coat is baked, the conveyor is started, moving the baked pieces out of the discharging end of the oven and the newly dipped pieces are brought into the baking chamber the first lot has vacated. These ovens are usually built either double or triple, depending on whether two or three coat work is desired. This type of oven conserves the heat better than the ordinary box type. With a baking temperature of about 450 deg. Fah. a new charge can be brought into the oven without the temperature dropping much below 300 deg. Fah., while in the ordinary box type the temperature must necessarily drop to a point where the operator can enter the oven to remove the baked pieces.

The continuous conveyor type oven consists usually of a long inclosure through which the work is passed on a slow-mov-

*From a paper read before the Cleveland Engineering Society, by C. D. Carlson, industrial heat engineer, Cleveland Electric Illuminating Co. —Iron Age synopsis.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers 1917-1918

President—T. Charles Orr, 281 Westmoreland Avenue, Toronto.
Vice-President—James Vallier, 701 Crawford Street, Toronto.
Sec.-Treasurer—Ernest Coles, P.O. Box 5, Coleman, Ont.
Sergeant-at-Arms — John Lougheed, 339 Lippincott Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner of Queen and Bathurst Streets, Fourth Thursday of each month, at 8 p.m.

ing conveying apparatus, and if desired all handling can be eliminated by installing apparatus for loading and unloading the conveyor automatically. The heating of this oven has been worked out carefully, in most cases the heaters being arranged within the different sections of the inclosure so that the incoming work is brought up to its final baking temperature by steps. Usually no heaters are installed in the first section, and when this is the case the hot baked work is brought out of the oven in such a way as to give up a good share of its stored-up heat to the cold incoming work. It is interesting to note that for the same amount of energy consumed as high as three times the amount of work has been gotten out of the conveyor oven as out of the box type.

Fire Hazard of the Process

While electrically heated ovens have been looked upon from the first as the solution of the prevention of fires and explosions which so often occur in japanning, two kinds of fires are possible. When pieces freshly dipped with japan are placed in an oven there is apt to be what is called a secondary drip when the heat is first applied. This waste japan will accumulate on the floor of the oven and bake, the deposit being increased with each successive charge until a thick, porous crust of baked japan has been formed, which, when heated from 500 to 600 deg. Fah., in the presence of oxygen will ignite spontaneously. If this burning were confined to the oven floor it would be harmless, but if it reaches the freshly japanned work quite a disastrous fire might result.

When the volatiles given off by the japan strike a surface with a temperature lower than their own they will condense and form a deposit on this surface, the flues of the oven naturally gathering most of the condensed volatile. This deposit may ignite spontaneously, backfiring into the oven, or the flues may become clogged so that proper ventilation is cut off and an explosive mixture left within the oven. From an electrical standpoint great care has been taken to prevent ignition, even where the precautionary measures have been disregarded, as the heating units are designed with a temperature not much over 100 deg. Fah. in excess of the oven baking temperature. This temperature, except in unusual cases, will be below the flashing point of japans.

Electric japanning is a new industry, having practically grown up within the past three years. To date it comprises a connected load of approximately 50,000 kw. distributed over 75 manufacturing plants in nearly as many cities. Among its largest users are firms like the Willys-Overland Co. which alone has a connected load of about 20,000 kw. in heaters; the Ford Motor Co. which has adopted electric ovens for its different assembly plants over the country, and the Dodge Brothers Co. which is baking its cars almost entirely by electric heat. In Cleveland to-day there are 18 electric ovens, divided between the box and semi-continuous conveyor types, in operation, while as many more are in the development stage. At present, plans are being worked out for several continuous conveyor electric ovens, and these will be in operation in Cleveland inside of a very few months.

Questions and Answers

Question—A bright acid dip which we commonly use for dipping sheet brass stampings was recently employed for dipping brass castings. The results were not satisfactory and we have been unable to obtain desired results from this solution. Kindly inform us if a differently proportioned dip is required for castings, or is the difficulty in the manner of treatment.—S. B.

Answer—To successfully brighten brass castings by acid treatment, the dipping solution should contain a greater percentage of nitric acid than is required for dipping sheet brass. A solution which produces excellent results on either red or yellow brass castings is composed of sulphuric acid, 1 part, and nitric acid, 1 part. Add the sulphuric to the nitric slowly, and when cool add approximately 2 oz. of hydrochloric acid to each ten gallons of acid mixture. Should the solution prove ineffective at first trial, add about one gill of water. A ten gallon dip seldom requires more than one pint of water, and as an excess will cause the dip to act too rapidly, thereby producing a matte surface on the metal, it is essential that water should be added carefully.

* * *

Question—What may we use as a substitute for liver of sulphur, in the process of oxidizing silver electro-plate.—C.M.

Answer—Ammonium sulphide may be employed for oxidizing silver electro deposits, and for many purposes is considered superior to potassium sulphide, as a thinner coating of silver will suffice, owing to the fact that ammonium sulphide produces a softer deposit and is quite easily relieved, thereby permitting a saving in silver as well as time required for the operation. As you are using oxidizing methods quite extensively, it may interest you to know how to prepare your own ammonium sulphide. Saturate a concentrated solution of ammonia with hydrogen sulphide. The hydrogen sulphide may be prepared by treating either iron sulphide, antimony sulphide, or barium sulphide, with hydrochloric acid. The sulphide is placed in a flask closed with a thistle funnel stopper for the introduction of the acid and a rubber delivery tube for the gas. To determine whether the ammonia solution is saturated, place 8 or 10 c.c.'s in a test tube, close the mouth of the tube with the thumb and shake the tube strongly. If pressure is produced in the tube this being noticeable on raising the thumb slightly, it indicates a saturated solution; if suction is produced, the solution is not saturated. This test applies to gas saturation of liquids only. When the concentrated solution of ammonia is completely saturated with hydrogen sulphide, the resulting solution is ammonium hydro sulphide. Now add to this solution a quantity of ammonia equal to the volume first employed and a normal solution of ammonium sulphide is obtained. If the ammonium sulphide is purchased, either the yellow or red sulphide will prove effective. Soft deposits of sulphide may be obtained from the potassium sulphurette solution by adding 4 or 5 oz. of liquid ammonia to the ordinary oxidizing solution. The above ammonium sulphide process is here given as a substitute for the present high priced potassium compound.

* * *

Question—We are having difficulty plating a soft metal piece which forms a portion of our finished product. The metal is an alloy of lead and antimony. We wish to brass plate the surface, and while we experience no trouble in obtaining a satisfactory deposit, the latter invariably blisters and ruins the commercial value of the finished piece, entailing expense and labor to restore the proper surface for plating again. Can you help us by suggesting a preventative for the blistering brass deposit?—P.H.

Answer—Without a knowledge of the composition of your brass plating solution we can only advise precautionary methods which are independent of your present plating process. Brass plating on alloys of lead and antimony can be successfully accomplished on a commercial scale if the brass solution and electric current are regulated with due consideration of the surface receiving the deposit. Where difficulties are encountered such as you describe you can overcome the blistering by giving the alloy a good coating of copper in a cyanide copper bath, the copper ordinarily adheres to such an alloy more securely than brass deposits. The copper deposit need not be heavy but shoult be clean and bright if you wish to avoid an extra buffing and cleaning operation.

* * *

Question—Would it be possible to produce an electro-deposit of nickel and copper from a cyanide solution, which would possess the same qualities as the metallic alloy known as "Monel Metal?" This alloy is quite non-corrosive and acquires a high lustre by polishing, while the color is very similar to nickel. It appears to me that an electro-plate of this nature could be used for many purposes.—B. & S.

Answer—Attempts have been made to produce an electro deposit of an alloy of copper and nickel from a cyanide solution, but the results obtained have been merely color films, no metallic deposit has been obtained either as a laboratory experiment or in commercial practice, that we are aware of.

* * *

Question—Is the addition of chloride of tin to a nickel plating solution beneficial? We understand tin is used in the manufacture of nickel anodes and have been told it is an excellent additional agent for nickel solutions, if introduced in the form of tin chloride.—W. G.

Answer—The addition of tin compounds in any form cannot be recommended. If you wish to observe the effect produced by chloride of tin in your nickel solution, you will find that a white insoluble precipitate forms, which remains suspended in the solution. The deposit obtained subsequent to the addition will be quite dark, resembling burnt nickel. These characteristics will be apparent in all deposits from the solution irregardless of the E. M. F. or current density employed.

* * *

Question—In our experience we have always made allowance for the "ageing" of our nickel solutions. Recently we have had occasion to believe that a similar "ageing" process is necessary for the efficient employment of cyanide solutions. Do you think so?—A. R.

Answer—Yes. Old silver plating solutions deposit better than new solutions. Old cyanide copper solutions are less troublesome than freshly prepared solutions, if they have not become contaminated by foreign matter. As the "ripening" of cyanide solutions progresses, the cyanide of potash decomposes and carbonate of potash and ammonia is formed. The ammonia causes the "ripening" effect. Possibly you have noticed a strong smell of ammonia from an old cyanide bath, into which you have never introduced ammonia direct, the decomposition of the cyanide has resulted in the formation of ammonia. In order to hasten the "ageing" of cyanide solutions the bath may be boiled for a few hours. This is an unpleasant and needlessly expensive method. The better way is to add liquid ammonia in small quantities until the odor of ammonia is only faintly perceptible after thoroughly stirring the solution.

* * *

Question—Owing to present scarcity of labor in this locality, I am compelled to do a large portion of the buffing and polishing in the shop I am employed in. They have a large supply of stitched buffing wheels; these I have found are not as satisfactory as the loose buff for our work. I would appreciate any information you can give me as to the advantages of stitched buffs.—P. & P.

Answer—Stitched buffs present no advantages over sectional buffs other than price. The stitched buff is cheaper and it is quite probable that this is why your firm has a stock on hand. Stitched buffs as you may be aware, are made from pieces of cloth which are too small to use in sectional buffs, therefore they can be sold at lower price. Stitched buffs are difficult to balance; some we have seen were so bad that a practical balance was impossible. The threads often cause annoyance and minor accidents by unraveling and catching in the work. Sectional buffs being softer, are usually employed for finishing treatments. Stitched buffs are quite satisfactory for first buffing operation on brass, or similar rough work. If you are cutting and coloring in one operation, the sectional buff would be preferable.

* * *

Question—Why is iron added to nickel in the manufacture of nickel anodes? Does the iron plate out on the work to any extent? Our plater informs us that the cause of serious rusting of our plated product is due to iron in the nickel.

Answer—In the manufacture of all nickel anodes with a nickel content less than 98 per cent. or 97 per cent., iron is used to facilitate casting the metal in good form and to render the anode capable of being disintegrated by dilute nickel solutions and a weak current. It has been determined repeatedly that from 1 per cent. to 2.5 per cent. of iron is present in nickel deposits obtained from solutions equipped with such anodes. The remainder falls to the bottom of the tank and accumulates in the form of iron hydroxide. Some platers claim that the iron has a tendency to whiten the nickel deposit, this is doubtful. Nickel deposits obtained from single salt solutions equipped with pure nickel anodes, and which reveal no trace of iron by analysis, are equally as white as those produced from baths containing iron.

* * *

Question—What cleaning compound is used for the removal of grease from flatware by manufacturers of such goods. Our line is made from same quality of metal, and we believe the process used by flatware makers would prove efficient in our case.—M. M.

Answer—Possibly the most popular cleaning compound for use on flatware is Kalye, this material does not discolor the surface of the metal during the cleaning operation. It is a very powerful solvent for greases, etc., which are usually present on metal surfaces entering the plating department, and is not objectionable to handle. Oakite is another compound which has proven particularly effective and satisfactory for cleaning flatware or similar goods previous to electro-plating. Of the two compounds we prefer the former.

* * *

Question.—How can I avoid oozing or spotting of castings after brass plating? Also, what is a suitable formula for Japanese bronze?—W. O. B.

Answer.—The cause of the spotting is the plating or cleaning solution, which becomes imprisoned within the walls of cavities and pin holes in the castings. This oozing effect is one of the most perplexing difficulties which platers have to contend with, and a great number of remedies have been suggested for its prevention. Of these, but few have proven worthy of our recommendation. The latter are as follows:—

First—Sound castings free from pin holes.

Second—Use only sufficient free cyanide in your brass solution to facilitate clean anodes and a yellow brass.

Third—Avoid unusually strong E.M.F. and do not crowd the capacity of the baths, as a brass solution poor in metal will often produce deposits which will develop spots on the surface. If the casting is porous and the pores contain either a pickling solution or an alkaline solution, the solution in the pores must be neutralized and removed. To neutralize the solution, immerse the castings in one of the following dips:—Water, 1 gal.; common alum, 2 oz.; or water, 1 gal.; oil of vitriol, 2 oz.; or water, 1 gal.; potassium bitartrate, 2 oz.

Rinse from either of these dips, first in clean hot and then clean cold water, repeat the hot and cold water rinse several times; do not merely swish the castings through the water, rinse them thoroughly and vigorously to assist in pumping the offending solution from the cavities, some of which may have only a pin hole opening at the surface, with comparatively large pockets beneath the surface. If the holes at which the spotting is noticeable are plainly apparent, a strong blast of compressed air will prove effective as a remover of the enclosed solution.

By dry heating the castings and delaying the buffing and lacquering operations as long as possible, the tendency to spotting out will be lessened. If you are using sodas in your brass solution, the spotting out will naturally be more pronounced in warm weather than would otherwise be the case. You can produce equally as perfect brass plating by the use of simple cyanide and metallic salt solution as is possible with a solution made more or less complicated by additions of soda salts.

To produce a Japanese bronze, use the following formula:—Potassium sulphuret, 1 oz.; ammonium sulphuret, ½ oz.; water, 1 gal. If the article to be treated has other than a copper surface, it must be copper-plated, preferably in an acid copper solution. A 15 or 20 deposit from a cyanide solution will answer but is not conducive to best results. After plating, rinse well in cold water and scratch brush on a soft wire wheel; clean again and immerse in the above solution. A short immersion or a more dilute solution produces light tones. The solution as per formula yields dark tones. When the desired result has been obtained, remove, rinse thoroughly and dry out by hot water and clean sawdust. Next brush the surface lightly, using a perfectly dry brass wire brush. The first brushing should be done with a wire brush wet with a very dilute solution of carbonate of soda and clean water. If the ammonium sulphuret is difficult to procure, you may substitute by using a few drops of liquid ammonia. The resulting color is not as perfect by this method, but is quite satisfactory for many purposes. Some operators prefer to use only ½ oz. of the potassium sulphuret per gallon of water. The results obtained in any case depend largely upon the quality of the chemicals used and the dexterity of the operator. There is but one Japanese bronze of this type, although, like the Tiffany Verde, there are several distinctly different methods of producing the finish.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON

Grey Forge, Pittsburgh	$47 95	
Lake Superior, charcoal, Chicago	58 00	
Standard low phos., Philadelphia	87 00	
Bessemer, Pittsburgh	55 95	
Basic Valley, furnace	53 00	
	Montreal	Toronto
Victoria	....	
Hamilton	....	....

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$ 64 00
Antimony	20 00
Copper, lake	35 00
Copper, eletrolytic	35 00
Copper, casting	34 00
Lead	13 00
Mercury	100 00
Nickel	50 00
Silver, per oz	0 82
Tin	63 00
Zinc	11 00

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$23 00	$22 00
Copper, crucible	26 00	27 00
Copper, heavy	26 00	26 50
Copper wire	26 00	26 50
No. 1 machine composition	20 00	22 00
New brass turnings	16 00	19 00
No. 1 brass turnings	14 00	16 00
Light brass	12 00	10 50
Medium brass	16 00	16 00
Heavy brass	18 00	18 00
Heavy melting steel	22 00	17 00
Steel turnings	11 00	8 00
Shell turnings	12 00	12 00
Boiler plate	18 00	10 50
Axles, wrought iron	25 00	24 00
Rails	21 00	18 00
No. 1 machine cast iron	28 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	19 00	9 00
Car wheels, iron	27 00	25 00
Steel axles	30 00	30 00
Mach. shop turnings	8 50	8 50
Cast borings	12 00	8 50
Stove plate	19 00	19 00
Scrap zinc	8 00	9 50
Heavy lead	11 00	10 75
Tea lead	7 00	7 00
Aluminum	25 00	35 00

COKE AND COAL

Solvay foundry coke	
Connelsville foundry coke	
Steam lump coal	
Best slack	

Net ton f.o.b. Toronto

BILLETS

	Per Gross Ton
Bessemer billets	$100 00
Open hearth billets	100 00
Forging billets	125 00
Wire rods	95 00

F.o.b. Pittsburgh

PROOF COIL CHAIN.

B

¼ in.	$12 00
5-16 in.	11 50
⅜ in.	11 15
7-16 in.	10 90
½ in.	10 70
9-16 in.	10 70
⅝ in.	10 50
¾ in.	10 40
⅞ in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, guaranteed	0.41
Babbitt metals	16 to 65
Putty, 100-lb drums	4 35
Red dry lead, 100-lb. kegs, per cwt.	15.45
Glue, English, per lb	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls	0 62½
Linseed oil, boiled, single bbls.	1 27
Linseed oil, raw, single bbls.	1 30
Plaster of Paris, per bbl	2 50
Plumbers' oakum, per 100 lbs.	9 00
Lead wool, per lb.	15
Pure Manila rope	37
Transmission rope, Manila	43
Drilling cables, Manila	39
Lard oil, per gal.	1 50
Sandpaper, B. & A...list plus	20
Emery cloth ......list plus	33 1-3
Borax, crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular.	0 15
Wood alcohol, per gallon	2 15
Whiting, plain, per 100 lbs.	2 20

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$11 00	$11 00
Sheets, black, No. 10	11 50	11 50
Canada plates, dull, 52 sheets	11 00	11 00
Canada plates, all bright	12 50	12 50
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B. W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W. G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	11 70
Premier, 10¾ oz	13 85	12 00
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$15 50
3-16 in.	11 70
¼ in.	8 40
5-16 in.	7 40
⅜ in.	6 35
7-16 in.	6 35
½ in.	6 35
⅝ in.	6 35
¾ in.	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard buishings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 50%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.50 to $0.54
Cobalt	1.75 to 2.00
Copper	.42 to .44
Tin	.73 to .75
Silver, per oz.	.86 to .88
Zinc	.16 to .18

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .20
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, acqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper, carbonate, anhy	.50
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate.	.12
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate .....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, singl and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 50
Leather in sdes	1 35i

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 00
Polishing wheels, bullneck	1.70
Pumice, ground	.05
Emery composition	.08 to .09
Tripoli composition	.04 to 06
Crocus composition	.07 to .08
Rouge, powder	.30 to .35
Rouge, silver	.50 to .55

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	53 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x28 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base	64 00	60 00
Braziers', in sheets, 6x4 base	55 00	52 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in. rd.	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamlss	0 58

ROPE AND PACKINGS.

Plumbers' oakum, per lb	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor Oil, per lb.	40
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	13
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	11

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	50

The General Market Conditions and Tendencies

Toronto, Ont., July 31.—The outlook for the manufacturing interests is steadily becoming more confused in spite of the large volume of business offering. The shortage of raw materials, particularly iron and steel, is becoming more acute, while the labor situation is also becoming a menacing problem to handle owing to the difficulty in obtaining sufficient help. There appears to be no doubt that the coal situation is serious, and the uneasiness among those interested in securing large supplies of fuel is increasing. Drastic measures will have to be adopted if factories are to be kept in operation this coming winter. Much valuable time has already been lost in dealing with the situation, and much remains to be done before the desired relief is effected.

Steel

The situation in the steel trade at the present time is one of doubt and uncertainty; many consumers consequently are staying out of the market pending developments. There is now considérable difference of opinion as to the extent and probable effect of the American Government price fixing scheme. There is a growing belief that the Government actions will not be so drastic as was at one time considered probable. It is felt that while steel prices for Government needs will likely be fixed on some equitable basis, it will be a more difficult matter to control the situation as affecting private consumers. It is also doubtful whether such action on the part of the Government is either feasible or desirable. Until this question is settled, little activity may be looked for in the market. For the same reason there has been a lull in the upward movement in prices, and here again opinions differ as to the probable effect on the situation by Government action. Some believe that the crest has been reached, while others declare that the law of supply and demand will prevail, and consequently prices will continue to advance. What will actually happen is exceedingly difficult to foretell, and the prevailing policy of watchful waiting seems to be the correct one.

There is no change in the situation in the primary market as regards black sheets. The American Government buying of sheets is increasingly heavy, which is restricting available supplies for other consumers. The output of sheets of all grades is pretty well sold up for the remainder of the year. No prices on sheets have as yet been fixed by the American Government, although it is paying considerably under the market for current requirements. The steel market in the United States is quiet, pending developments in the price situation. The new demand for steel products of all kinds is light, as consumers are holding off until it is known what the Government will do in the matter of prices. There have been no price changes this week.

Pig Iron

The pig iron market is less active than formerly on account of the uncertainty as to what the Government attitude is with respect to prices. For this reason buying has fallen off considerably until the situation clears. There is no change in the Canadian situation and prices are still withdrawn.

Scrap

The scrap market continues dull and unsettled, with a lack of interest on the part of consumers. Prices on scrap with the exception of heavy melting steel and machinery cast iron, are weak and unchanged.

Machine Tools

The situation in the machine tool trade locally is practically unchanged, the general run of business being principally for equipment for general engineering purposes. In the United States, Government business is the most important feature, and is occupying the attention of the trade almost exclusively. Deliveries are not any better, except on ordinary lathes, which are fairly easy to obtain. Large swing lathes, however, are difficult to get. Grinders, milling machines, both plain and universal screw machines, boring mills and planers are scarce. Prices of all types of machine tools are very firm, with an upward tendency owing to the continued high cost of raw materials.

Supplies

Prices of practically all lines of machine shop supplies continue to advance steadily owing to the high cost of raw materials, while deliveries are not showing any improvement. It is anticipated that there will be some restriction in the consumption of gasoline, as a serious shortage is feared. Although prices are unchanged in the meantime, it is likely that there may be an advance.

Metals

The metal markets continue dull and weak, but prices are unchanged meantime. Trading has again been light, as consumers are keeping out of the market in view of possible lower prices following Government price regulation. Locally business continues good, principally because of war orders, but the ordinary demand is also active.

Copper.—The market has a stronger undertone, but prices continue nominal and unchanged. There has not been a great deal of actual business, but more interest has been shown, which may result in a buying movement in the near future. Lake and electrolytic are quoted at 36c and castings at 35c per pound.

Tin.—The market is quiet but firmer, and quotations continue nominal. There is a scarcity of spot tin in New York caused by an unwillingness to grant shipping permits in England. Government price regulation continues to restrain the market. Local price, 63c per pound.

Spelter.—The American Government has recently purchased a considerable quantity of spelter at 11c and 11½c, according to grade, which represents an advance of 2c over the previous purchase. The price indicates that the Government authorities agree with the producers that the present production cost of spelter has been too close to the selling price. Following this transaction, the spelter situation has improved and the market is firmer. Local quotation unchanged at 11c per pound.

Lead.—The market continues strong and quotations are firmer. There is not enough lead in sight to satisfy current demand, especially for immediate or nearby delivery, and independents are now quoting the same price as the Trust, viz., 11c New York. The local situation is unchanged at 13c per pound.

Antimony.—The market has a weak tendency at unchanged and nominal prices. Local price, 20c per pound.

Aluminum.—The market continues quiet and lack of buying support has weakened it. Local price, 64c per pound.

Foundry Supplies and Chemicals.

There is a continued scarcity of raw materials and costs are still high. Prices of foundry and plating supplies are consequentl yvery firm with a decided upward tendency although there are no changes of importance to note in the meantime. The cotton and leather markets continue firm, the heavy demand causing a shortage which is keeping up prices of goods made from these materials. Prices of cotton buffs have advanced along with most lines composed of that material. There is no material change in the chemical situation, prices continue to hold firm and a scarcity of some lines is still a feature of the market.

TRADE GOSSIP

Oshawa, Ont.—The directors of the Canada Malleable & Steel Range Co. have decided to dispose of the plant.

Owen Sound, Ont.—Green & Woolrich have begun the construction of a new coal dock for the malleable iron plant. The new structure will be 80 ft. wide by 200 ft. long, and 200 piles will be driven.

Harry A. McKnight has resigned as superintendent of the plant of the American Car & Foundry Co., Jeffersonville, Ind., to enter the operating department of the Canadian Car & Foundry Co., Montreal, Que.

Frank H. Crockard, the new president and general manager of the Nova Scotia Steel & Coal Co., has arrived at New Glasgow, N.S. He recently attended a meeting of directors and was introduced to the heads of the various departments.

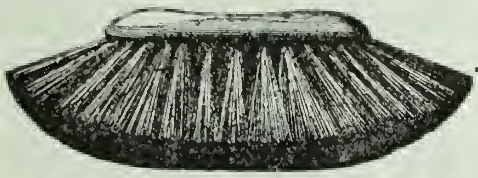
Cadet Claire A. Page, of the Royal Flying Corps, was accidentally killed on July 10, when his machine crashed down on a road near Ypres Junction, near Camp Borden, during an electric storm. Cadet Page belonged to Hamilton, where he was formerly sales manager of the Canadian Hart Wheels, Ltd.

Hamilton, Ont.—H. N. Cole, of Syracuse, N.Y., is visiting Hamilton. Mr. Cole explained that he is here in the interests of the Semet-Solvay Co. of Syracuse, which contemplates establishing a coke plant in this city. The company's prospective site is at the foot of Depew Street, and Mr. Cole is here to make some detailed report of the property.

Hamilton, Ont.—The National Abrasive Co. will begin at once the erection of a factory and office building on Biggar Avenue, at an estimated cost of $16,700. The contract has been awarded to the Hamilton Bridge Works, and completion is expected before September. The company will manufacture artificial abrasive, principally polishing and grinding materials. The initial investment in the Hamilton plant will be about $75,000.

B. F. Repton has been appointed comptroller of the Canadian Car & Foundry Co. and its subsidiaries, with full charge of the accounting work in its various phases. Mr. Repton was associated with Messrs. Price, Waterhouse & Co.. in New York, for over ten years, and subsequently held the position of general auditor to the Dominion Steel Corporation in Sydney, N.S., for several years. Mr. Repton has already entered upon his new duties.

Shawinigan Falls, Que.—The Canadian Aloxite Co., which will go extens-



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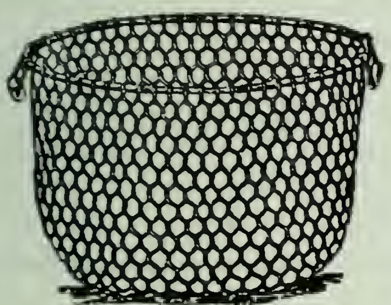

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The

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ively into the manufacture of carborundum and other abrasives, has started construction of a large plant at Shawinigan Falls. It will be completed some time towards the end of the year. The Shawinigan Water & Power Co. have contracted to supply 20,000 h.p. to the Canadian Aloxite Co., which is a subsidiary of the big Carborundum Co., of Niagara Falls, N.Y.

The Electric Steel & Engineering Co., which was recently incorporated at Ottawa with a capital of $2,000,000 is a merger of three concerns and the head office will be at Welland, Ont. The three companies included in the incorporation are Electric Steel & Metals, Ltd., of Welland, Ont., the Boving Hydraulic Engineering Co. of Lindsay, Ont., and the Wabi Iron Works of New Liskeard, Ont. No announcement as to plans will be made until after a meeting of the directors which is to be held shortly.

Amherstburg, Ont.—Within twelve months, if the present schedule is carried through, the big local plant of the Brunner Mond Co., Canadian branch of the Solvay Process, will be in full operation. The excavations of the big ten-story main building have already been completed, and the form work for the concrete foundations is partially in. Part of the reinforced concrete for the cellars has already ben run. Excavations for the boiler-house, milk of lime house and lime kiln are in and work on two chimneys, one 250 feet high and the other 175 feet, have already been started by the Canadian Kelly Co. A waterworks system will be installed.

Steel Co., of Canada Acquire Ore Lands.—The directors of the Steel Company of Canada, at a meeting held in Toronto recently, practically adopted a new policy which is likely to have an important bearing on the future of the company. In co-operation with American interests, the directors propose to acquire certain ore and coal properties situated in an advantageous location in the eastern States, from which such of its supply as is necesary in the future will be drawn. Hitherto the company has not controlled its supply of raw material, although it has enjoyed the reputation in the steel trade of having the benefit of some exceptional contracts. It is understood that the plans of the company included the construction of a considerable plant for the production of coke. The Steel Company of Canada has been the only large domestic steel corporation without its own ore and coal reserves.

The McKinnon Steel Co., has been incorporated at Ottawa with a capital of $500.000 to take over the business of McKinnon Holmes & Co. of Sehbrooke, Que. The incorporators are G. D. McKinnon, Alex. McKinnon and F. C. Johnson all of Sherbrooke.

Empire Stove & Furnace Co., has been incorporated at Ottawa with a capital of $100,000 to manufacture stores, furnaces and heaters, etc., at Owen Sound, Ont. The incorporators are A. A. Parks, A. J. Creighton and E. W. McQuay all of Oken Sound, Ont.

FOUNDRY AND MACHINE SHOP EQUIPMENT EXHIBITION

THE list of firms who had reserved space up to July 31 for the Foundry and Machine Shop Equipment Exhibition, from September 25 to 28, is both large and important, and gives every indication that when the opening date is reached there will be found in the Mechanics' Building, Boston, Mass., the biggest and most valuable display that has yet taken place in the history of the Institution. The list of reservations follows:—

Abell-Howe Co. .... Chicago
Ajax Metal Co. .... Philadelphia, Pa.
Albany Sand & Supply Co. .... Albany, N.Y.
American Foundry Equipment Co. .. Cleveland, Ohio
American Gum Products Co. .... New York
American Lighting Co. .... Chicago
American Molding Machine Co.. Terre Haute, Ind.
American Pipe Bending Mach. Co.. Boston, Mass.
Arcade Mfg. Co. .... Freeport, Ill.
Armstrong Cork & Insulation Co.. Pittsburgh, Pa.
Atkins & Co., E. C. .... Indianapolis, Ind.
Athol Machine Co. .... Athol, Mass.
Ayer & Lord Tie Co. .... Chicago

B. & B. Mfg. Co. .... Indianapolis, Ind.
Beaudry & Co., Inc. .... Boston, Mass.
Berkshire Mfg. Co. .... Cleveland, Ohio
Besly & Co., Chas. H. .... Chicago
Birkenstein & Sons, S. .... Chicago
Blystone Mfg. Co. .... Cambridge Springs, Pa.
Brass World Publishing Co. .... New York
Bridgeport Safety Emery Wheel Co. Bridgeport, Conn.
Brown Specialty Machinery Co. .... Chicago
Buckeye Products Co. .... Cincinnati, Ohio
Bullard Machine Tool Co. .... Bridgeport, Conn.

Carborundum Co. .... Niagara Falls, N.Y.
Cataract Refining & Mfg. Co. .... Buffalo, N.Y.
Chase, Frank D. .... Chicago
Champion Foundry & Machine Co. .... Chicago
Chicago Pneumatic Tool Co. .... Chicago
Chisholm-Moore Mfg. Co. .... Cleveland, Ohio
Cincinnati Pulley Machinery Co.. Cincinnati, Ohio
Clark, Charles J. .... Chicago
Cleveland Blow Pipe & Mfg. Co.. Cleveland, Ohio
Cleveland Milling Machine Co. ... Cleveland, Ohio
Cleveland Pneumatic Tool Co. ..... Cleveland, Ohio
Coale Lumber Co., Thos. E. ..... Philadelphia, Pa.
Curtis Pneumatic Machinery Co. ... St. Louis, Mo.
Cutter & Wood Supply Co. .... Boston, Mass.

Davis-Bournonville Co. .... Jersey City, N.J.
Debevoise-Anderson Co. .... New York
Dixon Crucible Co., Joseph ..... Jersey City, N.J.
Drouve Co., G. .... Bridgeport, Conn.

Federal Foundry Supply Co. ..... Cleveland, Ohio
Felt & Tarrant Mfg. Co. .... Chicago
Forbes & Myers .... Worcester, Mass.
Foreign Crucibles Corporation .... New York
Foundry Equipment Co. .... Cleveland, Ohio

Gardner Machine Co. .... Beloit, Wis.
General Electric Co. .... Schenectady, N.Y.
General Fire Extinguisher Co. ..... Providence, R.I.
Goldschmidt Thermit Co. .... New York
Great Western Mfg. Co. ..... Leavenworth, Kan.

Harrison Supply Co. .... Boston, Mass.
Hauck Mfg. Co. .... Brooklyn, N.Y.
Herman Pneumatic Machine Co.. Pittsburgh, Pa.
Hill, Clarke & Co. .... Boston, Mass.
Hoevel Manufacturing Corporation ..... New York
Holz, Herman A. .... New York

International Molding Mach. Co. .... Chicago
Iron Age, The .... New York

Jennison-Wright Co. .... Toledo, Ohio

Kellogg, Spencer & Sons, Inc. ..... Buffalo, N.Y.
Kelly, T. P., & Co., Inc. .... New York
King, Julius, Optical Co. .... Chicago

Lees-Bradner Co. .... Cleveland, Ohio
Lupton's Sons Co., David ..... Philadelphia, Pa.
Lynd-Farquhar Co. .... Boston, Mass.

McCrosky Reamer Co. .... Meadville, Pa.
McLain's System, Inc. .... Milwaukee, Wis.
MacLean Publishing Co. .... Toronto, Ont.
Malleable Iron Fittings Co. ..... Brantford, Conn.
Metal Industry .... New York
Michigan Smelting & Refining Co.. Detroit, Mich.
Midland Machine Co. .... Detroit, Mich.
Moltrup Steel Products Co. ..... Beaver Falls, Pa.
Monarch Engineering & Mfg. Co.. Baltimore, Md.
Mott Sand Blast Mfg. Co. .... New York
E. H. Mumford Co. .... Elizabeth, N.J.
Mumford Molding Machine Co. .... Chicago
Mahr Mfg. Co. .... Minneapolis, Minn.

National Engineering Co. .... Chicago
New England Coal & Coke Co. ..... Boston, Mass.
New Haven Sand Blast Co. ... New Haven, Conn.
Wm. H. Nichols Co. .... Brooklyn, N.Y.
Norma Co. of America .... New York
Norton Co. .... Worcester, Mass.

Obermayer Co., S. .... Chicago
Osborn Mfg. Co. .... Cleveland, Ohio
Oxweld Acetylene Co. .... Newark, N.J.

Pangborn Corporation .... Hagerstown, Md.
Paxson Co., J. W. .... Philadelphia, Pa.
Penton Publishing Co. .... Cleveland, Ohio
Pickands, Brown & Co. .... Chicago
Pittsburgh Crushed Steel Co. ..... Pittsburgh, Pa.
Portage Silica Co. .... Youngstown, O.
Pridemore, Henry E., Inc. .... Chicago

Quigley Furnace Specialties Co. .... New York

Railway Mechanical Engineer .... New York
Richey, Browne & Donald, Inc. ... Maspeth, N.Y.
Rivett Lathe & Grinder Co. ...... Brighton, Boston, Mass.
Robeson Process Co. .... New York
Rogers, Brown & Co. .... Cincinnati, Ohio

Sand Mixing Machine Co. .... New York
Shepard Electric Crane & Hoist Co. .. Montour Falls, N.Y.
Simonds Mfg. Co. .... Fitchburg, Mass.
Sly Mfg. Co., W. W. .... Cleveland, Ohio
Smith & Sons Co., R. P. .... Chicago
Smith Co., Warner G. .... Cleveland, Ohio
Standard Equipment Co. .... New Haven, Conn.
Sterling Wheelbarrow Co. .... West Allis, Wis.
Strong, Kennard & Nutt Co. ..... Cleveland, Ohio
Sullivan Machinery Co. .... Chicago

Thomas Iron Co. .... Boston, Mass.
Titanium Alloy Mfg. Co. .... Niagara Falls, N.Y.

United States Graphite Co. .... Saginaw, Mich.
U.S. Molding Machine Co. .... Cleveland, Ohio
United States Silica Co. .... Chicago

Wallace & Co., J. D. .... Chicago
Warner & Swasey Co. .... Cleveland, Ohio
Wheeler & Holcomb Co. .... Chicago
White & Bro. .... Philadelphia, Pa.
Whitehead Bros. Co. .... Providence, R.I.
Whiting Foundry Equipment Co. .... Harvey, Ill.
Woodison, E. J., Co. .... Detroit, Mich.
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The Scientific Metallic Sand Blast Material

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Its irregular shapes give it the cutting points which make it superior to the globules, shot, cleans quicker and better. No dust, no sand storage bins, no sand dryers when you use it. Doesn't pulverize like sand. One ton of angular grit equals carloads of sand. WRITE.

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Pittsburgh, Pa.
Established 1888.

Canadian Representatives: Williams & Wilson, Ltd., Montreal, Que.

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Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

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Tilghman-Brooksbank Sand Blast Co., Philadelphia.
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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
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Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Standard Equipment Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
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McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE MACHINES, HAMMER
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
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CRANES
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Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
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Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Woodison, E. J., Co., Toronto, Ont.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.


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Hyde & Sons, Ltd., Montreal, Que.
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Woodison, E. J., Co., Toronto, Ont.

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Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
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Hamilton Facing Mill Co., Hamilton, Ont.
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Stevens, Frederic B., Detroit, Mich.
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Hyde & Sons, Ltd., Montreal, Que.
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Ford-Smith Mach. Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Standard Equipment Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE MACHINES, HAMMER
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Demmler & Bros., Wm., Kewanee, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Lindsay, W. W., & Co., Philadelphia, Pa.
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Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Lindsay, W. W., & Co., Philadelphia, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Woodison, E. J., Co., Toronto, Ont.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

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Harrison Supply Co., Boston, Mass.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

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Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
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TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

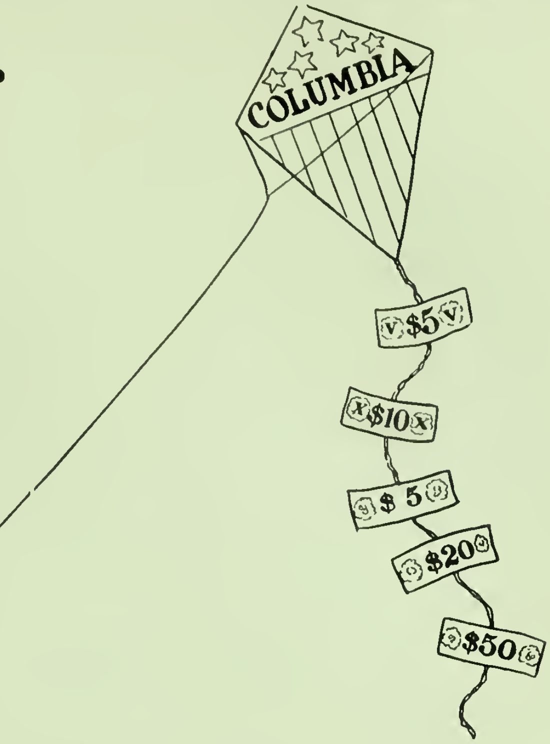
WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

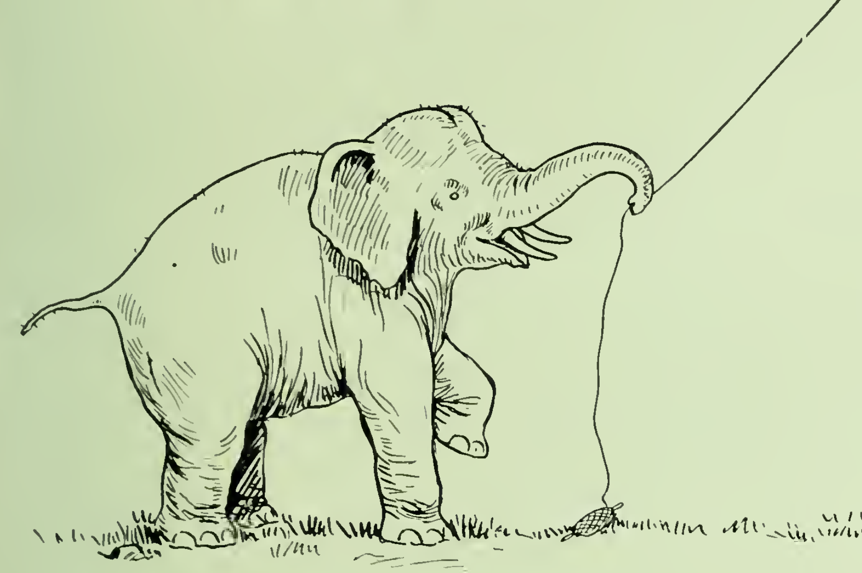
WIRE, WIRE RODS AND NAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

ADVERTISING INDEX

The Higher Cost of The Lower Price

A Short Tale of The Long Green





COLUMBIA Parting is a Parting that is really super-excellent. I originated both the product and that combination of words.

The basic material of Stevens Columbia Parting weighs 76 lbs. to the cubic foot and sells for $1.90 per cubic foot.

The heavier basic materials of other partings weigh 107 lbs. upwards to the cubic foot and cost anywhere from $2.14 to $3 per cubic foot.

You buy Parting by weight and use it by measure. Why pay $2.14 to $3 per cubic foot for the ordinary Parting when you pick the world's best for $1.90?

Again I use a very large barrel and pack it to the top. It is so light in weight that full to the top it weighs only 350 lbs. Smaller barrels, containing heavier partings, weigh 400 lbs. or over.

If heavier partings should be offered at ½c to ¾c lb. less than mine, all the above shows conclusively that there is such a thing as the higher cost of the lower price. Send for my booklet telling how to speed up and make money faster with Columbia Parting. Or, better still, send for a trial barrel —sent on approval if desired.

I sell other things about which there is no guesswork as to economy with thrifty buyers—Stevens Pure East India Plumbago—King Kore Kompound—Carbon Blacking—Core Oils—Core Gum.

Stevens Tripoli Compositions, Sub-Felt and Spanish Felt Wheels, Turkish Emery, Glue, and other supplies for particular platers.

All Stevens Specialties are especially good.

FREDERIC B. STEVENS

Manufacturer Foundry Facings and Supplies, Buffing Compositions and Platers' Supplies

FACING MILL: Corner Isabella Avenue and M.C.R.R.
WAREHOUSE and OFFICE: Corner Larned and Third Street

DETROIT, MICHIGAN

EXPORT WAREHOUSE: Windsor, Ontario

BRANCH: Hoosier Supply Co., Indianapolis, Indiana

NEW ENGLAND BRANCH: Frederic B. Stevens, Corner Water and Olive Streets, New Haven, Conn., E. E. Seeley, Manager

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, SEPTEMBER, 1917 No. 9

The Publisher's Page

TORONTO September, 1917

A Convention Message to Canadian Foundrymen

ON September 24th the 22nd Annual Convention of the American Foundrymen's Association will open in Boston, Mass.

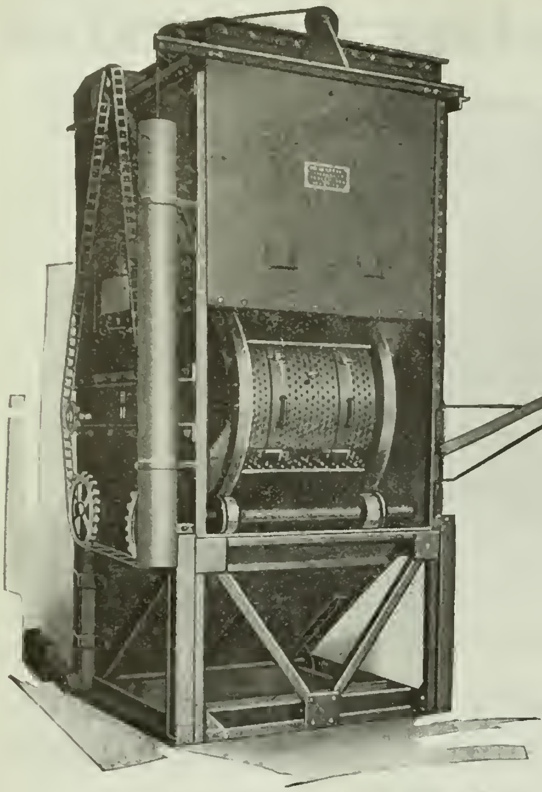
Owing to extraordinary conditions and the consequent pressure of business many of our readers may find it impossible to attend the Convention and personally inspect the equipment which will be on exhibition.

With the cessation of munition making and the return to the more general lines of manufacture will come new demands upon the foundrymen of Canada, new problems and the need of preparedness in the matter of knowledge and equipment. With the possibility of a further drain upon the manhood of this country and a still more serious shortage of labor confronting us more attention will have to be given to the efficient and economical operation of our foundries. It will, in many cases, be found advisable to purchase and install the very best equipment obtainable—equipment which will tend to greater output and at the same time conserve to the limit the supply of labor.

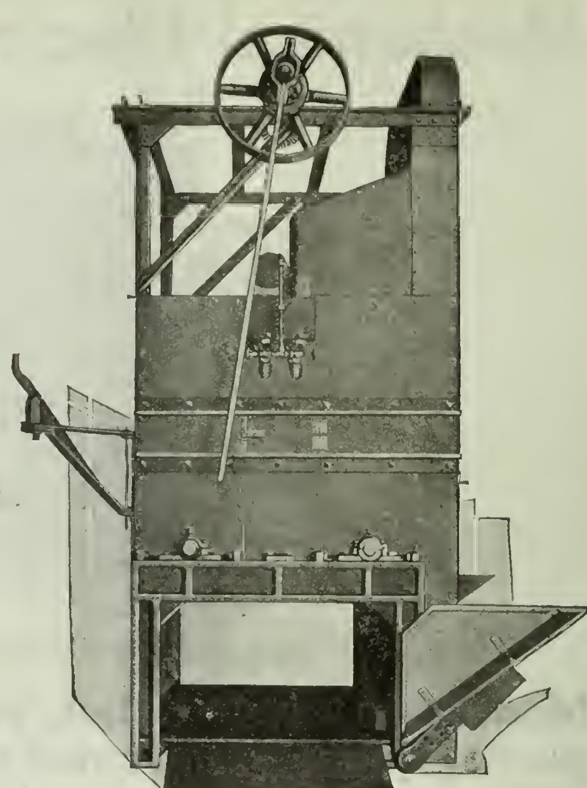
In succeeding issues we shall endeavor to render assistance of a timely character and thoroughly in keeping with the spirit of "greater efficiency" with which the industries of Canada are seized to-day.

Our editor will be in attendance at the Boston Convention and a report of the proceedings, including the various papers, will be given in our October issue, which like this, our Pre-Convention Number, will be unusually interesting from a buyer's viewpoint. You will find it well worth while to preserve this and our succeeding issues indefinitely as they will render valuable assistance in selecting the latest and best equipment. You will, moreover, have the satisfaction of knowing that the firms who solicit your business through this, your medium, are the firms best prepared to handle your inquiries and your orders and who are ready and equipped to render any special service you may feel you require.

Some of the firms represented in this issue could not show their complete line in one advertisement. If what you require is not shown in the advertising section we would suggest that you refer to our Buyer's Directory (at the back) and write the firms whose names you will find listed under the desired headings.



Front View With Sliding Door Raised

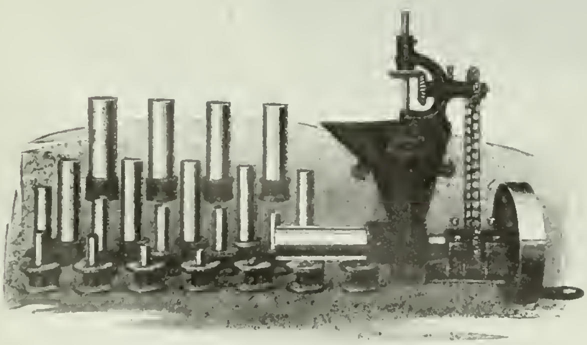


Side View. Truck is Run Underneath Barrel

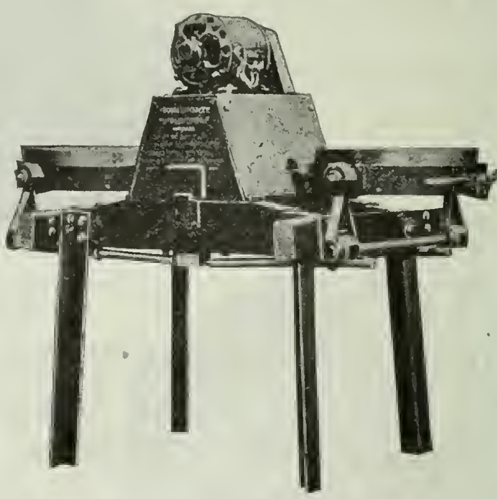
No. 3 Revolving Barrel Sandblast Machine

showing front and side views. Truck is run directly underneath the barrel and load is automatically dumped when the barrel revolves.

We will gladly refer you to malleable steel and iron manufacturers who are operating one or more of these barrels. Many of them have competing makes and can give comparative results. Learn from the operators what results they are getting.



Style A Hammer Core Machine
Other styles to make up to 7" round cores



Electric Duplex Shaker
The fastest, most substantial shaker built

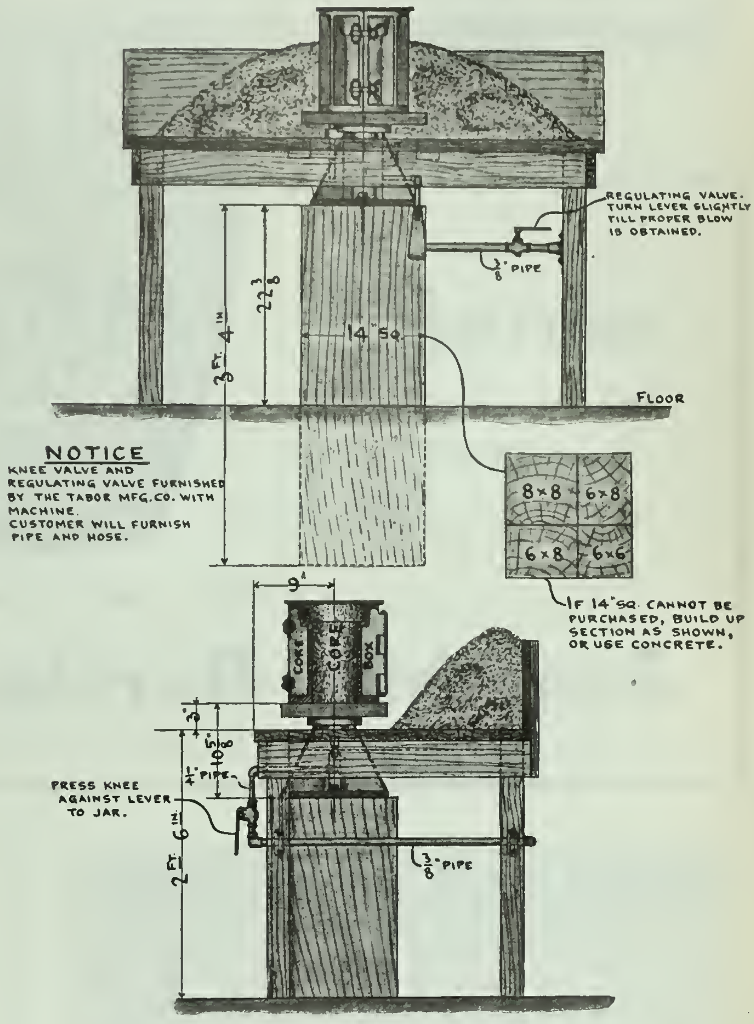
Send for Catalogues

Brown Specialty Machinery Company

2424 West 22nd Street, Chicago

TABOR

3″ Tabor Jarring Machine with 12″ x 14″ Table.



3″ Tabor Jarring Machine set in Core Bench.

FOR SMALL MOLDS AND MEDIUM SIZED CORES

Write for Bulletin M-J-P.

THE TABOR MANUFACTURING CO.

PHILADELPHIA
PA.

FOREIGN AGENTS:
Geo. W. Goodchild & Macnab, 56 Eagle St., Southampton Row, London, W. C.; Fenwick, Freres & Co., 8 Rue De Rocroy, Paris, France.

FOREIGN AGENTS:
Mitsui & Co., Ltd., New York, Tokio, Japan; Benson Bros., Sidney and Melbourne, Australia.

Let us assist you in "Grinding Down Costs"

To do this simply give us an outline of your grinding operation and we will furnish the **best** possible wheel for the purpose.

Gresolite
for Grey and Chilled Iron.

Emery
for Steel Foundry and General Purpose.

Corundum and Rexite
for Precision and Fine Tool Grinding.

Write for booklet "Safety as Applied to Grinding Wheels."

Canadian Hart Wheels
LIMITED
Manufacturers Grinding Wheels and Machiner
456 Barton Street East
HAMILTON, CANADA

Booths 347 and 354

At the Convention

BOSTON, SEPTEMBER 24 TO 28

Let us show you how this "Standard" Cinder Crushing Mill will reclaim up to 99½% of your metal contained in cinders, slag, skimmings, old crucibles, etc. Waste claims too many valuable points—your metal should not be among its claims.

Occupying booths 347 and 354 at the Convention, we will be able to demonstrate the points that have gone to put this crusher in the lead.

Everyone will not be able to get to the Convention. Let us send our bulletins to those who cannot attend. Showing you the principle of the "Standard" construction and the efficiency of its reclamation work.

WE WILL GLADLY CO-OPERATE WITH YOU.

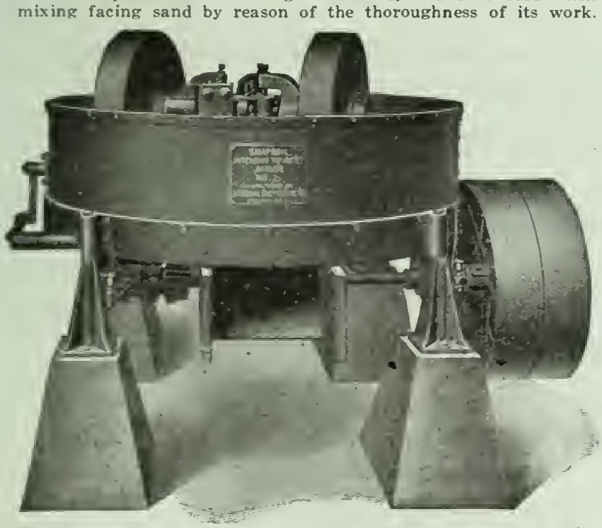
The Standard Equipment Co.
New Haven -:- Conn. -:- U.S.A.

A Message to Canadian Foundries

THE SIMPSON INTENSIVE FOUNDRY MIXER

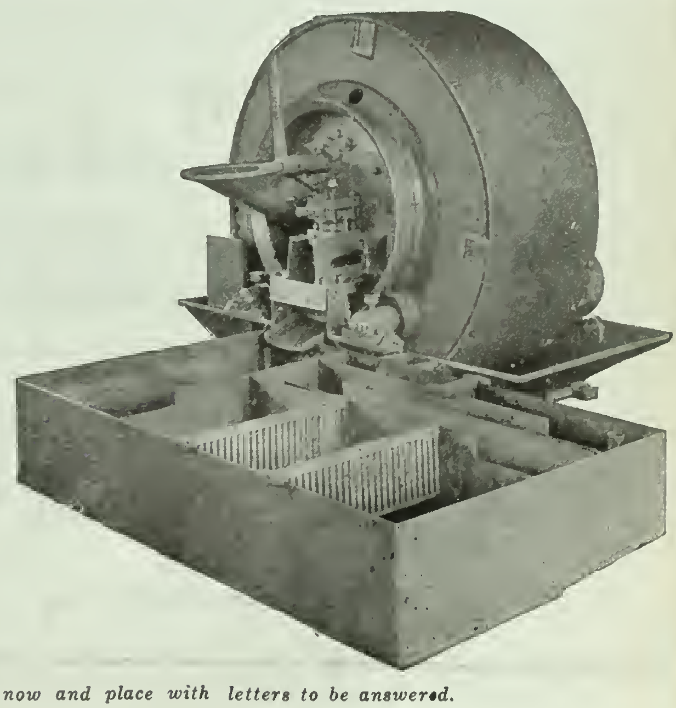
Saves Both Sand and Labor

Improves the quality of the castings.
Corrects "scabbing" due to imperfect mixing of facing sand.
Saves compound when mixing core sand, and coal dust when mixing facing sand by reason of the thoroughness of its work.



The Simpson Intensive Foundry Mixer is in successful operation in some of the best known foundries in Canada.
Write for details and prices to

National Engineering Co.
Room 505, Tacoma Bldg.
CHICAGO, Ill.



Peerless Parting Compound

The Perfect Parting
Light in Color
Light in Weight

Every Particle passes through the Bag

A Large Stock at all of our Warehouses

Number 702 Pure Ceylon Plumbago

The Standard Foundry Plumbago, in stock at all warehouses.

Every barrel guaranteed perfect.

The only safe Plumbago for you to use.

Send Your Order to

THE S. OBERMAYER CO.

CHICAGO CINCINNATI PITTSBURGH ST. LOUIS DENVER PHILADELPHIA MILWAUKEE CLEVELAND

Canadian Representative: E. B. FLEURY, 1609 Queen St. West, Toronto, Ont.

Rillton Sea Coal Facing

made at Rillton, Westmoreland County, by Obermayer.

We are busy, but give *all service* plus quality.

All orders, whether ton lots or carloads, receive our personal attention.

EVERYTHING YOU NEED IN YOUR FOUNDRY.

If any advertisement interests you, tear it out now and place with letters to be answered.

Are You Melting Sand ?

"WABANA"

Machine Cast Pig Iron

Cast in specially shaped moulds to permit of easy Handling, Piling and Breaking.

Chill Cast—*"SANDLESS"*—Pig Iron melts quicker or with lower fuel consumption than Sand Cast Iron. Machine Cast Iron is shipped 2240 pounds to the ton and it is *ALL METAL*—no sand.

We grade this iron according to the Silicon, as follows:

No. 1 Soft	Silicon	3.25% and over
1	"	2.50 to 3.24
2	"	2.00 to 2.49
3	"	1.75 to 1.99
4	"	1.30 to 1.74

An iron therefore for every Foundry purpose. Enquiries solicited. May we have the pleasure of quoting on your next requirements?

Dominion Iron & Steel Co., Limited

Head Office and Works, Sydney, N.S.

SALES OFFICES:

Sydney, N.S.; 112 St. James St., Montreal; 18 Wellington St. East, Toronto

Engineering Exhibits at the Canadian National Exhibition

Staff Article

The value of Canada's premier Annual Fair as an occasion on which to gain publicity is again justified by a visit to the Machinery Hall, while any doubts regarding the mechanification of the farmer are instantly dispelled by an examination of tractors, electric light plants, and other aids toward a labor-saving and luxurious existence for sons of the soil.

DESPITE the absence of a few notable exhibitors of former years, the engineering features of the exhibition, both in the Machinery Hall and elsewhere, have aroused probably a more wide-spread interest than for many years past. The fact that many people, brought in contact with engineering practice through the temporary activity of munitions production, are now earnestly endeavoring to find a permanent outlet for their efforts is one, if not the main reason for the great general interest displayed by visitors this year.

Present conditions, of course, have postponed any improvement in the facilities afforded exhibitors, but had proper and deserved encouragement been given in a timely manner, the machinery display would not be handicapped by comparison with certain annual events in the States, which are noted for the facilities offered exhibitors in such important matters as steam, gas, air and electricity supply, especially in the matter of reasonable charges for the latter service. As matters are now, it is only through the loyalty and patriotism of exhibitors, who annually face the expense and inconvenience of two weeks' dislocation of regular business, that the standard of the show has been maintained at its present level. In view of the services rendered to the Empire, and the great degree of confidence with which the industry is regarded as a mainstay of the country in the future, no excuse short of absolute lack of funds can justify a continuance of the present lukewarm attitude of the authorities toward engineering exhibitors. The thanks of the industry are indeed due to those who continue to "carry on."

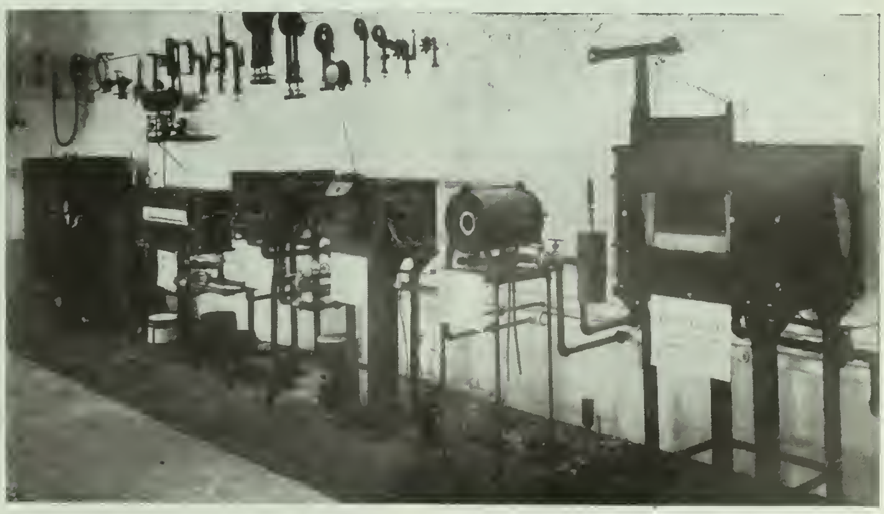
The general state of affairs is indicated by one noticeable change in the aspect of the show—munitions have disappeared and manufactures are returning. Machine tools are the heavyweights, as always, but developments largely due to the recent munitions activity are indicated by several of the exhibits. One of these is the increasing appreciation of the benefits of heat treatment in certain classes of work, and in this field much initiative has been displayed by the Canadian Hoskins Co., the well known pioneers in electrical furnace and pyrometer development. Their product now includes also gas-fired furnaces, ovens for enamelling, etc., and a unique product in the shape of Chromel, a non-ferrous alloy, which possesses marked non-corrosive properties, especially under the influence of heat. These properties are due to the high melting point of chromium combined with the great resistance of nickel to oxidization. This metal does not soften appreciably under heat like iron and has a life approximately 40 times as long. Applications already proven include carbonizing boxes, cyanide crucibles, lead pots, barium pots, pyrometer protecting tubes, etc.

PART OF PRATT & WHITNEY'S EXHIBIT OF SMALL TOOLS.

It is of especial interest at this time to know that this alloy is made in Canada in the Hoskins factory, an important part of the process being played by a special type of carbon resistance furnace which is also exhibited. Its simplicity of construction and efficiency of operation render it particularly useful in high temperature work.

Further interest in the combustion field is stimulated by the extensive display of manufacturers furnaces exhibited by the Consumers' Gas Co. of Toronto. Apparatus and equipment for the convenient use of gas as a heat-producing agent in many lines of industry are shown in operation, gas and air being piped to most of the exhibits. High temperature furnaces for special steel hardening, tool room furnaces, ovens, brazing benches and blow pipes demonstrate clearly the adaptability of gas to many processes. The effect of several furnaces at white heat is very marked from a display viewpoint, the entire exhibited being markedly effective.

Of similar interest to visitors is the demonstrations of oxy-acetylene welding work. L'Air Liquide Society show the use of their apparatus in the manufacture of storage tanks for acetylene gas, to withstand 975 lbs. pressure per sq. in. A sample of liquid air, which is produced during the manufacture of oxygen was an item of more than ordinary interest, in which one could test the effects of 350 deg. below zero on the human flesh. Mechanical apparatus for the application of the oxy-acetylene flame to manufacturing operations were featured by the Carter Welding Co., who showed the well known Davis-Bournonville apparatus cutting steel plates of any thickness and shape. The radiograph is an ingeniously arranged machine on the pantograph principle, which enables patterns to be copied



THE CONSUMERS' GAS CO. EXHIBIT ED GAS FURNACES IN OPERATION.

on large or small scales, the flame cutting the outline as determined by the master design; the roughing out of dies and similar work is a particularly useful field for this device.

Special appeal is made to the skilled mechanic and fine tool maker by the Pratt & Whitney exhibit of Canadian-made cutters, reamers, taps, drills, shell tools and special articles of a similar nature. The prestige attached to the name is well upheld by this exhibit, which is convincing evidence of the possibility of producing such goods on a commercial scale within the Dominion. Complementary to the foregoing are the machine tool exhibits of Canada Machinery Corporation, Garlock-Walker Machinery Co. and A. R. Williams Co. Both wood and metal-working machines are displayed on a large scale by the former, whose annual appearance is looked forward to with interest by a wide circle of acquaintances. A feature of Garlock-Walker is the showing of numerous views in lantern slide form, illustrating iron machinery from the raw state to the finished product. The entire history of iron is shown from the blasting of the rock by the miners, through railroad yards, ore docks, blast furnaces,

CLEVELAND PNEUMATIC TOOLS INCLUDED SPECIAL DESIGNS FOR WOOD SHIPBUILDING.

steel mills and foundries, pattern shops and machine shops till it assumes the form of a lathe, shaper or other machine tool, and demonstrates most convincingly the absolute dependability of modern manufacturing on this one metal more than any other. Suitable types of modern tools are on view to complete the exhibit.

A feature of the Williams exhibit is the demonstration of Stellite cutting tools on heavy forging machining. This wonderful alloy depends for its existence entirely on the Canadian deposits of cobalt, and during recent times has earned a wonderful reputation as a metal-cutting material. Numerous samples showing its application to tools for a wide range of operations are displayed by the Deloro Smelting & Refining Co.

Pneumatic tools and accessories possess considerable interest in view of their labor-saving and cost-reducing ability. The development of shipbuilding both in wood and steel has been carefully studied by the Cleveland Pneumatic Tool Co., and special wood-boring machines and drifting hammers are featured by them in addition to their latest types of regular hammers and accessories.

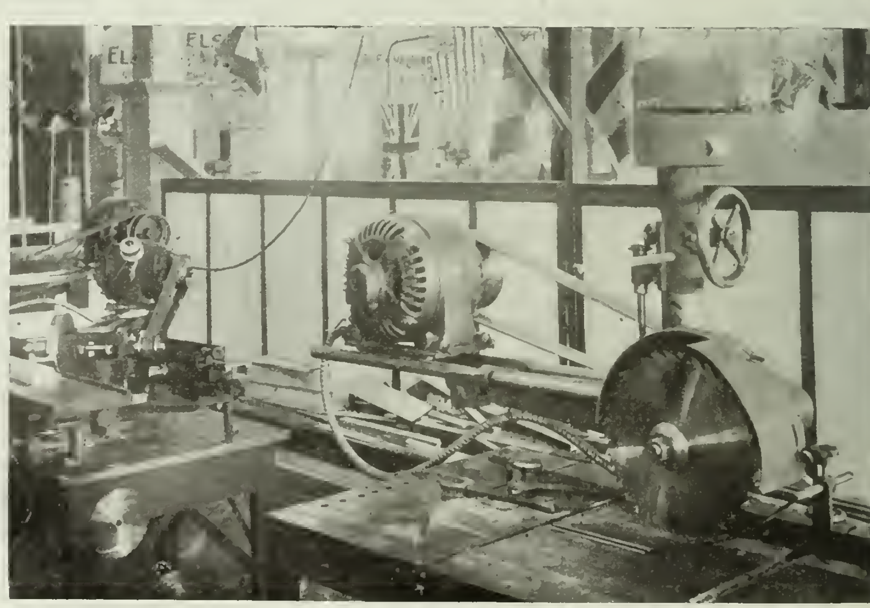
THE CARTER WELDING CO. SHOWED MECHANICAL APPARATUS FOR CUTTING AND SHAPING PLATES WITH OXY-ACETYLENE FLAME.

Transmission equipment and apparatus is featured by the Dodge line, one of the items of interest being an exhibit showing their wood pulley in different stages of construction, from the plain board of selected lumber to the perfectly finished wood-split pulley seen on the shafting. Ball bearing developments are also well shown, the increasing recognition of this apparatus as an efficiency factor being evidenced by the presence of the Canadian SKF Co., Ltd., which makes a convincing demonstration of the extreme accuracy and high grade of workmanship in their product. The exclusive feature of self-alignment which is an inherent part of the design is shown by means of bent shafts, which revolve as freely in a fan draft as if they were straight and true. The Chapman Co. makes an effective display.

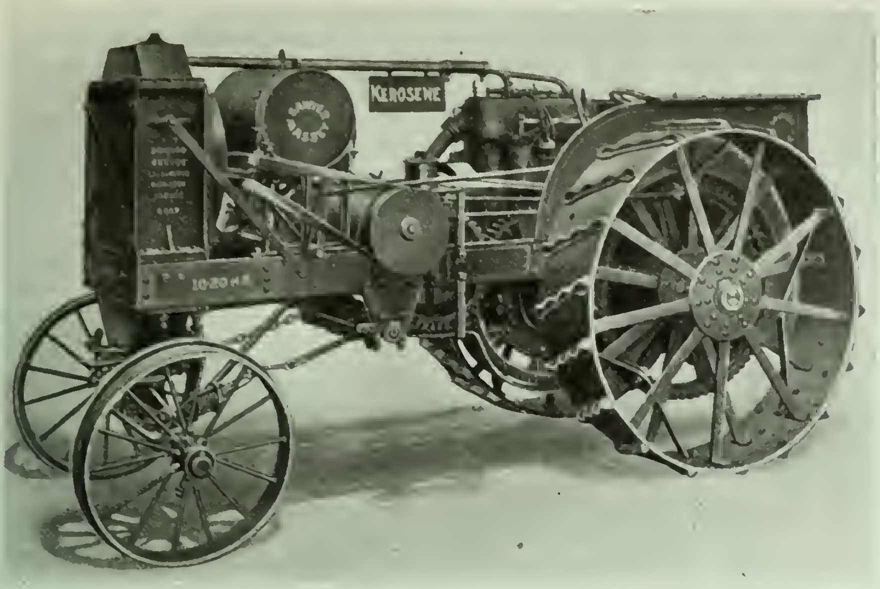
Belting exhibits are quite noticeable especially as most of the displays represent made in Canada goods. Of the four firms showing, each makes a distinctive type of product. Leather, rubber, and two varieties of stitched belting are available in weights, strengths, and finish for any kind of industrial need. Considerable local interest attaches to the two displays of that modern development of the saw bench known as the combination woodworker, one firm in particular having developed considerable business across the line.

Agricultural Engineering

Either engineers or farmers desirous of investingating farm apparatus which is the direct product of the machine shop find more than ample opportunity in the section devoted to this display. The present question of food control has thrown the production end further into the spotlight than might have happened in years, and the fierce blaze of criticism is turned loose on the numerous specimens of tractors, oil engines, pumps, electric lighting plants, along with other quasi-machine shop products such as



THE HUTCHINSON WOOD-WORKER PERFORMS LARGE VARIETY OF OPERATIONS.



SAWYER-MASSEY 12-22. 4 CYLIND ER. KEROSENE DRIVEN TRACTOR.

milking machines, and similar products.

As a Canadian built product, the Sawyer-Massey line of tractors makes a special appeal. Simplicity of construction has been combined with convenience and efficiency of operation in a markedly successful degree. The 4 cyl. vertical automobile type of motor is placed near the rear axle to give maximum adhesion, and allows the transmission case and jack-shaft to be placed amidship in a most accessible position. The clutch likewise benefits thereby, while the train of reducing gears to the driving wheels is also made very accessible. Approved design of steering gear with spring buffers is fitted to front wheels. Water cooling with fan radiator is incorporated in the design in a suitable manner the radiator construction being exceptionally robust. The motor is 4 in. bore by 6 in. stroke running 700 to 1,000 rev. per min., and gives 22 horse power at the belt pulley and 12 at the draw bar. Two speeds of 2¼ and 3½ miles per hour are provided, while weight of 5,200 lbs. enables three to four plows to be operated.

Allis-Chalmers are showing a 10-18 horsepower machine of the three wheeled type, the single front wheel following the furrow automatically and relieving the operator of much of the steering effort. It is operated by a 2 cyl. opposed type motor, 5¼ by 7 inch at 720 rev. per min. and weighs 4,800 lbs. The frame is a one-piece steel casting, heat treated, while the radiator is of the automobile type with centrifugal pump.

The 9-18 lease tractor was shown by the Fairbanks-Morse Co., and attracted attention through its compact design and wonderful hill climbing ability demonstrated on a 35 deg. incline. As illustrated the motor which is 8 cyl. vertical, is placed athwartships so as to obtain straight spur drive to rear axle. The front axle is pivoted vertically at the centre, with steering knuckles on the wheels. A truck type of radiator is fitted in conventional manner and has gear driven fan, and centrifugal pump circulation. Heavy duty roller bearings are used wherever desirable, including the transmission, and rear axle, and an oil tight housing encloses the ball pinion and gear. Two speeds are obtainable, along with ample power to pull two 14 in. plows.

CASE 9-18 AUTOMOBILE TYP E TRACTOR WITH 4-CYLINDER MOTOR PLACE D TRANSVERSELY.

ALLIS-CHALMERS THREE-WHEELED T RACTOR IN OPERATION ON A FARM.

ELECTRIC STEEL-HARDENING PROCESS

THERE has been recently patented and developed a method of hardening steel by means of electricity known as the Wild-Barfield process, which, while following recognized practice in the fact that the steel is hardened by heating and quenching, exhibits its principal departure from customary practice in the manner in which the correct temperature of the steel is determined.

The process is carried out by means of the electrical furnace, shown in the accompanying engraving, which contains an electrical heating coil embedded in the lining A; the cylindrical shell is of suitable heat insulating material. The actual furnace temperature is measured by a thermo-couple in the usual way, being maintained above the decalescent point of the steel to be hardened. The manner in which it is ascertained when the steel has reached this point involves recognition of the phenomenon that steel loses its magnetic properties when its temperature reaches the decalescent point.

Solenoid Principle

The heating coil when in use, acts in a similar manner to a solenoid coil, radiating magnetic flux which is increased when a core of magnetic material, i.e., the gauge or other steel body to be hardened, is inserted. The presence of liquid salt as a heating medium in the furnace slightly reduces the influence of the core on action of the coil.

On the exterior surface of the furnace is wound a coil of insulated wire B, connected to a reflecting galvanometer, whose spot of light is arranged to move on a scale in the usual way. When the piece of work is being inserted in the furnace, the increase of the magnetic flux from the heating coil induces a current in coil B and deflects the light spot. As soon as the piece of work is in position, the magnetic flux from the solenoid remains steady at the increased value so that the external current in coil B ceases and the light spot goes back to zero. These actions however are meanwhile irrelevant to the final determination of temperature.

The influence of the work during heating on the magnetic flux from the solenoid coil is stationary, until the temperature is reached at which the steel becomes non-magnetic, i.e., the decalescent point. The loss of magnetism by the work takes place in a comparatively short space of time, and affects the flux of the solenoid coil in a manner equivalent to withdrawing the core when magnetised. The decreasing magnetic flux of the solenoid coil brought about by this state of the work induces an external current in coil B in the opposite direction to that previously induced, deflecting the light spot accordingly, and if the work remained in place in this demagnetized condition the spot of light would return to zero when conditions became constant again. This second movement of the light spot is therefore the indication that the magnetism of the work is vanishing due to its assuming that condition which will enable it to harden when suddenly quenched.

Rapid Operation

Rapidity of operation is a feature of the apparatus, a 1 in. plug screw gauge being raised to quenching temperature in 1½ minutes, the use of a salt bath being also conducive to uniformity of results. Results of tests carried out at National Physical Laboratory, London, for the Hardness Tests Research Committee are given below. The steel experimented with was ordinary tool steel, containing 1.5 per cent. carbon. Two specimens were hardened in the usual way by quenching in water, and two others were treated by the Wild-Barfield process, as applied to screw gauges. The scleroscope and resistance-to-abrasion figures for these four specimens were as follows:—

	Scleroscope	abrasion
Water quenched	81-110	560, 560
Water quenched	78-112	420, 530
Wild-Barfield	68	710, 710
Wild-Barfield	70	710, 560

In connection with these figures it is to be noted that in the opinion of most the scleroscope, whatever property or combination of properties it may precisely measure, does not give a figure which is a just measure of that property which it is desired to confer on steel by "hardening" it. It does not necessarily follow, therefore, that the scleroscope figures quoted above imply that the Wild-Barfield process yields a softer material than the water quenched. On the other hand, the scleroscope figures do establish the fact that water quenching does not give a uniformly treated product; the figure obtained varies, it will be seen, over a wide range for different parts of the same specimen. Methods of directly testing resistance to abrasion are not yet wholly satisfactory, and it is quite probable that the figures 420 for the water quenched specimen and 560 for the Wild-Barfield are due to irregularities in the testing machine.

PRACTICAL COURSE FOR FOUNDRYMEN

DUE to conditions with which industrial managers are only too familiar, there is a great demand for trained foundrymen in responsible positions. Hence at this time opportunities are numerous and attractive for men whose practical knowledge has been consolidated and made

SELF-INDICATING ELECTRIC FURNACE FOR HARDENING STEEL.

readily available by specific training. To insure itself a supply of such men, the Westinghouse Electric & Mfg. Co. has recently established a course in foundry work for those of its employees between the ages of 17 and 21 who have completed at least the eighth grade of public school or its equivalent. The shop courses will include the following:

Bench and floor molding, machine molding, core making, tempering of sand, cupola operation, mixing of alloys, cost calculating Classroom instruction will be given during the course on blue print reading, mechanical drawing, shop problems and metallurgy, particular attention being given to the alloys of iron and copper.

The idea of the company is to give those desiring it a thorough all-round knowledge of this very important phase of its work.

MALLEABLE CAST-IRON

WITH the object of bringing before the attention of local manufacturers modern practice and investigation bearing upon malleable cast-iron in order, if possible, to obtain increased production, and at the same time to utilize some materials which have not yet been adopted in this country, Professor T. Turner of the University of Birmingham, has recently delivered lectures on the subject, under the auspices of the Ministry of Munitions.

In the course of these, he explained the practice of melting followed in the United States, where, he said, crucibles are seldom used, and cupolas are regarded as obsolete. Air furnaces, or open hearth gas furnaces, up to 25 ton capacity, are employed, with large annealing furnaces, charged through the roof, which is arranged so as to be removed in sections. The great difference in composition of the iron used relates to the sulphur which for the "black heart" process must be low, and usually does not exceed 0.08 per cent., while in the European process three times this quantity can be present without injury.

In each case it is now generally recognized that phosphorus up to 0.25 per cent. may be permitted, and even more is present in many good castings. The combination of mechanical tests with chemical and microscopical examination has led to a great improvement in the trustworthiness of the material from good makers. A standard wedge test was formerly regarded as satisfactory if the sample stood seven blows with a hammer, but there is now no difficulty in guaranteeing 35 blows, and over 100 have been recorded.

FOR PIN HOLES IN BRASS

PIN holes in brass castings may be caused by pouring very hot metal into poorly vented molds, molds rammed too hard, or molds made of sand that is too close which will not allow the vents to come off freely. To avoid them, do not pour any hotter than necessary to run the castings, vent the molds with a fine knitting needle and do not ram them very hard.

If the metal contains no aluminum, try the addition of 2 ounces per 100 pounds, pouring when the metal no longer smokes. If aluminum cannot be used, pour the molds with sufficient force to keep the pouring heads full, even if some of the metal spills when they are filled. Exercise care to have the molds so well vented that when the gases come off, they will explode when the red-hot skimmer is inserted underneath the bottom boards.

It is the men of little faith, the men with little souls, the rabbits of the business world, who add the tragedy to depressions.

It is the easiest thing in the world to find fault, but the kicker, the growler, and the industrial disturber, are making themselves public nuisances. We are growing awfully tired of them.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

SAVING MONEY STUDYING MATERIALS AND WATCHING SCRAP HEAP

By W. G. Astle.

BUSINESS has now entered upon a new era of economy, and every item is being subjected to a thorough examination by the modern business manager for the purpose of detecting and abolishing any waste. The four big groups under which this problem is being studied are Burden, Materials, Labor and Management. The greatest possibilities for saving are found in the item of materials, because out of the twenty billion dollars' worth of goods manufactured yearly, more than twelve billion dollars of this is cost of materials—the raw stuff out of which product is made, with tools to make it. That is three times the cost of labor and supervision.

After the efficiency man has come another specialist, who is known as the economy man, whose duties are to browse around the plant to see what is being used; how it is being handled; what is spoiled, thrown away through ignorance, carelessness and use of wrong materials. His supervision begins with the raw materials coming into the plant, with authority to change these if he can effect sane economies by substitution and improvement. His supervision then extends through the works, with its countless opportunities for leaks and extravagance, out to the scrap heap, where he often finds suggestions that, in turn, help him to develop better standards in the purchase of more material.

Street Railway Methods

One of the largest street railway systems in Canada has a system of concentrating at their main shops all responsibility for life of material. The car maintenance department is held responsible for all supplies from the time that they leave the storekeeper on requisition indorsed by the master mechanic, until he returns them back to the storekeeper as scrap. The question as to what is scrap is not left to the foremen for determination, but to two specialists. These men divide all return material into three heaps, the first is called "good for repair," the second "doubtful," and the third "rejected." The master mechanic has the last word as to what doubtful pieces shall be repaired. The scrap is carefully weighed and turned over for formal receipt by the storekeeper. Allowance is then made to each carhouse under the proper account number, and finally the auditing department assigns the credits on a money basis. The manifest which accompanies the material returned by any of the carhouses is regarded as an order for substitute material. The sub-stores at the carhouses can order as new only such material which is not subject to repair, but even these orders must be approved by the master mechanic before going to the storekeeper. No carhouse receives substitute parts unless it returns an equivalent number of old parts. The necessary adjustments for lost material are made monthly.

This system has been in use for some time and has proved very successful, especially in avoiding the unnecessary scrapping which arises when carhouse men are too eager to get rid of material which, while old, is still capable of repair and perfectly safe for re-use.

Economy of materials in designing and buying is very largely a technical matter, and there is plenty of room for technical improvements in methods when materials pass out of the storeroom into the works. More often, however, the problem is a human one; and the economy man cannot go very far until he has enlisted the co-operation of all the employees by pointing out to them waste, has developed better methods, has made clear the reasons for carefulness with materials, and has roused an economical spirit in the whole organization.

Electrical Concern's Operations

In handling its scrap, a large electrical company in New York holds the supply department responsible, as they are more familiar with the materials and the best methods of handling and disposing of them. The scrap material when received by the stores department follows the same routine as new material; that is, the weights are taken gross, by the receiving clerk, after which it is delivered to the yard foreman, who is in charge of the scrap shed. It is then separated and the weight of each class of bare metal, brass, copper, lead, etc., is taken separately before it is put into its respective bin. A credit slip itemizing the material is then issued to the job, and sent to the clerk in charge of the scrap ledger, who prices it at the value of the last scrap sale, posts the items in the scrap ledger, and forwards the original copy to the credit slip to the accounting department, where it eventually becomes part of the job order system.

Leaded and braided cables and underground tubes are put into ovens and redeemed as pig lead and bare copper. The loss resulting from this process is deducted from the gross figures, the net amount only being credited to the job. The iron piping from the underground tubes is redeemed where possible and returned to stock for further use. Short or crooked lengths are scrapped. A reduction oven is used in withdrawing the copper from these underground tubes. The oven is fitted with bars at intervals, each bar being higher than the preceding one, so that when the tubes are inserted. the rear end is about three feet higher than the end at the oven door. A fire is built under the tubes from the side of the oven and this becomes sufficiently hot to melt the compound, which flows from the tubes by gravity and feeds the flames. After the compound has run out, the copper is easily withdrawn as clean copper, and the tubes are either repainted or sold for scrap, depending upon their condition. The copper withdrawn from the tubes is cut up into small pieces and put into hogsheads and shipped monthly.

Another style of oven as used by this company is for burning the compound out of old junction coupling and elbow boxes. The compound is melted and burned out, and the iron is for the most part repainted and used over again. Such material as cannot be thus treated, is sold for scrap. Into still another oven all the short pieces of braided and leaded cables returned from jobs, and the insulated wire of all kinds are thrown. The bed of this oven is of concrete and is sloped toward the rear right-hand corner, so that the molten lead will run by gravity into a pot outside the oven. Here the dirt is skimmed off and the lead is taken up in ladles and cast into pigs, in which condition it is sold. The insulation having been entirely burned and the lead having run off, clean copper remains, and this is removed and packed into hogsheads for shipment as stated above.

Economy Every Employees' Concern

The cost of raw material has been steadily rising, wages have been increased, and prices have not been able, in a great many lines, to keep pace with this increased cost. Profits have shrunk everywhere, and to-day the business man must run his business on a much smaller margin than was common five or ten years ago. As practically everybody connected with the business organization is doing something with materials, the tracking down of waste and leakage is one of the big problems of modern management.

A large railway system, which used to collect its scrap material and junk at a central point and sell it to the junk dealers when it had accumulated, now has a large shop fitted up with machinery for working over each class of material and testing its output. New tires are put on car wheels formerly sold for a cent a pound, and they give years of additional service. Old rails are re-rolled and redrilled and sold to smaller roads. Old springs are retempered and the babbitt metal is melted out of old journals. A magnetic separator winnows iron and steel from brass in mixed scrap, nuts and bolts are rethreaded; thrack spikes are cleaned of rust and resharpened; tie plates, car wheels and car couplers are reclaimed. A vast assortment of crippled tools are made serviceable and sent back, such as shovels, tamping picks, track drills and jacks.

Then again, another firm of machinery manufacturers which uses large amounts of cotton waste in its factory, has been accustomed to throwing it in a corner when it became well soaked with oil. Each day it was gathered and burned up in the furnaces, as is quite customary the world over. But one day a man came to the manager and asked permission to periodically gather up the oil-soaked waste and replace it with clean material. The manager told him to go ahead provided money could be saved on the purchase of new waste; then he asked how much the service would cost per pound waste. He was surprised when the man replied that the new waste would not cost him a cent—that the oil-soaked waste would be gathered up and replaced with the same amount of new waste without charge. On investigation, it was found that this man had a little plant on the outskirts of the city where he gathered oil-soaked waste from nearly all industries in that entire section of the city. There he put the oil-soaked waste through a pressing and washing process by which it was cleaned so wel' that it looked like new. When the oil he pressed out was cleansed and filtered, he got three or four different grades, which he sold for approximately five times his cost of producing it. Many industries clean their own waste and make a good profit over the cost of cleaning it for re-use. The oil, which is easily drained off the top of the wash, is readily marketable at a price that much more than pays for the process.

The bonus idea has been applied to the saving of material as well as the saving of time, and employees share in economies; but, even without bonuses, there is little difficulty in showing men how economies benefit them by making it easier for their employers to meet competition, extending the business, and providing steadier work and higher wages.

The careful scrutiny of the scrap heap will bring about better standards in the purchase of new materials, because defects in the design and workmanship will be discovered, and then again, instances have been known where manufacturers have replaced articles when the defects have been called to their attention. Under the old scheme of selling scrap there would have been no claim for replacement.

PROFITABLE DISPOSAL OF METAL CUTTINGS

By D. Street.

METAL chips, in the shape of borings, turnings and planing scrap, often amount to 10 per cent. of the total production of the machine shops, and it is not altogether an easy matter to dispose of this waste material to advantage. It is apparent that the most economical way to deal with it is to use it in place of other materials in furnace mixing, but here there is a difficulty in charging a furnace with loose chips. The forced draught blows a large proportion away, and a further big percentage is subjected to violent combustion and goes at once into slag as ferric oxide. When loose chips are charged into a furnace it is safe to say that at least one-half of the total weight is wasted and the large amount of viscid slag that is produced seriously interferes with the efficient working of the furnace.

Proposed Methods

Some years ago it was suggested that the metal chips might be packed in wooden or cast metal cases before they were added to the furnace mixture, but, taking everything into consideration, this method is far from economical. Another method which was advocated was that the chips should be exposed in large volume to the atmosphere, so that they might rust into a solid form; but here again the method in practice is expensive. The proposal to feed the chips into the furnace with a low power blast has also been found to work unsatisfactorily. Some engineers have added binding material to the chips and pressed the mixture into bricks, but in almost every case it has been found that the binder disintegrated the moment it was exposed to heat and the briquettes simply broke into free metal dust. There was not only a great loss, due to oxidation under the action of the binder, but the furnace loss had also to be taken into account.

For many years past German engineers have done their utmost to develop the use of low-grade ore and waste metal in their country. They have been the largest users of waste steel plate, and the problem of utilizing metal chipings to the best advantage was tackled some little time ago with almost complete success.

Present Practice

In all German metal workshops the chips are saved and sheltered as far as possible from atmospheric influence. If the shop has not the necessary facilities for dealing with the chips itself, storage of them is made until a sufficient quantity has accumulated to justify despatching them to works which can deal with them efficiently. The method adopted is to load the metal scrap into a press and subject it to a very high pressure. The chips are thus compressed into briquette form without the aid of any binding material. The blocks can be loaded into the furnaces and practically no loss results through burning or through particles being blown away, and these blocks are used as a substitute for expensive grades of pig iron in the production of high-grade cast metal.

In steel foundries it has been pointed out that these briquettes might serve as a substitute for the low phosphorous white iron that is now in such demand. In fact, they can be economically used in any place where steel scrap is used, whether it be in the foundry or the steel mill, as briquettes of steel or wrought iron are a good charging material.

Chips from hard rolls, projectiles, and the like, may be mixed with grey iron chips, so as to make a uniform charging material. Chips from copper, brass, bronze and white metal have also been pressed into briquettes, and a considerable saving in cost has been effected. This is due to the fact that the cost of pressing the chips is much less than the value of the savings that are effected in other ways, such as in the oxidation of the metal in remelting, the easier methods employed in handling the chips and the less space that is required in which to store them.

BLOW AND GAS-HOLES IN IRON CASTINGS

By L. E.

IT sometimes happens in places where really good iron and coke are used in cupola melting, that holes under the skin of the castings cause trouble, and it may very well happen that the cause cannot be found by analysis of the metal and fuel. At the same time, it usually happens that the furnace man complains that his furnace burns away at points opposite the tuyeres, while the machinemen grumble at the hardness of the mettle, the whole thing appears somewhat incomprehensible on account of the good quality of the material used. In reality the fault is caused by the air blast being too high in pressure and too low in volume, there not being sufficient oxygen supplied to melt the iron rapidly by the high rate of combustion of the fuel. So long as the air pressure is enough to enable the whole of the fuel to get its supply of oxygen it is ample, but the quantity of air supplied must also be ample, and in all cases at least 6½ lbs. of air—roughly, 85½ cubic feet of air—is needed for each pound of coke used in the cupola if the best results are to be secured. To get this air the propeller, whether called a fan or blower, must be of sufficient size, there must be as nearly a straight passage for the air from the propeller to cupola, and this passage must be free from angles and sharp bends, and, last of all, the tuyeres must be of sufficient area.

The main air passage from the propeller apparatus should be larger than the exit orifice of the fan or propeller, owing to the friction of the walls considerably reducing its effective area, and the shorter the distance from the propeller to the cupola, the more efficient will be the work done.

CHART FOR DETERMINING LENGTH OF ROLLED-UP AND BALED STRAP IRON, ETC.

By N. G. Near.

THIS chart, plus a ruler and a pair of scales, will enable you to measure the length of rolled-up strap iron, flat iron, odd lengths in bales, etc. Even though the roll is not uniform, or if there are a number of rolls, or if the material is "all balled up," as the expression goes, it makes no difference to this chart, so long as the thickness and width are uniform. It is obvious that a chart of this kind is possible because the weight of wrought-iron and mild steel per cubic inch is a fairly constant quantity.

For example, if you find that a roll of your strap iron measures .03 inch in thickness and one inch in width and the weight is 22 pounds, what is the length of the roll in feet?

Very simple. Run a line through the .03 (left side of column A), and the 22 (column B), and locate the intersection with column C. Then through that intersection and the 1 (column A, right side), run another straight line and the final intersection with column D gives the answer as 200 feet, which you will find to be pretty accurate. The dotted lines drawn across this chart show how the above problem is solved via the chart. Solve your problem in the same way and it will come out OK.

This method is surely much simpler than to unwind a long roll of metal and measure it and then have to roll it up again. All you have to do here is to lay a straight edge across the c hart twice and the answer is found immediately.

To find the thickness of the metal accurately, if you have no micrometer caliper, measure the total thickness of ten layers, one on top of the other. Then divide by 10. It is always easy to divide

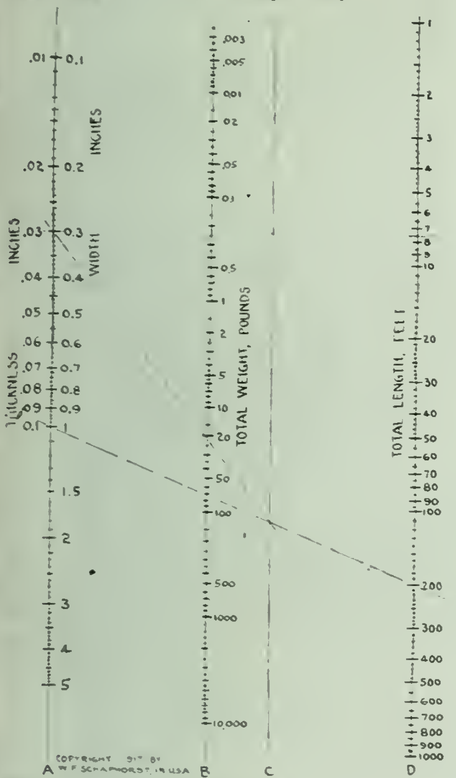


CHART FOR DETERMINING LENGTH OF ROLLED-UP STRAP IRON, BALES OF STRAP IRON, ETC., BY WEIGHING.

by 10. For example, if you find that with any ordinary rule the total thickness of ten layers is ⅜ inch, which is equal to .375 inch expressed decimally, it is a simple matter to point off one place to the left, which makes the thickness .0375 inch. Isn't that easy enough? Your answer is about as accurate as though you had used a pair of micrometer calipers.

The range of this chart, it will be noted, is wide enough to care for any ordinary roll of metal running up to a total length of 1,000 feet.

COAL DUST IN MOULDING SAND

By F. J.

THE inclusion of coal dust as an ingredient in moulding sand has three main objects: first the heat of the molten metal carbonises the coal dust and so makes the mould porus to the gases given off by the metal; second, the gas from the coal dust prevents in some measure the fusion of the sand by the iron, and thereby results in a casting with a much smoother face than would otherwise be the case; and, thirdly, the effect of the carbon in the coal is to make the skin of the casting soft and dark in color. Opinion and practice with regard to the selection, grading and proportioning of coal dust in moulding sand varies widely and though the subject of coal-dust has been by no means neglected, there is still room for a comprehensive study of the whole question, one embracing not only experimental research but also the gathering of information in regard to current practice in the best foundries.

In selecting a suitable quality of coal four points have to be watched: the bituminous quality of the coal, the ash content, the volatile content, and the proportion of fixed carbon. Hitherto, too much importance has been attached to low ash content and high percentage of carbon, without due regard for the fact that such a coal must necessarily prove low in bituminous qualities, and be altogether of too refractory a character to fulfil the four ideals. A good working coal dust for general foundry use should show about 12 per cent. ash, 37 of volatiles and 51 per cent. of fixed carbon. This ash allowance will seem high, but the volatiles have to be taken into consideration, and it has, in fact, been found that scabbed castings with harsh, uneven skin, have resulted from the use of coal dust in which the ash content was much lower. Especially was this the case in some experiments made with good class anthracite, in which the percentage of ash was under 4, and the conclusion arrived at was that the coal dust had resisted the heat so much, owing to the presence of a high percentage of carbon, that it had acted as a refractory, and actually prevented the escape of gases from the mould by closing up the pores. As regards the fineness of the coal dust, the grade must, of course, vary according to the class of work and the grade of the sand.

For very light castings a coal dust of exceedingly fine grade must be used, especially if the sand has an open tendency, while a slightly coarser, though still fine grade should be used for less light work. For the larger class of castings, in which it is necessary for a considerable volume of gases to escape quickly, the medium and coarse grades of coal dust are more appropriate, blackings or facings being used to secure a smooth, even skin on the casting. Where coal dust of too coarse a grade for the size of the casting is being used, the error is often evinced by the appearance of small pits on the face of the casting, which are easily distinguishable by their formation from the indentations caused by the presence of coarse grains in the sand, and are caused by gas from the carbonized coal grains pressing into the molten metal instead of escaping through the sand. As to the proportions, much depends upon local circumstances—class of casting, sand used, thoroughness of mixing and quality of coal dust, etc., but two mixtures which have been used with excellent results are as follows:—one, 55 parts old sand, 30 parts new sand and 15 parts coal dust. This is for heavy castings, and the other, which is suitable for light work is 70 parts old sand, 25 parts new and 5 parts coal dust.

PATTERN FOR LARGE MAIN CIRCULATING INLET VALVE

By James Edgar

IN view of the fact that shipbuilding and marine engineering have recently come to the front as important Canadian in-

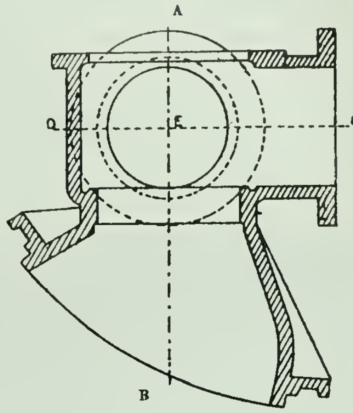


FIG. 1.

dustries, the article which follows, taken from the columns of our contemporary, the *Foundry Trade Journal*, will doubtless have more or less interest for those of our readers who are directly or indirectly concerned with the production of patterns and casting for marine engines and their accessory equipment.

The first thing to be decided when

FIG. 2.

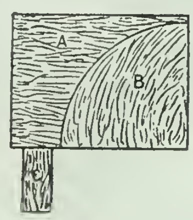


FIG. 3.

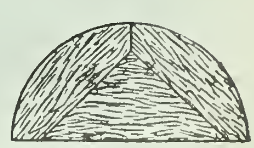


FIG. 4.

making a circulating inlet valve of the type shown in Fig. 1 is whether the square chest shall be made in the form of a shell pattern, leaving the moulder to cut a print in the sand and use the inside as a corebox, or whether a block pattern shall be used with a corebox. Both methods of construction have advantages. The shell pattern is certainly more economical, as it takes much less timber, and the expense of making a corebox is saved. It is also much lighter, and this is a very distinct advantage if the pattern has to be tried to place in the ship.

On the other hand, a blocked-up pattern will stand much longer, and prove

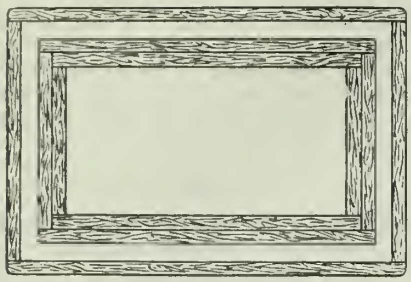


FIG. 5.

cheaper in the end, if many castings are wanted. However, it is very seldom that more than two or four castings of such a chest are wanted. It is usually necessary to "hand" this job, as there are almost certain to be cross angles on the flange of the square chest. This flange fits against the shell of the ship, and the position is usually marked on the drawing, the numbered frames being given. Occasionally approximate distances are given on the drawing, and after the pattern is made, it is checked at the ship, but more often moulds or templets are supplied by the mould lift from which the pattern is made, and sent off to the foundry. If the pattern-maker has to try it to place, a distance will be given from the line A B to a datum line, and, of course, the top flange must be level.

Two half-lapped frames should be first got out to make the joint of the pattern. They are dowelled together, and should be made of 1¼ in. or 1½ in. stock. It will be noticed in Fig. 6 that the frames include the branch C. It makes a much stronger job to bring the frames to the face of the flange than to fit the branches quite separately. It is also well to make the main body D with grounds and staves carrying it out to the face of the cover flange. The cover flange, not being thick, can be screwed on top. A really strong job can be made of the staved-up body by fitting three stays about 3 in. broad by 1½ in. thick, and letting them into the grounds as shown in Fig. 2.

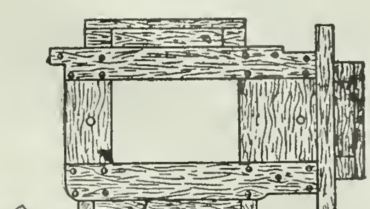


FIG. 6.

When the body has been fixed in position, the branch can be got out. It should be blocked up solid, and if a templet is stitched to it and a block screwed on the face to keep it square on the table, it can be cut at the bandsaw. The arrangement is illustrated in plan in Fig. 3, A being the templet, B the branch, and C the squaring block. The flange can be screwed on to the face. The prints for the branch C, Fig. 1, which would be 16 for the end of the chest, which will be still larger, had better be made with a 1 in. plate thicknessed with 2 in. timber on the back, as seen in Fig. 4. The top branch E, Fig. 1, unless it is very shallow, will be better built with segments. If it is very deep it can be staved, but staves have the disadvantage that they cannot be fitted and screwed as well as segments. The flange for this top branch must, of course, be dowelled on.

The square chest ought to be made and finished quite separately from the valve body and screwed on afterwards. It should be made to a line sufficiently far back from the face to clear the angles, the handling being done by alteration strips. Two plates have to be made for the top and bottom, and they can be temporarily battened together. Two ends can likewise be got out. The side pieces

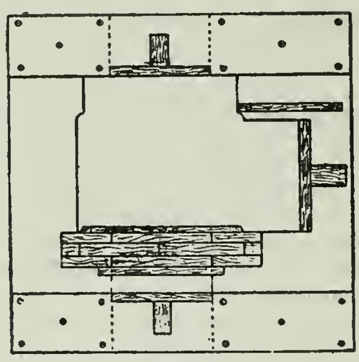


FIG. 7.

must be very carefully drawn off and dowelled together on edge. To build this chest one of the end squares should be first screwed to the bottom plate and two sides screwed on. The top end piece can now be laid on top of the other, the two temporary battens screwed on the outside. The dowelled sides can now be put in position, and temporary battens likewise screwed on to them. The top plate can next be put on.

The method of building one half on top of the other has obvious advantages. If care has been exercised in squaring and dowelling the sides, the top should lift "sweetly" from the bottom and without any drag. When the corners of the chest have been rounded off, the battens can be removed, and each half screwed to the valve body. A print will have to be screwed inside this chest to carry the body core. It will be observed that the print is smaller than the core for the valve seat, to allow sand around it.

The flange and the fitting strips on the face can now be attended to. Pieces ought to be screwed on, carrying the body to the face of the flange. It is usually possible to change the chest from port to starboard, by bringing the top piece to the bottom and the bottom piece to the top. The side pieces can also be turned upside down. The flange will have to be screwed on, taking care that the flange on the moulder's bottom half is screwed from the inside of the chest and on the top half from the outside. It is not necessary to explain the making of the fitting strips and spigot, which are screwed on the face. The moulder, of course, will have to loosen off these strips and

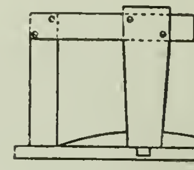


FIG. 8.

also the supporting ribs on the sides. A view of the face is shown in Fig. 5. The joint of the finished pattern is shown in Fig. 6.

In a valve as large as this, a plate or an open frame would be quite satisfactory for the body core. Some foundries prefer a plate, others prefer a frame. From the pattern-maker's point of view the work is the same, except that if a plate is made the end grounds for strickling the core will be a half diameter, whereas if a frame is used they will be a half diameter less the thickness of

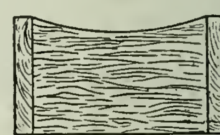


FIG. 9.

the frame. A plan of the frame with the grounds on is shown in Fig. 7.

A bridge piece should be made to carry the valve seat. It can be built in two or three thicknesses, and should be about 3 in. broad. A runner is screwed on each face of this ring, and the strickles will work on this runner with a semi-circular strickle, guided by a strip on the frame.

There is still a top branch core to be made. It is 16 ins. in diameter, and might be made with a pin board, as shown in Fig. 8. It may be that the moulder

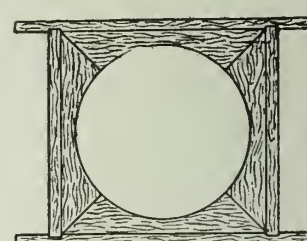


FIG. 10.

will prefer a box, and one can be made almost as cheaply as the pin board. An end view of a suitable box is shown in Fig. 9 and a plan in Fig. 10. It is simply a square frame with mitred skeleton pieces nailed inside. A skeleton box made in halves would be almost as expensive as a solid box, and this style is as convenient for the moulder, as it can be taken apart like any ordinary frame corebox.

Electric Steel Furnace Development and Services

By E. Kilburn Scott

In view of the rapidly increasing demand for high grade steels, attention has been forcibly directed to the service which the electric furnace renders in their production. War-stimulated development has nowhere been more marked than in this type equipment, and not a little insight into the progress made and the achievement compassed is made available in the detail of the article with its accompanying illustrations that follows.

ONE of the most striking developments of the steel industry of Great Britain, arising from the war, has been the rapid increase in number of electric steel furnaces, and so successful have they been that the prejudice against them is rapidly disappearing, and the change will probably rank as the most radical one since the time of Bessemer. Amongst factors which have helped to bring the electric furnace into favor are the following:

Electric Furnace Factors

(a)—The war demand for special tool steel for tools, dies, gauges, etc.

(b)—The demand for chrome and other special alloy steels for aircraft tubing, rustless steel, etc.

(c)—The difficulty in obtaining Swedish iron, which besides being scarce, is extremely expensive.

(d)—The difficulty in obtaining skilled labor to work the crucible steel process.

(e)—The necessity of profitably using turnings, millings, ends of tubes, bars, and other scrap steel.

(f)—The ease with which high-class steel can be made from second grade materials in electric furnaces.

Advantages of Electric Steel Treatment

The following are some of the advantages of treating steel in electric furnaces over the older methods by crucibles, and the Bessemer and open-hearth furnaces:

(1)—The charge is not in contact with the products of combustion of carbonaceous fuel.

(2)—The charge is under the absolute control of the operator; the conditions can be made oxidizing, neutral or reducing, as required.

(3)—The melting loss is an absolute minimum as compared with 7 to 15 per cent. in other processes.

(4)—The charge can be made up entirely of very cheap base material such as turnings, borings, millings, light scrap or large rough scrap, and can be easily melted and refined to a steel low in impurities and of exceptional quality.

(5)—The temperature can be controlled almost instantly over a very wide range, which allows a wider range of chemical refinement than is possible by other means.

(6)—Scrap containing valuable elements such as nickel, chromium, vanadium and tungsten can be melted without loss of these elements.

(7)—The steel produced is purer, more free from dissolved gases, slag fibre, etc., and therefore has much better physical properties than that produced by any other method.

(8)—Steels containing any desired percentage of carbon and even carbon-free can be produced.

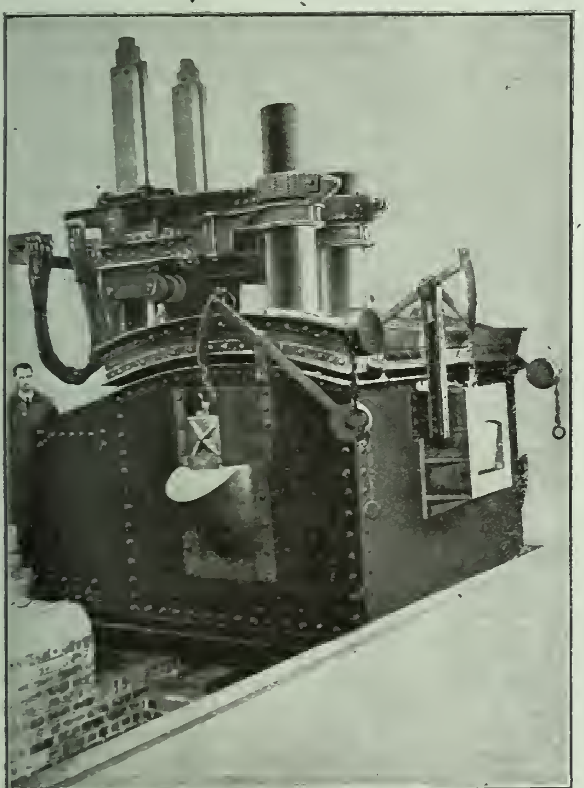


FIG. 1. THREE-TON GREAVES-ETCHELLS FURNACE.

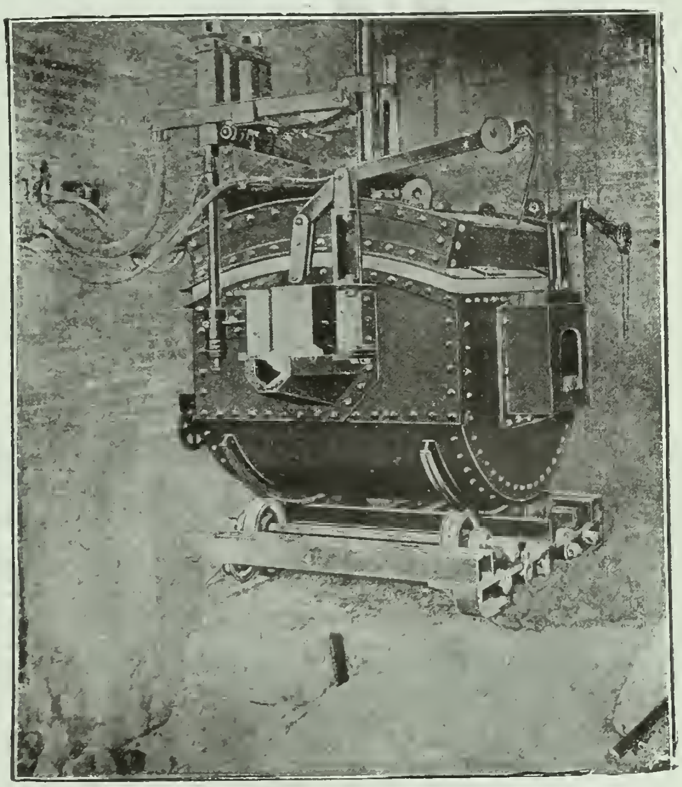


FIG. 2. HALF-TON GREAVES-ETCHELLS FURNACE.

High Quality Steel Castings

For the manufacture of high quality steel castings, the electric furnace is ideal. The superiority of electric steel castings over those made by any other process has been conclusively proved by the extremely severe conditions to which these castings have been subjected under specialized war conditions. The castings produced can be finished off dead mild and a one inch square bar can be bent double as cast, no expensive annealing operations being necessary. The carbon contents usually vary between .2 per cent. and .25 per cent., while the sulphur and phosphorus are each reduced below .015 per cent., and manganese and silicon are adjusted to suit the work. The tensile properties of ordinary electric cast steel are:

Maximum tensile strength, 35 tons per square inch.

Yield point, 25 tons per square inch.

Reduction of area 50 per cent.

Elongation, 30 per cent., while the maximum tensile stress can be readily increased to even 100 tons per square inch by the introduction of special elements such as nickel, chromium and vanadium.

Many plants that sell their steel swarf and scrap, cast iron borings, etc., at very nominal prices and purchase all their steel castings, could very profitably instal an electric furnace and make their own castings from the scrap.

Steel from the electric furnace is finished off under a reducing atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced, and is singularly free from blowholes when properly cast. This is due to the elimination of the gases that molten steel usually holds in solution, and the ease with which the steel can be poured into small and intricate castings, flowing smoothly like milk and setting perfectly quietly in the moulds is largely due to its purity.

Small Light Castings

For small, light castings, furnaces of not more than 1½ tons are recommended. Steel of low carbon content has a high melting point and must be cast at a very high temperature, and though the temperature is easily obtainable in the furnace, difficulties occur in handling large quantities of such hot metal in ladels, if a large number of castings are to be made. For small mild steel castings—many of which have proved an excellent substitute for malleable iron castings—smaller furnaces are recommended and several firms have installed furnaces of ½-ton capacity to melt steel for small engine parts of motor cycles and motor cars instead of using stampings.

Where large quantities of good steel are required, "The Hot Metal Process," as it is called, combines cheapness and quality. It has been adopted very extensively in the United States. The metal is first heated in a basic lined tilting open hearth furnace of large capacity, and is then run into a number of electric furnaces for final refining and addition of alloys. The process is continuous, and as the energy for first melting of steel is obtained direct from fuel, the amount of electrical energy is only that required to maintain the temperature during refining and assimilating of the alloys. Steel so produced commands high prices.

Electric furnaces are used for the melting of ferro alloys for open hearth and Bessemer plants, as it is found much more economical to make alloy additions in the molten form.

Types of Furnaces.

As the earlier furnaces were for small outputs, single phase alternating current was used, and to obtain a balance on a multiphase supply, several furnaces had to be worked together. Multiphase furnaces are better than single phase furnaces, because for a given output of steel, one such furnace is cheaper, takes up less room, and requires less attention than several single phase furnaces. With single phase, if one arc fails, the circuit is broken and the load falls to zero. This is liable to happen during the melting down period when the pieces of scrap metal change position under the electrodes. Two distinct types of electric furnaces are used for steel manufacture.

First, there is the induction type, which acts on the principle of an alternating current transformer, the metal being melted by having very heavy currents induced in it by a single phase or three-phase supply. These furnaces are used to a considerable extent abroad.

Second, there is the arc type of furnace, which has electrodes of carbon or graphite, the metal being melted by arcs formed between the electrodes and the charge, or between the electrodes themselves. Arc furnaces may work with single phase or two or three phases. Some arc furnaces have all the electrodes above the bath of metal, one of this class being the Heroult. As arranged for three phase supply, it has three vertical electrodes through the roof and the arcs are between each electrode and the bath, so that the molten metal forms part of the electrical circuit.

Two furnaces, namely the Girod and the Snyder, employ water-cooled steel studs, which pass right through the bottom or hearth. As the ends of the studs project into the metal of the charge, they burn away and have to be renewed at intervals. There is danger of the metal finding its way through the hearth; and the liability of trouble with water connections.

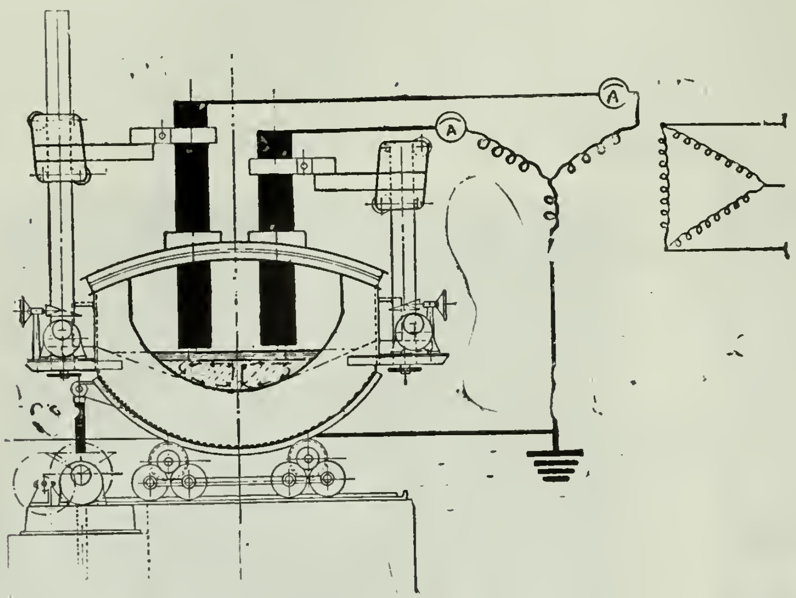


FIG. 3. SECTION THROUGH 6-TON FURNACE SHOWING CIRCULATION OF THE METAL AS IN BOTTOM HEATING.

It will be noted that in all the above-named furnaces the refractory material of the hearth does not require to carry current. The material may be therefore either acid (silica) or basic (magnesite).

The furnaces mentioned below have also bottom electrodes, but come under a different category because the hearth itself conducts electric current. It is, therefore, made of magnesite material as this, when heated, is a fairly good conductor. A furnace of this class is that of Electro-Metals Ltd., which was invented by Gronwall. It works with two phases and has two electrodes above the bath, whilst a third electrode below the hearth acts as a common neutral for the two phases.

Greaves-Etchells Furnace.

Another furnace which has met with considerable success is that of Greaves-Etchells, more than thirty having been installed or put under construction since January, 1916. As this is an all British production, both in inception and manufacture, a detailed description may be of interest. It is designed to operate on a three (or two) phase supply, and has two of the phases connected to electrodes above the bath, the third phase being connected to a copper plate below the electrically conductive hearth of magnesite.

The furnace body consists of a rectangular tank made of boiler plate riveted, and strengthened by angle sections. The bottom is dished and has two steel rails of vignoles section riveted to it. These rest on grooved steel rollers and the whole furnace, with its electrodes, etc., can be tilted backwards and forwards, by means of a screw and gear wheels. In the small furnace, the tilting is effected by a hand wheel and in the larger sizes by means of electric motor.

Each electrode is secured in a holder made of bronze or steel and each holder is attached to, but insulated from a steel jib, projecting from a wheeled carriage. The carriage travels up and down a vertical mast, which is made of two channel sections bolted on to the side of the body. In small furnaces, the electrodes are regulated by a hand wheel, and in large furnaces by a motor through single reduction gearing.

The roof is made of silica bricks, as these are fairly good insulators. They are set in a steel framing which rests on the silica brick walls projecting above the steel body of the furnace. The roof is domed and brought as low as possible so as to reduce the wasting away of the electrode by action of the gases. A roof will last about 100 heats and a duplicate one is provided with each furnace so that the steel melting can be carried on, except for the short time taken to change the roof. In order to obtain an even temperature through the bath of molten steel in the electric furnace, it was realized that heat must be applied below as well as above the bath, and in order to effect this the hearth of the furnace is specially constructed.

Bottom Heating Feature

Above 12 per cent. of the total energy of the Greaves-Etchells furnace is used in the hearth, and the "bottom heating" which results, is found to be of great advantage in melting down alloys. The heavier alloys, chrome, tungsten, vanadium and nickel, sink to the bottom of the bath, and if there is no bottom heatinging are apt to remain for a considerable time in a semi-fluid state. The hearth lining is never less than 20 inches thick, and is constructed mainly of dolomite and magnesite, in such a manner that the electrical resistance is high at the inside of the bath in proximity to the charge and decreases rapidly to a negligible quantity at the outside. The current flowing through the hearth generates a considerable amount of heat immediately below the liquid in the most efficient manner possible, while the electric arcs arranged over the bath maintain the slag and surface at the desired temperature.

The effect of this bottom heating is to cause convestion currents in the molten metal, which ensure a constant circulation and a uniform product. The outside of the furnace bottom remains cold, little or no heat being lost in this direction. This system of connection at first sight would appear to cause an out of balance load on the primary supply, but the system of transformer ratios is arranged to give a perfect balance when the upper electrodes are in equal adjustment. The high tension electric supply is transformed by means of a delta-star system of connection to low tension, the transformer house being as near as possible to the furnace in order to avoid heavy copper costs and energy losses in the low tension connections.

Transformer Connections and Short Circuiting

The equipment has to be designed to withstand short circuiting of the electrodes, as this occurs in all furnaces during the melting process when pieces of metal fall against the electrodes. The method usually adopted by furnace builders to provide against this is the introduction of considerable reactance in the electrical system, but unfortunately this reduces considerably the energy available in the furnace. Besides increasing the energy losses, it is also very objectionable to the supply authorities.

The Greaves-Etchells system of transformer connections is such that the short circuit current of one electrode must traverse two transformers in series and in different phase, which automatically lowers the power factor momentarily, and has a very strong buffer effect. The fact that there is always a permanent resistance in the path of the current through the hearth also limits very considerably the effects of short circuits. The combination of these factors provides the most effective means yet devised for protecting the supply system from shock, while allowing a high power factor to be obtained on normal load.

In all electric steel furnaces the metal is poured by tilting the furnace, and when this is effected by mounting the furnace on rockers, the end of the spout not only moves downwards, but also away from the ladle. Clearly the only way to keep the spout in one position would be to rotate the furnace round it, but this is out of the question because it would mean lifting the furnace bodily and take too much power. A 10-ton furnace, for example, may weigh as much as 90 tons.

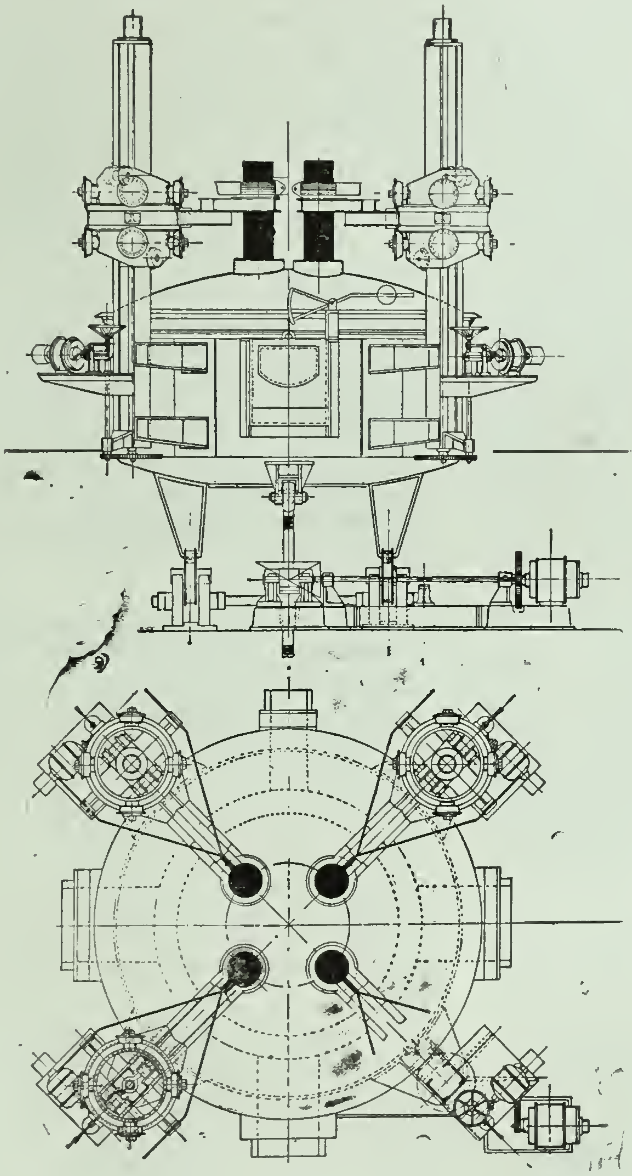


FIG. 4. PLAN AND ELEVATION OF 10-TON FURNACE.

The makers of the Greaves-Etchells furnace have compromised by arranging for the spout to descend in a vertical line so that the furnaceman and craneman have merely to see that the ladle is lowered whilst the metal is running out. This is effected by the system of compensating rollers shown in Fig. 3. The furnace is carried on two sets of rollers, and as it is tilted, it causes the top rollers to rotate the bottom rollers, and this moves the furnace bodily forward. The wheels are so proportioned that the movement forward is just the right amount to keep the end of the spout vertical as it descends. Greaves-Etchells furnaces are made in the following sizes:

Charge.	Kilo-volt Amperes	No. of top Electrodes	Diameter of Graphite Electrodes
½ ton	260	2	4"
1½ ton	520	2	7"
3 ton	800	2	8"
6 ton	1300	4	8"
9 ton	2000	4	9"
12 ton	2600	4	10"

High Speed or Special Alloy Steels

For the manufacture of high-speed steels or special alloy steels, a ½-ton or 1½-ton furnace is usually adopted, and the former can finish a charge from cold material and alloys in 2 to 2½ hours, with an energy consumption of 400 units.

To make up a charge from scrap, it is usual to place steel turnings and millings on the hearth, then pieces of bar and rail ends, tube ends, and finally large pieces of steel. The interstices between the large pieces are filled with turnings, etc., and some ore may be added. The amount of iron ore depends on the amount of iron oxide present in the form of rust on the scrap.

As the charge is melted, a slag of lime and fluorspar is made in order to eliminate the phosphorus as phosphate of lime. After this phosphate slag has been skimmed off, a new slag is made of best Buxton lime, fluorspar and white sand in the proportions of 30, 10, and 5. When this has fluxed, a small quantity of finely-powdered anthracite coal is spread on the slag, and this is continued until the slag is deoxidized. The steel is thus finished off under an atmosphere of carbonic oxide and a slag, out of which the metallic oxides have been reduced. When entirely deoxidized, a sample of slag falls to a fine white powder as it cools. Deoxidization of the slag results in deoxidization of the steel, through the constant reduction of silicon from the slag, and it may be hastened by addition of small quantities of ferro silicon.

Comparison With Crucible Melting

As a comparison with the crucible steel process, it may safely be stated that a ½-ton electric furnace running a charge every 2½ hours, or, say, 9 charges per day, will do as much as 36 crucible furnace holes, each having two 56-lb. pots. The electric furnace is operated by one skilled man, one unskilled man, and one ammeter boy, whereas the crucibles require 15 men, most of whom are skilled, or at any rate classed as indispensable. At two Sheffield works, girls are employed to regulate the electrodes.

Such an electric furnace with its transformers and switch gear will occupy about a quarter of the space occupied by the crucible plant, and the initial cost of the electric furnace will be about half of that of the crucible plant. The charge of the electric furnace can be made entirely from turnings, millings, etc., whereas in the crucible steel process only a very limited quantity of turnings, etc., can be used.

Owing to the low heat efficiency and high cost of labor, crucible steel is much more expensive to manufacture. The cost of renewing crucibles is considerably higher than the renewal of an electric furnace for the same output. Already several steel works have shut down their crucible plant since installing electric furnaces.

The introduction of the Bessemer and open-hearth processes of making steel left crucible steel-makers indifferent owing to the fact that these methods were employed for making ordinary kinds of steel in great quantity for structures, rails, etc. The coming of the electric furnace is a different proposition, as it competes directly and successfully in the special field that the crucible steel process has held so long.

The crucible steel process has been largely responsible for great waste of the nation's resource by reason of the coke having to be made in the Beehive ovens, this quality coke being necessary for the crucible steel process. The introduction of the electric furnace should help to stop this waste in the future. It may be mentioned that very soon there will be 50 electric furnaces at work in the Sheffield district of England, and the output of steel from them will be at the rate of over 200,000 tons per annum. In the United States over 100 electric furnaces are already at work and a single electric steel plant is being erected in South Chicago, which will give an output of 200 000 tons per annum.

IS THERE A SUBSTITUTE FOR IRON FOR PERMANENT MOULDS?

IT IS generally acknowledged that the labor costs on sand and other moulds run up the prices of castings to what is often nearly a prohibitive figure, and for this reason iron moulds are used for many things which have to be made in large numbers, and while these iron moulds are good up to a certain point, they still leave much to be desired. For instance, they are not in any way porous, and for this reason gases can only escape at points specially arranged instead of from any part of the casting (by absorption) as in sand moulds. This renders special care in dealing with the metal in very many cases, while in some instances it is not safe to attempt casting in iron moulds. Naturally, iron moulds in suitable cases prove economical, but in such instances as they are unsuitable they are merely a waste. What is wanted is a refractory material which can be made up into porous moulds having a capacity of holding up to 100 or more castings without alteration, and which can be recovered for remanufacture into moulds. Costs being a very important item, and the total expenditure having to be less than that of sand moulding, probably the matter is one that offers many difficulties, but such that probably could be overcome with patience and practical experimental work. For instance, grained emery or corundum would probably stand the wear incidental to casting; but could they be cemented in such a way as to remain porous, and be capable of being broken down and remain in good condition for making other moulds; and could this be done in a way that could be used in ordinary foundry practice? If this or a similar material could be adapted for the work, and show a saving of, say, 10 per cent. reduction in the cost of actual moulding, there would be from 15 per cent. to 20 per cent. savings to be made in the melting and pouring of the metal, the saving in time in dealing with the moulds after they are made being an important item. There is a good opening for inventiveness in the direction pointed out.—The "Practical Engineer."

BRITISH CONTROL RARE METAL DEPOSITS IN QUEENSLAND

RECENT advices from Australia are to the effect that practically all the big wolfram and molybdenite properties in North Queensland have been sold to the Thermo Electric Ore Reduction Corporation Ltd., whose registered offices are in London and works at Luton. By means of the latest machinery and appliances the new owners propose to work the mines to their utmost capacity. Four 250-h.p. Diesel oil engines and a complete electrical installation will form part of the new equipment, while the present 10 head of stamps will be increased to 40 head. By these means the annual output is to be multiplied several times. The company are also negotiating for the purchase of the Mount Carbine Wolfram Mines, which, with proper appliances, are estimated to yield 500 tons yearly, or half as much as the properties already acquired. The mines bought by the British company are expected to give 1,000 tons of wolfram per annum instead of 200 tons, as at present, with a corresponding increase of molybdenite and bismuth. During the war all of these rare ores and metals obtained in Australia are sold under agreement to the Imperial authorities.

Wolfram and scheelite are the principal ores of tungsten, and the metal tungsten is chiefly used in the manufacture of high-grade steel, such as is required for lathes and for inner tubes of big guns. It imparts to the steel great density, toughness, and hardness. Molybdenum, the metal derived from the ore molybdenite, is also used for hardening steel as well as for other purposes. All these steel hardening materials have commanded exceptionally high prices since the outbreak of war. As much as £2,000 per ton has been paid by Germany for molybdenite, so it is said, but the British Government fixed the price delivered in London at £525. For wolfram up to £1,000 per ton has been paid in the United States, but the price is now about £200.

READERS' QUERIES AND ANSWERS

WANTED an alloy for making white metal hollow-ware, such as is used in casting portable reading-lamp stands.—N. A. G.

If the casting is required to be of good colour, strong enough to withstand accidental rough use, and finish to a durable surface chiefly, try the following:—

Copper	49 lbs.
Zinc	36 lbs.
Nickel	15 lbs.
Aluminum	2 oz.

Melt the copper and nickel first with a borax flux, then add the aluminum, and then the zinc. By remelting from ingots, you will obtain better results than otherwise. May be used with heated iron moulds or for sand castings.

If the casting is not required to be stiff and resistant to possibly injury from sudden contact with hard objects, either of the following may answer your purpose.

Lead	75 per cent.
Antimony	10 " "
Tin	15 " "

Tin	91 parts
Antimony	9 "
Copper	2 "

The latter makes a very strong, tough alloy, which is very fluid when melted.

A mold, the composition of which we believe is patented, and which would no doubt serve your purpose for casting the latter alloy is made as follows: Mix 11 parts powdered soapstone with 1 part Portland cement, then wet the mixture with a solution of 2 parts water and 1 part sodium silicate. Form a mixture of the consistency of moulding sand and employ in the same manner. Remove the pattern and heat the mold to 300 or 400 degrees Fah. until well dried. It is then ready for use.

THE coloring of cements is an interesting subject and from experiments that have been made it is found that black is safe, as a rule, but it is better to avoid experiments with cheap blacks. The carbon blacks are preferable to lampblacks, because they do not have the same tendency to float on the top during mixing. Ultramarine blue, if of good quality will hold its color for a number of years, and generally possesses the virtue of fading out evenly. It cannot be classed as permanent, as can black, brown or ochre. Green is very unsatisfactory.

FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

REFLECTIONS FROM THE FETTLING SHOP OF A STEEL FOUNDRY*

By John Watson.**

IT is important at the outset to note that I am speaking from the standpoint of a jobbing steel foundry using open-hearth acid steel, for although first principles remain the same in jobbing as in repetition shops, cause and effect vary. For instance, we all recognize that one of the factors in foundry efficiency is a regular daily cast of a certain tonnage of castings. In a repetition shop this is a comparatively easy matter, as charges can be made up easily and small melting units are usually employed. In a jobbing shop the run of work may involve a variety of test specifications with their corresponding variety of analyses, and often it is a matter of great difficulty to assemble a daily cast to take the output of the large furnaces working in a jobbing foundry using acid open-hearth steel. This is a point on which close collaboration between the selling and manufacturing sides can greatly help the foundry efficiency.

Fettling Shop in Cinderella Role

The fettling shop in the Cinderella to its more favored sister, the moulding shop, and its open face is the mirror that reflects all the blemishes of that sister's vaunted superiority. I once heard a fettler say that if it wasn't for fettlers half the moulders would be out of a job. He did not mean the ordinary dresser, but the super-dresser, who, in Sheffield, is paid 18 cents per hour, plus extras, and is known by the euphonious name of the "knocker-up." This particular gentleman, coupled with the electric welder, is a standing monument to the inefficiency of the moulding shop.

Most of you will have heard of Euclid's famous axiom, "A straight line is the shortest distance between two points." Now in a steel foundry we have two such points—the order book and the loading bank—and the efficiency of our foundry depends on how near we can approximate to that straight line between these two points; but as we are not crows we have to modify our axiom by the consideration that the shortest distance may be round a corner, and to keep that curve efficient we must always keep before us the factor of continuity of direction—there must be no doubling back over the first track. Just as in our argument a straight line may be a curve, so a curve may be a straight line, and the application of the straight line curve is, in my opinion, the basis of success in manufacturing.

Value of Production Curves

It is surprising that the plotting of curves, and the correct solution of their meaning, is not more studied by managers than it is. I know of nothing more illuminating. Take, for instance, the curve of daily production plotted out, say, in tons delivered for each day worked; if you plot such a simple curve you will most probably get something like Fig. 1. Here is a curve showing the fluctuation of daily output, and the problem is to find out why the curve looks like a contour of the Himalaya Mountains, and how it can be made a straight line showing an equal daily distribution of output, as shown by the line A.

Suppose we have a fettling shop designed to finish and deliver 55 tons per week, then on an evenly-balanced output we should deliver 10 tons per day for five days, and five tons on Saturday, and our theoretical full efficiency line will be the line A. Our actual deliveries, however, are:—Monday, 5 tons; Tuesday, 7 tons; Wednesday, 0 tons; Thursday, 10 tons; Friday, 3 tons; Saturday, 8 tons. We get, on plotting, the shaded line or curve of actual output.

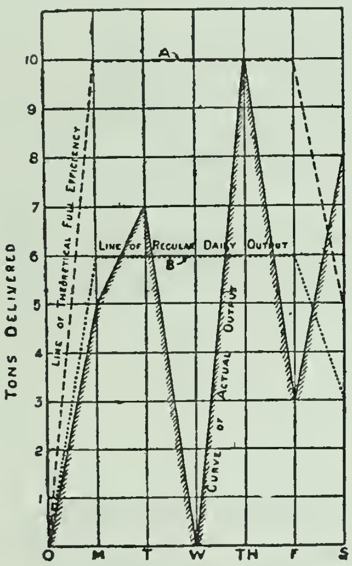


FIG. 1.

The manager's first problem is to reduce this irregular line to the line B showing regular daily output, and his next to make the line B coincide with the line A; that is what is meant by "push and go" in a steel foundry. An excellent education lies before the man who has never tried to solve this problem.

Let us see how in the solution of this simple curve we can utilize another not quite so simple, but vastly more illuminating. Let us try to find out what is happening between two points on our curve, say, during Tuesday's working hours, by plotting down a curve of the human effort expended in that day's production. In other words, we take the straight line M.T. and diagnose it. You will find great difficulty in plotting this curve, but assuming that we have succeeded, in our datal work jobbing foundry, it will appear like Fig. 2. Here is plotted down the curve of daily effort expended by a hand fettler scaling an annealed steel casting. We will assume that his maximum effort is at the rate of 8 sq. ft. per hour, then his theoretical line will be the line A. His actual effort, however, only produces the shaded lines shown on each period, and this curve is worth studying.

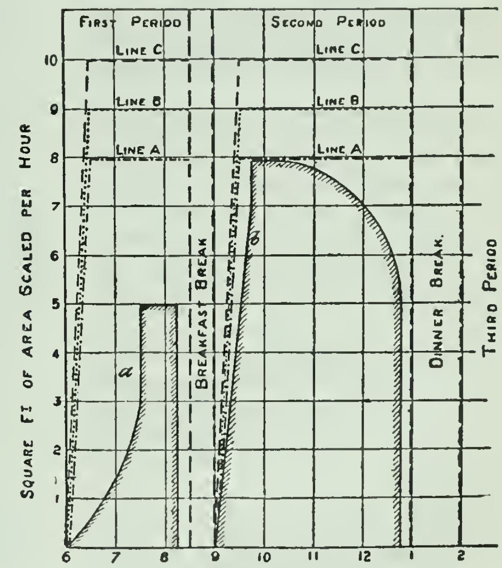


FIG. 2.

Factors in the Varying Daily Output

Let us follow it from 6 o'clock and trace its teaching. The straight line A is the theoretical full efficiency. It is a winter's morning, and the worker moves sluggishly; he is cold and most probably hungry, and his effort curve crawls slowly up to the point *a* about 7.30, when a sharp rise takes place in a few minutes. You will find that at this point the foreman has emerged from the warmth of his cabin, and the solace of his morning pipe and paper, and work goes on steadily with a straight curve to, say, 8.15, when the foreman goes back to his warm cabin and our curve drops sharply to the base line as our worker wanders off to warm his tea can. Then the breakfast break intervenes, and now see the change. The man is fed, he is warm with his hot tea and a smoke in front of the furnace, and his efficiency curve rises sharply to its maximum at about).45 a.m., and continues for an hour or so while he is feeling the benefit of his meal. His curve then droops, and again sharply drops when he wanders off to look for his dinner basket. The afternoon curve is a reproduction of the after-

*From a paper read before the Sheffield Branch of the British Foundrymen's Association.
**Steel Foundry Manager, Cammell, Laird & Co., Sheffield.

breakfast curve, except that it droops earlier and faster as the operator tires. The point *b* where there is a short, sharp rise about 9.45 o'clock, marks the manager's advent in the shop.

It needs no very hard thinking to read the lesson of this curve. The section No. 1 is absolutely inefficient and wants cutting out, so that our 6 o'clock start is damned to commence with. I consider it a relic of barbarism, and is, I believe, at the root of a great deal of bad timekeeping. In the man's most efficient stage covered by sections 2 and 3 of the curve, there is only one break in a period of 7½ hours. This curve then shows that a one-break day, allowing the operator to start warm and well fed and to finish without exhaustion, is the correct system.

If we are to give practical effect to a lot of the loose talk that goes on about educating the operators, then the question of physical exhaustion due to early starting and long hours must be considered. You cannot get good results from a tired body. I have taken it out, and I find the average hours worked apart from overtime are not more than 49 per week, so that you are really working a very badly balanced 48-hour week, and by readjusting the distribution of that time on the one-break system you must, in my opinion, get more efficient working.

It is often remarked that men lose very little time when they are on night shift because they are paid more money. I do not agree with that reason. I believe that it is mostly due to the fact that a man's household have time to prepare a decent hot meal for him and get him away in good time for his night's work. I find that men work on the night shift not from a love of it, but because it enables them to average up their wages which are low on the day shift through the often intolerable conditions of our six o'clock start. The great majority of men who lose time on the day shift are not slackers.

We have seen that efficiency rises when the foreman gets going—we have seen that efficiency rises when the manager gets going—and from this we reflect that the highest efficiency will be obtained by making this working period common to all who have anything to do with the business, i.e., manager, clerks and operators should start at the same time.

Efficiency Curve for Managers and Foremen

Before I pass from this curve I would suggest that it would make a bit of useful education to any foreman or manager to plot out this curve of his own efficiency. If he has the usual amount of self-conceit prevalent in foundries, he will get his curve away up above the theoretical maximum line (as shown by line C in Fig. 2). Of course, as the manager or foreman is supposed to be on top of his job, his theoretical efficiency line will be above the operator's line, as shown by line B. Now, if he is an honest thinker he will quickly recognize that the super-height of his curve is the measure of his amount of swelled head, and when he examines the same period of time on the production curve he will most likely find a V-shaped depression as we have on the first curve at W—the rut that the moulder is in. This curve of swelled head is one of the contributory causes to the rut. Erode the peak, and the rut will begin to fill up. By efficiency I mean a high rate of production of good quality castings, at a relatively low cost rate, from a body of well-paid, contented operators and staff.

Proper Sequence of Operations

I mentioned that we must always keep before us the factor of continuity of direction. How rarely one finds this in a jobbing steel foundry. There is rarely any idea of a proper sequence of operations. The furnace is often in the wrong place, drying stoves in the wrong place, making it incumbent on the travelling cranes to be continually shifting moulds backwards and forwards. If the furnace is at one end of the shop and the drying stoves at the other, you

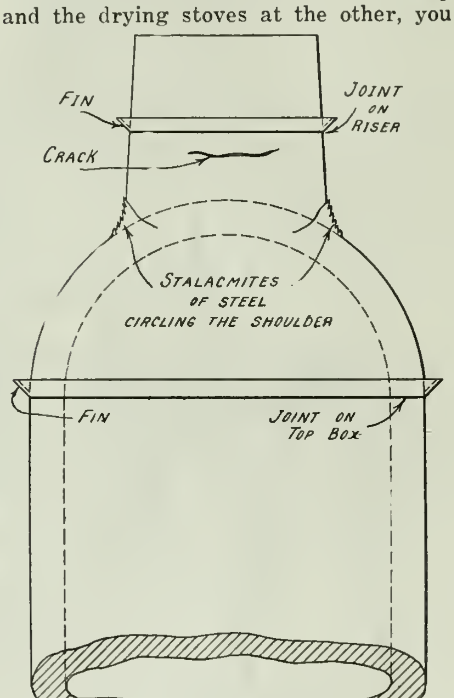


FIG. 3.

close and set the moulds at the stove end, the steel has to travel over the moulding area to the pit, and the moulders for an hour, say, are left craneless. That interferes with output.

Let us look at the sequence of operations in the foundry:—Moulding, coremaking, drying, closing, casting, knocking out, sand blasting, riser removal, annealing, fettling, testing, finishing, loading. I have left out pattern-making, for in jobbing-shops most of the patterns are sent in and the patternmaker's chief business is to keep the moulder right (if he can), in his closing. With the exception of hand moulding, core making and melting, the whole business is purely mechanical, and the speed of production largely depends on the balance of output from each operation, the perfection of the means of transit from one operation to another, and the efficacy of the machinery for performing each operation.

What a misnomer the term moulding shop often is in the jobbing foundry. How often one finds it a conglomeration of moulding area, box park, knocking-out shop, fettling shop, scrap-heap, and goodness knows what. The moulding shop should be a place to mould in; the dirty work should be done in other shops fitted for the purpose. Then a bit more of the valleys in the first curve will be found filling up.

There is no secret in a steel foundry; there is plenty of delusion, and the whole question of "quantity" resolves itself into an engineering problem of the application of the straight line. It is, however, when we come to consider quality in a steel foundry that we are confronted with the real problem. Quality is that condition in a casting that enables it to pass through all the successive stages from the casting pit to the loading bank with a minimum of trouble and cost and strengthens the salesman's hand by making the buyer (like Oliver Twist), ask for more.

Factors in Quality Output

Quality depends primarily on two factors:—1—The foreman moulder; 2—the molten steel. I put the steel last, because, in my experience, it is the least important of the two. The instructions given to the operating moulder by the foreman, such as the position to place the runner, the right way to mould the job, the position and size of risers, the use or abuse of core irons, and the putting on of brackets in 99 cases out of a 100 determine whether the job will be good or not, and it is in these points that the weak spot in our steel foundries lies. The great majority of foremen moulders are not properly trained.

It is a most melancholy reflection that such a fine body of men should be handicapped by what is a serious defect in our shop training. I mean that education of foremen to think on correct scientific lines, enabling them to rise above the "hit and miss" methods so prevalent in our shops. Employers of labor will have to face this question. and its solution starts with the apprentice moulder. A foreman must come from the operating moulders; he must go through the mill of the apprenticeship drudgery, but employers must insist that mental training proceeds with the manual training, and part of that mental training should, I think, be carried out in the works, so that lads can be taught to appreciate the coordination between manual effort and technical training, not as a thing apart from their daily toil, but as a powerful weapon to enable them to make that toil more productive in earning capacity for themselves, and for the man or corporation that employs them.

The excessive use of brackets, core irons and risers are, in my opinion, the distress signals of the foreman moulder. He is too often so obsessed by the fear of what the steel-maker is going to give him that his mind is incapable of analysing his difficulties correctly. It is always good policy for a manager when the foreman tells him that last night's charge was like "bull muck" to examine the charge sheet, and get busy in the fettling shop. He won't take long to find which casting has worried the foreman. You'll usually find it by the number of brackets on it—a kind of steel hedgehog. Tell a foreman a casting is a "ship casting," and he'll go bracket mad. Tell him it's a furnace door, and you'll get a better casting with no brackets on it at all. I firmly believe that the blaming of the steel-maker for bad or cracked castings is the greatest piece of bluff ever put up in a workshop. For many years now I have never failed to get correct test results from the steel supplied, except where it has been contaminated in the mould or spoilt by mechanical action in the mould. I do not think it reasonable to suggest that 30-ton steel, giving an elongation of 30 per cent. on 2 in. and 180 deg. bend (a steel being made daily in our Sheffield foundries), is a bad steel or a steel responsible for the cracks in castings.

Critical Period of Steel Castings

Foreman moulders do not fully recognise or believe that the critical period of a steel casting is just at the point of change from the liquid to the solid state, not only because the metal is then in a pasty condition, but because the main contraction comes on that moment, and the casting will crack if the mould and cores are not sufficiently friable to allow that sudden movement to be unrestricted. This contraction is so fast that in a job cast vertically you will frequently find that part of the steel near the base of the riser has lagged behind the mass and appears as a row of small stalagmites on the cold casting. I have repeatedly found them 5-16-in. long on the top end of a cylinder whose contracting length was 4 ft.

Fig. 3 illustrates the point. A dome-ended cylinder was cast with the dome end up and the feeding riser placed as shown. The joint of the top box and the riser box are shown. In cases where no fin formed at these joints the stalagmites of steel were much in evidence, but when fin did occur through bad jointing the stalagmites were absent, and the fins were bent almost vertical, and in one case, although the fin on the riser was only ¾ in. wide by 1/16 in. thick, a crack 9 in. long occurred on the riser just below the fin. Examples such as this show the speed of contraction, and the danger of cracking through even a very slight resistance to contraction at the critical point of solidification.

You can always tell whether a foreman grasps this question of contraction by watching if he slackens a job after it is cast. All slackening should be done when the mould and cores are being made and dried, and with the exception of easing round a riser the casting should not be disturbed until it is cold enough to lift, and I want to see foreman moulders so trained that, without a thought to the steel, they can produce a sound steel casting by scientific moulding methods.

A great deal has been talked about the excellence of German steel castings. I have examined every German casting I could get hold of, and I have not found one made of better steel than we are daily supplied with in our Sheffield foundries, but I believe I am right in saying their methods of moulding were superior. I have seen a German 12-ton ship casting, and it had been made with only eight brackets on it. I have seen a similar British casting made of better steel with 200 brackets on it, and the German casting was the more saleable article—"it had quality." My experience forces me to the conclusion that method of manufacture in the moulding shop and not the steel is the main factor in securing quality in steel castings.

FOUNDRYMEN'S CONVENTION AND EXHIBITION

THE success of the exhibition of foundry supplies and equipment, machine tools and accessories, to be held in Boston, Mass., during the week of September 24, concurrently with the annual conventions of the American Foundrymen's Association and American Institute of Metals, is already assured, since nearly 150 manufacturers have made reservation of 45,000 square feet of floor space, an amount well in excess of that occupied at Cleveland a year ago. Judging from the convention programme scope as regards subjects to be discussed, it is quite apparent that the development of foundry practice along right lines continues to expand and grow in importance. Program details follow:—

A. F. A. Programme, Monday, Sept. 24

10 a.m.—Registration, Mechanics' Building.

1 p.m.—Opening of Exhibition, Mechanics' Building.

3 p.m.—Joint opening session, American Foundrymen's Association and American Institute of Metals, Paul Revere Hall, Mechanics' Building.

Address of welcome, by Hon. James M. Curley, Mayor of the City of Boston.

Response to the address of welcome, by R. A. Bull, Duquesne Steel Foundry Co., Coreopolis, Pa.

Annual address by J. P. Pero, Missouri Malleable Iron Co., East St. Louis, Ill., president, American Foundrymen's Association.

Annual address by James L. Jones, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., president American Institute of Metals.

Report of Executive Board of the American Foundrymen's Association.

Report of the Secretary-Treasurer of the American Foundrymen's Association, by A. O. Backert, Cleveland.

"Fire Prevention in Large Industrial Establishments," by C. Johnson, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Appointment of Nominating Committee and Committee on Resolutions.

Tuesday, Sept. 25, 10 a.m.—Paul Revere Hall

"The Foundry from the Viewpoint of the Sales Engineer," by H. R. Atwater, Osborne Mfg. Co., Cleveland.

"The Relationship of the Engineering Department to the Pattern Shop and Foundry," by F. J. McGrail, Struthers-Wells Co., Warren, Pa.

"How Character Analysis Solves the Men Problem," by William Judson Kibby, Employment Specialist, Cleveland.

Report of A. F. A. Committee Advisory to the U. S. Bureau of Standards, by Richard Moldenke, Chairman, Watchung, N.J.

"Efficiency in the Foundry," by James A. Fitzgerald, Reno, Pa.

"Co-operative Shop Training," by W. B. Hunter, Fitchburg, High School, Fitchburg, Mass.

1.30 p.m.—Boat ride in and about Boston Harbor. Luncheon will be served on board.

Wednesday, Sept. 26, 10 a.m., Paul Revere Hall

"Improving the Relationship Between Employer and Employee," by J. F. Kent, American Cast Iron Pipe Co., Birmingham, Ala.

Report of A. F. A. Committee on Safety, Sanitation and Fire Prevention, by Victor T. Noonan, Chairman, Industrial Commission of Ohio, Columbus, O.

Report of A. F. A. Committee on Foundry costs, by B. D. Fuller, Chairman, Westinghouse Electric and Mfg. Co., Cleveland.

Report of A. F. A. representatives on the Conference Board on Training of Apprentices, by Frank M. Leavitt, Chairman, University of Illinois, Chicago.

"The Labor Situation as Relating to Co-operation Between the Employer and Employee," by G. B. MacIlwain, Babaon's Statistical Organization, Wellesley, Mass.

"Micro-Metallography for the Foundry," by Robert J. Anderson, Cleveland Metal Products Co., Cleveland.

Report of nominating committee and election of directors.

Malleable Session, 10 a.m., Mechanics' Building

"The Theory of the Modern Waste-Heat Boiler and Possible Application of Such Boilers to the Malleable Melting Furnace," by A. D. Pratt, The Babcock & Wilcox Co., New York.

"Application of Waste-Heat Boilers to the Malleable Melting Furnace," by C. D. Townsend, Danville Malleable Iron Co., Danville, Ill.

"Application of Pulverized Coal to the Air Furnace," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

"The Application of Pulverized Coal to Malleable Melting Furnaces," by Joseph Harrington, Advisory Engineer, Chicago.

"How Malleable Iron Has Improved," by Enrique Touceda, Consulting Engineer, Albany, N.Y.

"Troubles Encountered in Machining Malleable Iron: Causes and Remedies," by A. T. Jeffery, Dayton Malleable Iron Co., Dayton, O.

"Comparative Carbon Losses in Malleable Iron Annealing by Muffle and Pot Oven Methods," by Joseph B. Deisher," The T. H. Symington Co., Rochester, N. Y.

The Effect of Iron Oxide in Moulding Sand," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

3 p.m.—Baseball game, Fenway Park, Boston and Cleveland American League Teams.

8.15 p.m.—Theatre party.

Thursday, Sept. 27, 10 a.m., Paul Revere Hall—Gray Iron Session

"Note on Fine Molding Sands," by C. P. Karr, Associated Physicist, U.S. Bureau of Standards, Washington, D.C.

Report of A. F. A. Committee on General Specifications for Gray Iron Castings," by W. P. Putnam, Chairman, Detroit Testing Laboratory, Detroit.

"Briquetting Foundry Borings," by A. L. Stillman, General Briquetting Co., New York.

"Cast Iron Shells in Permanent Molds," by Edgar Allen Custer, Consulting Engineer, Philadelphia, Pa.

"The Seasoning of Gray Iron Castings," by L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R.I.

"Factors in the Economical Production of Small Cores in Large Quantities," by R. E. Kennedy, University of Illinois, Urbana, Ill.

"Modern Centrifugal Cupola Blowers," by J. W. Shugg, General Electric Co., Schenectady, N.Y.

"The Effect of High Sulphur in Gray Iron Castings," by T. Mauland, International Harvester Co., Chicago.

Steel Session, 10 a.m., Mechanics' Building

"Molding and Casting Large Slag Pots," by C. J. McMahon, Illinois Steel Co., Chicago.

"A description of a Small Open-Hearth Furnace," by David McLain, McLain's Systems, Milwaukee.

"Small Steel Castings for Ordnance Purposes," by Major C. M. Wesson, Watertown Arsenal, Watertown, Mass.

"A New System of Burning Crude Oil," by W. A. Janssen, Chairman, Davenport, Iowa.

"The Use of Vanadium in Steel Castings," by J. Lloyd Uhler, Union Steel Castings Co., Pittsburgh.

Report of A. F. A. Committee on Steel Foundry Standards, by W. A. Janssen, Chairman, Davenport, Iowa.

12.00 noon—Luncheon for the ladies followed by an automobile trip.

12.30 p.m.—Visit to the West Lynn Plant of the General Electric Co. Luncheon will be served at the works.

7.00 p.m.—Annual banquet, Copley-Plaza Hotel.

Friday, Sept. 28, 10 a.m., Paul Revere Hall

"Solution of Foundry Transportation and Conveying Problems," by Robert E. Newcomb, Deane Works, Worthington Pump and Machinery Co., Holyoke, Mass.

"Sand-Blasting in the Foundry," by H. L. Wadsworth, Sand Mixing Machine Co., Cleveland.

"Results of Tests in Blending and Mixing Sand by Means of Mullers," by R. F. Harrington, Hunt-Spiller Mfg. Co., Worcester, Mass.

"Factors Contributing to the Economical Use of Grinding Wheels in the Foundry," by Wallace T. Montague, Norton Co., Worcester, Mass.

"Refractory Materials Employed in the Metallurgical Industries," by H. C. Arnold, University of Illinois, Urbana, Ill.

Steel Session 10 a.m., Mechanics' Bldg.

"Electric Furnace Design," by John A. Crowley, John A. Crowley Co., Detroit.

"Recent Developments in the Application of the Electric Furnace to the Melting Problem," by Douglas Walker, Booth-Hall Co., Chicago.

"Comparison of Electric Furnace and Steel Converter for the Manufacture of Small Steel Castings," by C. R. Messinger, Sivyer Steel Casting Co., Milwaukee.

"The Electric Furnace From the Central Station Standpoint," by E. L. Crosby, Detroit Edison Co., Detroit.

"The Electric Furnace in the Iron and Steel Foundry," by Max Trembour, Metallurgical Engineer, Ludlum Steel Co., Watervelt, N.Y.

Plant visitation.

Program American Institute of Metals

Monday, Sept. 24

10 a.m. — Registration, Mechanics' Building.

3 p.m.—Joint opening session American Foundrymen's Association and American Institute of Metals, Paul Revere Hall, Mechanics' Building.

Tuesday, Sept.25

9.30 a.m.—Hotel Somerset. Melting and Casting Nonferrous Metals.

"Raw Materials Used for Crucibles," by Prof. A. V. Bleininger, Bureau of Standards, Washington, D.C.

"Melting Yellow Brass in New Form of Induction Furnace," by G. H. Clamer, Ajax Metal Co., Philadelphia.

"Casting Bearings in Sand and Metal Molds," by R. R. Clarke, Pennsylvania Lines West of Pittsburgh, Pittsburgh.

"Negative Experiments on Waste Core Sand," by Dr. H. W. Gillett, Bureau of Mines, Ithaca, N.Y.

"The Crucible Situation." by M. McNaughton, Jos. Dixon Crucible Co., Jersey City, N.J.

"The Electric Furnace, and Nonferrous Metals," by Dwight D. Miller, The Society for Electric Development, New York City.

"My Experience with Metal Melting Furnaces," by W. H. Parry, National Meter Co., Brooklyn, N.Y.

"The Briquetting of Nonferrous Light Metal Scrap," by A. L. Stillman, General Briquetting Co., New York City.

1.30 p.m.—Boat ride in and about Boston Harbor. Luncheon will be served on board.

Wednesday, Sept. 26, 9.30 a.m., Hotel Somerset—Uses of Nonferrous Metals for Munitions, Etc.

"The Present Status of Tin Fusible Plug Manufacture and Properties," by Dr. George K. Burgess, Bureau of Standards, Washington, D.C.

"Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

"The Use of Die Castings in Munitions," by Chas. Pack, Doehler Die Casting Co., Brooklyn, N.Y.

"Shrapnel Bullets," by Harold J. Roast, The Jas. Robertson Co., Ltd., Montreal, P.Q.

"A Few Points on Alloy Patents,'" by Wm. J. Rich, Patent Office, Washington, D.C.

Address by a representative of the United States Tariff Commission.

"The Use of Bronzes in Railroad Turntables and Movable Bridges," by O. E. Selby, Big Four Railroad, Cincinnati.

"Recent Industrial Uses of Aluminum," by F. G. Shull, Aluminum Co. of America, Boston.

"The Consumption of Copper and Its Varied. Uses," by H. D. Hawks, United Metals Selling Co., New York City.

3 p.m.—Baseball game, Fenway Park, Boston and Cleveland American League teams.

8.15 p.m.—Theatre party.

Thursday, Sept. 27, 9.30 a.m., Hotel Somerset—Testing of Nonferrous Metals.

"Comparative Tests on Test Bars and Actual Castings," by W. M. Corse, Titanium Bronze Co., Niagara Falls, N.Y.

"Analysis of Babbitts and Brasses," by E. W. Hagmaier, Buffalo.

"Standard Test Bars of 88-10-2 and 88-8-4, Being the Result of Co-operative Work of Six Foundries; a new series of Tests," by C. P. Karr, Bureau of Standards, Washington, D.C.

"The Expansion of Co-efficients of Alpha and Beta Brass," and "The Corrosion of Manganese Bronze Under Stress," by Dr. Paul D. Merica, Bureau of Standards, Washington, D.C.

"Corrosion of Brasses of the Muntz Metal type," by H. S. Rawdon, Bureau of Standards, Washington, D.C.

Address by Richard C. Maclaurin, President, League to Enforce Peace.

"The School End of the Job in Training Foundrymen," by Dean C. B. Connelley, Carnegie Institute of Technology, Pittsburgh.

"The Flux and Cleaner Question of Brass," by E. D. Frohman, S. Obermayer Co., Pittsburgh.

"Pyrometers—Their Construction and Application," by John P. Goheen, Brown Instrument Co., Philadelphia.

"Electrically-heated Core Ovens," by Dr. C. F. Hirshfeld, Edison Illuminating Co., Detroit.

"Brass Rolling Mill Alloys," by Roy A. Wood, Cheshire, Conn.

12 m.—Luncheon for the ladies, followed by an automobile sight-seeing tour.

12.30 p.m.—Visit to the West Lynn plant of the General Electric Co. Luncheon will be served at the works.

7 p.m.—Annual banquet, Copley-Plaza Hotel.

Friday, Sept. 28, 9.30 a.m., Hotel Somerset—Metallurgy and Metallography

"The Electrolytic Production of Antimony," by Prof. D. J. Demorest, Ohio State University, Columbus.

"The Electrical Properties of Some High Resistance Alloys," by Prof. M. A.

Hunter, Rensselaer Polytechnic Institute, and F. M. Sebast, Troy, N.Y.

"The Amorphous Theory in Metals," by Zay Jeffries, Aluminum Castings Co., Cleveland.

"The Volatility of Zinc and Cadmium," by John Johnston and Edward Schramm, American Zinc, Lead and Smelting Co., St. Louis.

"Surface Tension and Deoxidizing of Metals," by W. J. Knox, Metals Deoxidizing and Refining Co., New York City.

"Antimony—Its Metallurgy and Uses," by K. C. Li, Wah Chang Mining and Smelting Co., Inc., New York City.

"Development and Reabsorption of the Beta Constituent in Alloys Which Are Normally of the Alpha Type," by Prof. C. H. Mathewson, Department of Mining and Metallurgy, Yale University, and Philip Davidson, New Haven, Conn.

"The Swelling of Zinc Base Die Castings," by H. M. Williams, National Cash Register Co., Dayton, O.

Plant visitation.

YEAR'S WORK OF LAKE SUPERIOR CORPORATION

THE net earnings from operations of all of the subsidiary companies of the Lake Superior Corporation for the year ended June 30th last were $5,323,004.86, compared with $3,503,471.18 in the previous year, an increase of $1,819,533.68. To the net earnings mentioned there was added a balance of $340,087.33 brought forward from 1916, giving $5,663,092.19 available for distribution. Interest on bonds of subsidiary companies took $1,419,071.20. An amount of $586,485.12 was set aside for Magpie Mine Reserve and for sinking fund payments in respect of Helen, Carmelton, Lake Superior Mines, Fiborn quarries, etc. The losses and expenses in connection with the sale of miscellaneous assets reached the sum of $145,036.01. The amount of $1,243,155.14 was appropriated as reserves for depreciation, renewals, etc., of special assets (including renewal of coke ovens and docks, as also abnormal capital cost of construction and equipment), and $1,500,000 was set aside for general depreciation. These items totalled $4,893,747.77, and left the sum of $769,344.42 to be carried forward by all companies.

The Algoma Steel Company showed an increase both in the production of pig iron and unfinished steel as follows:

	1916-17	1915-16
Pig iron	348,519	258,504
Finished steel	280,296	215,466

The output consisted of shell steel together with rails and merchant bars.

The Algoma Steel Corporation has completed the two 75-ton open hearth furnaces which it had under way at the opening of the year and has carried through a third furnace of the same size. With a possible production of about 50,000 tons ingots per month, the directors consider that they have provided all the steel making capacity necessary for some time to come, and that subject to certain modernizing of the older furnaces, they will have a satisfactory open hearth plant.

Opportunity was taken to acquire the modern blast furnace built at Midland, Ont., a few years ago, by the Canada Iron Corporation. This furnace has been already moved to Sault Ste. Marie and when erected and improved will have an approximate capacity of 400 tons per day. With the addition of the blast furnace plant and with the ultimate possibility of operating four blast furnaces, the Algoma Steel Corporation should have a well balanced plant as between its pig iron and steel producing possibilities.

Satisfactory progress is being made with the development of the water power by the Great Lakes Power Company and the supply of power, which will be greatly helpful to the steel plant, is expected to commence about 1st January next.

Mr. Wilfrid H. Cunningham, the president, says in the course of his report:

"So far as the finances of the Algoma Steel Corporation are concerned, it is gratifying to be able to report that the position of the company has been much improved, especially through its having paid off, in March, its three-year note obligations ($2,432,000). A satisfactory sale was made during the year, of the steamship J. A. McKee, and of certain office buildings and adjoining lands. The price realized for steamship and lands approximated $750,000, all of which is or will be deposited with the trustees and will be available for further capital expenditure.

"Favorable reports have been received as to the coal mines. In view of the growing importance of these, the Lake Superior and Cannelton Coal Companies have opened an office in Cleveland, from which Mr. W. C. Franz, the president of those companies, will conduct operations.

"The present Helen Iron Mine is still producing, but the operation cannot be prolonged much further on account of the exhaustion of the Hematite ore. A considerable amount of diamond drilling has been done on the property during the year, with the result that a substantial tonnage of Siderite has been proved up. There are no further developments at Magpie Mine. Labor conditions have been unsatisfactory.

"Beyond progressing with their plans the Algoma Steel Corporation directors have not yet committed the company to construction work in connection with either structural or other mills. They consider that prices and deliveries are adverse to such work at present. The necessity for further mill development is, however, again very strongly emphasized.

"In the disposition of earnings for the year, the board of the Algoma Steel Corporation has deemed it wise, especially under the present conditions, to pursue a thoroughly conservative policy. In addition to the necessary sinking funds, care has been taken to provide for such as the inevitable rebuilding of the bi-product coke ovens, the extra depreciation caused to rolling mills through the class of material now being rolled, part of the abnormal cost of new construction, as well as further provision for Magpie Mine, general depreciation, etc."

UTILIZING WASTE HEAT IN BRITAIN

MILLIONS of units of electricity, generated in waste-heat stations in connection with coke ovens and blast furnace plants is the result of developments in the South Durham coal field in the north of England. In 1907 a corporation was formed under the title of The Waste Heat & Gas Electrical Generating Stations, Ltd., to promote the use of waste heat for power purposes, and the problem of using the waste heat from iron and coke oven plants has been solved to the extent where savings estimated at 150,000 tons of fuel per annum are now being effected.

Two of the leading power companies operate in conjunction with the waste-heat stations, supplying a combined total energy of 343,000 horse-power over an area of 1,400 square miles. The waste heat stations are placed close to the larger coke ovens and blast-furnace plants, and operate in parallel with the five main stations of the power companies. They are run at their maximum capacity, and all regulation of the power is effected by the main supply stations.

The main distribution and transmission system is three-phase, and the working pressure is 20,000 volts. The power is utilized chiefly in the engineering shops and shipbuilding yards situated on the Tyne and Wear, and as the purchasing companies have a market for their current many times greater than the output of any individual waste heat station, it is possible to run these stations continuously at their full capacity, and to utilize to the best possible extent the machinery installed in them. Unfortunately for scientific purposes, no figures have been published, or can be obtained, for the thermal or working efficiency of these North-East Coast waste heat stations, and therefore it is impossible to say how the system adopted compares in practical value and economy with the waste heat stations situated in other countries.

MOVING A BLAST FURNACE.

MOVING a blast furnace is something new in the iron and steel industry, but this has been undertaken by the Algoma Steel Co., which has purchased the No. 2 furnace of the former Canada Iron Corporation, Midland, Ont., and is now moving the entire furnace, including stoves, boilers and buildings, in fact everything but the foundations, from Midland to Sault Ste. Marie, a distance of about 400 miles. The steel company purchased this unused furnace because it expected that it could dismantle the plant and re-erect it in much quicker time than a new furnace could be built under the present conditions. This is a 275-ton stack. The contract for moving material required for its re-erection and enlargement has been placed with Arthur G. McKee & Co., consulting and contracting engineers, Cleveland.

STEEL INDUSTRY DEVELOPMENTS

The War-Created Stimulus given the Steel Industry is Reflected alike in the Nature and Application of New and Improved Equipment being Installed and Developed.

TURBO-BLOWERS FOR BLAST FURNACES—I.*

By R. H. Rice and S. A. Ross.**

THE blowing of blast furnaces is a process which, at best, is attended with considerable variation, both in the operation of the furnace, and in the factors which are necessary to the proper working of the plant as a whole. In modern furnace practice every effort is being made to reduce the number of variables and increase the steadiness of operation, and a careful study of these variables and what is being done to decrease or eliminate them will be useful. The variable elements which enter into the operation of a blast furnace are as follows:—

1.—Variations in the composition of the ore, and variations in the size of the particles thereof.

2.—Variations in the composition and in the size of the particles of the limestone.

3.—Variations in the carbon content, strength and size of the coke.

4.—Variations in the quantity of oxygen blown into the furnace, due to variations in barometer, temperature, and humidity of the entering air.

5.—Variations in the pressure and volume of the blast, due to the character of the blowing agent.

Of variables which have no relation to the blast, these are dealt with as follows:—

1.—Variations in the composition of the ore are being dealt with by proper combinations of ore; and variations in the size of the ore are being dealt with by proper means of sizing the ore, including crushing, screening, sintering and roasting.

2.—Analyzing and mixing various compositions of limestone in order to secure a uniform quality.

3.—Careful choice of coke, and proper attention to the uniformity of manufacture.

4.—An attempt to decrease variables in blowing was made by the introduction of the dry blast. The expense of the plant for this method of removing the moisture from air and the operating cost thereof is so great that this method of treating the blast has not made any considerable progress recently.

5.—The introduction of the turbo-blower has provided a means of rendering the blast conditions more uniform. Not only is the blast pressure held steady but also the very steadiness of the blowing permits accurate measurement of the air volumes, and accurate adjustments thereof, and compensation for variations in barometer, thermometer and humidity; so as to insure a constant rate of flow of oxygen into the furnace, and the accurate adjustment of this rate to the needs of the furnace conditions.

Steadiness and Control of Blast

It is difficult to demonstrate, to those furnace operators who have not had experience with the steadiness and ready controllability of the blast from a centrifugal compressor, what the effect of this steadiness of conditions will have on the furnace; which is in direct contrast to the attitude of those who have had experience with the operation of such units. In no case has there been a failure on the part of the people who have acquired experience with this method of blowing, to appreciate the improvements which result from these conditions.

It is only recently, however, that an accurate means has been provided for correcting the rate of blowing to correspond with the variations in atmospheric conditions. Experience with the use of these corrections is very limited; only one case is known to the writers where some of these corrections have been applied by observation of the atmospheric conditions and an arbitrary correction of the weight beam in accordance with this observation, and in this case (speaking of the Northern Iron Co., Port Henry, N. Y.), the correction has only been made for barometer and temperature, and no attempt has been made to correct for humidity.

It is not to be wondered at that those whose experience is exclusively with ordinary methods of blowing should fail to appreciate the desirability of the steady blast and the accurate measurement of oxygen, for the reason that there are so many variables which necessarily have occupied the attention of our blast furnace operators that it has been almost impossible to differentiate and evaluate the various variables which have to be dealt with. By the recent improvements in the operation of furnaces, which permit the removing of some of the variables by sizing of the ore, and by proper attention to the coke and limestone charges, some of these variables are being removed and the final step would seem to be the removal of all possible variations from the blast itself.

Blast Pulsations Absent

It goes without saying that the blast from a centrifugal compressor will be a steady flow without pulsations. The very nature of the apparatus necessitates this. It also seems evident, and has been proved by actual observation of the blast delivered from a reciprocating machine discharging its air in puffs, each puff corresponding to one stroke of the engine, that the flow of the blast must be more variable and produce some variations of effect in the furnace. Whatever these variations are, it seems evident that it is desirable to remove them. Experience with centrifugal machines on blast furnaces demonstrates this, and shows that an improved output, a somewhat less quantity of dust, and a general steadying up of conditions has resulted. A part of this improvement is due to the steadiness of the blast, and a part is due to the more accurate control of the rate of blowing.

An interesting experience which shows the importance, and even absolute necessity, of accurate control of the rate of air flow has been had with a blast furnace centrifugal compressor within the last few years. In this case the measuring device which was relied upon to determine the rate at which the blast was being blown was so located that the indications of this measuring device were inaccurate; at some time indicating more blast than was actually flowing and at other times less. The result of this inaccurate measurement of air was an inaccurate adjustment of the machine, causing excessive quantities of dust to be produced and a decreased output from the furnace as compared with the reciprocating engines, which were installed to blow the same furnace in alteration.

After operation in this condition for a considerable period the measuring device was relocated where the connections were more accurate. I am informed that the result of this relocation and consequent more accurate operation of the blower, was to decrease the quantity of dust to normal and increase the output of the furnace. In order to determine the effect of improvement in these parts such instances are of extreme value. They show the importance of the proper regulation of the rate of flow of blast and indicate the possibilities which can be expected when inequalities and irregularities are entirely removed.

Governor Controlled Rate of Blowing

A governor has been devised that is capable of accurately controlling the rate of blowing. This governor is used on blast furnace blowers built by the General Electric Co. It consists of a disc riding on the ingoing air in the centre of a frustro-conical portion of the inlet pipe. Movements of the disc are transmitted direct to the valve gear, and ample power is secured by the use of very moderate dimensions. The angularity of the walls of the conical pipe is determined by the desired accuracy of regulation. No packing is necessary and the device is therefore practically frictionless and wear-proof. Differing rates of flow are secured by moving a weight along a scale beam, which is graduated in cubic feet of free air per minute, and calibrated at

*From a paper read before the Engineers' Society of Western Pennsylvania.

**Of the Engineering and Turbine Research Departments, General Electric Co., Lynn, Mass.

the factory before shipment. A recent improvement of this governor consists of a means of adjusting the index on the sliding weight to compensate so that the weight can readily be reset to take account of variations in atmospheric conditions. The following is a description of this device, which is called a volume corrector.

Description of Volume Corrector

On the scale beams are marked with various numbers of cubic feet per minute. An index marked on the sliding weight is set opposite the number of cubic feet per minute which is desired should be held by the constant volume governor. This index is adjustable and its exact position is secured by the setting of three scales which are carried on the sliding weight. These scales are for barometer, atmospheric temperature, and atmospheric humidity. Proper settings on these three scales are made corresponding to atmospheric conditions, and this automatically sets the index on the sliding weight in such a position that the corresponding volume on the scale beam is corrected for the atmospheric conditions as set.

A phenomenon with which we had to deal in the early days of our experience with centrifugal compressors on blast furnaces was the so-called "surging" which appeared when the machines were operated at considerably less rates of blowing than those for which they were designed, or when excessive pressures were met with, as in case of tightening up of the furnace. The occasional phenomenon which is often called "surging" is only met with when, at normal pressures, the volume being blown through the centrifugal compressor is considerably less than that for which it was designed. In case of high pressures, for instance, with a tight furnace, this phenomenon may be met with, although the volume discharged is about that for which the machine was designed. It consists of an alternate forward and backflow of air through the compressor, and is the result of the improper functioning of the discharge vanes owing to the variation of blowing conditions from those for which the vanes were designed.

These alternate forward and back flows through the compressor result in a variation of pressure in the discharge mains of sometimes as great as two pounds, and cause some irregularity in the working of the furnace. This phenomenon is not peculiar to any one type of centrifugal compressor, but is met with in all types. For some time after the installation of our first machines this phenomenon was difficult to deal with, particularly as the first machines were designed for much larger quantities than have ever been blown through them. However, in the 10 years of experience which we have had with this apparatus effective means have been devised and applied which render it unnecessary that any such phenomenon should again give difficulty.

"Surge" Elimination

The steps which have been taken to eliminate this surging are: First, the reasonable proportioning of the machine to the requirements of the furnace; second, provision of a by-pass with an automatic valve which, under conditions which would ordinarily permit surging, leads back into the inlet a small quantity of air. This valve is self-compensating for variations in volume and pressure, and once adjusted needs no attention. The use of this apparatus increases the efficiency of operation in conditions where it is operative, since it maintains the proper air discharge pressure without diminution.

The centrifugal compressor, therefore, properly governed, affords a means of blowing the blast furnace with the steadiest possible conditions of blast and the most uniform rate of inflow of oxygen contents; a means of blowing which can be adjusted to meet any variations which may be necessary in the composition and mechanical conditions of the charge; and one which is automatic in operation when set for any existing condition and quickly reset for any change of condition of furnace or atmosphere, and one which requires comparatively little care and attention on the part of the operating staff.

Another feature, which tends to uniform operations, and permits of more accurate determination of the blowing conditions, is the fact that the turbo-blower is readily manufactured in such sizes that a single blower can be used for blowing a single furnace. In this way each blowing unit is adjustable to meet the exact furnace conditions with certainty, thereby increasing the uniformity of the product and the amount thereof; also decreasing the gas consumption, since the turbo-blower is more efficient in the larger sizes than in the smaller, and also because two units, whether of turbines or of engines, are less efficient than a single unit. This is on account of the fixed losses which exist in every turbine or engine unit and which do not increase in proportion to the size of the unit.

Turbine Efficiency

The efficiency of the turbine need hardly be argued here. It is the cause of its adoption as a prime mover in all our central power stations, and in practically all our industrial plants throughout the country in competition with all other forms of units. Very recent improvements in turbine construction have greatly improved the efficiency of such units, and these units of increased efficiency are now available in cases where steam consumption is an important requirement of blast furnace blowers. The discussion which will follow as to the cost of blowing furnaces will be based upon the use of one of these modern units. Another feature of this type of blowing apparatus is that, considering its efficiency, its first cost and cost of installation, its operating costs are also low.

Operation Costs

Reliable figures have been obtained from existing plants to the actual cost of operation, both for the gas plant and the steam plant. While these figures were not obtained from plants of the same magnitude, or located in exactly the same places, the conditions are so nearly uniform as to location, and figures for gas engines are obtained from plants which are so much larger than the turbine plants compared with them, that it is felt that the comparison is not unjust; in fact, any advantage which would obtain from the character of the plant appears to be in favor of the gas engine. It is well known that large plants operate with greater economy than smaller ones.

The gas engine figures are not those obtained from any one location, but are the result of comparison of figures of plants in several locations. In every case where choice of data could be made those results most favorable to the gas engine have been chosen. In selecting the gas engine installations best adapted for comparison with the steam turbine plant, the best possible examples of recent gas engine practice have been chosen; plants which are in the hands of most capable operators, installed for the purpose of securing the highest efficiency and containing all the various elements for proper operation for such plants. Furthermore, by reason of the care and supervision which is exercised over these plants it is believed that they are, without unnecessary expenditures, now in the best possible condition for service, and maintained at the highest practical efficiency.

Again, the physical location of these plants is also favorable, since they are placed at such points as give them readily proper supplies of ore, fuel, limestone, water and all the other materials necessary for economical operation, and they are equipped with handling devices for storing and transportation of these materials to the fullest practical extent. They are large plants, involving more than four blast furnaces, but in order to bring the plant unit down to one which would be most practical for consideration in new installations they have been reduced to the equivalent of a four furnace plant.

Plant Size Feature

In making this reduction no allowance has been made for a decrease of operating efficiency which would result in the reduction in size. On the other hand, the turbo-blower plant which has been selected for comparison is one which is used with only two furnaces. In enlarging it to the four-furnace plant no account has been taken of the increased economies which would result from the increase in size. Therefore it will be seen that the turbo-blower suffers in two directions; first, that the gas engine plants selected for comparison are larger than the plant which is taken as the standard unit, and second, the turbine plant, which is selected for comparison is, in turn, smaller. If these facts were taken into account we should expect that the figures would come out more favorable to the turbine than results actually given; but it is not desired, in making this comparison, to leave any doubt as to the conservatism of the result.

Installation First Cost

In considering the installation of a gas engine equipment for a steel mill of the type under consideration, the first fact which strikes the investigator is the first cost of the installation. It has not been customary in the past to consider the addition to operating cost which results from the charges necessitated by this capital investment. It is, however, of vital importance in considering the desirability of installation of one type of prime mover or another, that all the elements involved be taken into account in the same way that they are taken into account in other cases involving differences of first cost.

It is obvious that the capital invested in such plants must give some return to the investor, and a proper allowance for this return is a just and legitimate charge against operating expense. Furthermore, these investments involve taxes, which also should go against operating expense; and insurance is an item of the same class. Again, and more important than any of these, is the question of obsolescence, by which is meant the amount to be laid by as a sinking fund to retire or amortize the plant at the time when its usefulness becomes extinguished by the improvements in the available apparatus, whether as to efficiency, as to increased reliability, or in other ways; also to provide for the general ageing of the apparatus which takes place no matter how carefully the repairs and renewal of parts are taken care of. That is to say, this obsolescence charge which I am now discussing also includes depreciation.

It is, perhaps, not necessary to go too deeply into the necessity of an obsolescence or depreciation charge, but a familiar instance which is often cited, to show the necessity of the charge, is the case of the horse, investment in which is automatically extinguished by the ageing of the horse no matter how carefully he is taken care of, kept free from sickness, and otherwise preserved so far as possible in good condition. While the depreciation of machinery is often not so rapid or so easily seen as in the case of the horse, the two instances are fairly analogous.

If these fixed charges on the investment are not taken care of by charges against operating expense, they must be handled in some other manner, by charges against the product of the mills, or otherwise; which charges are wrongly allocated and do not show, unless put into operating expenses, the true value of investment in the various types of apparatus.

In most steel plants it has been the custom to consider merely the running charges. The management has been given the plants to operate, and it has been judged by this cost of operation without including the fixed charges due to investment. This had led to an inaccurate view of the desirability of extreme efficiency in the prime mover and does not consider the cost of obtaining this high efficiency. This leads to a use of the most expensive plant, provided such plant gives a larger output from the gas available without regard to the first cost.

SWEDISH IRON AND STEEL INDUSTRY

From time immemorial mining and the manufacture of iron have been industries of very great importance. The principal reason for this is that Sweden possesses one of the greatest supplies of iron-ore in Europe. According to a valuation of the supplies of iron-ore of the world at present known, which was published at the International Geological Congress of 1910, Germany's supply was reckoned at 3,607 million tons of iron-ore, France 3,300 million tons, and England 1,300 million tons, while the Swedish deposits of iron-ore are calculated at 1,150 million tons. It must also be observed that Swedish iron-ore is unusually rich. According to the above-mentioned extensive international investigation it is calculated that the whole world possesses 1,300 million tons of iron-ore which has 60% or more of iron; of this quantity Sweden owns no less than 1,035 million tons. The Swedish iron-ore supplies are found in two separate districts, one in the midlands, north and west of Lake Malar, and another in the far north of Sweden, a little beyond the Polar circle.

Increased Production

According to figures published by "Swedish Export," the total annual production of iron-ore in Sweden first exceeded one million tons during the period 1891-95 when the average annual output was 1,519,325 tons, rising in 1912 to 6,699,226 tons, the increase being very marked from 1910 on. In the year 1911 the whole world produced 136 million tons of iron ore, Sweden, with 6,150,718 tons occupying seventh position. Since 1871, Sweden and the United States have increased their production of ore almost ten-fold, Great Britain remaining almost stationary in this respect until recently.

The great bulk of the ore is exported, Germany taking by far the greater portion, followed by Britain, Belgium, France, and America in the order named. The chief reason for such exportation is the fact that Sweden lacks a natural supply of fuel.

High Quality Ore

As regards the quality of Swedish iron-ore it has been shown that no other country possesses a similar supply of ore with such a high percentage of iron; besides which the greater part of the ore mined in the midlands is unusually free from phosphor and sulphur, and consequently is an excellent material for the production of steel of the highest quality. Statistics show that the average quality of ore from the midlands contains 0.005—0.020% phosphor and 0.005—0.050% sulphur. During recent years the Swedish iron manufacture has obtained a further addition of ore free from phosphor and sulphur since the magnetic concentration of low grade ores has become more general, and as a consequence the production of briquettes. The development of the manufacture of concentrates and briquettes is shown by the following figures:

Year	Concentrates, Tons	Birquettes, Tons
1906	131,407	78,205
1907	178,567	88,532
1908	296,400	193,216
1909	225,983	148,380
1910	365,985	247,946
1911	381,190	255,948
1912	520.710	288,553

The total quantity of concentrates, which is manufactured according to the methods invented by Mr. Grondal, a Swedish engineer, has a percentage of iron of 50—70, and the percentage of phosphor only exceptionally exceeds 0.010%, although the raw ore which is refined has in certain cases contained more than 1% of phosphor. With the object of making the concentrates in piece-form and at the same time reducing its percentage of sulphur it is briquetted according to the Grondal method by heating up to 1,200—1,400 degrees C. without the addition of any binding substance, whereby the concentrate is softened by the heat and becomes a coherent mass. The briquettes thus obtained seldom have a percentage of sulphur of more than 0.010%. In 1912 the Swedish iron-ore mines employed 10,500 workmen and the value of the iron-ore produced was 49.6 million Kr.

Manufacture of Iron and Steel

The Swedish iron industry is of very ancient origin. According to the authority already quoted, as early as prehistoric times iron was manufactured in Sweden from hydrated ores, collected at the bottom of the lakes and marshes. The smelting was done by means of holes made in the ground and with the aid of wood as fuel. These holes were lined with slabs of stone. The inhabitants soon learned how to use the rich metals found in the ore, and small iron-works began to appear near the water-courses. Our ancient documents bear witness of a considerable mining industry. In a deed of exchange dated 1288 Stora Kopparberget is already mentioned and a deed of sale concerning certain interests in the Norberg mining fields bears the date 1303. In 1347 Stora Kopparbergs Bergslag obtained their first royal privileges. Several of our steel works still in existence were founded in the sixteenth and seventeenth centuries. An abundant supply of rich and pure ores, wealth of charcoal and more than sufficient water-power soon enabled Sweden to play an important part in the international iron market, and at the commencement of the eighteenth century Sweden was the country that produced the largest annual supply of pig-iron. At that time, however, several metallurgical inventions were made which very greatly neutralized the aforementioned advantages regarding the natural supplies upon which Sweden based her pre-eminence as an iron-manufacturing country. In the year 1730 cokes replaced charcoal as fuel for blast-furnaces in England, and very soon afterwards manufacturers learned how to eliminate phosphor from highly phosphoric pig-iron by means of puddling. Thus as soon as the discovery of the extraction of iron suitable for ordinary purposes from low quality ores with the aid of coal was made, the extent of the manufacture of iron in England, Germany and France soon exceeded that of Sweden.

Charcoal Versus Coke

The supply of very high quality ores and first class fuel in the form of charcoal has enabled Sweden to maintain her prominent position as the producer of the finest quality of steel in the world. As regards the manufacture of Swedish pig-iron it is, as has already been mentioned, chiefly based upon ores containing a minimum of phosphor, and charcoal as fuel. The supply of ore free from phosphorus can nowadays, especially through the introduction of Grondal's method, be said to be unlimited and the price of pig-iron is determined in the first place by the price of charcoal. Since, however, the waste wood obtained from the forests and saw-mills is becoming more and more used for the manufacture of cellulose, the supply of charcoal is being reduced and consequently its price has risen. The charcoal question is therefore of the greatest importance to the iron industry, and the most energetic efforts are being made to reduce the price of charcoal on the one side and to spare its consumption in the blast furnaces on the other. The coaling of the waste wood in furnaces instead of producing charcoal in heaps may be mentioned as an effort in the former direction. Charcoal heaps produce less coal than furnaces, besides which furnaces enable one to collect the by-products of tar, methylated spirits, wood-vinegar, etc.

On the other hand, as has already been mentioned, efforts are being made to reduce the consumption of charcoal at the iron works. Previous to the year 1900 all steel, even the simplest implements for home use, was produced from charcoal pig-iron whereas nowadays coke is beginning to be used as fuel at iron-works that manufacture steel for the Swedish market only. Thus in the year 1912, 86.000 tons of coke pig-iron were manufactured.

Electrical Developments

The most important step taken for the reduction of the consumption of charcoal dates, however, from the year 1910 when the electric blast-furnace, invented by three Swedes, Messrs. Lindblad, Stalhane, and Gronwall, was technically worked out at the expense of "Jarnkontoret", (The Institute for the advancement of the Swedish Iron Industry) so that it was then possible to introduce it into several Swedish ironworks. In this furnace only so much charcoal is consumed as is necessary for the reduction of the ore, while all the heat essential for smelting is supplied by electric power. About 1-3 h.p. is used per ton of pig-iron with an electrode consumption of 3 kg.

The consumption of charcoal at Swedish iron-works has, owing to the aforementioned measures, been constant during the last few years, while the manufacture of pig-iron has rapidly increased. The pig-iron, which is of the highest quality guaranteed to contain a maximum percentage of 0.020 phosphor and 0.010 sulphur, is used as raw material for tool-steel and especially for war-material (armor-plate, guns, etc.). Of the export of 1912 103,348 tons were shipped to England, 41,818 tons to Germany and 20,698 tons to France. Smaller quantities were exported to The United State of America, Italy, and Japan. As charcoal pig-iron of such an excellent quality cannot be produced in any other country, Sweden enjoys a certain monopoly of this special branch of the iron market.

Production of Wrought Iron and Steel

In Sweden, as in other countries, the production of wrought iron has for ages only been carried on in hearths with charcoal as fuel. The metal was prepared according to old German and Belgian principles after a system which is still to be found in Dannemora, where the world-renowned so-called Walloon iron, the purest wrought iron in the world, is manufactured. But at the commencement of the nineteenth century a new kind of blooming was introduced into Sweden from England, called the Lancashire hearth process, which compared with the Walloon process was characterized by a considerable reduction in the consumption of charcoal. These two processes are still used in Sweden for the production of large quantities of wrought iron known for its toughness, malleableness, and, in general, for its unusual low percentage of phosphor and sulphur. This wrought iron is chiefly sold for export, partly in the form of blooms, and partly in the form of rolled or forged bars. The highest qualities are used in England and Germany as raw material for the production of finest tool-steels.

DEVELOP BRITISH MINES

THE development of the mineral resources of Great Britain and Ireland, now being undertaken by a department of the Ministry of Munitions, under the direction of Sir Lionel Phillips, is likely to lead to far-reaching results. Sir Lionel Phillips is well known for his life's work in developing the mineral resources of South Africa, and is bringing his knowledge and experience to his task. A number of engineers of outstanding ability and position are also assisting the efforts of the department, and already considerable work has been done in furthering war purposes.

Control Wolfram Mines

Steps are being taken to control and expand wolfram mines, from which it is expected to produce a home supply of tungsten powder, an essential ingredient in the manufacture of high-speed steel. A complete survey of the lead resources of the country is also being carried out; new sources of supply being investigated and old working reopened. In one instance steps have been taken to assist in the drainage and development of an important lead mine from which there is a prospect of an immediate increased output.

Other Developments

Action is also being taken with regard to the production of zinc. A sulphur pyrites mine has been acquired, and certain low-grade copper deposits of considerable extent and promise are being carefully watched with a view to giving assistance in their working.

In the course of its immediate operations the department is gaining valuable information which will allow it to offer future suggestions as to the prospect of the normal base metal industry of the United Kingdom. It will also be enabled to report on the relative cost of home production against importation, and to advise as to the placing of the industry in the best position to meet emergencies.

B.C. COPPER OUTPUT INCREASE

THE amount of copper produced by smelting in the Province of British Columbia in 1916 was 65,379,364 pounds fine copper, valued at the average New York market price for copper at $17,784,494. These figures represent the amount of copper actually recovered, as nearly as it is possible to ascertain; the amount of copper really in the ore mined would be approximately twenty-five per cent. greater. This is the largest copper output in the history of the Province.

As compared with the year 1915, these figures show an increased production in amount of 8,460,959 pounds, or about 14.80 per cent., and in value the increase is $7,948,994, or 55.3 per cent.

The amount of copper produced during the year 1916 is the largest in the history of copper mining in the Province, the highest previous production, made in 1912, was 51,456,537 pounds, valued at $8,408,513.

Owing to this heavy demand for war purposes, principally for brass to be used in shells, the market price of copper increased steadily during the year. The year opened with copper at about 22.5 cents a pound in the New York market, and at the end of December it was 29 cents; the average price for the year was 27.202 cents, as compared with an average price of 17.275 cents in 1915. This higher market value of the metal assisted materially in raising the value of the copper produced, thereby greatly stimulating production.

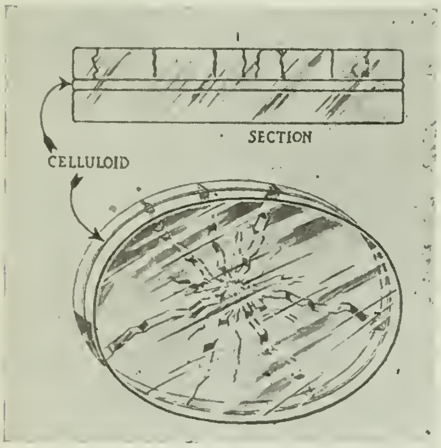
The large increase in quantity of copper produced this year is due to a greatly increased production from the coast district of some 7,000.000 pounds, largely from the Britannia mine, while the Granby Company's Hidden Creek mine, at Anyox, on Observatory Inlet, increased its production by about 2.000.000 pounds, says the B. C. Financial Times. The output from the Rocher Deboule mine, in the Omineca Division, was rather less than last year. The Trail Creek Mining Division and the Boundary District made very nearly the same production as last year; the output from Kamloops was greater, chiefly due to increased production from the Iron Mask.

NEW AND IMPROVED EQUIPMENT

A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

UNBREAKABLE GOGGLE GLASSES

A SAFETY glass, with a wide scope of applicability in connection with protective goggles and masks used by workmen where flying chips, the presence of gas, dust or unbearable light constitutes a hazard to the eyesight, has been developed by an optical firm. That it will appeal to machinists, foundry men, welders, sand blast operators, etc., can be gathered from the fact that, although the glass can be cracked, it cannot be actually broken even by a hammer blow, while in cracking there is no flying of splinters to jeopardize the eyesight of the wearer.



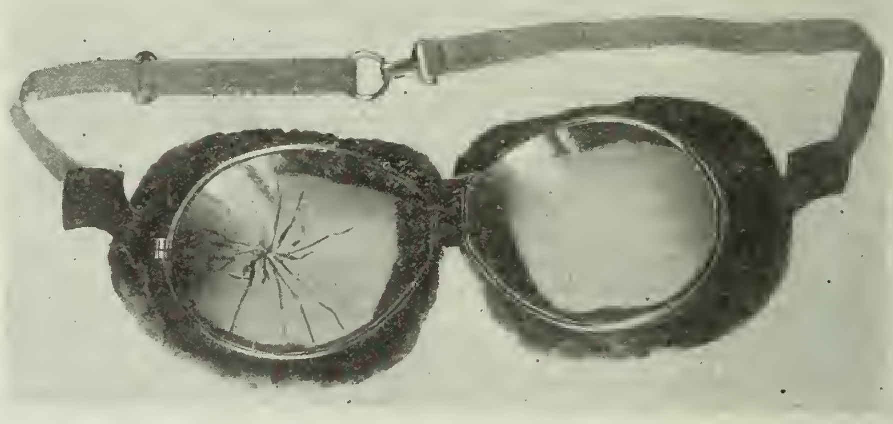
SKETCH SHOWING CONSTRUCTION OF UNBREAKABLE LENS.

"Resistal" is the trade name of the glass used in the manufacture of these safety goggles and masks, and its construction is made plain by the accompanying sketch. It comprises two layers of perfect optical glass, which may be plain or curved, with a layer of celluloid interposed, the whole being welded—not cemented—into a solid mass. The result is a crystal that has every virtue of the ordinary glass, with none of its dangers and drawbacks; it has at the same time all of the strength and safety features of the celluloid "light," but, unlike celluloid, it is unscratchable, is rigid, and absolutely fireproof. Neither is it affected by water, heat or cold, and the celluloid layer provides a heat-insulating medium which effectively prevents clouding up, due to moisture condensation.

Goggles fitted with these crystals are being offered in a variety of styles to suit individual tastes and needs, and in either clear, amber or euphos colors, by Strauss & Buegeleisen, 37 Warren Street, New York City. The firm also supplies the crystals in special forms for use in industrial masks. It is stated that these goggles have been adopted for the needs of the Aviation Corps, U. S. Army. while from the same quarter the makers have received orders for a large number of crystals for military gas mask purposes. The fact that the glass remains perfectly gas and water-tight even when badly cracked, makes it ideal for use in the latter application.

MECHANICALLY-OPERATED LADLE STOPPER

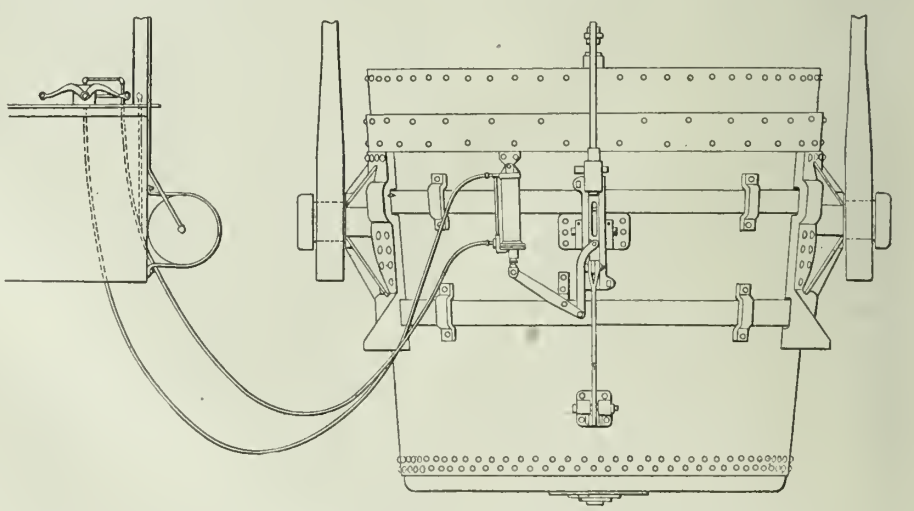
THE disadvantages of operating a ladle stopper in the usual manner in present practice are numerous, owing to the extreme heat of the molten metal, its liability to scatter over the operators and other causes, says the Iron Age. It is apparent that the ladleman and his helper standing on the platform adpositions, because the gases escaping, while the mold is filling, keep the metal in motion and eruption, frequently causing some to fall on the operators. Again, the operators are sometimes fatally burned by the metal escaping from a ladle overturning when a rope, chain, hook, or other part of the hoisting mechanism breaks, which is liable to occur at any time. It also occasionally happens after partly emptying the ladle, that the metal violently reacts, the escaping gas throwing the liquid metal to the roof of the building and rendering it extremely dangerous for the operators.



GOGGLES MAY HAVE THE OUTER GLASS CRACKED AND STILL THE LENS REMAINS INTACT WITH THIS PECULIAR METHOD OF LENS CONSTRUCTION.

A further serious objection is that not infrequently the stopper will only partially close the nozzle opening, due to imperfect construction, thereby allowing a stream of metal to escape when the nozzle is supposed to have been closed. The nozzle also occasionally breaks, owing to sudden expansion when the hot metal strikes it, causing a leak, so that while the ladle is being conveyed from mold to mold, the metal from a leaky nozzle striking the top edges of the molds, splashes upon the operators and frequently burns seriously.

To overcome these objections and obviate the necessity of employing ladlemen, George A. Wettengel has devised



PNEUMATIC APPARATUS FOR MECHANICALLY OPERATING THE LADLE STOPPER WHEN POURING STEEL.

an improved stopper operating mechanism in which the operation of the stopper is entirely under the control of the cranemen or the pusher, who is always a sufficient distance away to insure his safety.

According to U.S. patent No. 1,207,251, it consists of a mechanical means of raising and lowering the ladle stopper. Secured to the ladle and to one side of the usual stopper mechanism is an air cylinder, as shown by the illustration, the piston rod of which is connected to the sliding plate by means of a link and lever. Mounted in the crane cage is an air valve similar to those used on pneumatic hoists having flexible tube connections to the cylinder and to the air tank. The ends of the tubes have quick detachable hose connections. A tank is attached to the crane and is supplied with air from a motor-driven compressor. The operation of the device is as follows:

After the ladle full of molten metal is in place over a mold, the cranemen raises the lever of the air valve admitting air under pressure to the cylinder which raises the stopper thus admitting the metal to flow through the nozzle into the mold. When the mold is full, the lever is lowered so as to admit air into the opposite end of the cylinder, which lowers the stopper and stops the flow of metal. This is not only a safety device, but it is also a labour saver, no ladleman being required.

PATTERNMAKING NOTES

By J. W. Broadbent.

DURING a wide experience of pattern making, the writer has had numerous opportunities for observing the varied success attending the use of nearly every kind of wood used in the construction of patterns. Perhaps it has been the amateur, who, making his own simple pattern out of a packing case, has sent it to the foundry, and, outside a few strong words by the moulder has had produced for a few cents what would have cost as many dollars if placed in the hands of a competent pattern-maker supplied with the best of materials.

Wood Not Perfect

Until some material is produced which is less sensitive to atmospheric changes than wood, we must still use this material for patterns, and it is only by the skill and judgment of the pattern-makers that the tendency to warp and twist can be overcome.

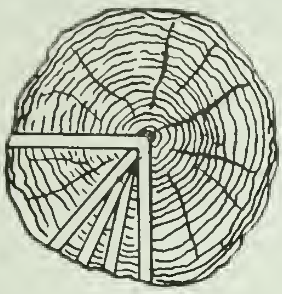


FIG. 1.

For general use, white pine is the wood which alone has stood the practical test and granted that good sound boards are obtainable, no better material could be desired.

It is soft, easy to work with, cutting tools, and comparatively free from liability to warp, and then again it is cheaper than the majority of woods. Boards under 12 or 14 inches in width should be discarded for pattern work, as narrow boards are hard and heavy, and more difficult to work, wherever wide boards are from trees of mature growth and farther away from the outside sap.

One of the first things to consider is that the wood must be perfectly dry and thoroughly seasoned, and the natural process of air drying is recommended in preference to kiln dried stock, provided that the wood is sheltered from the weather and that the air has free access to all parts of the plank. It naturally follows that in kiln dried wood the outside surfaces and ends of the board are dried more rapidly than the inside, producing a state that when the pattern is being worked and fresh surfaces are brought into contact with the atmosphere, the wood—released from the stresses of the outside surfaces—warps.

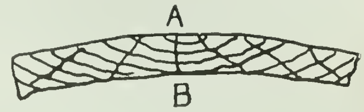


FIG. 2.

Cause of Warping

All timber is porous and in the living tree these pores which run lengthwise of the log, are filled with liquid; it is the evaporation of this liquid which seasons or dries the timber, consequently the ends of a board always dry first,which causes the ends to crack or check. For small and delicate patterns, a close grained wood, such as mahogany, should be used, for in a close grained wood the pores are smaller and moisture cannot

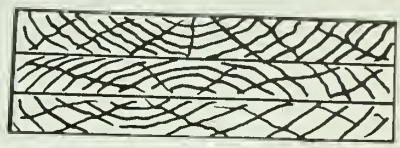


FIG. 3.

MECHANICS BUILDING, BOSTON, MASS., WHERE THE EXHIBITION OF FOUNDRY EQUIPMENT AND SUPPLIES WILL BE HOUSED.

enter so freely as in an open grained wood, and therefore is not so susceptible to the changes of temperature and humidity.

Mahogany is an excellent wood to use for patterns provided a good quality is obtainable, it is easy to work, is hard and strong, and takes glue and varnish nicely.

Most people, including many patternmakers, seem to connect quarter sawed lumber with hard woods, and look on it only as a means of showing the beautiful markings on the face of the board. This is not so, for we may get quarter sawed pine, which may be used to advantage in many patterns where there are no ribs or supporting pieces to hold the pattern straight.

Quarter Sawed Lumber

A quarter sawed board is cut from the log radially as in Fig. 1, and can be easily distinguished by looking at the grain on the end of the board.

There is considerable waste in cutting quarter sawed stock, which naturally makes the lumber more expensive, as only a few boards are sawed radially from each log, but when we consider the convenience of having a pattern keep its shape and stay practically straight during many changes of temperature or humidity, it is surely worth the little extra expense.

Under the best of conditions, a board will have a tendency to warp, as in Fig. 2, and unless one side is damp, the board will always curl away from the part nearest the heart of the tree, the reason being the side A is of older growth, and the cells are more compact than the side B, which is nearer the sap wood. As the wood seasons, it naturally follows that the newer growth with the more open cells, will dry and shrink faster than the side A, thus causing the board to warp in the manner shown.

Gluing Boards

When gluing two or more boards together they should be gluel as shown in Fig. 3, by placing two outsides or two insides together so that the tendency of one piece to warp will counteract that of the other.

Gluing boards together with the grain of one board at right angles to the other always proves unsatisfactory and should never be attempted with less than four pieces, for if the joints do not split altogether, the shrinking of the boards in opposite directions warps the whole in such a manner as to be practically useless for a pattern which is required to keep its original shape.

Fig. 4 shows a method often used where a fairly large flat surface is needed in a pattern where there are no ribs or other means of helping to keep the wood straight. A wide board is cut into narrow pieces and the pieces reversed and glued together as shown, the warping of the narrow pieces in opposite directions is so insignifiicant as to have very little effect on the shape of the whole.

FIG. 4.

MUST ECONOMIZE IN COAL

AN intimation that both Canada and the United States might have to be placed on "coal rations" was contained in a statement upon the fuel situation which Sir George Foster made in the House of Commons at Ottawa on Aug. 22, in reply to a question by W. E. Knowles, of Moose Jaw. This course might be necessary, the Minister of Trade and Commerce said, so as to distinguish between absolute necessary services and those not so necessary. Further, he stated a distinct call would have to be made to all interests to save coal just as food was being saved.

The Minister of Trade and Commerce said the production of non-anthracite coal in Canada last year was 13,800,000 tons. Of this over 6,000,000 tons came from the Maritime Provinces, chiefly Nova Scotia; 2,800,000 tons from British Columbia, 4,600,000 tons from Alberta, and a small quantity from Saskatchewan. This was not sufficient to meet the country's needs, and about 13,000,000 tons of bituminous coal had been imported from the United States. This represented the consumption with the exception of some 1,800,000 tons exported as bunker coal.

Import All Anthracite

As regards anthracite, Canada was entirely dependent upon the United States. Last year 4,500,000 tons of anthracite had been imported into Canada, 250,000 to the Maritime Provinces, 2,000,000 to Quebec, 2,000,000 to Ontario, and about half a million to Manitoba.

The total importation of fuel coal for domestic and industrial purposes was 17,500,000 tons, but stocks of anthracite in Canada were down about a million tons, which meant that for next year we were dependent upon the United States for 18,000,000 tons of coal.

As to the Canadian coal situation, Sir George could see no possibility of increasing the amount mined. There had been strikes and delays in the West, which had decreased the possible output, while in Nova Scotia the output had been decreased by shortage of labor due to enlistment and other causes. On the other hand, the war caused a very great increase in consumption in the Maritime Provinces. As a result coal which would in the ordinary way have gone to Quebec Province, from the Maritime Provinces would now be used there, and Quebec Province would have to import from the United States.

U. S. Coal Production

In the United States the normal production was 867,000,000 tons of anthracite, and last year the production was 509,000,000 tons of bituminous. As to the high prices and fear of shortage, Sir George said the war had caused a vast increase in coal consumption for industrial purposes, steel alone accounting for 40,000,000 tons. This had reacted on the railways, which were requiring 30 per cent. more for haulage than last year, which meant another 40,000,000 tons. In addition there had been a shortage of land haulage, while there was a shortage of water transport on the lakes due to the fact that war conditions had caused vessels to turn to more lucrative traffic.

There was need for co-ordinating the coal dealers and jobbers in Canada with a view to quick distribution of the coal when it arrived in Canada, and making arrangements for the supply, while on the other side the work of the Fuel Controller was to keep in touch with miners, transportation and so on, so as to secure adequate production.

COREMAKING BY WOMEN IN FOUNDRY IN BRITAIN.

"With present activities," said Sir George, "it is not impossible that both the United States and Canada will have to be put on coal rations so as to distinguish between absolutely necessary services and those not so necessary.

QUEBEC MINERAL PRODUCTION

THE annual report of the Mines Branch of the Department of Colonization, Mines and Fisheries of the Province of Quebec has just been issued. It covers the calendar year ending December 31, 1916.

This report, which is addressed to the Honourable Honore Mercier, the head of the Department, shows that the mining industry of the Province is in a healthy condition. The mineral production for the year in question amounted to a value of $13,287,024, which is the highest ever recorded, being an increase of nearly $200,000 over the previous banner year, 1913.

These results are all the more gratifying if we consider that the increase is wholly attributable to the products of the mines proper, such as asbestos, copper, cromite, magsestite, molybdenite, zinc, and lead, whereas the building materials, as stone, brick, lime cement, show decreases. Yet the total shows a marked advance as compared with previous years.

Besides the technical review of the mining operations the report goes fully into the statistics of accidents in mines, and the measures to be taken to prevent them. There has been a shortage of labor in the mines of the province which has been keenly felt and which has resulted in a very notable raise of the average wages.

The report also gives a full account of the results of an investigation of the mineral resources along the line of the Transcontinental Railway, between Hervey Junction and Doucet. The volume is carefully edited and well illustrated, and will be much appreciated by the interested public.

SPELTER AND SULPHUR

IN a paper published in England by the Society of Chemical Industry, H. M. Ridge points out that the main source of spelter today is zinc blende, which, when pure, contains 67 per cent. zinc and 33 per cent. sulphur, but generally contains also some sulphide of iron and other impurities.

The utilization of the zinc contents of the deposit of argentiferous zinc and lead ore at Broken Hill presented unusual difficulty, because of the presence of garnet and rhodonite of about the same specific gravity as zinc blende. This was first overcome by the use of the Wetherell electro-magnetic separator with an intensely strong magnetic field. The process, however, was too expensive to be able to compete permanently, and was superseded by the modern methods of flotation. To-day the whole of the zinc concentrates at Broken Hill are produced by flotation, but these methods have not, up till now, proved effective for separating fluorspar or carbonates from blende.

The usual method of separating the sulphur from blende is to roast the ore with a sufficiency of air to form zinc oxide and sulphur dioxide. If the sulphur has to be used for technical purposes the fumes must not be contaminated and diluted with fire gases. Constructional difficulties were encountered in the design of furnaces for this purpose. Muffled furnaces have to be used, in which the fire gases do not come into contact with the ore, and the heat units have to be passed through firebrick in order to maintain the heat while the last units of sulphur are being oxidized, and while any sulphates which may have been formed are decomposed.

THE BRITISH COAL DISTRIBUTION SCHEME

By Mark Meredith

THERE is not the slightest doubt that the British Coal Controller is to be congratulated on the scheme that is to be put in operation on September 1, for reorganizing the transport of coal by public railway for inland consumption in the British Isles. By arranging that coal shall be sent from pits in certain specified directions instead of in any direction there will result the enormous saving of not less than 700,000,000 ton miles per annum. Apart from the ensuing economy in labor and reduction in wear and tear of rolling stock, this means that some millions of tons of coal that would otherwise be required for locomotive use in what is now seen to be largely unnecessary haulage will be freed for national purposes: in addition wagons and locomotives will become available for use overseas is required. Special provision has been made for meeting cases in which certain particular descriptions and qualities of coal are required for special purposes, such as for automatic stokers, gas producers and coke ovens. Firms needing coal for use in these will receive certificates issued by the Controller of Coal Mines entitling them to specified supplies of the particular fuels mentioned in the certificates. These fuels will be provided by diversion, where necessary, from firms who have not received certificates. Anthracite is the only variety of coal not affected by the new regulations. Its occurrence is limited geographically speaking, and it has been found impossible to make it fit in with the scheme. It can therefore be distributed in any direction, as heretofore, in this respect resembling coal that is conveyed otherwise than by public railway from the colliery or is conveyed to a port for shipment. This latter exception affects London particularly since the greater portion of the coal consumed in the metropolis is water-borne. Over 170,000,000 tons of coal per annum, are involved in this scheme and of this quantity factories need 55,000,000 tons; mines, metal industries and chemicals, etc., also 55,000,000 tons; domestic consumption 30,000,000 tons, and railways 13,000,000 tons. No allowance is made in these figures for the 80,000,000 tons of coal required for export and bunkers, which is not affected by these regulations. There is only one point that need have further attention and it would be a good suggestion that an instruction should be appended to these regulations that no unpicked coal is to be transported from the pits to the consumers, for in a year thousands and thousands of tons of dirt are transported owing to the so-called economies now practised at the pit heads.

Screenings

Three young fellows were strolling along a country lane, and saw approaching them a very patriarchal-looking old man. Thinking to take a rise out of him, they accosted him thus: "Hail, Father Abraham, Father Isaac or Father Jacob." "Nay, my sons," the old man replied, "I am none of these, but rather Saul seeking his father's asses, and lo! here have I found them."

During the voyage of a great liner, a waggish Welshman was approached by a fellow-passenger, who said:

"We are getting up a tug-of-war between a team of married men and a team of single men; you are married, aren't you?"

"No," replied the Welshman, "I am only seasick; that is what makes me look like this."

For the first three years of their married life the wife's mother had lived with the young couple. Then, one morning, without even stopping to pack, hubby fled.

The young wife rushed upstairs and told the news to her mother. "I suppose some nasty low woman is responsible for his leaving you," said the latter.

"Yes, mother," said the sorrowing wife, "there was a woman in it."

"Her name?" demanded the good lady, palpitating like an enraged motor-omnibus.

"You, mother," came the whispered reply.

"Me? Well, I'm sure I never gave him any encouragement.

First Alderman—"Here's a fine looking street."

Second Ditto—"You're right; what's the best thing to do with it?"

"Let's have it dug up for a sewer."

"But wouldn't it be proper to have it paved first?"

"Of course; I thought you would understand that. Then, after it is paved and a drain put in, we'll have it repaved."

"All in readiness to be dug up again for the gas-pipe? I see you understand the principles of municipal economy. And after we have it repaved for the second time, then what?"

"Well, then it will be ready for widening. There's nothing I admire so much as system in the care and improvement of our roadways."

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Vol. VIII. SEPTEMBER, 1917 No. 9

PRINCIPAL CONTENTS

FOUNDRY TRADE OUTLOOK ENCOURAGING

MORE than ordinary interest should be displayed by Canadian foundrymen in the coming conventions of the American Foundrymen's Association and American Institute of Metals, with their accompanying exhibition of foundry and machine shop equipment and supplies. The outbreak of war just over three years ago found the machinery business in its various spheres of activity in a somewhat sickly condition, and while a revival, probably unprecedented in its history followed and is still largely being maintained, it cannot be said that foundry work has cut a leading figure. It is of course true that machine tool castings were in large demand, and such products as cast steel shell billets were no insignificant requirement. Gray iron castings are the backbone of the foundry industry of any country, and while these were the constituent of machine tool equipment to an abnormal extent, the fact remains that the call for such castings as the constituent of a myriad miscellaneous line of products was materially restricted.

Shell-making, to meet both its own requirements and those of its Allies does not begin to tax America's steel-making and machining capacity as it has done in the case of this Dominion. There are other directions, however, where the excess capacities can find an outlet, and while gun-making can lay fair claim to a share of the latter, it goes without saying that the realms of shipbuilding and marine engineering are quite broad enough to include a multiplicity of enterprise in their construction programmes. Both gray iron and steel castings are essentials of the twin industries, that of marine engineering more than shipbuilding, and in spite of the fact that general mechanical engineering, stationary steam and railroad engineering require castings—gray iron and steel, of exceptional quality, size and weight, it may be said that each of the latter features enters into ship and marine engine construction to much greater degree, besides having the additional accompaniment of casting requirements, where quality, size and weight are not necessarily so important from a manufacturing standpoint.

Shipbuilding and marine engineering so far as Canada is concerned are but in their infancy, but we should not lose sight of the fact that the prospects and possibilities are such as to transcend those of shell-making, and with the achievement of the latter still fresh in our minds, is there any reason why we should not only equal its accomplishment but go one better. The past thirty months has been largely in the nature of a machine shop display, and while for the next handful of years at least, this departmental feature is likely to lose little by way of comparison, let us not forget that the foundry is going to have its innings and must needs measure up to its confrere.

The production of marine engine and ship equipment castings is to a large extent new to foundrymen, both here and in the United States, under which circumstances there is all the more reason why the interchange of views made possible by such meetings and the Exhibition as are about to be held should be heartily welcomed. Canadian foundrymen have not participated as largely by personal representation in past years as they should, aside altogether from the period of the war. Now, however, being allied in a common cause, and filling, in addition, a common need, is there any good reason why aloofness should not be less marked on the coming occasion and for all time?

More than usually interesting business and social sessions and outings have been arranged by the Executive Council of the Associations, which taken in conjunction with the comprehensive display of foundry and machine shop equipment and supplies to be staged in the Mechanics' Hall, make it, from all angles, incumbent that every foundryman who can be spared from our shops, should make his headquarters in Boston for the week of September 24.

INDUSTRIAL NOTABILITIES

WILLIAM S. ATWOOD, assistant to vice-president and managing director, the Canadian Car and Foundry Co., and Canadian Steel Foundries, Montreal, Welland and Fort William, with head office in Transportation Building, Montreal, was born at Conneaut, Ohio, January 19th, 1876 son of Edwin and Marion Atwood.

He received his education in the Public and Correspondence Schools, and

WILLIAM S. ATWOOD.

came to Canada in January, 1902. Previous to joining the staff of the Canadian Car & Foundry and Canadian Steel Foundries, he occupied the positions of draughtsman with the Simplex Railway Appliance Co., Hammond, Ind.; mechanical engineer with same concern at Montreal; and mechanical engineer, the Dominion Car & Foundry Co., Montreal.

Mr. Atwood married Jessie A. Elliott, daughter of A. B. Elliott, April 7, 1897, the family consisting of one daughter. His Clubs are Engineers', and Country; his Societies, the American Society of Mechanical Engineers; Canadian Society of Civil Engineers; K. of P., and I.O.F. His recreations are golf and tennis, and in religious persuasion he is Methodist. The family residence is 225 Metcalfe Avenue, Montreal.

Photo courtesy International Press.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

ELECTRO GALVANIZING*

By W. E. Sharples.

THE electro-galvanizing industry is a development of the last twenty years for the protection of such articles as could not satisfactorily be galvanized by the hot dipping process. It can be applied to all classes of work, but it has its sphere chiefly in the

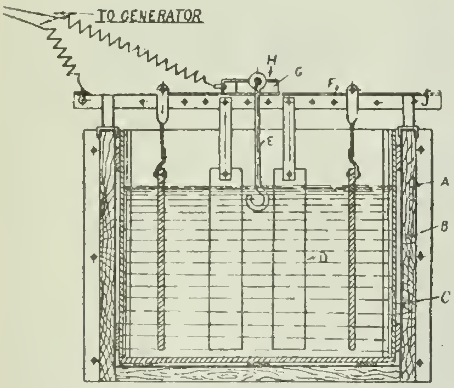


FIG. 1. ELECTRO-GALVANIZING BATH (SIDE ELEVATION).

protection of such articles as springs, screws, bolts, nuts and such things, which cannot be conveniently subjected to the temperature of the hot galvanizing bath. Consequently, this process has its advantages in the treatment of hardened and tempered goods and machine parts. It cannot, however, conveniently compete with the hot dipping process for such goods as sheets, tanks, boilers and the like.

The zinc coating is effected by electro-deposition from a bath containing zinc salts. The coating may be deposited upon metals such as iron, copper, etc., and although no alloy is formed between the zinc and the covered metal, the adhesion of same is complete, providing, of course, that care is taken to ensure that the surface of the articles to be treated is clean and bright. In the United States, this process has been given the commercial development above noted.

The equipment of an electro-galvanizing plant consists essentially of two departments, viz., cleaning and dipping departments. The cleaning department consists of sand blasting apparatus, suitable tanks for pickling, scouring and rinsing. The dipping department consists of suitable tanks for holding the zinc salts, copper conductors, anodes, low voltage generator, automatic devices if adopted, and rinsing tanks. If the class of work treated is very varied in character it will, perhaps, hardly be a commercial success to adopt automatic apparatus for the mechanical handling of the material, except it is done on a large scale. The surface of the zinc coating has not the smooth bright surface that is obtained by the hot dipping process, but has a matte or frosted finish.

*From paper read before Institute of Metals.

Preliminary Cleaning

The articles to be electro-galvanized must be, as before stated, thoroughly free from all cinder, scale and oxides. The cleaning of the articles can be very considerably speeded up by the process of sand blasting, practically eliminating the use of acids. The process may be carried out by means of the fixed type or a mechanical sand blast rolling barrel. The term sand blast is in its simple form a stream of sand and air at pressure. Under these conditions the sand gathers speed as it is carried along with the air, and thus striges the object with great force. The cleaning action of the blast is considerably greater when the jet is directed slantwise to the object than when directed at right angles. Great care has to be exercised in the making and choice of material for the sand blast apparatus, otherwise excessive wear will take place.

There are two systems of sand blasting—the suction and pressure systems—the latter is that most widely adopted. The former consists of a cast-iron nozzle with removable air tip, hard blast tip, air control valve and hose for conducting the sand. The mode of operating this type is to submerge the end of the sand hose in a receptacle containing sand, and then open the air valve. The action of the air flowing through the nozzle causes the dry sand to be ejected from the hard nozzle with considerable velocity.

The latter type is the pressure or single hose type, where the air is admitted to a closed receptacle containing sand under the same pressure as that to be used in the blast. There is a rinsing chamber into which the sand is fed through a suitable valve, the sand mixing with the air, which enters through a separate apparatus, the mixture being discharged through a single hose and nozzle. The core of the hose is generally made, in the better installations, of practically pure rubber. The air pressure used varies. In the more modern installations working between 10 and 70 lb. pressure per square inch the maintenance cost is not so great and apparatus is less bulky. A one inch hose and ¼-inch nozzle will consume approximately 70 cubic ft. at 60 lb. per square inch pressure. The men operating sand blasting apparatus should always wear some suitable protection for the eyes and respiratory organs, especially in the large sizes of apparatus, where the man actually enters the blast chamber.

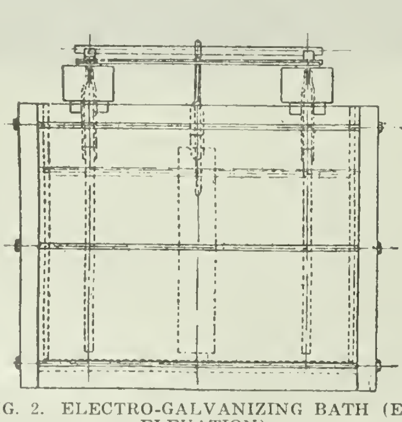


FIG. 2. ELECTRO-GALVANIZING BATH (END ELEVATION).

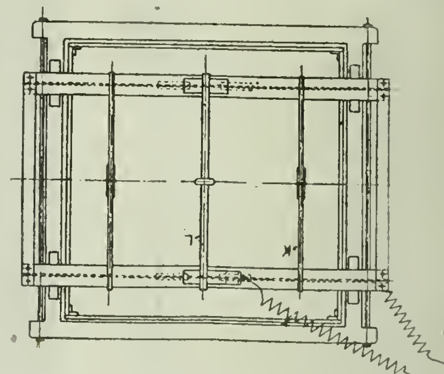


FIG. 3. ELECTRO-GALVANIZING BATH (PLAN).

In some cases diamond grit and steel chilled shot is being used, sinces these substances do not become disintegrated in the same way as sand, consequently they can be used many times before it becomes necessary to replace them. After the material to be electro-galvanized has thus been subjected to the action of the sand blast, it is put through the pickling process. Cold rolled material and malleable iron can be easily pickled, requiring but a mild solution of acid, but hot rolled metal requires a strong solution of acid owing to the hard scale. Cast iron is probably the most difficult substance to treat owing to the class of mixture, temperature at which it is cast, facing used, and burning in of the sand.

Pickling, Neutralizing and Rinsing Tanks

In the electro-galvanizing industry the pickling, neutralizing and rinsing tanks are usually made of timber. The reason for this is that owing to the articles having been subjected to the action of the sand blast, the scale etc., has nearly, if not all, been removed. Consequently they only require to be subjected to the action of a mild pickle to ensure perfect cleanliness, which is absolutely essential to the success of the process. These tanks are usually made of good quality cypress or pitch pine. If care is taken in the construction, there should be no necessity to line them with sheet lead. This latter method of finishing off a tank is very often seen, but nevertheless it is a very serious item in the cost of construction of the tanks.

Tanks used for holding acid solutions should be put together, for preference, with copper bolts and nuts although if one does not care to go to this expense a good substitute is obtained by using iron bolts well coated with tar. After the material has been treated in the pickling tank, it is passed forward to the neutralizing tank, to neutralize any acid left upon the surface of the article. The material is then passed forward to the scouring and rinsing tanks where any remaining traces of grease are removed. It is now ready for submerging in the electro depositing bath.

Electro-Galvanizing Bath

The electro-galvanizing bath is constructed of timber usually good quality cypress or pitch pine, in an exactly similar manner as the tanks used for pickling, neutralizing and rinsing.

The construction of this tank is clearly shown in Figs. 1, 2, 3. A is the timber tank, suitable bolted together with copper bolts and nuts for preference. Iron bolts and nuts may be substituted if well coated with tar or some good anti-corrosive paint.

B is the lead sheet lining, which, as one can understand, is the chief item of expense in the construction.

C is a secondary lining of timber; the object of fixing this lining is to protect the lead lining from puncture due to rough usage.

D are the zinc anodes which are suitably supported from the conductor bars F.

There are two of these conductor bars, one on each side of the tank. They are supported on, and insulated from, the tank by means of porcelain insulaters J. The zinc anodes D are supported upon the the conductors bars by means of copper or steel clips; in the case of those directly supported between the conductor bars, copper or steel rods (K Fig. 3), rests upon the bars upon which are slung the other anodes. The number of these anodes, of course, varies with the size of the work to be treated. The hook E is for supporting the work to be coated in the electrolyte. This hook is fixed on a rod L, Fig. 3, which is either made of copper or steel. The rod L rests upon copper plates H, Fig. 1, which in turn are insulated from the conductor bar F, by means of suitable insulators G. The two conductor bars are connected together by means of flat bars. One of the copper plates H, and the conductor bars F, have suitable connections, for the purpose of completing the electric circuit from the generator.

Attention is required to see that the connections are kept in a state of cleanliness so as to prevent any resistance to the flow of electric current through the electrolyte. The material is suitably supported in the depositing bath by means of bolts and hooks, the zinc anodes are then fixed round the article —as evenly spaced and distant from the article as possible. The zinc anodes are connected to the positive pole of the dynamo. and the material to be coated, or cathode, is connected to the negative pole of the dynamo. The current is now switched on, when the deposition will then begin to take effect. After the deposit of zinc upon the article has taken place to the required amount, the article is removed to the rinsing bath, where it is well rinsed. It is then transferred to the drying stools, where it is examined.

The electric current is generally derived from a dynamo driven by a motor, either belted or direct driven. A voltmeter, ammeter, and rheostat are required to control the voltage and amperes required for the varying classes of work treated. It is a convenience to have the dynamo and control apparatus situated as close to the electro depositing bath as possible, so that they may be under direct control of the operator.

The dynamos used in this class of work are of the low voltage high ampere capacity type, the capacity varying, of course, upon the class and quantity of work to be handled in a given time. opinions differ as to the voltage required, but it is a fact that a low voltage will give softer and tougher deposit than a high voltage. Some galvanizers use a voltage of 2 volts for light work, while others use 7 volts. If the work in hand is large a higher voltage is necessary, due to the resistance set up, owing to the size of the tank and the distance of the work from the anode. One square foot of exposed surface will require from 7 to 15 amperes, and will require approximately 30 minutes to deposit a coating of zinc weighing 1 oz. per square foot. Cast anodes are preferable to rolled anodes, as the structure is more crystalline and open, and is consequently disintegrated more easily under the action of the current. The anode surface should be about 30 per cent. greater than the cathode surface. The electrolyte or zinc solutions used in the depositing baths vary as to their contents. Below are given three representative electrolytes:

(1)—Zinc sulphate, 200 lbs.; sulphate of sodium crystals, 20 lb.; sulphate of aluminium, 10 lb.; boric acid, 3 lb.; water to 100 gals.

(2)—Zinc chloride, 125 lb.; ammonium chloride, 60 lb.; grape sugar, 10 lb.; water to 100 gals.

(3)—The following solution will give a very soft deposit which will stand bending: Zinc sulphate, 200 lb; ammonium chloride, 12½ lb.; sulphurlc acid, 3 lb.; water to 100 gals.

Attention should be given to see that the electrolyte does not become neutral, as this causes the deposit to become spongy. Consequently, the electrolyte should be periodically tested with blue litmus paper, which upon dipping the same in the solution should become red immediately. At the same time, to ensure there is not too much free acid in the solution, it should be tested by dipping in the solution a piece of Congo paper, which should not become blue when dipped.

There are a great many mechanical plating machines upon the market adapted for the coating of articles with zinc. These mechanical contrivances differ from each other in their construction and in the arrangement of the anodes. The class of work covered by means of these machines is very varied, some being made to deal with small articles in bulk, such as screws, tacks, etc., up to such articles as wire netting, tubes, etc.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers 1917-1918

President—T. Charles Orr, 281 Westmoreland Avenue, Toronto.
Vice-President—James Vallier, 701 Crawford Street, Toronto.
Sec.-Treasurer—Ernest Coles, P.O. Box 5, Coleman, Ont.
Sergeant-at-Arms — John Lougheed, 339 Lippincott Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner of Queen and Bathurst Streets, Fourth Thursday of each month, at 8 p.m.

Questions and Answers

Question.—In the manufacture of a brass cup shaped piece upon which we solder a small brass lug and a strip of tinned brass, we have experienced considerable difficulty in removing the discoloration caused by heat during the soldering operation. We find the removal of the tarnish by chemical means to be a rather expensive operation and as the elimination of even a portion of the present labor would be well worth accomplishing, we shall appreciate any suggestion which you may offer regarding the reduction of costs for this particular purpose.—A.R.W.

Answer.—The discoloration which you refer to may be prevented to a very great extent by the absorption of superfluous heat during the soldering operation. We are confident you will find preventive measures less costly and equally as satisfactory as the treatment necessary for removal of the tarnish by either chemical or mechanical means. Mix two parts of asbestos with one part of portland cement, in water to the consistency of mortar, or purchase ordinary prepared asbestos stove lining which contains fire clay in place of the portland cement, and mix with water in same manner. Fill one of the cup shaped pieces of brass with the asbestos paste. Form a small ring on one end of a short piece of ⅛ in. wire and insert the other end in the center of the asbestos, filling or plug. This wire is to be used as a means of handling the dried plug. Set the mould aside until dry, or drying may be hastened by slow heat, too much heat will crack the plug while drying. During the soldering operation the asbestos plug is simply placed inside the cup shaped piece of brass and the soldering operation is performed as usual. The asbestos plug will absorb the surplus heat and prevent the brass from becoming discolored. The soldering flux may have some effect upon the results obtained, therefore a good non-corroding soldering paste is prefer[illegible] and the brass will then require no subsequent treatment for removal of stains or tarnish. A sufficient number of the plugs should be made to enable the soldering operation to proceed continuously with cool plugs. This idea is now being used by manufacturers of munitions and is remarkably effective in reducing the cost of production. The material necessary is cheap and very little time is required to prepare a large number of plugs. The use of the plugs does not increase the cost of soldering as no extra time is consumed by inserting or removing the plugs. A trial will convince you of the practical value of this simple preventative measure. By using a rotating carrier, similar to a wheel in a horizontal position the soldering operation may be more rapidly effected as it is then possible to employ an assistant to insert the plug and place the small pieces in position for heating and soldering. The heating is effected by a gas flame on either side of the pocket for holding the brass cup and as the conveyer moves from the flame, it passes between two pipes from which a blast of cold air is forced upon the soldered articles. One man or woman proficient at soldering will, with the assistance of a boy or girl, easily solder 2,000 to 2,500 complete pieces in ten hours.

* * *

Question.—What solution can we use to produce a black smut on brass, which will relieve easily. We are using black nickel but it is too hard for relief work.

Answer.—Make a solution of sodium carbonate and water, with a density of 5 deg. Beaume. Mix a small amount of nickel carbonate and liquid ammonia, and add the mixture to the sodium carbonate solution until a slight grey deposit is obtained by use of weak electric current. Stir the solution thoroughly to facilitate a uniform solution. When a grey deposit is obtained, add small quantities of copper carbonate and ammonia mixed in same manner as the nickel carbonate, add the copper-ammonia mixture until a satisfactory black smut is produced. If the smut becomes too hard add more copper carbonate and ammonia. If too soft add more nickel carbonate and ammonia. You will find this formula will enable you to prepare a solution which will effect a great saving in time and material. It can be used on silver, brass, copper, nickel-silver for any purpose where a relief deposit is necessary. Keep the container highly covered when not in use.

* * *

Question.—How is sulphuretted hydrogen made, and how is it used to detect the presence of copper in a nickel solution.

Answer. — Procure a wide mouthed bottle and a tight fitting cork or rubber stopper, a small glass funnel with long stem, two pieces of glass tubing about four or five in. long and a foot or so of rubber tubing of a diameter to snugly fit the glass tubing. Cut two holes through the stopper and insert the funnel stem through one hole and to within about one inch of the bottom of the bottle, insert one of the glass tubes in the other hole in the stopper and only to about one inch below the stopper. Connect the latter tube to the rubber tubing and insert the second piece of glass tubing to the free end of the rubber tubing. This will form a cheap and efficient apparatus for the manufacture of sulphuretted hydrogen in small quantities.

To make the gas.—Place a small quantity of iron sulphide in the bottle, add water until the bottle is about one third full, then pour a little sulphuric acid in the funnel, do not allow the liquid in the bottle to reach the short tube.

To use the gas.—take a quantity of the nickel solution to be tested, in a beaker or small glass vessel and place the glass tube at the end of the rubber tubing, in the nickel solution and allow the gas to enter the solution. If the nickle solution is alkaline or neutral, add enough sulphuric acid to render it acid or until blue litmus paper is turned red when immersed in the solution. If the gas causes a brown precipitate to form, copper is in the solution. To remove the copper,—allow the gas to flow until precipitate ceases to form, allow to settls, filter and boil to expel all sulphuretted hydrogen, then neutralize with ammonia.

* * *

Question.—For several months past we have experienced great difficulty with some of our heavy castings after plating. These castings have deep back grounds and after being finished for a short time begin to show blisters on the portions which are not polished, these places are also dark; small brown spots appear, and the plate peels off, then rust spreads quickly and the surface finish is ruined. We have been told that our pickling method was responsible for the results, but as we have always pickled our castings, we hesitate in condemning this method of preparing grey iron castings for polishing and plating. Please give us your opinion regarding the question .

Answer.—It has frequently been said that work properly pickled is half polished. This statement is true to a great extent when referring to steel stampings, angle iron, brass and bronze castings, etc., but it does not apply with force to grey iron or malleable castings. "57 varieties of pickles" may be found in the various metal finishing plants as well as on the shelves of wholesale grocery show-rooms. Any pickling solution will have bad effects in the finished product where a back ground which cannot be polished is included. Some platers have very effectively killed the acid remaining in the pores of the casting, to some extent by treating the strong alkali solutions, but the results are always doubtful. Possibly this has been the case with your product heretofore, or perhaps those in charge of the solutions have become careless, or endeavored to economize and overstepped the limits. If hydrofluoric acid has been used we can only say that hydrofluoric acid has caused more trouble in the pickling room and subsequently in the plating room than any other chemical employed in the treatment of metal goods. Pickling at best is a dirty, sloppy, unhealthy task and we dare say you have experienced considerable trouble in keeping a man of even shadowy intellect at it long enough to get him trained to do the work uniformly well. There are two ways which we would suggest to overcome the trouble confronting you at present. Mill the castings thoroughly and scratch brush them. This method is still being employed by some very prominent stove manufacturers, but it is necessarily slow and expensive, valuable space is required for sufficient mill or tumblers and power for these is no small factor in the costs. Thus additional room, power and labor is required for scratch brushing. Therefore this method is not at all practicable for general use although as stated it is used by several firms. The more efficient and less expensive method is sand blasting. The first cost of installing a sand blast is not much greater than the cost of a pickling plant, and if the improved steel shot are used instead of sand, the work can be treated very quickly and at no greater cost than pickling or possibly at a lower cost, and the results both at the time of treatment and during continued use of the finished article, are not to be compared from the standpoint of durable, clean surface. Sand blasting is superior to pickling in many respects, smaller space is required for given amount of work, less power, greater cleanliness, larger efficiency, defective castings are easily detected, clean white back grounds are asserted, the pores of the metal are not charged with acids which may eventually ruin the casting as well as the finish, time and labor in filling and unloading mills is eliminated, there are no broken castings as a result of improper tumbling, no castings lost in pickle tank or ruined by over pickling and a clean uncontaminated surface is produced for the electro-deposited metal finish, the metal shot now employed for blasting permits of absolute safety, and removes 99 per cent. of the danger attending the use of glass sand. Our advice is. Throw your pickling solution in the sewer, and install a blasting apparatus, your finished product will then be a thing of beauty instead of a constant menace to your peace of mind.

WHEN glycerine is unobtainable the following is recommended as a flux for soldering Britannia metal: Olive oil, 500 grammes, tallow, 400 grammes. Melt and slowly stir in 250 grammes of powdered resin and bring the mixture just to a boil. All the mixture to cool, then stir in 125 grammes of a saturated solution of sal ammonia. Use when cold.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON

Grey Forge, Pittsburgh	$47 95	
Lake Superior, charcoal, Chicago	58 00	
Standard low phos., Philadelphia	87 00	
Bessemer, Pittsburgh	51 95	
Basic Valley, furnace	48 00	
	Montreal	Toronto
Victoria		.....
Hamilton	.....	.....

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$ 64 00
Antimony	20 00
Copper, lake	34 00
Copper, electrolytic	34 00
Copper, casting	33 00
Lead	13 00
Mercury	100 00
Nickel	50 00
Silver, per oz.	0 98
Tin	64 00
Zinc	11 00

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$22 00	$22 00
Copper, crucible	23 00	27 00
Copper, heavy	23 00	26 50
Copper wire	23 00	26 50
No. 1 machine composition	20 00	22 00
New brass turnings	16 00	19 00
No. 1 brass turnings	14 00	16 00
Light brass	12 00	10 50
Medium brass	16 00	16 00
Heavy brass	18 00	18 00
Heavy melting steel	21 00	17 00
Steel turnings	12 00	8 00
Shell turnings	12 00	12 00
Boiler plate	22 00	10 50
Axles, wrought iron	30 00	24 00
Rails	25 00	18 00
No. 1 machine cast iron	25 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	19 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	29 00	30 00
Mach. shop turnings	8 50	8 50
Cast borings	12 00	8 50
Stove plate	19 00	19 00
Scrap zinc	8 00	9 50
Heavy lead	10 00	10 75
Tea lead	7 00	7 00
Aluminum	30 00	35 00

COKE AND COAL

Solvay foundry coke	13 05
Connelsville foundry coke	14 00
Steam lump coal	7 25
Best slack	6 50

Net ton f.o.b. Toronto

BILLETS

	Per Gross Ton
Bessemer billets	$ 75 00
Open hearth billets	95 00
Forging billets	100 00
Wire rods	90 00

F.o.b. Pittsburgh

PROOF COIL CHAIN.

B

1/4 in.	$12 00
5-16 in.	11 50
3/8 in.	11 15
7-16 in.	10 90
1/2 in.	10 70
9-16 in.	10 70
5/8 in.	10 50
3/4 in.	10 40
7/8 in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, guaranteed	0 37
Babbitt metals	18 to 70
Putty, 100-lb drums	4 35
Red dry lead, 100-lb. kegs, per cwt.	15.45
Glue, English, per lb.	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	0 61
Linseed oil, boiled, single bbls.	1 49
Linseed oil, raw, single bbls.	1 52
Plaster of Paris, per bbl.	2 50
Lead wool, per lb.	15
Sandpaper, B. & A. list plus	20
Emery cloth list plus	33 1-3
Borax, crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular.	0 15
Wood alcohol, per gallon	2 15
Whiting, plain, per 100 lbs.	2 20

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$11 00	$11 00
Sheets, black, No. 10	11 50	11 50
Canada plates, dull, 52 sheets	11 00	11 00
Canada plates, all bright	12 50	12 50
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B. W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W. G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	12 70
Premier, 10¾ oz.	13 85	13 00
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$15 50
3-16 in.	11 70
1/4 in.	8 40
5-16 in.	7 40
3/8 in.	6 35
7-16 in.	6 35
1/2 in.	6 35
5/8 in.	6 35
3/4 in.	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard buishings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 50%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.50 to	$0.54
Cobalt	1.75 to	2.00
Copper	.40 to	.38
Tin	.68 to	.70
Silver, per oz.	1.05 to	1.00
Zinc	.16 to	.18

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .20
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, acqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper, carbonate, anhy	.50
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate.	.12
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, singl and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 50
Leather in sdes	1 35

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3 00
Polishing wheels, bullneck		1.70
Pumice, ground		.05
Emery composition	.08 to	.09
Tripoli composition	.04 to	06
Crocus composition	.07 to	.08
Rouge, powder	.30 to	.35
Rouge, silver	.50 to	.55

* Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	53 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x28 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base	64 00	60 00
Braziers', in sheets, 6x4 base	55 00	52 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in. rd.	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamlss	0 58

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor Oil, per lb.	40
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	50

The General Market Conditions and Tendencies

Toronto, Ont., Sept. 4.—The machinery exhibit at the Canadian National Exhibition, now being held here, is in general character similar to that of pre-war years. There are no exhibits showing munitions machinery or equipment exclusively, and in this respect it is in line with the last developments in the machine tool business. An interesting feature, and one showing possibilities of considerable development, is the exhibition of farm tractors. These are being used extensively now, and are bound to become more popular as they improve in design and workmanship.

Steel

The situation in the iron and steel trade is practically unchanged from last month, and prices continue stationary, with a weaker tendency. It is understood that some progress is being made in regard to the adjustment of the embargo on steel from the United States, but no announcement has been made regarding the progress of negotiations. No official statement has been given out from Washington concerning the U.S. Government price fixing policy, although a public announcement of maximum prices for various grades of steel from certain mills is expected shortly. It is believed that steel prices will be fixed by the War Industries Board on a cost-plus-profit basis, but whether or not this will be extended to include steel for private consumers is not known. In the meantime the market is unsettled, with new business almost at a standstill. Consumers are buying as little material as possible in the hope of lower prices, and are waiting until the situation clears up. There is still a shortage of steel, but some relief is looked for now that the mills have more tonnage available for domestic requirements. This will also to some extent relieve the tight situation caused by the embargo. The Canadian mills with their increased capacity will be in a better position than ever before to supply the demands of the home market. Production has shown an increase lately on account of the cooler weather, but the coke situation continues to cause considerable anxiety and the steel output may be curtailed because of this unless supplies of coke can be steadily maintained, which at the present moment appears rather doubtful.

In the United States market, demands for war purposes, and particularly for shipbuilding, are more than sufficient to keep all steel producers working at the limit of capacity. There is not enough steel to meet all demands, and with Government and Allies requirements having to be filled before the private consumer can participate, the latter has to take what he can get. Private enterprise is consequently considerably restricted. For this reason, and because of the prevailing high prices, domestic business is slow. The trade is waiting developments at Washington, and until the price fixing policy is settled no important change in the situation is anticipated. Prices continue to show an easier tendency, particularly on semi-finished material, and further declines are looked for. Production is being curtailed because of lack of men and shortage of raw materials. There is a serious deficiency in supplies of pig iron and semi-finished steel at some important plants. The sheet market continues active, with buying principally for U. S. Government account. Prices in the home market are unchanged.

Pig Iron

The situation in the domestic pig iron market is unchanged, and prices of foundry iron continue nominal at $60 a ton. Considerable difficulty is being experienced in getting coke in sufficient quantities owing to the scarcity of cars. On the other side of the line there is a heavy demand for pig iron, and the furnaces are having difficulty in completing contracts. Deliveries are somewhat delayed, but production is improving with cooler weather. Coke production is increasing, but shortage of cars is holding prices firm. The trade is expecting an announcement from Washington within a short time as to the price at which coke is to be sold. In view of possible Government control of the coke market, lower prices are anticipated.

Scrap

The market for old materials continues quiet at unchanged prices, but a moderate recession in values is likely, particularly in copper and brass. Steel and cast iron scrap are in good demand and the prices have been well maintained on the basis of last week's quotations. Supplies of shell steel turnings now considerably reduced in volume are being readily absorbed with prices showing a firmer tendency. The new steel plant at Ashbridge's Bay is using considerable of this material and dealers' stocks are not by any means, as heavy as they were a few months ago.

Machine Tools

The past week has been fairly quiet in the machine tool trade in regard to sales, although the Machinery Hall at the local exhibition has been the centre of considerable activity. The trend of events in the trade is reflected in the exhibits as there is comparatively little machinery or equipment being shown that would be required exclusively in the manufacture of shells. In this respect the exhibits follow more along the lines of pre-war times than last year.

Supplies

Although there has been lately some falling off in demand for machine shop supplies, business continues in steady volume. The difficulty now is to obtain goods promptly and dealers are obliged to place their orders well ahead which means carrying considerable stocks. Prices on all lines are holding very firm with advances on some goods. Due to recent advances in the price of Mid-Continent oil to $2.00 a barrel, there is a firm situation in the refined products such as gasoline, benzine, and coal oil. The heavy consumption is an additional factor that is giving firmness to the market. Prices of gasoline and benzine are unchanged.

Metals

Comparatively little interest is being displayed by consumers in metals and the markets are quiet. The reason for the lack of interest is the uncertainty surrounding the United States Government's attitude with regard to prices. There is some apprehension in the trade in regard to future developments and the markets are consequently easier although prices are unchanged in the meantime. The local situation is unchanged from last week and the market continues somewhat unsettled.

Copper.—The market is neglected and no business of consequence is now offering. Production is the U.S. is being seriously interfered with by labor troubles at the mines, some of which are said to have closed down. The larger producers are practically out of the market and there is some fear that the supply will be insufficient to permit copper to be used for any purpose other than for munitions and war equipment. Prices are entirely nominal and unchanged, lake and electrolytic being quoted at 34c and castings at 33c per pound.

Tin.—The market is quiet with no feature of particular interest to note. Business is dull owing to uncertainty in the situation in London, where the market has been subject to considerable fluctuation. Local price 64c per pound.

Spelter.—The spelter situation continues unsettled and the market has an easier tendency. It is said that production has fallen off considerably on account of the inability of producers to sell spelter at a profit at current prices. Local price 11c per pound.

Lead.—The market is very quiet but has a fairly strong undertone and prices are holding steady. Consumers are keeping out of the market pending developments at Washington. Local situation at 13c per pound.

Antimony.—The market is still quiet and prospects are not too bright for immediate improvement. Prices are unchanged at 20c per pound.

Aluminum.—Little interest is shown in aluminum and the market is rather unsettled with an easier undertone. Price 64c per pound.

Foundry Supplies and Chemicals

Prices of foundry equipment have not as yet shown any indication of coming down, although the expected decline in cost of raw materials will ultimately be reflected in finished goods. Lower costs, however, will not immediately follow recessions in raw materials as other factors have to be taken into consideration. Increased operating charges, including higher wages than formerly obtained, will tend to keep manufacturing costs up and consequently prices of machinery and equipment will be maintained at high levels for some considerable time. The foundry trade is quite active, particularly the steel casting end of the business. This in itself will tend to hold prices firm until such time as the demand begins to fall off which, in view of the favorable trade conditions, will not be just yet. As a general rule, however, prices are not advancing to any marked extent, but continue to hold firm. While the crest of prices of chemicals has doubtless been reached, conditions are such that no important declines may be looked for as the demand is still active and indications point to a continuance of existing conditions for some considerable time. Prices generally are holding firm with no changes to note.

READERS QUERIES

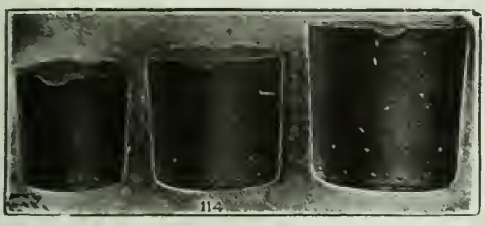
WHAT percentage of scrap should be used in machinery castings to have just the right grade of grain to work well on lathe?

Is scrap in too large quantity supposed to harden grain of casting to a great extent?

Does coke, when not well proportioned, affect much the quality of casting?

What is the difference in grade of casting when cast very hot, and just hot enough to run well?

What is the best mixture to obtain good grade castings for lathe work, in a 24-inch cupola.—K.P.



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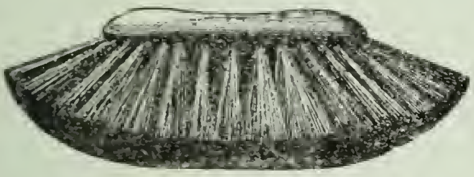

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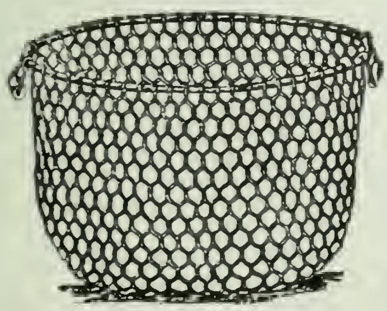

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INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

Walkerville, Ont.—Fred F. Ferguson, of St. Thomas, Ont., will establish a grey iron foundry here.

The St. Maurice Foundries, Ltd., has been incorporated with a capital of $49,000 to carry on a foundry business at Three Rivers, Que.

R. B. Bennett, of Tacoma, Wash., has been appointed consulting engineer for the Ladysmith Smelting Corporation, Ladysmith, B.C.

Shawinigan Falls, Que.—Church, Ross & Co. of Montreal, have been awarded the contract for erecting a factory for the Canadian Aloxite Co. F. T. Tone is manager of this concern.

Owen Sound, Ont.—At the regular meeting the Town Council unanimously endorsed the new steel industry by-law after several amendments had been proposed. It was also decided to hold the election on the by-law on Sept. 15.

Copper Cliff, Ont.—The Canadian Copper Corporation will increase its capital stock to $10,000,000. The new capital will be used to develop the property, and will include the erection of a 3,000-ton mill.

Hamilton, Ont.—General contract for the Steel Company of Canada's coke oven plant to be erected here has been awarded to the Wilpute Coke Oven Corporation, New York. The cost will be about $1,500,000.

Thomas Peck president of the Peck Rolling Mills, Montreal, died at Kennebunk Beach, Me., on Sept. 5, aged 75. Mr. Peck had been associated with the steel business all his life and had been president of the concern for the last five years.

C. Royer, for several years manager of the L'Air Liquide Society, Montreal, has severed his connection with the firm. He contemplates starting as a consulting engineer in the oxy-acetylene process of cutting and welding in general engineering practice.

C. Wheeler, for the past two years general superintendent of the St. Lawrence Iron Foundry, and also the St. Lawrence Machinery Co., recently incorporated, has resigned his position. The strenuous work of the past year has necessitated Mr. Wheeler taking a well-earned rest.

Sault Ste. Marie, Ont.—The blast furnace which the Algoma Steel Co. have removed from Midland, will when erected have an approximate capacity of 400 tons of pig iron per day. The company have recently installed a 75-ton open-hearth furnace, which will bring the steel making capacity of the plant up to 50,000 tons of billets per month.

Fred S. Ferguson, manager, and **Thomas Charlton**, foundry superintendent of the Canada Iron Corporation, St. Thomas, Ont., have resigned, and will open the new plant of the Standard Foundry & Supply Co., at Walkerville, Ont. They were each presented with a club bag by the employees of the Canada Iron Corporation last Saturday as a token of regard.

Ottawa, Ont.—Potash has been discovered at Muskoka Lake, Ont., and the Salts and Potash Co. of Canada (of Toronto) have been granted permission on the application of J. Ogle Carss, to divert water from the lake to extract the potash, and also to lease vacant Dominion lands abutting on Muskoka Lake in connection with the recovery and utilization of the potash and other minerals.

John Watson & Son of Montreal, Ltd., Montreal, Que., have recently secured contracts for metal and architectural iron work for the following buildings. The new Toronto Terminal station; C.N.R. station at Montreal; American Can Co. factory, Montreal; power house at Lennoxville, Que.; John Aird's bakery at Montreal; Consumers Cordage Co., Montreal, and the new office building for the greater Montreal Land & Investment Co.

Acquire New Plant.—Owing to the increasing volume of business, the St. Lawrence Welding Co., of 138 Inspector Street, Montreal, have acquired a new plant at 39 Olier Street, where they intend to handle all their heavy work, a feature that is now a large portion of their general output. The shop at 138 Inspector Street will be retained to take care of small welding repairs. In addition to the new plant of 100 by 24 feet, a new section, 25 by 40 feet, has been built, to be used as a brass foundry, work in this portion to be commenced in the near future.

Algoma Steel Co.'s Output.—The output of the Algoma Steel Corporation, Sault Ste. Marie, Ont., for the year ending June 30, was 348.519 tons of pig iron and 280,296 tons of finished steel. The output consisted of shell steel, together with rails and merchant bars. Operations have been largely governed by the requirements of the Imperial Munitions Board, which has regulated the distribution of the company's product. Throughout the twelve months somewhat difficult conditions have prevailed, especially as regards labor and materials, the deliveries of the latter having been seriously hampered. Especially was this the case with coal, the bringing in of which on account of car shortage necessitated continued and expensive importation throughout the winter months after the close of lake navigation. Conditions have improved somewhat, but materials are generally and necessarily more difficult to obtain, whilst deliveries are only obtainable far ahead.

U. S. Company for Greaves-Etchel's Furnace.—T. H. Watson & Co., Sheffield, England, who control the patents of the Greaves-Etchells Electric Furnace, announce the formation of an American company to handle the furnace business in the United States and Canada. The new company will be known as the Electric Furnace Construction Co., with head offices in the Finance Building, Philadelphia. The Greaves-Etchells furnace is well known in the Sheffield district, and other parts of England, and over thirty furnaces ranging in size from ¼ ton to 12 ½ tons capacity have been contracted for, including special Government equipments. Frank Hodson, a partner of the T. H. Watson & Co., is now in the United States arranging the details of the new company, and will act as its president. F. J. Ryan, who resigned as Eastern manager of the Snyder Electric Furnace Co. on June 1, will be general manager. The two inventors, Mr. Greaves and Mr. Etchells, will act in associate capacity to the company's technical staff and when necessary will take charge of actual installation.

CATALOGUES

The Webster and Perks Tool Co., Springfield, Ohio, have for distribution in the trade a useful pocket calculator for use in connection with grinding operations. The calculator is a celluloid device containing a sliding card with tables on each side. On one side of the calculator is a table of circumferences and a rule for obtaining surface speeds of abrasive wheels, while on the other side is a table of grinding wheel speeds with rule for finding revolutions at a given surface speed.

Electric Travelers.—Catalogue No. 130, issued by the Whiting Foundry Equipment Co., Harvey, Ill., describes the various types of cranes built by this firm, showing the latest improved construction. While this catalogue deals chiefly with electric traveling cranes, a variety of other types are also featured, which includes cranes for every service. Crane trolleys, bridge trucks and other parts of the electric traveller are illustrated and described covering the principal features while details of other types of crane are also dealt with. A large number of excellent half tones show the several types of crane in operation featuring the wide field of application for this company's products. The concluding pages 74 to 79 are devoted to the Whiting line of foundry equipment and railroad specialties. The catalogue contains 81 pages and includes a list of some recent users of Whiting equipment.

BOOK REVIEW.

The Canadian Mining Manual 1916-17. by Reginald E. Hore, Editor of the *Canadian Mining Journal*, 448 pages 6 in.

x 8¾ in. Published by The Canadian Mining Journal, Toronto. This is the third volume of the new series of this useful and popular handbook of information concerning the minerals and mines of Canada. The publication of the handbook was delayed in order to deal more fully with developments in 1916. Reports covering this period were not available until some months after the close of the year and advantage was taken of this delay to incorporate considerable information covering the early months of 1917. The information contained in the manual will doubtless appeal, to those interested in the subject, more at this period than formerlly owing to the greater interest that is being taken in the minerals of Canada as a result of the war. The need of developing our mineral resources is becoming more apparent and any literature that will assist towards this end will be received with greater interest on this account. The publishers have, as in former years, freely used extracts from government publications, company reports and technical journals, etc., which fact guarantees the accuracy of the data contained in the volume. The manual covers all the various phases of mining activity in Canada and contains much useful information on the various minerals found in this country, including location of the mines, physical properties of the minerals and methods of mining, etc. The sections covering coal, copper and nickel are of particular interest at this time. A list of mining companies and their product is a useful feature of this publication. The manual is fully illustrated and is bound in attractive red cloth covers.

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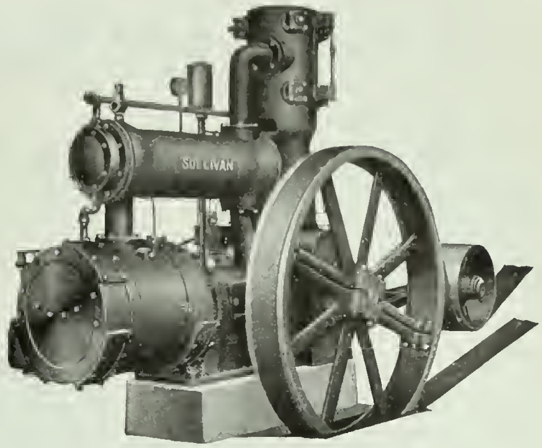

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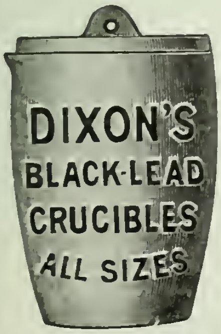

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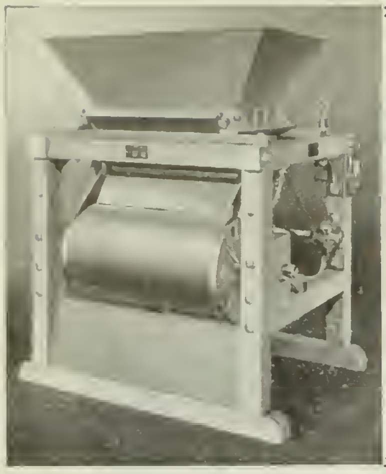

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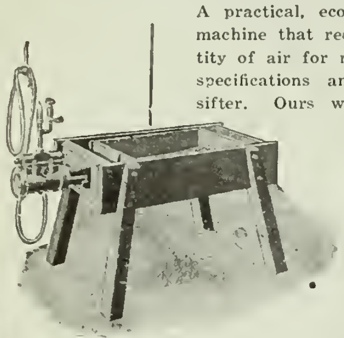

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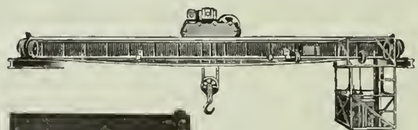

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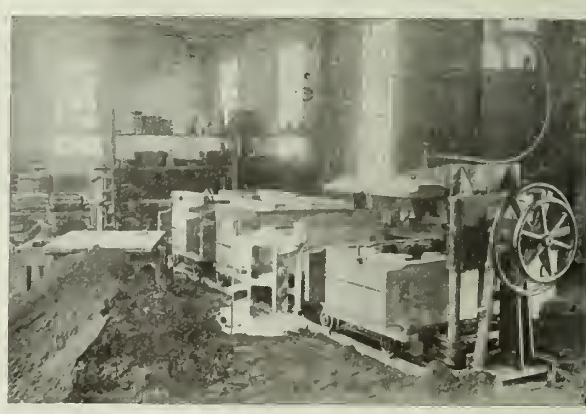

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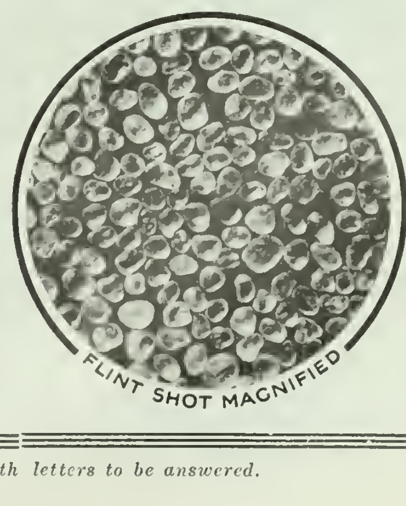

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Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Seidel, R. B., Philadelphia.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Ltd., Walkerville, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.


Quality
Service
STEEL & IRON
PRODUCTS
OF
Every Description
THE
STEEL COMPANY
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CANADA
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DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Sly, W. W., Mfg. Co., The, Cleveland, O.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

ENGINEERS, FOUNDRY, MECHANICAL, ELECTRICAL
Chase, Frank D., 122 S. Michigan Ave., Chicago Ill.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Brodin Pattern & Supply, Ltd., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, WAX AND PAPER
Brodin Pattern & Supply, Ltd., Chicago, Ill.

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
MacLeod Co., Cincinnati, Ohio.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Eng. & Mfg. Co., Baltimore.
Obermayer Co., S., Chicago, Ill.
P. & O. Supply Co., Milwaukee, Wis.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MAGNETS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
Hyde & Sons, Ltd., Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.
Vickers, Charles, 712 Cedar Ave., Niagara Falls, N.Y.

MIXERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Machine & Fdry Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
P. & O. Supply Co., Milwaukee, Wis.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

PULLEYS, MAGNETIC

Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

RAMMING PLATES AND MACHINES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RAPPING PLATES

Federal Malleable Co., West Allis, Wis.

RESPIRATORS

Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.

RETORTS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RESIN

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE

Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES

Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES

Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY

Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT

Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Whitehead Bros. Co., Buffalo, N.Y.
U. S. Silica Co., Chicago, Ill.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
U. S. Silica Co., Chicago, Ill.

SAND CONVEYING MACHINERY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST ASSORTERS

MacLeod Co., Cincinnati, Ohio.

SAND BLAST MACHINERY, BARRELS, ETC.

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL

Harrison Supply Co., Boston, Mass.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.

SAND MOLDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST ROOMS

MacLeod Co., Cincinnati, Ohio.

SAND BLAST CABINETS

MacLeod Co., Cincinnati, Ohio.

SAND BLAST ROTATING TABLES

MacLeod Co., Cincinnati, Ohio.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.

SAND SIFTERS

Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont
Woodison, E. J., Co., Toronto, Ont.

SEPARATORS

Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS (MOISTURE AND OIL)

Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.

SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.

SHOT, FLINT

U. S. Silica Co., Chicago, Ill.

SIEVES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED

Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES

Can. Hanson & Van Winkle Co., Toronto, Ont
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE

Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS

Can. Hanson & Van Winkle Co., Toronto, Ont
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS

Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES

Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS

Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg.

TORCHES

MacLeod Co., Cincinnati, Ohio.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENTILATING SYSTEMS

Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.

VENT WAX

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WELDING APPARATUS, OXY-ACETYLENE

MacLeod Co., Cincinnati, Ohio.

WELDED PRODUCTS

P. & O. Supply Co., Milwaukee, Wis.

WHEELS, GRINDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

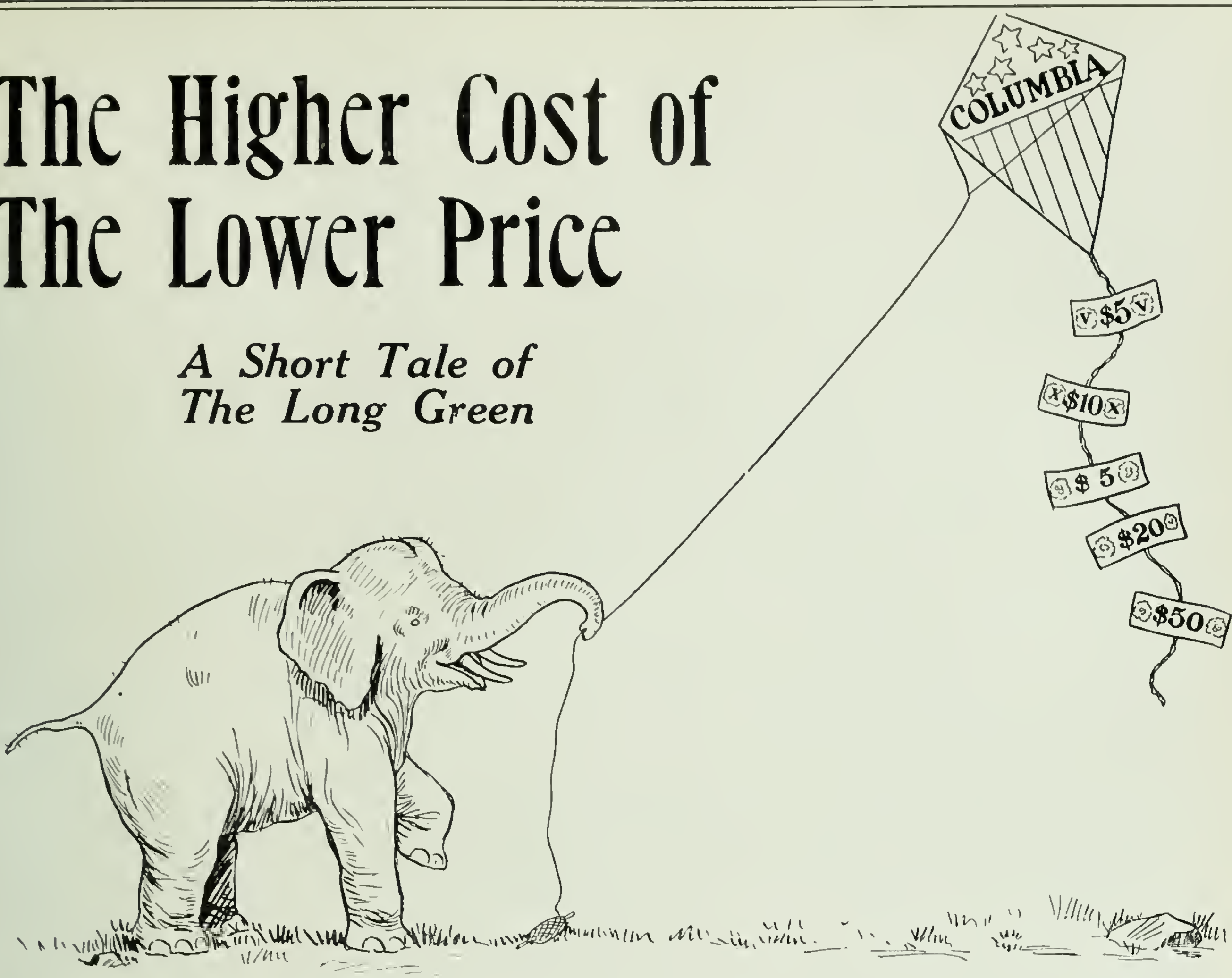
WIRE, WIRE RODS AND NAILS

Can. Hanson & Van Winkle Co., Toronto, Ont
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

ADVERTISING INDEX

The Higher Cost of The Lower Price

A Short Tale of The Long Green



COLUMBIA Parting is a Parting that is really super-excellent. I originated both the product and that combination of words.

The basic material of Stevens Columbia Parting weighs 76 lbs. to the cubic foot and sells for $1.90 per cubic foot.

The heavier basic materials of other partings weigh 107 lbs. upwards to the cubic foot and cost anywhere from $2.14 to $3 per cubic foot.

You buy Parting by weight and use it by measure. Why pay $2.14 to $3 per cubic foot for the ordinary Parting when you pick the world's best for $1.90?

Again I use a very large barrel and pack it to the top. It is so light in weight that full to the top it weighs only 350 lbs. Smaller barrels, containing heavier partings, weigh 400 lbs. or over.

If heavier partings should be offered at $\frac{1}{2}$c to $\frac{3}{4}$c lb. less than mine, all the above shows conclusively that there is such a thing as the higher cost of the lower price. Send for my booklet telling how to speed up and make money faster with Columbia Parting. Or, better still, send for a trial barrel—sent on approval if desired.

I sell other things about which there is no guesswork as to economy with thrifty buyers—Stevens Pure East India Plumbago—King Kore Kompound—Carbon Blacking—Core Oils—Core Gum.

Stevens Tripoli Compositions, Sub-Felt and Spanish Felt Wheels, Turkish Emery, Glue, and other supplies for particular platers.

All Stevens Specialties are especially good.

FREDERIC B. STEVENS

Manufacturer Foundry Facings and Supplies, Buffing Compositions and Platers' Supplies

FACING MILL: Corner Isabella Avenue and M.C.R.R.
WAREHOUSE and OFFICE: Corner Larned and Third Street

DETROIT, MICHIGAN

EXPORT WAREHOUSE: Windsor, Ontario

BRANCH: Hoosier Supply Co., Indianapolis, Indiana

NEW ENGLAND BRANCH: Frederic B. Stevens, Corner Water and Olive Streets, New Haven, Conn., E. E. Seeley, Manager

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, OCTOBER, 1917 No. 10

The Publisher's Page

TORONTO October, 1917

Measuring Direct Returns

EVERY advertiser is entitled to know what he is getting for his money.

Every publisher is anxious that his paper shall be credited with the returns which it produces.

Yet the fact of the business is that it is next to impossible to trace all of the results of advertising. Direct returns as a measure of the value of space are therefore inadequate, and fail to indicate the accomplishments of the advertising.

This is indicated in a particularly convincing way by the experience of a well-known book publisher, whose business is handled entirely by mail, and is therefore altogether the product of advertising.

All ads published are keyed; direct advertising is likewise watched carefully, with special key numbers, so as to enable the publisher to note the percentage of returns from each piece of advertising sent out.

In spite of all this, however, the business which can be definitely attributed to specific forms of advertising is only about fifty per cent. of the total.

In other words, at least half of the business cannot be credited at all, and yet without any question it is the result of advertising, because all of the business of the house is secured in this way.

As a result of his experience, this book publisher now multiplies the direct results of advertising by two in order to get a line on the complete results.

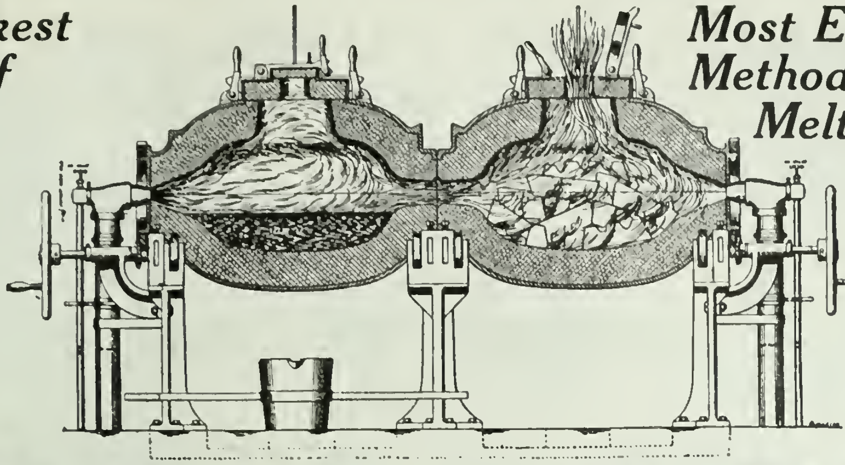
Most advertisers in other fields would probably be able to use a larger multiple, especially if they have salesmen and are following up their advertising in other ways, because in that event the situation is complicated by the opportunity for personal solicitation to interpose and take up the work where it was left off by the printed advertisement.

Consequently, when an advertiser says he didn't get results, an analysis of his business would probably demonstrate that results were secured, but were not credited to specific media.—*Class.*

The Quickest Method of Melting

Most Efficient Method of Melting

Melts Brass, Bronze and Aluminum



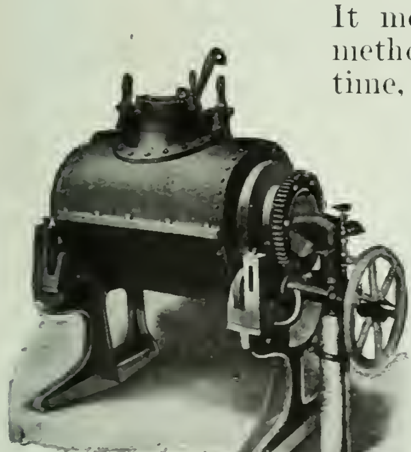
Melts all Non-ferrous Metals

MONARCH

Double Chamber Melting Furnace

Decide to Invest now! Haven't you been thinking of investing in a "**Monarch**" **Double Chamber Melting Furnace,** for a long time but have been putting off this thriftwise event for no particular reason. You can't afford to delay any longer with the cost of production hitting the high spots and still going up.

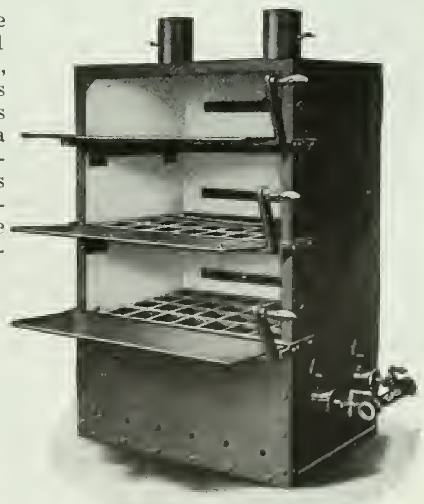
It melts faster and more efficiently than the crucible method. You can melt two classes of metal at the same time, each chamber is independent of the other. But you can have it made a continuous melter if you so wish —made according to order. One chamber can be operated by gas while the other is operated by oil if it proves an advantage. Upkeep and repair costs are remarkably low.



Monarch Rockwell Single Chamber Furnace—"Simplex"

All furnaces shipped guaranteed and are built in sizes from No. 1 to No. 4. No. 1 has a total melting capacity of 600 lbs., No. 4 over two tons per heat. This is only one of our many types of furnaces and at the same time, we manufacture a Simplex single chamber, without crucibles, (all capacities and fuels), as well as complete line of Crucible types for Reverberatory, Soft Metal Melting, Core Ovens, Pumps, Blowers and miscellaneous foundry equipment.

Send for Catalog C. F. 10, 1917

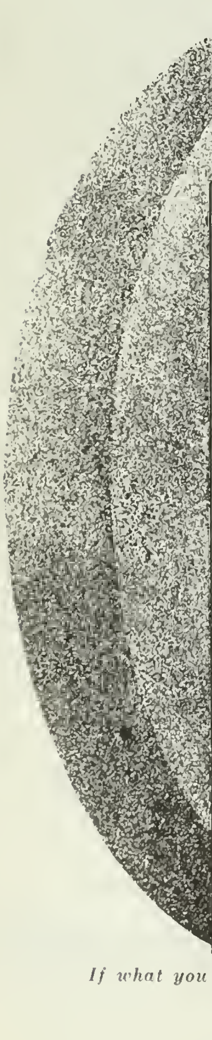


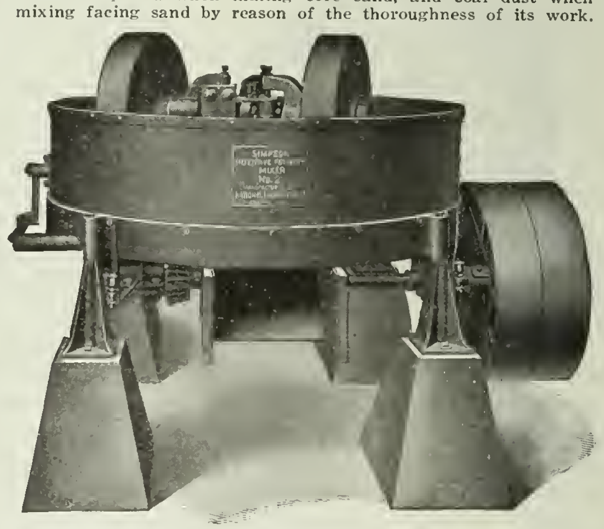
Arundel Drop Front Core Oven —All Fuels

The Monarch Engineering & Mfg. Company

1206 American Building, Baltimore, Md., U.S.A.

Shops at Curtis Bay, Md.





If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

English Moulding Machines

"Jarr" Ramming
"Head" Ramming
"Hand" Ramming

The most efficient on the market.
Well built to suit rough usage.

Write for particulars to the makers.

Britannia Foundry Company

Coventry, England

DAVENPORT JOLT

TABLE 60 x 72 INCHES

Write for

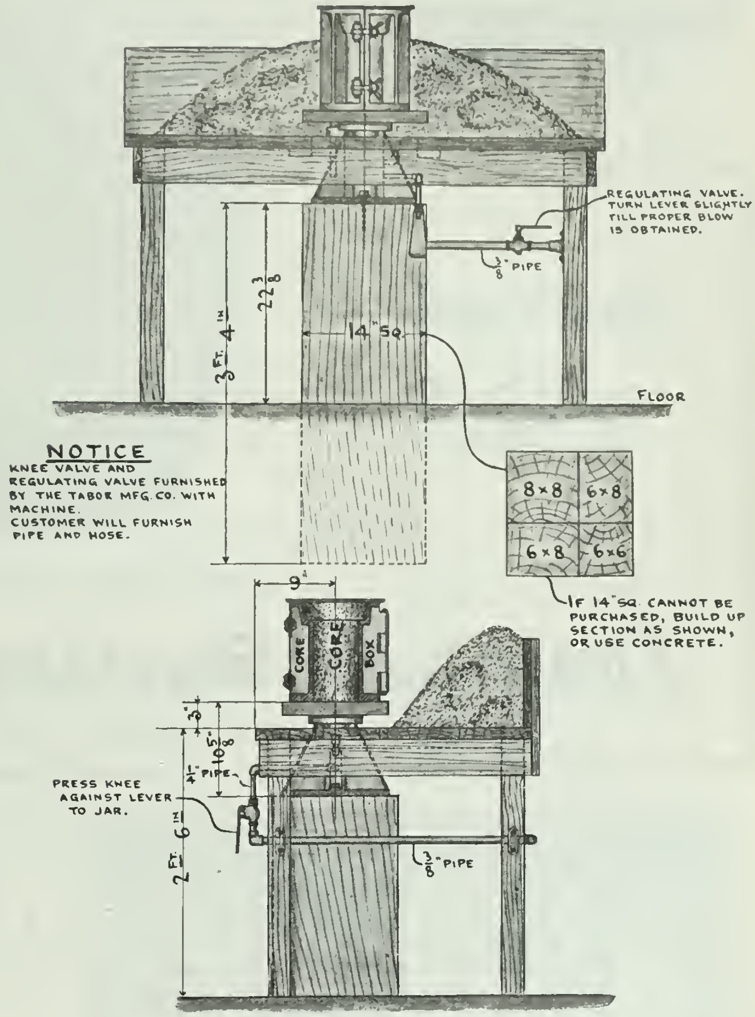
THE DAVENPORT LINE OF MOLDING MACHINES

Davenport Machine & Foundry Company

DAVENPORT, IOWA

TABOR

3" Tabor Jarring Machine with 12" x 14" Table.



3" Tabor Jarring Machine set in Core Bench.

FOR SMALL MOLDS AND MEDIUM SIZED CORES

Write for Bulletin M-J-P.

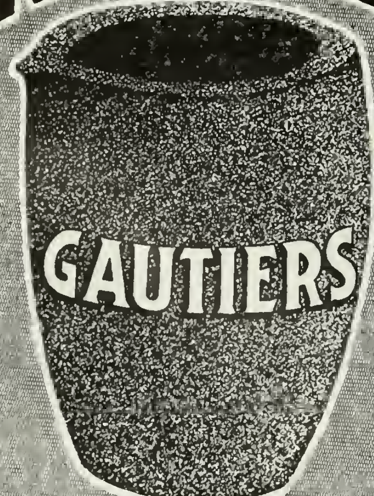
THE TABOR MANUFACTURING CO.

PHILADELPHIA
PA.

FOREIGN AGENTS:
Geo. W. Goodchild & Macnab, 56 Eagle St., Southampton Row, London, W. C.; Fenwick, Freres & Co., 8 Rue De Rocroy, Paris, France.

FOREIGN AGENTS:
Mitsui & Co., Ltd., New York, Tokio, Japan; Benson Bros., Sidney and Melbourne, Australia.


JBCo


GAUTIERS

EXTERIOR VIEW OF FACTORY.

Abrasive Wheel Manufacturing Plant and Equipment

Staff Article

The progress which has been made in the manufacture of abrasive wheels in recent years is due to the more general adoption of grinding in our machine shops and foundries, and also to the variety of abrasives that have been introduced for a wide range of application. The grinding wheel greatly used, particularly where superior finish and accuracy, and time and labor-saving constitute the end in view, the latter pertaining largely to foundry work.

THE growth of the Dominion Abrasive Wheel Co. business is typical of many Canadian industries, and the new plant now in operation at Mimico, Ont., emphasizes the development which has taken place in the manufacture of grinding wheels.

The demand for artificial abrasives during the past year or two has been stimulated by the scarcity of emery, due to supplies of the latter being cut off on account of the war. The best quality emery is found in Turkey and Greece; but as this material is practically unobtainable, artificial abrasives are now used almost exclusively. The use of artificial abrasive wheels has been steadily increasing for some years, but owing to its lower cost, the emery wheel has always found a ready market. The fact, however, that the artificial abrasive is more efficient will tend to make it more popular than the emery product and the cost will doubtless be reduced in course of time.

Abrasives and Their Origin

Before proceeding with a description of the Dominion Abrasive Co. plant, a brief reference to abrasives and their origin will assist in a better understanding of this concern's product and method of its manufacture. The principal natural abrasives are emery and corundum, while the principal artificial abrasives now on the market include carborundum, alundum, crystolon, and carbolite. Emery is similar to corundum, but is not so hard, and is not as pure. Corundum is found principally in Ontario, and is much in demand by makers of grinding wheels. It is an ideal abrasive for most kinds of grinding, as the grains keep their sharp points longer than emery and the absence of impurities is also an important feature. The corundum deposits in Ontario contain at least 90 per cent. crystalline alumina. Carborundum, carbolite and crystolon are artificial abrasives, and products of the electric furnace. They are each different formations of the same substance—carbide of silicon.

Carborundum is a crystalline formation of the elements carbon and silicon produced by subjecting a mixture of coke and sand in an electric furnace to an intense heat of 7,000 degrees Fah. for 36 hours. Alundum is oxide of alumina in crystalline formation. It is made by fusing bauxite to an intense heat in an electric furnace. Bauxite in its natural state has the appearance of clay, and it has to be dried and prepared in the form of gravel before being put in the electric furnace. The best bauxite mines are found in the southern part of the United States.

Vitrified and Silicate Processes

The choice of abrasives for grinding wheels and the process employed in their manufacture depend upon the purpose for which they are to be used. The Dominion Abrasive Co. employ two processes — vitrified and silicate, the majority of wheels being made by the former method. The vitrified process is of much longer duration than the silicate, both in regard to the manufacture and also as to the baking operation. Wheels made by the vitrified process are those mostly used on cylindrical and surface grinding machines. They are free cutting, well balanced, porous and wear well. The majority of wheels

MIXING DEPARTMENT, SHOWING MIXING KETTLES AND GRINDING WHEEL MOULDS DRYING ON BENCHES. DRY-ROOM IN THE BACKGROUND.

used are made by this process. Vitrified wheels take about ten to twelve days to manufacture, while silicate wheels can be produced in about 24 hours. An important feature in the manufacture of grinding wheels is the selection of the correct grain and suitable bond to produce a graded wheel. It is essential that wheels of a certain grade should all be alike and care must be taken in manufacturing to obtain this result so that wheels can be duplicated any time. The bond is a mixture of a special kind of clay and crushed quartz for a flux.

Plant Layout.

When the company was formed, the factory was located at New Toronto, but in time the premises became too small for the increasing business, so a move was made to Mimico, where a site covering three acres was purchased adjoining the Grand Trunk Railway main line, Toronto to Hamilton. A new factory was built on the site and manufacturing operations started on August 5, 1917. under E. W. Sawyer as general manager.

The plant comprises two wings each 150 feet long by 50 feet wide, lying at right angles to each other, with a kiln room 90 ft. by 64 ft. connecting them. One wing contains the mixing and shaving department, and also a dry room, while the other wing contains the finishing department, store room, shipping department and the silicate process department. The entire building is of brick construction, with steel sash for the windows. The roofs of the two wings are of wood sheeting covered with roofing material and supported by steel roof trusses. The roofs are monitor type, with windows opening the entire length and operated from the ground by chains. The roof of the kiln room is made of reinforced concrete with skylights. The office building is also of brick construction, 29 feet square and built separate from the factory. A siding from the G. T. R. runs along one side of the plant.

Mixing and Shaving Departments

Manufacturing operations begin at one end of the mixing department and the description will be in the meantime, confined exclusively to the vitrified process. The abrasives, of which there are several kinds, are received at the plant in barrels and are arranged in order according to size of grain. The clay for making the bond and the feldspar for the flux are also assembled at the same end.

The process consists in mixing suitable clays and fluxes in certain proportions with the grains of abrasive. The materials are mixed in certain pre-determined proportions with water in a mixing kettle. This is known as the wet process. In preparing the mixture before the water is added, great care is taken to get the correct proportion of abrasive and different clays so that wheels made from a certain mixture may be uniform and that they can be duplicated at any time. Orders issued from the office specify the grit and grade and the wheels are thus made to a standard formula. The possibility of wheels varying in quality from the desired grade is obviated by the use of improved methods, and care in weighing out the correct proportions of abrasives and clays.

After being thoroughly mixed, the mixture is made up into moulds supported round the periphery by stout paper. The moulds are laid on boards for the preliminary drying which occupies from 18 to 24 hours. Very small wheels and sticks are made up in plastic form in moulds. The moulds are then taken to

SHAVING DEPARTMENT, SHOWING SHAVING MACHINES AND EXTERIOR OF DRY ROOM.

the drying room to be dried out again, which makes them hard enough to be handled. The drying room contains several rows of racks upon which are laid the moulds, and is heated by steam heat, being maintained at a temperature of about 100 degrees Fah.

The next process consists of shaving the wheel. The wheels are moulded larger than the size required and are shaved off on a machine resembling a potter's wheel. There are six of these machines each being driven independently from a motor-driven line shaft running in Chapman double ball bearings and located below the machine. A Crocker-Wheeler motor operates the line shaft, while the shaft hangers rest on the floor. Briefly, the machine consists of a horizontal revolving plate located in an open box. The moulds are placed on the plate and the shaving is done by a vertical steel cutter operated by hand on a cross slide above. The wheels are left large enough to allow for shrinking in the kiln and trueing up when baked. The hole is also put into the wheel on the machine while it is in its semi-finished state.

Burning or Baking Process

The wheels are now ready for the baking in the kilns. There are four brick kilns at this plant, each being 12 feet diameter inside and 19 feet diameter outside. They are about 11 feet high inside. Each kiln is built up of 22,000 red brick and 11,000 firebrick. They have seven fire holes and are fired with coal. The kilns are constructed so that the heat inside can be regulated by means of a damper placed in the centre at the top of the arch or roof. The heat comes up from the fires inside and passes down through holes in the floor to the flue.

The wheels are stacked up inside the kiln, each wheel being placed on a fireclay tile with sectional fireclay saggers around. The wheel is covered all over with quartz sand which keeps the flame from the wheel and helps to maintain

KILNS FOR BAKING GRINDING WHEELS. TILES AND SAGGERS CAN BE SEEN ON THE FLOOR TO THE RIGHT. NO. 1 KILN IS READY FOR BEING DRAWN.

an even temperature. There is a tile on top and bottom of each sagger, thus forming a kind of box. The kiln holds several hundred wheels, the number varying according to the sizes. Each kiln hold approximately $2,000 worth of wheels when rated at prevailing prices. The kiln is started with a slow fire, is worked up for 72 hours, and attains a maximum temperature of 2,300 degrees Fah. The kiln is then allowed to cool down gradually for a period of five days, when the charge is drawn. This baking process is a delicate one and the utmost skill is required to successfully burn a kiln, every possible device being used to bring the operation under perfect control. If the temperature is allowed to change too quickly, the wheels will be cracked. If they receive too much heat they will be harder than intended, and if not enough, they will come out too soft. The heat has to be sufficient to vitrify or partially melt the clay so that the bond may fulfil its function. As a precautionary measure, tests are taken to make sure that the wheels have been baked to the correct degree of hardness. Trial pieces covered with the actual material or mixture used for wheels are inserted into the kilns and samples are taken at certain intervals until the condition of the test pieces shows that the wheels have been baked the proper length of time. This method has been found to be very reliable for this particular class of work.

SILICATE PROCESS DEPARTMENT SHOWING TAMPING STOOLS, WHEEL MOULDS AND OVEN IN BACKGROUND.

The fire clay rings or saggers as they are termed in the trade, are made in sections and are moulded from fireclay in the mixing room. After being moulded, they are dried out on curved wooden racks. The fireclay tiles are also made in the mixing room. The fireclay is mixed in a clay mill, a certain proportion of used crushed material being mixed with the fresh clay. The saggers and tiles are baked before being used. The wads for making the joints for the saggers are made in the mixing room, a wad machine being used for this purpose.

Finishing Department

The wheels when taken from the kiln are sometimes found to have warped during the baking process. These wheels have to be trued up, which is done on a number of machines installed in the finishing department. Some of these are very similar to facing machines, but others are converted grinding machines and incidentally they are very suitable for the job. The wheel is held in a chuck and the steel cutter is carried in a tool post on a slide. Both the face and periphery of wheel can be trued up with the one cutting tool at one setting. Some of these machines were built by the Safety Emery Wheel Co. of Springfield, Ohio; and others are converted Ford-Smith grinding machines. The line shaft runs in Chapman double ball bearings and is operated by a Crocker-Wheeler motor. A system of galvanized ducts connected to each machine is installed for carrying away the dust. A Sheldon motor-driven exhaust fan is installed for this purpose. The atmosphere is consequently quite clear and the men suffer no ill effects from operating the machines.

Silicate Process

Up to this point, the manufacture of vitrified wheels only has been dealt with. The company, however, have a separate department for producing wheels by the silicate process. The principal advantage of this process is that wheels can be made in a comparatively short time. Larger wheels can also be made by this process than is possible by the vitrified process. The silicate wheel gives very satisfactory results for many purposes, but is not used to the same extent as the vitrified wheel.

For silicate wheels the same abrasive materials are used as for the vitrified process; a different bond is, however, employed. Silicate of soda or water-glass is the principal ingredient in the bond for these wheels. After it has been thoroughly incorporated with the abrasive grains in a special mixing machine, the whole mass has a thick adhesive quality. In this condition it is rammed into moulds. This part of the work recures considerable skill, and the uniformity and balance of the wheels depends largely upon the skill of the moulder. The moulds are fixed on tamping tools, which have a revolving plate on the top so that the mould will revolve readily while being tamped. A wire web is put in the mould during the tamping process. There are six tamping stools.

When the tamping is finished, the top and bottom plates of the mould are bolted together and the mould placed in an oven for the baking process. The oven is heated by a coal fire, but the fire gases are excluded. The baking causes a chemical reaction which hardens or sets the bond, and after sufficient cooling the wheels are ready for the finishing room. The oven is equipped with a Thwing Pyrometer and the maximum temperature attained is approximately 800 degrees Fah. The moulds are kept in the oven for about 24 hours. Many shapes and sizes of wheels are made by this process and the product is very regular and clean in appearance.

All wheels have a sticker giving the grade and number. The company does a considerable export business and ships a large number of wheels to the Old Country. They make any grade required by their customers. while wheels of almost any shape can be manufactured. This

FINISHING DEPARTMENT, SHOWING TRUEING WHEELS WITH DUST EXHAUSTING SYSTEM. WHEEL STORAGE IN BACKGROUND.

company, as in the case of other grinding wheel manufacturers, have for the past year or two experienced great difficulty in obtaining an adequate supply of abrasive material, but in this regard, the situation is improving and as a result a material increase in output is anticipated. The company have a well equipped and up-to-date plant with ample room for extensions when necessary.

GOLD PRODUCTION IN CANADA

COMPARATIVE figures of the world's production of gold in 1916 shows that Canada improved her position slightly as compared with other countries. In 1914 Canada came seventh in the list with a contribution of $15,925,044, or 3.4 per cent. of the total output of all countries for the year; in 1915 the figures rose to $18,977,901, which represents 3.9 per cent. of the total and placed Canada in fifth place. That place was retained in 1916, with a total of $19,162,025 and the percentage to the grand total up to 4.8 per cent.

Although every effort was made to speed up the production of a metal for which the demand was greater than ever, the world output of a new gold in 1916 at $470,442,068 fell short of that of 1915 by $8,110,154; the total, however, was $10,344,640, or 2.2 per cent., higher than that of 1914. The largest output came from the Transvaal where $192,-138,000 was the value of the production in 1916.

BIG CUT IN STEEL PRICES

UNIFORM steel prices for U.S. Government, the public and the Allies, which represent reductions of from 40 to 70 per cent. in the present market quotations, were approved recently by President Wilson.

The prices were determined in an agreement reached between steel producers and the War Industries Board after conferences lasting more than a month. The prices, all subject to revision January 1, 1918, but to become effective immediately, follow:

"Iron ore, basis, lower lake ports, price agreed upon $5.05, gross ton. No change.

"Coke, Connellsville, price agreed upon $6 net ton; recent price $16 a ton; a reduction of 62.5 per cent.

"Steel plates, basis Chicago and Pittsburgh, price agreed upon $3.25 hundredweight, recent price $11 hundredweight; a reduction of 70.5 per cent.

"Pig iron, price agreed upon $33 gross ton; recent price $58 gross ton; a reduction of 43.1 per cent.

"Steel bars, Pittsburgh and Chicago basis price agreed upon $2.90 per hundredweight, recent price, $5.50 per hundredweight; a reduction of 47.3 per cent.

"Steel shapes, basis Chicago and Pittsburgh, price agreed upon $3 hundredweight; recent price $6 hundredweight; a reduction of 50 per cent."

IRON WEAPONS OF THE AZTECS

WHEN Cortez had completed the conquest of Mexico, the Spaniards, among a great many other peculiar and extraordinary observations which they made in that remarkable country, were particularly struck and puzzled by one fact.

They noticed that the Aztecs possessed certain implements, such as knives, daggers, etc., made of iron, but it seemed that only the most distinguished of the natives possessed such, that iron was a great rarity and was prized higher than gold. At first the Spaniards believed that the Aztecs extracted the metal in some crude fashion from its ore, which abounds in many parts of the country, but they soon ascertained that this was not the case. They found that not a single smelting furnace existed in the empire, and their surprise was not small when they learned that the Aztecs were totally unacquainted with any method of extracting the iron from the ore, which, indeed, they had never suspected of any kinship with the highly valued metal.

The question whence the Aztecs had procured the little iron they possessed became a perplexing problem to the Spaniards, which they were never able to solve. The natives do not seem to have enlightened them much on the subject, for when asked they mysteriously pointed to the sky, and indicated that they obtained their iron from the regions above. Such assertions, no doubt, the Spaniards received with an incredulous smile, and they concluded that the Aztecs procured it by way of traffic from some other, perhaps more civilized, nation which they suspected to exist and kept looking for north and south for more than a hundred years.

It was left to modern science to unravel the mystery. The Aztecs were quite correct; the iron of which they had made their implements was not fashioned from materials of this terrestrial globe, but had come to them from the unknown regions of space. Their iron was, in fact, of meteoric origin, like that of the Mayas of Yucatan, and the Incas of Peru, of which many weapons are still preserved for collections.—Hensoldt.

DEVELOPMENT OF OXYGEN MANUFACTURE

By J. W. G.

THE use of oxygen in connection with welding processes, carbon removal from engine cylinders, etc., has become such a commonplace matter in the ordinary routine of manufacturing activities that little or no thought is ever given to the processes whereby this now indispensable gas is separated and prepared for use.

The commercial production of oxygen dates from the year 1886, in which year operations were commenced by an English concern to develop a process invented by two Frenchmen, the Brin brothers, their process being based on previous discovery by Boussingault in 1851, that barium monoxide absorbs oxygen from the atmosphere when it is heated to 1,000 deg. F., and gives it up again when the temperature is raised to 1,600 deg. F. This cycle of operations was repeated indefinitely, the barium monoxide remaining unaffected by the alternate heating and cooling.

Despite the lapse of time from the original discovery of the process, many practical difficulties still remained until Brin's Oxygen Co. succeeded in developing the manufacture to such a high degree of perfection, that the barium process maintained its superiority against all efforts to develop other processes of obtaining oxygen on a commercial scale.

The commercial liquefaction of air had meanwhile been developed by Prof. Linde of Munich, in 1895, and from that time on the ultimate eclipse of the barium process became more and more a matter of time. The actual process of obtaining oxygen through liquefying air is a highly specialized proceeding and its success has been very complete, the barium process being entirely discarded, although the possibilities of electrolytic cells are the subject of intense experiment and research by interests allied with electric power supply companies, and developments in this direction are pending.

Despite the decadence of the original process, it is gratifying to know, especially at this time that oxygen production in Germany, France and United States was first put on a commercial basis with barium plants designed and erected by the original Brins' Oxygen Co.

OXIDE of aluminum is so nearly of the same specific gravity as the metal that it does not allow the molten metal to clear itself when in small globules or grains. For this reason mechanical aid has to be given. In practice the scrap is so far heated in the crucible that it becomes a pasty mass, in which state it is equeezed and kneaded for some time, preferably with an oak or other hardwood rod of fair cross area, and then the heat is raised, and with some manipulation of the rod the metal is cleared of the dross and dirt. If melted rapidly, a dirty mass of metal and oxide is produced with a heavy loss of actual metal held in the skimmings from which it cannot dissociate itself, owing to its slight weight.

A writer in the Blast Furnace and Steel Plant observes that with all its advantages, such as convenience of handling and absence of shock, the press has two failings. In the first place it is harder to get rid of scale, which is dislodged by the impact of a hammer, and it cannot strike in a mould as large a forging as a hammer its equivalent in other respects. The Midvale Steel Co. consider a 500-ton press as the equivalent of a 2¼-ton hammer, a 1,200-ton press as equal to a 10-ton hammer, and a 2,500-ton press as equivalent to a 25-ton hammer. Nevertheless, a 4½-ton hammer can make drop-forgings beyond the capacity of a 1,200-ton press, which in this respect is about equal to a 2½-ton hammer.

Annual Convention of American Foundrymen and Metal Men

The twenty-second meeting of the American Foundrymen's Association and the annual meeting of the American Institute of Metals were held conjointly in Boston, Sept. 24 to 28, and were marked by hospitality, patriotism and Entente sincerity which circumstances have not allowed full expression of in recent years. Active participation in the war imparted intense interest to the proceedings of two bodies whose active efforts are directly influencing it.

SEVERAL hundred delegates to the twenty-second annual meeting of the American Foundrymen's Association and the annual meeting of the American Institute of Metals were present at the joint opening meeting of the two organizations in Paul Revere Hall, Mechanics' Building, Boston, Sept. 24. A formal welcome on behalf of the city was extended to the visitors by Mayor Curley, the response of the visitors being made by R. A. Bull, of the Duquesne Steel Foundry Co., Coraopolis, Pa. J. P. Pero, president of the A.F.A., delivered his annual address and reviewed the work of the organization.

The major part of the convention period was spent by each organization in conventional manner, the meetings of the American Institute of Metals being held at the Hotel Somerset, with an occasional joint meeting at the quarters of the A.F.A. The application of the members' activities toward munition production was a feature of the non-ferrous topics. Following the usual entertainment features, the convention closed Sept. 28, the A.F.A. members adopting vigorous resolutions in support of the Government in carrying on the war against Germany, pledging their plant, efforts, and endorsement of the second Liberty loan. Officers elected on the closing day were: American Foundrymen's Association—President, Benjamin D. Fuller; vice-president, Stanley Flagg; secretary and treasurer, A. O. Backert. American Institute of Metals—President, W. M. Corse; senior vice-president, William B. Price; secretary and treasurer, F. L. Wolfe.

The exhibition of foundry equipment was held on the two floors of the Mechanics' pavilion, numerous moulding machines and sand-blast machines being in operation and providing the major attractions.

CONVENTION PAPERS, A.F.A.

General Topics and Foundry Costs

"The Foundry From the Viewpoint of the Sales Engineer," by H. R. Atwater, Osborn Mfg. Co., Cleveland.

"The Relationship of the Engineering Department to the Pattern Shop and Foundry," by F. J. McGrail, Struthers-Wells Co., Warren, Pa.

"How Character Analyses Solves the Man Problem," by William Judson Kibby, Cleveland.

Report of A.F.A. Committee Advisory to the U. S. Bureau of Standards, by Richard Moldenke, chairman, Watchung, N.J.

"Efficiency in the Foundry," by James A. Fitzgerald, Reno, Pa.

"Co-operative Shop Training," by W. B. Hunter, Fitchburg High School, Fitchburg, Mass.

Report of A.F.A. Committee on Classification of Technical Literature, by Richard Moldenke, Watchung, N.J.

"Facilities for Technical Training at Massachusetts Institute of Technology," by John Ritchie, Jr., Massachusetts Institute of Technology, Boston.

"Improving the Relationship Between Employer and Employee," by J. F. Kent, American Cast Iron Pipe Co., Birmingham, Ala.

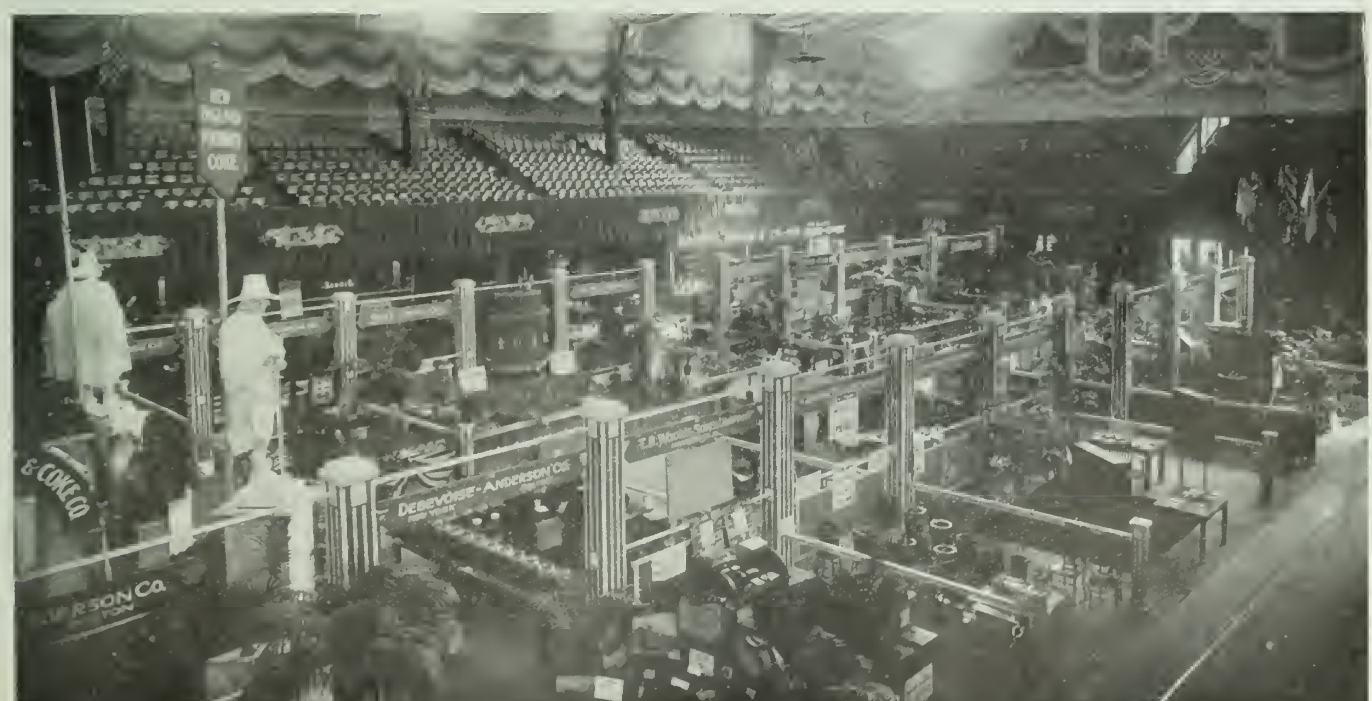
Report of A.F.A. Committee on Safety, Sanitation and Fire Prevention, by Victor T. Noonan, chairman, Industrial Commission of Ohio, Columbus, O.

Report of A.F.A. Committee on Foundry Costs,, by B. D. Fuller, chairman, Westinghouse Electric & Mfg. Co., Cleveland.

Address on Cost Work of the American Foundrymen's Association, by C. E. Knoeppel, C. E. Knoeppel & Co., New York.

Report of A.F.A. Representatives on the Conference Board on Training of Apprentices, by Frank M. Leavitt, chairman, University of Chicago, Chicago.

Report of the A.F.A. Committee on Industrial Education, by Frank M. Leavitt, chairman, University of Chicago, Chicago.



SUPPLIES EXHIBIT LOOKING ACROSS MAIN EXHIBITION HALL.

Address, "The Labor Situation as Relating to Co-operation Between the Employer and Employee," by G. E. MacIlwain, Babson's Statistical Organization, Wellesley, Mass.

"Micro-Metallography for the Foundry," by Robert J. Anderson, Cleveland Metal Products Co., Cleveland.

Malleable Session

"The Theory of the Modern Waste-Heat Boiler and Possible Application of Such Boilers to the Malleable Melting Furnace," by A. D. Pratt, Babcock & Wilcox Co., New York.

"Application of Waste-Heat Boilers to the Malleable Melting Furnace," by C. D. Townsend, Danville Malleable Iron Co., Danvill, Ill.

"Application of Pulverized Coal to the Air Furnace," by Wr. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

"The Application of Pulverized Coal to Malleable Melting Furnaces," by Joseph Harrington, Chicago.

"How Malleable Iron Has Improved," by Enrique Touceda, Albany, N.Y.

"Troubles Encountered in Machining Malleable Iron: Causes and Remedies," by A. T. Jeffery, Dayton Malleable Iron Co., Dayton, O.

"Comparative Carbon Losses in Malleable Iron Annealing by Muffle and Pot Oven Methods," by Joseph B. Deisher, T. H. Symington Co., Rochester, N.Y.

"The Effect of Iron Oxide in Molding Sand," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

Gray Iron Session

"Notes on Fine Molding Sands," by C. P. Karr, U. S. Bureau of Standards, Washington, D.C.

Report of A.F.A. Committee on General Specifications for Gray Iron Castings, by W. P. Putnam, chairman, Detroit Testing Laboratory, Detroit.

"Briquetting Foundry Borings," by A. L. Stillman, General Briquetting Co., New York.

"Cast Iron Shells in Permanent Molds," by Edgar Allen Custer, Philadelphia.

"The Seasoning of Gray Iron Castings," by L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R.I.

"Factors in the Economical Production of Small Cores in Large Quantities," by R. E. Kennedy, University of Illinois, Urbana, Ill.

"Modern Centrifugal Cupola Blowers," by L. C. Loewenstein, General Electric Co., Schenectady, N.Y.

"The Effect of High Sulphur in Gray Iron Castings," by T. Mauland, International Harvester Co., Chicago.

Steel Session

"Molding and Casting Large Slag Pots," by C. J. McMahon, Illinois Steel Co., Chicago.

"A Description of a Small Open-hearth Furnace," by David McLain, McLain's System, Milwaukee.

"Steel Castings for Ordnance Construction," by Major C. M. Wesson, Watertown Arsenal, Watertown, Mass.

"A New System of Burning Crude Oil," by W. A. Janssen, Davenport, Ia.

"The Use of Vanadium in Steel Castings," by J. Lloyd Uhler, Union Steel Castings Co., Pittsburgh.

Report of A.F.A. Committee on Steel Foundry Standards, by W. A. Janssen, chairman, Davenport, Ia.

"Notes on An Electric Furnace Design," by John A. Crowley, John A. Crowley Co., Detroit.

"Recent Developments in the Application of the Electric Furnace to the Melting Problem," by Douglas Walker, Booth-Hall Co., Chicago.

"Comparison of Electric Furnace and Steel Converter for the Manufacture of Small Steel Castings," by C. R. Messinger, Sivyer Steel Castings Co., Milwaukee.

"The Electric Furnace From the Central Staion Standpoint," by E. L. Crosby, Detroit Edison Co., Detroit.

Final Professional and Business Session

"Solution of Foundry Transportation and Conveying Problems," by Robert E. Newcomb, Deane Works, Worthington Pump & Machinery Corp., Holyoke, Mass.

"Sand-Blasting in the Foundry," by H. L. Wadsworth, American Foundry Equipment Co., Cleveland.

"Experiments to Determine the Most Effective Means of Mixing and Blending Foundry Facing Sands," by R. Harrington, Hunt-Spiller Mfg. Corp., Boston.

"Oxy-Acetylene Welding and Cutting," by Stuart Plumley, Davis-Bournonville Co., Boston.

"Factors Contributing to the Economical Use of Grinding Wheels in the Foundry," by Wallace T. Montague, Norton Co., Worcester, Mass.

"Refractory Materials Employed in the Metallurgical Industries," by H. C. Arnold, University of Illinois, Urbana, Ill.

SIDE AISLE OF SUPPLIES EXHIBIT IN MAIN EXHIBITION HALL.

CONVENTION PAPERS, A.I.M.

Melting and Casting Non-ferrous Metals

"Raw Materials Used for Crucibles," by Prof. A. V. Bleininger, U. S. Bureau of Standards, Washington, D.C.

"Melting Yellow Brass in New Form of Induction Furnace," by G. H. Clamer, Ajax Metal Co., Philadelphia.

"Casting Bearings in Sand and Metal Molds," by R. R. Clarke, Pennsylvania Lines West of Pittsburgh, Pittsburgh.

"Negative Experiments on Waste Core Sand," by Dr. H. W. Gillett, U. S. Bureau of Mines, Ithaca, N.Y.

"The Crucible Situation," by M. McNaughton, Jos. Dixon Crucible Co., Jersey City, N.J.

"The Electric Furnace and Nonferrous Metals," by Dwight D. Miller, Society

MAIN AISLE OF SUPPLIES EXHIBIT IN EXHIBITION HALL.

for Electrical Development, New York.

"My Experience With Metal Melting Furnaces," by W. H. Parry, National Meter Co., Brooklyn, N.Y.

"The Briquetting of Nonferrous Light Metal Scrap," by A. L. Stillman, General Briquetting Co., New York.

Use of Nonferrous Metals for Munitions, Etc.

"The Present Status of Tin Fusible Plug Manufacture and Properties," by Dr. George K. Burgess, U. S. Bureau of Standards, Washington, D.C.

"Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

"The Use of Die Castings in Munitions," by Charles Pack, Doehler Die Casting Co., Brooklyn, N.Y.

"Shrapnel Bullets," by Harold J. Roast, Jas. Robertson Co., Ltd., Montreal, P.Q.

"A Few Points on Alloy Patents," by Wm. J. Rich, Patent Office, Washington, D.C.

Address by a representative of the Lnited States Tariff Commission.

"The Use of Bronzes in Railroad Turntables and Movable Bridges," by O. E. Selby, Big Four Railroad, Cincinnati.

"Recent Industrial Uses of Aluminum," by F. G. Shull, Aluminum Co. of America, Boston.

"The Consumption of Copper and Its Varied Uses," by H. D. Hawks, United Metals Selling Co., New York.

Testing of Nonferrous Metals

"Comparative Tests on Test Bars and Actual Castings," by W. M. Corse, Titanium Bronze Co., Niagara Falls, N.Y.

"Aanalysis of Babbitts and Brasses,' by E. W. Hagmaier, Buffalo.

"Standard Test Bars of 88-8-4, Being the Result of Co-operative Work of Six Foundries; a New Series of Tests," by C. P. Karr, U. S. Bureau of Standards, Washington, D.C.

"The Expansion Coefficient of Alpha and Beta Brass" and "The Corrosion of Manganese Bronze Under Stress," by Dr. Paul D. Merica, Bureau of Standards, Washington, D.C.

Address by Richard C. Maclaurin, president, League to Enforce Peace.

"The School End of the Job in Training Foundrymen," by Dean C. B. Connelley, Carnegie Institute of Technology, Pittsburgh.

"The Flux and Cleaner Question of Brass," by E. D. Frohman, S. Obermayer Co., Pittsburgh.

"Pyrometers—Their Construction and Application," by John P. Goheen, Brown Instrument Co., Philadelphia.

"Electrically-Heated Core Ovens," by Dr. C. F. Hirshfield, Edison Illuminating Co., Detroit.

"Brass Rolling Mill Alloys," by Roy A. Wood, Cheshire, Conn.

Metallurgy and Metallography

"The Electrolytic Production of Antimony," by Prof. D. J. Demorest, Ohio State University, Columbus, O.

"The Electrical Properties of Some High Resistance Alloys," by Prof. M. A. Hunter, Rensselaer Polytechnic Institute, and F. M. Sebast, Troy, N.Y.

"The Amorphous Theory in Metals," by Zay Jeffries, Aluminum Castings Co., Cleveland.

"The Volatility of Zinc and Cadmium," by John Johnston and Edward Schramm, American Zinc, Lead & Smelting Co., St. Louis.

"Surface Tension and Deoxidizing of Metals," by W. J. Knox, Metals Deoxidizing & Refining Co., New York.

"Antimony—Its Metallurgy and Uses," by K. C. Li, Wah Chang Mining & Smelting Co., Inc., New York.

"Development and Reabsorption of the Beta Constituent in Alloys Which are Normally of the Alpha Type," by Prof. C. H. Mathewson, Department of Mining and Metallurgy, Yale University, and Philip Davidson, New Haven, Conn.

"The Swelling of Zinc Base Die Castings," by H. M. Williams, National Cash Register Co., Dayton, O.

DIRECTORY OF EXHIBITS

Abell-Howe Co., Chicago.—Howe Trucks in various styles. Operating displays of American High Speed Chain for power drives. Union Pressed Steel Chain for general engineering use, and American Electric Hoists with foundry control.

The Ajax Metal Co., Philadelphia, Pa.—Variety of Ingots made by the Ajax process, and castings made from same, together with other interesting features. Variety of babbitt metals and die castings.

Albany Sand and Supply Co., Albany, N.Y.—Molding Sand.

American Foundry Equipment Co., Cleveland, Ohio.—For description of exhibit, see Sand Mixing Machine Co.

American Gum Products Co., New York City.—Goulac Core Binder, Cores and Castings made from Goulac Core Binder.

American Lighting Co., Chicago.—Industrial and railroad floodlights, using 750 or 1000 watt standard lights with a glass reflector, highly silvered and polished.

REPRESENTATIVE DISPLAY OF FOUNDRY EQUIPMENT IN ANNEX ADJOINING MAIN EXHIBITION HALL.

American Molding Machine Co., Terre Haute, Ind.—New 10" Jolt Rock Over Machine, and also new Jolt Stripping Plate Machine, with 12" draw.

American Museum of Safety, New York City. Exhibit of Safety Appliances.

American Pipe Bending Machine Co., Boston, Mass. Pipe bending machine in operation.

Ariade Manufacturing Co., Freeport, Ill.—Hand Squeezer. Air Squeezer, 24" Power Rollover Jolt Pattern Drawing Machine, No. 2 Modern Molding Machine, 24" Modern Jolt showing a ferrule plate, 38" Modern Jolt, Piston Drag Machine, Piston Cope Machine. Combined Jolter and Squeezer. Norcross Jarring Machine, and 3" Midget Core Jolter.

Armstrong Cork and Insulation Co., Pittsburgh, Pa. Insulating Brick, Cork Covering for water brine and ammonia lines, high pressure covering for steam pipes, corkboard for cold storage and refrigeration. Display to include raw materials, finished products and miniature models, together with interesting tests.

Asbury Graphite Mills, Asbury, N.J.—Samples of Ceylon and American Graphite for Foundry Facing, lubricating, Stove polish, Paint, and Electrical purposes.

Athol Machine Co., Athol, Mass.—Vises of many types, and an assorted display of mechanics' tools. Photographs illustrating welfare work of the company.

E. C. Atikns & Co., Indianapolis, Ind.—Saws of all kinds including metal-cutting circular saws, hack saw blades, frames, hand saws, metal cutting machines, and foundry plates.

Ayer & Lord Tie Co., Inc., Chicago.—A&L Interior Creosoted Wood Block Floor installed in booth, with photographs showing installations in all types of plants throughout the country.

B. & B. Manufacturing Co., Indianapolis, Ind.—Stationary Power Molding Machine, Portable Power Molding Machine, Stationary Hand Jar and Squeeze Machine, Portable Hand Jar and Squeeze Machine, and Post Power Molding Machine.

Beaudry & Co., Inc., Boston, Mass. 100-pound Power Hammer arranged for motor drive, and a similar power hammer of 50 pounds capacity.

Berkshire Manufacturing Co., Cleveland, O.—Air and Hand Squeezer Molding Machines, Flasks, Vibrators, Patterns, etc.

Charles H. Besly & Co., Chicago. Besly Vertical Spindle Disc Grinders, Besly Patternmakers' Disc Grinders, Wide Faced Ring Wheel Grinders, and Double Spindle Disc Grinders.

The Bilton Machine Tool Co., Bridgeport, Conn.—Universal Gear Hobbing Machine, and Automatic Gear Milling Machine.

S. Birkenstein & Sons, Chicago.—Brass and Bronze Ingot, Aluminum Ingot. (Virgin and Alloys), Babbitt, Solder, Phospher Copper, Phosphor Tin, and all non-ferrous base metals. Castings made from these products.

The G. S. Blodgett Co., Inc., Burlington, Vt. Two types of Portable Bake Ovens, used extensively in foundries for baking cores. These ovens are also sold for enameling and japanning purposes.

Blystone Manufacturing Co., Cambridge Springs, Pa. Blystone Core Sand Mixer equipped with rotary screen and electric motor.

Brass World Publishing Co., New York City.—The Brass World.

Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.—Belt and motor driven Grinding and Polishing Machinery. Also a number of grinding wheels.

Brown Specialty Machinery Co., Chicago. Core Machines, Electric Duplex Shaker, Revolving Barrel Sandblast Machine equipped with cloth screen type dust arrester and exhaust fan. which will be in operation.

The Buckeye Products Co., Cincinnati, O.—Furnaces. metal melting, non-crucible and crucible; gas and oil fuel. Air and electric vibrators, parting compounds, core compounds, metal fluxes, core oven. patented flax pins, also patented flax guides with removable pins, etc.

Carborundum Co., Niagara Falls, N.Y. Carborundum and Aloxite Wheels, special Carborundum Wheels for malleable grinding, and samples of crude material from which these wheels are made.

Cataract Refining and Mfg. Co., Buffalo, N.Y. Core Oils, Parting, Cutting Oils and Compounds, Tempering and Quenching Oils.

Champion Foundry and Machine Co., Chicago. Champion Electric Sand Riddles in operation.

Frank D. Chase, Chicago and New York.—Foundry design and construction data, including photographs, paintings and plans of buildings and equipment, including furnaces, ovens, and stacks; printed literature illustrating foundries designed and outlining the foundry engineering service.

Chase Turbine Manufacturing Co., Orange, Mass. Semi-automatic Polishing and Buffing Machine.

Chicago Pneumatic Tool Co., Chicago. Pneumatic Riveting and Chipping Hammers, Pneumatic Drills, Hammers and Hoists, Electric Drills and Grinders, Electric Sand Sifter, and Chicago Universal Hose Couplings.

Chisholm-Moore Manufacturing Co., Cleveland, O.—Chain Hoists and Eye Beam Trolleys.

Cincinnati Pulley Machinery Co., Cincinnati, O.—Nine motor-driven ball bearing drilling machines of different types and speeds, adapted to varying conditions of machine shop work.

Charles J. Clark, Chicago.—Blast volume meters, and allied instruments for foundry use. Will introduce at this exhibit a new instrument for use in connection with cupola and other furnaces.

Cleveland Blow Pipe and Mfg. Co., Cleveland, O. Dust Collecting System for use on buffing, polishing, grinding and emery wheels, consisting of motor-driven exhaust fan, dust collector, and special hoods. Sheet metal shower baths.

Cleveland Osborn Manufacturing Co., New York—Foundry supplies.

Cleveland Pneumatic Tool Co., Cleveland, O.—Complete line of air-operated tools for foundry purposes, in operation, such as chipping hammers, riveting hammers, sand rammers for foundry use, air drills, portable casting grinders, air hose, hose couplings. etc.

Thomas E. Coale Lumber Co., Philadelphia, Pa.—White pine and sugar pine pattern lumber.

Combined Supply and Equipment Co., Buffalo, N.Y.—Angle Stem Single-piece Double-head Chaplets, tinned.

Corn Products Refining Co., New York.—A working exhibit showing the making of cores, also the drying, using Kordex.

Curtis Pneumatic Machinery Co., St. Louis, Mo.—Vertical double-cylinder single acting compressor. water cooled with a regulating sight feed splash oiling attachment. This compressor is motor-driven with automatic pressure control, and is provided with a circulating pump for cooling water. Pendant vertical cylinder air hoists and horizontal rope compounded cylinder air hoists. suspended from single I-beam trolleys. Single I-beam hand-operated bridge crane with trolley, and single I-beam bracket bridge crane.

Cutter & Wood Supply Co., Boston, Mass.—Foundry Equipment, Tools and Supplies, Machinists' and Patternmakers' Supplies.

Davis-Bournonville Co., Jersey City, N.J.—Oxy-Acetylene and Oxy-Hydrogen Welding and Cutting Apparatus, Acetylene Pressure Generators, Portable Acetylene and Oxygen Tanks, Oxygraph and Radiagraph Cutting Machines, Accessories.

Debevoise-Anderson Co., Inc., New York City.—Interesting exhibit of Foundry Iron, Charcoal Iron, ores, coke, limestone, etc.

Dings Magnetic Separator Co., Milwaukee, Wis.—Type M., No. 3 Separator, complete with motor generator set, Type O No. 2 Separator, complete with D.C. motor, 12" x 24". Magnetic Pulley Type Separator, with D.C. motor, and hand magnet for finding iron in light brass.

Divine Bros. Co., Utica, N.Y.—Polishing Wheels, Buffs, Glue Heaters, Polishing wheel balancers, and a general line of polisher supplies.

Joseph Dixon Crucible Co., Jersey City, N.J.—Crucibles, Covers, Stirrers, Stoppers, Sand Crucibles, Scorificrs, Cupels. etc.

Stanley Doggett, Inc., New York City.—Parting Compounds, "Original Perfection Brands," "Facamold," substitute for Lead and Plumbago, Talc and Soapstone Facings.

G. Drouve Co., Bridgeport, Conn.—Anti-Pluvius Puttyless Skylights, and Window Operators.

Eastern Brass and Ingot Corporation of New York, Waterbury, Conn.—Briquet-Ingots (made from brass chips).

Federal Foundry Supply Co., Cleveland, O.—Six sizes of Jolts, six sizes of Squeezers, and Combination Jolt and Squeezer Machines. Core ovens. Samples of plumbago, core washes, snap flasks, slip jackets, etc.

Felt & Tarrant Manufacturing Co., Chicago.—Comptometer. Adding and Calculating Machines.

Forbes & Myers, Worcester, Mass.—Electric Grinders.

Foreign Crucibles Corp., Ltd., New York City.—Samples of Imported Graphite Crucibles.

The Foundry and The Iron Trade Review, Daily Iron Trade and Metal Market Report, Cleveland, O.—Represented by John A. Penton. A. O. Backert, C. J. Stark, H. Cole Estep. Charles Vickers. J. D. Pease, F. V. Cole, S. H. Jasper, G. O. Hayes, J. F. Ahrens, E. L. Shaner, and A. J. Mueller.

The Foundry Equipment Co., Cleveland, O.—Coleman Foundry Equipment, Coleman Rolling Drawer Core Oven, Portable Rack Type Oven, Coleman Hand Squeezer, Coleman Aluminum Melting Furnace, Oil Burner, Crucible Lifter, etc.

Gardner Machine Co., Beloit, Wis. Five types of belt and motor driven polishing lathes; ten types of sizes of Gardner Grinders, as well as an assortment of supplies. Show board with actual sample pieces of work done on Gardner Grinders. New machines in operation.

General Briquetting Co., New York. Represented by George R. Cowan.

General Electric Co., Schenectady, N.Y.—Electric Core Baking Furnace, Blower Sets. Fans, Heaters, Lamps. and Supplies. Lantern Slides. Photographs of various installations.

General Fire Extinguisher Co., Providence, R.I.—Sprinkler System complete with supervisory service connections and cabinet for demonstration of action of sprinkler in case of fire. Rector System of heating. Hale Mixers for industrial and domestic purposes.

General Platers' Supply Co., Inc., New York—Genuine Imported Graphite Crucibles.

Goldschmidt Thermit Co., New York.—Complete line of samples of Carbon-free metals and alloys, including tungsten, chromium-manganese, ferro-chromium, ferro-tungsten, manganese-copper, cobalt, etc.

Great Western Manufacturing Co., Leavenworth, Kansas.—Gyratory Foundry Riddles.

Harrison Supply Co., Boston, Mass.—Metallic sand blast abrasives, including chilled shot and crushed shot for sandblast purposes.

The Hart & Hutchinson Co., New Britain, Conn. Steel lockers for factory use. New solutions of the coat room problem.

Hauck Manufacturing Co., Brooklyn, N.Y.—Cupola lighters, mold dryers, ladle and rivet heaters, torches and forges.

Hayward Co., New York City.—Photographs of equipment for handling various materials with different kinds of hoisting apparatus.

Herman Pneumatic Machine Co., Pittsburgh, Pa.—13" Cylinder Plain Jarring Machine, and Combination Jar Squeeze Machine.

Hill, Clarke & Co., Inc., Boston, Mass.—Lathes, Shapers, Milling Machines, Grinders, Drilling Machines, Bench Lathes, Screw Machines, Power and Arbor Presses, Pipe Machines, and Cutting-off Machines.

Hoevel Manufacturing Corporation, New York City.—Revolving barrel sandblast machine with pressure tank, and rotary table sandblast machine with pressure tank.

Herman A. Holz, 1 Madison Ave., New York.—The Erichsen Machine for Testing Metal Sheets. The Brinnell Meter (portable hardness tester).

International Molding Machine Co., Chicago.—Molding Machines.

The Iron Age, New York City.—An exhibit of good fellowship and hearty welcome to all who attend the Convention.

The Jennison-Wright Co., Toledo, O.—Kreolite Wood Blocks for factory floors. Enlarged photographs of Kreolite Wood Block factory floors; samples of wood treated with Kreolite oil.

Spencer Kellogg & Sons, Inc., Buffalo, N.Y.—Liquid Core Compounds and Pure Linseed Oil.

T. P. Kelly & Co., Inc., New York.—Foundry Supplies.

Julius King Optical Co., Chicago.—Safety Goggles, Helmets, Masks, etc.

The Lamson Co., Boston, Mass.—Lamson Gravity Roller Conveyors, Lamson wire-line message and parcel carriers, Lamson pneumatic tubes for handling orders, etc., in factory and office.

Arthur E. Lane Lumber Co., New York City.—Sequoia Lumber for pattern work.

The H. M. Lane Co., Detroit, Mich.—Industrial Engineers. Foundry and Metallurgical Specialists.

Lees-Bradner Co, Cleveland, O.—For a description of this exhibit, see Lynd-Farquhar Co.

Lewis-Shepard Co., Boston, Mass.—Elevating trucks for handling goods on platforms.

Lublum Electric Furnace Corporation, New York City.—Model of Ludlum Furnace. Samples of tool steel, pig iron, washed metal, and iron and steel castings, etc., now being made by the Sweetzer Bainbridge Metal Alloy Corporation. Large photographs of furnaces in operation, together with analysis of products, descriptive pamphlets, etc. Represented by Thornton W. Rice, Vice-President, O. D. Conover and G. E. Munro.

David Lupton's Sons Co., Philadelphia, Pa.—Models of various types of Lupton Steel Sash and other products. Lupton steel partition and doors, Lupton rolled steel skylight. Detailed drawings and photographs of installations.

Lynd-Farquhar Co., Boston, Mass.—26" Combined open side crank planer and shaper in operation. Lees-Bradner gear generating machine and a thread milling machine in operation.

MacLean Publishing Co., Toronto, Can.—The Canadian Foundryman; Canadian Machinery.

The MacLeod Co., Cincinnati, O.—Sand Blast Hose Machine, Oxy-Acetylene Welding Torch, Combination Buckeye Heater, Cupola Lighter, Ladle Dryer and Skin Dryer for molds.

J. S. McCormick Co., Pittsburgh, Pa.—General Foundry Supplies.

McCrosky Reamer Co., Meadville, Pa.—Complete line of Adjustable Reamers; Wizard quick-change chucks and collets; drilling, tapping and stud setting devices; turret tool posts for lathes; Searchlight Universal lamp brackets, and other cost-cutting devices for the machine shop.

McLain's System, Inc., Milwaukee, Wis.—Samples of Semi-steel castings of light section, such as automobile cylinders, pistons and other castings containing 20% to 50% steel, made by McLain graduates. Open hearth steel castings poured of metal from McLain Carter Open Hearth Furnace. Projectiles weighing up to 1,400 lbs. a special feature.

Mahr Manufacturing Co., Minneapolis, Minn.—Fuel Oil Torches for Cupola Lighting, mold drying, etc., ladle driers and heaters, melting furnaces, rivet furnaces, and forging furnaces.

Malleable Iron Fittings Co., Branford, Conn.—Complete line of "All Steel" vibrators. Complete line of vibrator accessories, including hand valves; blow guns, starting valves of all kinds, hose clamps, etc. Equipment in operation.

The Metal Industry, New York City. Represented by Palmer H. Langdon, editor and publisher; Louis J. Krom, managing editor; George W. Cooper, advertising manager, and Thomas A. Trumbour, circulation manager.

Michigan Smelting and Refining Co., Detroit, Mich.—Detroit Standard Ingot Brass, Sillman Apex Bronze, Tin and lead products, including solders, lead pipe, babbitt metals, etc.

Midland Machine Co., Detroit, Mich. Small Jar-ramming Roll-over Machine, hand-rammed roll-over machine, and a small jar-ramming roll-over machine for making cores, designed for light operation by women in the core room, if necessary. All machines in operation. Motion pictures of machines in operation in various plants.

Moltrup Steel Products Co., Beaver Falls, Pa. —An extensive display of flattened steel pattern plates, core plates, finished machine keys, finished machine racks and cold drawn steel bars.

Monarch Engineering and Mfg. Co., Baltimore, Md. Brass Furnaces, Tilting Coke Crucible Furnace, Tilting and Stationary Oil Crucible Furnaces, and Acme Core Ovens.

Mott Sand Blast Mfg. Co., Inc., Brooklyn, N.Y. —A working exhibit consisting of Sand Blast Tumbling Barrel, hose type machine, cabinet, and accessories.

E. H. Mumford Co., Elizabeth, N.J. Molding Machines.

Mumford Molding Machine Co., Chicago.—Power Squeezers.

National Engineering Co., Tacoma Building, Chicago. Simpson Intensive Foundry Mixer in actual operation mixing foundry sand. Simpson Continuous Core Reducer and National Screen Separator.

National Safety Council, Chicago. Safety exhibit.

New Chicago Crucible Co., Chicago.—Crucibles.

New England Coal and Coke Co., Boston, Mass. —Modell of Bunker Hill Monument reproduced from by-product coke.

The New Haven Sand Blast Co., New Haven, Conn. Self-contained Sand Blast Rolling Barrel, Hose Type Sand Blast Machine, Diamond Grit, Chilled Shot, and other Sand Blast accessories.

William H. Nicholls Co., Inc., Brooklyn, N.Y. Jolt Ramming and Power Squeezers with automatic gravity drawing device, plain power molding machine, plain combination jolt-ramming and power molding machine with roll-over device.

Norma Co. of America, New York.—Ball bearings, roller bearings, precision testing instruments, etc.

Norton Co., Worcester, Mass. Bench and floor types Grinding Machines in operation. Grinding wheels used in Foundry work.

O. K. Crucible Co., New York.—Japanese crucibles.

S. Obermayer Co., Chicago.—Power and floor sprue cutters, brass furnaces, tumbling barrel, core ovens, bellows, ladles and shanks, rosin mills, snap flasks, etc. Hausfield Open Flame Brass Melting Furnace. Combs' riddle.

Oliver Machinery Co., Grand Rapids, Mich.—16" tool room engine lathe in operation. Photographs of complete line of pattern shop machinery, and the Universal Wood Milling Machine.

The Osborn Manufacturing Co., Cleveland, O. —Hand and power operated machines. Direct Draw roll-over jolt machines, plain air squeezers, combination jolt squeezers, "Little Wonder" roll-over machines, drop plate and stripping plate machines, combination jolt stripper squeezer machines.

Oxweld Acetylene Co., Newark N.J.—Complete line of Oxweld Equipment, part of it in actual operation. Oxweld low pressure type acetylene generating unit, Oxweld portable pressure generator in operation.

Pangborn Corporation, Hagerstown, Maryland. —Enlarged photographs of various types of machines and out-of-the-ordinary installations of Sand blast and allied equipment, together with specimen castings before and after sand-blasting.

J. W. Paxson Co., Philadelphia, Pa. Foundry equipment and Surplus, Sand Blast Machinery, Sands, Facings, Moving Pictures, Photograph and Blue Print Display Fixture.

Peerless Machine Co., Racine, Wisconsin.—Peerless High Speed Heavy duty Metal Cutting Saws.

The Philadelphia Bourse, Philadelphia, Pa.

Pickands, Brown & Co., Chicago. A patriotically trimmed display of Solvay Coke in the form of a wheel hub, with gilded spokes.

Pittsburgh Crushed Steel Co., Pittsburgh, Pa. —Samples of all sizes of Angular Grit, the original angular metallic sand blast abrasive.

Portage Silica Co., Youngstown, O.—Steel Molding Sand, Sand Blast Sand, and Core Sand.

Henry E. Pridmore, Chicago.—Electric jarring machine in combination with air power rock-over power draw machine. Electric jarring machine in combination with air stripping plate machine, plain hand rock-over drop machine, plain air power rock-over hand draw machine, hand stripping plate machine, and air power squeezer machine.

Quigley Furnace Specialties Co., New York City.—Furnace specialties, including powdered coal controllers, Lalor automatic oil valves, electric furnaces, high temperature furnace cement, and pyrometer equipment.

Railway Mechanical Engineer, New York City. Copies of Railway Mechanical Engineer. Photographs in frames illustrating application of all types of machinery to railroad work, textbooks, etc.

Richey, Browne & Donald, Inc., Maspeth, N.Y. Small working model of Roller-Ramming and Molding Machines, and Sand Handling Appliance.

Rivett Lathe and Grinder Co., Boston, Mass. Back-geared precision bench lathe mounted on a cabinet with individual motor drive and attachments. Two sizes of internal grinders complete with standard equipment. Improved threading tool.

Robeson Process Co., New York City. Photographs, specimens of cores bound with glutrin, and samples of glutrin.

Rogers, Brown & Co., Cincinnati, O.—The largest collection of samples of pig iron ever brought together. Bee-hive and by-product oven, metallurgical coke, a wide assortment of ferrous alloys, grey iron, semi-steel, and malleable iron castings of unique, practical, and ornamental character.

THE SPIRIT OF NEW ENGLAND—REPRESENTATIVE FIGURES ON A COKE EXHIBIT IMMEDIATELY IN FRONT OF PLATFORM.

Safety First Shoe Co., Providence, R.I. Molders' Shoes.

Sand Mixing Machine Co., New York City.—Sand Mixing Machine, "Humane" Sand Blast Room, Rotary Table Sand Blast Room, and Sand Blast Tumbling Barrel.

Shepard Electric Crane and Hoist Co., Montour Falls, N.Y. Electric Hoists. Section of monorail track and T-bar conductor with insulators and accessories. Enlarged photographs showing entire Shepard line.

Simonds Manufacturing Co., Fitchburg, Mass. —Hack Saw Blades, Files, Metal Cutting Circular Saws and Metal Slitting Saws. Inserted Tooth Metal Cutting Saw in operation on a machine.

W. W. Sly Manufacturing Co., Cleveland, O.—Sand Blast Room, Horizontal Sand Blast Barrel, New Style Pressure Tank, Baby Sand Blast Mill with Dust Arrester; Resin Mill and Two-section Drawer Type Core Oven.

R. P. Smith & Sons Co., Chicago.—"Protecttoe" Safety Shoes for Molders and Foundrymen.

Werner G. Smith Co., Cleveland, O. Linoil and other grades of core oils; specimens of cores and castings. Plumbago, firebricks and fire clay.

Standard Equipment Co., New Haven, Conn. Cinder Mill in operation.

Sterling Wheelbarrow Co., West Allis, Wis.—Sterling Rolled Steel Flasks, Special Foundry Barrows, General Foundry Barrows, Shop Boxes, Flask Pins, Wedges, Skim Gates.

W. F. Stodder, Syracuse, N.Y. Cyclone Suction Sand Blast Nozzle.

Strong, Kennard & Nutt Co., Cleveland, O.—Goggles and Safety Appliances.

Sullivan Machinery Co., Chicago.—Sullivan Angle Compound Plate Valve Short Belt Driven Air Compressor, 445 cu. ft. capacity. Sullivan splash oiled single stage, belt driven air compressor. Sullivan end rolling finger plate valves for angle compound compressor. Photographs and literature describing Sullivan air compressors of all classes.

Swan & Finch Co., New York City.—Core Oil, Cutting Oil, and special products used in foundry and shop practice.

Thomas Iron Co., Hokendauqua, Pa. "Thomas Vanadium" Pig Iron.

Titanium Bronze Co., Inc., Niagara Falls, N.Y. Bronze and Copper Sand Castings including Titanium Aluminum Bronze Castings. Bronze Die Castings of Titanium Aluminum Bronze.

United Compound Co., Buffalo, N.Y.—Buffalo Brand Vent Wax for core venting purposes, and Buffalo Brand Pattern Wax, a substitute for beeswax and bayberry wax.

United Metal Hose Co., Inc., New York City. Metallic hose for pneumatic tools, sand blasting, welding and cutting apparatus, steam, water and oil.

United States Graphite Co., Saginaw, Mich. — Graphite foundry facings.

U. S. Molding Machine Co., Cleveland, O.—Plain Air Squeezer, Jar and Squeezer, Jar Squeeze Pattern Draw Machine, Plain Jar Machines, Jar Pattern Draw Machine, and Roll Over Pattern Draw Machine.

United States Silica Co., Chicago.—Samples of Flint Shot. Views of plants where Flint Shot is produced, also where it is used. Booklets and other literature describing the product, and reprints of trade paper advertisements regarding factories where its advantages have been demonstrated.

Wadsworth Core Machine and Equipment Co., Akron, Ohio.—Complete Core Room Outfits.

J. D. Wallace & Co., Chicago.—Wallace Bench Planer in operation.

The Warner & Swasey Co., Cleveland, O. —Universal Hollow Hexagon Turret Lathe on Bar Work, Universal Turret Screw Machine on Bar Work and Plain Head Turret Screw Machine equipped to do Bar Work.

Wentworth Institute, Boston, Mass.—Demonstrations and work in applied science as given in Foundry courses. Work in molding by students from selected assortment of patterns, showing various methods.

Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.—Exhibit of Safety Appliances used in the Westinghouse works.

Wheeler & Holcomb Co., Chicago.—"Safety First" wearing apparel, including gloves and mittens made from asbestos cloth and leather. Aprons, leggins, spats, and other apparel for protecting foundry and steel works operators.

[illegible]e & Bro., Inc., Philadelphia, Pa.—Copper and brass ingots and castings (rough and smooth made from these in ingots). Babbitt Metals.

Whitehead Bros. Co., Providence, R.I. Foundry sands, supplies and equipment.

Whiting Foundry Equipment Co., Harvey, Illinois.—Foundry equipment including a ten-ton crane trolley, teapot spout ladle, and round plate barrel tumbler. Photographs and drawings of extensive line of Foundry machinery.

T. A. Willson & Company, Inc., Reading, Pa. Industrial Eye Protectors known as Willson Safety Goggles and Willson Safety Flange Goggles featuring Super-Tough lenses and the Willson Patented Safety Flange.

T. B. Wood's Sons Co., Chambersburg, Pa.—Peerless Patented Tapered Snap Flask and Automatic Adjustable Patented Jacket. Flasks fitted with pin equipment of different designs will be shown in various sizes, as well as jackets in corresponding sizes.

E. J. Woodison Co., Detroit, Mich.—Woodison Electric Jar, Stripping Plate, Roll Over Mo[illegible] Machine. Woodison Air Squeezers. Doroner [illegible] tern Grinders. Electric Vibrators, Woodseed Liquid Core Compound, Foundry Facings, Supplies, Fire Brick, Platers' and Polishers' Supplies.

CANADIAN REPRESENTATION.

H. W. Burgess, the Wallaceburg Brass and Iron Mfg. Co., Wallaceburg, Ont.

Frank M. Meyers, Hyde & Sons, Montreal, Que.

Wm. Bamnow, Dodge Mfg. Co., Ltd., Toronto, Ont.

J. Briggs, Frost & Wood Co., Smith's Falls, Ont.

R. J. Hopper, Pratt & Letchworth Co., Brantford, Ont.

Wm. H. Inglis, Ottawa Car Mfg. Co., Ottawa, Ont.

B. G. Newton, MacLean Publishing Co., Toronto, Ont.

T. H. Jones, Canadian Westinghouse Co., Hamilton, Ont.

F. Paquet, Deloro Smelting & Refining Co., Deloro, Ont.

Wm. M. Maybank, E. J. Woodison Co., Toronto, Ont.

A. J. Palmer, Empire Mfg. Co., London, Ont.

J. D. Riffer, St. Catharines Brass Works, St. Catharines, Ont.

H. J. Roast, Jas. Robertson Co., Ltd., Montreal, Que.

J. L. Rummer, Frost & Wood Co., Smith's Falls, Ont.

Arthur C. Steer, Dominion Copper Products Co., Ltd., Montreal, Que.

C. J. Seeley, T. McAvity & Sons, Ltd., St. John, N.B.

M. E. Tuck, T. McAvity & Sons, Ltd., St. John, N.B.

Peter Bain, MacLean Publishing Co., Toronto, Ont.

Leonard Kipp, Mueller Mfg. Co., Sarnia, Ont.

C. V. Barton, Martin Mfg. Co., Whitley, Ont.

G. E. Purkis, Canada Foundries and Forgings, Ltd., Brockville, Ont.

R. J. Paquette, the Spence Co., Ltd., Montreal, Que.

J. J. McFadyer, E. J. Woodison Co., Toronto, Ont.

F. Washburn, Canada Foundries and Forgings, Ltd., Brockville, Ont.

T. Essery, Webster & Sons, Ltd., Montreal, Que.

A. M. Campbell, Canada Foundries and Forgings, Ltd., Brockville, Ont.

B. W. Meill, Canada Machinery Corporation, Galt, Ont.

M. B. Karr, Brown's Copper and Brass Rolling Mills, New Toronto, Ont.

L. S. Mitchell, R. Mitchell Co., Ltd., Montreal, Que.

W. Beatty, Beatty Bros., Ltd., Fergus, Ont.

L. B. Bennettt, Maxwells, Ltd., St. Mary's Ont.

D. G. Bell, Dominion Coal Co., Glace Bay, N.S.

J. Webb, Canada Machinery Corporation, Galt, Ont.

H. E. Ouellette, Dominion Foundry Supply Co., Ltd., Montreal, Que.

D. Bell, Dominion Coal Co., Glace Bay, N.S.

A. Oliver, Sheldons, Ltd., Galt, Ont.

J. R. Ellis, W. F. Vilas, Cowensville, Que.

G. H. Weaver, Dominion Foundry Supply Co., Montreal, Que.

F. E. Gardiner, Dominion Copper Products Co., Montreal, Que.

W. F. Vilas, Cowensville, Que.

Herbert Smith, Jenkins Bros., Ltd., Montreal, Que.

George F. Foss, Foss Hill Mach. Co., Montreal, Que.

G. F. Carmichael, McKinnon Dash Co., St. Catharines, Ont.

W. A. Janssen, Canadian Steel Foundries, Ltd., Montreal, Que.

C. F. Moss, Pratt & Letchworth, Brantford, Ont.

A. J. Oliver, R. McDougall Co., Galt, Ont.

J. Dunaldoon, Miller Bros. & Sons, Montreal, Que.

A. Darisse, Desjardins Co., St. Andre, P.Q.

H. A. Gutenkunst, Canadian Malleable Iron Co., Owen Sound, Ont.

F. A. Fisher, Enterprise Foundry Co., Sallville, N.B.

F. Crossley, McClary Mfg. Co., London, Ont.

H. Hertfelder, Dodge Mfg. Co., Toronto, Ont.

F. C. Hatch, Martin Mfg. Co., Whitley, Ont.

Dominion Government.

J. L. Hummer, Frost & Wood Co., Smith's Falls, Ont.

C. H. Bennett, Western Foundry Co., Wingham, Ont.

J. J. Cunningham, Western Foundry Co., Wingham, Ont.

J. Leishman, American Locomotive Co., Montreal, Que.

J. M. C. Moore, McClary Mfg., Co., London, Ont.

THE APPLICATION OF PULVERIZED COAL TO MALLEABLE MELTING FURNACES*

By Joseph Harrington, Chicago.

MELTING malleable iron with powdered coal as a fuel must still be considered in the experimental stage. The assurance that its advocates feel comes from an analysis of the requirements for melting and the definitely defined results that can be obtained with this fuel in securing controllable temperatures. In but one instance known to the writer has malleable iron been melted with powdered coal on a commercial scale, and this experiment was so brief that the only practical effect was to supply the observers with a fund of optimism and a feeling of certainty that had the work been continued, economical operation would have been effected. My analysis, therefore, must necessarily be more or less along the lines of theory, but I hope thereby to bring out in discussion such actual experiences as have been obtained, confirming or rejecting the theories advanced in this paper.

A Diversity of Opinion

In conversations with foundrymen I have developed a considerable diversity of opinion as to the temperatures which actually obtain in the malleable furnace. This experience does not differ in any way from that which one develops when the matter of high temperature in steam boiler furnaces is under discussion. It is not the simplest matter to determine temperatures above the range of the thermo-electric couple. Nominally at least, the metal couple can be utilized up to 2,400 degrees Fahr., but rapid deterioration takes place at these temperatures and the reading to a considerable degree is unreliable. The use of the radiation or optical pyrometer is also uncertain to a certain extent, because of the ease with which the instrument may be put out of adjustment and the care that must be exercised in focusing on a solid body without a gas screen to affect the intensity of radiation. When a good instrument is properly used the readings are correct, and the writer has developed temperatures in this manner up to 3,000 degrees. Under these conditions the amount of excess air supplied was cut down to near the limit, the carbon-dioxide resulting being about 16 per cent.

Temperature is also affected by the size and proportions of the furnace, so that a proper design will enable the engineer to secure temperatures which are sufficiently high and at the same time practical in the matter of brickwork maintenance.

The iron charge melts at various temperatures, ranging from 2,200 degrees to probably as high as 2,600 degrees, so that it is necessary to obtain at least the latter temperature for the prompt and economical production of fluid iron. This can easily be obtained with pulverized coal, especially if it is introduced as in a bunsen burner, which provides the elements in proper proportion within the fuel jet itself. The question of proper mixing of the fuel with the air for its combustion is absolutely vital, and in this process particular care must be taken that all of the elements are under control. Both the coal and the air must be introduced in such a manner that the character of the flame can be changed at will in accordance with the requirements of the charge at its various stages of heating and fusing.

Charge Should Be Heated Rapidly

During the early stages of heating, the charge is cold and should be brought up to melting temperature as soon as possible consistent with the proper soaking effect. The charge as a whole should come to its melting temperature with a reasonable degree of uniformity, so the various ingredients will not be melted at different times and enter the bath unmixed. The time element in this introductory period is one that affects the fuel economy only. The curve of temperature rise should be as steep as possible, because this is usually a period when the combustion is least complete and the loss consequently greatest. With powdered coal I venture to state the firing end of the furnace can be brought to a high heat within an hour, even though the furnace is cold to start with. With hand firing this period is often several hours long. Herein we see

*A paper read at the annual meeting of the American Foundrymen's Association, at Boston, Sept., 1917.

the first evidence of economy with this fuel.

The second period is one in which both fuel economy and effect on the charge are to be considered. After the iron reaches its melting point the charge begins to subside and becomes liquid. This is a period when it is almost probable the loss of the valuable ingredients in the iron takes place. We have present the necessary temperature in both the metal and the oxygen, together with an intimate mixture of the two which practically necessitates the oxidation of an appreciable percentage of carbon, manganese and silicon in the charge. Not only do these elements burn out, but other and less desirable elements may increase if the contact is unduly prolonged. The presence of sulphur in the furnace gases is one that has been commented upon in many different ways. Foundrymen almost always go to the expense and trouble of buying a special grade of coal which is low in sulphur on the theory that this harmful element should be kept as low as possible for the sake of its effect on the product. At the same time I have heard it emphatically stated that some of the best physical tests were obtained from iron which analyzed high in sulphur, so that it is not definitely defined in my own mind just what weight the amount of sulphur in the coal should have in such a discussion.

Not Like Other Fuels

In any event, as has been so clearly stated by Mr. Spring of the Crane Co., the burning out of certain elements may be serious and the melting of the charge should therefore be effected as rapidly as possible. The intense and sustained temperatures which can be produced with powdered coal would certainly lead to the belief that the desirable conditions for quick melting could readily be obtained. It must always be borne in mind that the fuel we have under discussion is nothing like solid fuel. We introduce the entire body of fuel directly into the chamber to be heated and at the same time it is of such a nature that the mixture is most intimate and the combustion most complete. Any proportion of air and fuel may be introduced, so that the character of the resultant flame may be nicely adjusted to the requirements of the melting process. This is in very sharp contrast to the average hand fired furnace wherein the blast has to be shut off periodically while the door is opened for firing. The production of heat during this time is suddenly lowered, and the temperature of the furnace correspondingly drops. After the fresh charge has begun to burn freely, the temperature mounts to a point slightly higher than before and about the time the fire is in its best condition, the blast is again shut off and the operation is repeated.

The temperature curve is therefore one of alternate risings and fallings making it like a saw-tooth. This, of course, is not strictly the case with the relatively few natural draft furnaces, but the effect of the introduction of the fresh fuel is the same. The fire has to be continually raked, and the production of gas naturally varies. Not only does it vary, but it is under very little control, the only effect which the average furnaceman desires being the production of the required temperature. To this end he sacrifices everything else and under unfavorable conditions he may fire several hours just as hard as possible before the charge is properly heated.

More Hard Firing

After the iron has all liquefied and becomes covered with a layer of slag, further hard firing must be resorted to in order to produce a temperature high enough to render the iron sufficiently fluid for its purpose. With the iron thus protected from the effect of the furnace gases the presence of more or less oxygen is a matter of indifference so far as the iron itself is concerned. Under these conditions, with powdered coal the excess air can be proportioned to produce the most intense temperatures, and I do not hesitate to state that flame temperatures well in excess of 3,000 degrees may thus be created. A peculiar effect which accompanies a powdered coal flame in proper condition is the absence of the heavy rolling opaque flame which is so noticable under ordinary conditions. It was found after many experiments with fuel oil that the non-luminous flame was the hottest. This, of course, is similar to the gas flame of the bunsen burner as compared to the fish tail burner. With powdered coal the condition chemically is similar, but on account of this fuel having a high percentage of fixed carbon in it, absence of luminosity cannot be obtained. At the same time the extent of the flame can be controlled so that complete combustion will take place within five or six feet of the burner even when this burner is delivering 500 to 600 pounds of coal per hour. The effect of the direct contact of such a flame with any object is extremely destructive. It is possible to melt a clay fire-brick almost as readily as a piece of iron after it is placed in exactly the right relation to the jet. The point of most intense temperature is just about at the end of the flame, and one can readily appreciate the reason why a pile of iron must liquefy promptly when one considers that the flame temperature is perhaps as high as 3,500 to 4,000 degrees.

Effect on Furnace Lining

Another serious question which arises in this connection is the effect upon the refractory lining of the furnace. This should be divided into two parts for discusion. First, the effect on the brick of the temperature alone, and second, the fluxing effect due to the chemical action between the bath or the slag and the brick which forms the furnace walls.

So far as the first is concerned I would not consider that the deterioration of the refractories would be any greater than with ordinary methods of firing. In the first place the powdered coal jet does not impinge directly upon any brick work, and there need be, therefore, no blow pipe action whatsoever. The controllability of the flame is such that just the right furnace temperature may be secured and I do not believe it is a necessary consequence that the high temperature jet will result in any greater fusing of the brickwork than now obtains with the long continued hand firing. A good brick should be able to withstand 2,800 degrees indefinitely, and 3,000 degrees for moderate periods. I doubt if these temperatures are often reached in the malleable furnace.

The second consideration of the firing effect is more serious, but is one which I feel can be kept under control. The chemical analysis of furnace slag does not differ in quality from the analysis of ash from powdered coal. Ash analyses show a wide range in the percentages of the various ingredients, but seldom any great diversity in the ingredients themselves. These are the oxides of silicon, aluminum, iron, manganese and calcium, which corresponds to the elements appearing in the malleable furnace slag. The addition, therefore, of melted coal ash to the bath does not alter anything except the range of its chemical constituents. The effect on the furnace lining may be altered in case the addition of the coal ash should bring some one element greatly in excess of the others, but I can see no reason why the addition of these elements should make the character of the slag seriously different. It would even be possible to introduce a certain amount of lime for instance, should it be necessary to keep the slag basic. In fact almost any such element could be introduced with the coal and very intimately mixed with it, so that the resultant slag could be readily controlled, both as to chemical analysis and fluidity. I cannot but feel, therefore, that fears regarding the destruction of the furnace sidewalls are based on considerations which will disappear when the matter is more fully studied.

Less Carbon Burned Out

All the evidence which I have been able to obtain from the brief practical experience with this fuel in this service, is that there was an actual diminution in the burning out of carbon to the extent of some 2 to 5 per cent., rendering it necessary to decrease the amount of new pig in the charge to that extent in order that the character of the iron should be the same. This experience is much the same as that which has been accepted by steel manufacturers in their experience with this fuel in heating steel. With fuel oil in steel heating service, we find from 6 to 8 per cent. of excess oxygen in the gases, the actual oxidation of the iron due to the heating in the furnace being about 4 per cent. With powdered coal in the same furnace the amount of excess air is reduced to between 2 and 3 per cent., so that the amount of oxygen actually present in the furnace gases is less than one-half and the oxidation of the metal is substantially reduced. Observations indicate that this reduction may be as great as 50 per cent.

What is true when iron is only heated to rolling temperature should most certainly be true when actually melted, so that the grounds for believing in a re-

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NEW AND IMPROVED EQUIPMENT

A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

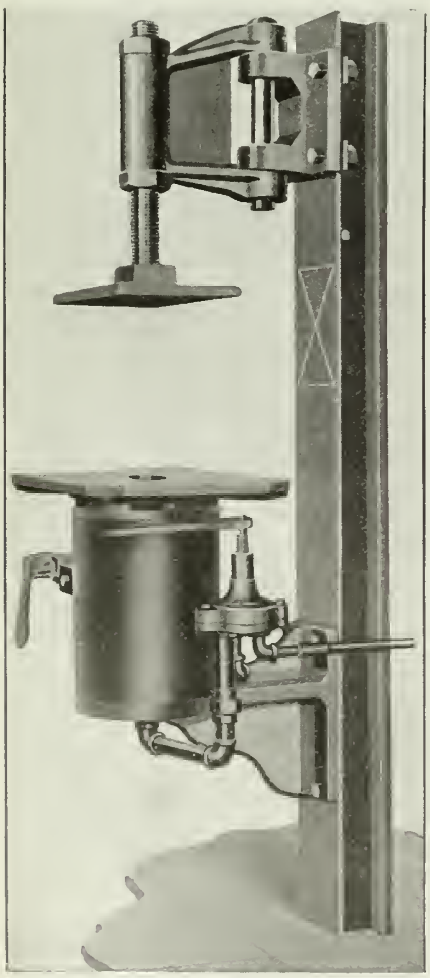
NEW SQUEEZER MOULDING MACHINE

THE moulding machine illustrated in the accompanying engraving is of the squeezer type, and has been specially designed to combine speed, efficiency, simplicity, and fool-proofness. The Rapid moulding machine is the product of the Federal Malleable Co., West Allis, Wis., who have developed it during the past two years so as to enable it to be operated by unskilled moulders over a wide range of work.

Highly refined features have been avoided, and rapid and simple adjustment provided, whereby castings may be made varying in weight from considerably less than an ounce to over fifteen pounds in weight.

The bench plate is 21 in. long by 14 in. wide, while the squeezer head is 14 in. long by 8 in. wide. Maximum adjustment between squeezer head plate and bench plate is 15 in. The cylinder has a bore and stroke of 8 in. by 5¼ in., and operates at from 65 to 85 lbs. pressure per sq. in., 80 lbs. being recommended for general use. The shipping weight is 800 lbs.

These machines are fitted with the Rapid operating valve, which is self-seating and leak-proof.



SQUEEZER TYPE OF MOLDING MACHINE WITH RAPID ADJUSTMENT FOR WIDE RANGE OF WORK.

FIG. 1. PLATE VALVES ARRANGED IN CAGES TO REPLACE LARGE POPPET VALVES PREVIOUSLY EMPLOYED.

RECENT DEVELOPMENTS IN BLAST FURNACE BLOWING EQUIPMENT

AFTER the general adoption of the steam turbine in large central power, the erroneous impression gained ground that the replacing of the reciprocating blowing engine by the turbo blower could only be a question of a comparatively short time. This expectation of the uninitiated was not realized and it is doubtful if it will ever be realized.

The same laws of nature which give the steam turbine advantages over the steam engine, are obstacles in the case of the turbo blower. Firstly, the steam turbine excels the steam engine only in the region below atmosphere, and in the compression of air for blast furnace use this region is absent, because, naturally the compression must start with atmospheric pressure. Secondly, the losses in the earlier or high pressure stages of the steam turbine are converted into heat which can be utilized in the latter stages, while in the turbo blower the losses in the early or low pressure stages mean additional work to be done in the latter stages. Thirdly, the steam turbine utilizes the highly efficient process of converting pressure into velocity, whereas, the turbo blower tries to utilize the very inefficient process of converting velocity into pressure. Fourthly, the central power station utilizing large turbo generators, makes power for the sake of selling it. High steam pressure, superheat and vacua which are impracticable around a blast furnace, can be introduced in the central station. Larger and larger units can also be installed, whereas the size of the turbo blower is limited by the size of the blast furnace.

While for these very reasons engineers with knowledge of the underlying principles always had their doubts concerning general adoption of the turbo blower, another rather unexpected reason has considerably delayed and hindered its introduction. The reason in question is, incorrect governing of the blower and consequent dusting of the furnace. The turbo blower is a machine supposedly free from pulsations, and great advantages were expected from a steady stream of air going to the furnace. But practice has shown that, quite on the contrary, the vast majority of turbo blowers vary in volume delivery a much greater amount than reciprocating blowing engines do. The amount of ore lost by dusting due to this fluctuation of air supply is so great that most blast furnace managers are, at the present time, afraid to install turbo blowers.

In blowing engines the course of development likewise has been following

FIG. 2. SHOWING HOW VALVES HAVE BEEN MADE TO FIT A PREVIOUS SEGMENTAL ARRANGEMENT.

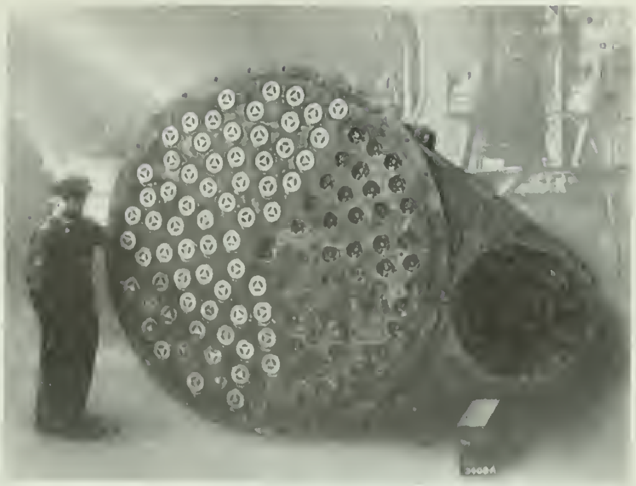


FIG. 3. ILLUSTRATING METHOD OF INSTALLING PLATE VALVES IN PLACE OF EXISTING VALVES IN THE HEAD.

rather unexpected lines. By comparison of the number of new furnaces built with the number of new blowing engines and new turbo blowers installed, it is found that a comparatively small amount of new blowing equipment has been added. This surprising result is explained by the fact that a very large number of existing blowing engines have been rebuilt in such a way as to have a larger capacity and to serve a greater number of furnaces than heretofore. The possibility of increasing the capacity of existing blowing engines is largely due to the increase in piston speeds made possible by the introduction of plate valves which have been mentioned before in our columns. A great amount of rebuilding of existing blowing engines has been done by the Mesta Machine Company of Pittsburgh, Pa., with plate valves manufactured under Iversen patents.

The so-called rebuilding of blowing engines is, in some cases, limited to the simple replacing of the existing valves by automatic plate valves. In other instances it means more than that, namely, the removing of old cylinder heads and replacing them by heads containing plate valves. In the most extreme cases it means the removal of the whole air end including the air cylinder.

An illustration of the methods employed in replacing an old type of valves by plate valves is shown on Fig. No. 1. Here are seen plate valves arranged in cages, which take the place of large poppet valves, originally operating in the head. The cages are dished in order to reduce clearance to a very small amount. In many cases the clearance volume is smaller than it was with the original valves, while in other cases it is increased slightly, depending upon the type of valves being replaced by the cages. But even in this latter case, the advantages gained by the instantaneous opening of the valves, and the larger area secured, are so overwhelming, that the slight increase in clearance volume fades into insignificance.

The arrangement of the valves in cages offers several advantages. The removal of one cover plate exposes all outlet valves of the cage to inspection on the delivery side. The inlet cages are made in two parts so that the removal of one cover and the top of a cage exposes all the valves of that cage to inspection. In the extremely rare case of breakage of a valve, the whole cake can be easily removed and replaced by a spare one.

Fig. No. 2 shows how valves have been made to fit a segmental arrangement of old valves. Fig. No. 3 illustrates the method of installing valves in place of existing valves in the head. This latter method as a rule gives some increase in valve area, but not enough to warrant increasing the speed of the engine materially. This method is to be recommended particularly in the case of old blowing engines equipped with leather valves. The advantage is twofold: first, the plate valves are always tight and in consequence deliver more air, whereas leather valves soon begin to leak, due to warping or charring of the leather; second, higher pressure can be blown.

The second method, namely, that of replacing old air heads with new ones, ist very widely practised at the present time. Fig. No. 4 shows the appearance of such air heads. The third and last method, namely, that of replacing the old air end has been necessary only very occasionally. Fig. No. 5 shows the ap-

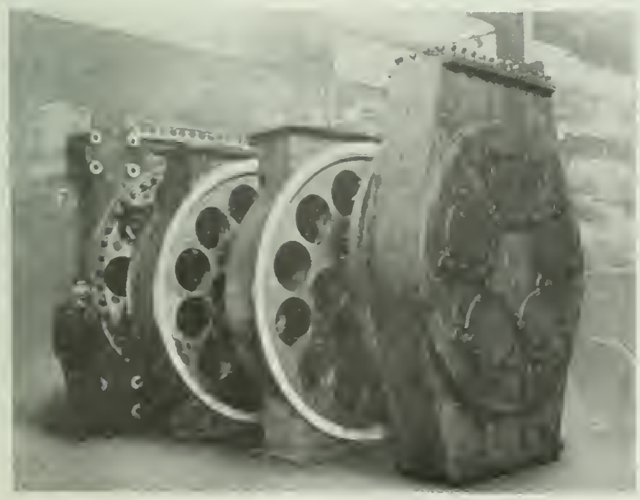


FIG. 4. REPLACING OLD AIR HEADS WITH NEW ONES.

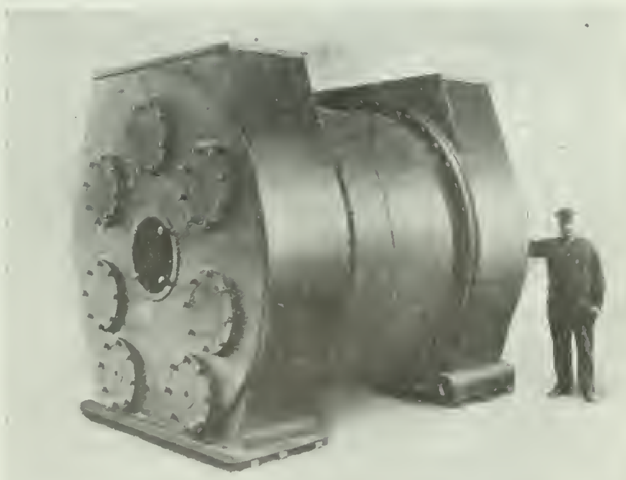


FIG. 5. NEW AIR ENDS WHICH HAVE REPLACED OLD ONES.

pearance of such an air end.

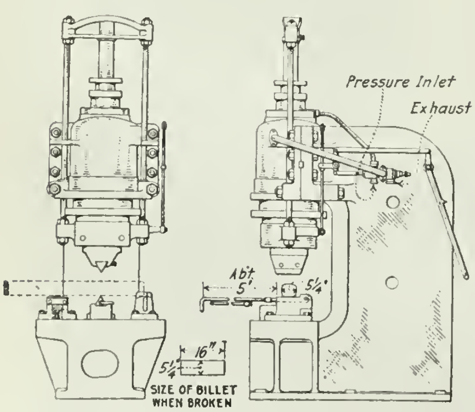
Mention has already been made of the fact that plate valves allow higher piston speeds. This feature is beneficial in several ways. Right now, due to the poor trade of coke available, many furnaces are troubled by the necessity of more air than was used in the past when better coke was on hand. Increasing the supply of air has pulled several furnaces out of a bad predicament. More air means not only more pig iron, but in addition, more furnace gas, more steam and steady profitable operation.

The installation of plate valves, and the resulting possible increase in speed of the blowing engines, has enabled a number of plants to erect another furnace without installing additional blowing units. The heretofore customary practice of blowing a furnace with three or sometimes four tubs, has given way to the present possibility of blowing a furnace with two tubs only; and, in fact, a great many furnaces in this country are being blown to-day, using only two 84 in. diameter blowing tubs equipped with automatic plate valves. From this it can be seen that the blowing capacity of existing plants can be increased 50 to 100 per cent. by equipping the present engines with automatic plate valves.

200-TON HYDRAULIC BILLET BREAKER.

THE machine shown in the accompanying line drawings was designed for breaking steel bars into 16 in. lengths, for use in munitions manufacture. A feature of the design is the provision of triangular section notching blades which nick the blade top and bottom simultaneously and thus avoid the necessity of turning over the billet to nick the bottom side. Their peculiar section enables them to be reset in the dies so as to get the use of three cutting edges.

The bar to be cut is fed over a spring supported roller which carries it clear



200-TON HYDRAULIC BILLET BREAKER.

of the bottom knife so that it can move over to the right hand stop. The upper knife is then forced down by the hydraulic cylinder, the spring supported roller yielding sufficiently to allow the work to be nipped between the two knives. After being thus notched, the lower knife is withdrawn by hand, and renewed pressure by the ram bends the bar down sufficiently far to break it. If the material is more than usually soft, it may be necessary to notch it all around.

The ram operates under a pressure of 1,500 lb. per sq. in. and has a diameter of 20 in. with stroke of 12 in. giving a capacity of 38 billets per hour. Power is supplied direct from a three-throw pump 2½ x 6 in., driven by a 25 horsepower motor through double helical gearing. A weight controlled relief valve is fitted on the pump system. The machine is a recent design developed by a Yorkshire engineering firm in England.

NEW METHOD OF SMELTING POOR IRON ORE

ACCORDING to the "London Times," two young Norwegian engineers have made an important discovery within the realm of steel smelting, which will probably have far-reaching results. The discovery has been patented and consists of a new method of smelting poor iron ore by electric energy into first-class steel at a very low cost and with less fuel. The smelting will be done by assistance of coal oxide gas and water gas, and the new important factor of the discovery is that the coal gas by passing through a flame oven is reduced to coal oxide, which can be utilized again.

The well-known metallic expert, Dr. Groendal, welcomes the new process, and has put his different metallic patents at the disposal of the young engineers. Practical people are sanguine of the success of the new smelting process, which will specially suit a country like Norway with only poor iron ore deposits, but plenty of cheap water power at disposal. The Norwegian mining trade journal, "Bergverkflyt," referring to this new discovery, says: "We welcome this discovery with sincere pleasure, and hope it will make our naturally poor country rich and mighty."

Export of Coal to Canada.—A despatch from Washington, D.C., states that continued export of coal to Canada in large amounts through Great Lakes ports at the expense of the Northwestern States will be checked immediately by the Fuel Administration. Dr. H. A. Garfield, the Fuel Administrator, has requested the Exports Administration Board to permit no more coal to be shipped from the country except under license restrictions, and asked that no licenses be granted unless they are approved by the Fuel Administration. Coal heretofore, along with other American products, has gone to Canada under blanket licenses issued by Collectors of Customs. "The Fuel Administration," said Dr. Garfield, "does not intend to cut off Canadian exports, but with this supervision it will be able to equalize the distribution of coal, and see that the Northwest and Canada both get their fair shares."

PALAU is the name of a new alloy of gold and palladium which has recently undergone tests at the United States Bureau of Standards, having been originated by a Californian metallurgist as a substitute for platinum in laboratory crucibles. The loss in weight on heating to 1,200 deg. Cent. is intermediate between that suffered by crucibles of platinum containing 0.6 and 2.4 per cent. iridium respectively. The melting point of the alloy is 1,370 deg. Ceut., which corresponds to that of an alloy of 80 per cent. gold and 20 per cent. palladium. In resistance to most of the chemical reagents to the action of which such ware is ordinarily exposed, palau compares favorably with ordinary platinum ware.

THE behaviour of silicon-iron alloys under the action of various acids was discussed by Prof. O. L. Kowalke recently before the American Electro-Chemical Society. The author's conclusions are that silicon-iron alloys of about 3 to 5 per cent. silicon are attacked very readily by sulphuric, hydrochloric, acetic, and citric acids. These alloys are not excessively brittle. Silicon-iron alloys of about 16 to 18 per cent. are exceedingly resistant to action of sulphuric, hydrochloric, nitric, acetic, and citric acids. These alloys are so brittle that they must be ground; they cannot be machined. A solid solution of FeSi in iron near 20 per cent. silicon is resistent to mineral acids. Search is in progress for a third metal which can be added to the iron-silicon alloys to improve their strength and still retain the resistence to the action of acids.

TO BLACKEN COPPER

TO BLACKEN copper evenly without injuring the surface, 2 ounces of sulphuret of soda should be dissolved in 1 gallon of warm water to make a mixture that will blacken the surface without eating into it. The articles should be cleaned as for plating, then dipped into the dip until a uniform black is produced, and then rinsed in hot water and dried as usual. The finish is greatly improved by dry scratch brushing the articles after they have been blacked.

PULVERIZED COAL

Continued from page 173

duction of oxidation are certainly good.

The situation commercially at this moment is rather peculiar. Almost without exception foundrymen will admit all of the foregoing, and the figures which I have prepared in a number of cases showing the probable savings, have remained undisputed. These savings are as much as 100%. per annum, and yet the entire industry seems to be waiting for the other fellow to do it first. It is certainly a case where precedent is strong, and the reluctance of the foundrymen of this country to take the first step will probably be balanced by their eagerness to fall in line just as soon as the pioneer has completed his installation.

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PRINCIPAL CONTENTS

THE FOUNDRYMEN'S CONVENTION AND EXHIBITION

THE outstanding event of the past month in foundry circles was naturally the annual meetings of the American Foundrymen's Association and American Institute of Metals with their accompanying Exhibition of foundry equipment and supplies. From whatever point of view the combination function be judged, bubbling over success is the most fitting description one may apply, everybody being satisfied with what they saw and heard besides being primed with anticipation of the coming year having still larger progress to unfold.

Canadian foundrymen to the number of about fifty made Boston their headquarters during convention and exhibition week, and took advantage to the full of getting first hand information relative to more efficient administration and operation of the plants they represented and for the quality and quantity output of which they are more or less responsible. It does not seem, however, that the value of Foundrymen's Week is sufficiently appreciated by Canadian foundry interests, else instead of a representation of a bare half hundred, something more nearly approaching four or five times that number would see it to be to their best interests to be present. The publishers of this journal, recognizing the educational advantages to be derived by its subscribers, have associated themselves during the past decade with the exhibition feature of the foundrymen's annual, having as a matter of fact the unique distinction of being the only Canadian institution with a booth in the exhibition hall.

It has been suggested that on future occasions headquarters for Canadian foundrymen be there established, and that a systematic campaign be organized and waged with the idea of inducing our foundry executives and operators to take fuller advantage of the benefits of this annual combination gathering. We are pleased to cooperate in such an effort, and early in the New Year, by which time the plans will be more fully developed, an active propaganda along the lines indicated will be launched.

The flag-raising ceremony which marked the official opening of the exhibition, and which was repeated each morning at 9.30 a.m., was happily inspired, the enthusiasm aroused by the unfurling of the Union Jack to the strains of Britain's National Anthem, along with those of the Stars and Stripes, and the Tricolor, to the national airs of the Star Spangled Banner and the Marseillaise respectively, contributing to a spirit of good humor and good fellowship otherwise unapproachable in character and results.

To the men responsible for foundrymen's exhibition and convention week, and the success attending their efforts, no greater compliment can be paid than that they played their part in true workmanlike fashion and gave complete satisfaction to each and all of their clients.

IRON AND STEEL SITUATION

ALTHOUGH the embargo has precipitated a crisis in the iron and steel industry, events have been leading up to the climax for some months. Conditions in the trade have, for some time past, been causing considerable anxiety, but it is only quite recently that the real significance of these developments has come to be realized. Shortage of steel and high prices have been hampering manufacturers' operations increasingly of late, but the embargo has brought the situation to a climax. The situation is serious, more especially to those manufacturers not engaged upon war work, it being assumed that licenses will be issued on steel for war purposes only. No important developments are expected until the committee of manufacturers appointed to investigate the situation has necessary data upon which to base its report to be submitted to the Minister of Trade and Commerce.

In the meantime the market remains in a very unsettled condition and business is almost at a standstill. Consumers are placed in an unfortunate position, not knowing how they stand in regard to obtaining material or what price they may have to pay. This applies of course only to imported steel, but as this class of material forms a considerable proportion of the requirements of Canadian manufacturers, it is an important factor in the situation. While consumers are naturally anxious in regard to the outcome of the pending negotiations with Washington, it is fair to presume that their position will be viewed in a sympathetic manner and suggestions given the consideration that their importance merits. Owing, however, to the exigencies of the situation it appears doubtful whether relief can be obtained to the full extent desired, otherwise the purpose of the embargo would be defeated.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

THE USE OF ACIDS AND BASES IN THE PRODUCTION AND MAINTENANCE OF CLEAN METALLIC SURFACES—I

By Abe Winters

DURING the past two years manufacturers of metal goods, and munitions in particular, have been required to give unusual attention to the methods in general practice for the production of clean metallic surfaces and in the case of munitions, the preservation of uniformly clean and unprotected surfaces of brass and steel. While it is possible that the average manufacturer who has the opportunity to profit by this experience in his usual business, may apply the principles in the economic treatment of metal surfaces after the war, we have many reasons for doubting their adoption. Every formula of apparent worth has been tested by men responsible for the production of perfect parts of the various types of munitions of war, and we have begun to take notice of what may be termed a "'British Government" specification for clean surfaces on metals.

The preservation of clean surfaces on iron and steel has been a subject of great interest since these metals were first utilized for either useful or ornamental purposes, hence the present necessity does not find us entirely unprepared. The progress made during past centuries, in the preservation of iron surfaces from corrosion has been exceedingly slow and eminent scientists have devoted valuable time to the subject, with but moderate success. In this paper we do not intend to refer to the preservation of massive metallic surfaces, such as architectural metal work, underground conduits, or marine machinery, we will confine our references to the specific needs of manufacturers of ordinary metal wares as found upon the Canadian markets today.

Suitability of Hydrochloric Acid

For the simple pickling of iron or steel in plants where sand blasting is not employed, the most natural solvent is hydrochloric acid. No other single acid is as effective; it is superior to sulphuric acid although the latter is generally used for ordinary pickling of iron and steel. Iron rust and scale are simply oxides of iron and hydrochloric acid is theoretically the correct solvent. This may be proven by the fact that an ignited oxide of iron is scarcely soluble in sulphuric acid, while it may readily be dissolved in hydrochloric acid. Iron scale is really ignited oxide of iron. In actual practice on a commercial basis the hydrochloric acid should be diluted with water,—using 22 per cent. HCl, the proportions would be 50 parts acid and 50 parts water. Strong acid naturally attacks the iron or steel more rapidly than the dilute acid and would require careful attention. The action should proceed slowly if other operations are being attended by one man; a warm solution acts more rapidly but the process of speeding up a pickling operation is frequently a costly move and the better plan is to allow ample time for the treatment. The time may vary from two minutes for light rust to several hours for a very thick scale. Agitation hastens the action and may be facilitated by several very inexpensive methods.

Avoiding Subsequent Rust

The principle objection raised against the use of hydrochloric acid as a pickle for iron or steel is the increased liability of the metal to acquire a subsequent coating of rust. With the advantages offered by the clean and positive action of this acid, this objection is of very little importance in view of the fact that the pickled surface may be satisfactorily protected from further corrosive action of either acid or elements by simply immersing the iron or steel in a solution composed of one half pound of lime dissolved in one gallon of water, the lime having been previously slacked. Rewash and immerse in a hot solution of whale oil soap and water,—four ounces of the plastic soap per gallon of water. This forms an invisible film and protects the surface. The lime water neutralizes the acid and its use is commendable as a final wash for all pickled iron or steel.

Many manufacturing plants find it comparatively easy to keep a considerable amount of metal parts polished and ready for plating in advance of the capacity of the plating department. In some factories this is an established custom, and the stock is oiled before leaving the polishing department, we find that usually a certain percentage of this oiled stock is eventually returned to the polishing department to undergo a second or special polishing operation owing to defective surface caused by rust. When it is expedient to carry a stock of polished parts in the plating department, a safer and simpler procedure would be to keep the parts immersed in a solution of lime water, soda water or other mild alkaline liquid. If the period of storage is less than a few months, the commercial grade of chemicals will suffice, but if the period is liable to be indefinite,the chemical should be quite pure. Polished surfaces of iron or steel may be retained clean and bright in this manner and will require less labor and expense to prepare for plating or enameling.

Polished iron and steel surfaces resist corrosion better than the same articles ground, but not polished, the improved resistance being due to the lesser number of small cavities to hold moisture, because of the condensed and repellent nature of the surface due to the polishing, cold rolled sheet steel and rods are rendered more dense by the rolling process, and they are less affected by corrosion than the bars from which they are cold rolled. A wire nail corrodes less than a cut nail, so does a hammered or so-called wrought nail.

Burnished surfaces resist corrosion and are more repellent of moisture than polished ones; but if corrosion is once established on them as a spot, it appears to concentrate its energy to produce a deep corrosion, that is difficult to eradicate.

In any steel, manganese in excess tends to produce an increased corrosion, evidently from its unequal distribution and the galvanic action on the adjacent metal. The composition of wrought iron and the processes it is subjected to between the bloom and the finished article have a great effect in determining its rate of corrosion. Iron containing sulphur and iron containing phosphorus differ in corrodibility. The latter is less affected, being harder and more crystalline in composition while the former has the sulphur element to aid corrosion. Neutral iron made from both of the above brands has a different rate of corrosion than either.

The same quality of iron worked in the rolls, in the one case both lengthwise and crosswise, to produce sheets, differs in corrodibility from that worked principally in one direction. All the latter forms tend to disintegrate by corrosion into strips, needle or fibrous form, owing to the granular character of the iron being changed by the rolls into parallel fibres, that are not interlocked as the cross-rolling arranges them. If these facts are given due consideration when ordering stock for the manufacture of the various lines of metal goods usually finished in large quantities by modern methods, a great amount of refinishing and dissatisfaction could be avoided.

Removal of Scale by Electrolysis

Theory of action.—The iron scale which is a magnetic oxide and difficult to dissolve in sulphuric acid, is reduced to a lower state of oxidation under the action of the electric current and thus becomes soluble. As the iron or steel which is treated is made the cathode, in the same manner as in electro plating. The metal is not attacked. Hydrogen gas liberated by action of the electric current mechanically forces off some of the scale and the balance is reduced in a rapid manner, thereby effecting a gain in time over ordinary pickling which offsets the cost of the electric current. The solution is composed of 25 per cent. sulphuric acid and 75 per cent. water. When freshly prepared the solution will register approximately 25 degrees Beaume. A lead anode is employed and a current density of from 40 to 70 amperes per square foot is permissible. Temperature of solution should be about 60 degrees Fahr. Free sulphur in small quantities is added occasionally to the bath to depolarize the anode and when it becomes oxidized by action of current changes to sulphuric acid and partly replenishes the bath.

Action of the acid on iron scale produces sulphate of iron. When solution becomes saturated, it is allowed to crystallize and the crystals of iron sulphate are removed. Naturally we may expect this solution to become quite warm in a short time if the volume of solution is small and the maximum current density is employed. Care should be exercised during the initial operations to avoid an excessive rise in temperature as the results attending such conditions are sometimes disastrous to the product being treated.

Questions and Answers

QUESTION—We wish to coat the inside of two large sheet steel plating tanks with some material which will prevent the deposition of metal upon the sides of the tank during the operation of brass and copper solutions. We use the solutions hot and metal deposits in hard, rough patches opposite the anodes. In the course of a year the annoyance and loss of current from this source is considerable. We are informed that precautions have to be taken in the case of silver baths for this trouble and shall appreciate any practical suggestion you may offer?

Answer.—The usual insulating material employed for cold baths will not answer for hot solutions. You can insert a wooden lining in the tanks, pine or spruce half in. in thickness will suffice for a short period, but does not prove as satisfactory as a more durable material such as cement. A cement lined iron tank will cost but little compared to the advantages gained over any other form of insulation. A form is built in the tank and Portland cement, mixed with one to one and a half parts clean fine sand, is poured in at one continuous fill. The inner surface may be troweled off with thin pure cement, and if slowly dried the result will be very durable and permanent If you maintain proper free cyanide in the solution, the tendency to plate out on the tanks will be greatly diminished.

* * *

Question.—How can I produce the finish called casket hardware green or Venetian bronze? It is a substitute for French grey on silver.

Answer.—Silver plate from solutions containing bisulphide of carbon does not acquire the desired color in the Venetian bronze dip, therefore solutions producing dead white surfaces are advised when this formula is to be employed for oxidizing. For each gallon of water required for the dip, dissolve 2 oz of potassium of sulphide and add ¼ oz. liquid ammonia. The solution should be moderately warm when used. Immerse the articles momentarily, remove and note the acquired color, the tones change quickly from yellow to purple, brown to grey, and then to the final color of green. By careful attention to these changes the operator may become very adept in repeatedly producing exactly the same tone. When the color is correct, remove the article from the dip quickly, and rinse vigorously in cold water. To darken the color, use boiling water for drying. To retain the color as it comes from the dip, use drying water only moderately warm. Relieve and lacquer in the usual manner.

* * *

Question.—Will you publish a formula for a good brass solution for large iron castings, weighing from ten to twenty-five pounds? A good yellow color is required. What is the composition of good brass which would be required for this bath?

Answer.—For detailed information regarding the superior advantages of simple baths we advise you to refer to previous issues of this journal. The formula given below will give you ample opportunity to judge the respective merits of the two methods used in commercial practice—copper carbonate, 3 oz.; carbonate of zinc, 1 oz.; potassium cyanide, 6 oz. If you desire a bright or semi-matte surface, add ¼ to ½ oz. caustic potash (in stick form) to each gallon of solution. Keep the free cyanide sufficient to maintain clean working anodes, and freedom from variegated colors in the deposit. The usual composition for brass anodes is 66 parts of copper and 34 parts of zinc. We advise narrow anodes for all brass or bronze baths.

* * *

Question.—Would a simple solution of whale oil soap be effective in the reduction of buffing or polishing paste from nickel-plated stove castings? Could the solution be used with the electric current as in ordinary electro-cleaning?

Answer.—Yes. A whale oil soap solution made by dissolving ½ lb. of the soap in each gallon of water required together with 4 oz. of sodium carbonate or soda ash per gallon, used at or near the boiling point will effectively remove all traces of buffing or polishing paste from nickeled surfaces, if assisted by an electric current of high tension, say 6 to 8 volts, and full ampere density of the circuit. If the solution is operated merely as an ordinary cleaning bath, the articles will require a light swabbing treatment to remove surface stains left by the dried paste. The whale oil soap solution will not tarnish the surface of the castings, unless, when used as an electric cleaning solution. The castings are allowed to remain in the bath under the action of the current for a long time; one minute is sufficient if the solution and current are properly adjusted.

* * *

Question.—During the electro-plating of a sheet steel case in an acid copper solution, we experience frequent trouble from streaks upon the surface of the copper plates. These streaks become furrows if the deposit is permitted to accumulate and the finish is ruined, necessitating a stripping operation, which is expensive and unpleasant. We will greatly appreciate any information you may be able to furnish us relative to the problem.

Answer. — Streaking in acid copper deposits may be directly or indirectly caused by two or more conditions. The more general cause is the presence of certain organic substances in the solution. Usually this organic matter is introduced in the form of commercial grade of dextrine, which contains gluten and causes the acid copper solution to become colloidal, with disastrous effects on thick deposits from the bath. By precipating the gluten as gluten tannate, by means of additions of tannic acid, and filtering the precipitates, the bath may be rendered normal. If you require the use of an additional agent, use only the chemically pure dextrine and operate the bath with usual current density.

* * *

Question.—I have recently prepared a new nickel plating solution. During the first week the bath gave good deposits, smooth, white and adherent. Every batch now is more or less a failure owing to peeled nickel. The bath was made from 12 oz. of double nickel salts dissolved in each gallon of water. What is wrong and how can I correct the condition?

Answer.—Your difficulty is not unusual with the old type of simple double sulphate solutions. New baths of this kind almost invariably act in a similar manner when operated as in modern commercial practice. To correct the present condition, add 2 or 3 ozs. of nickel sulphate per gallon of solution; remove a portion of the solution to a clean barrel and dissolve the salt by means of live steam injected into the solution. At the same time add about 2 oz. of ammonium chloride or magnesium sulphate per gallon of total bath. These additions will replenish the metallic strength of the solution, and furnish the required acidity and conductivity without in any way producing a condition which is liable to alter suddenly. Hereafter use only nickel sulphate when toning up the metallic content of your nickel solutions.

* * *

Question.—Kindly let me know the know the cause of severe irritation on my hands and arms. I cleaned a tank which contained brass plating solution, my hands and arms became wet from contact with the cloth which I used to mop out the tank, one of my knees is also affected. My physician does not appear to understand the symptoms and has prescribed applications of zinc ointment. I obtain very little relief from its use. Is the trouble infectious? Can you recommend a remedy?

Answer.—The irritation you describe is known as cyanide infection, and is evidently in the first stage. If you continue at your duties in or about a plating room, the portions of your body now afflicted will eventually become covered with blisters, which will cause you much greater pain and anxiety than the present condition. Applications of zinc ointment rarely allay the irritation, even in the mildest form of the trouble. The wisest plan for a plater thus afflicted to adopt is an entire change of employment. To obtain temporary relief, you may use the following remedy which has proven eminently successful in many very severe cases which have come under the writer's observation during recent years. Wash the parts in warm soft water, allow to become nearly dry without wiping. While the parts are still moist, apply the inner portion of a freshly squeezed lemon to the parts, rubbing gently. The acid from the lemon will neutralize the poisonous excretions from the skin and afford a cooling sensation of relief. The juice from the lemon may be taken internally with benefit. In fact, two or three lemons used in the manner described each day will effect a certain cure if you keep away from the plating room and live in the open as much as possible. Cyanide infection will return to you if you resume your duties among plating solutions. We have known many cases which obstinately refused to be cured until a position foreign to plating was adopted by the victim. Physicians, as a general rule, can only experiment with a case of cyanide poisoning such as platers are prey to. The affliction is frequently termed eczema and remedies both useless and often injurious are prescribed. You may also use a ten per cent. solution of citric acid as an hourly wash if you desire. Many platers use the citric acid wash as a preventative at the close of the day's work. During the continuance of your trouble abstain from all foods which tend to create excessive heat in the blood, such as beans, porridge, etc.

* * *

Question.—In the production of certain finishes on electric fixtures we employ the nickel bath for the first operation. The nickel deposit we obtain is spotted, bright on some portions and dull grey on other portions. As the deposit is not subsequently buffed, we must have a uniform finish of silvery whiteness when removed from the bath. Our solution contains both double and single nickel salts, boric acid and magnesium sulphate. What should we do to prevent further spotted deposits?

Answer.—In order to ensure perfect success in your attempt to prevent the spotted nickel deposits, we would advise giving the tank equipment and solution a general overhauling, clean all connections, give extra attention to contacts between anodes and positive rod, use at least 50 per cent. greater anode surface than cathode surface area, (by this we mean effective anode surface). If the solution has not been filtered recently, it should be filtered carefully. Test the solution with blue litmus paper. If paper becomes decidedly red, neutralize with aqua ammonia to the point where blue litmus is only turned deep purple. Remove a portion of the solution to a clean barrel or stoneware crock and dissolve enough nickel sulphate in this solution by boiling with steam, to equal 3 oz. of nickel sulphate per gallon for total bath, return the solution to the tank while the solution is still hot and immediately mix the whole solution thoroughly; the stirring should be prolonged for several minutes and vigorously performed. Suspend a mass of scrap wire in the solution by a copper wire or rod of ample size and electrolyze the solution with the full E. M. F. available and the resistance switch of the tank closed to the limits of the board. If this does not allow an excessive volume of current to pass, connect the tank direct to dynamo. Electrolyze the solution in this manner during the settling period and continue for several hours if solution is not required for production. Do not allow nickel anodes to becomes foul, or the metallic strength of the solution to become lowered greatly if you desire freedom from similar trouble in future.

* * *

Question.—We have received a quantity of wrought iron articles for polishing and plating. The surface of the iron is covered with thick scale. How can we remove the scale by chemical treatment?

Answer.— Prepare a solution of hydrofluoric acid 5 to 15 parts and water 85 to 95 parts. Use at 100 deg. Fahr. The solution will require either stoneware, cement or lead lined receptacle. After scale is removed, wash the iron in cold water and then in boiling lime water. The later treatment neutralizes the acid in pores of metal and prevents rusting of the pickled surface.

* * *

Question.—In the manufacturing of automobile accessories consisting of steel we have heretofore finished the various parts by plating in brass bath for thirty minutes, then in acid copper bath for thirty minutes, and finally plating in nickel bath for one hour. This process is expensive for several obvious reasons and does not give a satisfactory protection to our product. We will greatly appreciate any information you may be able to furnish relative to the production of a durable coating on steel at a reasonable cost.

Answer.—If you desire a metallic coating of greater anticorrosive qualities than the coating described and also wish to have a nickel finish, we would advise plating the steel with zinc until a deposit which will withstand a Price test of three one minute immersions is obtained, then transfer to a nickel solution and plate for thirty minutes. This method will reduce the amount of labor necessary to maintain your usual output and the maintenance costs will be lower. The coating of zinc and nickel will excel any other combination of electro-deposited metals for the purpose of protection from atmospheric influences. Modern solutions for both baths are advised, and are not expensive to operate.

* * *

Question.—We are producing a number of small metal figures which are intended to represent Canada in the present great war. The finish chosen is copper with a verde effect over a portion of the clothing of the figures. We have tried at least a dozen formulas for verde antique and are not satisfied with the results obtained. If you can suggest a method which would be superior to those we have tried we shall greatly appreciate the favor.

Answer.—The following verde antique finish was originated by J. A. Anderson and is probably the best verde for figure finishes in use today. It produces fawn color for face, arms and limbs, and an emerald green verde effect in crevices of draperies etc. There are two solutions required to obtain the final finish. Solution No. 1:—Chloride of ammonia, ½ oz.; Red oxide of iron, 2 oz.; Copper sulphate, 1 lb.; water 1 gallon.

This solution is used as a dip while boiling. The article to be treated must be heavily coppered, preferably in a copper sulphate solution. Buff, such parts as face, arms and all smooth parts, while clothing and similar parts can be sanded, brushed or dipped. Clean in hot alkaline solution, rinse and immerse in No. 1 solution while the solution boils; after a few seconds remove, rinse in cold water and then immerse momentarily in hot lime water, then for a few seconds in a clean dilute solution of lye, again in lime water and dry in hot saw dust. Set aside until cold, buff lightly on small clean buff without application of any compound. This will produce the fawn shade, if it is not dark enough, repeat the dip until color is satisfactory.

As the article is removed from the "fawn" dip, it will be covered with a bright yellow powdery substance, this will be removed by the light buffing and the fawn shade beneath will be revealed. After obtaining a satisfactory fawn color, which is frequently the case with the first immersion, and the surface has been treated as described above, stipple the parts where the verde is desired, with a solution made by dissolving the following chemicals in one gallon of water:—Copper sulphate, 8 oz., sodium chloride, 4 oz.; zinc chloride, 1 oz.; ammonium chloride, 8 oz.; 26 per cent. acetic acid, 2 oz.; glycerine, 1 oz.

The solution must be used warm for best results. Use a sash brush or sponge. When completed, allow the article to stand twelve or fifteen hours so that the colors may become clear and prominent. When verde is satisfactory, buff over the entire surface on same small buff to produce uniform coloring, and apply a thin coating of transparent lacquer. When lacquer is hard, apply a coating of wax (beeswax 2 oz., turpentine 1 pint). When wax is dry, brush lightly with a soft hair wheel (about 600 rev. per min.). An excess of chloride of ammonia in solution No. 1 will cause the fawn color to merge into a terra cotta, which is also very pretty. Too little of the chloride of ammonia causes a purple tone, or kermess finish. Do not touch the fawn colored surface previous to lacquering as it soils very easily. The beauty and richness of the finish will be greatly increased by several coats of lacquer. The elegance of this finish will amply repay you for the time taken to produce it.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON

Grey Forge, Pittsburgh	$47 95	
Lake Superior, charcoal, Chicago	58 00	
Standard low phos., Philadelphia	87 00	
Bessemer, Pittsburgh	51 95	
Basic Valley, furnace	48 00	
	Montreal	Toronto
Victoria	.....	
Hamilton	.....	.....

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$ 64 00
Antimony	20 00
Copper, lake	34 00
Copper, electrolytic	34 00
Copper, casting	33 00
Lead	13 00
Mercury	100 00
Nickel	50 00
Silver, per oz.	0 98
Tin	64 00
Zinc	11 00

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$19 00	$18 00
Copper, crucible	21 00	20 50
Copper, heavy	21 00	20 50
Copper wire	21 00	20 50
No. 1 machine composition	20 00	18 00
New brass cuttings	16 00	17 00
No. 1 brass turnings	14 00	15 75
Light brass	12 00	10 00
Medium brass	16 00	14 00
Heavy brass	16 00	16 00
Heavy melting steel	21 00	17 00
Steel turnings	12 00	8 00
Shell turnings	12 00	12 00
Boiler plate	22 00	18 00
Axles, wrought iron	30 00	24 00
Rails	25 00	18 00
No. 1 machine cast iron	25 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	10 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	29 00	30 00
Mach. shop turn'gs.	8 50	8 50
Cast borings	12 00	8 50
Stove plate	19 00	19 00
Scrap zinc	6 50	6 50
Heavy lead	10 00	9 00
Tea lead	7 00	7 00
Aluminum	30 00	25 00

COKE AND COAL

Solvay foundry coke	13 05
Connelsville foundry coke	14 00
Steam lump coal	7 25
Best slack	6 50

Net ton f.o.b. Toronto

BILLETS

	Per Gross Ton
Bessemer billets	$ 75 00
Open hearth billets	95 00
Forging billets	100 00
Wire rods	90 00

F.o.b. Pittsburgh

PROOF COIL CHAIN.

B

1/4 in.	$12 00
5-16 in.	11 50
3/8 in.	11 15
7-16 in.	10 90
1/2 in.	10 70
9-16 in.	10 70
5/8 in.	10 50
3/4 in.	10 40
7/8 in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, guaranteed	0 37
Babbitt metals	.18 to 70
Putty, 100-lb drums	4 35
Red dry lead, 100-lb. kegs, per cwt.	15.45
Glue, English, per lb.	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	0 61
Linseed oil, boiled, single bbls.	1 49
Linseed oil, raw, single bbls.	1 52
Plaster of Paris, per bbl.	2 50
Lead wool, per lb.	15
Sandpaper, B. & A. ..list plus	20
Emery cloth ......list plus	33 1-3
Borax, crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular.	0 15
Wood alcohol, per gallon	2 15
Whiting, plain, per 100 lbs.	2 20

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$11 00	$11 00
Sheets, black, No. 10	11 50	11 50
Canada plates, dull, 52 sheets	11 00	11 00
Canada plates, all bright	12 50	12 50
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	12 70
Premier, 10¾ oz.	13 85	13 00
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$15 50
3-16 in.	11 70
1/4 in.	8 40
5-16 in.	7 40
3/8 in.	6 35
7-16 in.	6 35
1/2 in.	6 35
5/8 in.	6 35
3/4 in.	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard buishings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 50%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.50 to	$0.54
Cobalt	1.75 to	2.00
Copper	.40 to	.38
Tin	.68 to	.70
Silver, per oz.	1.05 to	1.00
Zinc	.16 to	.18

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .20
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, acqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper, carbonate, anhy	.50
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate.	.12
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate .....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, singl and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 50
Leather in sdes	1 35i

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3 00
Polishing wheels, bullneck		1.70
Pumice, ground		.05
Emery composition	.08 to	.09
Tripoli composition	.04 to	06
Crocus composition	.07 to	.08
Rouge, powder	.30 to	.35
Rouge, silver	.50 to	.55

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	53 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x28 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base	64 00	60 00
Braziers', in sheets, 6x4 base	55 00	52 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in. rd.	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamlss	0 58

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor Oil, per lb.	40
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	50

The General Market Conditions and Tendencies

TORONTO, ONT., Oct. 9.—The chaotic condition prevailing in the iron and steel industry is causing considerable anxiety in manufacturing circles, and seems destined to restrict production of many products required for the carrying on of manufacturing operations. The effect of the embargo will be widespread, as the shortage of iron and steel will make it very difficult for some consumers to continue operations, except in a limited way. While certain industries, such as those engaged upon war work, will perhaps not be affected to any great extent, there are others which will be seriously hampered. The whole question is so complicated, as many industries are closely connected, that an adjustment satisfactory to all seems almost an impossibility. Those manufacturers to whom relief cannot be extended will be obliged to accept conditions with good grace in view of the necessity of providing for war requirements first.

Steel

The outlook in the trade in regard to the embargo continues obscure, and will remain so until the question has received further consideration by the authorities at Washington. What is likely to develop is difficult to say, but it is not easy to be optimistic concerning the outcome of the negotiations. The embargo was put on for the specific purpose of conserving the steel output for war poses. As the U. S. Government requirements for this purpose are increasing all the time, the supplies available for domestic requirements are that much less. Canadian consumers will naturally be affected to the same extent as those in the States, if not more so; it is, therefore, difficult to see how the situation can be materially improved. Steel will be allowed to come in under license for shipbuilding, railways and farm implements, which covers a fairly extensive field, but there are still many other industries not engaged in war work which will unfortunately suffer. This latter contingency could hardly have been avoided, embargo or no embargo, for there has been for sometime a shortage of steel which promises to become more acute in view of the heavy demands for war purposes. Although much has been written about the serious situation created by the embargo, which in the main is true, it must not be forgotten that for some time past deliveries have been very backward and supplies difficult to obtain. The embargo has served rather to bring the situation to a climax than to add greatly to its difficulties. It has, however, brought the trade to a more thorough realization of existing conditions, and in this respect may be a blessing in disguise, for a united effort is now being made to obtain relief.

There has been no further development in regard to prices, which continue on the same basis as last week. What is likely to materialize in this regard is problematical, as the situation is so confusing. On account of conditions prevailing in the market, business is practically at a standstill. The state of the market here reflects conditions across the line, where the steel industry continues unsettled pending the completion of the Government regulation of prices. Until this matter is finally disposed of the present unsettlement seems destined to be prolonged. Canadian mills are hardly likely to take any action, even if they propose doing so, until the situation in the States becomes more settled.

Pig Iron

Business is practically at a standstill, owing to the unsettled situation created by the embargo and price regulation. Consumers are showing a disposition to await developments as the outlook is so uncertain. There is every reason to expect continued quiet conditions in the market as most consumers are covered for 1917 and the output of practically all furnaces has been sold up to Jan. 1st. An announcement is expected shortly at Washington giving definite prices on all grades of pig iron. Local prices are unchanged in the meantime but are nominal.

Scrap

The market is practically stagnant due to the unsettled conditions created by the embargo and price regulation. Prices on all scrap metals are unchanged and are more or less nominal as it is difficult to quote prices when so little metal is changing hands. While the market has a weak tendency just now, it appears likely that owing to the shortage of good scrap, prices may become firmer. No developments of importance however, may be expected until the market is more settled.

Machine Tools

The list of products upon which an embargo has been placed includes boring mills, 42 in. and larger; lathes, 30 in. swing and larger, and planers over 36 in. wide. It is likely that exception will be made in the case of tools required for railway shops and shipyards, although this has not been stated definitely. In any event, it should encourage the building of these tools in Canada to a greater extent than formerly. Business has been rather quiet this week, although the renewed activity in the munitions industry is creating a demand for special tools for 6-in. shells.

Supplies

The demand for machine shop supplies is fairly active and prices continue firm, with an upward tendency on some lines. One firm of dealers report a scarcity of emery wheels and carborundum wheels, and have accordingly instructed their representatives to discontinue quotations. In lieu thereof they are placing an artificial abrasive wheel before the trade, which they are quoting at 45 per cent. off list. Recent costs of asbestos sheeting to importers from the United States have necessitated a material advance in prices locally. Where formerly the range of prices was from $9 to $12 per 100 pounds, the new range is from $12 to $15, representing an advance of 25 per cent. This material is scarce and very hard to obtain. A shipment came into the local market recently and the first cost to importers established a new record for this material. Other building materials held steady in price during the week.

Metals

The metal markets continue dull and featureless, while prices are unchanged on the basis of last week's quotations. The copper market holds firm, due more to the embargo than for any other reason, although the decline in production may have something to do with it. Tin is unchanged with light demand, while lead is holding steady. Spelter aluminum and antimony are dull and unchanged.

Copper.—Although the price of copper has been fixed at 23½c New York, there is practically no business being done at this figure, except by the U. S. Government. Supplies of copper available for private consumers are very scarce, and the serious decline in production caused by the strikes has aggravated the situation. The local market is holding firm on account of the embargo, the price regulation not having as yet affected this market. Lake and electrolytic copper is quoted at 32c and castings at 31c per pound.

Tin.—The market is steady and a little firmer, although prices are unchanged. The London market has advanced. Tin is quoted nominally at 63c per pound.

Spelter.—The market is quiet and easier in New York owing to the lack of buying interest. Locally there is no change in the situation and spelter is being quoted at 10½c per pound.

Lead.—There is a fair demand for lead and the market is holding steady at unchanged quotations. Price, 11c per pound.

Antimony.—The market is dull, with no inquiry, but prices are steady at 19c per pound.

Aluminum. — The market continues dull and demand light. Consumers are well supplied for the time being, and have retired from the market. Local price, 62c per pound.

Foundry Supplies

The abnormal situation in the iron and steel industry is naturally affecting the market for foundry equipment and supplies. The increasing demand for iron and steel for war purposes is creating a shortage of material for commercial purposes, and it is likely that in due time the manufacture of foundry equipment will be restricted unless intended for use in the production of war equipment, either directly or indirectly. The outlook for manufacturers of foundry machinery is not particularly bright on account of the possible restrictions and also because of the shortage and high cost of raw materials. Although in regard to the latter feature there is possibility of lower prices following the price fixing policy adopted by the U.S. Government it is unlikely that there will be any improvement in the supply of raw materials, indications pointing rather to a more pronounced shortage.

CANADA MAY GET SOME U.S. EXPORTS

THE Department of Trade and Commerce, Ottawa, has received further information from Washington respecting the licensing of certain exports, "whose conservation is necessary on account of the limited supply and the needs of the United States in its successful prosecution of the war." Among the exports licensed are iron and steel products necessary to Canadian war and commercial industries. While the Exports Administrative Board of the United States has practically prohibited the export of these articles, export licenses may be granted:

(a) When destined for actual war purposes or when they will directly contribute thereto.

(b) In certain unusual cases when such exports will contribute directly to the immediate production of important commodities required by the United States.

(c) And also in certain other cases where the articles may be exported in limited quantities without detriment to the United States.

(d) Further licenses may also be

FOUNDRY FACINGS and SUPPLIES

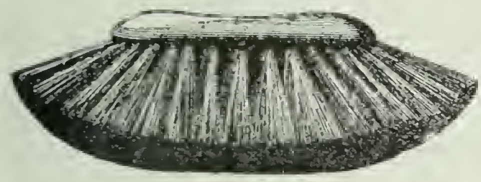
Sold Direct to the Consumer

MADE IN CANADA

We Can Help You!

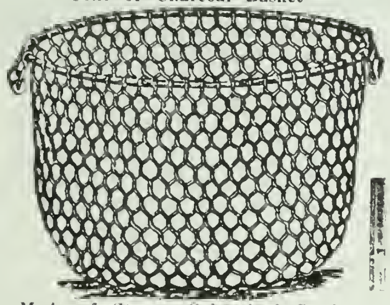
To meet war-economy demands to the best advantage, the consumer should buy *direct from the manufacturer* if at all feasible.

We sell direct to the consumer and can help you to economize in your foundry practice. Give us a trial order and you'll appreciate how extensively we can help you to economize.

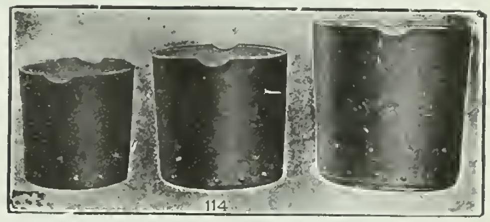


A Brush much in favor in Foundries everywhere

Coke or Charcoal Basket



Made of Strong Galvanized Steel Wire



Highly Serviceable Foundry Ladles

We are well stocked and can serve you with the best of foundry facings and supplies of all kinds in quick time.

Think of a few lines that you need to replenish and give us a chance to show what we can do for you.

Quality goods and quick service is our aim

The Hamilton Facing Mill Company, Ltd.

HAMILTON, CANADA

granted for limited quantities of these conserved articles when required for purely medicinal or pharmaceutical purposes.

A committee of leading iron and steel men, working in connection with the Department of Trade and Commerce, has been appointed to secure information on the effect in Canada of the United States regulations. The difficulty arises chiefly in connection with industries not actually war industries, although related thereto.

Iron and steel "destined for actual war purposes" can be secured, but concerns not engaged in the manufacture of war supplies will be unable to secure the articles listed, unless the regulations are relaxed.

ONTARIO'S METALLIFEROUS PRODUCTION

RETURNS received by the Ontario Bureau of Mines from smelters, refining works and metalliferous mines of the Province for the six months ending June 30, 1917, are summarized in the table below which gives comparative figures for the corresponding period in 1916.

It will be noted that above figures are for pig iron produced from Ontario ore only. Export figures for 1916 are not available for iron ore. Nickel and copper in matte have been valued at 25 and 20 cents per pound, respectively, whereas copper was valued at 18½ cents per pound in 1916.

Gold.—It was anticipated that the production for the half year would show a decline as compared with the same period in 1916, owing to labor troubles and labor shortage at the Porcupine camp. Nearly all the mines, including the Hollinger and Dome, have been developing their ore bodies and increasing milling capacity in preparation for the time after the war when labor will be more plentiful and operating costs decreased. In the meantime, production and dividends have been curtailed. New producers are Gold Reef and Tommy Burns at Porcupine, Teck-Hughes at Kirkland Lake, and Miller Independence at Boston Creek. A single stamp is dropping at the Rognon on Wabigoon Lake, District of Kenora. Mines, in order, producing 5,000 ounces or more gold were Hollinger, McIntyre, Dome, Porcupine Crown, Tough-Oakes, Schumacher and Porcupine V. N. T.

Silver.—High prices for silver, which averaged 75.44 cents for the half year as compared with 62.53 cents for the same period in 1916, have stimulated production from the Cobalt camp. The lowest New York price was 71.75 cents on March 27, and highest 78.64 on February 15. This advance in value has offset increased mining costs. If the Miller Lake O'Brien continues shipping at the same rate throughout the year, Gowganda will show a record production for 1917. The increase is attributed to the high grade vein discovered in the summer of 1916. The Hargrave mine is now shipping regularly. A new shipper this year is the National, formerly the King Edward mine. The Mining Corporation of Canada (Cobalt Lake and Townsite-City mines) shipped over 2,000,000 ounces in the half year. Shippers of 500,000 ounces or more were as follows: Nipissing, Kerr Lake, O'Brien, Beaver and Coniagas mines. Silver recovered from gold ores totalled 38,492 ounces and from copper ores 646 ounces.

Nickel-Copper.—The production of nickel-copper matte at Copper Cliff and Coniston shows a small decrease as compared with the same period in 1916, due to shortage of labor. Assays of samples of nickel-copper matte for their precious metal contents were made for the Royal Ontario Nickel Commission by Ledoux and Company of New York. Platinum and palladium were found in quantities varying from 0.32 ounces to 1.97 ounces per ton of matte. These metals are quoted at $100 per ounce. The British American Nickel Corporation have announced that their new electrolytic refinery will be located at Murray mine, and will have an initial capacity of 5,000 tons of nickel per annum. The Port Colborne refinery of the International Nickel Company will produce 7,500 tons of nickel, and provision is made for quadrupling the capacity.

Copper.—Shipments for the half year came from three sources, the Tip Top mine near Kashabowie, the Hudson Copper Company at Havilah, and the Kenyon Copper Company of Massey. The last mentioned operates the Massey mine where a 100-ton Callow flotation mill is producing 20 per cent. concentrates. Shipments from Bruce Mines are included under nickel-copper. The Port Arthur Copper Company at Mine Centre is erecting a concentrator and will be shipping soon.

Iron Ore and Pig Iron.—Shipments of ore were from the Helen and Magpie mines of the Algoma Steel Corporation, and a small shipment from Moose Mountain. Helen ore is shipped to the Magpie mine for treatment. In all, 61,796 tons worth $231,937 were marketed, of which 24,322 tons were exported to the United States. Pig iron produced at Sault Ste. Marie, Hamilton, Port Colborne and Deseronto totalled 347,190 tons worth $6,067,050. Out of a total of 577,773 tons of ore smelted only 77,202 tons came from Ontario, and in the table the quantity of pig iron produced and value of the same is figured on a pro rata basis.

Molybdenite.—The production of this ore is increasing rapidly. Concentrators are now in operation at Renfrew, Mount St. Patrick and Ottawa, and in the half year treated ore from thirteen different mines. At Orillia and Belleville, 80,334 pounds of ferro-molybdenum worth $200,835 were produced.

Lead.—Smelters at Galetta and Kingston produced 912,934 pounds of pig lead worth $114,953 from Ontario ores. The Kingston Smelting Company also treated 1,895 tons of lead ore from the United States. Ontario ore came from the Galetta and Frontenac mines.

SUMMARY OF METALLIFEROUS PRODUCTION, SIX MONTHS, 1917.

Product.		Quantity. 1916.	Quantity. 1917.	Value $ 1916.	Value $ 1917.
Gold	ounces	235,060	228.673	4,822,740	4,586,941
Silver	"	10,267,743	10,073,787	6,188,269	7,584,439
Cobalt (metallic)	lbs.	121,817	162,250	103,677	237,004
Nickel (metallic)	"	13,933	45,864	5,899	19,073
Nickel oxide	")	(	5,495)	(	1,648
Cobalt oxide	")	410,408 (	153,498)	204,638 (	175,308
Other Cobalt and nickel comp'ds.	")	(	122,076)	(	15,879
Molybdenite	"	12,631	36.777	13,075	47,942
Lead	"	......	912,934	......	114,953
Copper ore	tons	922	1,543	14,368	45,688
Nickel in matte	"	20,651	20,230	10,325,766	10,115,000
Copper in matte	"	11,426	10,381	4,207,620	4,152,400
Iron ore (exported)	"	......	24,332	......	85,135
Pig iron	"	......	40,968	......	715,912
				25,886,052	27,897,322

STEEL OUTPUT INCREASES

THE total production of steel ingots and direct castings in Canada in the first six months of the current year amounted to 836,149 short tons, an increase of 246,596 tons, or 42 per cent., over the corresponding period of 1916.

Average monthly production was 139,858, against 98,259 in the first half of 1916, and 106,268 tons for the full year, 1916. A new high record in output was reached in May, 155,346 tons, but the June figures show a falling off of about 18,000 tons.

Pig iron output, as estimated by the Mines Department from returns covering all producers, was 586,998 short tons, as against 562,097 in the first six months of 1916. The average monthly production was 97,833 tons, or only slightly higher than the average for the full year, 1916, which was 97,438 tons.

Imports from the United States have been on a considerably larger scale. The total imports of steel ingots and direct castings for the first six months of the year totalled 139,640 short tons, against 47,493 in the same period in 1916; in pig iron the increase was from 29,801 tons last year, to 38,858 tons this year.

Production figures in short tons by months this year are given as follows:

	Pig iron.	Steel Ingots, etc.
January	89,187	130,990
February	83,801	120,629
March	103,789	152,420
April	101,504	139,669
May	108,799	155,346
June	99,858	137,095

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INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

Three Rivers, Que.—The City Council have decided to proceed with the construction of a pumping station and reservoir.

Welland, Ont. — Fire caused $3,500 damage to the plant of the Welland Machine and Foundries, Ltd., last Sunday. The blaze was confined to the roof of the molding shop.

Victoria, B.C. — The five-masted schooner Malahat, built by the Cameron-Genoa Mills Co., will make its maiden voyage as a sailing ship, owing to the non-arrival of the auxiliary engines. They will be installed on the completion of the first voyage.

Sarnia, Ont.—The plans for the new Romeo foundry, locating at the corner of Christina and Exmouth streets, are being prepared, and the machinery and other equipment has been ordered. It is expected that the new plant will be nearly completed by the end of the year.

Sherbrooke Firm Gets Marine Contracts.—It is understood that the firm of MacKinnon, Holmes & Co., Sherbrooke, Que., have recently received from the Imperial authorities a large order for marine work which will keep their plant in operation for many months to come.

Shelburne, N.S.—The new steamer Keith Cann was launched on Sept. 18 at the shipyard of the Shelburne Shipbuilders Ltd. The vessel was christened by Miss M. Cann, daughter of Chas. W. Cann of Yarmouth, N.S. The Keith Cann is 130 ft. long, 25 ft., wide and 11 ft. 6 ins. deep.

Trenton, N.S.—Fire on Sept. 19 destroyed the machine shop at the Eastern Steel Co's. Plant. The damage is estimated at $125,000 which was practically all covered by insurance. The building which was constructed of reinforced cencrete was reduced to ruins and the machinery badly damaged.

Princeton, B.C.—The Canada Copper Corporation, will begin erection of its 3,000-ton mill on its property near Princeton, B.C., immediately. Development in the mines is being pushed, that mill may run to capacity as soon as possible after it is completed. Anticipating operations on a large scale, the company is building a modern town on its property and an extensive power plant is being installed.

The Crane Packing Co., Chicago, manufacturers of the well known "John Crane" flexible metallic packing for all vapors and liquids, announce the establishment of their Eastern office in the Woolworth Building, New York City. Their engineer, A. W. Payne, with much experience with packing problems in the oil, mining and industrial fields, has been placed in charge of this branch.

Woodstock, Ont. — The Canadian Linderman Co., has rented the Tobin Arms Factory, and will instal machinery at once and put the factory in operation, working day and night on the order which the company has received for $14,000,000 worth of munitions for the United States Government. The Linderman people have their head office and factories in Muskegon, Mich.

Vancouver, B.C.—The Coughlan Shipyards, at which six big steel steamers will be constructed and at which four are already under construction, will also build the boilers for the vessels and a permit has been taken out for the construction of a boiler shop. The work done will be on a big scale as the steamers are to be 425 feet long and each will have a deadweight carrying capacity of 8800 tons.

Sault Ste. Marie, Ont.—The Algoma Steel Corporation is erecting another blast furnace, which when completed will have a capacity of 400 tons of pig iron per day. The furnace will be finished by the new year. The company recently completed its latest open-hearth furnace at the "Soo" plant, with a capacity of 75 tons per hearth, or about 200 tons per day, and makes the tenth open-hearth furnace which the company has in operation, as well as the duplex furnace, which has been most satisfactory.

Sherbrooke, Que.—The Southern Canada Power Co. is building 88 miles of high tension transmission lines, connecting up the cities of Sherbrooke, Magog, Waterloo, Granby and St. Johns. It is expected that these lines will be completed this fall. When completed this will give the company over 160 miles of high tension transmissions, principally 50,000 volt. The company have recently purchased property on the main street in Granby, almost opposite the Post Office, and are erecting a new substation, office and store for the sale of electrical equipment.

Metal Supervisor Will Be Appointed.—The appointment of a supervisor of metal and fibre by the Dominion Government is indicated in an order-in-Council, which also authorizes the Minister of Customs to fix the price of scrap iron and scrap steel, rags, waste and other materials of metal or of animal, vegetable or mineral fibre. The supervisor is authorized to make such enquiries as the Minister of Customs deems necessary into the quantity, location and ownership of such materials, as well as into the prices at which they are held for sale. It is provided that any person who contravenes the provisions of this order-in-Council shall be guilty of an indictable offence and liable to a fine not exceeding $5,000 or to imprisonment for a term not exceeding three years.

A. W. McLimont, a leading traction expert, has been appointed general manager of the Winnipeg Electric Railway Co., in succession to Wilford Phillips who has retired. Mr. McLimont is a Canadian and was born in the city of Quebec. Although a young man, he has held a number of important positions, but the work which brought him most prominently in the public eye was the electrification and operation of a considerable proportion of the transportation lines of New York, Mr. McLimont was employed as engineer under the New York Public Service Commission in New York, and became so successful that his services were in demand throughout the United States. Latterly he has been in control of some nine hundred miles of road, constituting the Michigan United Railway System.

CATALOGUES

Reducing Valves.—Bulletin issued by Chaplin-Fulton Mfg. Co., Pittsburg, Pa., describes the "Fulton" steam reducing valve, and also gives directions for setting and operating this device. Two types are illustrated together with prices for the various sizes.

Radial Brick Chimneys. The Alphons Custodis Chimney Construction Co., New York, have gotten out an interesting bulletin showing a number of tall chimneys which they have constructed, with principal dimensions. The bulletin also contains details of the radial brick used and a copy of Kent's table of size of chimneys for steam boilers.

Boiler House Elevators is the title of a 28 page catalogue recently issued by the Ed. Bennis & Co., Little Hulton, Bolton, England. The catalogue after dealing with the advantages of elevating and conveying machinery in boiler plants, proceeds to describe the "Bennis" elevator, drawing attention to its principal constructional features and also to the economies that can be effected by its use. The greater part of the catalogue comprises several very clear views, covering a number of installations showing the wide field of application. A brief description accompanies each illustration detailing the chief points of interest.

Electro Platers Equipments and Supplies.—The Canadian Hanson & Van Winkle Co., Toronto, have issued a new illustrated catalogue and price list "B," dealing with an interesting and extensive line of electro-plating and polishing supplies which they manufacture. In this catalogue particular attention is called to the new plating dynamo, which is fully described, to a complete line of new polishing and buffing lathes and grinding machinery. Other products featured include polishing wheels and a complete line of lacquers, while in addition the catalogue describes at length a line of anodes, chemicals, and plating solutions, etc. The catalogue is gotten up in an attractive style and contains 104 pages, with a large number of illustrations.

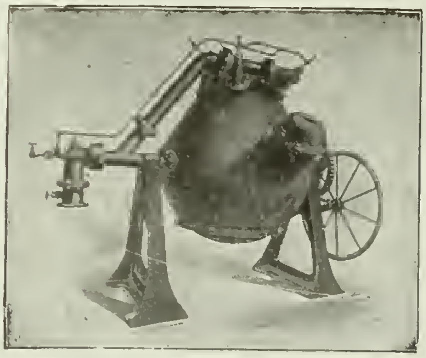
Machine Stoking.—A new catalogue entitled "Recent Developments in Machine Stoking," has been issued by Ed. Bennis & Co., Little Hulton, Bolton, England. The opening pages contain a description of the "Bennis" patent improved smokeless chain grate, including matters relating to its durability and draught feature. Following are a number of views showing important installations, each briefly described. The catalogue also contains several sectional views of Bennis chain grates under various types of boiler. An interesting table is shown giving results of tests of this stoker under different types of boiler. The concluding pages contain a table of sizes of Bennis Chain grate stokers and also a table of properties of saturated steam. The catalogue contains 39 pages and is gotten up in attractive style.

BOOK REVIEW.

United States Artillery Ammunition by Ethan Vial, managing editor *American Machinist*. 97 pages, 8¾ x 11½ in. Fully illustrated. Published by The McGraw-Hill Book Co., Inc., New York. Price $2. This is the third of the series of munitions books compiled by the editorial staff of the *American Machinist*. The book was published for the purpose of giving shop men, engineers and manufacturers an accurate knowledge of the sizes, tools, shop work and gauges necessary in the production of the most common United States shells and cartridge cases. The book contains six chapters describing in turn the machinery operations used in the production of the following types and sizes of shell. 3 in., common shrapnel; 3 in., common high explosive shell; 3 in. naval shells; 3.8 in. to 6 in., shrapnel and high explosive shells; 6 in., naval shells and lastly 3 to 6 in. cartridge cases. For each type of shell every important machining operation is shown in a separate drawing. Several operations are also shown by means of half-tone illustrations. The operations on each type of shell are described in detail and particular features of each are also given. The book has list of contents and index, and is bound in substantial cloth covers.

RECENT ELECTRIC FURNACE ACHIEVEMENT

THE abnormal demand for munitions has, perhaps, done more than anything else could have done towards breaking down the prejudice against electric steel. Before the war had been in progress many months our armament makers found themselves accumulating enormous quantities of borings, turnings, screwings, etc., of very high grade steels, containing chrome, nickel, and other costly alloys. In ordinary times these turnings were of comparatively little value on account of the difficulty of remelting them without the loss of most of the alloys. But when the quantities of turnings produced in munition making became abnormal, it was at once realized that the best solution of the problem of utilization was afforded by the electric furnace, because it was capable of saving all the nickel and almost all the chrome, whilst remelting the scrap, besides which it could, if necessary, oxidize the chrome whilst retaining the nickel. Admittedly, no type of electric furnace was exactly perfect; but with a view to further perfection in the matter of treating these turnings, certain Sheffield metallurgists set to work in earnest to see what could be done to meet the new conditions. The result is the invention of a type of furnace for which the claim is made that something approaching perfection—certainly a very high level of efficiency—has been attained.



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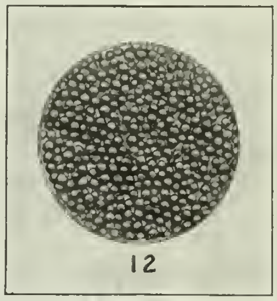

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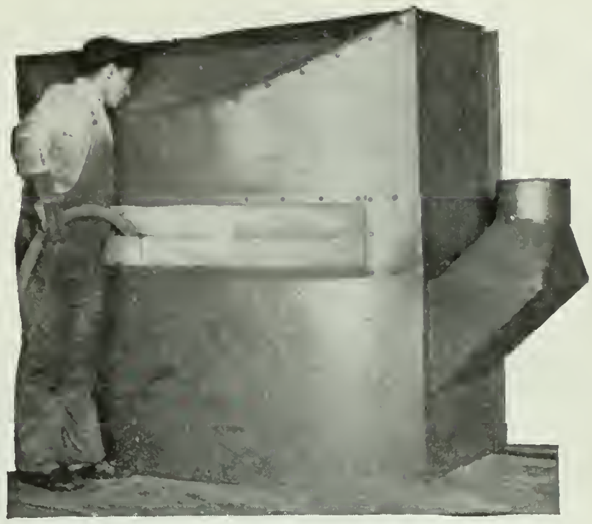

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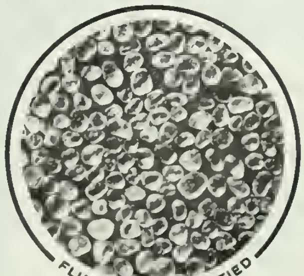

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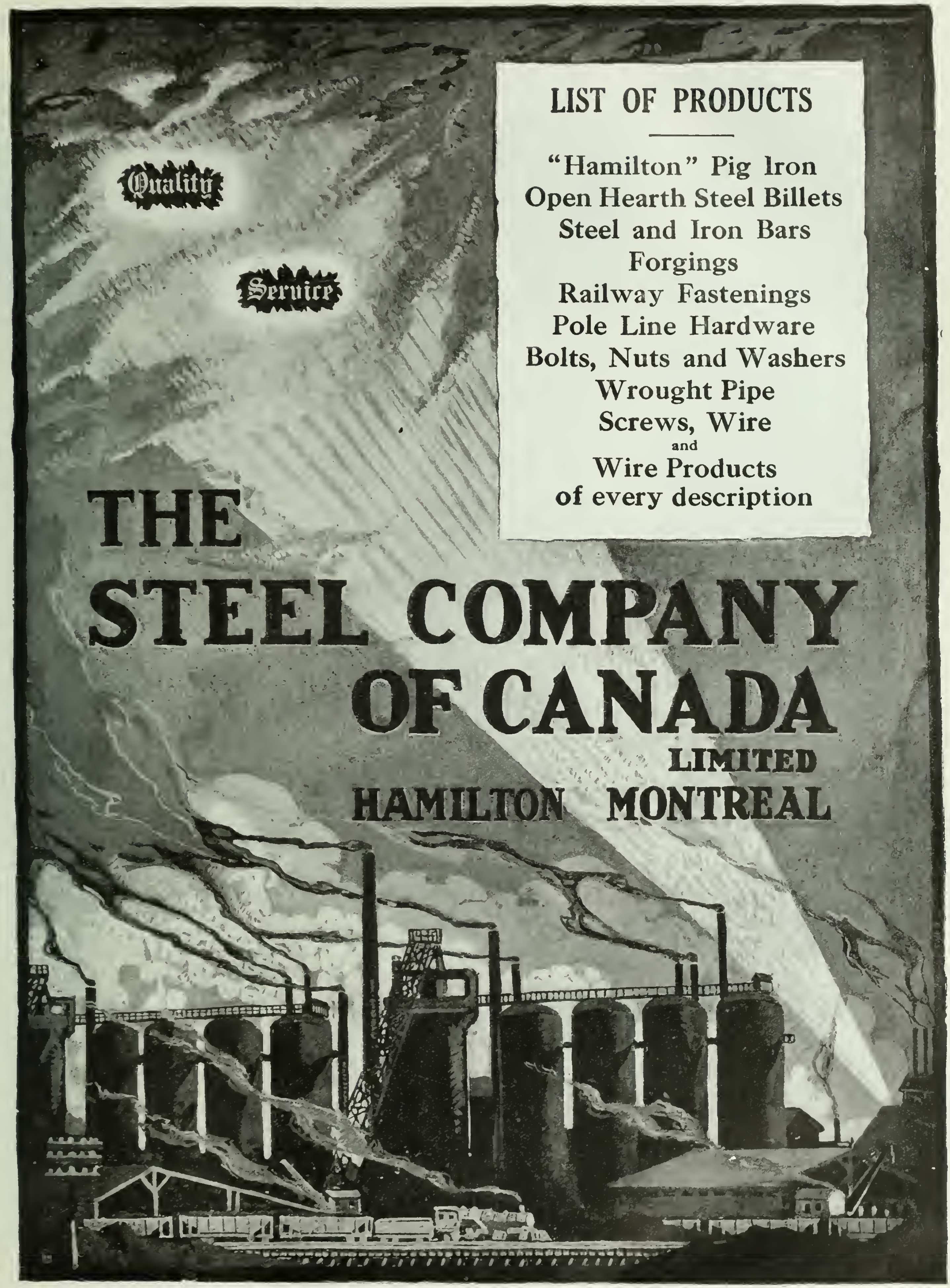
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Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hawley Down Dratt Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MAGNETS

Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS

Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
Hyde & Sons, Ltd., Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.
Vickers, Charles, 712 Cedar Ave., Niagara Falls, N.Y.

MIXERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES

Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Machine & Fdry Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES

Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

PULLEYS, MAGNETIC

Ding's Magnetic Separator Co., Milwaukee, Wis.

RAMMING PLATES AND MACHINES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RESIN

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE

Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES

Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY

Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
U. S. Silica Co., Chicago, Ill.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
U. S. Silica Co., Chicago, Ill.

SAND CONVEYING MACHINERY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL

Harrison Supply Co., Boston, Mass.

SAND MOLDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS

Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SEPARATORS

Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
U. S. Silica Co., Chicago, Ill.

SIEVES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED

Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS

Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

ADVERTISING INDEX

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

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The Publisher's Page

TORONTO November, 1917

The Economy of Business Paper Advertising

By H. E. CLELAND, NEW YORK

Awarded the Higham prize at the convention of Associated Advertising Clubs, at St. Louis, June, 1917. This prize is given annually to the one delivering the most constructive address in the fewest words.

ECONOMY is a many sided question and may mean anything up to the threshold of total abstinence. But Webster tagged it best when he said it means "a judicious expenditure of money."

War is shoving economy of this kind into the spotlight, thereby proving that war is not all battles, blood and what Sherman said it was. War has its good side. It has upset a centuries-old and centuries-rotten despotism. It has whipped British manufacturing methods into a state of high efficiency. It has waked up a snoring America.

In these conditions there's room for the advertising man, whether he be publisher, agent, salesman or user, who persists in dressing advertising in garments of glittering guff. It must be stripped to its effective self; made ready to fight, not to pose.

In brief, advertising must now line up with every other business and make every dollar spent for it a "judicious expenditure of money."

The business press of the country welcomes this return to the fundamentals, for with this attitude must come a full appreciation of the effective economy of business paper advertising.

Business paper advertising has never posed. It never has been nor will be surrounded by the pomp and circumstance of enormous circulation. It cannot hope to fly the banner of tremendous rates. The average cost per page is so low that it doesn't sound respectable.

In short, business paper advertising is not the bass drum of this band. It doesn't make the noise—but it carries the tune, clear and true.

We assert for it a very high efficiency per dollar of cost. And that, we believe, is the aim—and rightfully the aim—of every straight-thinking advertising man.

THE REASONS WHY

And these are the reasons why it is effective.

First, the editorial character of each paper limits the circulation to those men in an industry or trade who are responsible for results. These are the men who actually buy or recommend the buying of the machinery or merchandise advertised in the paper. Therefore, waste circulation practically does not exist and is in every event cut to the bone. Hence, at the very beginning we strike at effective advertising's greatest extravagance, waste circulation, and put in its place intensive circulation.

Second, the buying power per subscriber represents an infinitely greater sum than the buying power per subscriber of any other class of publication because each buyer purchases for business and not private consumption.

Third, the editorial contents of the paper are in harmony with the advertising pages. The first tells a man "how" and the second shows "what with." To borrow the simile of a colleague of mine, the whole paper may be regarded as an enormous advertisement with the editorial pages carrying the educational copy and the advertising pages representing the return coupon.

In a recent investigation as to the effectiveness of advertising run next to reading matter and advertising which was segregated, it was demonstrated that when the reading matter next to the advertisement was germane to the product advertised, then results from the advertising were far and away ahead of results when the reading matter was on a subject foreign to the product advertised.

This investigation was carried on in the general field, but I regard it as one of the best arguments for business paper advertising I have ever heard. In a sense, all advertising in a business paper is "next to reading."

Those three fundamental reasons form the backbone of effective economy in advertising and sum up thus:—

THE CONCLUSIONS

Business paper advertising is economical because it reaches—and the advertiser only pays for—a circulation of tremendous buying power which is continually being taught by the publication itself to want the products advertised.

The business of the busines papers is to exert a wise and wide influence upon the commercial and industrial development of the country.

We cannot surround them with flowers and furbelows, nor is it necessary to allure the non-technical, non-trade man with pictures of Gertie Coughdrop, "the film's flossiest flapper."

Our readers are not to be caught by any cheap expedients. And those editors and advertising writers who find it necessary to mount their untamed vocabularies, jab them a couple of times with their favorite adjectives, and ride off in a ribald revel of words, have no place in the modern business publication.

Business papers are not intended to amuse, are not intended for the tired business men. They touch men—and men only—on that side of their lives which occupies most of their wakeful hours. They instruct, lead, guide and help men to do things, to build things and to sell things. They are for the world's doers when they are in the midst of doing.

In one of Mark Sullivan's editorials in Collier's he says:—

"Progress is no monopoly of the cannon makers. In one issue of the 'Electrical World' we note that the Columbus (Ohio) Railway, Power & Light Company has set out to make its buildings safer. Fire escapes, standard doors, and other improvements have been added, along with a rigid system of inspection to prevent the accumulation of waste and grease, so that in three years fire risks and insurance rates have been cut nearly in half. In Johnston, S.C., F. M. Boyd, manager for the Carolina Public Service Company, has devised a new type of twenty-five foot pole with a twelve-foot mast-arm sticking out on the street side so as to keep the poles lined up on the curb, but get the wires away from the beautiful old elms and water oaks that are the glory of Johnston's highways. Anyone who has seen the ruin and multilation left by fanatical tree trimmers will appreciate Mr. Boyd's device. The Ohio Electric Light Association reports that its members have saved from three to five cents per ton on all coal handled at certain of their power houses by putting in an eight-hour day for firemen. This ought to interest the old-timers who think twelve hours' toil an inalienable right for engine-room workers. Those three items cover vital subjects and are only part of the grist in one issue of a live technical journal. That's how our United States goes along."

Those of you who know Collier's know that this comment is from an authority whose point of observation is a long way from the bull pen.

(Continued next month.)

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Up-to-Date Patternmaking and Pattern Storage Building

Staff Article

There has recently been completed at the John Bertram & Sons Co. plant, Dundas, Ont., a pattern shop and pattern storage building, which is likely to rank among the best of its kind in the Dominion. The structure is indicative of the progressive spirit dominating the administration of this old-established concern, recognizing as it does, among other things, that valuable patterns should be stored in nothing short of a fireproof structure.

OWING to the variety of types and large size of many of the machine tools which are built at the Bertram plant, Dundas, Ont., the patterns form an important feature in the company's plant. They would be in many cases costly to replace, and suitable storage, is therefore, all the more necessary. The pattern shop and storage are part of a scheme of expansion which is now under way at John Bertram & Sons' plant, and includes a general store and machine shop projected and a handsome office building nearly completed. It should be here stated that the old pattern shop and storage was pulled down in order to make way for an overhead travelling yard crane, which operated between the foundry and the new storage building, thus facilitating the handling of large patterns, etc.

INTERIOR VIEW OF PATTERN SHOP SHOWING LOCATION OF MACHINERY. LAYOUT FLOOR IN BACKGROUND.

Constructional Features

The general character of the building will be noted from the accompanying illustrations. It is of flat slab reinforced concrete construction with brick curtain walls, and steel sash with factory wired glass. It is of modern construction in every respect and is absolutely fireproof, even to the extent of providing a sprinkler system and fire doors, which close automatically in case of fire.

The building is 100 feet square and approximately 45 feet high, with a concrete roof, and is constructed so that another storey can be added when required. There are four storeys, including the ground floor and a basement. The building has approximately 45,000 square feet of storage, excluding the spaces occupied by the elevator shaft, stairway and pattern shop. The stairway is built inside the building, and is isolated from the storage rooms, access being obtained by fire doors on each landing. The stairs are of concrete, with chequered steel plate treads and iron pipe handrails. The elevator, which is 12 feet square, runs from the basement to the top floor, the motor and operating mechanism being located in the basement. The elevator was supplied by the Otis Fensom Elevator Co. Each floor has a sprinkler system connected to a standpipe running the full height of the building and served from an existing water tank on the premises. The pressure regulating apparatus is located in the basement. The basement and second floors are used for storing large patterns, and for this reason have plenty of head room, being about 12 feet high. The ground floor, which is also lofty, is partitioned off to form a pattern shop and a pattern storage. The pattern shop takes up rather more than half the floor area, and is separated from the storage by hollow-tile walls, which can be removed in the event of the entire space being required for a pattern shop.

EXTERIOR VIEW OF PATTERN SHOP AND PATTERN STORAGE BUILDING. OVERHEAD TRAVELLER NOW RUNS ALONGSIDE IN FRONT OF MAIN ENTRANCE.

Pattern Shop Feature

The pattern shop is exceptionally bright and roomy, and has a hardwood floor. A work bench, equipped with Emmert's universal pattern vises, extends the full length of the south side of the shop. The machinery is grouped about the centre of the shop, leaving ample space for the lay-out floor, where the larger patterns are assembled. The shop also contains a lavatory and foreman's office.

The machinery at present installed comprises the following units, but other equipment will be installed in the near future. The machinery driven from the line shaft includes a Downer grinder, a small wood-turning lathe, a tool grinder, and a C.M.C. 30 in. by 40 feet wood-turning lathe. The transmission equipment, including wooden pulleys, was supplied by the Dodge Mfg. Co. The line shaft is driven by a 5 h.p. Can. Westinghouse motor, controlled by a starter, supplied by the Condit Electrical Co., Boston, Mass. All the other machines are driven by individual motors, using Hydro-Electric current 3-phase, 25-cycle. These machines include the following:—A 24-inch planer supplied by P. B. Yates Machinery Co., Hamilton, Ont., and driven by a 10 h.p. Can. Westinghouse motor; one C.M.C. rip saw, driven by a 5 h.p. Can. Westinghouse motor; one 16-in., a C.M.C. jointer, driven by a Can. Westinghouse 5 h.p. motor; an 18-inch cut-off saw, by P. B. Yates Machine Co., driven by a 3 h.p. Crocker Wheeler motor; and two 36-in. C.M.C. band saws, driven by 3 h.p. Crocker Wheeler motors. Ample provision for artificial lighting has been made, the main switches for both the pattern shop and entire building being located in the pattern shop. The section of the ground floor not occupied by the pattern shop is used for storing large patterns.

SHOWING STEEL STORAGE RACKS FOR SMALL PATTERNS ON THIRD FLOOR OF PATTERN STORAGE BUILDING. NOTE SPRINKLER SYSTEM.

Small Pattern Storage

The third and top floors are used for storing smaller patterns. An interesting feature on the third floor is a system of steel racks for storing the smallest patterns. There are six rows of racks, each being approximately 80 feet long. The top racks are barely six feet from the floor, so are easy of access. The accompanying illustration shows, in a general way, the arrangement and style of these racks. The racks are all numbered and a record of the patterns is kept by means of a card index. The larger patterns on the other floors are arranged in numbered sections and a record is kept in the same way. The patterns themselves are also numbered. By means of the above system it is easy to keep track of each and every pattern in the building, and no time is lost when any particular pattern is wanted.

Overhead Runway System

A system of overhead runways is installed to facilitate the handling of heavy or bulky patterns. The system, which was supplied and installed by the Herbert Morris Crane & Hoist Co., of Niagara Falls, Ont., is used in all parts of the building except on the third and fourth floors, where the lighter patterns are kept. On the second floor the runway serves two sides and one end of the store room for carrying patterns to the elevator. There is a switch in the system where the two lines connect up near the elevator. The layout in the basement is essentially the same as on the second floor. On the ground floor the system is arranged to serve the storage section and also the lay-out floor in the pattern shop. The branches of the system converge at the elevator, the tracks and switches being arranged to give the most efficient service. The pulley blocks have a capacity of one ton, and the trolleys are equipped with a buffer device.

The general contractors for the building were the E. G. M. Cape Co. of Montreal, who sub-let the various smaller contracts. It may be of interest to note that some of the concrete work was done in almost zero weather, which apparently had no ill-effect. The construction of the building was completed in May and machinery in the pattern shop installed during the month of July. All the contracts have been successfully carried out, and the building is a valuable addition to the company's plant.

PART OF LAYOUT FLOOR IN PATTERN SHOP, SHOWING SYSTEM OF OVERHEAD RUNWAYS WITH ELEVATOR IN BACKGROUND.

WOMEN IN FOUNDRY WORK

"DILUTION" in engineering works of all kinds is generally recognized as a means of getting over the difficulties of the actual present times in engineering industries; and whilst it is essential as a means of overcoming the demands for larger output, there is little doubt that there are limits to the employment of women on work which has hitherto been done by men. In the general foundry, for example, there would not appear to be much room for female la[illegible] the core-making department, as owing to the heaviness of the work and the weights to be lifted, strength considerations would prove a severe handicap. In specialized work of a light character, however, women might be very well employed, and after preliminary training they should turn out quite as much work and be paid as high wages as the men.

Certain rules are as necessary in the foundry as they are in the engineering shops. Of course, suitable dress must be worn whilst at work; such things as high-heeled boots, floppy "munition" outfits, stiff corsets, and such like, would have to be thrown aside for the working period, and practical men's dress used, as freedom of movement is essential in the whole of the work, while at the same time skirts and loose garments are not conducive to safety. But as these commonsense methods have been accepted by women and girls in munition factories generally, there should be no hindrance in this direction. It is more important to observe that female labor should be closely confined to moulding and core-making; the melting and handling of metal, and the pouring and dealing with the metals in the moulds being done by men and boys, this part of the work not being at all suitable for women. When molten metal has to be dealt with, chances cannot be taken with any degree of safety, and whilst a splash will only cause a man to give a hearty swear, with a woman the chances are that the ladle or crucible would be dropped, and on a damp floor this would be disastrous, and probably the ambulance would be often wanted.

Much of the art work which used to be imported could be produced by women up to the pouring stage, and particularly that done by the **cire perdu** process; but heavy work would be beyond their strength, if nothing more. Women are doing good work in machine shops at the present time, but what appears to be lost sight of is that the bulk of the women are on repetition work of what may be called the "one job" type, and really that they are not doing the run of work which has to be taken by the male operatives.

PRESENT POSITION AND FUTURE PROSPECTS OF CANADA'S IRON AND STEEL INDUSTRY*

By D. H. McDougall**

IN reviewing the iron and steel industry in Canada, a clear distinction must be drawn between the position during war time, and the position that may be forecast after the war.

The present condition of the steel and iron industry is one of artificial stimulation, brought about by the action of numerous temporary factors, prominent among which are: Extraordinary demand for munitions steel; increased cost of transportation, accompanied by congested railroads, and shortage of shipping; an unparalleled coal shortage; and a severe and increasing shortage of labor.

These factors, all abnormal and arising out of war conditions, have rendered temporarily obsolete all hitherto accepted standards of economics, and they have been accompanied by an increased cost of living, large increases in wages, and increases in the selling prices of steel and steel products. No one can say how far these extraordinary conditions will extend, or how long they will last, but some day the world will resume its normal course, and the laws that govern normal times will again operate.

Therefore, in considering the after-war situation of the Canadian steel industry, we should see what the permanent essentials of a successful steel industry are, apart from present unusual and evanescent conditions.

Factors that favor success and permanence in steel and iron manufacture are:—

Geographical location, giving cheap access to world markets, and opportunities for the cheap assemblage of raw materials.

Close proximity of metallurgical coal, iron ore of good grade, and limestone deposits of suitable quality. All these raw materials should be accessible in large quantities, and so placed as to render mining costs and transportation reasonably cheap.

General conditions favoring the manufacture of steel in large tonnage.

A review of the iron ore and coal deposits of Canada will show that such a combination is to be found in very few places in Canada, and that already large steel and iron works exist at the localities where the manufacture of iron and steel is permitted by natural conditions to rest upon a permanent and commercial foundation.

The location of iron and steel plants in all parts of the world has been primarily determined by the proximity of coal, and it does not seem probable that any steel plant can exist and pay profits in normal times which has not to hand a plentiful and inexpensive supply of metallurgical coal. It is perhaps hardly an exaggeration to say that the steel industry is always an outgrowth of a coal mining industry.

Present conditions favor the commencement of small war industries. For example, the time is opportune for the opening up of small and easily accessible coal areas, the operation of which in normal times was not profitable; and in the same way, small smelting plants and small works for making munitions have been commenced and successfully worked because of the unbalanced state of demand and supply. These passing conditions, on the other hand, act to the disadvantage of large and long-established concerns, or at the most they offer merely an opportunity to get rid of the load of debt that is the legacy of the depression that preceded the war and persisted for some time after hostilities commenced.

After-war conditions will eliminate most of these small ventures, and in the days of financial stress that are surely coming the mainstay of industry and the hope of the country will be the large and long-established companies, who, if they are wise, will have stored financial reserves and expended profits on rehabilitation of plant, as a safeguard against the future.

Applying these general principles to specific cases, it would seem advisable that the energies of the country should be concentrated on ensuring the future of the large steel works on Sydney Harbor and on the Great Lakes, and that these existing works should be looked to for the production of steel and iron in large quantities, because in these places only is there available a sufficient quantity of coal, iron-ore and limestone.

For the treatment of steel in small quantities to produce tool-steels, crucible-steel and special alloyed steels, the electric furnace has a future, and industries of this kind will probably increase in the populous parts of Quebec and Ontario.

It is also advisable that any increase in the rolling and forging capacity of Canadian steel works should take place at the large and established plants referred to. These plants have hitherto regarded the manufacture of rails as their chief activity, but in the future, and with a view to after-war conditions, it seems probable that the rolling of ship-plates and other commercial shapes will become necessary. It is self-evident that the manufacture of finished steel products can nowhere be so satisfactorily and economically carried on as at the existing plants.

Considering particularly the question in what way it may be possible to obtain some considerable increase in the production of iron and steel in the future, that is, after the war, the first point to be determined is: Allowing for the rolling in Canada of steel shapes and forgings now finished outside of Canada, for all the export business obtainable, and for all Canada's own requirements in iron and steel, what tonnage of iron and steel over and above the existing capacity of Canadian works will be required?

Summarizing, and applying these principles, it would appear that the Canadian steel industry should be guided towards two main ends, namely:—

That the present abnormal demand for steel should be supplied as far as possible by the extension of existing plants.

That these existing plants should prepare to enlarge the variety of their finished products.

That should it then appear there was a necessity for greater production of iron and steel such as to require new plants, these plants should comply with the factors that have already been named as requisite to commercial permanence, and as giving ability to compete in world markets.

By following along these general lines, the existing plants will be extended, rehabilitated and modernized, and given an opportunity to accumulate financial reserves to carry them successfully through the troubled days ahead, and they will be placed in a position enabling them to enter world markets, and to compete with other countries, particularly the United States.

*Canadian Mining Institute Bulletin.

**General Manager Dominion Steel Corporation.

PROCESSES IN MANUFACTURE

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

HEAT TREATMENT OF LARGE FORGINGS

By Sir William Beardmore, Bart.

IN the heat treatment of large forgings, there are no metallurgical principles involved which do not apply with equal force to the heat treatment of small forgings, such differences as exist being entirely due to the limitations which large forgings impose on the practical conditions under which the heat treatment is carried out. For every class of forging, it is desired that the material from which it is made should give the mechanical tests required by a suitable choice of composition, but, in addition, it is most necessary that the material be in such a physical condition that brittleness and chance of sudden failure be reduced to a minimum.

In carbon-steel forgings produced to meet a definite mechanical test specification, this is equivalent to saying that the steel must possess the least crystalline growth or the smallest grain size, and the object of all heat treatment is to confer this condition on the forging before it leaves the steel works. It is well known that, at any chosen temperature, the time the material is kept at its heat and the time taken to cool down to normal temperature again have an all-important influence on the grain size, and it is for this reason that in large forgings all the difficulties of heat treatment are magnified; and, in the author's opinion, a limit is ultimately reached in the size of the forging beyond which a plain carbon-steel cannot be used with safety, and the use of an alloy steel becomes imperative.

The slowness with which heavy masses of steel cool down results in large crystal grains at the centre of the mass, and, to avoid this, recourse has to be made to oil-quenching to hasten the cooling down, and so to diminish the size of the grain, while a subsequent reheating is generally necessary to remove the hardness introduced by the quenching operation. With small forgings, a simple annealing will put the material into the condition which will give satisfactory and safe results, but for large forgings some form of heat treatment is very necessary to get the best results.

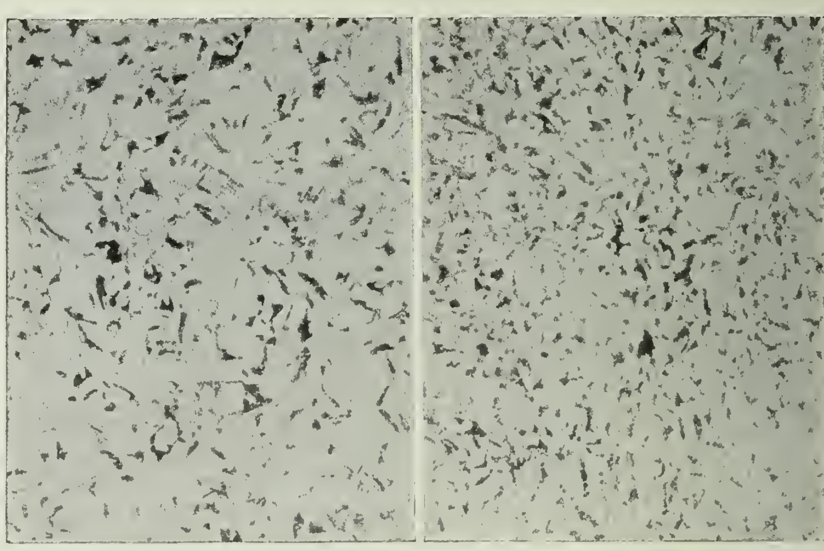
It is a fact which is not sufficiently realized by engineers that, in plain carbon-steel, the effect of oil-quenching is not uniform over the cross-section, but diminishes the farther one goes from the outside surface. With very large forgings, therefore, a stage is reached at which, owing to the size of the forging, the quenching effect at the centre is so small that it is insufficient to confer any benefit on the material, and it becomes impossible to guarantee the uniform results which are wanted. That this effect is a real one can be seen from the accompanying photomicrographs of a large oil-treated shaft and from the tests taken. This shaft is 18 inches diameter, and of the following per centage composition:—

C.	Mn.	Si.	S.	P.
0.18	0.65	0.10	0.048	0.037

It was heated in 820° C. (1,505° F.), kept two hours and cooled in oil. Tests were taken from the outside skin and centre, and gave results as shown in the following table:—

	Elastic Limit Tons per sq. in.	Ultimate Stress. Tons per sq. in.	Elongation on 2 inches. Per cent.	Reduction of Area. Per cent.
Outside	17.5	33.1	27.0	53.1
Centre	15.0	29.0	31.0	46.0

The structures are given in photomicrographs, Figs. 1 and 2, being the outside and inside respectively. The tests taken from the centre of the shaft have a lower tonnage than those from the outside, due to the fact that the quenching is not so effective. Photomicrograph Fig. 2, confirms this. With a higher carbon steel it can be understood that the difference will be greater.



OIL HARDENED 18-INCH SHAFT MAGNIFIED 100 DIAMETERS.
FIG. 1. OUTSIDE SKIN. FIG. 2. INSIDE.

The effect of work is very important, and there is an intimate relation under practical conditions between the grain condition of a forging and the amount of work which has been put on it during forging. For the very best results, the ration of the cross-section of the ingot and the largest cross-section of the forging should have a minimum value which it is advisable should not be less than three. Preferably it should be as great as possible, but it cannot always be adhered to, since for large sizes it is limited by the maximum size of ingot with which the presses can deal and sometimes by the shape of the forging itself. For an ingot 83 inches in diameter the maximum size of the forging should not exceed 48 inches for the best practice, and from a steel-maker's point of view, until the demand warrants the outlay of plant for dealing with still larger ingots, larger forgings than this should be built up rather than manufactured in one piece. In this connection the cause of commercial efficiency would be better served if engineers, in bringing out new designs in heavy steel construction, would consult the metallurgist and the steel manufacturer as to the best method of using their combined knowledge in the design and production of special requirements.

Though not strictly a forging, the following example illustrates very well what has been said above regarding the heat treatment of heavy forgings. The order specified steel discs 55 inches dia-

*From a paper presented before the Institution of Mechanical Engineers.

meter and 11 inches thick with a mechanical test of—

Yield-Point. Tons per sq. in.	Ultimate Stress. Tons per sq. in.	Elongation (on ratio $\frac{\text{length}}{\text{diameter}} = 10$) Per cent.
23	45	20

They were required to revolve at a high speed, and for magnetic reasons it was necessary to use a carbon-steel. The ingots were forged and then rolled to size from material of the following composition:—

C.	Si.	Mn.	S.	P.
0.53 0.54	0.18	0.50	0.029	0.040

and were given a heat treatment after this operation, which consisted of—

(1)—Heating to 780° C. (1,436° F.) for 2 hours and cooling in oil.

(2)—Heating to 550° C. (1,022° F.) for 4 hours and cooling in air.

Tests were taken from the centre of the slab (midway between the two surfaces), and they gave the following results:—

—	Yield-Point. Tons per sq. inch.	Ultimate Stress. Tons per sq. inch.	Elongation (on ratio $\frac{\text{length}}{\text{diameter}} = 10$) Per cent.	Reduction of Area. Per cent.
Cross test	23.6	42.3	14.0	39.3

This was the best that could be obtained, and was below the specified tests. There were two reasons for this; the carbon was too low and the thickness of the slabs was too great to allow the oil-quenching taking sufficient effect to attain the high tonnage required. An-

higher carbon material giving—

C.	Si.	Mn.	S.	P.
0.62/0.63	0.25	0.70	0.023	0.024

other ingot was therefore cast, from a and it was forged and rolled to 5½ inches thick to the size given in Fig. 3.

In this way it was sought to avoid any unsoundness that might exist down the centre line. At the same time the test specification was amended so that the elongation required was 22 per cent. on 2 inches instead of 20 on a ratio $\frac{\text{length}}{\text{diameter}} = 10$. The plate was heat-treated as follows:—

(1)—Heated to 900° C. (1,652° F.), kept 1 hour and cooled in oil.

(2)—Heated to 760° C. (1,400° F.), kept 1 hour and cooled in oil.

(3)—Heated to 640° C. (1,184° F.), kept 8 hours and cooled in air,

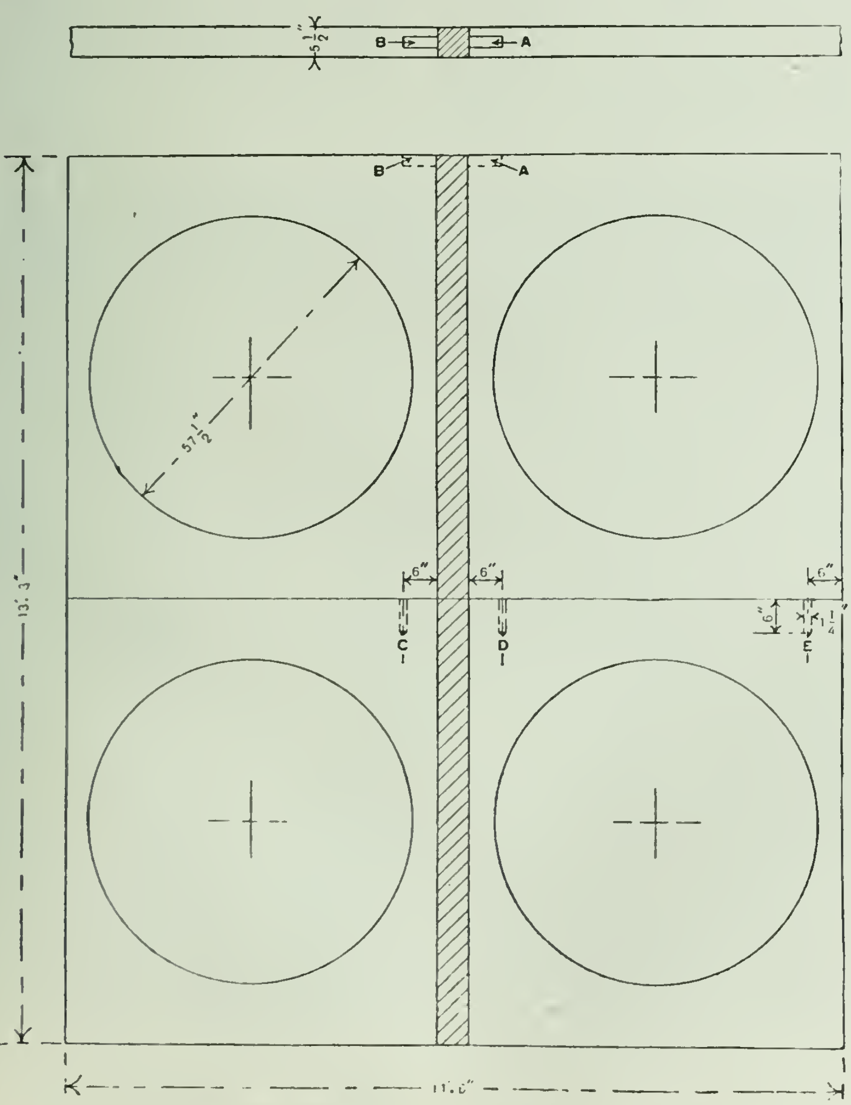


FIG. 3. FORGED AND ROLLED SLAB USED FOR TEST.

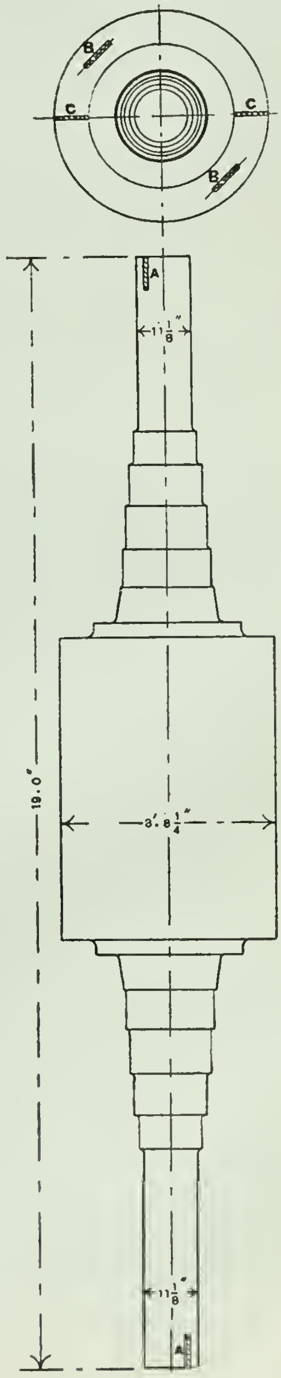


FIG. 4. LARGE ROTOR SPINDLE.

and the following tests refer to the corresponding letter in Fig. 3:—

Fig. 3.	Yield-Point.	Ultimate Stress.	Elongation on 2 ins.	Reduction of Area.	Fracture.
	Tons per sq. in.	Tons per sq. in.	Per cent.	Per cent.	
A	28.1	46.2	28.0	52.4	Silky fibrous.
B	27.9	46.0	27.0	44.4	(10% fibrous. (90% fine gran.
C	27.2	46.6	25.0	47.2	(40% fibrous. (60% fine gran.
D	26.4	46.0	26.0	42.0	(30% fibrous. (70% fine gran.
E	26.8	46.2	27.0	44.4	(50% fibrous. (50% fine gran.

These results are satisfactory according to the test specification, and show the improvement effected by slight changes in the method of manufacture. The improvement due to rolling to a smaller thickness alone was seen when first material containing 0.53 to 0.54 per cent. carbon was rolled down from 11 inches to 5½ inches, and then retreated in the same manner, for it gave the following tests:—

—	Yield-Point.	Ultimate Stress.	Elongation (ratio length 10).	Remarks.
	Tons per sq. in.	Tons per sq. in.	Per cent.	Ins. thick.
Length	26.3	44.9	15.8	5½
Cross	25.7	44.2	16.5	5½
Cross	23.6	42.3	14.0	11

This result could have been still further improved by decreasing the thickness to 3 inches, but it shows how important the effect of work is on carbon-steels, and how it may make just that difference between success and failure.

For high-tensile material—that is, material over 40 tons strength—where the factor of safety is limited owing to the special conditions under which the material has to be employed, it will generally be safer to use an alloy steel, since for the same tonnage a very much tougher material can be developed; but, for material whose tensile strength is below this figure, there is not the same necessity, and excellent results can be obtained from oil-treated low-carbon steel.

Fig. 4 indicates the outline of a large rotor-spindle which was made to the following test specification:—

Yield-Point .... 20 tons per sq. in.
Ultimate Stress ......36 tons per sq. in.
Elongation on 2 ins. ..24 per cent.

It will be seen from the drawing that the largest diameter was 3 feet 8¼ ins., and the minimum diameter only 11⅛ ins., so that if such an ingot were used as would give the requisite amount of work for the largest section, the amount of time and money spent in forging down this ingot to 11 inches would be out of all proportion; and so in this case, as in many other cases, the best metallurgical conditions are incompatible with the best commercial conditions, and a compromise has to be effected. An ingot 60 inches in diameter was used of the following composition:—

C.	Mn.	Si.	S.	P.
0.38	0.89	0.21	0.029	0.044

In the heat treatment of this job, and of jobs having similar shapes, when the forging is put into the furnace, the time taken to heat up the heavy centre section is much longer than the time taken to heat up the end sections. For instance, the end-pieces of 11 inches diameter could be heated up in about 4 hours, while the centre would take about 20 hours to reach the same heat, so that before the forging would be uniform the end-pieces would have been at their best for 16 hours, and would have grown such a crystalline grain in consequence that any good effect of the oil treatment would have been annulled. To avoid this, the ends were covered with asbestos sheets, leaving only the centre exposed when the forging was charged into the furnace, and this sheeting was removed after 15½ hours in the furnace, so that the forging attained its heat uniformly as a whole, and the crystal grain in consequence was uniform throughout.

The test results obtained were very good, and are given below. A refers to length tests taken, one from each end of forging, B to tests taken circumferentially from a ring taken from the centre part after treatment, and C to tests taken radially from the same ring. In both B and C tests two tests were taken from opposite diameters:—

Fig. 4.	Yield-Point. Tons per sq. in.	Ultimate Tons per sq. in. Stress.	(on 2 inches). Per cent. Elongation
A	22.6	38.8	27
	22.8	39.2	27
B	22.8	39.2	28
	22.4	38.8	28
C	22.4	38.8	30
	22.4	35.8	24

The treatment given to this rotor was as follows:—

(1)—Heated to 800° C. (1,472° F.), for 2 hours and cooled in oil.

The centre part attained its heat in 19 hours 30 minutes, and the ends were uncovered after 15 hours 30 minutes, so that they attained their heat simultaneously with the centre part.

(2)—Heated to 550° C. (1,022° F.), in 11 hours 30 minutes, and kept at heat for two hours.

A very troublesome feature of large forgings which have been heat-treated is the distortion which takes place, due to internal stresses probably set up by the operation of quenching. On machining the forging, and especially on removing the outside surface, these stresses are partly relieved, and the forging distorts and takes up a new shape under the influence of the forces still left in the material, so that it loses straightness and generally adds very largely to the time occupied in machining. It is advisable on this account to rough-machine the forging after treatment, and then to re-anneal it before the final treatment is done. Allowance for this re-annealing can be made on the first testing, and where the final machining is intricate and accurate, it will be found to well repay the cost, since trouble in the machine shops due to distortion will be reduced to a minimum.

Hardening Nickel Steel Rifle Barrels.—The temperature generally used for hardening nickel steel rifle barrels is 1500 to 1525 degs. Fah.; and for manganese steel from 1475 to 1500 degs., but has to be varied, according to the chemical analysis of the different steels from which the barrels are to be made, says the *Iron Age*. The barrels are brought up to the required temperature in about one to two hours, depending upon their number and the heating factor of the furnace, and then allowed to soak at that temperature for a similar length of time, after which they are quenched in a tank of oil. The quenching solution, being oil, is not liable to crack or warp the barrels, and it should be kept at a constant temperature of from 70 to 100 degs. Fah.

Concerning Spring Steel.—Spring steel is said to become brittle when used as cathode in a hot cyanide solution, either sodium cupro-cyanide or simple sodium cyanide. The effect is more pronounced with the simple salt. Brass and phosphor-bronze are not affected. Brittleness is not produced by the liberation of hydrogen on the steel. The carbon content is not changed by the electrolysis. The crystalline structure is not changed by electrolysis. The brittleness is not produced in annealed wire; the brittleness is produced by use as cathode whether the wire is coiled or not bent in any way. The brittleness is not produced when the wire is used as anode, or when it is suspended in the solution without the passage of electricity.

The Education and Training of Foundrymen by Mail

By C.T.R.

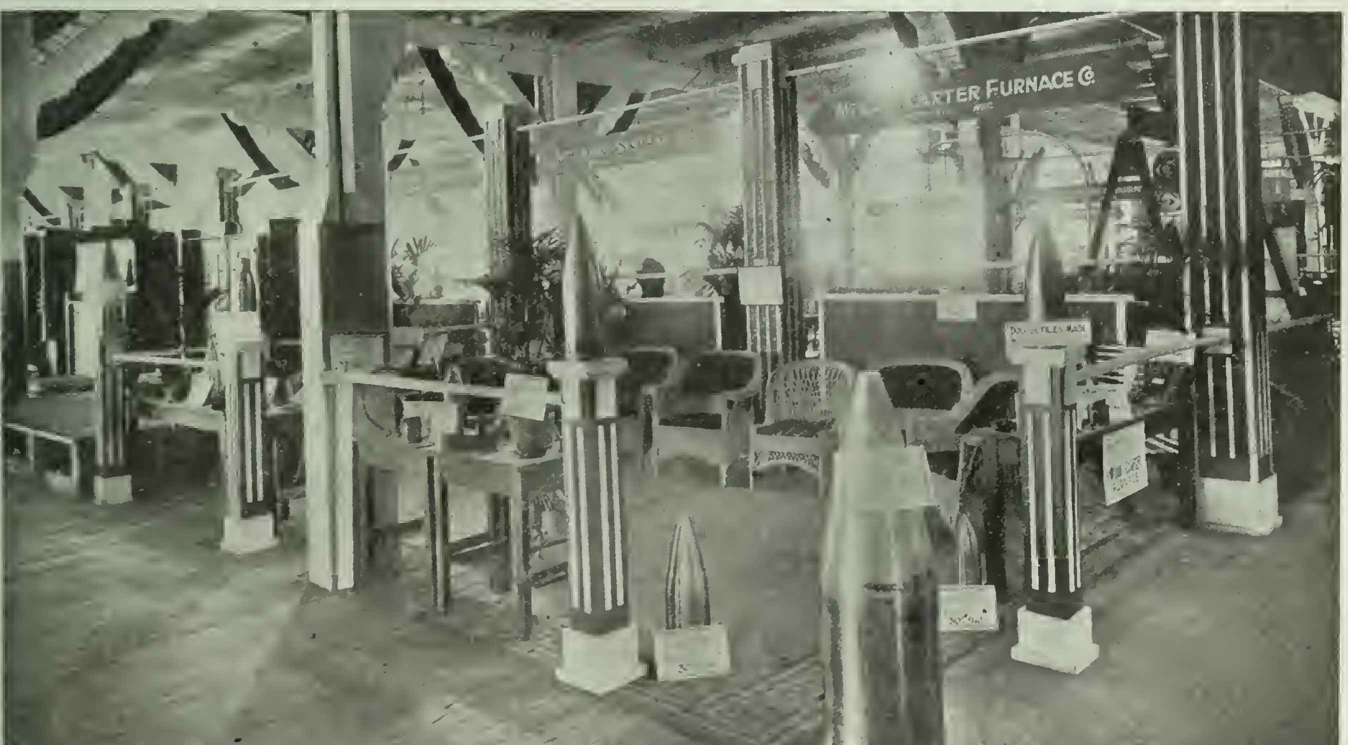
It should be the ambition of every man, who has a trade, to become a high grade exponent of same, and while common school, high school and university education as preliminaries may and do contribute a whole lot to that end as auxiliaries to natural deftness and keenness of perception, research, discovery and development, which are increasingly active, make it encumbent that the further education of oneself suffer neither restriction nor let-up in its quest and appropriation. Opportunities to this end are many and varied.

AT the recent Exhibition of foundry equipment and supplies held in the Mechanics' Building, Boston, Mass., under the joint auspices of the American Foundrymen's Association and the American Institute of Metals, not the least interesting among the many excellent booth displays, because of its war-time appropriateness and actual practical demonstration of progressive foundry effort, was that staged by "McLain's System," of Milwaukee, Wis.—to wit, the tangible and visible results of instruction in foundry practice by mail. For obvious reasons, we refrain from making observations or from giving even a brief description of the varied type and size shell shown in the accompanying illustration; the fact that they are in no sense experimental projectiles, but real war-time utilities, and the further fact that their metallic constituent and method of production are creations of a system of instruction for foundrymen by mail—otherwise correspondence—make elaboration or intricate detail superfluous and unnecessary under the circumstances.

Foundrymen beyond the confines of the United States are not as familiar as they might be with the history and development of McLain's System, which is practically the life story and foundry experience of one man—David McLain—crystallized, and made to shoot its beams of light into the darkness, figuratively speaking, so long surrounding foundry practice and militating against progressive effort, not to mention achievement. It is not, of course, to be understood that David McLain was the lone star in the foundry firmament, but he certainly can lay claim to be one of less than a score of American foundrymen who have been responsible for the craft uplift of the present century, and to whom the greatest credit is due for the high standing the industry to-day enjoys, not only in the United States, but also in Canada and Great Britain.

It should be an inspiration to budding and prospective foundrymen to know that David McLain rose from the ranks. Somehow our hearts go out to such a one, no matter what his particular vocation. Great Britain's present chief of staff for the conduct of her gigantic military operations—Sir William Robertson—rose from the ranks. Men are rising to prominence—in some cases to mere publicity—every day; the records are, however, not always such as to inspire. McLain's history of himself, starting with his birth in Belfast, Ireland, and his quitting the "Old Sod," when five years of age, with his parents, to journey to Pittsburgh, Pennsylvania, is brimful of human interest, and has a tendency to make one feel like getting to know the man a little better and compare notes and personalities with a view to finding out just where his strength lies comparatively.

Times were hard in Pittsburgh; therefore, during the panic of 1873 little Dave McLain set out to help support the family of which he was a member. He seems to have been destined for the foundry from his early boyhood, for at ten years of age we find him twisting hay ropes for core barrels in Smith's pipe foundry, Pittsburgh, at $2.25 per week. An explosion in a pipe pit, which killed twenty men, unnerved him somewhat, so



"McLAIN'S SYSTEM" BOOTH AT THE EXHIBITION OF FOUNDRY EQUIPMENT AND SUPPLIES, HELD IN BOSTON, MASS., DURING WEEK OF SEPTEMBER 24, 1917.

he quit foundry work, but not for long; to use his own words, "I naturally drifted back to the foundry, working both in iron and steel." The latter circumstance seems to have been a very great convenience, as well as profitable, for, quoting him again, "when I could not get a job in one I would work in the other." The human interest reference above to Dave

DAVID McLAIN IN A TYPICAL DEMONSTRATION POSE.

McLain's business career may at this point be judged as to merit by the following paragraph:

"At the age of eighteen," he says, "I was married and earning moulder's wages. All I could see ahead of me was the sand heap—'typical of the times.' I had no education to speak of, neither had I influential friends; yet I felt I must get away from it. On the floor to my right was John Williams, 65 years of age; on my left was Frank Jones, some 52 to 55 years of age. I would stop work at odd times, lean on my rammer, look first at John and then at Frank, and wonder if I was going to end the same way."

Books on foundry practice were not available in those days, and trade papers were more or less in their infancy, in both of which respects the rising generation have much to be thankful for, and perhaps more so as regards iron and steel founding. Later from the brain of an ambitious moulder was evolved and established, that world-known publication, "The Foundry," of Cleveland, Ohio. Evening class tuition in the arts and crafts, technical and correspondence school instruction were, if existent, but as the shadow to the substance of our day.

Dave McLain was dour enough to have been born in the "Land of the Heather," judging by the way he persisted in educating himself, notwithstanding many apparently insuperable difficulties. As a result we find him in charge of a grey iron and steel shop at the age of 23, from which circumstance he lays claim to being the oldest steel foundryman, in point of experience, in the United States or Canada.

Mixing irons by analysis, not by guesswork, tradition, or some rule-of-thumb method, equally unsatisfactory, had burned itself into the heart and head of young McLain; little wonder, then, is it that the melter, so long regarded as a sort of craft deity, but who in reality knew nothing of the constituent of his cupola mixtures, got out of harmony with his surroundings. "All irons are good irons when you know how to use them," is an axiom of McLain's System, and few will be disposed to challenge the assertion.

At 35 years of age David McLain was drawing $3,000 per year as foundry superintendent. He was still drawing heavily—and is yet, on the research of himself and others in the matter of a larger and wider development of foundry enterprise, and it was when, with 35 years' practical experience behind him, he made his decision and established his system of scientific mixing and melting and the manufacture of the much discussed material entitled semi-steel. As regards nomenclature, much difference of opinion exists as to the product being so described. For the purpose of this article, nomenclature is largely, if not wholly, immaterial.

McLain's research and experiment in the direction of charging certain percentages of steel into the iron foundry cupola, to attain a product of some definite strength, homogeneity, and readily machined, did not at first appeal to those more directly concerned, or whose best interests were most directly at stake. Steel had been added to iron in the ladle for 50 years or more preceding the McLain discovery, and even slight amounts were on record as having been charged to the cupola. So far as large percentages of steel being employed in light castings are concerned, no records were, however, available.

With confidence begotten of knowledge, therefore, and being a "child of the foundry," so to speak, and with the best interests of his craft as strongly embedded in his bosom as those of his own personal interest, in January, 1908, David McLain quit a high-salaried position to establish what is getting to be quite universally known as McLain's System of Instruction for Foundrymen by Mail. In the decade now almost past since embarking on this new and untried enterprise, vicissitudes have not been lacking, opposition being on many occasions powerful, menacing, and jeeringly disposed. Here and there good sports among foundrymen came out into the open. They recognized a ring of sincerity about Mac that was worth taking a chance on, and to their surprise they won out on the venture.

Good news travels quickly; in any case, there are men in all ranks and trades and crafts who are on the lookout for bigger and better things, and such never fail to be in the right place at the right time. Is it any wonder, then, that there is today no representative of the foundry craft more highly respected and appreciated—iron or steel—by his confreres and contemporaries, in the United States, than David McLain, and no more popular enterprise than McLain's System of Foundry Instruction by Mail.

The open-hearth furnace for steel melting, as well as the cupola for grey iron or semi-steel, is included in the scope of the work undertaken by McLain's System, Goldsmith Building, Milwaukee, Wisconsin, and, judging by the clientele—plant administrative, foundry superintendents, foundry foremen, and men on the floor, whose ambitions are to get on top of the sand heap, who have passed through and are still on the books of the "System," it is not assuming too much when we make prediction that the coming handful of years will show even greater development than any like period preceding, much as that most immediate has unfolded.

Unique in many respects as is this McLain's System from trade uplift and efficiency of production points of view, that of its business management and administration is easily no less so. Known to hundreds of foundrymen all over the United States, Canada, and Europe is the signature of "I. V. Scanlan," attached to letters of technical and practical import issued from McLain's System headquarters. Foundrymen attending the annual exhibition of equipment and supplies for the first time receive the surprise of their lives in meeting I. V. Scanlan, for I. V. is not a man at all, but a keen-eyed, alert, slenderly-built young woman.

I. V. SCANLAN,
Secy.-Treas. and Chief Assistant, McLain's System, Incorporated.

Miss Scanlan has the distinction of being the only woman in the world who teaches the foundry business to foundrymen. The technique of the subject, the diagnosis of complicated metals and mixtures hold no terrors for her; as a matter of fact, she simply revels in the work, bringing to the many problems involved a brain that many of us are disposed to envy, and a precision of expression readily appreciated by those interested in the various solutions. As first assistant to Mr McLain, she has assumed almost entire charge of the business, and that she is partner in same as well is due to Mac's business acumen, for he discovered quite early in his correspondence school enterprise that she was too valuable an asset to risk losing by any chance.

Needless to say, hard work and hard study are the secret of Miss Scanlan's success, and aside from the personal instruction of her chief, nothing has contributed more to acquirement of the craft knowledge she now possesses than the intimacy with progress and development in foundry practice recorded in the columns of trade and technical journals.

MANGANESE IN STEEL MAKING*

By Dr. Henry M. Howe.

PASSING by the deoxidizing and desulphurizing effect of manganese as foreign to our present purpose, its effect on the mechanical properties of the steel seems to me in the last analysis due primarily to its retarding action both on the transformation and on the coalescence of the micro-constituents into progressively coarser masses, which while increasing the ductility lessens the cohesion in general, including the hardness and the elastic limit, and thus lessens the effective strength.

Before considering the retarding of the transformations by manganese let us refresh our memory as to these transformations, and as to the three prominent states of steel, between which they play:

The common low-temperature alpha or pearlitic state;

The high temperature or non-magnetic austenite state into which the metal passes spontaneously when heated up through the transformation range, say 725 to 900 deg. C., Ac^1-Ac^3;

The intermediate or martensitic state, in which carbon steel is caught in transsit from the austenite to the pearlite state by means of a rapid cooling, as for instance on hardening by quenching small pieces in water.

The alpha state is magnetic and relatively soft and ductile, as in annealed carbon steel; the intermediate or martensitic state is magnetic, hard, and brittle as in hardened steel; while the non-magnetic high temperature or austenitic state when preserved in the cold, as in manganese steel, combines great ductility with hardness of a peculiar kind to which I will refer shortly.

In carbon steel this transformation is so rapid that it occurs to a very marked degree even in the water quenching of thin pieces, as is familiar to us in the fact that when this steel is made nonmagnetic and austenitic by heating say to 900 deg. C., and is then quenched in water, it transforms as far as the magnetic, hard, brittle, martensitic state of common hardened steel even in this rapid cooling.

Most of the alloying elements, and notably carbon, manganese and nickel, retard this transformation greatly. Thus 2 per cent. of manganese plus 2 per cent. of carbon retard it so that in the water quenching of thin pieces the austenitic state is preserved. With 5 to 7 per cent. of manganese it is so slow that even in air cooling it goes only as far as the intermediate martensitic state. Hence the brittleness of these steels of manganese content. With about 12 per cent. of manganese the transformation is so sluggish that the austenitic state is preserved even through a common slow cooling.

The water-quenching of manganese steel in current manufacture is not to prevent the loss of the austenitic state, but to suppress the precipitation of the iron-manganese carbide, cementite, which would occur during slow cooling. The broad plates of this cementite would embrittle the mass by forming partings of low cohesion. It is derived from the large carbon content of the ferromanganese used, the cheapest source of manganese. Carbon-free manganese steel should not need quenching.

Industrial Value of Manganese Steel

The industrial value of this manganiferous austenite or manganese steel seems to be due to its combination of great ductility with great effective hardness. I say effective hardness, because initially it is rather soft. My own experiments indicate that the Brinell hardness of an undeformed specimen is only 125, or that of steel of about 0.22 per cent. of carbon when annealed, that of ultra low-carbon steel being about 75. But the hardness increases very greatly on the slightest deformation. Even that incidental to the Brinell test increases the observed Brinell harness to 223 easily, or to that of 0.60 per cent. carbon steel when annealed.

This hardening under deformation is one of the first things that forces itself on the user of this material. The first strokes of the hacksaw cut it rather easily, but the deformation thus set up in the path of the saw quickly causes such hardness as to bring the sawing to an abrupt end, thus giving the absolutely false impression that the material has a soft skin. This hardening causes the apparently contradictory combination of effective hardness with very low proportional limit, even as low as 28,250 lb. per square inch. The proportional limit represents the cohesion of the undeformed material, the effective hardness represents the cohesion as exaggerated by the deformation incidental to service. In the same way the act of tensile rupture may increase the Brinell hardness of 540, or that of about 0.50 per cent. carbon steel when hardened.

The surface of the jaw of a manganese steel rock crusher, deforming under the great pressure, quickly hardens itself, so that the combination of a very hard surface with a ductile back develops spontaneously. As fast as this hard surface wears away it is replaced by a new one made equally hard by the deformation which it at once receives.

This hardening probably represents in part the same cause which leads to the increase of cohesion in general, including the hardness, of all the malleable metals under all forms of deformation, such as wire drawing, and in part the martensitization of the austenite. That is to say, the arrested transformation from austenite through martensite to the alpha state which is due in cooling through the transformation range but is restrained by the retarding action of the manganese, is now stimulated by the deformation sufficiently to cause it to proceed as far as the martensitic state, with consequent hardening and embrittling effect. This martensitization through the stimulation of the arrested transformation is a common property of austenitic steels which have only a moderate excess of the retarding elements over the quantity needed for causing the retention of the austenitic state. It occurs strikingly in austenitic 20 per cent. nickel steel.

The retarding effect of manganese on the structural changes of carbon steel shows itself by leading in general to finer structure, to finer ferrite masses, finer network structure, and finer pearlite, indeed probably often to the replacing of lamellar pearlite with sorbite. This greater fineness leads to better quality in general and to a higher elastic limit in particular, though of course with a corresponding sacrifice of ductility.

Value of High-Manganese in Low-Carbon Steel

The great value of manganese for this purpose has not begun to receive the attention which it deserves. It is probable that a manganese content of say 1.25 per cent., with a correspondingly lessened carbon content, may be used so as to lessen the danger of cracking and the residual stresses when a high elastic limit is sought, because this large manganese content in and by itself raises the elastic limit by giving a fineness of structure which otherwise would be sought by increased violence of cooling or by the use of a lower drawing temperature. In other words, the use of 1.25 per cent. of manganese lessens the needed violence of cooling, and permits the use of a higher drawing temperature, in both ways tending to mitigate the residual stresses, and in the former way lessening the chances of cracking.

A 10 per cent. aluminum bronze to which was added 1 per cent. of 30 per cent. manganese-copper had the following physical properties: Ultimate strength, 63,800 pounds per square inch; elastic limit, 19,700 pounds per square inch and elongation in two inches, 49.3 per cent.

*Presented at the annual meeting of the American Society for Testing Materials.

FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

NOTES ON THE MANUFACTURE OF CLAY CRUCIBLES

By G. C. White

THE manufacture of crucibles is an industry but lately developed in Canada. Its introduction has been necessitated by unprecedented consumption, high cost, and the difficulty of getting any quantity when required without any delay. Formerly those crucibles made from German clays were the best, and when it became necessary to use American clays the results obtained in the experimental stage will long be remembered as totally unsatisfactory.

It was found that although the analyses of clays resembled one another there was a vast difference in their resistence to heat and binding power, which two details are obviously the prime requisites of good crucibles. A simple test to establish these factors can be arrived at by making up patties in the laboratory, placing them on a piece of boiler plate, and applying heat. The relative shrinkage, bond, and fusibility can then be observed in a general way

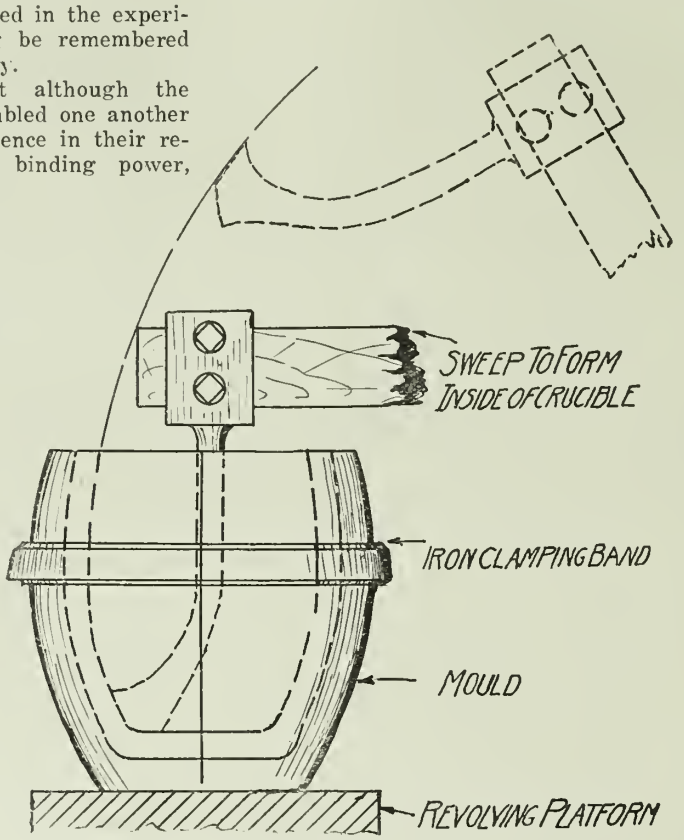
Composition

Like a commercial fireclay, the mixture for crucibles must be varied to suit the service conditions. For example, too much silica permits of crumbling—although it is fire resisting, it fluxes easily at sometimes low temperatures. Alumin is refractory and has good binding power, while magnesia, manganese, iron, lime, etc., are injurious. Slight additions of coke cut down the shrinkage during drying. The quantity of water present in the clay is important as it affects the general character of the structure of the clay. Its content should not be too low, about 10 per cent. being preferable. A few analyses collected from various sources will show the variations of clays from different localities.

	German	Bohemian	American	English
Si02	64.9	45.6	74.9	73.6
A1203	23.8	39.0	17.20	16.50
Fe203	0.8	0.5	0.79	0.27
CaO	...	0.6	0.29	1.17
MgO	0.5	0.1	0.46	0.21
Alkali	1.4	0.5	1.61	5.84
Water	8.4	13.6	5.44	2.45

The rational analyses of the above show that the clay substance varies from 100 to 33.5 per cent., quartz 0 to 40.72 per cent., and felspar 9 to 25.31 per cent.

In making the crucible the clay is proportioned and thrown into the mill which is in reality a mixer. The mill is a vertical cylinder split at the vertical center line to permit of cleaning. The mixer blades are helically inclined and tend to force the mixture to the bottom of mill where a conveyor screw forces



SKETCH ILLUSTRATING METHOD OF FORMING CRUCIBLE.

the clay out through an orifice which forms an 8 inch diameter sausage. This sausage is put into a revolving mold which is split on the vertical center line. A sweep or arm, having the profile of the inside of the crucible desired to be formed, is now forced down through the center of the clay gradually shaping it, as shown in sketch. When the shape is satisfactory the mold is stood on a post and rocked to loosen crucible. The top of the post is the shape of the removable bottom, or else the mold is opened up, permitting the crucible to remain on the bottom of mold if this is more convenient. The molds are of wood, canvas, silk or jute, and lined and well oiled each time before they are used. A heavy black oil is satisfactory, such as car oil.

The drying time is approximately 2 months and the temperature is varied, increasing as the operation progresses and starting at 200 deg. Fahr. The preliminary heating is done with steam coils and must be very slow as on this heating and the moisture content depends the ultimate structure and strength of the product. Annealing must be done when the crucibles are to be used and the charge must be put in while the crucibles are hot. If the crucibles are allowed to cool after annealing they are useless for the purpose for which they were intended. This annealing is done at 1,300 deg. Fahr. and takes from 12 to 15 hours.

The life of a crucible depends to a large extent on the quality of the steel being melted, which in turn governs the quality of the slag. The slag line cuts into the interior of the crucible, at slightly above the middle, consequently the crucible is weakened at this point and, provided it is strong enough for another charge, the next one is figured so that the second slag line comes below the first slag line. The life is, therefore, from 1 to 3 heats. The absorption of carbon by the steel when made in a clay crucible is practically nil.

Several American companies have gotten away from their crucible troubles by melting in electric furnaces but the high cost of power in some localitities makes it necessary that Canadian manufacturers develop the manufacture of crucibles.

PATTERN MAKING NOTES

By J. W. Broadbent

Fillets

A CASTING would never pass the examination of a critical inspector unless all sharp corners were eliminated; not only has a casting a more finished appearance but it is greatly strengthened by putting fillets in all corners as in Fig. 5. Cast iron is composed of a number of minute crystals and these crystals always set themselves at right angles to the cooling surface, thus in a right angled casting, Fig. 6, there will be a break in the crystals in the angle of the casting, which will form a permanent source of weakness, and under ordinary conditions the casting will break here before anywhere else.

By forming a curve, however, as shown in Fig. 7 the crystals will form without any line of separation; and it is easily seen that a hollow cylindrical form of casting Fig. 8 will be the strongest, because the crystals will all radiate symmetrically.

From a moulder's point of view, fillets are a great convenience for they enable him to make a much cleaner casting, the sand not having the same liability to break away as in a square corner. Several methods are adopted by the pattern maker for filling in these angles,—either by working the fillet out of the solid wood of the pattern, or making them separately of wood, leather, beeswax, putty or lead.

Kinds of Fillets

Of these methods the first one always proves the most satisfactory and a good example is a hub for a pulley, the fillet of which can be very conveniently turned to make a good strong job by recessing the web of the arms as in Fig. 9 which method does away with the feather edge of the fillet.

Figs. 10 and 11 show two methods of making strong fillets, but owing to the expense are seldom used on any but standard patterns. For all straight surfaces the wooden fillet answers the pur-

FIG. 5.

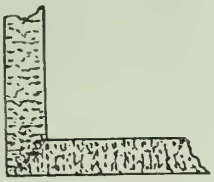


FIG. 6.

pose fairly well, but has a habit of curling away from the pattern when glue is applied.

If the fillet is made with an angle of 93 deg. and the glue put on very sparingly, no difficulty should be found in making it lie down snug in the angle of the pattern.

Leather Fillet Preferred

Leather fillet is now the most popular and by far the best to use, for it can be easily adjusted to any kind of surface, either straight or curved, and is easily fastened to the wood by either shellac or

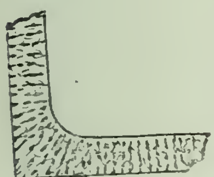


FIG. 7.

FIG. 8.

thin glue. It can be bought in all sizes from ⅛ in. up.

The method of applying is to cut the fillet to the necessary length and lay it on a board where the adhesive material can be easily brushed over it. It is then laid in the angle of the pattern and rubbed into position with a tool rounded at the end so as to give the required curve to the soft leather.

A rounded piece of wood is a common tool used for this purpose but Fig. 12 shows a better tool for applying leather fillet, it is made by fastening different sizes of ball bearings to a round rod, and no pattern maker's kit is complete without a set of these.

All surplus glue should be wiped off before it sets, which is easily done with a piece of rag dipped in hot water.

There are some who claim that fastening leather fillet with shellac is a waste of good material. It is true that glue is cheaper than shellac, but when we consider the time spent in wiping off all the surplus glue, and that if the shellac does ooze out a little the damp sand will not stick to it, the ultimate cost works out about the same.

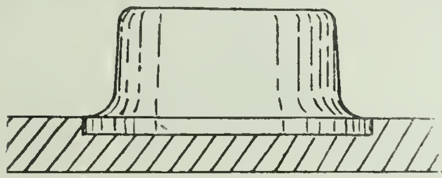


FIG. 9.

Beeswax and its Application

For some classes of patterns, beeswax is an indispensable material, not only for fillets and filling nail holes, but for parts of the pattern itself. It should be applied hot after the first coat of shellac has been put on the wood, and if a small proportion of resin is added to the wax, it will adhere better and set harder. Fig. 13 illustrates a cheap and effective apparatus for melting beeswax, The beeswax is melted in an ordinary

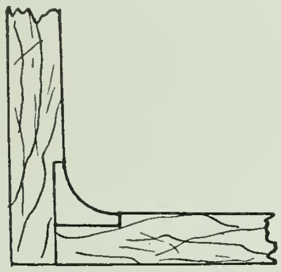


FIG. 10.

tin cup heated by an alcohol lamp, the beeswax being applied with a curved spoon Fig. 14.

Putty takes too long to harden to make a good job and it is necessary to give the angles a light coat of lead and oil before using the putty or it will not stick. Lead fillet has never met with much success, as it is heavy, takes too much nailing and does not lie close to the wood.

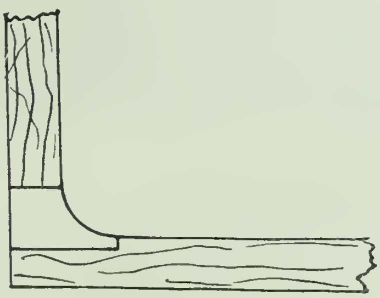


FIG. 11.

It is often necessary to make a pattern in a hurry and the pattern-maker decides to let the moulder cut the fillets out of sand. In these cases the appearance of the finished casting depends upon the skill of the moulder, and if appearance is not to be considered, it is advisable to use three-cornered fillets, they are easily nailed into the angles and fully answer the purpose for which fillets are intended, that is—to strengthen the casting, or to prevent shrinkage in a place that would weaken the casting and to make

FIG. 12.

the moulder happy by not having any sharp corners of sand in his mould.

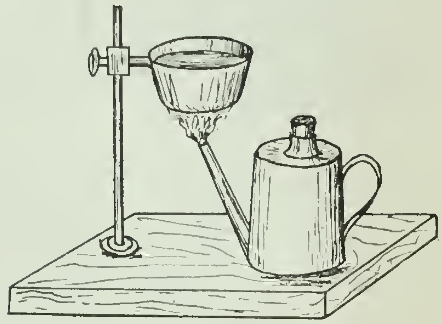


FIG. 13.

ELECTRIC FURNACE DEVELOPMENT

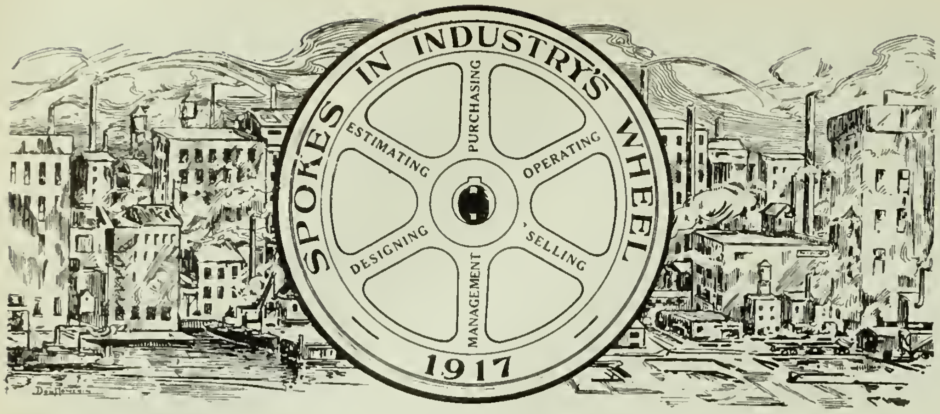
THE number of electric furnaces in Sheffield now built, or building, is about forty, with every probability of a further increase. Turnings, borings, etc., are being converted into steel for shells, rifle barrels, light armor plates, and aircraft. Until the introduction of the electric furnace, there was no type that could melt more than a somewhat limited proportion of turnings per heat. It was necessary to use a large percentage of new raw materials, such as pig-iron bar-iron, etc., along with the scrap. Now, not only is it possible to have a whole heat of turnings, but to have "boils" of ten and even fifteen tons, by the electric process, whereas prior to

FIG. 14.

the war few electric furnaces were of more than 2½ tons capacity. Now these larger furnaces can make sound steel direct from turnings, and at less cost than by the crucible process. The introduction of this type of furnace is, perhaps, one of the most outstanding features of war-time developments in Sheffield's chief industry.

Greaves and Etchells have assisted largely in this recent development and have recently perfected a special furnace of small capacity for the production of high-speed and other tool steels, besides their larger furnace for the melting of turnings. They claim that electric steels made by their process have the following advantages over other steels: (1) Regularity of composition, (2) lowering of sulphur and phosphorous contents, (3) absence of gases, (4) higher yield of sound ingots, and (5) positive control of all furnace operations. They also claim that their furnace, used in connection with a basic open-hearth furnace, permits the production of steels higher in quality than acid steel at a lower cost price than the latter.

nace, permits the production of steels higher in quality than acid steel at a



The constitution of industrial enterprise is largely departmental—"Spokes in a Wheel." This series has for its object the featuring of, in racy, interesting and instructive fashion, the training, experience and achievement of those who to-day are transmitting effectively, energy in a variety capacity as "Spokes in the Wheels" of steam, electrical and hydraulic and refrigeration engineering.

ROBERT MORTON HAMILTON

THE career of the subject of this sketch began about the same time as the machine tool industry in Galt had its inception. Robert Morton Hamilton was born in Brantford, Ont., on March 8, 1864, of Scotch parentage, as his name indicates. He was educated partly at the Public School, Brantford, and later moving to Listowel, attended the High School there for two years, which he left at the age of 14, in 1878, to start an apprenticeship in McIlwraith & Austin's machine shop in that town. This concern was in a small way of business, the work consisting chiefly of repairs to farm and general machinery usually found in country districts. The company went out of business not long after young Hamilton joined it, so he had to look around for another job.

There was at Baden, Ont., at that time a machine shop owned by the Livingston family, who were also the proprietors of a linseed oil mill. This machine shop was originally the property of the father of Adam Beck, of Hydro-Electric fame, but was turned over to Mr. Livingston a short time before our youthful mechanic resumed his apprenticeship after his brief stay at Listowel. Our spoke in his early days must have exhibited a natural liking for machinery, and while in Baden got plenty of experience, as the firm made a varied line of machinery and also Corliss engines.

The fame of Galt as a town with good machine shops spread to Baden, where our spoke was busy absorbing mechanical knowledge and aroused his ambition. Realizing that opportunities would be greater in Galt, he went to that town in 1882, and secured a position as machinist at McGregor & Gourlay's Works. He stayed with this firm until 1886, when an opportunity presented itself to start in business on his own account. Our spoke, who was then only 22 years of age, joined J. J. Stevens in an enterprise which was the foundation of the machine tool industry in Galt. Mr. Stevens was a draftsman with McGregor & Gourlay. These two ambitious young men started in building machine tools with a capital of less than $1,000, in an old blacksmith shop in Ainslie Street. They admit that they had more nerve than capital, but this did not

ROBERT MORTON HAMILTON.

prevent them from making a success of the enterprise, for, two years later, in 1888, they built a new shop, which is now owned by the S. J. Shimer Co. Some encouragement may be gleaned from this phase of our spoke's career, for it showed that a large amount of capital is not necessarily essential to success. It also proves that a good deal can be accomplished by a judicious mixture of pluck and hard work. This firm, Stevens, Hamilton & Co., were well known for the good quality of their product and they achieved considerable success until 1895, when they sold the plant to McGregor & Gourlay. In passing it should be mentioned that Mr. Stevens ultimately opened up another machine shop where he specialized in building the Jones & Lamson turret lathe. This concern is still in existence. When Stevens, Hamilton & Co. sold their business, Mr. Hamilton received stock in the McGregor, Gourlay Co. as his share of the transaction and remained with the latter concern as head of the machine tool branch of the business. The McGregor & Gourlay Co. moved the plant to their own premises in Concession Street, which is now the head works of the Canada Machinery Corporation.

From about this period the machine tool industry in Galt began to grow from comparatively small proportions until now it is the most important machine tool centre in Canada, when considering the number of firms engaged in the business and various types of tools built there. A few years later, in 1910, the Canada Machinery Corporation was formed, one of the firms absorbed being the McGregor, Gourlay Co. About this time Mr. Hamilton, needing a rest and change of scenery, took an extended vacation, returning to the Canada Machinery Corporation in the fall of 1914 as works manager. Since then the C.M.C. has enjoyed a most prosperous run of business, which coincided with Mr. Hamilton's return to the scene of his former activities. While the C.M.C. have not been actually engaged on production of munitions, they were for some time working night and day on machine tools for this purpose, and, although not so busy now, are actively engaged on work of a more general character.

Mr. Hamilton is fond of traveling, having recently returned from a combined business and pleasure trip to the Pacific Coast. He went as far North as Skagway and visited Prince Rupert and other ed readily.
important points while en route; this be-

From the foregoing it will be seen that the subject of this sketch has truly grown up with the machine tool industry in Galt. When he went to Galt in 1882, the town had a population of about 6,000; now it has a population of over 12,000, the increase having mostly taken place in recent years. It was the reputation of the Galt machine shops and also the opportunities for advancement for mechanics through the Mechanics Institute and Free Library that attracted our friend to this town. While following his vocation during the day-time he was able to attend night school at the Institute. This is an advantage which few of the smaller towns possess and it means a great deal to the ambitious apprentice. Mr. Hamilton is a firm believer in technical education and study of technical journals. He urges apprentices to embrace every opportunity of acquiring knowledge by these means, and in no better way can this be done than by study in the evening particularly when day classes are not available or if the apprentice cannot spare the time during the day as is usually the case. He advises apprentices to work when they are young if they want to accomplish anything. He believes that any young mechanic with application, good habits and thrift, and able to grasp opportunities now presented by technical schools and journals, etc., can forge ahead so that by middle life he should be in a good position and able to enjoy the good things that life offers. Although our spoke is a hard worker, he is able to find time for activities in other useful directions. Being an Elder of the Knox Presbyterian Church, he takes a prominent part in the work of that body, and is also a member of the Galt Business Men's Club. He is not an active politician, but is a firm believer in the necessity of raising more troops in Canada to aid in the successful prosecution of the war. Mr. Hamilton is fond of outdoor life, but does not claim to be an athlete of any distinction. He says that he is too busy working to play ball, but gets lots of pleasure from motoring. His thoughts turned to more serious things, even in his younger days, for at the age of 24 he married Miss H. J. Webster, daughter of William Webster of Galt. He has a family consisting of three daughters and one son.

Mr. Hamilton believes that there is a bright future for the machine tool industry in Canada, providing that Canadian manufacturers specialize more in the design of tools they make; this, of course, presumes a demand sufficient to encourage manufacturers to do this. He believes that mechanics in Canada are fully as well trained as those in the United States, but admitting this, the business will have to grow until firms are able to specialize more so than at the present time.

PIONEER DAYS IN THE FOUNDRY

By John Woodside.

I WAS a pioneer, not of my own choosing, but because I was born so; for I was born in the middle year of last century in a pioneer log-house, between the fast developing booze centre, Ballyduff, and the later and better known Railway Station, Bethany. Many of my earliest days were spent on the old Hili-of-Bones farm, where the grinning "think tanks" of aboriginal inhabitants were still dug up in startling numbers. Those landmarks in Durham County show the place of my birth.

Ere I came to years of full memory the pioneer spirit had carried us away up to the lands of the newly opened up "Indian Peninsula," where we settled in the solid "bush," near the namesake of famous Irish Tara, though the "halls" that interested the early settlers here most were the "hauls" of suckers from the shallow Big Sauble river, upon a crossing and small water power of which the village was built. Here my earliest recollections were of crashing maple, beech, and elm. of flaming piles and smoke-filled skies. The maple yielded us about all the sweets we needed; the beech and butternut was our nut supply; while the "beaver meadows" on every creek yielded an abundant supply of such fruits as wild grapes, red plums, and choke cherries, for the possession of which we had sometimes to contend with the black bear. These garden spots also afforded some grazing on coarse grasses for the pioneer cattle, though they generally had to eke out their winter supplies with basswood and elm browse. We had only to scratch the surface amongst those big stumps to make it produce such crops of potatoes as the old pioneers sigh for in vain now.

Youthful Occupations

My first, well remembered toy was a small axe, armed with which I went forth to mimic warfare with the surrounding forest, sometimes to the detriment of the ornamental trees left near home by the pioneer father; and I never lost my love for this great pioneer weapon, the axe.

Canada could fittingly have chosen her shapely axe as a national emblem in place of the more ungainly wood cutter, the beaver; for her sons certainly excelled in the use of this implement, as they now are excelling in the use of weapons of war. We boys were the fire spreaders in season, and had to be closely watched out of season, and many a fortune in hard woods we sent up in smoke.

I passed on to hoe, to hand spike, to harrow and plough, to scythe and cradle, and before I finally left the rural life I had, for at least a couple of harvests, bound after the wonderful new harvester, handled by two men—one to drive and the other to rake off the grain in bunches, to the sweating men to a side of the square, who deftly twisted the straw bands and passed them around the sheaves.

This was in the earlier 60's, while the U. S. was torn with war, and occasional "skeddadlers" came across to our harvest fields, and we youths, with fine disdain for a soldier afraid, used to chant to them, from a distance , the latest ditty: "Bull's Run, Bull's Run, Bull's Run and Candy; Yankee doodle, doodle, do, and Yankee doodle dandy." We had no more sympathy with a slacker in those days than we have to-day.

Looking for a Job

I was 16 years of age before I ever saw a foundry, or dreamed of my future fate. Then I went into Owen Sound to try for a place. I happened to arrive at the shop just as they had finished the cast, and viewed with some dismay the steaming chaos. The old boss, who met me as I came out, asked me how I liked the looks of that place, and I promptly asked him for a chance in the cooler-looking region of the machine shop. No chance; so as I had decided to change from the muddy ruts of the country road to the enticing sidewalks of town, I accepted the inevitable, and tackled the sand heap, and received a pretty thorough course in foundry practice, in green sand, including cupola work, for an apprentice had to go the rounds in those small shops, at the rate of $30, $40, $50, and $60 per year, with board and lodging.

So pioneering was in my blood; and when, after some years at the trade, I received an offer to go out to Tara and put in a small foundry plant, along with their agricultural works, I cheerfully accepted the offer, though the monetary inducements were not heavy—$1.25 per day during construction work, and then the dazzling raise to $1.50 when moulding commenced; so I had an inducement to hurry the instalment. It looks small nowadays, but the highest city wages then were $1.75 to $2 per day, and living was cheap. We had no bikes, nor autos to sigh for. I did scrape up enough, after a while, to buy a big horn in the local brass band, and found it a most interesting diversion.

Preparing the New Shop

As soon as sleighing was good, I proceeded to the most convenient sand pit of moulding sand and helped load and deliver to the new shop, some 15 miles distant, a dozen loads of "the best local." This was dumped down against the wall of the shop—the outside wall—exposed to the variable winter weather of that districts: snow, rain and frost alternating.

We occupied the ground floor of a two-storey shop building, the upper floor being sometimes used as a work room and store room. This had its disadvantages, when we got going below, and the heat opened some cracks in the floor, through which dust, sawdust, and other things sifted down, but we knew that we sent back a fair equivalent in gases, smoke and foundry or beam dust.

The cupola equipment, ladles, etc., had been brought from Owen Sound; it was the old-fashioned style—a square base plate laid on a brick box foundation, only open in front; four columns encircled the shell, and supported the top plate, also square, upon which the local bricklayer erected a stack up through the roof to a safe height, the charging door, of course, being in it. Fire brick and clay had been provided; so I went to work and lined up the cupola, springing a small arch over the tapping pole, placing two tuyeres in regulation position, and altogether making a job which called forth the commendation of the local brick artist, who looked it over and remarked "some job."

We had installed a heater, with a flat top, or baking cores on, and around this I piled as much of the new sand as I could conveniently chop out; and it promptly went into mud, necessitating a drying and burning on plates to fit it for work. This, with a couple of loads of old sand from the town shops, sufficed for a start. The soil was a solid clay, and pretty well frozen before I started to work. It looked neat when I got floors levelled along each side, and a marsh up the middle; but as we heated up and it got thoroughly thawed out, it went into various shapes. I put as much dry sand on top as I could spare, to keep the clay from sticking to my feet, and made a start at moulding.

Some plow patterns and flasks had been purchased in town; some new boxes were built to suit smaller work, amongst which was the main article manufactured in the new works—fanning mills. Now a set of fanning mill castings consists of some 16 pieces, exclusive of the gears; and as we had no knowledge of snap flasks or match boards, we had gone on picking those patterns out one at a time with a pair of tweezers reversed. We had attained to a set gate for them, however, which hastened somewhat the work. But for one man to do some core work for the plows and make up a heat of a couple of plow beams for weight—plow points were, of course, a snap to fill up with—along with this other nest of stuff, and cultivators, turnip seeders, scufflers, etc., and then do his own melting, was likely to become monotonous.

We had always ground our own facings, in town, out of anthracite, charcoal, and sea coal; another 'prentice job; so we secured enough to start on, though the half-barrel of inflammable charcoal dust which I kept stored under the little core bench, in a corner beside the cupola, was blamed, much later on, for catching a spark and eventually setting fire to the bench, shelves and core boxes against the brick wall, and eating its way through the floor above and also the roof, when it was fortunately discovered and extinguished.

The millwright of the shop had put up a home-made fan, not warranted to be noiseless; so in the merry springtime we had all ready for the momentous event in the history of the village, and a goodly crowd assembled to see the first iron run, and incidentally to discover how we induced it to run; but they were doomed to disappointment that day, for though our new fan went off with a fair volume of sound, no pressure resulted; no spark blew from the tapping hole; no sound at the tuyeres; the fan builder had evidently copied the big open fan of the fanning mill, and no pressure was gained, so after nearly an hour of fruitless effort we gave it up, dropped the bottom and announced for next evening.

They ripped the thing apart, cut out a snail shell spiral, and put it up with a light sheet iron band for a cover. Again I had all ready, the new fan started with a more business-like tone, sparks flew, the tuyere pipes thrilled to the pressure, and soon a trickle of molten iron appeared. The crowd, again assembled, were becoming absorbed in the spectacle of the fizzing fireworks, when with a rending crash the fan above gave way; the spectators mostly hastened from the scene, nor stood upon the order of their going. When we rushed upstairs, we found that something had got loose; one of the riveted fan blades, we presumed, and had made rags of the sheet iron cover, though forunately without injuring the arms or sides of the fan. So it was another drop; this sorting over so much mixed material from under the cupola was trying, but we hoped it would not ever be thus.

Next day everything was ready again, but the crowd was not so large, and they betrayed an air of uneasiness; but this time all went well, the molten iron flowed, it was controlled, and ran into the moulds almost like water, and those who had persevered got their money's worth. The only jar was when the top plate, having been cast in a solid ring, upon getting very hot on the inner side, burst with a bang, which shook the stack a little, but did no further damage. To close the show, I dropped the bottom, with even a greater show than before of hot stuff, and finished my reputation, for the report was around the village next morning that the bottom had again fallen out of the furnace.

UNIQUE HIGH TEMPERATURE ALLOYS

By Mark Meredith.

THERE are two metals worth attention in most places where there are facilities for making and casting them—one being what is called "Mitis" iron, which, if properly made, is a homogeneous form of wrought iron which, without annealing, can be bent or forged either hot or cold, and very well takes the place of mild steel—it can be case-hardened—and the other is a form of bronze containing anywhere up to 60 per cent. of iron, but probably most usefully about 20 per cent, and which can be rolled and otherwise worked whilst it is practically incorrodible. Both of these to be successful must be made from carbon free iron, and both must be quickly melted in closed crucibles to prevent absorption of carbon in a gaseous state so far as possible; the successful results in each case being conditional upon the absence of carbon, phosphorus and sulphur. Only the best Swedish iron can be used in the work, and in the case of the iron only a small proportion of scrap arising from the casting processes can be utilized a second time, for which reason there must be an outlet for the scrap metal for cupola use. The bronze can, of course, be remelted if properly made with as pure commercial metals as are obtainable.

In the case of the iron castings, there is little or no saving in cost over ordinary annealed malleable castings, whilst it is possible that even a higher cost may occur, the chief advantage being that time is saved, the castings being ready as soon as made; this not being the case with the ordinary annealed malleable iron castings, which often take a month or more for delivery. With the bronze the metal can be produced for 13c per pound or less, ready for pouring into the moulds, whilst machined castings are practically incorrodible when exposed to the air. There is nothing to prevent these things being made anywhere so long as the appliances are in existence, but this is just where the trouble comes

In making iron castings the iron should be melted in, roughly, 75-lb. lots (net), and it should be fluid in about 2 to 2½ hours; the crucibles are then opened and aluminum up to 0.5 per cent. added in the form of ferro-aluminum with an Al content of from 8 to 10 per cent., the actual amount being determined in the laboratory according to the iron used. The melting point of the iron will be somewhere between 1,500 deg. and 1,600 deg. Cent., or from 2,700 deg. to 2,900 deg. Fah., and it takes about 160 lbs. of really good furnace coke to melt each 100 lbs. of iron in a good furnace.

In making the bronze, the iron has to be melted as for the iron castings, and to this is added the copper at a red heat and with a melting point of about 1,050 deg. Cent., or 1,925 deg. Fah.; this being followed by the tin or zinc, both of which melt at a low temperature, and if added in as hot a state as possible, by the reactions caused, no additional heat is necessary. The alloy when made melts somewhere between 1,050 deg. and 1,200 deg. Cent., according to content, or, say, from 1,900 deg. to 2,100 deg. Fah., which is about the range for cast iron.

As there must be the greatest freedom from carbon possible, clay or other crucibles free from carbon must be used, and, as such crucibles can rarely be used again after being cooled down, as many successive melts as possible must be secured for the sake of economy, this meaning that in practice either single or multiple pot furnaces must be provided with forced draught to ensure that the carbon of the fuel is reduced to the highest state of combustion—carbonic acid—and it also means that the heat must as far as possible be held in the furnaces and not sent up the flues. Of course, crucibles for this kind of work are stood on stands to keep them steady and in position, this assisting in the arrangement of the blast, and as this should not, as a rule, exceed 3 in. on the water gauge, there should not be excessive fusing of the walls of the furnaces, provided dry, or possibly preheated air is sent in.

To secure high rates of combustion large volumes of air at just sufficient pressure to cause it to penetrate to all parts of the fuel should be carefully arranged, while it is also desirable that the fuel should be broken to a moderate size to expose as much surface as possible. The physical structure of the coke has much to do with both the volume and pressure of the air used, and can only be determined by actual trial at the furnaces being operated.

Various forms of furnace can be used, but in every case the object aimed at should be that of concentrating the heat on the crucible or crucibles, which the particular form of furnace is made to contain, the mere burning of fuel not always being equivalent to heating power. There are many furnaces working well in various places for both single crucibles and for three and four crucibles in each fire, for which reason there should not be much difficulty in selecting a suitable form. Only the best workmanship in erecting and the best material will stand the intense heat for any time, which in general practice confines the choice very largely to fireclay bricks, which in the best forms will stand up to approximately 1,700 deg. Cent., and magnesia bricks up to 2,150 deg. Cent., whilst chromite bricks will stand up to 2,000 deg. Cent. It is really advisable to use the magnesia bricks, irrespective of cost: however, with a well constructed and carefully fired furnace the walls are not the hottest part, and a good fireclay brick will stand very well; but all depends on the bricks, in some cases the method of manufacture not being all that can be desired. quite irrespective of the content of the fireclay.

Manufacturing Uses of Low Temperature Electric Ovens*

By C. F. Hirshfeld **

The utilization of electric heat on a large scale found excellent opportunity in the japanning of automobile bodies, and investigation of the reasons for the superior quality of product has yielded much valuable information. Following a detailed description of the art of japanning, the author deals with the application of low-temperature heating to foundry work and indicates the economies and improvements possible by its use in this industry.

THOSE who have become familiar with the various uses of electric furnaces of one sort and another have come to recognize the fact that, in a general sense, the electric furnace can not be considered a commercial competitor of furnaces heated by combustion. The use of the electric furnace must make possible the attainment of something unattainable by combustion methods or else there is no possibility of its being used in place of the older type excepting, possibly, under very unusual conditions as to the relative costs of fuel and electrical energy.

If this is true of high-temperature processes such as are commonly associated with electric furnaces it needs no argument to prove it true for low-temperature processes in which combustion methods have a greater advantage on an energy cost basis, because of the lower temperatures at which the products of combustion can be discharged.

This condition is frankly admitted, and it should be understood at the start that it is not the intention of this paper to urge the general substitution of electric heating for combustion heating in low-temperature proccesses in general, or in some low-temperature processes exclusively. There are certain low-temperature processes which, under certain corcumstances, can be conducted to better commercial advantage by means of electric heating than is possible by means of combustion heating, and it is the purpose of this paper to point out some of these processes, some of the phenomena connected therewith which indicate the advisability of heating electrically, and some of the possibilities which electric heating unfolds.

Electric Heating Not New

The term low temperature is not exact, but for present purposes may be taken as referring to temperatures below about 290 deg. C. (554 deg. F.). Such temperatures are below practically all commercial metal-melting temperatures but are common in numerous baking and drying operations which form a surprisingly large part of industrial processes.

The exploitation of electric heating for such low temperatures in industrial practice is really comparatively old, since numerous small electrically heated appliances operating at such temperatures have been used as a matter of convenience in manufacturing establishments for a number of years. During the past few years, however, the use of electric heating for such temperatures has been adopted in cases calling for the installation of equipments with capacities ranging from several hundred to several thousand kilowatts. This is obviously a different sort of a proposition, and must be based on a far broader consideration than mere convenience.

The best example of the extensive adoption of electric heating for low-temperature work is furnished by the electric japanning equipment installed during the past few years. For this reason this industry will be discussed at some length.

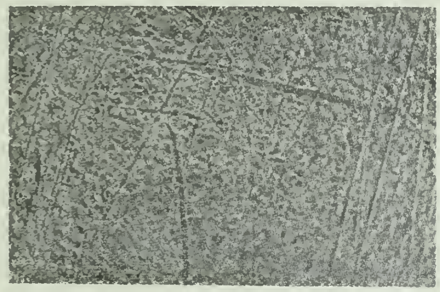


FIG. 1.

The name "japan" originally referred to a sort of liquid lacquer or varnish made from vegetable sources in Japan and used as a protective or decorative coating on objects made of wood and other materials. This original japan was converted into a hard, brilliant material by exposure to sunlight. At the present time the word japan is used as a sort of collective title for a number of paint-like materials which are intended to be baked at various temperatures between 100 deg. C. (212 deg. F.) and 260 deg. C. (500 deg. F.) and which are generally used for decorative or protective coatings on metal objects.

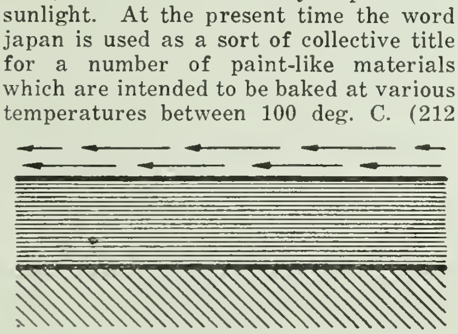


FIG. 2.

Originally, these baking japans were much like varnishes to which pigments had been added, but as the development of industry made more and more specific demands the number of japans manufactured was greatly increased and many different type formulas were adopted. At the present time one can purchase under the name of "japan" materials varying all the way from combinations of pigments with driers, linseed oil and expensive gums to materials which are little more than Gilsonite or other asphaltic compound carried in a suitable solvent with enough oil or similar material to make it resilient after baking. Driers are often included in the mixture, but this is not a universal practice.

The changes which occur during the baking of these japans are very complicated, and are not yet entirely analyzed from the scientific standpoint. It is certain that the solvent partly or wholly evaporates during the baking, and it is also certain that the oils and gums undergo oxidation and polymerization. It is also probable that complicated reactions occur between the numerous varieties of hydrocarbons and hydrocarbon derivatives present in the mixture.

The general lack of exact knowledge is shown by the fact that few, if any, makers of japan can predict the behavior of their materials under unusual conditions.

At the present time a number of chemists who have been specially trained in the technology of paints and varnishes are at work on japans, and it is probable that more exact information with regard to these materials will be available in the future.

Former Status of Japanning

When electric baking of japan was first considered a few years ago, it was found that practically all japanning practice was of an empirical character. Moreover, no two japanners seemed to agree upon the proper methods of applying and baking a given japan even when all essential variables, such as weight and character of work, were the same. Discussion of the various problems with many users and with many makers of japans brought out the fact that practically all agreed upon certain rules and regulations, but that there was a large mass of so-called trade secrets which were, partly or wholly, mutually contradictory.

Obviously, this particular art had not yet progressed beyond the empirical state. Scientific analysis had not been extensively undertaken, no consistent mass of scientifically accurate facts had been accumulated, and operators were hired on the basis of a self-advertised collection of rules of thumb combined with most wonderful and weird imaginary charms of varicus sorts for insuring excellent results. The executives responsible for factory production were entirely at the mercy of these self-styled experts, some of whom were really remarkably clever men, but many of whom could really lay no claim to such a title. It is not surprising that under such conditions, the japanning room should have been a source of constant

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**Chief of Research Department, The Detroit Edison Co.

worry. On one day very satisfactory results were obtained, and on the next all sorts of imperfections appeared.

In many establishments an average rejection of as much as 10 per cent. of the finished work was regarded as a characteristic of japanning processes and was taken as a matter of course. In some instances on record rejection of over 50 per cent. for several days in succession occurred at irregular intervals.

After many abortive efforts to find means of studying what actually occurred during baking it was decided to resort to the microscope, in the hope that surface structure might throw some light on the matter. The results obtained greatly exceeded anticipations.

Microscopic Structure

A typical structure resulting from baking japan slowly in a direct-fired gas oven is shown in Fig. 1. This is a reproduction of a microphotograph. The straight and curved lines have no significance, the pock-marked surface being the feature of interest. Several perfect craters, which show at different points in the figure, indicate the probable origin of the pock marks as collapsed craters.

The formation of these craters seems to be typical of all baking methods in which the heating is done by means of hot gases bathing the work. It is possible that their occurrence may be explained by what may be called sub-surface vaporization. Imagine, for instance, that the diagonally hatched part of Fig. 2 represents a part section of a piece of metal and that the horizontally hatched part represents a section through a coat of japan applied to the surface of the metal. Assume now that hot gases, such as heated air or hot products of combustion, pass horizontally over the surface as indicated by the arrows.

It is obvious that vaporization of the solvent will occur at the surface of the liquid japan and that the temperature of the surface will be raised rapidly. Chemical change will, therefore, occur first at the exposed surface, and it seems probable that this surface films over rapidly.

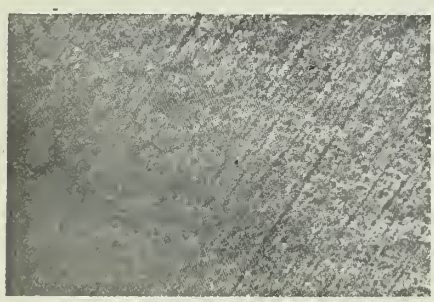


FIG. 3.

The condition would then be similar to that in a can of paint which has been left open to the atmosphere for several days; there would be a rather tough film on the side next the air with practically unchanged material below. If a can of paint in this conditon be imagined to be heated from below to such an extent as to cause vaporization of some of the constituents one of two things must happen; either the vapor must work its way along the under side of the film until it reaches the walls of the can and escapes or it must blow a crater in the film and escape in that way. In the case of japanned surfaces heated from the outside such subsurface vaporization could only escape through the surface, as there is ordinarily no break such as occurs at the wall of the can assumed above. The microphotograph reproduced in Fig. 1 would seem to indicate that vapors do escape through the surface while this is still in a somewhat plastic condition.

These craters are probably partly self-sealing, as the process is ordinarily conducted, but it is obvious from the illustration that the healing is not perfect. A collection of such craters is all that is necessary to account for poor gloss and poor weathering qualities.

It would be expected that the crater formation would be least severe with very long bakes, with gradually rising temperature, that it would be most severe with short time bakes and steep temperature gradients, and that a very short bake might actually result in pushing off flakes of the crater surface. No evidence of such flaking has been found, but finished work has been known to flake in a way which suggested a possibility of such a cause.

In Fig. 3 is shown a microphotograph of a piece of work directly comparable with that shown in Fig. 1. The metal was exactly the same in both cases, the pieces were prepared and dipped in the same japan, at the same time by the same man. They were dipped exactly alike and then baked, one in a direct-fired gas oven for 90 minutes and the other in an electrically heated oven for 45 minutes. It is obvious that the electrically baked piece has smaller and more evenly distributed craters, and that the surface is more perfect.

Similar comparative photographs of second and third coats show far more perfect surfaces resulting from electric heating. Reproductions of microphotographs of the fluid coats are given as Figs. 4 and 5. It is perfectly obvious that the electrically baked coat shown in Fig. 5 is much smoother and more perfect than the other which was baked by pure convection heating. It should be noted that many, if not all, of the large black spots which show in these two figures are small particles of carbon and that they were probably thrown out of the volatiles by a species of cracking, in contact with the air used for ventilation.

Remarkable Time Saving

It is interesting to note that the baking of the coats in the gas oven consumed a total of 5½ hours while the three corresponding coats were baked electrically in 2 hours and 40 minutes.

Inspection of pieces baked in direct-fired gas ovens and similar pieces baked in electrically heated ovens always shows that the electrically baked material has a higher and more perfect gloss or finish.

This could be accounted for by assuming some action between products of combustion and the japan itself, and some evidence seems to indicate such action under certain conditions. However, in view of the microphotographs already referred to and the explanation given to account for the craters, it seems more likely that the difference is due to the way in which heat is applied.

As a matter of fact, practically all heat transferred to the work in a direct-fired gas oven is carried to it by hot gases, that is, the transfer is by convection. In an

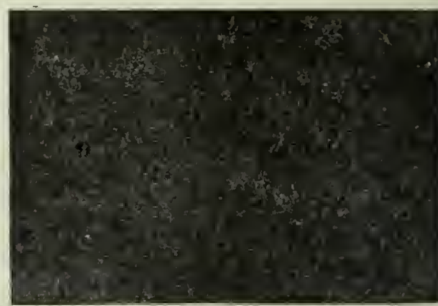


FIG. 4.

electrically heated oven at least part of the heat is brought to the work in the same way because of the circulation of oven atmosphere set up by the presence of the heaters. The rest of the heat is transferred by radiation from the hot heaters, and it seems probable that the action of the heat received in this way is different from that received by convection. It is at least probable that radiant energy penetrates the japan coat to a considerable depth before being entirely absolved and converted into heat, and this causes more rapid setting of the inner portions of that coat.

If craters are due to the causes assumed above, it should be possible to eliminate them entirely by baking the japan in a reversed direction, that is, from the inside out. This can be done electrically by heating the metal itself either by the direct passage of current or by induced eddy currents.

Methods of Applying Heat

Certain experiments were conducted on a small scale for the purpose of determining the relative effects of baking by pure convection, baking by combined radiation and convection and baking by heating of the metal itself. For this purpose similar samples, dipped in the same japan, were baked in bottles. For convection baking filtered air was heated in an electric oven to the proper temperature and was then drawn through a bottle in such a way as to make it bathe the enclosed sample. For combined convection and radiation, the sample was surrounded by electric heaters enclosed with it in a bottle, the volatiles being drawn off and circulation being maintained by means of a small laboratory pump. For baking by internal heating the bottle and its enclosed sample were suspended in an alternating magnetic field of sufficient intensity to give the desired temperature gradient. During baking volatiles were removed by a small laboratory pump as before.

Inspection showed the sample baked by convection heating to have the poorest surface and that baked by internal heating very obviously had the highest gloss and most perfect surface. It was hoped that reproduction of micro-photographs of these samples could be given in this paper, but it was unfortunately impossible to prepare them in time for inclusion.

It is of particular interest to note that baking by internal heating is essentially an electric method, and that it is far removed in every way from methods previously in use. It is further important to note that with this method a maximum metal temperature of the order of 170 deg. C. (338 deg. F.) and a bake of 15 minutes are perfectly capable of giving better results than can be obtained with external electric heating with 45-minute bake and a maximum temperature of 230 deg. C. (446 deg. F.). It seems probable that one coat baked in this way will prove the equal of two or three baked by the older methods. The effect of all this upon energy charges for a given weight of metal baked is perfectly obvious.

It seems hardly necessary to discuss at greater length the various phases of the japanning art. It should be evident that electric heating opens up opportunities for improving the product and the production methods used in obtaining that product. It should also be evident that electric heating is capable of reducing factory operations in this field to so exact a procedure that accurate laboratory control is made possible. With industrial conditions brought to this point it becomes possible for research chemists to work to advantage toward the improvement of the japans themselves and toward the improvement of the methods of their utilization.

Application to Foundry Work

An equally promising field exists in foundry core rooms. The baking of foundry cores is at present a most haphazard process in the majority of foundries. A casual inspection of one batch of exactly similar cores will generally show colors varying from a light tan or even lemon-yellow to a dark chocolate brown. One of the numerous varieties is certainly better than all the rest, and it would seem desirable to determine which one is the best for a given set of conditions and then to make all of them like it.

Preliminary experiments conducted for the purpose of discovering whether the essential properties of cores varied as

FIG. 5.

greatly as their colors gave most astounding results. Strength was taken as reference in this case, although admittedly it is only one of numerous properties which must be considered in defining a perfect core.

One set of experiments was made upon exactly similar cores, made of the same materials and tamped to the same extent. They were baked at different rates and also with different maximum temperatures. Curves of strength plotted against time of bake and also plotted against maximum temperatures were sharply domed in all cases, and showed variations of several hundred per cent. in any one case. Samples of these cores were shown to experienced foundry men after rupture, so that both exterior and interior were visible, and they picked out as good cores which had shown relative variations of over 100 per cent.

Another set of experiments was made to determine the effect of air circulation. Again a number of exactly similar cores were tested. Baking methods were alike in every respect excepting for the quantity of air drawn over the core during baking. Strength of core was plotted against quantity of air passed in unit time, and again a sharply domed curve was obtained. Apparently, excess air is detrimental, though not to the same extent as a deficiency of air. What is most important is the demonstration that some definite quantity of air gives the best results.

Probable Developments

It seems probable that investigation will show that porosity, brittleness, character of surface, and all of the other properties which must be considered in connection with cores will be affected in some such way as strength has been shown to be affected by the variables studied. If this is true, it certainly seems as though the foundries which carefully study their production methods and costs will ultimately demand more perfect control of the core-baking process. When this time arrives it seems probable that electric heating will play a part similar to that which it has played in the japanning field during the past few years.

As a matter of fact, there are now in operation several electrically heated core-baking ovens, and their users all appear highly enthusiastic over the results attained.

The core problem appears to the author as one of the most promising fields for combined chemical and engineering investigation, and he feels certain that improvements such as those shown possible in japanning will appear insignificant in comparison with these which are possible of attainment in the core room.

Japanning and core-baking have been used as examples because of the tremendous extent of both of these industries, and because it happens to be possible to record the results of a small amount of experimental work in both of these fields. It must not be assumed, however, that they represent the only possibilities for the application of electricity to low-temperature baking.

There are numerous other low-temperature baking processes, and the majority are in the same undeveloped state as are the two cited above. One very important field in which little has been done is the baking of food stuffs, such as bread and other cereal products. Electric heating has been applied to the baking of such materials in several cases with very gratifying results, improving both the appearance and quality of the product.

In conclusion, it is well to call attention to the fact that the introduction of electrical methods for such purposes as enumerated above should be of particular interest to the chemist, because it makes it possible to reproduce on an industrial scale a sequence of operations and conditions which have been worked out on a small scale in the laboratory. It makes it possible to control industrial production to the same extent that laboratory investigations are controllable, and it thus opens to the chemist in the industrial field a tremendous opportunity for improvement of product and increased production.

CANADIAN STEEL OUTLOOK

A MEETING of prominent manufacturers was held at Ottawa recently to discuss the serious situation that has developed because of the embargo on the export of steel products from the United States. War has increased the demand, both domestic and foreign, for steel products made in the United States. Munition and ordnance plants, shipyards and other industries in Britain and other allied countries, in Canada and in the United States are calling for supplies of ship and boiler plates, angles and other rolled forms used in vessel and other construction. To control the disposition of the output of these products, the United States has prohibited exportation except under license and has established a priority board, such as exists in Great Britain, to pronounce upon applications for such licenses. The list of articles covered by the proposition includes boiler tubes of iron and steel, chrome nickel steel, ferro-manganese, ferrosilicon, ferro-vanadium, iron and steel ship, boiler and tank plates one-eighth of an inch thick and heavier and wider than six inches, pig iron, scrap iron, scrap steel, spiegeleisen steel billets, steel blooms, steel ingots, steel bars, steel slabs, tin plate and tungsten.

The stocks of certain of these products for which Canada has depended upon the United States are stated to be running low. Hence manufacturers are faced with the necessity of considering the question of securing further supplies. Some of the articles included in the United States list are produced in Canada and some of them may be produced by extensions of existing plants. Ship plates and larger sizes of shapes and angles for shipbuilding and of structural steel are not made in Canada.

The steel manufacturers have, therefore, met to consider the situation and are taking steps to estimate their immediate requirements in the products, which cannot be freely exported from the United States, showing in detail, the quantities and the specific purpose for which the goods are required. These statements will be presented to Sir George Foster and the Trade and Commerce Department will forward them through the British Ambassador at Washington to the United States Priority Board with such backing as can be given them. To what extent that body will satisfy Canadian demands cannot be predicted. There is a feeling that materials needed for war purposes, including the carrying out of the shipbuilding programme, may be granted in full. Consideration will be given next to the applications for materials for industries indirectly connected with war activities and for transportation, such as for building locomotives. Finally, the requirements of other industries will be taken up. Should the demands of industries of this class not be met the erection of bridges and large buildings might perhaps be retarded.

Those present at the conference were: F. C. T. Ohara, Deputy Minister of Trades and Commerce; P. L. Miller, of the Canadian Vickers Co., representing the shipbuilding industry; R. M. Davy, of the Dominion Bridge Co., D. D. Fraser, of the Montreal Locomotive Co.; R. Harmer, of the Sawyer-Massey Co., for the manufacturers of farm machinery; T. McC. Hutchinson, representing merchants handling plates for general trade; F. R. Humphage, Walkerville, for firms using high carbon and alloy steel; C. A. Waterous, of the Waterous Engine Co., for the builders of boilers, tanks, pulp and general machinery. In addition, representatives will be appointed for the car builders, railways and foundry men. Three representatives will get in touch with firms throughout Canada to learn their needs.

U. S. PIG IRON PRICES FIXED

E. H. GARY, Chairman of the Committee on Steel and Steel Products of the American Iron and Steel Institute, has issued the following statement:—"By agreement between the General Committee on Steel and Steel Products of the American Iron and Steel Institute and the War Industries Board, approved by the President, the base price of No. 2 foundry iron and also basic iron was fixed at $33 per gross ton, f.o.b. cars at furnace.

"From these base prices the sub-committee on pig iron, iron ore and lake transportation has reported to the general committee a list of differentials which the general committee believes as fair and reasonable and in accordance with the usages of the trade, and therefore recommends to the iron industry that the same be adopted to take effect immediately. It is hoped that there will be no hesitancy in accepting this recommendation.

"The grade of No. 2 foundry iron to be equivalent in analysis to: silicon, $1.75 to $2.25; sulphur, not over .05. No. 2 soft southern iron equivalent to No. 2 foundry of same silicon content.

"Differentials from the above base price for No. 2 foundry iron to be made for the following changes in specifications:—

"Forge or mill iron, $1 per gross ton under base.

"Foundry iron running silicon $1 to $1.75, .50 per gross ton under base.

"Foundry iron running silicon $2.25 to $2.75, .50 per gross ton over base.

"Foundry iron running silicon $2.75 to $3.25, $1.50 per gross ton over base.

"Foundry iron in excess of $3.25 silicon and $1 per gross ton for each ½ per cent. of silicon over the price for $3.25 silicon iron.

"Manganese, sulphur and phosphorus variations to be adjusted as formerly customary in each district, having respect to the base price.

"Where iron is sold by fracture the usual grading prevailing in each district to continue.

"Malleable iron, .50 per gross ton above base.

"Bessemer iron, 10 per cent. per gross ton above base.

"Basic iron, base price.

"Charcoal iron—Southern or warm blast charcoal iron, a maximum of $10 per gross ton above base for iron ranging .40 to .60 phosphorus, and silicon $1 to $2.

"For grades running below these analyses corresponding reductions as usual to the trade to be made.

"Cold blast charcoal iron a maximum of $22 per gross ton above base, with customary reductions for lower grades, as recognized by the trade.

"Lake Superior iron $2.50 per gross ton above base for iron averaging $1.25 silicon. Other grades to be adjusted as per the custom of the trade, depending upon the silicon, phosphorus and manganese contents of the iron.

"All of these charcoal iron differentials to be considered in connection with the base price.

"High silicon or silvery iron—For iron containing 6 per cent. silicon, $7 per gross ton above base; 7 per cent. silicon, $9 per gross ton above base; 8 per cent. silicon, $11.50 per gross ton above base; 9 per cent. silicon, $14 per gross ton above base; 10 per cent. silicon, $17 per gross ton above base.

"Three dollars per gross ton advance for each 1 per cent. silicon for 11 per cent. and over.

"Bessemer ferro-silicon—For iron containing 10 per cent. silicon, $22 per gross ton above base; 11 per cent. silicon, $25.30 per gross ton above base; 12 per cent. silicon, $28.60 per gross ton above base.

"Low phosphorus iron—Iron containing phosphorus and sulphur not exceeding .04 and silicon not exceeding 2 per cent. For copper bearing iron, $17 per gross ton above base; for copper free iron, $20 per gross ton above base.

"A sliding scale of $1.50 per gross ton advance for each reduction in phosphorus of .005 per cent. below .04, and $1.75 per gross ton for each 1 per cent. of silicon in excess of 2 per cent."

U.S. EXPORT RESTRICTIONS

THE United States Government has placed export restrictions on a large number of products except when for war or directly contributory purposes. Industries in Canada not engaged in work which might be stated to be for war purposes or directly contributory thereto may suffer great hardships through the shutting off of supplies of necessary raw materials from the States. It is understood that materials required in the manufacture of agricultural implements for railway equipment and for shipbuilding will be licensed for export to Canada. The following materials are included in the list of export restrictions:

Acetone
Alcohol
Aluminum
Ammonnia salts
Ammonia nitrate
Anhydrous ammonia
Arsenate of lead
Arsenate of soda
Boiler tube (iron and steel)
Carbolic acid (phenol)
Castor oil and castor beans
Chrome nickle steel
Cyanide of sodium
Ferro-manganese
Ferro-silicon
Ferro-vanadium
Iron and steel plates, including ship, boiler, tank and other iron and steel plates ⅛ of an inch thick, and heavier and wider than 6 inches, whether plain or fabricated.
Mercury salts
Nitrate of soda
Nitric acid
Nitric salts
Phosphoric acid
Phosphorus
Pig iron
Potash and chlorate of potash
Potassium salts
Saltpeter
Scrap iron
Scrap steel
Searchlights and generators (suited for Army and Navy use)
Soldium sulphite
Spiegeleisen
Stearin and stearic acid
Steel billets
Steel blooms
Steel ingots
Steel sheet bars
Steel slabs
Sugar
Sulphate of ammonia
Sulphur and sulphuric acid
Superphosphate
Tin plate
Toluol
Tungsten
Wireless apparatus

U.S. GOVERNMENT FIXING STEEL PRICES

THE War Industries Board, Washington is prepared to extend Government control to the entire steel trade. The fixing of prices for plates, shapes, bars and pig iron was but the beginning, and before the board finishes there will be 150 articles of steel manufactured under fixed prices. This will be done even if Congress fails to pass the Pomerene bill providing for Government control of iron and steel products.

Should that bill become a law, the Government will have specific authority to name the maximum price for every article in the iron and steel trade, but if it does not pass, the same tactics will be adopted as were used in dealing with the four articles named. The Government will enter into an agreement with the manufacturers under which they will bind themselves to charge stipulated prices for all the 150 articles. These prices will apply not only to the United States Government, but to the Allies and the general public.

FUEL REGULATIONS ISSUED

AN order-in-council has been passed by the Dominion Government authorizing regulations issued by the Fuel Controller for Canada, respecting the importation and sale of coal, which go into effect in November.

Provision is made for the licensing of all importers and dealers in coal now doing business in Canada, and that may, hereafter, desire to do so. Application must be made to the Fuel Controller before November 21, by registered letter, for a dealer's or importer's permit. Heavy penalties are provided for doing business without permit. Provision is also made for the cancellation of permits in cases where any dealer has been found guilty of giving short weighs or where any other sufficient cause exists.

Under the regulations every mine operator in Canada must forthwith enter into an agreement with the Fuel Controller fixing the maximum prices per ton he may charge for the output of his mine.

The most far-reaching provision of the new regulations are those dealing with dealers' commissions and profits. Brokers are allowed a maximum of 30 cents per ton for their services, wholesalers a maximum of 35 cents per ton, and retail dealers a sum not exceeding 50 cents per ton. These maximum profits are allowed over and above reasonable overhead and handling charges, and will effectually do away with profiteering in coal.

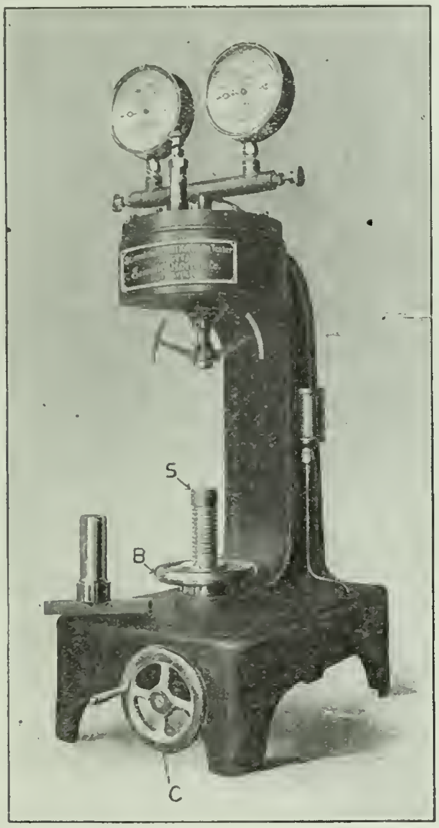
BRINELL HARDNESS TESTING MACHINE

A SIMPLE and accurate device for testing the hardness of metals is found in the improved model Brinell testing machine, which is a development of the common "ball and indentation" method for determining the degree of hardness of the metal undergoing test. The indentation or Brinell method, which is now very largely employed, consists in pressing a hardened steel sphere, which will not undergo deformation, into the surface of the metal to be tested and measuring the diameter or preferably the depth of the indentation. The degree of hardness may be computed by dividing the total load or force acting on the ball, by the area of indentation in the test sample, this area being determined by direct observation of the diameter of the circular depression by means of a convenient form of microscope.

While this method of computing the hardness numeral yields very valuable results, it is quite generally conceded that more accurate results are obtainable from direct measurements of the depth of the indentation in the test piece rather than the diameter of indentation. The Bureau of Standards and other laboratories have found that the plastic flow of the metal of the specimen, when pressure is applied in the ball, introduces uncertainties in the measurements of diameter, which do not arise when depth measurements are employed. This is a valuable point in favor of the latter method because the depth of indentation is directly proportional to the amount of pressure applied, while the diameter of indentation is not. Another advantage in using this machine with depth gauge, is that the extra operation of measuring the diameter of indentation is done away with and the personal equation is entirely eliminated.

The machine is a hydraulic press consisting of a heavy base in which the hydraulic power generation and transmission is provided; the upper neck formed with the base into a single piece casting, carrying the hydraulic piston, upon the end of which is mounted the standard hardened steel ball, 10 millimeters in diameter; and two pressure gauges. As shown in the figure, the depth gauge is mounted directly on the piston rod and reads the depth of the indentation accurately. The hydraulic pressure is produced by an easy turning spindle wheel, permitting a steady and finely regulated increase and decrease of pressure. The liquid employed is glycerine and the plunger of the press is constructed with a glycerine seal or trap so that no air can leak in behind the plunger during the compression.

The operation of the machine is simple and requires no special training nor does it involve any calculations. To make the test, the specimen to be tested is placed on the automatic levelling stage, mounted on the spindle, which



BRINELL HARDNESS TESTING MACHINE.

permits irregularly shaped pieces to be tested, and any size up to 15 inches can be accommodated. The spindle is fed up to the stationary ball by turning the handwheel until the sample just touches the ball and the pointers of the depth gauge tend to register. The initial scale reading on the depth gauge is noted and the pressure applied slowly by turning the handwheel clockwise until the pressure gauge on the top of the machine indicates 3,000 kilograms, if hard metal is being tested, or 500 kilograms if the metal is soft. After the pressure has been acting for 1½ minutes, the reading of both pointers on the depth gauge may be taken, which completes the mechanical part of the work and the pressure may then be removed.

The mean of the two scale readings, using the figures noted on the scale, multiplied by 0.2 will give the depth of the indentation in millimetres. A convenient way to compute the depth of the indentation in millimetres is to add the two scale deflections and divide by 10. The hardness numeral is then found by referring to the table for depth measurements. A microscopic attachment can also be supplied for measuring the diameter of the indentation should that method be followed.

The weight of the machine complete is about 550 pounds.

The machine, which is the product of the Scientific Materials Co., Pittsburgh, Pa., is carefully, substantially, and accurately constructed.

1917 CANADIAN COAL OUTPUT

THE mines branch of the Department of Mines, Ottawa, has received from the principal coal mine operators returns of their production during the first three months of 1917 on the basis of which the following estimates have been made of total production during this period. According to these estimates the total production of coal during the first quarter of 1917 was 3,590,991 short tons, comprising 1,233,934 tons in January; 1,143,956 tons in February, and 1,213,101 tons in March.

The record would appear to show that the average rate of production in Nova Scotia and British Columbia was less than the average rate of production during 1916, but greater in the Provinces of New Brunswick, Saskatchewan and Alberta.

The exports of coal during the three months were 501,570 tons, as against exports of 737,744 tons during the corresponding period of 1916.

The imports of coal during the three months were 3,921,824 tons, as against imports of 4,002.892 tons during the corresponding period of 1916.

The production of oven coke during the first three months of 1917 was 308,690 tons—the imports during the same period being 207,139 tons, and the exports 5,606. tons.

WHAT is claimed as the tallest chimney in the world was recently completed for a copper smelter at Sagonoseki, Japan. It is constructed of concrete, 570 ft. high 26¼ ft. inside diameter at the top, and 42 ft. in diameter at the base. The great height was decided on to carry the fumes from the smelter to an altitude that would avoid killing the surrounding vegetation. The foundation, which is 95 ft. in diameter, contains 2,700 cubic yards of concrete. For 150 ft. the chimney is reinforced by a concrete lining separated from outer shell by a 5 ft. air space. The opening at the base is 31 ft. high and 20 ft. wide. The flue connecting the furnaces and chimney is 30 ft. in diameter, and 2.500 ft. long, and is provided with openings for cleaning. In the construction of the chimney 400 tons of steel were used.

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A Monthly Technical Journal devoted to the Foundry and Metal Industries

PETER BAIN, M.E., Editor. B. G. NEWTON, Manager

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PRINCIPAL CONTENTS

CANADA TO AID UNITED STATES

JUST as the various phases of the war and its ever increasing demands have time and again exceeded the most sanguine hopes, so they would seem to render futile any attempt to forecast accurately the extent to which United States requirements will draw upon Canadian resources. Some slight idea may be gained from the statement that when the United States authorities were ready to place contracts for thirty-three million 75-millimetre shells, the utmost capacity available there only totalled eleven and a half million, based on delivery by Oct. 1, 1918. The urgency of the situation caused immediate consideration to be given to Canadian capacity, much of which was dormant or running at reduced output.

The 75-mm. shell, which is approximately the same size as the British 3.3 in., is of the high explosive type, and this size has, in view of the location of the United States front in France, been adopted for use, in this war at any rate, as the United States standard. The degree to which France's gun production has been expanded, and the fact that shells can be obtained rapidly and in great excess of the corresponding American gun production are obvious factors influencing the decision to use this shell.

Just here the value of our past experience in shell making becomes apparent. Not a few factories changed from 18-pdr. shrapnel to 18-pdr. high explosive and then back again to shrapnel. The trouble involved, however unpleasant at the time, is now proving its own recompense. The attitude of the American Government is thus expressed by certain individuals in close touch with developments: "The Canadian manufacturer can get all the 3 in. high explosive shell orders from the United States that he can undertake; they will insist on deliveries right to the day; and the only basis for orders will be past performances." The intention of Washington authorities is, we understand, to put Canadian orders on a fair business basis, our information being to the effect that "they would certainly favorably consider a Canadian firm who had a plant already equipped before placing an order with an American or any other firm who were not equipped."

On Nov. 9, a special telegram from Washington stated: "American firms insist on delivery guaranteed, and think Canadian Government or Imperial Munitions Board should be responsible for fulfilment of contracts on time." Later developments have confirmed this announcement, and the close touch maintained by the Imperial Munitions Board with the numerous shell factories in the Dominion since the slowing down of production will insure the immediate placing of very many contracts in the most suitable and desirable quarters.

Of almost equal importance to munitions production is that of building engines, boilers and marine auxiliary equipment for the gigantic output of ships now rapidly assuming shape in the States. Demands on firms capable of handling general engineering work are growing in insistency, as evidenced by several American firms now building vessels for the Emergency Fleet Board, and who are now in a position to let sub-contracts to Canadian firms for equipment. Nautical instruments are also included in the equipment for which the Board is now in the market, so that the field is wide enough to include almost all varieties of our metal-working plants.

An important point, and one which will influence and also greatly facilitate the securing of contracts, is that, whether negotiating with the individual builders referred to, or with the Board direct, our manufacturers should state clearly and completely, in the first instance, the particular specialty or specialties they are prepared to furnish. Failing this, and in the absence of specific knowledge of marine requirements, a full statement of past activities and type of product, together with such evidence as will convince the contractors of the firm's ability to meet new and varied demands, should be submitted without delay.

Official announcement is pending regarding the reported transfer of 400,000 tons of Japanese shipping to the Atlantic Ocean. This fact alone indicates the gravity of the situation, the necessity for speeding up everything beyond all preconceived limits, the possible extent to which Canada must yet exert herself, and the impossibility of considering any other than a successful termination to hostilities.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

THE USE OF ACIDS AND BASES IN THE PRODUCTION AND MAINTENANCE OF CLEAN METALLIC SURFACES—II.

By Abe Winter.

IN the substitution of cold rolled steel for sheet brass in the manufacturing of various products, a matte surface is often required and many platers have found a matte steel surface rather difficult to produce. The cold rolled steel may be matte finished quite as easily as sheet brass after the plater has become acquainted with the peculiarities of the process we here describe. This steel matting method permits the plater to utilize the old bright dipping solution and is so closely allied to the latter that no serious failures should attend its adoption. A stoneware crock of at least 15 gallons capacity should be installed in a convenient corner of a tank of cold water. If the quantity of steel to be treated in one day is considerable we would advise a larger crock. Into the stoneware crock pour about five gallons of the old bright dipping acid and add about five gallons of fresh bright dipping acid which has previously been prepared and become cold. A quantity of this mixture should be prepared and kept in readiness for replenishing the dip, and is composed of one gallon of nitric acid to two gallons of sulphuric acid.

Clean the steel in the usual manner and immerse in the mixture, keeping the steel in motion, preferably perpendicular to the container, after a few seconds remove and rinse in cold water inspect the results quickly and repeat the immersions with perpendicular motion until the desired matte is obtained. As the dip ages, the duration of treatment will become materially reduced and the operator will experience little difficulty in reproducing the exact effect in a speedy manner.

Adjusting the Dip

When the dip is working correctly the steel surface will be gray in color and clean after rinsing, but continuous use of the dip causes the solution to become quite warm and in this condition produces a black surface on the steel. At this stage we employ approximately six quarts of the new acid mixture kept in reserve, and by adding this amount to the operating dip we restore the cleanly working conditions desired.

A few suggestions which may assist the plater during the trial period are as follows: Free the steel surface of surplus water before each immersion, water decreases the power of the dip. Do not defer the addition of new acid mixture when rise in temperature of solution is indicated. If after a few days the dip refuses to produce usual results, siphon off the acid and remove the precipitate which has formed, return the solution to the crock and proceed as heretofore stated if replenishments are necessary.

If an old bright acid dip is not obtainable for this process the dip may be prepared by dissolving about one pound of steel drillings in each three gallons of new acid mixture. The steel surfaces treated in this dip may receive subsequent deposits of any metal usually employed on matte dipped brass or nickel silver goods, by judicious use of the copper or brass baths and the cost of the final product is greatly reduced.

Removing Pastes and Greases From Plated Surfaces

The time and labor required to wash the plated product after the final coloring is many times the cause of serious delay in the progress of the article through the factory. Generally an article in the course of manufacture is regarded to release a carrier pigeon from the was a very simple matter. Craig arranged as practically finished when it leaves the plating department after the plating operation, yet we have seen great quantities of such parts piled high before a boy or girl who worked unceasingly from morn till night, washing, scrubbing and wiping the pieces in an endeavor to "catch up" to the buffer. Aside from the annoyance of these delays the cost is usually greater than necessary. A sheet iron tank equipped as for plating and connected with the source of current, and containing a solution composed of ¼ lb. whale oil soap, ½ lb. soda ash, and ½ oz. of cyanide per gallon of water, will serve as a very valuable agent in the speeding up of the final washing operation.

Nickel plated castings which usually require soaking and brushing may be quickly and thoroughly cleaned by this solution if a strong electric current is applied. If the articles are removed from the solution at regular intervals the plated surface will be faultlessly clean and lustrous, lengthy immersions cause the surface to become slightly tarnished, in which case the cyanide dip is used to restore the proper finish. After removal from the cleaning bath the parts are immersed immediately in clean boiling water and when the metal has acquired a temperature approximately equal to the water, the parts are removed and dried by rapid swinging motion in the air; small articles may be dried in fine clean maple sawdust.

In the preparation of ornamental metal goods for plating there are often certain pieces which have deep backgrounds, these backgrounds become filled with the polishing or buffing compound during the preparatory treatment and the paste quickly hardens when cold and its removal requires considerable time and labor. The National Cash Register Co. of Dayton, Ohio, spent much time and money in searching for a method which would facilitate the ready removal of this hard compound and after many experiments they adopted the following solution: 2 oz. chipped laundry soap, 1 oz. causticized soda, 2-3 oz. soda silicate dissolved together in 1 gallon of soft water. Neutral soap gives best result in the above. Water containing magnesia or lime should be treated with about 1 oz. of caustic soda per gallon.

War Prices Induce Economy

This solution is a result of war-time prices for chemicals previously used in cleaning and has given excellent satisfaction. It does not injure the finish, is quick in action, moderate in cost and efficient under most severe conditions. It was found that the price of the soap had no bearing on its efficiency for this purpose. The cheaper grades were frequently the most effective. This point may well be noted and an inventory taken of the high priced supplies purchased for various purposes in the factory, many of which are sold under trade names altogether foreign to the preparation.

The plater who expects to keep pace with present developments must not accept every thing handed him by exploiters of new compounds and blindly follow their directions, the plater must investigate, experiment and think. If your electric cleaning solution is prepared from a compound which is only 75 per cent. soluble and you are paying 5 or 6 cents per lb. for same, the loss in one year is considerable, and the useless sediment at the bottom of your cleaning tank is a hindrance to perfect cleanliness. A simple solution of soda ash, 5 oz., and sodium hydroxide, 2 oz., will yield perfect results on a great variety of metal surfaces and the maintenance cost will not exceed one-tenth the cost of many prepared compounds as is the case with any cleaning solution used constantly, this solution will require replenishing at certain intervals, usually from 2 to 4 oz. of the soda is added per gallon.

Many prepared compounds are inef-

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fective unless the solution is used at boiling point. This fact is indicative of an inferior cleaning solution. Reversed current is also unnecessary with a proper cleaning solution, and should not be employed if perfectly clean cathodes, free from oxides are to be repeatedly produced.

Questions and Answers

Question.—I am operating several mechanical plating machines with nickel solutions. The anodes have become foul with a green slime and the solution is covered with a thick scum after remaining idle for a few hours. What should I do to prevent this condition?

Answer.—Remove the solution and anodes from the tanks—filter the solution carefully by using three or four squares of factory cotton tacked over a wooden frame—do not agitate the solution while filtering—allow it to pass slowly. Wash and gently brush the anodes, wash the tanks and cylinders. Return the anodes and solution to the tanks and add 2 oz. of boracic acid per gallon of solution. As all solutions are reduced in volume during the above cleansing process, the boracic acid may be dissolved in a small quantity of water by boiling and added to the solutions, then the bath should be well stirred. The occasional addition of boracic acid to the mechanical plating machine solution will prevent further formation of green slime or scum, and improve the quality of the nickel deposit.

* * *

Question.—We are manufacturing a cast iron article which we wish to nickel plate. We want a good surface, lustrous and durable with white backgrounds. Our plant is small and we wish to operate it at full capacity. How long should we plate the iron in the nickel solution for satisfactory results?

Answer.—If you will prepare a nickel solution of nickel sulphate, 24 oz., sodium chloride, 3 oz., boric acid, 2 oz., and water 1 gallon, and operate the solution with 2¼ volts, with from 8 to 10 amperes per square foot of cathode surface, using nickel anodes of 95 to 97 per cent. nickel, you should obtain a very satisfactory deposit in 30 to 45 minutes. The deposit should be beautifully white on the backgrounds and hard enough for ordinary purposes, yet soft enough to permit coloring easily to brilliant finish on the high lights. Furthermore, this solution will not produce a brittle deposit or require the constant care necessary with double sulphate solutions when the latter are worked hard. The speed of deposition is greater and the cost of maintenance less than is the case with double salt solutions. Avoid overpickling the iron. If you prefer to operate the double sulphate solution, the time required will be from 1 hour to 2½ hours, depending on density of solution, temperature and shape and size of your product. With a small plant and a large volume of work in process we would certainly advise the more modern solution. An extra heavy deposit, fine grained and very resistent to wear may be obtained in 1 hour and 20 minutes. In the installation of equipment for the rapid plating solution, due consideration must be given the conductors, these must be of ample size to allow passage of greater current than is used with the old style solution. All connections must be of perfect fit in order to avoid loss of power. Firms who intelligently test the merits of the single sulphate nickel solution almost invariably adopt the bath in preference to the slow and troublesome sulphate solution.

* * *

Question.—Why is a silver strike used and what is the solution? Our plater insists on having a silver striking solution, but is not certain he has a correct formula. This uncertainty on his part makes us doubtful of value of a strike.

Answer.—Evidently your plater has not utilized his time of apprenticeship to good advantage. The silver striking solution is used where the silvering is required to be upon soft metals or steel. It enables the plater to finish the various wares usually silvered, in a very practical and efficient manner owing to the cleaning properties of the solution, and the rapid and certain results. The possibility of contaminating the regular silver bath is reduced by using a strike solution in preference to coppering or brassing the goods before silvering. The silver plating of modern flatware in large quantities was made commercially possible by the use of the silver strike solution. The preliminary strike solutions vary in composition, some contain no silver, this bath acts merely as a cleaning solution and consists of cyanide and water. It removes oxides and stains and prepares the metal being treated for the regular strike. The regular strike solution consists of large proportions of free cyanide and small proportions of silver. For instance, cyanide 32 oz. and silver 10 to 16 pennyweights per gallon of water. The bath should register about 20 deg. Beaume, and as cyanide varies in quality, the amounts stated here may require altering. In any event, the bath should be constructed to meet the requirements of your product. For steel you may find it advisable to operate three strike solutions. This is often necessary, while for some soft metals one strike will suffice.

A SIMPLE method of filling up cracks in the water jackets of motor-car engines, which is often adopted in France, says a writer in the "Autocar," consists in making use of a liquid solution in which advantage is taken of the property possessed by copper salts to deposit their metallic contents when in contact with iron. To fill up a crack in a water jacket, all that is necessary is to fix the cylinder vertically in a bath or tank; plug up the lower water outlet in the jacket with a cork; then fill the jacket through the upper inlet with a sufficiently concentrated solution of sulphate of copper, which will at once commence to leak away through the crack or cracks and collect in the bath. The liquid should be scooped up as it collects and re-poured into the water jacket; the leakage will be quickly reduced to a slight "weeping" at the crack. When this weeping period has been reached, stop up the upper inlet with a cork in which a bicycle tire valve has been fitted, and by means of a tire inflater force air into the jacket. At first the degree of weeping will increase, but it will gradually disappear and become almost colorless instead of a bluey tint, the repair of the crack then being completed.

MAGNESITE is a product of alteration of magnesium silicate, and occurs as veins and patches in serpentine, talc-schist or dolomite-rock. It is extensively mined in the Island of Euboea, in the Grecian Archipelago, near Salem in Madras, and in California, U.S.A. It is principally used for the manufacture of highly refractory firebricks for lining steel furnaces, and electrically-operated furnaces; also for making plaster, tiles and artificial stones; for the preparation of magnesium salts, for whitening paper pulp and wool, and as a paint.

"BORRODISING" is the name given to a system of electro-deposition of zinc which has been introduced as a preventive against corrosion of the steel fittings of aeroplanes and seaplanes. It is described as a method of cold electro-galvanizing carried out in such a way that the zinc so unites with the underlying metal that only by extreme wear can the surface of the steel be exposed. As the metal is not subjected to the usual pickling bath prior to the galvanizing, it is claimed that there is no reduction in the strength of the metal after treatment.

BLACK nickel can be removed from brass articles by dipping in an acid dip composed of equal parts of oil vitriol, nitric acid and hot water. This dip should be used as hot as possible. After the black nickel has been removed the articles can be bright dipped and colored over as usual.

If the black nickel solution is made up with arsenic the articles should be dipped in a hot silver solution until the black color is faded out, then the silver stripped off by dipping in a hot dip made of 12 parts nitric acid and one part oil vitriol. After the silver has been stripped off, the articles should be given a light dip in the black boil dip, then bright dip as usual.

AN alloy that has proved very satisfactory for ships' propellers is turbadium bronze. This material has a tensile strength of 35-42 tons with an elongation of 14-20 per cent. on a 2 in. test piece, and it is not appreciably corroded by sea-water. According to the Chemical News, its composition is, approximately, copper, 48 per cent.; zinc, 46, 45; tin, 0.5; lead, 0.1; iron, 1; aluminium, 0.2; manganese, 1.75; nickel, 2.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$32 75
Lake Superior, charcoal, Chicago	35 50
Standard low phos., Philadelphia	37 00
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	33 00

	Montreal	Toronto
Hamilton	....	$50 00
Victoria	....	50 00

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$ 62 00
Antimony	18 00
Copper, lake	32 00
Copper, electrolytic	32 00
Copper, casting	31 00
Lead	8 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	0 98
Tin	72 00
Zinc	10 50

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$19 00	$19 00
Copper, crucible	22 50	21 50
Copper, heavy	22 50	21 50
Copper wire	22 50	21 50
No. 1 machine composition	20 00	20 50
New brass cuttings	16 00	17 00
No. 1 brass turnings	15 00	15 75
Light brass	11 00	10 00
Medium brass	15 00	14 00
Heavy brass	16 00	16 00
Heavy melting steel	20 00	20 50
Steel turning	12 00	8 00
Shell turnings	12 00	12 00
Boiler plate	23 00	18 00
Axles, wrought iron	30 00	24 00
Rails	26 00	20 50
No. 1 machine cast iron	25 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	15 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	32 00	30 00
Mach. shop turn'gs.	8 50	8 50
Cast borings	15 00	8 50
Stove plate	19 00	19 00
Scrap zinc	5 00	6 50
Heavy lead	7 00	7 00
Tea lead	6 00	5 75
Aluminum	30 00	25 00

COKE AND COAL

Solvay foundry coke	....
Connelsville foundry coke	....
Steam lump coal	....
Best slack	....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	
Wire rods	57 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

¼ in.	$12 00
5-16 in.	11 50
⅜ in.	11 15
7-16 in.	10 90
½ in.	10 70
9-16 in.	10 70
⅝ in.	10 50
¾ in.	10 40
⅞ in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 35
Solder, guaranteed	0 37½
Babbitt metals	18 to 70
Soldering coppers, lb.	0 53
Putty, 100-lb. drum	4 75
White lead, pure, cwt.	16 55
Red dry lead, 100-lb. kegs, per cwt.	16 25
Glue, English, per lb.	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	0 61
Linseed oil, boiled, single bbls.	1 49
Linseed oil, raw, single bbls.	1 52
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A...list plus	20
Emery cloth ......list plus	33 1-3
Borax, crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular.	0 15
Wood alcohol, per gallon	2 15
Whiting, plain, per 100 lbs.	2 20

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28.	$ 9 50	$ 9 50
Sheets, black, No. 10.	12 00	12 00
Canada plates, dull, 52 sheets	12 00	12 00
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B. W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W. G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	10 95
Premier, 10¾ oz.	13 85	11 25
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$15 50
3-16 in.	11 70
¼ in.	8 40
5-16 in.	7 40
⅜ in.	6 35
7-16 in.	6 35
½ in.	6 35
⅝ in.	6 35
¾ in.	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard buishings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 50%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.50 to $0.54
Cobalt	1.75 to 2.00
Copper	.36 to .38
Tin	.76 to .78
Silver, per oz.	1.05 to 1.00
Zinc	.14 to .16

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .20
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, acqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret.	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper, carbonate, anhy	.50
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate.	.12
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate .....(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, singl and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1.95
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, bullneck	2 00
Pumice, ground	07
Emery composition	10 to 12
Tripoli composition	06 to 09
Crocus composition	08 to 12
Rouge, powder	.30 to .35
Rouge, silver	.50 to .55

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	53 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x28 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base	64 00	60 00
Braziers', in sheets, 6x4 base	55 00	52 00

BRASS PRODUCTS.

Brass rods, base ½ In. to 1 in. rd.	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamlss	0 58

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.39
British Manila rope	.33
New Zealand Hemp	.33
Transmission rope, Manila	.45
Drilling cables, Manila	.41
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor Oil, per lb.	40
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	50

The General Market Conditions and Tendencies

TORONTO, Ont., Nov. 6.—A revival in the munitions industry is imminent, due to orders for shells which will be placed in Canada by the United States Government. Some orders have already been placed and negotiations for others which are pending will, it is fully expected, be closed very shortly. Representatives of Canadian shell manufacturers are negotiating with the Imperial Munitions Board in regard to prices and at least a dozen firms are expected to participate in the contracts. The shell covered in the contracts is the French 75 millimetre type which has been adopted by the United States Government for the army. It is a high explosive shell and is similar in design to the British 18 pdr. shrapnel. Quick delivery is doubtless the principal reason for these contracts coming to Canada. The Imperial Munitions Board who are assisting in the negotiations have appointed a prominent manufacturer, Lloyd Harris, to represent them in Washington.

Steel

Although the outlook is clearer in regard to conditions in the steel trade in Canada, the situation still remains serious by reason of the shortage of iron and steel. It is even possible that there will be a scarcity of steel required here for the manufacture of war equipment or articles contributory thereto, that is when steel produced in the States is needed for their manufacture. The reason for the tight situation is the abnormal demand for steel in the States. In fact the demand is so heavy that it may not be possible for mills in the States to supply steel for purely commercial purposes in Canada except in limited tonnages. F. C. T. O'Hara, Deputy Minister of Trade and Commerce, while in Washington recently made arrangements with the Priority Board which it is hoped will greatly assist the Canadian manufacturer to secure materials which he needs from the United States. In view of the serious situation, the Deputy Minister strongly urges rigid economy in the use of all metals for any purposes whatsoever; this implies a careful conservation of all scrap. The outlook for manufacturers not engaged on war orders is not particularly bright, but it is apparent that very little more can be done to improve their position. It is fortunate however, that Canadian mills will benefit under the new conditions by the elimination of considerable competition although they cannot supply all the different classes of material that will be required. It is here of course where the principal trouble lays, for this material must be imported from the States which is now a difficult matter on account of the embargo.

Prices of steel products continue stationary with the single exception of the lighter gauges of black sheets which have again declined. There is not a particularly heavy demand for this material, and prices at the time of the advance went up in sympathy with other materials rather than for any other reason. It appears to be the intention of the War Industries Board to leave the matter of price fixing in the hands of a sub-committee of the American Iron and Steel Institute who it is expected will announce in due course prices on products not yet fixed. The price regulations have not as yet been reflected in the situation here and the market continues firm. Business of late has not been sufficiently large in volume to really affect the market, the unsettled outlook having caused many consumers to hold off buying until conditions become more favorable. War orders continue to keep the steel trade very active. Considerable steel is being used in the manufacture of marine forgings, while the pending contracts for shells for the United States Government will absorb a large quantity of steel.

A large proportion of the output of steel in the United States is being utilized for war purposes. The shipbuilding branch of the industry alone is responsible for the largest bulk of the steel now on order. All the steel plants in the States are working at a capacity which is only limited by the equipment of the several shops in machinery and men. Prices of steel have a weaker tendency and appear to be gradually declining towards levels recently fixed. Business with the mills is largely for Government account and private consumers are not buying heavily. Price regulation has reached another stage, maximum prices having been fixed, subject to revision Jan. 1st, on certain steel articles including sheets, pipe, cold rolled steel, scrap iron, wire and tin plate. The prices for sheets range from $4.25 to $6.25 per 100 lbs. f.o.b. Pittsburg, according to grades. On ¾ inch pipe to 3 inch black steel pipe a discount of 52 and 5 and 2½% f.o.b. Pittsburg was fixed. The discount on cold rolled steel is 17 per cent.

Pig Iron

An important step towards more settled conditions in the market in the States has been made. A list of differentials has been issued by the American Iron and Steel Institute. The differentials are based on the base price of No. 2 foundry iron which was fixed at $33 per gross ton f.o.b. cars at furnace. The list is given in another section of this journal. The situation locally shows no improvement and prices continue nominally unchanged. The furnaces are well sold ahead and there is very little iron to be had. Production is not increasing and it is doubtful if it is keeping pace with the requirements. The coke situation has not improved materially. It is almost impossible to secure any desirable quantity for prompt delivery at the established price as operators claim that they can produce no more than is sufficient to fill contracts.

Scrap

The old material market continues dull but the outlook is improving owing to the scarcity of new materials. The volume of business is light as buyers are looking for lower prices and dealers are not anxious to sell at current values. There is not a great deal of scrap to be had and prices are consequently holding firm.

Machine Tools

Some renewed activity in the machine tool business may be expected following the placing of contracts in Canada for shells by the United States Government. The shell in question is the 75 mm. French pattern which has been adopted by the United States Government. It is a high explosive shell and is not unlike the British 18 pdr. shrapnel except of course that there are no bullets inside. The shell has to be heat treated on account of the high bursting pressure required. Machinery used for shrapnel will be suitable for the new shell. The French shell is made from a forging with comparatively thin walls and it is hardened and heat treated to increase its elastic limit and tensile strength. The bursting pressure is as high as 18,000 lbs. per square inch. It has no base plug as is common in British high explosive shells. A notice has been issued by the Dominion Government prohibiting the export of shell machinery except under license, which appears to indicate a continuance of shell contracts for the British Government.

Supplies

Prices of machine shop supplies continue firm with an upward tendency in some lines. The market is steadier however, and business active. Blacksmith's forges and blowers have advanced, one size, the 18 inch round riveted forge, is now quoted at 20 per cent. as against 40 per cent. off list. Blowers which were formerly 10 per cent. on list are now 40 per cent. on list. Iron rivets and burrs which were formerly 17½ per cent. are now 15 per cent. off list. Soldering coppers have declined 2c per pound. One pound coppers are now quoted at 71c, 1¼ lb. at 68c; 2 lb. at 67c; 2½ lb. at 65c; 3 lb. and up 64c per pound.

Metals

An advance in the price of tin is the only feature of importance to note in an otherwise dull situation. The metal markets generally are quiet and signs of activity are wanting. The advance in tin is due to a scarcity of spot metal because of the difficulty which exists in regard to shipping permits. The copper situation is unchanged, a scarcity of spot metal being the principal feature of this market. Lead continues firm but spelter is dull and easy. Both antimony and aluminum are unchanged.

Copper.—The situation in the copper market continues somewhat obscure. While large consumers appear to be getting what they require the position of the dealers and smaller consumers dependent upon them is not yet clearly defined. The primary market is completely in the hands of the Copper Production Committee with deliveries and sales regulated according to consumers' needs and with a view to protect the United States Government and the Allies. Local prices are unchanged and nominal, lake and electrolytic being quoted at 32c and castings at 31c per pound.

Tin.—The development of an acute shortage in spot tin together with the uncertainty as to future supplies has caused the market to become active and higher. Unless the situation speedily improves the shortage threatens to interfere with important contract work for the Government and Allies. While this refers to the products of tin and its alloys in all forms, it especially applies to the manufacture of babbit metal which is of utmost importance in the construction of motors and machinery of almost every description, and into the composition of which tin enters to the extent of 25 to 95 per cent. Tin has advanced 3c and is now quoted at 66c per pound.

Spelter.—The market is dull and weak, although there has been no change in prices. Local quotation 10½c per pound.

Lead.—Although the Trust price of lead is unchanged at 5½c per pound the independent producers have raised the price, ranging from 6¼ to 6½c New York for spot metal. The market generally is firmer but little lead is offering. Local price firm at 8½c per pound.

Antimony.—The position of antimony shows no improvement, the market being weak and demand light, price 18c per pound.

Aluminum.—The market continues quiet and easy with quotations unchanged at 62c per pound.

Foundry Supplies and Chemicals

The steady advance in prices of many raw materials continues to be the outstanding feature in the market and prices of finished products have for this reason an upward tendency. Although iron and steel have reached the top, other materials, such as cotton felt and leather, are still climbing. The shortage in these materials, due to excessive demand for war purposes, is having marked effect on the situation and a scarcity of finished goods has resulted. Felt polishing wheels have advanced and are now quoted at $3.25; Bullneck wheels are also up, being now quoted at $2; other supplies which have advanced include pumice, now 7c; emery composition 10c to 12c; tripoli composition 6c to 9c; crocus composition 8c to 12c per pound. There have been no important changes in prices of chemicals, although there is a shortage of some lines.

TRADE GOSSIP

The Wallace Foundry Co. of North Vancouver has been incorporated with a capital of $75,000.

Sydney, N.S.—The Sydney Foundry & Machine Co., will build a foundry at Halifax, to cost $7,500. Wilfred Clarke is manager.

Sarnia.—The Holmes Foundry Co., a recently organized concern, will build a plant here. It is expected that construction work will commence shortly.

Tillsonburg, Ont.—A large gusher struck a few days ago near Port Burwell promises to be one of the richest gas wells in the district.

Port Arthur, Ont.—Representations have been made to Ottawa asking that the Atikokan Iron Co's. plant be taken over and operated under government supervision.

Preston, Ont.—The Preston Woodworking Co., are building an addition, 40 x 100 feet, to their plant to accommodate the pattern shop and to make more room in the main building.

Sarnia, Ont.—The plans for the new foundry, to be built on the north side of Exmouth Street, Point Edward, have been completed by the engineers and the tenders and specification are now ready for the contractors.

J. J. Scullan, connected with the Toronto plant of Canadian Allis-Chalmers, has been appointed general superintendant of the company's branch at Bridgeburg, Ont.

Lloyd Harris, president of the Russell Motor Co., Toronto, has undertaken, at the request of the Imperial Munitions Board, the duty of representing the Board at Washington, D.C.

H. J. Fuller of New York, president of the Canadian Fairbanks-Morse Co., has been appointed to represent the Imperial Munitions Board in New York in connection with munitions and marine equipment contracts.

J. Nelson Hunter, of the Combustion Engineering Corporation, New York, has joined the British Royal Flying Corps. Five other members of the Corporation's drafting-room staff have joined various branches of the service in the United States Army and Navy.

Frank G. Burch, who for several years has been connected with the sales staff of the Mussens Ltd., and later with the Canadian Allis-Chalmers Co. has become associated with the Canadian Ingersoll-Rand Co. as a salesman for the Montreal district.

The Nova Scotia Steel Co., New Glasgow, N.S., has attached to its staff Miss Whidden of Birmingham, Ala., to inaugurate social welfare work among the employees. Miss Whidden has had large experience in this class of work in the States.

The Canuk Supply Co., Montreal, announce that J. T. Dohn, manager of their Toronto office, has been transferred to the Winnipeg office as manager there in charge of territory west of Fort William, Ont. W. J. Espey has been appointed manager of the Toronto branch, and E. L. Foley has been made eastern sales manager with headquarters at Ottawa.

Export of Munitions Machinery Prohibited.—An order-in-council has been issued on the recommendation of the acting Minister of Customs ordering that the exportation to the United Kingdom, British possessions and protectorates and to all foreign countries, of plant, machinery and equipment of all kinds for the manufacture or production of munitions of war shall be and is hereby prohibited except under license from the Minister of Customs.

The Electric Furnace Construction Co. of Philadelphia, Pa., announces that Frank Wharton Brooke, formerly metallurgist at Crowleys, Detroit, Mich. and at the Ludlam Steel Works, and G. W. Ketter, who has just finished the erecting and installation of ten to six ton furnaces at the British Forgings, Ltd., Toronto, Ont., and who has been erecting and superintending electric furnaces for years, have joined their staff at Philadelphia.

Lieut.-Col. Thomas C. Irving, Jr., D.S.O., of Toronto, Commanding Officer of the 1st Canadian Engineers, has been killed in action. Lieut.-Col. Irving went overseas with the first Canadian contingent as a captain with the Canadian Engineers. In October, 1915, he was gazetted major of the Second Field Co. Engineers. He was decorated with the D.S.O. for distinguished conduct on the field and later was promoted to a lieutenant-colonel. Before joining the C.E.F., Lieut.-Col. Irving was a member of the Moffat-Irving Steel Co., and vice-president of the C. W. Hunt Co., consulting and inspecting engineers of Toronto.

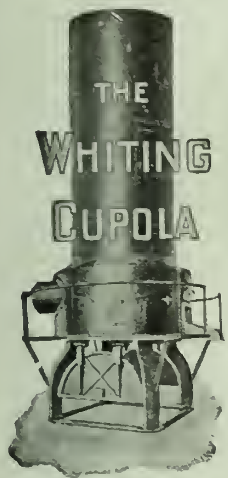
Winnipeg, Man.—Tenders covering work that will represent an expenditure of approximately $1,250,000 are being called for by the Administrative Board of the Greater Winnipeg Water District, as follows:—Tenders for the gate house and intake at Shoal Lake will be received up to Nov. 16; for cast iron gate valves, air valves and sluice gates up to Nov. 26; for material to be used for the pipe line from the Red River to the McPhillips Street reservoir up to Dec. 3, and for the construction of the pipe line up to Dec. 3. Chief engineer, W. G. Chace; chairman, R. D. Waugh.

Big Coal Production in B. C. and Alberta.—A gratifying report in connection with the output of coal in district 18, which comprises part of the Province of British Columbia and part of Alberta, has been received by the Dominion Minister of Labor at Ottawa from W. H. Armstrong, Director of Coal Opstates that the total output in Alberta for the third quarter of the year is 1,324,-452 tons, an increase over the same period last year of 335,384 tons. His statement does not include the output in the mines of South-eastern British Columbia.

Maximum Prices Fixed for Steel Supplies.—President Wilson at Washington on Monday approved an agreement made by the War Industries Board with the principal steel manufacturers of fixing maximum prices, subject to revision January 1, on certain steel articles, including sheets, pipe, cold rolled steel, scrap iron, wire and tin plate. The prices for sheets range from $4.25 to $6.25 per 100 pounds f.o.b. Pittsburgh, according to grades. On three-quarter-inch pipe to three-inch black steel pipe a discount of 52 and five and 2½ per cent. f.o.b. Pittsburgh was fixed. The agreement on cold rolled steel was 17 per cent.

New Steel Company Incorporated.—A new concern, the Alloy Steel Works, has been incorporated with an Ontario provincial charter to take over the steel plant on Front Street, Toronto, formerly operated by the Moffatt-Irving Steel Co. The new concern will continue to make steel castings by the electric furnace process which at this plant utilizes flue dust or fines for making steel. The company contemplates enlarging the capaccity of the plant by the installation of another furnace. John R. Russell and H. T. Armstrong of Toronto are interested in the new venture which is capitalized at $100,000.

Halifax, N.S.—Tenders addressed to the Naval Store Officer, H.M.C. Dockyard, Halifax, N.S., will be received up to Thursday, Nov. 15, 1917, for the purchase of any or all of the following: Steel, various; iron, various; brass, copper, lead and metal, old; stoves, ranges; kettles, various; rubber boots and rubbers; rubber, old; hoses, rubber, rubber-lined and canvas; leather boots, belting and scrap leather; wash-stands, lockers, chairs, etc.; sacks, coal; files, old; cordage, old, paperstuff; wire-rope, old; bunting, old; hammocks, old; cable, old; bronze braided and electric; carpets and rugs; ship's boats; miscellaneous tools; diving gear; canvas, old; lamps and lanterns, oil and electric; clocks, telescopes, binoculars, barometers, logs, etc.; pipe elements, ex "Belleville" boilers, life belts, and cork, old; refrigerating plant, including vertical steam engine, copper and iron coils, etc.; rigging returned from patrol vessels; and steam launch, high speed, engine and boiler complete, including spare gear. Complete lists, with quantities offered for sale, may be had on application to the Naval Store Officer, H.M.C. Dockyard, Halifax, N.S.



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WANTED — SECOND-HAND CUPOLA AND other foundry equipment. State full particulars and price. Box 344, Canadian Foundryman.

FOR SALE—2 TUMBLING BARRELS, 24 X 36 (cast iron staves and hollow trunnions for exhaust). Also six hand squeezers, 30-inch, with vibrators. Apply Pease Foundry Co., Ltd., Brampton, Ont. c1lf

WANTED — POSITIVE CUPOLA BLOWER, about 28 cu. ft. displacement, in first-class working order. Send full particulars and price. The Jenckes Machine Co., Limited, St. Catharines, Ontario.

Substitute for Sheet Steel.—An asbestos-cement composition is being manufactured in England as a substitute for sheet steel for various purposes. Ground asbestos is mixed in the proportion of one to six with Portland cement and worked into a paste with water. A machine something on the order of those used in making paper forms it into sheets, which are trimmed to size and if desired corrugated for roofing purposes. After seasoning the material is ready for use. It is durable, resistant to climatic conditions, particularly acids in the atmosphere; fireproof and also a non-conductor of heat.

Brantford, Ont.—An announcement has been made from New York that the American Steel Products Corporation has been organized with a capital of one million dollars, the officers being W. P. Kellett, president; D. O. Johnston, vice-president; treasurer, M. M. McGraw; secretary, P. H. Secord; W. S. Brewster, of Brantford, and W. S. Tomlinson, Toronto, directors. All but the latter are Brantford men. The new organization will take in the Dominion Steel Products Co. of this city, and it is expected that as a result the local company will double its present plant. The local plant is now working on the line and propeller shafting for one hundred of the new ships being built in the United States.

CATALOGUES

The Perfect Machine Co., Galt, have issued a catalogue describing an interesting line of machine shop tools including lathes, drills, power hack saws, grinders, special machinery and tools, jigs, dies, etc. The capacity and dimensions of each tool illustrated are given together with the principal features of construction.

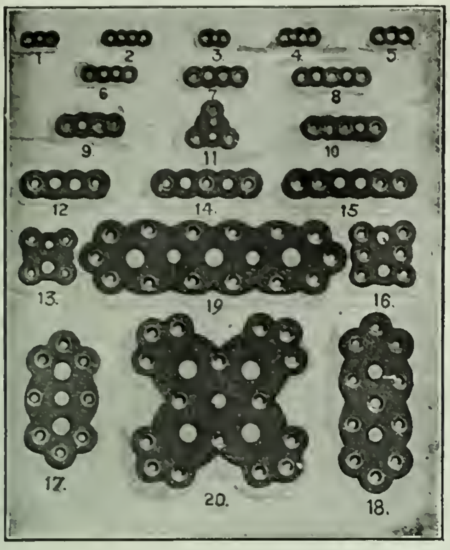
Grinding and Polishing Machinery.—The Webster & Perks Tool Co., Springfield, Ohio, have issued a loose leaf folder containing a number of leaflets illustrating and describing an extensive line of ball bearing and plain bearing grinding and polishing machinery. A specification is included for each type of machine, giving the principal dimensions, etc.

Woodworking Machines. — Bulletin issued by the Preston Woodworking Machinery Co., Preston, Ont., deals with the question of labor-saving and shows two woodworking machines in this connection. The machines are a high-speed ball bearing shaper and a veneer taping machine. An open letter to Canadian woodworking manufacturers is also a feature of this bulletin.

FIRM WANTS CATALOGUES

IN the recent fire which destroyed the entire forging plant of the Cluff Ammunition Co., Ltd., Atlantic Avenue, Toronto, the firm's records were completely lost. They are anxious to renew their catalogue file, and would appreciate new copies of equipment, manufacturers' literature, etc.

Obermayer Rapping Plates and Lifters



Our Rapping Plates and Lifters are the best, made from Malleable Iron. Smooth, true, straight, accurately machined and tapped.

Complete stock in all our Warehouses.

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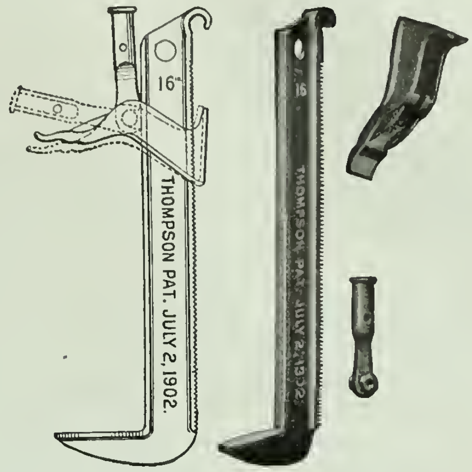

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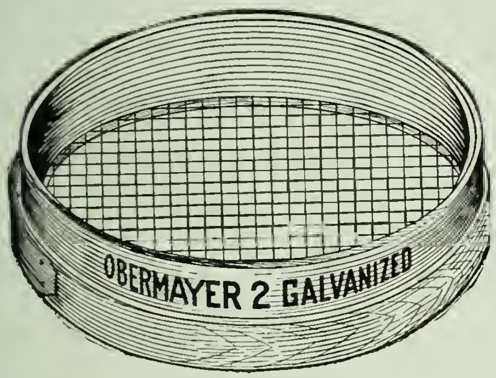

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Repair Defective Castings with National Iron Filler Cement

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Is Absolutely Uniform

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SHOT DOES NOT WEAR THE HOSE, NOZZLE OR MACHINE AS FAST AS SAND, AND IT CLEANS EASILY 100% BETTER.

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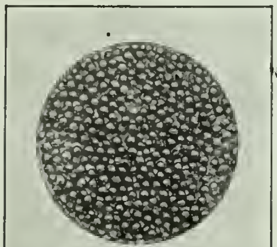

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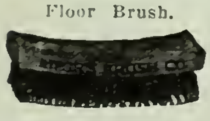

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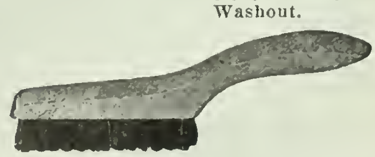
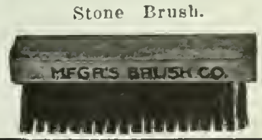


Shoe Handle Washout.

Stone Brush.



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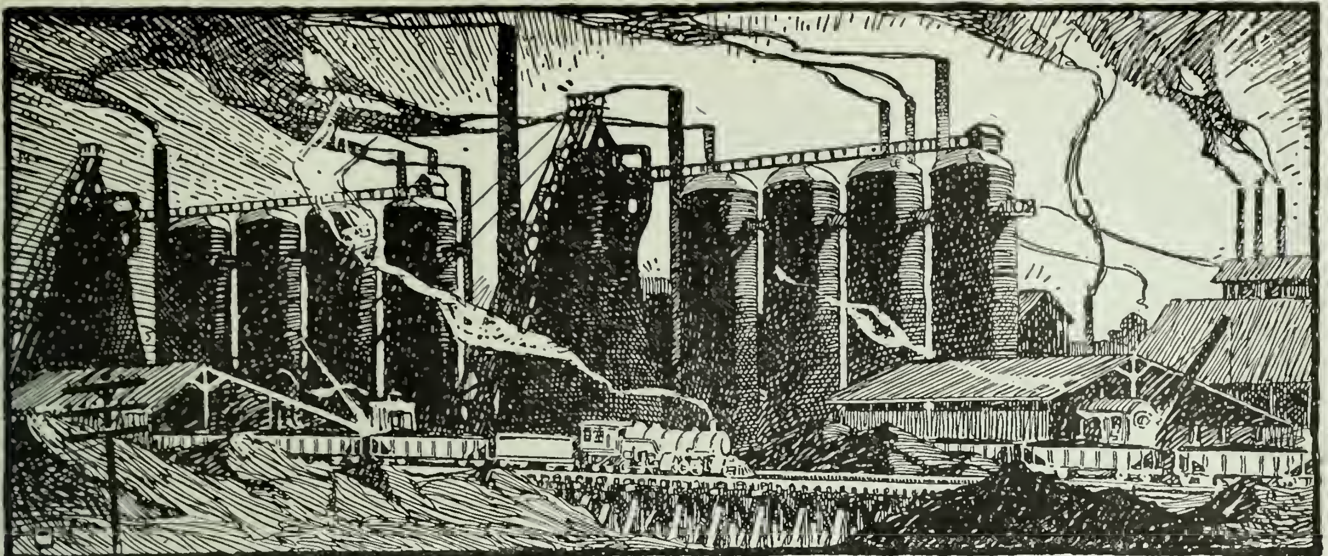

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Can. Ingersoll-Rand Co., Sherbrooke, Que.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Can. Ingersoll-Rand Co., Sherbrooke, Que.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT MACHINES AND SQUEEZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Midland Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Seidel, R. B., Philadelphia.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

MAGNETS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Can. Inspection & Testing Laboratories, Montreal.
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
Hyde & Sons, Ltd., Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.
Vickers, Charles, 712 Cedar Ave., Niagara Falls, N.Y.

MIXERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Machine & Fdry Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Sherbrooke, Que.

PULLEYS, MAGNETIC
Ding's Magnetic Separator Co., Milwaukee, Wis.

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY

Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
U. S. Silica Co., Chicago, Ill.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
U. S. Silica Co., Chicago, Ill.

SAND CONVEYING MACHINERY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL

Harrison Supply Co., Boston, Mass.

SAND MOLDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS

Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SEPARATORS

Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
U. S. Silica Co., Chicago, Ill.

SIEVES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED

Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Can. Hart Wheels, Hamilton, Ont.

TALC

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS

Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCulloch-Dalzell Crucible Company, Pittsburg,

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, GRINDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE

Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

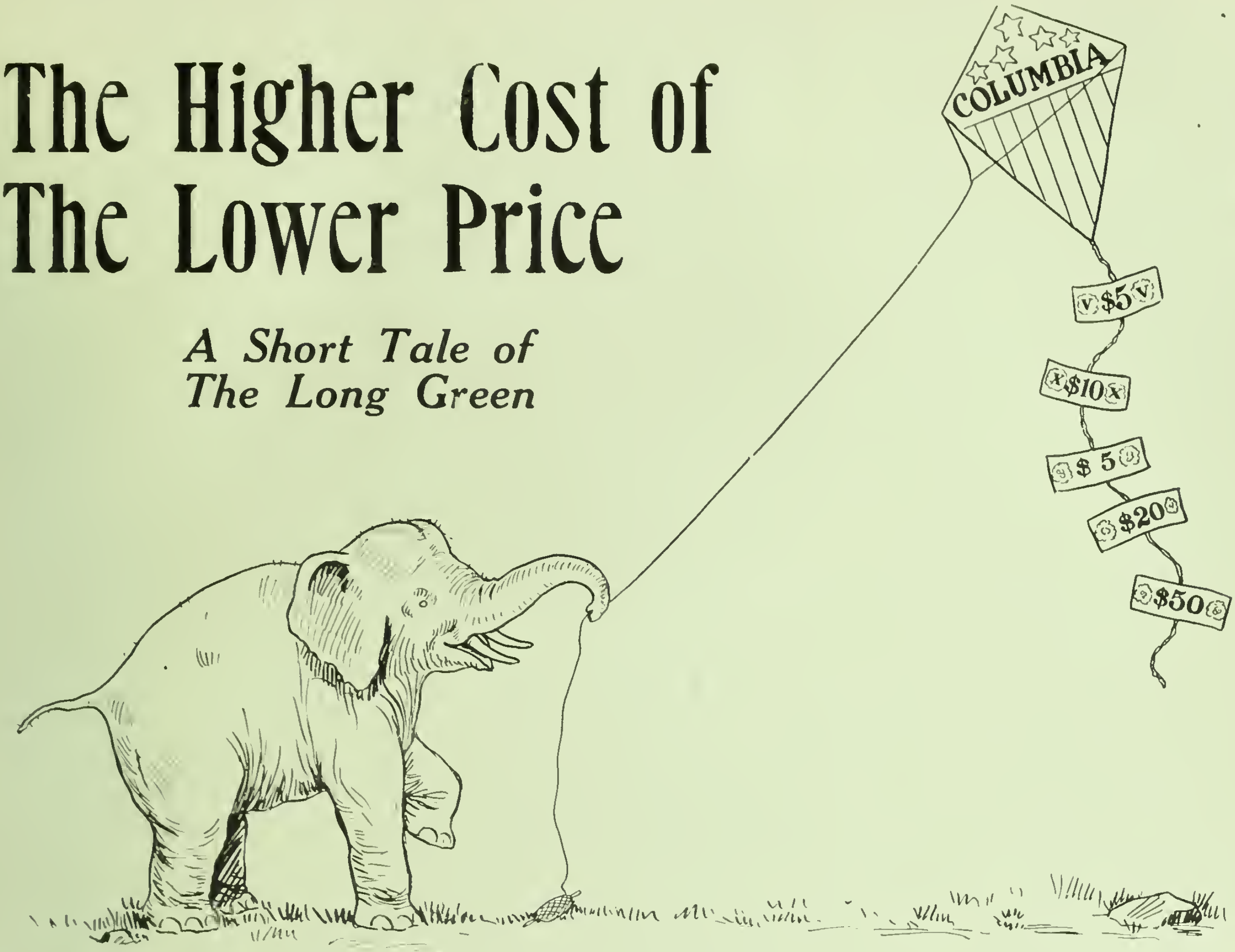
WIRE, WIRE RODS AND NAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

ADVERTISING INDEX

The Higher Cost of The Lower Price

A Short Tale of The Long Green



COLUMBIA Parting is a Parting that is really super-excellent. I originated both the product and that combination of words.

The basic material of Stevens Columbia Parting weighs 76 lbs. to the cubic foot and sells for $1.90 per cubic foot.

The heavier basic materials of other partings weigh 107 lbs. upwards to the cubic foot and cost anywhere from $2.14 to $3 per cubic foot.

You buy Parting by weight and use it by measure. Why pay $2.14 to $3 per cubic foot for the ordinary Parting when you pick the world's best for $1.90?

Again I use a very large barrel and pack it to the top. It is so light in weight that full to the top it weighs only 350 lbs. Smaller barrels, containing heavier partings, weigh 400 lbs. or over.

If heavier partings should be offered at $\frac{1}{2}$c to $\frac{3}{4}$c lb. less than mine, all the above shows conclusively that there is such a thing as the higher cost of the lower price. Send for my booklet telling how to speed up and make money faster with Columbia Parting. Or, better still, send for a trial barrel—sent on approval if desired.

I sell other things about which there is no guesswork as to economy with thrifty buyers—Stevens Pure East India Plumbago—King Kore Kompound—Carbon Blacking—Core Oils—Core Gum.

Stevens Tripoli Compositions, Sub-Felt and Spanish Felt Wheels, Turkish Emery, Glue, and other supplies for particular platers.

All Stevens Specialties are especially good.

FREDERIC B. STEVENS

Manufacturer Foundry Facings and Supplies, Buffing Compositions and Platers' Supplies

FACING MILL: Corner Isabella Avenue and M.C.R.R.
WAREHOUSE and OFFICE: Corner Larned and Third Street

DETROIT, MICHIGAN

EXPORT WAREHOUSE: Windsor, Ontario

BRANCH: Hoosier Supply Co., Indianapolis, Indiana

NEW ENGLAND BRANCH: Frederic B. Stevens, Corner Water and Olive Streets, New Haven, Conn., E. E. Seeley, Manager

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. VIII. PUBLICATION OFFICE, TORONTO, DECEMBER, 1917 No. 12

The Publisher's Page

TORONTO DECEMBER, 1917

The Economy of Business Paper Advertising

By H. E. CLELAND, NEW YORK

Awarded the Higham prize at the convention of Associated Advertising Clubs, at St. Louis, June 1917. This prize is given annually to the one delivering the most constructive address in the fewest words.

(Continued from last month)

SO, in a quiet, substantial, and most-times unheralded way, the business papers are leaders of progress in their respective industries and in this character they tie to them the progressive men of the industries. Only progressive men are worth while to advertisers. Therefore, the business papers not only aim directly at those industries where the advertisers' products may be sold, but they automatically select the men in each industry whose words carry weight of buying authority. But modern business papers—those which, for instance, are members of the Associated Business Press—go even further and put before the advertiser the exact number of each classification of subscribers. So that, in a technical industry, for instance, the advertisers are shown how many firms, executive officers, purchasing agents, superintendents, engineers, etc., are on the paid subscription list and from these the advertiser may estimate the buying power which each publication holds for his product.

In other words, the business papers are helping to put advertising closer to the status of an exact science.

And that, in turn, spells greater economy in advertising.

"BUYING POWER" THE TEST.

I said that the buying power per subscription in a business paper was greater than the buying power per subscription of any other medium because things are bought for business and not private consumption.

To illustrate this, one industry last year bought approximately $500,000,000 worth of goods and 90 per cent. of this industry is covered by two business papers having a total paid circulation of 22,000, or an average of material bought per subscriber of about $20,500.

Since it is a fact that less than five per cent. of our population has an income of over $4,000 per year, it may readily be seen that private and business consumption are far, far apart.

I quote from an industry with which I am familiar and not one picked because of its exceptional buying capacity. There are probably many which exceed it.

So, the thought is that each dollar invested in business paper advertising buys more potential sales results because each appeals to a greater buying power.

And that, too, is economy in advertising.

THE POTENT THING.

Now, all of you advertising men know that the really potent thing in advertising is cumulative effect. You know that even poor and mediocre advertising, persisted in, pays and pays handsomely.

You know, on the other hand, that sporadic advertising, even of the best kind, has only a temporary effect and that effect is seldom of sufficient force to pay.

The splurger makes his splash, the ripples die out and the surface becomes calm and serene. He loses because his advertising is too costly to be kept up continuously.

THERE IS NO SUBSTITUTE FOR CONTINUITY IN ADVERTISING.

It is possible, because of the low rates in business papers, for practically any manufacturer to advertise week in and week out or month in and month out, to hammer away until by sheer force of persistence he drives his claims home and sells his prospect.

It takes time to sway men the advertiser's way. It takes repeated effort to get the first return from advertising.

The advertising catacombs are filled too full of the bones of half-tried efforts.

There are publishers who permit and agents who induce advertisers to adopt "splurge" advertising, and these I charge with the crime of high treason against the cause of effective advertising.

Advertising which cannot reap the benefits of cumulative effect is not as profitable as it ought to be. Therefore, it is not as economical as it might be.

Business paper advertising is economical because, intensive circulation permits rates low enough to allow practically any manufacturer to advertise continuously.

FOLLOW THE SALESMAN'S METHODS.

That advertising is best which comes closest to the best in salesmanship.

What does the salesman do? Assume that he is selling steam engines, does he make a house-to-house canvass of say, Chicago? Not on your life. Aside from the utter insanity of that procedure, it takes twelve years and eight months for one man to make a house-to-house canvass of Chicago. He picks out steam power plants or plants in course of design or of building and goes to those and no others.

Does he make his sales talk to the office boys and stenographers in those plants? Not in one thousand years. He goes to the man who buys or recommends.

Does he talk to these men about steam calliopes or about steam engines? You know the answer.

Does he endeavor to show the economy and efficiency of the steam engine as a prime mover and does his talk resemble that of an engineer or a chauffeur? You know the answers to that, too.

Now, why does the salesman do these things? Because the efficient salesman knows how to follow the straight line—the shortest distance between two points—and because his concern will not pay for the super-expense of roundabout methods.

For precisely the same reason, the wise manufacturer uses the business papers to carry his advertising message.

(Concluded next month)

The Allies will Win *Their Cause only is Just*

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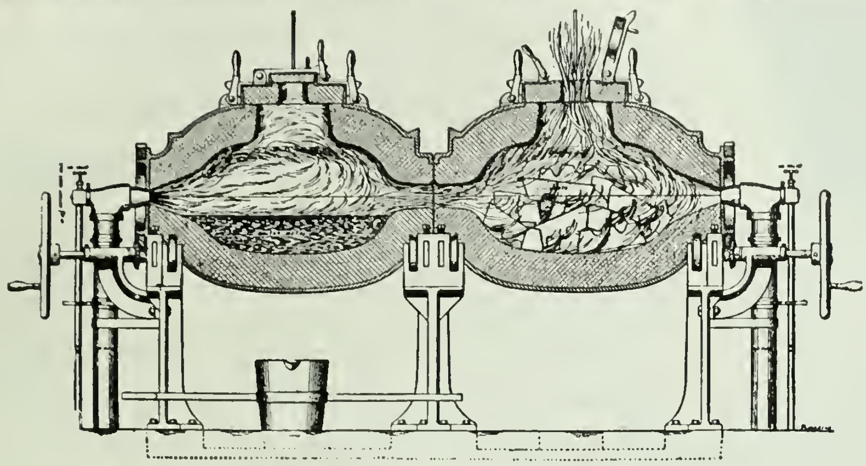

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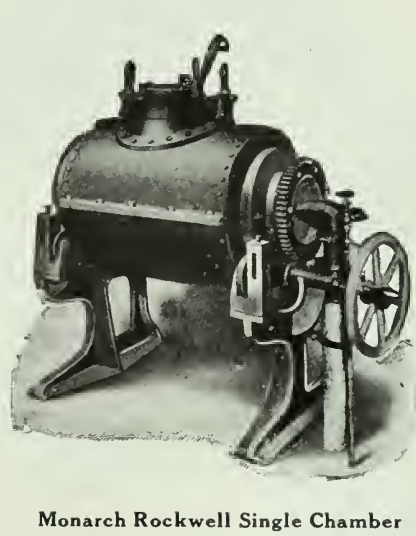

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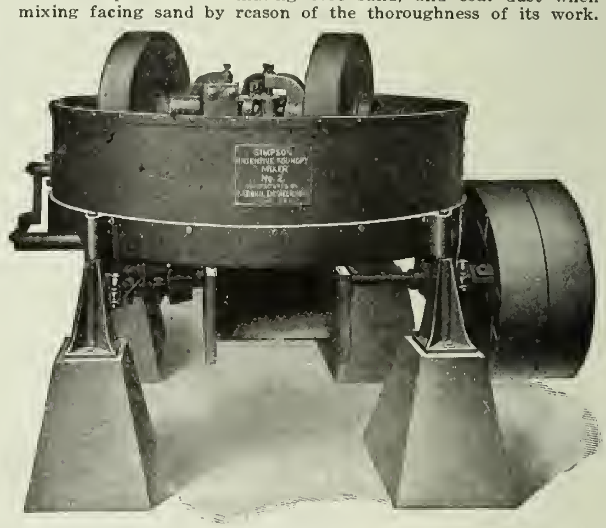

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The Shell Industry in Canada from a Metallurgical Viewpoint*

By Hugh Lamont**

In the course of a resumé of Canada's early efforts to produce munitions in quantity and quality, the author mentions several features, more or less insignificant individually, but having, collectively, a vital influence on the ultimate success of the work. The microphotographs demonstrate convincingly the value of expert scientific knowledge, and how it may be applied to the solution of vital problems beyond the scope of ordinary factory routine.

IN the first days of August, 1914, when the European crisis seemed likely to lead Great Britain into hostilities, the Government of Canada, confident in the patriotism of the Canadian people, pledged the support of the Dominion to the Imperial authorities in case war could not be averted. Thus it was that Canada, as an integral part of the British Empire, found herself in a state of war when Britain's declaration of August 4th was issued. The greater part of the militia was called out—bridges, public utilities, strategic points had to be guarded; but the greatest task of all was the enlistment and the equipment of the first Canadian Expeditionary Force, which, amounting to 33,000 men, was mobilized early in September and sailed overseas early in October.

Since that date Canada's contributions in men have gone steadily forward, until to-day her armies at home and abroad are rapidly approaching the half-million mark, with effective measures provided for reinforcements as required—no small contribution from a country of about seven million population scattered over the area which Canada comprises.

But the war could not be won by men alone, and it was quickly demonstrated that the artillery arm of the service was to play a part hitherto undreamed of, and the call for munitions and more munitions was early heard. Britain's arsenals were entirely inadequate, and she quickly began converting her industrial plants into munition factories. The Canadian Government, knowing the need for munitions and hoping to stimulate Canadian business, asked the co-operation of the manufacturers in producing shells.

Initial Attitude

Naturally there was a certain amount of reluctance on the part of the Canadian manufacturers to engage in a business entirely new to them. Different causes contributed to this attitude. The specifications called for a degree of accuracy in machining and strength of metal in the finished product, which to say the least was imposing. But most of all, the size of the original orders and the uncertainty of renewals, in fact, the uncertainty of the war itself as to how long it would last, all tended to caution the manufacturer to go slow, for in every instance it was necessary for the manufacturer to expend considerable capital to equip his plant to handle the business.

The pioneer manufacturers were induced to go into the business, not by the hope of making profits, but rather by a patriotic desire to do their bit in helping to win the war. Then, too, there was the matter of financing which the Canadian Government had to contend with, and at the very outset the munition industry required a considerable outlay of capital. Canada, young and undeveloped, had all along been a borrowing nation, and just at the outbreak of the war was experiencing a period of trade depression brought on by the bursting of the most sensational land boom in her history.

However, the Canadian Government, acting as the agent of the British War Office, was successful in placing the first order for shells, some 200,000 shrapnel, with the Canadian manufacturers about the first week in September, one month after hostilities commenced. This order was split among some half dozen concerns. From that initial order in September, 1914, the business developed, so that by November, 1915, the munition industry was the most important in Canada, embracing in all 320 firms. By April, 1917, when the United States entered the war, 630 firms were engaged in the production of shells and shell parts, giving employment to over 225,000 operatives, and the business involved an expenditure of $5,000,000 a week, with a daily average output valued at $1,500,000.

During the first part of the war the purchase of munitions was entrusted to a body known as the Shell Committee, representing and responsible to the British authorities. Later on this committee was replaced by the Imperial Munitions Board, but the business is carried on practically on the same principles.

The steel billets or rolled stock are purchased by the board from the steel manufacturer; it is then allotted to the different forging companies, who are held responsible for each shell less those required for testing purposes. From the forging companies it is distributed to the machining and assembling companies, who in turn are required to turn back to the board an equal number of shells as they receive less those required for test. Provision is also made governing each manufacturer's responsibility, and, considering the extent of the business and the fact that in only a few instances are completed shells produced by any one firm, the very small number of misunderstandings arising speaks well for the way the business is conducted, and especially bears evidence to the efficiency each Canadian manufacturer has attained in the respective operations allotted to him.

Returning to the original orders which were issued early in September, 1914, the manufacturers interested immediately began to get their plants in shape to handle the work. Machines had to be rebuilt, or new machines bought, but the first orders were practically all turned out on old machines with the necessary machining accessories to cover the requirements. In the matter of heat treating, old equipment, if there was any at all, was not practical, and new equipment had to be purchased.

In these matters each manufacturer had access to the Dominion Arsenal at Quebec, the only plant in Canada manufacturing shells, and was assisted so far as possible by the men in charge of the various departments. As each manufacturer had his equipment installed a trial lot of shell forgings were supplied to him and the problem of meeting the specification began.

Shrapnel Material

In shrapnel this specification called for a yield point or elastic limit of 36 long tons, or 80,640 lbs. per square inch, and ultimate breaking strength of not less than 56 tons, 125,440 lbs. per square inch, with an elongation of not less than 8 per cent. in ⅝ in. The test specimen is taken from the shell when partly machined, and after receiving final heat treatment at a point where the maximum bursting strain occurs, and known as the set-up point. The forgings were made from 3½ in. rolled stock, plain carbon steel from 0.45 to 0.55 in carbon, under 0.05 in sulphur, under 0.06 in phosphorus, manganese from 0.50 to 1.00, and silicon under 0.30 per cent. In the bar the steel must show a yield of 19 tons, 42,560 lbs., ultimate breaking strength 35 tons, 78,400 lbs., and an elongation of 20 per cent. in 2 in.

As the shell received a final heat treatment no strict specification was issued concerning the physical properties of the steel in the forging. But in order to meet the specification for the finished shell recourse was necessary to the double heat treatment. This necessitated the installation of two furnaces and quenching tanks. Further, each shell had to be nosed, requiring still another furnace and nosing press. Add to this the changes necessary to existing machinery, and it is not surprising that the end of October was reached before installations anywhere were completed,

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*A paper read before the Steel Treating Research Society of Detroit, Oct. 19, 1917.

**Manager, Toronto Testing Laboratory, Ltd., Toronto, Ont.

and the actual work of making shells that would be acceptable to the War Office begun.

Then came a period of trials and tribulations. The rough forging as received had first to be cut to length, rough turned inside and out, the recess for the copper rifling band cut and wave lines in the bottom of this recess formed before the final heat treatment was given, so that failure to pass specification not only entailed the loss of the shell forging with which the manufacturer was charged, but all the machine work done on it.

As machined for heat treatment the metal in the base of the shell would be ½ in. thick while the walls would be not more than ¼ in. Oil was used as a quenching medium though some water hardening was done, but on the whole it was found too severe and was frowned upon by representatives of the War Office. Pyrometers had been installed to keep accurate watch on the temperatures, scleroscopes to test the hardness after quenching and after tempering, but if the shells would not harden, they could not pass the physical requirements.

To enumerate all the difficulties that arose would be as easy to set down a list of Job's ailments. Sometimes it was the steel, sometimes the oil, next it would be the furnace that was at fault, and again the pyrometer. Expert and amateur suffered alike. Reputations were shattered and men lost faith in their fellowmen.

Growth Follows Success

By November 15, 1914, the government sent an urgent appeal for shells by November 30. Promises were made which unhappily could not be fulfilled and it was not until the latter part of December that shipment of Canadian shells began. Small at first, but they quickly grew in volume. Before the first orders were complete larger orders came and other manufacturers were preparing their plants to handle the business.

When it is considered that not only had changes in machinery to be made, but in many cases changes in plant layout, considering also the equipment that had to be added, and the general lack of knowledge concerning a business, as it were, hastily thrust upon him, the Canadian manufacturer is entitled to a great deal of credit in that he was shipping completed shells less than four months after receiving his initial order, and five months after war was declared.

To revert to some of the early troubles encountered in heat treating, as a rule the steel supplied was rather close to the lower limit both as to carbon and manganese, if not actually dropping below, though forgings really below specification were rare. But being close to the lower limit, especially in carbon, limited the range in which such shells should be quenched and tempered to get the required physical properties. The man in charge of the heat treating always aimed to carry his steel well past the critical range, but should the shell not show a proper hardness in quenching from that temperature, a higher temperature was tried, many cases of overheating resulting.

Microstructure of one of first shells heat treated in any Canadian plant is shown in Fig. 1.—carbon 0.47, manganese 0.53, magnified 100 diameters. Heated 1700 deg. F. quenched in oil, reheated to 1000 deg. F. cooled in air. Elastic limit, 34.7 tons, ultimate breaking strength 53.5 tons, elongation 19 per cent. Shells from this steel had previously been quenched from 1490 deg. F., reheated to 1100 deg. F. and failed. It was finally passed by quenching from 1550 deg. F. and reheated to 800 deg. F., the elastic limit reaching 39.6 tons, ultimate breaking strength 58.5 tons with an elongation of 14 per cent.

Whether or not the increased elastic limit and ultimate strength was altogether due to the lower temperature at which these shells were tempered is a question. The repeated heating may have refined the ferrite grain somewhat, the quenching temperature no doubt had an influence, but in the writer's opinion the tempering was the greatest factor.

In the early days numerous instances came under the writer's attention where shells, under 0.50 in carbon, which failed after being tempered at 1000 deg. F., were brought within specification by quenching from exactly the same temperature and reheating not over 800 deg. F., in some instances the ultimate strength being increased 6 tons, while the elongation in no instance went below 12 per cent.

The shrapnel shell being 9 in. deep with an inside diameter of 2½ in., it is obvious that success in hardening depends to a great extent on the manner in which the shell is lowered into the oil. The usual method of dipping base downward, allowing the oil to flow over the edge to the inside and swinging backwards and forwards was on the whole sufficient. An early installation provided for pumping cold oil into the interior of the shell as it was being lowered into the tank. This method proved very useful especially in low carbon, low manganese steels.

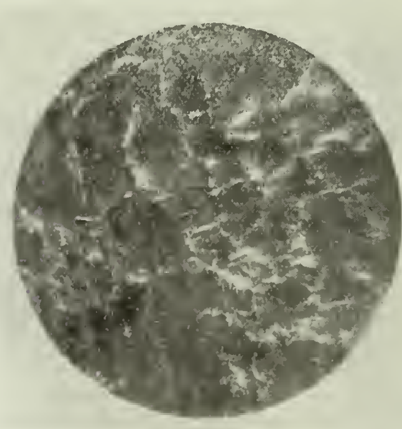


FIG. 1.

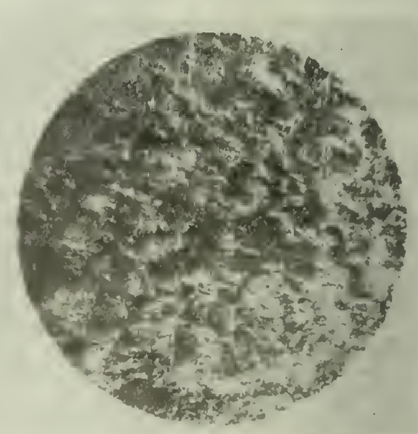


FIG. 2.

Quenching oils were another source of trouble especially in the early days. Some were justly condemned and some unjustly. Frequently an oil was accused of losing its life when the fault was due to a leak in the tank allowing water from the cooling system to penetrate, forming an emulsion, which as a quenching medium was far from being a success. In some cases the forgings were annealed at about 1200 deg. F. before machining. The better machining qualities were an offset to the extra operation, besides the steel was in better shape to receive final heat treatment.

Steel Makers Help

The steel companies were quick to recognize the value of a few extra points of carbon and manganese, so that as the work progressed less and less difficulty was encountered in hardening and in many cases, after quenching, it was necessary to reheat to a noticeable redness in order to sufficiently temper the steel.

Fig. 2 shows the microstructure of an average shrapnel shell recently made, carbon 0.52, manganese 0.75, magnified 100 diameters. The shell from which this specimen was cut was heated to 1550 deg., quenched in oil, reheated to 1000 deg., and cooled in air. Elastic limit 42 tons, ultimate breaking strength 70 tons, elongation 15 per cent.

Under a higher magnification the sorbitic condition of the steel is plainly seen. This is the condition which the manufacturer aims to produce. The temperatures in average practice vary from about 1450 deg. to 1600 deg. for quenching and from 800 deg. to 1100 deg. for tempering, depending on the carbon content. In ordinary furnace practice 20 minutes would be about the average time required to heat the shells for quenching with possibly a little longer time for tempering.

It would be about April, 1915, that the first orders for high explosive shells were placed in Canada. First came the 3 in. shell, in outer design the same as shrapnel, but with thicker walls. These shells were machined from bar stock and required no heat treating. Later came the 4.5 in., and 6 in. high explosive, and later still the 8 in. and 9.2 in., which cover the range of Canadian manufacture. All these shells had to be forged, and as the demand for high explosives grew rapidly, many new forging companies entered the field.

It being necessary for the shrapnel

shell to receive a final heat treatment, no strict specification covering the properties of the steel in the forging was required, whereas the high explosive shell not undergoing such treatment must possess the required physical properties before leaving the forging plant. The specifications covering this type of shell call for an elastic limit or yield of 19 tons, and ultimate breaking strength of not less than 35 tons, and not more than 50 tons, with an elongation in 2 in. of not less than 14 per cent. The maximum carbon content is 0.55 and while there apparently is no minimum the forging companies are not required to accept anything under 0.40 per cent. The minimum manganese content is 0.40 and maximum 1.00, sulphur and phosphorus under 0.05 and silicon under 0.30 per cent.

The shells are forged from either rolled or cast blanks; while many of the 4.5 in. and 6 in. shells have been forged from cast blanks, the tendency is to produce these types from rolled stock. The 6 in. and under are forged with a solid base. The 8 in. and 9.2 in. are forged with a solid nose, the blanks being cast with an tapered nose approximating the taper in the finished forging.

For the forging operation, the blanks are generally heated to a temperature of from 2000 deg. to 2200 deg., either in large continuous furnaces or in smaller batteries where the shells are all brought up to forging temperature together. The piercing, as a rule, is done in one operation and the shells cooled. The cooling is either retarded or accelerated according to the carbon content.

Where the carbon drops down to 0.40 per cent., accelerated cooling is necessary, whereas in the higher carbon steels the cooling must be retarded as much as possible. Practice in this respect varies in different plants and for the different types of shells. As a rule, low carbon heats are stacked in the open, considerable space being left between each shell for circulation of the air. High carbon heats are stacked closely, well protected from the air and may be covered with cinders or some similar medium to retain the heat. In no case is it permissible that the shells be in contact with each other during cooling. Test pieces are taken from each heat after forging, and any heats failing to pass the specifications are set aside to be normalized or annealed.

Failures and Their Treatment

Rejected heats may be either too weak or too strong and must be either brought up or toned down. Failures generally occur in those heats close to the minimum and maximum carbon content. Low carbon heats, showing a failure to reach the minimum breaking strength, low in elastic limit, and high in elongation, should be brought to a heat slightly above the critical range and cooling accelerated.

High carbon heats showing too great a strength and low elongation should be heated well up but not through the range and cooled slowly. It is not often that rejected heats fail to respond to the annealing treatment.

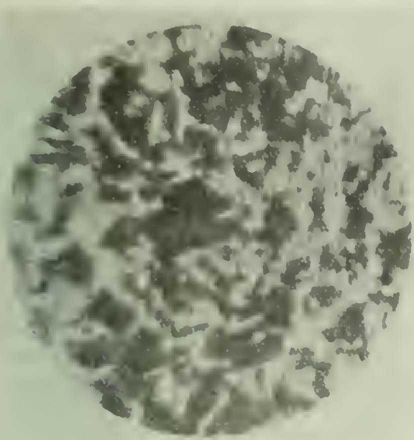


FIG. 3.

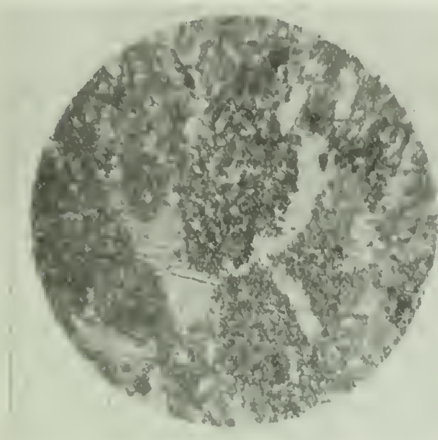


FIG. 4.

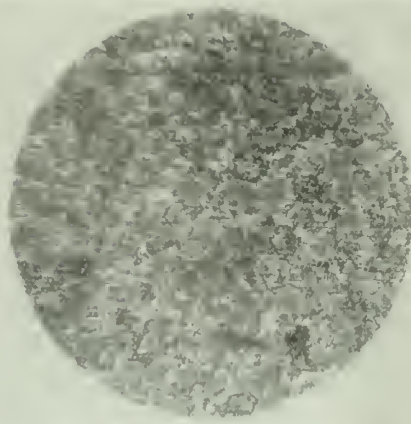


FIG. 5.

Some low carbon, low manganese heats, failing to respond to ordinary air cooling, have been brought up to strength by an air treatment which consists of forcing cold air into the interior of the shell, the exterior at the same time being subjected to similar treatment.

Fig. 3 shows the microstructure of a 0.40 carbon steel as forged which failed in the test, magnified 100 diameters. Yield, under 19 tons, ultimate breaking strength 34.5 tons, elongation 26.5 per cent.

Fig. 4 shows the same steel annealed at a temperature of 1400 deg. Magnified 100 diameters. In this specimen the heating has not been sufficient to break up the ferrite grain, yet the refining of the pearlite has added sufficient to the yield and ultimate breaking strength to pass specifications. Yield over 19 tons, ultimate breaking strength 38 tons, elongation 26 per cent.

Fig. 5, microstructure of a similar steel, 0.440 carbon, 0.76 manganese, heated to 1550 deg., cooling accelerated. Yield over 19 tons, ultimate breaking strength 48 tons, elongation 19 per cent. In this specimen the heating has been carried through the range, a new structure being formed.

Fig. 6 shows the structure of a 0.50 carbon steel as forged, and cooled quickly. Magnified 100 diameters. Failed too short.

Fig. 7, a similar steel as forged, cooling retarded. Magnified 100 diameters. The retarded cooling has permitted the normal amount of ferrite to separate out. This steel passed. Yield over 19 tons, ultimate breaking strength 38.7 tons, elongation 23 per cent.

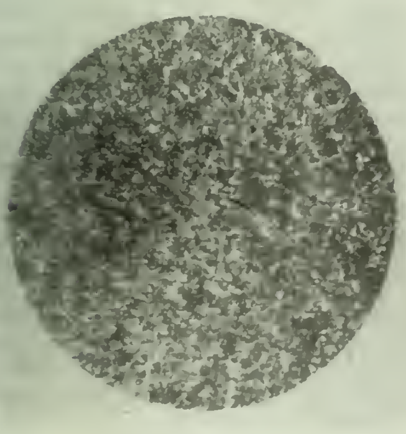


FIG. 6.

FIG. 7.

While it is true that the munition industry in Canada has not developed anything new in heat treatment so far as the science is concerned, still the Canadian manufacturer has proven his ability to meet the demands made upon him. Eight hundred thousand completed shells every week, a greater production of munitions than that of any nation before the war except Germany, is evidence of the part Canadian industry is playing in the Allied cause.

EFFICIENCY IN THE FOUNDRY*

By James A. Fitzgerald, Reno, Pa.

WHAT is efficiency; where does it start, and where does it end? Efficiency is the easiest and shortest route by which we may obtain a particular desired result. Its starting point is closely allied with a good cost accounting system and its end is unmeasurable.

We are informed by statistical reports that the failures in the business world run exceedingly high, and we naturally wonder why this is true. Upon investigation we find either a deplorably inefficient cost accounting system or gross inefficiency in the way the business is being conducted, due either directly to faulty cost accounting or to errors of the men in authority. In the latter case, failure comes because men do not take sufficient time to consider the vital factors which control the destiny of business. I sincerely believe that there is not a man living who at some period of his life has not had the amibition to go into business for himself and has enjoyed the promise of future success. Many have succeeded after years of struggle, and if one could induce these men to honestly relate their advancement to success, they would, without doubt, mention their method of cost accounting, its efficiency or inefficiency, and its results.

Business Warnings Are Unheeded

On the other hand, there are many failures of which we are uninformed, because we surround ourselves with the promise of a bright future, thus preventing us from heeding the warnings sounded by the mistakes of others. For this reason, a number of manufacturers approach near to the brink of business disaster before they learn the necessity of promptly making radical changes in order to repair the damage done by inefficiency and improper cost accounting.

Efficiency in the foundry does not always imply that efficient methods shall exist only in the foundry proper. On the contrary, efficiency must be applied in all departments. If efficient management reflect in a most desirable manner the effort that has been put forth by the men in charge.
exists all along the line, the foundry will

A few years ago, whenever we had occasion to call on foundries, we generally found an ill-lighted, vile-smelling, dust-covered, dirty institution.

To-day, conditions are just the reverse. Why? Because in the old days very little scientific work along foundry lines had been accomplished. The foundryman kept no real record that he could refer to and find out where or at what point in the transaction of his business he had sustained a loss. The casting business was decidedly risky from a financial standpoint, or at least was considered as such. To-day we have well-lighted, ventilated and heated foundries, with all of the most modern and up-to-date conveniences. Moreover, our shops are scrupulously clean. Why have these changes come about? One foundryman will say competition brought them, and another will say we did it in order to better our financial standing. Others will present other reasons, and each of these has a certain bearing on these changes. However, the two great factors which have brought about the transformation in the foundry are system and science. With system we keep an accurate record or records of what is being done, and with science we determine beforehand what results we may reasonably expect before we spend our money. In the foundry, as in all other lines of business, we are dealing with natural laws which have been in force ever since the beginning of time. As long as we recognize these natural laws and keep within certain well-defined limits, we may anticipate results with the assurance of success.

*A paper read at the annual meeting of the American Foundrymen's Association, at Boston, Sept., 1917.

STEEL CHIMNEY TROUBLES

By T. J.

CHIMNEYS built up of steel plates require protection both inside and outside, if they are to have reasonably long life and perform their work properly. The outside of a chimney is exposed to the action of sun, wind and rain, and the approved method of protecting it from rust is to give it a coat of good paint, which should be renewed whenever and wherever it shows signs of peeling off and exposing the metal to the influence of the elements. On the inside the chimney is exposed to the action of the gaseous products of combustion, which may have a temperature of several hundred degrees. Any form of paint would, therefore, be quite useless. Besides it must be remembered that the gases which flow up the chimney are derived from the combustion of fuels containing carbon, hydrogen, and sulphur, and, therefore, contain carbon dioxide, steam and sulphur dioxide. The steam in the chimney gases will condense if cooling takes place to any great extent, and the moisture will combine with the dioxides of carbon and sulphur to form carbonic acid and sulphurous acid. Both of these acids are corrosive in their action on iron, and they are particularly active in the presence of heat. Therefore, the inside of the chimney needs to be well protected.

The usual method of protecting the interior of a steel chimney is to line it with brick, which is laid up against the wall of the chimney. It is advisable to fill the interstices between the lining with a grout made of cement, as this will not only give support to the brickwork, but will at the same time prevent the corrosive acids from reaching the shell. Such a lining should extend to the top of the chimney to be effective. If it is carried up only half-way or even to two-thirds of the full height of the chimney the corrosion is localized at the part of the structure that it is most difficult to reach. The formation of moisture, due to condensation of vapor in the flue gases, will occur in the upper part of the chimney rather than in the lower, because the gases grow colder as they ascend, due to radiation from the shell of the chimney. It is, therefore, very advisable to carry the lining all the way up to the top.

It will be found upon observing steel chimneys that are in service that the signs of discoloration and corrosion on the outside are largely confined to the upper half of the structure. The rings or sections composing the chimney are put together in such a way that each overlaps on the outside of the ring below it, so that the edges of the circumferential seams face downward outside. This construction prevents rain and snow from collecting on the edges of the plates outside. On the inside, however, the edges face upwards, and if moisture is formed it will lodge on these edges, find its way through the joint and run down outside, streaking and discoloring the chimney. A continuous lining from the top to the bottom will lessen the radiation loss, reduce and perhaps eliminate condensation and in any case eliminate the moisture from the edge of the plates.

EFFECTS OF STORAGE UPON THE PROPERTIES

A SERIES of experiments, started ed in 1910, to determine the effects of storage upon the properties of bituminous coal has recently been completed by the Engineering Experiment Station of the University of Illinois. The object has been to devise methods of storing which will avoid the risk of spontaneous combustion and to determine the extent to which coal deteriorates in storage. Professor S. W. Parr, under whose direction the tests have been conducted, summarizes the results in Bulletin No. 97 of the Engineering Experiment Station. It is shown that, if properly sized and carefully handled, coal may be stored without danger of spontaneous combustion; that the actual loss of heat value, or deterioration, resulting from storage is slight; and that underwater storage eliminates entirely all risk of spontaneous combustion or of deterioration. The extent of the waste and economic loss incident to the present method of seasonal production, with its attendant abnormal demands upon transportation facilties is discussed, and it is estimated that the lack of storage facilities in large distributing centers necessitate a capital investment in mines and railroad cars of $500,000,000 in excess of the amount which would be required if production could be maintained at a uniform rate throughout the year.

Evidence accumulates that the gold resources of Northern Ontario are extensive. Developments at Porcupine have been well up, and Kirkland Lake shows signs of being a good second. A satisfactory feature is that the newer gold camps are scattered over a wide area

Fuel Economy Possibilities in Brass Melting Furnaces*

By L. C. Harvey

Developments in the production of ships' fittings and similar equipment have resulted in greatly increased use of brass in various forms. Despite the urgency of the demand, the cost of production warrants close attention to all opportunities for economy, and the experiences of the author are thereby of more than passing interest at this time.

FUEL economy is a very engrossing proposition, and one in regard to which it is to be hoped that the future will furnish ideas and methods that will make past efforts in this direction appear very primitive and inefficacious.

Let us consider, first of all, the amount of coal mined in the world for one year, and the possible extent of the wastage of that year's supply of coal. For 1910 the amount was about 1,300,000,000 tons, and it is improbable that anything like 5 per cent. of this fuel was ever turned into actual useful work. This means that 1,235,000,000 tons of coal were mined only to be wasted in heat radiation and other losses; this represents enough fuel to melt and superheat 2,500,000,000 tons of brass to 10 per cent. above its melting temperature.

Until petroleum becomes available in bountiful quantities, and its price in consequence is brought down to reasonable limits, the only fuel to consider is coal. Now coal should be used as mined, in the furnaces direct, or in gas-producers adjacent to the furnaces. The process of coking the coal is only a means to obtain a clean, smokeless fuel, of intense heat value, at the expense of considerable wastage during this costly process of coke manufacture.

Scope of Paper.

This paper has been written in the hope of encouraging progress in the direction of economy in fuel. It relates only in a very superficial degree to the quantities of fuel used in the melting of brass, but it is hoped that the points brought out will be accepted as of such national importance—apart from individual interest—that close investigation will be made generally into fuel consumptions in brass foundries.

Considerable quantities of copper, brass and bronze used for gun-mountings, heavy plate, stern tube liners, propellers and other products are melted in reverberatory furnaces, chiefly for the reason that very heavy castings are required; but these furnaces consume several times the amount of fuel that would be used to melt the same amount of metal in crucible furnaces. Reverberatory furnaces are, therefore, greater fuel wasters even than crucible furnaces, which are themselves extremely inefficient. It is not an uncommon occurrence for a reverberatory furnace to burn twice as much fuel per ton of metal melted as the quantity that would be used in the usual types of crucible pit furnaces, and six times the amount of fuel required for tilting furnaces.

The amount of metal melted and the weight of fuel used in these reverberatory furnaces have not, however, been taken into account in this paper, so that the estimates I mention refer only to crucible melting plants. It is quite impossible for anyone to give exact figures for tonnage output of metals melted in crucibles under the present conditions without full access to Government and trade statistics, but it can be definitely accepted that whereas the assumed figure for the quantity of brass melted in this country during 1916 is one that probably falls a good way short of the real collective output of the brass foundry trade, the deductions arrived at in regard to fuel used are under-estimations.

I have been closely associated with melting and casting-shop practice for many years, and on behalf of the Morgan Crucible Company have been privileged to design the crucible melting plants supplied to most of the large Government and private undertakings which have been instrumental in producing the enormous quantities of metal—notably brass for fuse rod and cartridge strip—that have been required by the Government during the past three years. In order to keep a clear issue under consideration, the calculations given in this paper refer only to the melting of this class of metal.

Low Efficiency of Present Practice

Though much thought and ingenuity have been expended during recent years upon the equipment of coal-consuming plants with more efficient types of boilers, fuel economizers, mechanical stokers, feed-water heaters, etc., with one ultimate end—the saving of fuel—in the brass foundry, it is still the general practice to melt metals in small uneconomical coke-fired crucible furnaces of the pit type, having heat efficiencies of only 2 per cent. to 6 per cent. This is the range of efficiency for the general type of coke-fired natural draught crucible brass-melting furnace, and unfortunately more often than not it falls to the lower figure.

Assuming, for sake of argument, that the output of brass for the above-mentioned purpose during the war rose to 2,000,000 tons in 1916 for Great Britain alone, the amount of coke required to melt this quantity of metal in small pit furnaces of 5 per cent. heat efficiency would have been 800,000 tons.

This presupposes that the coke has a calorific value of 12,960 British thermal units per pound, and that 261 British thermal units are required to melt brass of, say, 70:30 mixture and to superheat the alloy to 10 per cent. above its melting point.

In other words, the total amount of heat imparted to the metal would be 1,169,280,000,000 British thermal units, representing 41,714 tons of coke, which means that the balance of 758,286 tons of coke would be wasted in radiation and flue losses. This amount of useless fuel at 35s. per ton would cost £1,327,000, and the total amount of 800,000 tons £1,400,000.

The relatively large capacity crucible tilting furnace had fortunately been developed during the ten years previous to the outbreak of war, and very large plants of this type were immediately put down. So far was this the case that, taking into consideration the tilting furnaces existing prior to August, 1914, together with the new plants put down especially for war work, it can be accepted that of the quantity of brass mentioned —2,000,000 tons for 1916—one-third of this total was melted in tilting furnaces.

Now the average all-round working heat efficiency of the coke-fired crucible tilting furnace on 70:30 brass is about 15 per cent.

If, therefore, the whole of this assumed 2,000,000 tons of metal had been melted in tilting furnaces, the amount of fuel used would have been reduced to one-third, say, 266,666 tons of coke, of which the heat value of 41,714 tons would have been imparted to the metal and that of 224,952 tons of coke wasted in furnace and flue losses. In money this would mean £393,666 spent on useless fuel in tilting furnaces as against £1,327,000 in pit furnaces. Assuming that 2,000,000 tons of brass were cast in 1916, of which one-third was melted in tilting furnaces, these plants were responsible for saving the nation approximately 178,000 tons of coke, having a total value of £311,500.

This, however, is not the whole story, for the coke used in melting furnaces has to be made from coal, in which process there is a further wastage. Gases and volatile constituents which could be utilized in the melting chambers of furnaces are lost in the coke ovens. That "metallurgical" or "foundry" coke is necessary for cupola work is undisputable; but this high-grade fuel for brass melting is not essential if systems can be modernized and improved so that coal can be used direct instead of having first to convert it into coke.

This can be done in two ways, by the use of—

*A paper read before the Institute of Metals, London, September, 1917

(a) Powdered coal, which is the most efficient way of using solid fuels.

(b) Unscrubbed producer gas, a compromise, but still a more or less direct application of solid fuel.

The first system is the ideal one, resulting in no loss of heat prior to burning in the furnace.

The second method is a convenient heat efficiencies of crucible melting furnaces cannot be raised to 30 per cent. and 40 per cent. by careful study and application of improved methods of combustion and utilization of the heat carried off in the waste gases. Electric crucible furnaces have actual heat efficiencies of 50 per cent. to 75 per cent., but this is exclusive of previous wastage

The overall working efficiency of small gas-fired pit-type crucible furnaces is approximately the same as for the larger tilting type, and can be taken at 15 per cent. Assuming the calorific value of town gas to be 550 British thermal units per cubic foot, then 2,126,000,000 cub. ft. of gas would be required to melt and superheat the 2.000,000 tons of brass. In

TABLE I.—RELATIVE QUANTITIES OF COAL USED IN VARIOUS TYPES OF CRUCIBLE FURNACES.

Type of Furnace.	Pit Furnace	Tilting Furnace	Tilting Furnace	Single Crucible Pit Furnace or Tilting Furnace		Multiple Crucible Pit Furnace, or Single Crucible Tilting Furnace	Pit Furnace	Tilting Furnace
Fuel	Coke	Çoke	Powdered coal	Town gas		Producer gas	Oil	Oil
Heat efficiency	5%	15%	15%	15%		10%	5%	14%
Tons, or cubic feet of fuel used for an output of 2,000,000 tons of brass....	800,000	266,666	......	14,336,000,000 cu. ft.		....	530,000	200,000
British thermal units value per pound or cubic foot.	12,960	12,960	12,960	550		135	19,700	19,700
Tons, or cubic feet of fuel used to useful purpose (net)	41,714	41,714	41,714	2,126,000,000 cu. ft.		8,661,000,000 cu. ft.	26,497	26,497
Tons, or cubic feet wasted in losses (net)	758,286	224,952	224,952	12,210,000,000 cu. ft.		89,600,000,000 cu. ft.	503,503	175,303
Coal Values (Coke and Gas in Terms of Coal.)								
Tons of coal used.....gross	1,143,000	380,951	266,666	†1,371,832	‡548,734	733,267	§805,633	§304,012
Tons of coal usefully employed* ....gross	60,735	60,735	41,714	†177,166	‡70,867	70,960	......	......
Tons of coal wasted........	1,083,265	320,216	224,952	†1,194,666	‡477,867	662,307	......	......
Ratio of net coal or oil utilized to useful purpose to gross fuel mined	1 to 27	1 to 9	1 to 6	†1 to 32	‡1 to 13	1 to 12	1 to 19	1 to 7
+ Saving over coke fuel pit furnaces in terms of coal used to melt and superheat 2,000,000 tons of ordinary brass	......	+702,049	+876,334	—†228,832	+‡594,266	+409,733	......	......

*Allowing for losses in production of coke, etc. †Inclusive coke produced. ‡Exclusive coke produced.
§Heat equivalent value of oil in terms of coal.

NOTE.—Figures given above for "gross" tons of coal used in the case of "town gas" include the by-products gas-coke, coal-tar, etc., the commercial value of which would be deducted before arriving at a final efficiency figure for this system of heat development and application.

one where large plants are concerned, but it is not so readily applicable to the small foundry, and in any case there are producer losses which are absent in the first system. These losses, however, probably counterbalance the energy required to grind coal to the powdered state.

Powdered coal can be applied and burnt as readily as liquid fuel or gas, and it has many of the important advantages of these fuels in so far as running costs for crucibles, linings, labor, etc., are concerned. It is well known that these costs are much below those for coke-fired furnaces.

Referring again to the figures mentioned above, we will consider what this means in quantities and cost of coal, if used direct in powdered form.

For the 2,000,000 tons of brass, if melted in pit furnaces, 800,000 tons of "metallurgical" or "foundry" coke were required. In terms of coal this would mean about 1,143,000 tons of coal. On the other hand, if crucible tilting furnaces had been used entirely the overall amount of coal burnt as powdered coal, leaving the efficiency of the furnace still at 15 per cent., would have been approximately the same as the figure given for coke, viz., 266 666 tons, or a saving of 733,334 tons of coal for 1916, if the powdered coal system had been available. A very small amount of this gross saving of fuel would have been used in supplying air under a slight pressure for burning the powdered coal.

This, again, is still allowing for a relatively low furnace efficiency of 15 per cent., but it is inconceivable that in current generation and distribution. If the overall losses of steam and current generation, resistance losses in mains, etc., are taken into account, an efficiency of 50 per cent. in the electric-heated furnace drops down to about 10 per cent.

Use of Gas Fuel

During the past three or four years town gas has been very successfully employed in crucible melting furnaces from the standpoint of cleanliness, convenience, and especially life of crucibles, viewed from which this system has many important claims. But as a fuel economizer it has none. Let us briefly consider this question on similar lines to those followed in the case of coke furnaces.

TABLE II. — APROXIMATE RELATIVE HEAT VALUES AND FLAME TEMPERATURES OF FUELS

	Heat Value of Cold Gas or Fuel	Theor. Max. Flame Temp. Air at 0 deg. C.	Theor. Max. Flame Temp. Air at 300 deg. C.
Coke pro. gas (B.T.U.)	(143 gross (136 net	)1,600)	1,700
Dowson soft coal gas	(148 gross (139 net	)1,600)	1,700
Mond soft coal gas....	(159 gross (145 net	)1,530)	1,630
Wood producer gas....	(161 gross (153 net	)1,600)	1,700
Riche wood retort gas.	(385 gross (349 net	)1,860)	1,990
Anthracite produc. gas	(173 gross (161 net	)1,670)	1,780
Water gas............	(317 gross (294 net	)2,030)	2,160
Town gas.............	(600 gross* (550 net*	)2,000)	2,100
	B.T.U. per lb.		
Metallurgical coke.....	12,960	2.090	2.250
Bituminous coal.......	14.000	1,990	2.160
Petroleum (water-free)	19,700	2,160	2,310

* Maximum values (pre-war).

pit furnaces and tilting furnaces the total amount of gas burnt for this quantity of brass would have been 14,336,000,000 cub. ft.

In terms of coal, assuming 1 ton to yield 12,000 cub. ft. of gas, this would mean approximately for either the pit furnace or tilting furnace 177,166 tons used for useful purpose and for the production of 106,000 tons of gas coke, and 1,194,666 tons of coal wasted in heat radiation and flue losses, and production of 717,000 tons of gas coke. It will therefore be seen that, apart from leakage in the gas mains, which may be considerable, pit furnaces and tilting furnaces take a maximum quantity of 1,371,832 tons of coal as gas: 1,143.000 tons of new coal as coke (800.000 tons of coke), at a value of, say, £1,143.000 (taking coal at £1 per ton); or £1,400,000 as coke (at 35s. per ton).

On the other hand, tilting furnaces would take 380,951 tons of new coal as coke (266.666 tons of coke), at a value of £380,951, as against 1,371,832 tons of coal for making gas (60 per cent. gas-coke production would equal 823 300 tons of this by-product, which can be re-used in gas producers).

These costs, however, bear a more striking significance if they are considered in relation to the usual charge for gas at prices charged for town supply. Say this is 2s. per 1.000 cub. ft., then the cost alone for melting the 2,000,000 tons of brass would be £1.433 600.

The suggestion therefore arises that gas, if used, must be produced upon the site, and this brings us to the second proposition already mentioned—producer gas. Producer gas cannot be economically generated for very small plants, but for the larger capacity melting furnaces, even when only one or two units are installed, the producer-gas system presents a very convenient arrangement; and I believe a simple and efficient producer for small melting plants will shortly appear upon the market. Assuming for sake of argument that producer gas had been used for melting the 2,000,000 tons of brass, the following figures show the approximate costs of this system.

Brass can be melted with a consumption of about 20 cub. ft. of 135 British thermal units gas per pound of brass in tilting furnaces, and with about the same consumption in multiple crucible pit furnaces (it is no use considering single crucible pit furnaces for low-power gas). For this producer gas 1 lb. of coal will yield, say, 60 cub. ft. of gas, so that the tonnage of coal required for pit and tilting furnaces would be about 666,607 tons, costing £666,607 for fuel alone to melt and superheat the brass, and 10 per cent. at least can be added for losses in the producer, which brings the coal consumption and value to 733,267 tons and £733,267. Thus we have a virtual saving of, roughly, 40 per cent. in quantity of coal, and 50 per cent. in cost of fuel when gas is made in producers instead of taken from the town mains.

Fuel Oil Applications

Fuel oil would have been very generally taken up had it been possible in past years to rely upon constant supply at a reasonable price; but it is fortunate for the nation that these doubtful factors prevented the wide adoption of this fuel. Shortage and ultimate discontinuance of supply would have been disastrous.

Up to some few years ago compressed air or steam had to be employed for efficiently pulverizing the relatively small quantities of oil for crucible furnaces. Compressed air is in every way preferable to steam as a means of pulverizing liquid fuel to be burnt in contact with plumbago crucibles, and it is especially so for high heat generation, but considerable power is necessary to drive the air compressor.

Some years ago I designed a low-pressure air-blast burner, which has now been fitted to some hundreds of crucible furnaces, and this gives just as satisfactory results as does the high-pressure system; yet this is not the ideal method, and it is hoped that it will not be long before a more efficient system of burning oil with natural-draught burners replaces all the old methods which employ compressed air, steam or forced draught.

It may therefore be interesting to complete this survey of fuel costs by the inclusion of those for fuel oil, but a figure bearing some relation to the prices taken for coal and coke must be assumed. Fuel oil has been quoted recently at 160s. per ton, but in order to bear some relation to coal and coke at the prices taken, the cost of oil must be reduced to, say, 80s. per ton.

The heat efficiencies of single crucible pit furnaces and tilting furnaces are, roughly, 5 per cent. and 14 per cent. respectively. Taking the calorific value of fuel oil at 19,700 British thermal units per pound, pit furnaces will require 530,000 tons at a cost of £2,120,000, and tilting furnaces 200,000 tons at a cost of

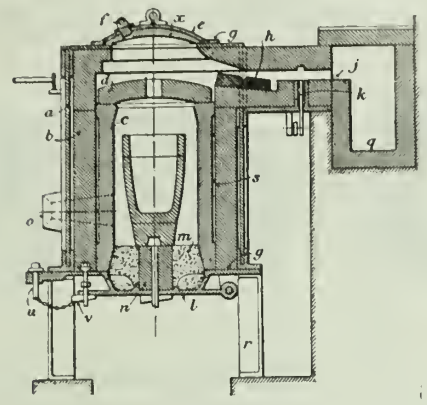


FIG. 1. SECTIONAL ELEVATION OF SUGGESTED FURNACE.

£800,000. Leaving out of account the small home production of fuel oil this large quantity of oil would have to be brought from abroad, and if used in pit furnaces 503,503 tons, and in tilting furnaces 175,503 tons of the fuel would be shipped to this country only to be converted into heat to be dissipated in radiation and flue losses.

I have confined my figures to the melting of brass alone, and they do not include the fuel used for melting the large quantities of malleable iron, certain steels, aluminum, special alloys, cupronickel, etc., that are melted in crucibles.

The furnace efficiencies given above are those for general all-round work. Actual test efficiencies would be somewhat higher.

Comparative Efficiencies

From a point of view of overall working heat efficiencies there is therefore not much to choose between crucible tilting furnaces for any class of fuel—coal, coke, oil, town gas, or producer gas —if the most economical size and type is taken for each fuel; but where pit fur-

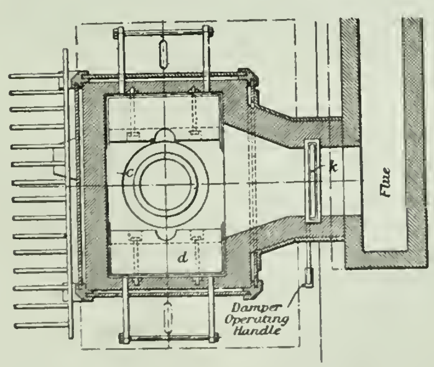


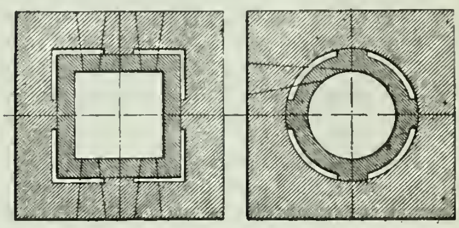
FIG. 2. PLAN OF SUGGESTED FURNACE.

naces are concerned there is a very marked difference, and those fired by means of town gas now hold the palm. For convenience of comparison the quantities of fuel and their costs, and also the heat efficiencies of furnaces for different kinds of fuel, are given in Table I. (above). Table II. (above) shows the approximate heat values of different fuels.

The reason why tilting furnaces have so much higher heat efficiencies than pit furnaces is in a measure due to the elimination of many of the absurdities of the pit type, but chiefly is it due to the higher grade and quicker-heating crucibles used in the former when taken in conjunction with the larger capacities of the crucibles. For output and cost of melting it is undisputed that the tilting furnace plant is a long way ahead of pit furnaces, but on the question of quality of alloy made the tilting furnace has not definitely proved that it possesses this feature. Experts seem still to maintain that the pit furnace taking smaller crucibles has not yet been superseded as far as quality of metal is concerned.

It is quite conceivable that this is so, and as the efficiency of the present-day pit furnace is so very low it becomes more than ever necessary to see whether the design cannot be improved. With this end in view I have suggested a furnace as illustrated in Figs. 1 and 2.

In this furnace it is intended that the lining shall be thick, in order to reduce the amount of heat radiation. An air insulating cavity is suggested between



FIGS. 3 AND 4. SHOWING AIR INSULATING CAVITY BETWEEN INNER AND OUTER LINING.

the inner and outer firebrick lining (Figs. 3 and 4), or this cavity can be packed with zirconia earth. The outside of the furnace to be fitted with expanded metal for lagging. The flue outlet to be central, and the flame issuing to be at any time visible to the operator. The secondary flue opening to the main flue to be controlled by means of a damper, and a preheating hearth to be arranged in this flue passage. The furnace to have an outside metal cover, so that all products of combustion and zinc smother will be drawn into the main flue. The bottom to be in the form of a hinged pan for collection of spilled metals and the space above filled with quartz nodules into which slag can soak below the level of useful fuel (in coke-fired furnaces) and away from the burner inlet of oil or gas-fired furnaces.

When it is essential to use small capacity crucibles a greater degree of economy can always be obtained in multiple crucible furnaces. Very useful types of gas-fired furnaces have recently been described—notably the Hermansen furnace and the Parsy furnace, both of which are on the self-contained producer principle.

A type of oil-fired multiple crucible furnace that I designed some years ago has given, I believe, very good results. The difficulty I had to contend with was the absence of control of any one crucible in a multiple crucible furnace having one large melting chamber. Figs. 5 and 6 show a furnace which entirely gets over this difficulty.

It has a common melting chamber at the base of the crucibles, but the upper portion is divided off into separate compartments, each with its own flue outlet.

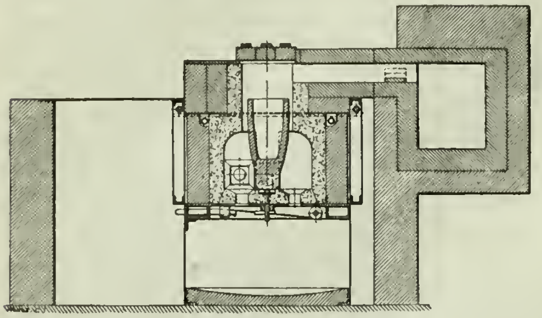


FIG. 5. SECTIONAL VIEW OF MULTIPLE CRUCIBLE FURNACE FOR OIL, GAS, OR POWDERED FUEL.

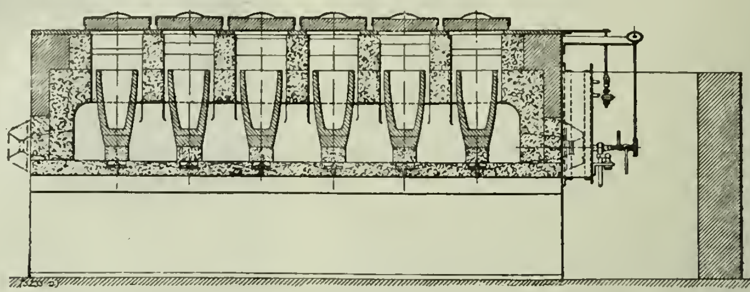


FIG. 6. SHOWING ARRANGEMENT OF CRUCIBLES IN FIG. 5 AND LOCATION OF FUEL BURNERS.

It is found that the removal of any one cover in no way affects the actual melting conditions in the other chambers. This design makes it possible to use two oil fuel burners for a six-crucible unit instead of six burners for separate furnaces. The working efficiency of this type of furnace is about 10 per cent., as compared with 5 per cent. in single crucible furnaces. There is a saving of 50 per cent. of fuel in favor of the multiple crucible furnace.

Waste Due To Poor Refractories

The relatively poor qualities of refractories used as linings are in a great measure responsible for ever-varying fuel consumptions.

When a furnace is newly lined it has the highest heat efficiency, but as the lining becomes worn or broken away the fuel consumption can well be double the amount used when the lining is new. In order to overcome this trouble to some extent in tilting furnaces, and so keep the fuel consumption at a more uniform level, I have suggested the special form of grate pan shown in Fig. 7. It is found that more or less liquid slag at the end of a heat moves to the front of a tilting

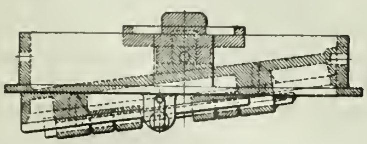


FIG. 7.

furnace as the metal is poured, becomes set round the front of the crucible and obstructs the passage of air at this point. The result is that the lining is cut away by the inrush of air and intense heat at the back and round the sides of the coke space, and the fuel space becomes greatly increased at these points. It is hoped that with the new form of bottom grate pan the slag will accumulate below the useful fuel line, thereby saving the life of the lining and reducing fuel consumption.

Radiation losses can be reduced to a certain extent by providing composite linings. It is well known that the most refractory materials, such as carborundum, are at the same time good conductors of heat. In the *Foundry Trade Journal* for July 12, 1912, certain facts bearing upon this were noted; for instance, a firebrick of moderately good quality, although relatively inferior as a refractory material, was shown to have radiated much less heat than the higher-grade refractories—silica, alundum, silicon carbide, magnesia—whereas the ordinary red building brick showed undoubtedly the best insulating properties. An inch of lagging on the outside of the furnace also reduced heat radiation losses by more than 50 per cent.

The greatest loss of heat in a melting furnace occurs in the waste gases, and it has been proposed that CO_2 recorders should be used as a guide to the state of combustion. This is more or less impracticable, owing to the number of furnaces often installed.

Suppose there are 50 pit fires connected to one main flue, it would then be necessary to fit a CO_2 recorder in each individual branch flue. An analysis of gas in the main collective flue would not indicate which furnace was working inefficiently. Besides, in coke-fired furnaces the constituents of waste gas vary momentarily, and when fresh fuel is added there is a high percentage of CO, which passes straight into the flue. Only when gas or oil-fired furnaces are used can the combustion be confined within economical limits. A visual flame issuing from the central furnace flue outlet then indicates the state of combustion with sufficient clearness for all practical purposes.

These suggestions are only put forward as possible means of improving the heat efficiencies of pit-fire furnaces for coke, oil or gas, but the real question remains still unsolved, viz., how to utilize the major portion of the heat contained in fuel. The satisfactory application of powdered coal certainly offers an alluring proposition.

In conclusion I would express my indebtedness to the Morgan Crucible Company, Limited, for permission to submit this paper to the Institute of Metals, and for the information which has enabled me to estimate the output of brass for 1916 within probable limits.

The paper has been written almost at the last minute; but if members consider that it is incomplete and inconclusive, I hope that it will serve as an incentive to others to continue this research, and at the next meeting perhaps there may be given a really valuable treatise upon this subject.

BRITAIN TO USE CANADIAN MATERIALS

AN announcement from London, England, states that the Executive Council of the Imperial Institute has constituted an Advisory Committee for Canada. This committee consists of Sir George Perley, K.C.M.G., High Commissioner for Canada, chairman; Sir Robert Kindersley, K.B.E., governor Hudson's Bay Company; J. G. Colmer, C.M.G., former secretary, High Commissioner's office in London; J. H. Plummer, Dominion Steel Corporation, and Sir Keith Price, of the Ministry of Munitions.

One of the most important matters on which action is being taken by the committee is that of the more extensive utilization of Canadian timbers in the United Kingdom. The Imperial Institute Advisory Committee on Timbers has been taking evidence on this subject. Arrangements have been made for a series of practical trials of selected British Columbia timbers to be carried out by H. M. Office of Works, with a view to the inclusion of these timbers in official specifications.

There will probably be a considerable demand by tanners in the Dominion for Indian cowhides (kips), which before the war were mostly taken by Germany and Austria. Small trial consignments of the kips have been supplied by the Hides Committee to Canadian tanners, and several firms have expressed a desire to see larger samples. The committee has sent a representative collection of Indian cowhides to Canada, and the Department of Trade and Commerce has undertaken to arrange for these to be exhibited at a number of convenient centres in the Dominion.

The outbreak of war caused a very large increase in the demand in the United Kingdom for special steels containing molybdenum and other comparatively rare metals. The British Government finally took control of the supplies of molybdenum ore and the Imperial Munitions Board at Ottawa was commissioned to purchase Canadian ore on their behalf. Considerable quantities of molybdenite ore are now being produced in Canada, largely through the special assistance given by the Canadian Department of Mines.

FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

PATTERN-MAKING NOTES

By J. W. Broadbent

THERE are many varnishes on the market strongly recommended for finishing patterns, and the lower the price of the varnish the stronger the recommendation, but there is nothing "just as good" as shellac cut with pure grain-alcohol and mixed right in the shop, for manufacturers delight to add foreign materials which cause the moulder to turn grey and find the biggest sledge in the shop to coax the pattern out of the sand.

Varnish

How often we hear the remark made, either by a pattern-maker, or a man in the shop who comes around to dab a little shellac on a cut. "What is that stuff made out of "

Lac is the name applied to the substance in its first form, a resinous incrustation formed on the twigs and young branches of various species of trees by an insect resembling the cochineal fly, whose home is in different parts of India. The insects in large numbers fasten themselves on the young shoots and there they live, eat and die getting their nutriment from the sap of the plant, depositing the resinous substance on the branches and over their bodies, forming in appearance a cocoon.

The twigs are gathered by the natives in June and November and are known as "stick lac," and are taken to the factories where the resin is crushed and washed in hot water to free it from the coloring matter from which dyes are made. It is then known as "seed lac" and after being melted and strained through thick canvas, it is spread in thin layers or rolled between iron rollers to produce the flaky substance known as shellac which is so useful in our industries.

Shellac varies in color from dark amber to almost pure black and can be bleached white by extracting the resin; white shellac varnish does not dry so quickly or produce so hard a surface as orange shellac which color is generally used in pattern making.

Shellac varnish should be prepared in a glass or glazed earthenware vessel and never kept in a metal can, as the oxidation of the metal discolors the varnish; it is well to keep the container air tight as much as possible as the alcohol evaporates very rapidly.

Purpose of Varnish

The idea of applying shellac to a pattern is to fill up the pores of the wood thus producing a hard, smooth surface able to protect the wood from the moisture in the sand and make it easier to withdraw the pattern from the mould. It is a common error to assume that shellac when applied to wood will dry in ten minutes time and is then ready for the next coat. To produce a good hard surface several hours should be allowed between each coat and each coat rubbed down with fine sandpaper before the next is applied.

It is absolutely necessary to have a pattern smooth and flat before the varnish is spread, for putting numerous coats of shellac on a rough coarse job only makes the roughness more apparent.

Coloring matter is added to varnish, the general practice being to varnish patterns so as to distinguish the core prints from the main body of the pattern. Black, the most common color used is produced by adding lampblack, red by adding Chinese vermilion and blue by adding Prussian blue. It is necessary to have this coloring matter perfectly dry and the best results are obtained by mixing to a smooth paste with a little varnish and then adding varnish to this mixture until the desired consistency is produced.

Desirability of Color

From observation the writer has come to the conclusion that if all small patterns were finished in the original color of the orange shellac, they would receive better treatment in the moulding shop, besides leaving the construction of the pattern more visible when alterations or repairs have to be made.

Shellac and plaster of paris or shellac and powdered chalk mixed into a thick paste form an excellent filling for nail holes and holes made by the moulders vent wire; it dries quickly and after being worked into the holes and cracks, what projects is easily sandpapered off, then after a coat of varnish is applied a good hard surface is the result.

Glue

A good quality of glue should be used in the pattern-shop, "good" glue when allowed to soak in cold water will swell up without dissolving and when again dried should resume its original properties. It should be free from specks or grit and of a light brownish yellow transparent appearance, breaking with a glassy fracture.

There is no hard and fast rule as to the proportions of water and glue to be used, this is sometimes determined by the class of work to be glued; thicker glue being required when gluing the end grain of wood. The best method of mixing is to soak the hard glue in cold water over night and then cooking this in an aluminum vessel surrounded by water, either heated by steam, gas, or electricity. The electric glue heaters now on the market are admirable for the purpose, keeping the glue at a uniform temperature. The outside kettle should never be allowed to get dry as burned glue is practically useless.

Strength of Glued Joint

The strength of a glued joint depends, not on the amount of glue used, but upon the quality and the perfect fitting of the joints and surfaces, for it is easily seen that when the surfaces are pressed into close contact there only remains a very thin film of glue and such an amount as has entered the pores of the wood. A good joint, glued under the best of conditions, will withstand a pull of 700 lbs. per sq. in. Nothing should ever be put on the joints to prevent the glue from soaking into the pores of the wood.

When gluing the end grain of wood, or where the grain runs diagonally in such a way as to present the end pores of the wood for the gluing surface, this end wood should be first "sized" that is: it should receive an application of thin glue and after being allowed to dry and scraped lightly with a sharp tool, the joint may be glued in the ordinary manner.

Wherever possible, glued joints should be nailed or secured with screws that is if they can be placed in such position that they will not present themselves to any cutting tools used in turning or shaping the pattern.

Contraction of Castings

When cast iron and other metals are in their molten state they occupy more space than when cooled off to the temperature of the atmosphere; in the natural process of cooling they contract, and, therefore, it is necessary to make the mould into which such metals are poured larger in such proportions as have been found by practice to govern the contraction of different metals.

Shrink Rules and Their Use

To enable the patternmaker to build up his patterns, with the necessary allowance for this contraction of metals without wasting time making approximate calculations, what is commonly called a shrink rule is used. Shrink rules are made longer than the standard rules of measurement, and are graduated proportionately, for instance: the foot rule generally used for measuring a pattern from which a casting is required in cast iron would be exactly ⅛ in. longer than the standard rule.

For general work the following contractions have been found to work out fairly well:

Cast Iron—	
Small castings with cores	1/8 in. per ft.
Large thick castings	1-16 in. per ft.
Beams and girders	1-10 in. per ft.
Large cylinders	3-32 in. per ft. dia.
Small cylinders	1-16 in. per ft. dia.
Malleable iron	3-16 in. per ft.
Steel	3-16 to 1/4 in. per ft.
Brass—	
Thick castings	5-32 in. per ft.
Thin castings	3-16 in. per ft.
Copper	3-16 in. per ft.
Aluminum	17-64 in. per ft.
Zinc	5-16 in. per ft.
Lead	5-16 to 1/4 in. per ft.
Tin	9-32 in. per ft.
Silver	1/8 in. per ft.

These rules, of course, will not hold good in every variety of castings, and must not be taken too literally, as cases happen in the moulding shop which knock all one's pet theories on the head, for it is only by practice and observation that just the exact allowance for contraction can be given in special classes of work.

A heavy casting will contract less than a light one, and hard white iron will

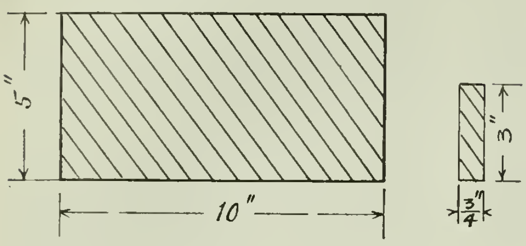


FIG. 15.

contract more than soft grey iron, as also different mixtures of iron will contract differently.

Cores will often prevent the free contraction of a casting, and the rapid or steady lowering of the temperature of the metal in cooling also has an influence on the ultimate size of the casting.

There is always an element of uncertainty about the contraction of a badly proportioned casting, and where heavy and light sections are combined there is danger of the casting cracking from the unequal contraction, making it necessary for the moulder to expose the heavy parts to the air as soon as the solidity of the metal will admit of it. A good example of uneven contraction is a pulley with a heavy hub, where the thin rim contracting faster and more than the arms and hub, often causes the arms to crack, the reason being that the metal in the thin rim has become solid, and is already contracting while the heavy hub is yet in a semi-molten state. When the hub solidifies it contracts, pulling the arms with it and causing a strain which will make the arms crack when the pulley gets a slight jar.

Importance of Proper Proportions

The patternmaker in a small shop where no draughtsmen are employed has often to design his own jobs, and it is necessary that he should be able to produce work in proper proportions, and not put a big heavy hub on an otherwise light pulley, or heavy ribs or flanges on a weak casting, thinking by doing so that the casting is strengthened. Some castings having heavy ribs crack much sooner than if the supposedly strengthening pieces were left off altogether owing to the strains caused by the cooling of the metal.

As an illustration of the unequal contraction of light and heavy castings, we will assume that two bars are cast, each 12 ft. long, with the sections shown in Fig. 15, one being 10 in. by 5 in. and the other 3 in. by 3/4 in.

Upon measurement of the cooled castings it will be found that the light one has contracted twice as much as the heavy one.

Theory of Contraction

The most plausible theory that can be presented for this unequal contraction is that some parts of a casting must cool faster than others, and it naturally follows that the outward portions—these being nearer to the sand of the mould—must be the first to solidify. In the heavy casting the outside commences to cool, and also endeavors to contract, but owing to the mass of metal inside this crust being in a semi-molten condition, and not yet in a state of contract, the outside is held in tension.

There is a certain feature in the nature of iron that permits its particles to be stretched to a certain limit, but when this limit is exceeded the result is a cracked casting. As the inside begins to cool and tends to contract, the outside has by this time lost most of its heat and contracted about all it can, thus forming a resisting force and preventing the natural contraction of the inside portion. In the light casting there are none of these conflicting forces to contend with, and it, therefore, contracts about all that the grade of iron composing it naturally calls for.

Effect of Rapping

Small castings, say, 6 in. or under in size, will generally come out as large, and sometimes larger, than their patterns, owing to the moulds becoming enlarged by rapping the pattern. In theory, the shrinkage of a casting 3 in. long would be 1-32 in., and it is easy to see that it does not need very much effort for a moulder to enlarge a mould to that extent. In machine moulding, where the loosening of the pattern is reduced to a minimum, there will necessarily be the average variation in size between the casting and pattern.

Another effect of the variation in sections of a casting is to cause the casting to "buckle" or "warp," and it is impossible to lay down any reliable rules as to how much this warping will be. The only guide as to how much a pattern must be rounded in the opposite direction to that in which the casting will go hollow is by observation and experience. The rule appears to hold good that a long light narrow casting will warp more than a broad heavy one, and a slight excess of metal in a light casting will cause a curve in the direction of that excess.

GANISTER AND ITS USE

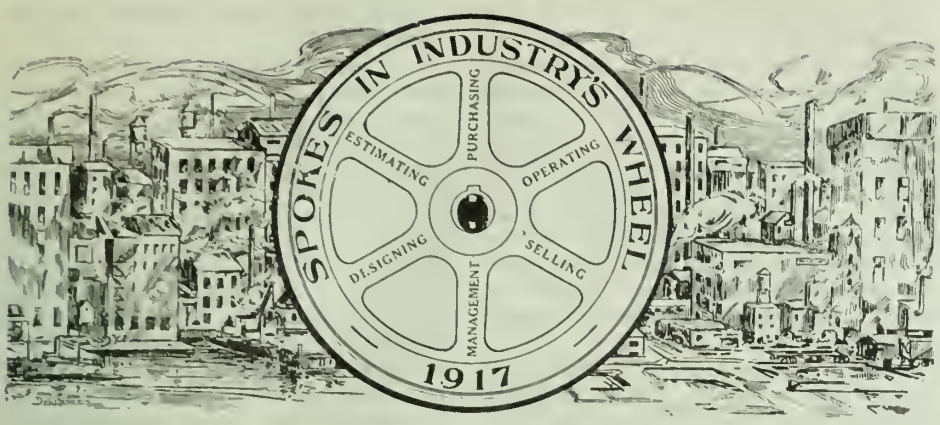
GANISTER is supplied in finely crushed or ground form and when properly used stands heat well, but, of course, under certain conditions it fuses and runs to slag, particularly where another material which acts as a flux is being used in the furnace. For cupola work rather a coarse form of ganister is used, especially where the whole of the furnace is rammed up with this material, but for brass and other crucible furnaces a finely powdered ground ganister should be used. In preparing any form of ganister for use it has to be damped down and trodden and kneaded into a putty-like mass; the tougher it is made the more durable it becomes in the presence of direct fire-heat. For patching and daubing up furnaces where the fire-brick is burnt away, about the best material to use is finely ground ganister of the quality selected for steel furnaces. In making repairs all clinker should be chipped off the bricks, and then a wash of good clay slurry applied. While this is still damp, the ganister, trodden and kneaded stiff like putty, should be put in and beaten smooth with a mallet or other suitable implement, as smooth a surface as possible being secured. This material, well put on, will stand for a considerable time, and as it is not specially costly can be used with freedom.

ANNEALING CAST IRON

THE detrimental effect on the strength of grey iron castings, due to annealing, is more or less known, and recent experiments by Sir Robert Hadfield have shown that disastrous effects on the strength of such may occur, the microstructure of treated samples affording a complete explanation.

The strength of grey cast iron depends largely upon the pearlite it contains; by annealing, part at least of the carbide in the pearlite becomes dissociated. Its carbon, thus rendered free, is drawn into positions alongside the already existing graphite plates, the consequent shelling of which further weakens the iron, already rendered weaker by the loss of its pearlite. Any advantage, therefore, which might occur by the lessening of initial stresses is more than counterbalanced by the severe deterioration of the quality of the material which takes place.

Some attempt is made to "anneal" important castings, such as large turbine casings, by subjecting them, by the means of steam, to as high, or to a slightly higher temperature, than they will be subjected to in use, before the final machining is done. It is found that by this means they do slightly change form, and so relieve some initial strains, and it is, of course, advisable that any change that will take place on heating should be dealt with before the final boring out, especially in view of the great precision of form which is required in turbine engines to permit sufficient, but not excessive, clearances of the numerous blades.



The constitution of industrial enterprise is largely departmental—"Spokes in a Wheel." This series has for its object the featuring of, in racy, interesting and instructive fashion, the training, experience and achievement of those who to-day are transmitting effectively, energy in a variety capacity as "Spokes in the Wheels" of steam, electrical and hydraulic and refrigeration engineering.

MELVILLE P. WHITE

SEVERAL important changes were recently made in the organization and management of the works of Canadian Allis-Chambers, Limited, Toronto. Mr. Melville P. White, manager of the Architectural, Bronze and Iron Works for the past 11 years, has had his jurisdiction extended to include also the management of the Davenport Works, under the title of Works Manager. Born in Woodstock, Ont., he served his indentures for architect with the well-known firm of Burke, Horwood & White, Toronto, and afterwards was associated in architecture with S. S. Beaman of Chicago. Leaving that firm, he remained eight years with the Chicago Ornamental Iron Co. In 1906 he returned to Toronto to become manager of the Architectural Bronze and Iron Works, which has since developed until it has become second to no plant of its kind on the continent.

MELVILLE P. WHITE.

THOMAS BATE

Mr. Thomas Bate, who has been appointed Mechanical Superintendent of the Davenport works of Canadian Allis-Chalmers, Limited, was born in Manchester, England, in 1877, educated at the Grammar School of that city, and apprenticed to the Sir Robert Peel, Soho Iron Works in 1891. Having studied applied mechanics and mechanical drawing and steam engineering under Prof. Jamieson, he came to Canada in 1893, and soon afterwards entered the service of the Canadian Pacific Railway, Delorimier Avenue shops as improver. After a short time in the shops of John Gillis & Co., Carleton Place, as improver on boat engines, he entered the service of the Canada Atlantic and Parry Sound Railway at Ottawa, in 1898 as journeyman machinist. In 1899 he was promoted to the position of locomotive foreman and shore engineer for the Canada Atlantic Railway and Transit Co. at Depot Harbor, Ont. In 1902 he re-entered the services of the Canadian Pacific Railway as locomotive foreman at White River, Ont., and was gradually promoted on Eastern and Western lines, until at the time of leaving that company, he had risen to the position of Assistant Works Manager, Angus Shops, Montreal.

THOMAS BATE.

As a testimonial of esteem, the staff and six thousand employees of the Angus Shops presented Mr. Bate with an illuminated address and a cabinet of silver and also a silver plated traveling club bag for himself, and a traveling case in French pearl for Mrs. Bate.

PERSEVERANCE AND HABIT

A LOCOMOTIVE starting a long train of freight cars is a familiar sight, and the first thought that it suggests is that a vast amount of energy is being expended in proportion to the results. The driving wheels, losing their grip on the rails, whirl round at high speed, and deafening noises come from the exhaust pipe and from clanking side-bars and couplings, creaking wheels, and other sources. These evidences of wasted energy continue for only a short time, however. The engineer sands the rails, the driving wheels "bite," and the train gets away; and unless engine troubles develop, or steep grades are encountered, the locomotive has little difficulty in keeping the train moving after the first inertia has been overcome.

There is a striking similarity between this and accident-prevention work. We are all creatures of habit, and history shows that bad habits are easily formed and hard to break, while good ones are often hard to achieve and easy to break. This fact has a decided bearing on accident prevention. It is generally agreed among men engaged in safety work that in making a shop safe, mechanical safeguards, while important, do not have as great an influence as careful workmen. "Careful workmen" are men who have given serious thought to the proper and safe way of doing their work, and have consequently formed the habit of being careful at all times. There may have been temptations to take chances, but perseverance in doing the right thing soon developed the safety habit; and—here is where the example of the locomotive and the freight train comes in—once the habit became well started, the man found it easier to keep on than to stop.

On the other hand, a man who is given to taking chances, and has thus far escaped injury, will either fail to see the logic of exercising care, or else, perceiving the wisdom of carefulness, will find the chance-taking habit so ingrained in him that being careful at all times is next to impossible. Each time he knowingly takes a chance and escapes injury his determination to be careful will be weakened. A man who will avoid standing or passing under a crane load, and five minutes later will creep between railway cars rather than walk around them, cannot be considered a careful man. It cost him little effort and perhaps no loss of time to avoid the crane load, but walking around the freight cars might take a couple of minutes. He preferred the short cut between the cars, with the attendant chance of inquiry, rather than the assured safety gained by walking around the train. This man is inconsistent, and yet he is typical of thousands of workmen, who either fail to start right or fail to keep going after they have set their feet in the safe path.

Accident prevention resolves itself into a continuous, competently-directed campaign to inculcate the habit and thought of carefulness in the workmen. The head of a plant must not falter in rendering moral and material assistance while starting and continuing such work. A lack of interest on his part, or on the part of his immediate subordinates, will have the same effect on accident-prevention work that shutting off the steam from the locomotive will have on the freight train. Steady, forward progress is supplanted by the slackening motion due to mere inertia, the energy expended in starting the freight train or the safety habit is largely wasted, and an equal amount of energy must be expended to get the work going again.

Neither the freight train nor the safety habit is automatic or self-sustaining. There must be a constant supply of fuel, —coal in the case of the locomotive, and supervision and direction in the case of the safety work. There are many difficulties to be overcome, chief among them being proving, to the full satisfaction of the workmen, the folly of careless ways, and arousing their unwavering faith in the benefits of caution. But persistence and perservance along these lines will gradually develop careful methods among the men, and lead them to substitute careful habits for chance-taking or careless ones. Those addicted to the chance-taking habit are sure to be injured some time, while the men of careful habits are reasonably certain of freedom from injury.—The Travelers Standard.

AWAKENING YOUR ENERGY

By W. Doolittle

THE life worth living, the life called real and purposeful, is one that is moulded and made by persistent striving and constructive energy. Swinging one's self forward daily with determination, forward and on a body animated and alive from head to heels.

We are not to be as vegetables that sprout up in the springtime of youth and wither and fall in the winter of life; living and breathing, and drawing substance; anchored in the same spot; without having made a single inconspicuous move.

Why Are You?

Look you deep, and consider well. The pangs of child-birth have been suffered and endured for you, not in order that you might be what you are now, but what you ought to be. Not in the lagging, bragging lazy-bone class, but, a living, wide-awake, alert, thinking human being.

You, who step into to-day, you of that class who are in the habit of wasting your time in listless endeavors, you, yourself, the human form that you are, awaken! The great energizing force within you calls you now to meet a challenge. A challenge direct from the great universe, not alone to give battle to the elements of earth and sky, but to push forward, forge ahead, and become an active, persisting, determined energized individual.

You are not to stand and stare; nor should your arms be akimbo or hang lifeless at your sides. But on these your sleeves should be rolled up; your spine fully straightened; your head and eyes clear; your nerves calm but vibrating; every part of your anatomy ready at all times to be brought into play. These are the pre-requisites to turn yourself from what you are now, into an ever-ready-to-thrust forward type of mortal.

We desire the good things, the luxuries of life; but instead of pushing forward and trying to obtain these by legitimate means, many live on the supposition or hope, that some day, someone, will be accommodating enough to die and leave them the wherewithal to secure these. The point to be emphasized is, that the thing worth the having, is worth the most energetic striving for. The mere thinking and wishing method has no place beside the man with unflinching power, whose superabundant energy is going to capture all that he most necessarily needs or wants. The great fault with the average of mankind is, that a little feeble expenditure of energy exerts such a strain upon one's ordinary efforts, that a two hours' relaxation is required for each hour's exertion. A slight bend of the back-bone requires a stimulant to put it back in place.

Many Are Lacking

Very few of us have that get-up-and-go, that swinging energetic gait, that forward going spirit, that buckles up and turns over obstacles. We spend much time in useless thought. And too much time in babbling talk. We know little of quietness—the great silence that moves steadily, uncomplainingly forward, that makes each action count for something useful and big. The best that was ever obtained, or ever will be obtained, fell in the right white palm of the man who went determinedly forward, and stood his ground till he got it.

You who sit and whine, you who despair, wake from your sleep. The day is far fetched. Things may look to you more hopeful to-morrow, but to-day, this very moment, if you choose to make it so, has more hopes that can be realized if you are only wise enough, know enough to turn your steps towards them. Your energy is the mainspring in the clock of your existence. And it has run down a long ways. A few winding turns will not give you much speed. You need a thorough winding, and that winding process needs to be enacted with despatch.

Deep in the marrow of your bones, along the entire length of your spinal column, your cords and sinews,—all that is within you of flesh and blood and soul, is one vast network of ripping, vitalizing human energy. Only the will of you, only the brain of you, needs to press the starting button to set in motion that force called energy. And that energy, be what it is, is bound by the propelling power of which it is composed, to force you ahead in unswerving, unrelinguishing epoch-making achievements.

Can that fact be driven home, deep in the core of that being you call self. That which to you is a human frame built on symmetrical lines. Endowed at the top with a thinking machine called a brain. Extremities called arms, and hands that do your bidding, limbs and feet that propel you. Can you not awaken these to serve with greater energy, with greater power, with greater activity? Working towards some grand end, be it small or big, but working and incessantly working, striving each day towards accomplishing something, in putting the mark of your personality and name, indelibly and uneraseable upon that which your efforts expend.

A UNIQUE STEEL

RECENT advances in British steel manufacture are indicated by the description of a certain steel which now forms part of the regular product in a Sheffield works. The two properties of toughness and hardness are combined in a hitherto almost unknown degree; the material is so hard that no cutting tool will act on it and so tough that a rod may be bent double while cold without fracture. Any shaping or finishing required must be done by grinding. It is made in castings, rolled bars and sheets, and forgings. It is mainly used for crusher jaws and rolls, dredger bucket lips, screening bars, gears, pins and bushes, and points and crossings of railways and tramways. It is also used now for light body armour such as helmets and shields, and for car and machine gun armour plating. A great many more uses will be found for this material. Its strength is 55 tons tensile and elongation 40 per cent. in 4 in.

IN co-operation with the Bureau of Mines, an investigation of the electric melting of brass is being conducted at Cornell University. The experiments indicate that the use of a suitable electric furnace will materially reduce melting losses and the Bureau of Mines now is testing an electric furnace built according to the design worked out by the laboratory tests. This furnace is of commercial size and is being tested with a view to ascertaining its suitability for such processes as are used for cartridge and shrapnel cases.

COMPARATIVE CARBON LOSSES IN MALLEABLE IRON ANNEALING BY MUFFLE AND POT OVEN METHODS*

By Joseph B. Deisher, Rochester, N.Y.

We know that carbon in any ferrous metal must exist in the form of combined carbon or graphitic carbon or both. To go a step farther, we must admit that, after all, it is principally the proportion and condition of the carbon present which determines in what class we shall ultimately define such metal—that it, whether we shall call it wrought iron, steel, malleable iron, or gray iron. Therefore, it seems hardly necessary to state that the vital importance of carbon in malleable iron cannot be over-estimated. However, the limitation of my subject does not invite any prolonged discussion of this element except as it is affected by the annealing process.

Combined carbon represents a condition where practically all of the carbon present has, due to certain laws of metallurgy, gone into solid solution with iron, forming iron carbide, or, in malleable practice, what is generally known as hard iron. Had the greater part of the carbon not gone into solid solution, an ordinary gray iron casting would have been the result, representing a composition of free graphite, combined carbon and pure iron. Here, the carbon would largely exist as graphitic carbon. The former represents a proper composition for annealing, while the latter does not.

Then, we may consider that the annealing of malleable cast iron consists of heating a hard iron casting of the proper chemical composition to a degree of temperature where practically all of the iron carbide is dissolved from solid solution, without subsequent fusion, after which the casting is allowed to cool to handling temperature (150 to 300 degrees, Fahr.) under conditions that will permit the carbon to precipitate as minute graphite deposits in a texture of practically pure iron. In other words, the annealing process is simply a precipitation or conversion of carbon which had previously been driven into solid solution with iron; but, this conversion is most always accompanied by a loss of carbon, and it is this removal of carbon that later on we are to discuss.

As briefly outlined herein, the annealing process seems very simple; yet, there are many conditions that may interfere with the perfect conversion of the carbon, some of which we will discuss in the following order: Hard iron composition; annealing temperatures; time required to dissolve iron carbide; rate of cooling; and removal of carbon.

Hard Iron Composition

In the first place, the analyses of the hard iron composition must, of course, come within certain specified or ratio limits; else, the iron carbide will not completely dissolve under ordinary annealing temperatures. To establish these limits is not the purpose of this paper. For the sake of brevity, we must assume that they are known. However, it might be appropriate here to state that a hard iron composition figured on the silicon alone is no better than guess work, so far as obtaining uniform physical results in the annealed product is concerned. In fact, the most uniform results can obtain only where we know with some degree of accuracy the total carbon content in the hard iron; and such knowledge is not readily available without the total carbon analyses of the pig iron, which, due to its high and variable carbon content, determines the percentage of the various grades of scrap material that can be carried in the melting mixture. The blast furnace people are reluctant to furnish or guarantee the carbon analyses of pig iron, which is a matter of such vital importance to the successful production of high-grade malleable iron castings that I hope it will merit thorough investigation by a competent committee.

Annealing Temperatures

In the matter of annealing temperatures for malleable cast iron, much depends upon the chemical composition of the hard iron. Ordinarily, the iron carbide commences to be slightly affected after the temperature has reached approximately 1,250 degrees Fahr., but the chemical union forming the carbide is not greatly weakened until a temperature of at least 1,400 degrees is reached. In fact, it is, for many reasons, desirable to run the temperature considerably higher than 1,400 degrees; and, therefore, below is given a table showing what may be considered safe maximum and annealing temperatures for both pot and muffle type ovens:

	Maximum Deg. Fahr.	Minimum Deg. Fahr.
Pot oven	1650	1450
Muffle oven	1700	1500

Exhaustive tests have shown that prolonged annealing has no detrimental effect upon the physical strength of the product, unless the temperature is run too high, in which case troubles too numerous to mention may result. Prolonged or repeated annealing at high temperatures will, however, have a growing tendency to produce a pearlite rim, which seriously interferes with any machining operation; but, the unreasonable length of time required to produce the rim, under normal annealing conditions, eliminates this as a disturbing factor. Therefore, it would seem only reasonable to assert that when malleable cast iron is seriously over-annealed it is usually because the temperature has been run too high rather than too long. However, on the other hand, it is, I believe, also a safe assertion to state that so far as annealing is concerned more poor-grade malleable cast iron is produced as the result of under-annealing than over-annealing. If the above temperature limits are adhered to and good results do not obtain, the trouble is not directly due to annealing temperatures.

Heat distribution sometimes brings up a troublesome problem, the difficulty being to reach the minimum temperature at the coolest point in the oven without exceeding the maximum temperature at the hottest point. This is largely a matter of oven design; and, unless any two points in the oven can be held within the limits herein prescribed, there is something radically wrong with the oven or the manner in which the burden is arranged. The trouble mught be that the flues are not clean.

Time Required to Dissolve Iron Carbide

For reasons not generally understood, it has been found necessary to hold castings at annealing temperature from 60 to 72 hours before the cooling process is commenced. Otherwise, the result will almost invariably show that the iron carbide has not been completely dissolved; that is, the annealed casting will show that a portion of the carbon remains in solid solution, as combined carbon, causing a brittle, inferior product.

It would seem that the chemical union forming the solid solution of carbon in iron is not thoroughly dissolved immediately the annealing temperature has been reached, or, if the iron carbide is completely dissolved in less than 60 hours, we have yet to discover the means of preventing a portion of the carbon from re-combining when the casting is cooled to handling temperature. Then, assuming, for the sake of argument, that it has been found necessary to hold the castings at annealing temperature for 60 hours, three questions arise which should invite interesting discussion, namely:

1.—Are 60 hours actually required to dissolve the iron carbide?

2.—Does the iron carbide dissolve in less than 60 hours, the balance of the allotted time being required for precipitation of graphite carbon?

3.—Does the precipitation of graphite carbon immediately follow the gradual dissolution of the iron carbide, requiring 60 hours to complete the conversion process?

I should answer the first question negatively. It is my opinion that dissolution of the iron carbide is very largely a matter of heat penetration, particularly where the muffle type oven is used. In the pot oven, there is little doubt but that the nature and composition of the packing material affects the dissolution of the iron carbide, which assumption is in part at least borne out by the fact that malleable annealing can be successfully conducted with this type of oven at approximately 50 degrees lower temperature than is required in the muffle oven. This does not necessarily mean that the temperature at which the iron carbide is affected in the pot oven is lower than in the muffle oven. In the pot oven, after say 1,400 degrees temperature is reached, it would seem that the effect of the oxide packing material tends to hasten the dissolution of the carbide at a lower ultimate temperature than is required in the muffle oven. In other words, I believe that by skilful manipulation of oven temperatures, the iron carbide can be dissolved in less than 60 hours after annealing temperature has been reached.

*A paper read at the annual meeting of the American Foundrymen's Association, at Boston, Sept., 1917.

In regard to the second question, I am inclined to believe that the iron carbide can be dissolved in less than 60 hours, and that it is the obstinate or lagging precipitation of graphite carbon, at the usual annealing temperature, that delays the conversion process, under present practice. Then, assuming that such is the case, the question arises as to the state of the carbon between dissolution and precipitation. In my opinion, after the annealing temperature has thoroughly penetrated the entire body of the hard iron casting, the chemical union forming the iron carbide is so weakened that the rate of cooling determines whether the carbon will remain in solid solution as combined carbon or precipitate as graphite carbon. In other words, after dissolution of the iron carbide, I believe that the carbon exists in a semi-soluble state, from which it will precipitate as graphite if cooled under proper conditions.

It is doubtless unanimously agreed that the third question covers in a general way about what really happens. In fact, practical tests have shown that where test wedges were removed from the oven at regular intervals before 60 hours had elapsed after the annealing temperature was reached, combined carbon was almost invariably found to exist in direct proportion to the length of time the wedges were held at or above annealing temperature. However, in my mind, this does not prove conclusively that 60 hours are actually required to completely dissolve the iron carbide. On the other hand, I am inclined to think that in the test wedges just referred to the annealing temperature had not completely and uniformly penetrated the entire body of the metal and also in removing the wedges from the oven before the regular period for annealing was completed the cooling was too rapid. In other words, had the annealing temperature been as high as the castings would stand at the commencing of the anneal and the wedges that were withdrawn before the 60 hours of annealing had been completed, cooled very slowly, the results would doubtless have shown that a greater percentage of the carbon had precipitated as graphite.

In this connection, I recall an incident where by accident the arch forming a muffle chamber in a muffle type oven fell in and the fire had to be shut off about 36 hours before the regular time. The stack damper and the oven were sealed up practically air-tight and allowed to cool down as slowly as possible, with the result that when the oven was opened the castings were found to be fairly well annealed. The carbide appeared to be completely broken up, but there was scarcely a trace of decarbonization visible without the aid of a microscope. This condition I attribute to the fact that the annealing temperature was high when the accident occurred and the cooling was extremely slow, allowing plenty of time for the precipitation of graphite. It might also be of interest to know that the castings were not sealed. Professor Touceda has done some very enlightening research work along this line, but it has occurred to me that some of the conclusions he has arrived at in regard to the length of time required to break up the iron carbide, may, after further experiments, be altered by the effect of higher initial annealing temperature and slower rate of cooling. It should be thoroughly understood that I take no exception to the conclusions he has reached, based upon the experiments as they were made.

We must realize that one of the greatest drawbacks to the malleable industry is that it takes too long to anneal the castings. While my experience in malleable annealing has not gone far enough to justify any revolutionary results, there is no doubt whatever in my minds, but that the time required under present practice for this operation can be very materially reduced. To that end, if the presentation of this paper stimulates discussion and exchange of opinion regarding the points brought up, its purpose will have been accomplished.

Rate of Cooling

Aside from the absolute necessity of first completely dissolving the iron carbide, the rate of cooling is, in my estimation, of the utmost importance, particularly where it is desired to complete the annealing process in the shortest time possible.

It is generally considered that the sooner the castings can be brought to annealing temperature, the better; but the same rule does not hold true in the matter of cooling to atmospheric temperature, after the annealing temperature has been reached and held for the required time. After the iron carbide is dissolved, the object then is to cool the oven under such conditions as will prevent recombining of the carbon. If cooled too fast, all the carbon will not precipitate as graphite.

Practical tests have shown that the recalescence point in cooling malleable cast iron from annealing temperature is slightly under 1,400 degrees. Plotted cooling curves have shown that at this temperature there is an abnormal liberation of heat from some source, presumably the result of rapid precipitation of carbon, first as graphite, then as carbon monoxide and carbon dioxide gas, depending upon the amount of oxygen present; hence, the ultimate removal of a portion of the carbon, as will be mentioned later on in this paper. Therefore, we will establish 1,390 degrees as the critical point in annealing at which graphite will precipitate with most repidity.

It is held by some authorities that, after the iron carbide is completely dissolved, the castings should be held at or slightly above the critical point in cooling for several hours in order that the precipitation of graphite carbon may be more complete, the theory being that graphite carbon will precipitate with more rapidity the nearer the critical point just referred to is approached. Contrary to such theory, it is the practice of some foundrymen to run the temperature to the highest point just before the fire is shut off; then seal up the oven and, as they express it, "allow the castings to soak." To my mind, such practice is quite the reverse of what it should be. In other words, I am inclined to believe that the nearer the temperature of 1,400 is reached in cooling, the more favorable become conditions for the precipitation of graphite carbon, providing, of course, the temperature has previously reached the point where all iron carbide was dissolved. Therefore, it would seem the better practice to reach the highest temperature at the beginning of the anneal, such temperature to be held until the iron carbide is dissolved; then, gradually drop to 1,400 degrees, a temperature which some believe will better favor the precipitation of graphite carbon. This would also lessen the danger of warping. In fact, I would not be at all surprised that, when the temperature is run high at the end of the anneal, some of the carbon is, due to being more nearly soluble in iron and lack of time in cooling, forced back into solid solution as combined carbon which would otherwise have precipitated as graphite had the temperature not been run so high just before the cooling process was commenced. In some cases, where the sulphur-manganese ratio may not be properly balanced in the hard iron composition, such practice is also much more apt to produce a pearlite rim or "picture-frame" fracture, a source of extreme annoyance where the castings have to be machined. However, this condition is rarely, if ever, produced by annealing alone, except where the annealing is prolonged almost indefinitely or the temperature run entirely too high.

A point which might have been mentioned in connection with establishing the critical point in cooling is that, while approximately 1,390 degrees represents the point in temperature at which graphite carbon precipitates with most rapidity (assuming, of course, that the iron carbide has been dissolved by subsequent heating at higher temperature), it does not necessarily follow that the precipitation of graphite ceases immediately the temperature drops below 1,390 degrees. In fact, the precipitation of graphite carbon, in some cases, may continue until the temperature drops to 1,242 degrees, below which temperature all precipitation is arrested. Therefore, in reality, 1,242 degrees is the critical point for dissolution of the iron carbide; or, in other words, this is the temperature at which the chemical union forming the carbide commences to weaken upon heating and is also the point at which the precipitation of graphite carbon ceases upon cooling. Malleable iron annealing could not be successfully conducted at either 1,390 or 1,242 degrees temperature, if at all, due to the length of time that would be required to dissolve the iron carbide; and, therefore, these temperatures are extremely important only in the matter of cooling the castings from annealing to handling temperature.

As to the effect of further cooling between the temperature of 1,242 degrees and handling temperature of the castings, this, I believe, depends solely upon the condition of the carbon when the temperature of 1,242 degrees in cooling is passed. Where combined carbon is present, the effect of the rate of cooling upon that part of the structure representing the carbide would be about parallel to the tempering of a piece of soft steel of the same carbon content, heated and cooled under similar conditions. In other words, the more rapid the cooling, the harder would become the crystallization of the carbide and consequently the more brittle the casting; and, vice-versa. Were all the carbon in graphitic form at 1,242 degrees temperature, the cooling might be forced to handling temperature without detriment to the physical characteristics of the metal. This is based upon the theory that iron and free carbon are not readily, if at all, soluble at 1,242 degrees Fahr.; therefore, the formation of iron carbide is impossible, and where there is not combined carbon present in ferrous metal it can usually be hardened very little by tempering. As a practical test, a well annealed malleable test wedge was heated in a hand-forge to a cherry red and quenched in cold water, without the slightest effect upon the ductility of the metal or condition of the carbon. Then, a duplicate wedge was heated to a slightly higher temperature and cooled under the same conditions, with the result that the carbon was re-combined and the metal very brittle, showing a steely, white fracture. In the first test the critical point was not reached where the iron and free graphite were soluble; and, as practically no carbide was present to commence with, the metal was not hardened to any noticeable extent by tempering. In the second test it would seem that the temperature was reached where the free graphite became dissolved in iron and by sudden cooling through the critical range was forced into solid solution as combined carbon, which composition was still further hardened by tempering.

The point which I wish to make clear is that where conditions have been ideal for conversion of the carbon, more liberty can be taken in cooling the castings from 1.242 degrees Fahr. to handling temperature, thus saving considerable time at present allowed for gradual cooling through the same range of temperature.

Removal of Carbon

It is possible to accomplish the conversion or annealing process without removing any carbon whatever; but, as this is neither practical nor desirable, it will not be discussed. The removal of carbon is entirely the result of oxidation; and, where no oxygen is present, no carbon can be removed. Oxygen for the removal of carbon in malleable iron annealing is supplied usually by an oxide packing material or by air, depending upon the type of annealing oven used.

For years it was thought that malleable iron annealing could not be accomplished unless the hard iron castings were packed in iron-oxide scale; but, as the tonnage of the industry rapidly increased, this packing material became harder to obtain, with the result that today most any kind of refractory material is used in the place of iron-oxide scale, and with comparatively good results. Some plants have even gone so far as to adopt the muffle-type oven, where no packing material at all is used. The castings are simply stacked up in the oven and protected from contact with the flame by muffled chambers or by covering with sheet-iron plates and sand or scale. Practically the only difference in the results obtained is that more carbon is removed from the casting where a strong oxide packing material is used, as will be shown later on in this paper.

While decarbonization or the removal of carbon in the anneal is in most cases desirable, some, I am afraid, are disposed to over-estimate its importance. In other words, it is the complete conversion rather than the removal of carbon in the anneal that determines the malleability of the product. It is a well-known fact that the higher the total carbon content in malleable cast iron (even though the conversion in the anneal be perfect), the lower will be its ultimate strength, the strength being affected in direct proportion to the minute cavities made necessary for graphite deposits in the ferrite structure. Even so, it does not necessarily follow, by any means, that the removal of carbon in the anneal is absolutely essential to the production of high-grade malleable iron. While at least a small amount of carbon will always be removed in the anneal, the total amount of carbon should be regulated in the white iron—a fact which cannot be too forcibly impressed upon those who desire to maintain a high-grade product.

While possibly somewhat foreign to my subject, the statement just made again emphasizes the importance of knowing the carbon content of the pig iron entering into the mixture when charged into the melting furnace, inasmuch as the color method for making preliminary carbon tests, as used in steel practice, cannot be employed by the malleable melter, because the total carbon in hard iron is so much higher than in steel. Unless the total carbon can be regulated with some degree of accuracy more than guess-work in the melting mixture, the hard iron will not be of such consistency that we can reasonably expect uniform results to obtain in the anneal, regardless of the type of oven or annealing practice employed. Therefore, I again call to the attention of the association a most valuable service which can be performed for its malleable members by setting into motion some plan for a united request or demand upon pig iron dealers to furnish and guarantee the total carbon analyses, as well as the various elements which it is their present practice to supply.

To further emphasize the importance of regulating the total carbon in the hard iron. I can state as an absolute fact that the best malleable cast iron never results from a hard iron composition in which the total carbon is around 3.00 per cent., regardless of the amount of carbon removed in the anneal. However, in this connection, caution should be used not to run the carbon too low, else trouble will result from other sources. If the total carbon is allowed to go below 2.20 per cent. in the hard iron, the iron carbide will not dissolve under ordinary annealing temperatures, which is only one of the numerous troubles that will result from running the carbon too low.

In another part of this paper the statement is made that prolonged annealing will have no detrimental effect upon the physical strength of malleable cast iron, unless the temperature is run too high; also, that the removal of carbon in the anneal is not essential to the production of high-grade malleable iron. These statements are best corroborated by a series of practical tests conducted by Prof. Touceda, to whose liberal generosity I am indebted for many favors. In one of these tests eight test wedges were poured from the same ladle of iron and annealed in such a manner that one of the wedges was annealed eight times, one seven times, and so on down the line until one of the wedges received only one anneal. Physical tests showed that there was practically no difference in ductility between the wedge annealed once and the one annealed eight times; and, after each successive anneal, the physical test showed but very little comparative variation in strength. Upon analytical examination, however, it was found that the total carbon was diminished by each successive anneal — the first anneal showing a total carbon of 1.40 per cent., while the eighth anneal showed that only 0.22 per cent. of carbon remained. The test showed conclusively that the consistent removal of carbon in each successive anneal did not improve the quality of the product; and, at the same time, it demonstrated that prolonged or re-annealing, under normal conditions, will not affect the strength of the metal.

Muffle Oven Versus Pot Oven

There are two types of oven generally used for annealing malleable cast iron; namely, the muffle oven and the pot oven, either of which has its particular advantages and disadvantages. The typical muffle oven is in reality an oven built within an oven, that is, the construction of the outside oven, or oven proper, is very similar to the pot oven, except that it encloses two small arches, separated by a partition, which form the muffle chambers in which the castings are placed for annealing. When filled with castings, the muffle chambers are sealed up as nearly air-tight as possible. The fire-box is arranged usually at the rear end of the oven in such a manner that the flame passes directly over the arches of the muffle, returning through specially constructed flues in either side-wall and underneath the floor to the main stack flue at the back end of the oven directly underneath the fire-box. There is, of course, a damper in the base of the stack for regulating the distribution of heat throughout the oven, which is a simple matter if the flues are kept clean.

In regard to the pot oven, I take it that all present are familiar with the general design of this type of oven and that a brief description is unnecessary. It is nothing more or less than the muffle oven, minus the muffle chambers.

The principal advantages in favor of the muffle type oven are the elimination of labor required to pack, handle and shake out the pots, cost of packing material, expense of renewing pots, etc. Among the objections to the muffle oven may be noted the following:

1.—On acount of the heat having to penetrate the brick arch forming the muffle chamber, it requires somewhat longer to bring the castings to annealing temperature.

2.—Not being supported by packing material, the castings are more apt to become warped or contorted.

3.—There is more danger of the castings becoming scaled, due to air leaking into the muffle.

4.—Small and delicately constructed castings cannot be annealed in this type of oven unless they are packed in trays.

The muffle-type oven is particularly adapted to annealing medium and heavy castings, where packing material is not necessary to prevent warping and where a small amount of scale on the castings is not a serious objection. For this class of work the muffle type oven has everything in its favor.

The pot oven is used by some foundrymen probably because they have never tried any other method of annealing; by others, because the nature of their work requires that the castings be annealed in packing. There is no doubt but that the pot anneal produces a cleaner and better casting for machining or nickel-plating, but so far as physical strength is concerned, the pot oven has no particular advantage over the muffle oven. Of course, the principal objection to the pot oven is the expense and inconvenience of packing the casting in pots However, where light and intricate castings are to be annealed, I can suggest no alternative.

Practical Tests

For the purpose of further proving certain statements made in this paper, I have had cast from the same ladle of iron a set of 30 test wedges and 30 tensile test bars. These were annealed in three lots of 10 wedges and 10 tensile bars each. Two lots of these tests were annealed in a pot oven, one lot being packed in mild packing material and one lot in strong packing material. The mild packing material was mill scale mixed with coke breeze; the strong packing material was iron-oxide scale. The third lot of tests was annealed in a muffle type oven, without packing material. The comparative results are shown in the accompanying table.

COMPARATIVE RESULTS OF POT OVEN AND MUFFLE OVEN ANNEALING.

	POT OVEN		MUFFLE OVEN
	Mild Packing	Strong Packing	Without Packing
Total carbon in hard iron (per cent.)	2.63	2.63	2.63
Combined carbon after anneal (per cent.)....	0.53	0.13	0.05
Graphitic carbon after anneal (per cent.)....	1.75	1.85	2.12
Total carbon after anneal (per cent.)......	2.28	1.98	2.17
Total carbon removed in anneal (per cent.).	0.35	0.65	0.46
Wedge test (length of butt in inches).......	2⅞	2⅜	2
Tensile strength (pounds per square inch).....	49,448	50,044	49,542
Elastic limit (pounds per square inch)	38,746	37,122	37,398
Elongation (per cent. in 2 inches)	6.3	6.7	7.3

Total carbon in hard iron was determined from hard iron shot, cast in water The carbon determinations after anneal were made from drillings taken entirely through the butt end of test wedges. The test wedge was 6 inches long, 1 inch wide, ½ in. thick at butt and tapered to wedge point. The tensile test bars were round, ⅝ in. in diameter. Each of the above tests represents the average for 10 bars, five of them being annealed near the roof and five near the floor of the oven, about midway between front and back end.

Unfortunately, the heat from which the above tests were poured was too high in both carbon and manganese to produce an extremely ductile and tough material. However, it accomplished the purpose for which the tests were made.

By reference to the tabulated results, it will be noted that the mild packing material removed less carbon than the strong packing, and that more combined carbon remained in the iron annealed in mild packing, which strengthens the statement that in addition to removing more carbon the oxide packing material has a tendency to hasten the dissolution of the carbide after annealing temperature has been reached. I would also call attention to the fact that, while the muffle-type oven removed less carbon than the oxide packing material in the pot oven did, the conversion of carbon in the muffle oven was more nearly complete. This, in conjunction with the results of the physical tests, proves that it is the conversion rather than the removal of carbon in the anneal that produces ductility.

In closing, I wish to express my appreciation of services rendered to the writer by the Eastern Malleable Iron Co., in whose laboratory some of the tests herein referred to were made.

WAR SERVICE BOARD FOR U. S. FOUNDRY INDUSTRY

IN order to maintain proper contact between the foundry industry and those departments of the United States Government which purchase castings a war service board of five members has been organized by the American Foundrymen's Association, the members being: R. A. Bull, chairman, Duquesne Steel Foundry Co., Pittsburgh; J. C. Haswell, Dayton Malleable Iron Co., Dayton, O.; G. H. Clamer, Ajax Metal Co., Philadelphia; H. D. Miles, Buffalo Foundry & Machine Co., Buffalo, and C. C. Smith, Union Steel Castings Co., Pittsburgh.

The personnel of this board is representative of every branch of the foundry industry, including gray iron, steel, malleable iron and non-ferrous metals. Furthermore, its members are affiliated with the leading organizations of casting manufacturers of the United States, as follows: American Foundrymen's Association, National Founders' Association, American Institute of Metals, American Malleable Casting Association, and the Steel Founders' Society.

In view of the tremendous task undertaken by this board, numerous sub-committees undoubtedly will be appointed to represent the various lines of each branch of the industry. A survey of the foundry trade of the country undoubtedly will be made to ascertain the class of work for which each shop is best adapted. The establishment of an office in Washington is being considered.

IMPROVED LABOR CONDITIONS RESULT OF WAR

SIR ROBERT HADFIELD has recently stated in *The Observer* that before the war his firm employed 6,000 men and imported many things from Germany. They now employ 15,000 men and make everything previously imported. Working hours have been reduced, with, Sir Robert states, the most satisfactory results. The shorter hours make good men better and bring the medium workman up to something higher than the old-time average. Looking back over recent industrial history, he says that the fact becomes apparent that in the pre-war days we in England were very skilful in our efforts to impede our own progress. On one side the employers, and on the other side the men, devoted vast vital energy to the creation of great combines, each devised as if for the purpose of preventing its side from advancing. Had not Germany forced war upon us we might have had good reason to fear for the future. For years our employers had made an earnest and successful fight against the 48-hour week. Now, under war conditions, when it is necessary that we should produce at a maximum, we have turned to it as a means to just that end and find it most efficient. The hostility of the men to various progressive things was as unfailing as, for instance, their opposition to labor-saving machinery. Now they have learned that the better the tools the better the workman, and that the better the workman he better his pay. An intelligent workman should have more self-respect than is indicated by willingness to do labor which a machine could do as well. In England workers are only now beginning to realize this. The fact that workmen are not themselves machines is not yet appreciated at its full value even in America, for if workers should be too proud to rank themselves as machinery, employers should be too wise thus to rank them All employers have been doing so.

BEFORE the war the Germans obtained annually about 900,000 tons of iron pyrites from Spain for the manufacture of sulphuric acid, and they themselves produced about 300,000 tons every year at Megen, in Silesia. In 1912 and 1913, however, they increased their purchases from Spain to 1,200,000 tons per annum. Owing to the stoppage of the Spanish supplies by the war, they had to look about for other sources, and have, no doubt, found some in occupied Poland, and small quantities also in Greece and Turkey. Besides this Germany has received about 400,000 tons of pyrites annually from Norway.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

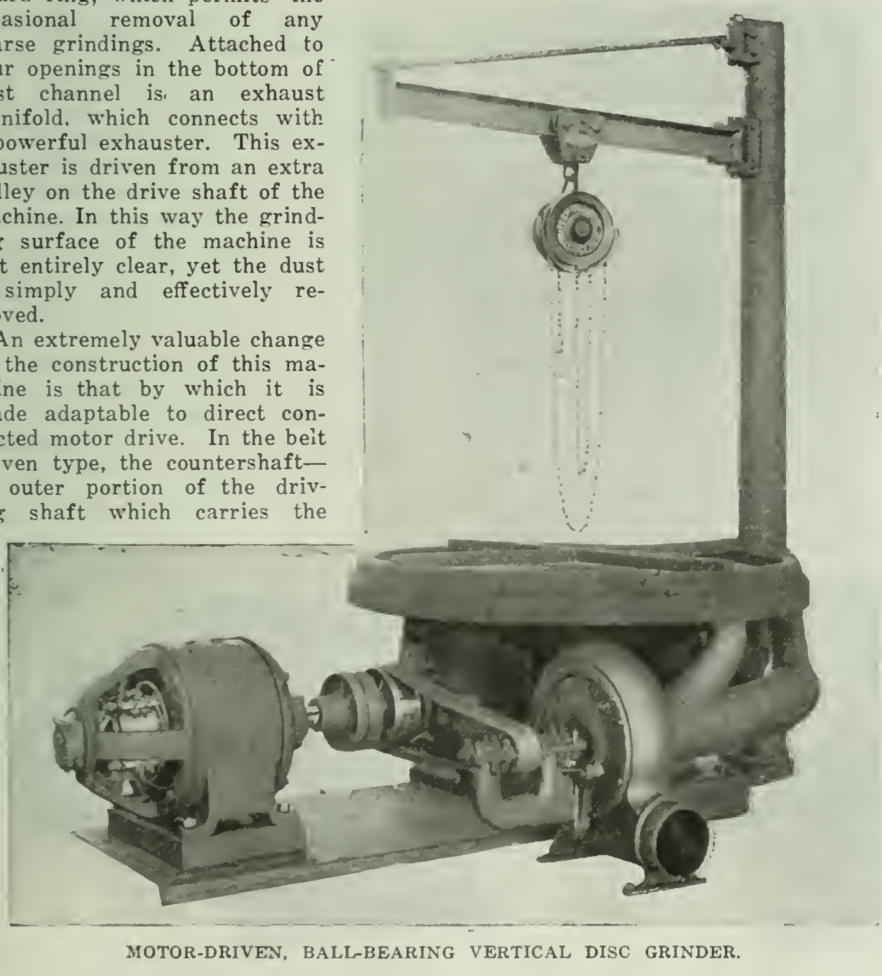
MOTOR DRIVEN, BALL BEARING VERTICAL DISC GRINDER.

THE Gardner Machine Company, of Beloit, Wisconsin, are now building a new vertical spindle disc grinder, which embodies several interesting features. Most conspicuous of these, as shown in the accompanying illustration, is the hoisting attachment, designed to handle the heavy pieces which this machine is built to grind, also to apply and remove pressure weights used in grinding lighter castings.

The attachment consists, briefly, of a one ¼ ton hand chain hoist, mounted on a trolley and swinging jib. A crane column to which this jib is attached is rigidly fixed on the base of the machine. By means of this arrangement, any heavy parts can easily be lifted from the floor and swung on to the surface of the grinding wheel. Another feature of this machine is the dust exhaust system, which is claimed by the makers to practically eliminate the dust problem. A channel is cast into the base of the machine just below and around the edge of the disc wheel. Above this and just over the edge of the disc wheel is fixed a detachable guard ring, which permits the occasional removal of any coarse grindings. Attached to four openings in the bottom of dust channel is an exhaust manifold, which connects with a powerful exhauster. This exhauster is driven from an extra pulley on the drive shaft of the machine. In this way the grinding surface of the machine is left entirely clear, yet the dust is simply and effectively removed.

An extremely valuable change in the construction of this machine is that by which it is made adaptable to direct connected motor drive. In the belt driven type, the countershaft—or outer portion of the driving shaft which carries the tight and loose pulleys—is connected to the driving shaft proper by a flange coupling. By removing this countershaft, and the outer bearing, a motor may be mounted on a plate bolted to the sub-base, as shown in the illustration. The rotor shaft of the motor is connected to the driving shaft by means of a flexible coupling. Thus the necessity of mounting the motor on a side bracket, and driving the shaft through sprockets and chain is eliminated. The direct connection with the driving shaft does away with all lost motion and friction incidental to the old type, reduces the number of wearing parts, and produces a more compact and efficient machine. Also the interchangeable feature may appeal to those who contemplate a change to motor driven machinery at some future time.

The design and construction of the whole machine is such as makes it suitable for heavy grinding operations. The 53 in. disc wheel is carried on a spindle 3⅝ in. diameter, and is supported by a heavy cast iron flange, 20 in. diameter by 1⅜ in. thick. The spindle is mounted in two self-aligning radial ball bearings and the end thrust is taken on an exceptionally heavy thrust bearing, the balls of which are 1⅛ in. diameter. The equipment has been made ball bearing throughout, being a complete change from the old type and one which insures smooth running qualities and a marked saving in power. The spindle has a speed of 500 rev. per min., and is driven by means of a pair of hardened steel bevel gears, having a ratio of 2.4 to 1. These gears are enclosed in a dust protected housing and provision is made for ample lubrication. The entire weight of this equipment is 4,600 pounds.



MOTOR-DRIVEN, BALL-BEARING VERTICAL DISC GRINDER.

DRUM REVERSE SWITCH

ONE of the latest products of the Westinghouse Electric & Mfg. Co. is a small drum reverse switch (Type 810), for operating motors in machine tool, woodworking and other services requiring reversing of the motors. The small size and neat appearance of this reverse switch make it especially adapted for mounting directly on the machine. Not withstanding its small size this switch is exceptionally rugged and has proven successful on the most severe services.

A terminal board of heavy micarta forms the back of the switch, and on the front side of this board are mounted the stationary contracts. The movable contacts are mounted on cast brass brackets clamped on the shaft, from which they are thoroughly insulated. Good contact is insured by phosphor-bronze springs, on the movable contacts, these being protected by copper shunts.

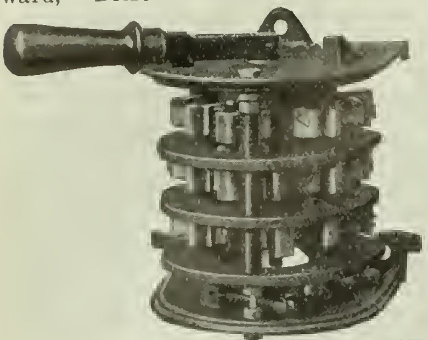
DRUM REVERSE SWITCH SUITED FOR MOUNTING DIRECTLY ON MACHINES.

Heavy barriers of asbestos lumber separate adjacent sets of contacts so that cross-arcing is impossible. All live parts are protected from exposure by an enclosing cover of sheet steel, lined with asbestos, and held in place by two ring latches, which permit its easy removal for inspection or renewal of contacts.

These switches are made for alternating-current or direct-current circuits. For alternating-current service and for direct-current service without dynamic braking, they are provided with "Forward," "Off" and "Reverse" positions.

For alternating-current service the motor is connected directly across the line.

For direct-current applications with dynamic braking, the switch handles have five positions as follows: "Forward," "Drift" "Off and Brake," "Drift,"



SWITCH WITH COVER REMOVED AND CONSTRUCTION EXPOSED.

and "Reverse. They may be used with automatic starters for shunt and com pound-wound motors. With compound-wound motors having heavy series winding for tail-stock and cross-rail service, they may be used to connect the motor directly to the line, either with or without resistors permanently connected in series with the armature.

When remote mechanical control is desirable, both alternating-current and direct-current switches can be furnished with extended shaft, permitting either gear or sprocket operation.

ADJUSTABLE SPEED MOTORS

PAST applications of interpole motors to machine tool operation have made apparent the limitations of this type of motor and suggested changes in design wherein the operating characteristics might be further improved. The principal factor in these limitations is the distortion by the armature reaction of the flux distribution in the main air gap. The amount of this distortion is dependent upon the relative values of the armature and field magnetizing forces, and is, therefore, greatest when the motor is operating at high speed or weak field. This distortion is effective in producing instability, poor commutation, high voltage between adjacent commutator segments and large load losses at weak field.

A commutating pole motor, in which this undesirable field distortion is to a large extent eliminated, has been designed and produced by the General Electric Co., Schenectady, N.Y., and is marketed in Canada by the Canadian General Electric Co. The principle is to distribute the compensating winding instead of concentrating it at the pole faces of the commutating poles, the magnetizing strength of the distributed winding being equal and opposite in direction to the magnetizing force of the armature.

Commutating Advantages

The design of the type R.F. motor, as it is styled, further provides a concentrated commutating winding, the effect of which is to widen the neutral or commutating zone and so insure sparkless commutation over the entire speed range of the motor. This makes for freedom from commutator troubles under the most severe conditions of service and considerably simplifies the control and protective apparatus required when applied to machine tool operation. Therefore, for ordinary classes of work, such as driving shapers, slotters, lathes, etc., a simple type of drum controller can be used, allowing theoperator full control of starting, stopping, reversing and speed of the motor It also provides a design of by means of a single handle. motor with which, for such service as planer operation, magnetic control of a very much simpler type than that used with the conventional commutating pole type of motor can be employed without sacrificing excellence of commutation. The current peaks, even under abnormal operating conditions, are limited by the inherent characteristics of the motor itself. This motor may be accelerated from low speed to high speed, when connected to a friction load corresponding to rated output at high speed, by inserting total field resistance in one step. The current taken from the line under this condition will be well within the ordinary setting of protective devices.

The motor is rated on a basis of the allowable heating in a two-hours' continuous load at full field speed, its heating under this condition being assumed as equivalent to that attained by the motor under all day load conditions in actual service. The main field coils, as shown in Figs. 3 and 4, are so designed as to withstand without injury full potential continuously with the armature at rest. This insures low temperature rise in field coils under all day operation of the motor with the armature running, and in addition protects the motor against injury when the careless workman inadvertently leaves his work with the line switch closed and the motor at rest.

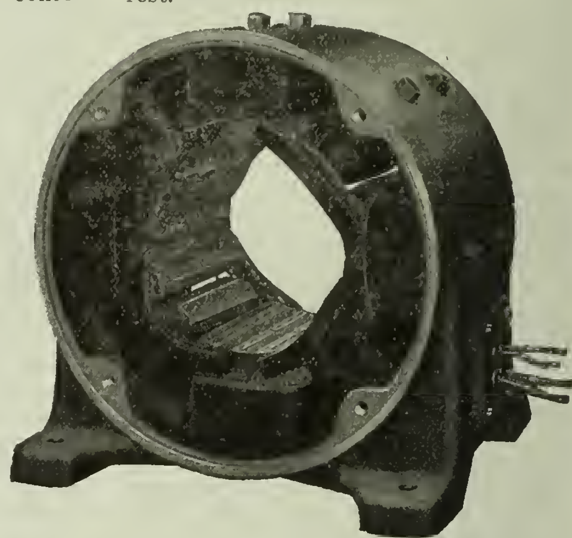


FIG. 3—MAGNET FRAME SHOWING CONSTRUCTION AND ARRANGEMENT OF POLE PIECES.

The construction of the motor is in keeping with the service conditions, the diameter of the armature being kept as small as possible to diminish its flywheel effect, and the frame, end shield and housing assembly being conspicuously rugged and compact. The arrangement of the compensating coils on the laminated poles is shown in Fig. 5, and the method of bolting the poles to the magnet frame in Fig. 3.

It is often desirable to protect the motor from chips, flying particles, etc. This can best be done by equipping the motor either before or after installation with a set of either perforated or solid metal covers, divided in halves so that the top half or all the opening may be enclosed. In the majority of cases the

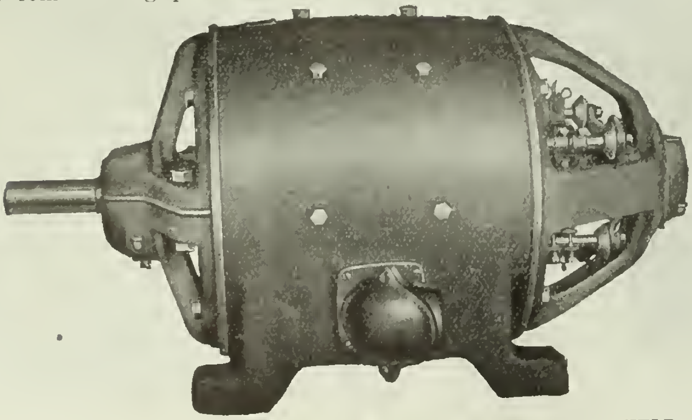


FIG. 1—MOTOR WITH OPEN END SHIELD.

FIG. 2—ENCLOSED VENTILATING TYPE.

top set of covers will provide ample protection and not cause sufficient extra heating to affect the rating. However, if the machine is completely enclosed, as in Fig. 2, an air pipe connection for forced ventilation should be provided if the motor is to run at normal rating.

FIG. 4 SHUNT FIELD COIL ON ALUMINUM, ALSO INTERPOLE COIL.

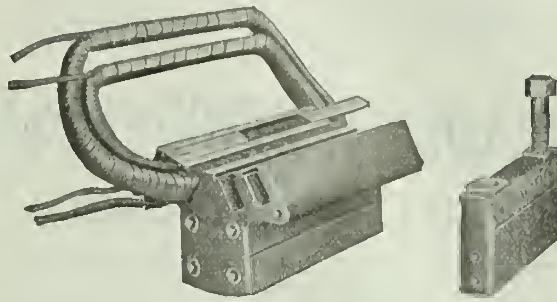


FIG. 5 — LAMINATED MAIN POLE AND INTERPOLE WITH COMPENSATING COILS IN PLACE.

TITANIUM.

TITANIUM is metallurgically somewhat in the position which aluminum occupied forty years ago. Very widely distributed, though not generally in large deposits, titanium might be utilized in various ways if the smelting difficulties could be overcome. Chemically titanium stands between carbon and silicon on the one side, and zirconium and the rare earths on the other. It occurs mostly as oxide, TiO_2, alone as rutile, or associated with iron as ilmenite, $FeO.TiO_2$. The chief European deposit is at Kragero, in Norway; very large deposits of ilmenite are found in the Quebec Province (near Rapid River and Saguenay River), in the United States, India, Ceylon, Nigeria, Queensland and South Australia. The titaniferous iron-sands abounding on the shores of Taranaki Bay, New Zealand, first attracted attention in the British Colonies; but they are unsuitable for the blast-furnace, and even the quite recent attempts at briquetting the ore and smelting it in electric and other furnaces have hardly been successful so far, as we see from the Bulletin of the Imperial Institute, vol. XV., No. 1, 1917, which contains a very instructive article on "The Distribution and Uses of Titanium Ores," amply stocked with references. The pig-iron from the titaniferous sands is too rich in phosphorus and sulphur. Earlier attempts made at Norton, in England, to smelt titaniferous iron ores were given up, owing to the pasty condition of the slag and the uncertainty of the ore supply. That uncertainty does not exist at Sanford Hill, in the Adirondacks (New York) and in the Iron Mountains of Wyoming; but the smelting is not prospering, and the replacement of the silicon in the iron by titanium is not liked. Yet rail steel is notoriously improved as to strength and abrasive resistance when about 1.7 lb. of titanium (as iron alloy) is added in the ladle per ton of steel; and ferro-titanium was much used for this purpose in the days of Bessemer steel, though the metal had to be reduced by the aid of aluminum. The action of titanium, which binds the nitrogen in iron to a nitride, is said to be less marked with open-hearth steel; but basic steel has been improved in this way at Osnabrück, at any rate.

INCREASED PRICES MAKE UP DEFICIT

HIGHER prices of metals rather than larger production will probably account for the considerably increased figures of the mining industry this year. The Ontario Bureau of Mines has given out an interesting result of the mining history of the province in the first nine months of the year. This includes the production of the metalliferous mines and works of Ontario and for purposes of comparison figures for the corresponding period of 1916 are also given.

Notwithstanding the falling off in the output of gold, silver and copper, the aggregate value for the nine months was some $2,000,000 more than for the same period in 1916. Higher prices for silver, copper and nickel are largely responsible for this increase.

Of the total gold production, the Hollinger Mine yielded 161,702 ounces, McIntyre 59,779 ounces, Dome 58,978 ounces.

Gold being the standard of value, and having a fixed price, was practically the only metal which did not share in the general increase of prices. Indeed, the high prices of labor and supplies have for the time being lowered the rate of expansion for this branch of the industry. The output for the first nine months of this year was some 20,000 ounces less than for the corresponding period of 1916.

STEEL FAMINE FEARED IN BRAZIL

UNITED STATES Consul General Gotschalk, at Rio de Janeiro, reports that interviews with several iron and steel importers of Rio de Janeiro disclose a general belief on the part of the best informed among them that within four or five months there will be a complete famine of structural iron and steel and of iron and steel goods generally in that city. Several of the more careful of these importers are quietly buying up all the old iron and steel they can find, with a view to facing this expected situation. It is interesting in this connection to observe that there is a noticeable revival of interests in certain projects which have been for a long time under consideration to establish a domestic steel industry.

A representative of an American concern recently arrived at Rio de Janerio, bringing with him machinery that had been ordered by the Government-owned Central Railroad of Brazil for a large steel plant to be erected at some point on the lines of the railroad.

EXPORT OF CANADIAN COPPER TO BRITAIN INCREASES

A LARGE increase in imports of Canadian copper and zinc into Great Britain is shown in the annual statement of the trade of the United Kingdom for 1916. Exports of copper regulus and precipitate from Canada to Great Britain rose from 800 tons in 1912 to 6,071 tons last year. The respective values were $120,000 and $919,000. Exports of crude zinc, in cakes, from Canada, advanced during the comparative period from 997 tons, valued at $98,500 to 1,236 tons, valued at $539,100.

AN alloy of 2 per cent. palladium with silver is said to form a good substitute for platinum in contact and spark devices. The alloy which gives the greatest resistance to spark erosion is 60 per cent. palladium and 40 per cent. silver. Palladium raises the melting point and lowers the thermal conductivity.

THE St. Charles deposit of iron ore in Quebec is one of titaniferous magnetite, occurring in large segregation masses. The quantity available is estimated from 1,000,000 to 5,000,000 tons. A sample was found to contain 50.53 per cent. of iron, 10.55 per cent. of titanium, with 0.02 per cent. sulphur and 0.03 per cent. phosphorus. By magnetic concentration the iron can be raised to 77 per cent.

IT IS stated that the firm of Franz Schilling & Sohn, bell founders to the Court, at Apolda, Hanover, have melted down some 70,000 church bells during the war, the metal of which has been used for military purposes. The famous Kaiserglocke from the Cologne cathedral, cast from cannon taken from the French during the Franco-German war of 1870-71, will, it is further said, also be removed for the same purpose. Lightning conductors, rumor also states, are being also pulled down from the churches, and their metal used for army requirements.

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PRINCIPAL CONTENTS

LABOR AFTER THE WAR

THERE can be no doubt but that the greatest of after-war problems will be the relations between capital and labor. Men are now being paid wages for munitions and other war-time work which has raised the level of the market to previously unheard of levels. True much of the increased return has been absorbed by the higher cost of living, but in the period after the war, when munitions work stops—when the nations now spending so recklessly start to retrench—the present returns for labor cannot be expected to last. The crux of the situation will be that industrial wages will decline more rapidly than will the cost of living and the civilian individual will then feel the pinch of war conditions, which, generally speaking, he has been far from doing so far.

When the demand for munitions ceases and there is still a shortage in the world food supply, Canada should take her place in the sun to a greater extent than ever as a producer of foodstuffs. For a time at least, especially with the return of the troops, the movement of population promises to be from the urban centres to the rural districts, just as it was the opposite for months after war industrial activity commenced, and not a little evidence is already forthcoming that a "back to the land" movement of fair proportions is gaining momentum and popularity.

Shipbuilding continues active, but not nearly so much so nor on so comprehensive a scale as the exigencies of the situation and the wealth of opportunity warrant. The number of vessels contracted for and building in our various plants reaches a fair total, as do also the launchings, although the latter for the present year will include many craft altogether distinctive from the much needed ocean-going freighter. Our export trade is now, to a large extent, dependent on "bottoms," and will be trebly so at least when all menace of the seas has been removed. Our plant capacity has nevertheless been but little developed, while the immediate outlook for a determined effort to that end is none too bright.

We accepted munitions-making as but temporary in its sojourn, yet we went into it so whole-heartedly as to both astonish ourselves, our neighbors, our friends and our enemies with the results achieved. Shipbuilding, on the other hand, in spite of its known high-degree permanence as a staple industry, has not as yet developed the equivalent of the munitions enthusiasm, and may possibly fail to do so while the difficulty of securing materials of construction continues. The strongest possible support—Government and individual, financial and otherwise—should be made immediately available for the propagation of this very desirable industrial enterprise, in view of the fact that much of our future success in a commercial sense is thereon dependent. The issues are sufficiently momentous to make the subject of supreme national importance, second only to the otherwise successful prosecution of the war besides being co-related to it.

VALUE OF A TRADESMAN'S ADVICE

WHAT is the difference between professional and trade advice? If a man follows a profession, such as that of the lawyer or doctor, he invariably seeks remuneration for services rendered, and it is quite proper that he should do so, as this is undoubtedly the source of his livelihood; but what is the status of the man who works at a trade during the day and is requested in a casual interview with one of these professional men to advise him concerning some small matter pertaining to tradesman knowledge? While a machinist was paying a visit to a physician some time ago in connection with a slight physical disability, the conversation turned to automobiles, with which the tradesman was quite familiar. As it turned out, the car owned by the doctor was not in the best of running condition. Before the patient left, the doctor knew considerably more about his motor than he did before the machinist called.

In the course of a few weeks the tradesman was confronted with a bill of several dollars for professional services rendered. What comparatively was the value of the "services rendered" to the doctor? If the machinist had put in a bill for his services, it is very unlikely that payment would have been made. The wage earner probably did not give a thought to receipt of payment for the advice he gave his physician; notwithstanding, the question still remains, what is the parallel between the two "services rendered?"

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

WAR TIME EFFICIENCY IN ELECTRO-PLATING

By Abe Winters

WITH reference to electro-plating in general, the conditions affecting the business have of late assumed a stage more nearly normal than has been the case since early in 1915. Existing war contracts are being completed with a greatly reduced expenditure of money for needless labor and supplies.

During the introduction of munition manufacture into Canada, the electroplating industry suddenly became of unusual importance, the period immediately following the first allotment of contracts for fuses, clips, plugs, and military metal goods of various kinds, was indeed, actually revolutionary in its effect upon certain phases of the electro-plating industry. Unfortunately, this revolution was not always in a direction which would result in permanent benefit or credit to either the firm engaged in the business, or the platers in charge of the plating plants. Extravagance was tolerated as never before, managers who were noted for their selfish and extremely economical ideas were readily induced to install elaborate equipment and operate the same with lavish outlay of money for labor and supplies. A reaction is now gradually becoming apparent, and the ultimate result will depend very largely upon the metal and chemical market during the ensuing year.

Immediate Efficiency required

In any case, present conditions make it imperative that manufacturers give their plating methods special attention and insist on a reasonable degree of efficiency in every operation and in the general maintenance of the polishing, plating and buffing departments. Foremen who have indulged in the careless and deliberate waste of material and supplies during the past two years will require tactful attention from the superintendent. The readjustment of methods and privileges will necessarily be accomplished with the gradual return to normal business.

Efficiency in a plating department during periods when business increases by leaps and bounds is quite a different proposition to efficiency in a plating department during a period when business is normal or on the decrease. There are at least two ways in which the latter situation may be met, and while we admit that the ideas mentioned herein may well be adopted during all periods, the period of normal or decreasing business is usually the one during which the introduction of economical ideas is of especial interest and receive the sane consideration of both employer and employee.

Organization and Labor

All work treated in the departments under discussion should proceed according to a simple, systematic routing, and the clerical requirements should be reduced to the least possible minimum consistent with accuracy. A foreman possessing sufficient intelligence to enable him to appreciate the value of a routing system and personally attend to the requirements of the same within the limits of his department is less expensive in the long run than the employment of a clerk to attend the routing system through departments in charge of men incapable of performing simple problems in arithmetic.

The preparation of a very large percentage of the wares plated to-day can be conducted much more rapidly, satisfactorily and cheaply by the substitution of female labor for boy labor. One boy working more or less alone may prove a success; two boys working together very frequently produce less work than one boy, and are not as reliable as girls when carefulness and speed are essential.

Holders for the various parts being plated should be constructed of suitable dimensions to facilitate the use of maximum current densities; sufficient numbers of holders should be available for at least twice the requirements of one load in the tank, thereby enabling the preparation of work to continue without interruption.

Electric Cleaning Desirable

The cleaning operation should be performed with the assistance of the electric current whenever possible. If one compound or combination of alkalis does not produce a solution suited to the particular conditions of your wares as they enter the plating room do not discard the electro-cleaning idea as one adapted to only a very limited field. The important point to consider is the adaptability of the electrolyte to the purpose for which it is employed; in other words, a solution must be used which will act as a solvent for the material or substances to be removed from the articles to be cleaned; therefore, prepare the cleaning solution with this point in mind. There are compounds on the market to-day which make possible the electrolytic cleaning of many wares which were regarded as scouring jobs only a few months ago; furthermore, these compounds make the adoption of rapid processes feasible and practicable with the low current supply, which is very often the first obstacle encountered when electrolytic cleaning is attempted by small manufacturers. Electrolytic cleaning will effect a very appreciable saving in labor costs if the operation is given intelligent attention.

It is in the actual plating operations and the maintenance of solutions and current supply that the greatest care is required in order to promote efficiency and the reduction of loss through waste of time and supplies. A plating bath with a capacity for plating 100 square feet of cathode surface should be operated with the full load, and the loading and emptying should proceed continuously. By converting a double sulphate nickel bath into a single sulphate bath and employing suitable corroding salts, together with nickel anodes of high nickel content and properly cast, the output of many plating rooms could be tripled, and the cost of producing the change would not equal the loss in time by the slower method during the period of one month.

Brass goods of ornamental design, or which are not subjected to severe wear, should not be allowed to remain in process of plating longer than sufficient to obtain a metallic coating which will permit coloring to proper lustre with reasonable care.

Hustling is Not Ability

In the performance of the various duties pertaining to plating the foreman and helpers should proceed with calm deliberation at all times; efficiency is not indicated by indulgence in haphazard obedience to the dictations of every authority in the plant—hurry-scurry actions in the presence of those higher up will never convince anyone of your ability to plate or your devotion to your duties. Efficiency in plating includes the elimination of useless motions, needless steps and the display of bluff.

The exercise of constant vigilance with reference to electrical connections, cleanliness of contacts, solutions and the department in general is essential to success. The writer recently visited a plating plant where the cleanliness of the room and finally the cleanliness of the articles being plated had been so badly neglected that the resulting loss to the firm operating the plant approximated one thousand dollars per week for four weeks by reason of cancelled orders. In

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PLACE AND DATES OF MEETING

The Occident Hall, corner of Queen and Bathurst Streets, Fourth Thursday of each month, at 8 p.m.

this particular case the negligence was due to improper or insufficient supervision on the part of the works manager. Inefficiency on the part of a superintendent tends to encourage inefficiency in the foreman, and particularly so in the case of foremen platers, many of whom profit unwisely by the executive's lack of knowledge of practical electro-plating practice.

Questions and Answers

Question.—A copper solution I recently prepared from cyanide, copper carbonate and sodas is now working very badly. The anodes are black all the time, the solution registers 13 deg. on the hydrometer and the deposits, which are brownish red, blister to such an extent that I have been compelled to stop using the bath. I shall appreciate your assistance.

Answer.—Reduce the density of the solution to about 5 or 6 deg. Beaume by removing a portion of the liquid to a clean receptacle where it may be kept for future use, and making up the original volume of the bath by addition of clean water. Add cyanide sufficient to clean the anodes when bath is at rest. Do not add more sodas. Operate the solution at 120 to 150 deg. F. if possible and avoid introducing a cathode surface area in excess of the effective anode surface. The e.m.f. should be at least 4 volts and the current density permissible will depend on the composition and shape of the cathode. Sodas must be introduced with care as they are frequently the direct cause of blisters.

* * * *

Question.—One of our products is made of several pieces of cold-rolled steel soldered together. Our polishing operations on this particular piece are three in number, the final operation being on tampico brush and emery. We have suggested the elimination of this final operation but our plater, who also supervises the polishing department, tells us the operation is essential for the production of a surface suitable for receiving a deposit of nickel. Kindly give us your opinion regarding the subject.

Answer.—The attitude of your plater regarding your suggestion is positive evidence of a lack of interest in his employer's prosperity. The suggestion you have made is one which might easily be tried and if found worthy of adoption it would mean an increase in output without extra effort. The surface of the cold rolled steel after receiving two wheel operations should be such as to warrant the deposition of nickel or other metal direct upon it after cleaning. We would expect the final brushing operation to lend uniformity of finish only if soldered joints are not rough, in which case the brush would smooth the joints. Adherency of the deposited metal does not depend upon the third wheel treatment in any event. An experiment with a few pieces should prove convincingly the possibility of the success attainable by eliminating the final brushing, and perhaps aid in getting your plater out of a rut which will sooner or later lead to a bad end. Ruts should not be tolerated in war times.

* * * *

Question.—We use a compound called Natrolin for making our cleaning solutions. The solution is heated by steam exhausting into the tank and the operators swab the articles to be cleaned while wet with the Natrolin solution. Our plater has recently left our employ and as labor is scarce we are trying to supervise operations. The above method seems wrong to us, but, before altering the conditions we seek your advice.

Answer.—Heat the solution with live steam by passing through a coil of iron pipe and exhaust the steam into your hot water tank or sawdust drying box coils. Temperature of Natrolin solution should be at least 120 deg. F. Swabbing the work at the cleaning tank is not good practice, being wasteful and injurious to hands and health of the operators. If the solution could be operated in connection with the electric current as an electric cleaner, the operation of swabbing might be avoided and same output obtained with less labor than you require at present. In any case do not allow steam to escape direct into the cleaning solution, as the strength of solution is thus being continually reduced through loss of solution by overflow, or else the solution is not heated to a degree sufficient for softening or removing the greases which are present on the surface of articles being treated, and consequently more labor is required for the completion of cleaning. A small quantity of soda ash used with the Natrolin as an electric cleaning solution will increase its efficiency and retard the formation of an objectionable sediment on the articles undergoing treatment.

* * * *

Question.—Recently I had occasion to tone up a double sulphate nickel solution and added 2 oz. single salts and 4 oz. of common salt per gallon as per information obtained from a U.S. trade paper. The solution certainly throws on a heavy plate but it is dull and very hard to color by buffing. Is there any way I can manage to get a brighter plate from this bath, one that will color easier?

Answer. — An overdose of sodium chloride (common salt) is evidently the cause of the dull matte which you find difficult to color. The conductivity of the solution has been improved and by reason of increased corrosion of the anodes you are really getting a superior deposit; less sodium chloride would suffice. You will find the restoration of the bath to bright plating tendency a rather unsatisfactory task, and much will depend upon its daily management. We suggest a further addition of 2 oz. single nickel salts per gallon and from 3 to 4 oz. boric acid per gallon. Operate the solution as acid as safety will permit. Constant use without depleting the bath will assist in bringing about the desired condition.

If after a few weeks use, the above additions have not proven entirely satisfactory, we advise removing the solution from the tank and boiling it for about ten minutes. Maintain a large effective anode surface at all times and vary the current density sufficiently to allow daily study of the results. Frequently a bright plate is obtained from such baths for a short period after replenishing, and then the reverse conditions return. If this happens try a further addition of single nickel salt. If persistent, you will eventually be able to produce a better deposit without further trouble.

* * * *

Question.—A large amount of our products are made from small round steel tubing. We polish the surface with emery applied to a tampico brush and obtain a smooth clean finish. These pieces are cleaned for plating by both electric cleaner and swabbing with fibre brush; no pumice is used. When the tubes are plated they present a very rough dirty appearance, which suggests the presence of pumice underneath the plate. It is practically impossible to properly color the deposit of nickel on such surfaces by ordinary buffing. The plater blames the polisher who in turn blames the plater. Kindly lend us some assistance in solving the problem?

Answer. — Without inspecting a sample of the plated tubing we must indict the plater. The condition, however, is neither the result of improper polishing or negligence in cleaning or rinsing. It is the direct result of too high current density during nickeling. The deposit is being forced and the point of actual "burning" has been reached. The slightest excess of current beyond that used would increase the granular structure of the deposit to such an extent that the true source of the trouble would be evident to an amateur. It is purely a result of current conditions during plating. You may overcome the difficulty by either reducing the current at the tank or by increasing the concentration of the nickel solution thereby enabling the employment of higher current density than is possible with the weaker solution. If your nickel solution is a double sulphate bath use the single salts only for replenishing and trouble from crystallization during the cold weather will not be so liable to occur. Two to three ounces of boric acid per gallon will also assist in relieving the situation.

* * * *

Question.—Is there any practical remedy for black spots at the points of contact on zinc plated steel goods?

Answer.—We have never seen an acid zinc solution which would deposit a clean plate at the point of contact with a holder. The only remedy known to us is the changing of the point of contact during deposition. The change should be made when about two-thirds of the time allowed for deposition has elapsed. If the article being plated is large it would be better to invert the piece.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$32 75	
Lake Superior, charcoal, Chicago	37 50	
Standard low phos., Philadelphia	....	
Bessemer, Pittsburgh	37 25	
Basic, Valley furnace	33 00	

Government prices.

	Montreal	Toronto
Hamilton	....	$50 00
Victoria	....	50 00

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$ 62 00
Antimony	18 00
Copper, lake	32 00
Copper, electrolytic	32 00
Copper, casting	31 00
Lead	8 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	0 98
Tin	82 00
Zinc	10 56

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$19 00	$19 00
Copper, crucible	22 50	21 50
Copper, heavy	22 50	21 50
Copper wire	22 50	21 50
No. 1 machine composition	20 00	20 50
New brass cuttings	16 00	17 00
No. 1 brass turnings	15 00	15 75
Light brass	11 00	10 00
Medium brass	15 00	14 00
Heavy brass	16 00	16 00
Heavy melting steel	21 00	20 50
Steel turning	12 00	8 00
Shell turnings	12 00	12 00
Boiler plate	23 00	18 00
Axles, wrought iron	30 00	24 00
Rails	26 00	20 50
No. 1 machine cast iron	25 00	25 00
Malleable scrap	21 00	20 00
Pipe, wrought	15 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	32 00	30 00
Mach. shop turn'gs	8 50	8 50
Cast borings	15 00	8 50
Stove plate	19 00	19 00
Scrap zinc	5 00	6 50
Heavy lead	6 00	7 00
Tea lead	5 00	5 75
Aluminum	28 00	25 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

1/4 in.	$12 00
5-16 in.	11 50
3/8 in.	11 15
7-16 in.	10 90
1/2 in.	10 70
9-16 in.	10 70
5/8 in.	10 50
3/4 in.	10 40
7/8 in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 36
Solder, guaranteed	0 38½
Babbitt metals	18 to 70
Soldering coppers, lb.	0 53
Putty, 100-lb. drum	4 75
White lead, pure, cwt.	16 20
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 38
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	0 78
Linseed oil, boiled, single bbls.	1 42
Linseed oil, raw, single bbls.	1 45
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A. ...list plus	20
Emery cloth ...list plus	0 20
Borax, crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular	0 15
Wood alcohol, per gallon	1 80
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 9 50	$ 9 00
Sheets, black, No. 10	12 00	12 00
Canada plates, dull, 52 sheets	12 00	12 00
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B. W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W. G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	9 70
Premier, 10¾ oz.	13 85	10 00
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$15 50
3-16 in.	11 70
1/4 in.	8 40
5-16 in.	7 40
3/8 in.	6 35
7-16 in.	6 35
1/2 in.	6 35
5/8 in.	6 35
3/4 in.	6 35

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard buishings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 50%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.50 to $0.54
Cobalt	1.75 to 2.00
Copper	.36 to .38
Tin	.86 to .88
Silver, per oz.	1.05 to 1.00
Zinc	.14 to .16

Prices per lb.

NAILS AND SPICES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .20
Acid, hydrochloric	.05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium, carbonate	.08
Ammonium, chloride	.11
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.07
Arsenic, white	.10
Caustic soda	.07
Copper, carbonate, anhy	.50
Copper, sulphate	.16
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.12
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide substitute	.20
Silver nitrate ...(per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.46
Sodium cyanide, 98-100%	.38
Sodium hydrate	.05
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, singl and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1.95
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3 25
Polishing wheels, bullneck		2 00
Pumice, ground		07
Emery composition	10 to	12
Tripoli composition	06 to	09
Crocus composition	08 to	12
Rouge, powder	.30 to	.35
Rouge, silver	.50 to	.55

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	48 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	55 00	48 00
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 16 oz. base	64 00	49 00
Braziers', in sheets, 6x4 base	55 00	48 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd.	0 43
Brass sheets, 24 gauge and heavier, base	0 48
Brass tubing, seamless	0 55
Copper tubing, seamless	0 60

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.39
British Manila rope	.33
New Zealand Hemp	.33
Transmission rope, Manila	.45
Drilling cables, Manila	.41
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor oil, per lb.	50
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
P.H. and Imperial	[illegible]
Globe	50
Vulcan	50
Disston	50

The General Market Conditions and Tendencies

TORONTO, Ont., Dec. 4.—The remarkable success of the Victory Loan will be gratifying to Canadians as well as to our Allies, not only because it shows a determination to "carry on" with the war, but also by reason of the benefit that will accrue to Canadian industries in the form of orders for war supplies. The munitions industry in particular will benefit by the success of the war loan, as a considerable proportion of the money will be appropriated for the manufacture of shell. Already arrangements have been made to distribute substantial orders for shrapnel, 4.5-inch and 6-inch shell, which will keep many plants actively employed for several months.

Steel

The iron and steel market is somewhat dull, the situation being practically unchanged. Business is on the quiet side owing to the difficulty that is being experienced in obtaining steel for any purpose other than for war equipment and munitions, etc. Judging from the number of inquiries received by local merchants, there is little doubt but that business would be brisk if all the material that is required could be obtained;

this applies to imported steel as well as domestic material. The inquiries cover a variety of lines and come for the most part from manufacturers who are suffering from the shortage of steel. Manufacturing operations are being restricted on this account, which is creating a scarcity in a number of articles required for every day use. Manufacturers should place their orders for iron and steel goods required in their business well ahead of time and not allow stocks to become depleted before ordering fresh supplies, by this means avoiding delays in deliveries.

From all accounts the outlook for the steel companies is very favorable, the volume of orders on hand being as large as at any previous time. Production continues on a favorable basis, and a continuation of open weather will help considerably towards this end. Munition orders will continue to be an important factor in the steel trade, and will account for a considerable proportion of the output during the next six months.

Prices of steel products, with few exceptions, are holding firm, there being no changes to announce this week except in galvanized sheets, which have declined about 50c per 100 lbs. It is likely that there will be a further decline in prices of the lighter gauges of black sheets, although they are unchanged in the meantime. In the primary market inquiries for black sheets are heavy and manufacturers are making every effort to take care of their regular customers. Large requirements by the Government have made it necessary for producers to supply only consumers who are engaged in the manufacture of essentials.

Chicago warehouse prices are down, steel bars being now quoted at 4.10c; structural shapes, 4.20c, and plates, 4.45c. The steel market in the United States has been more active in the past week than at any time since prices were fixed, with some increase in private demand in nearly all lines and with many large Government contracts reported. It is believed that the unfilled tonnage statement for November will not show nearly as much of a decrease as the previous one.

Pig Iron

There has been no change in the domestic pig iron market this week, but the situation in the States is becoming more serious owing to the scarcity of fuel and labor. The shortage of fuel at the blast furnaces in the Pittsburgh district continues to be extremely acute and has resulted in an additional number of stacks being banked. The shortage of coke is curtailing the output of pig iron and in turn the production of steel. Steel companies in the United States have been buying low phosphorus iron recently in Canada, and notwithstanding the recent embargo placed on shipments by the Dominion Government, the metal has been released; but hereafter licenses will have to be secured to obtain Canadian material. On the other hand, the United States furnaces are in receipt of heavy inquiries from Canada for basic and Bessemer iron.

Scrap

The market for iron and steel scrap is fairly active at unchanged prices, which are holding firm. The supply of these materials is, however, none too heavy, which is keeping the market firm. Prices of copper and other non-ferrous metal scraps are weak and demand light.

Machine Tools

Business in the machine tool trade is gradually becoming more active and the outlook is brighter than it has been for some time. That further shell orders will be placed in Canada is assured by the announcement that the Imperial Munitions Board has received instructions from the British Government to issue contracts for shrapnel, 4.5-inch and 6-inch shell to all Canadian firms equipped to produce these sizes. The volume of these contracts, it is understood, will keep the plants actively engaged until well into the new year. This is all entirely new business, and is, therefore, additional to those contracts now being executed. New equipment will be required in a number of plants to increase production and also to replace worn-out tools. Canadian machine tool builders will benefit by this new business and another spell of activity is assured. Owing to the increasing activity in the United States, deliveries of machinery from across the line are becoming more backward, some classes of equipment being very difficult to obtain.

Supplies

The market for machine shop supplies is steady and prices are holding firm, although there are fewer changes being made now than formerly. A very fair demand is reported by dealers, who are looking for increased business from munition plants.

Metals

There is no material change in the situation in the metal markets and prices generally are holding firm at last week's levels. There is no change in the tin situation although some relief is expected shortly, in which case prices will probably decline. The copper situation is gradually being cleared up although there has recently been some confusion in the trade in the States in regard to jobbers' re-sale prices. The Sub-Committee, Washington, has made suggestions as to the fixed differentials between the various grades of spelter but did not make any suggestions in regard to the base price. The lead market is quiet and unchanged, as is also the antimony market. An improvement in the position of both these metals is looked for when the shrapnel contracts are placed.

Copper.—There is some confusion in the primary market over the resale price for jobbers but the situation is gradually being straightened out. The producers will supply copper after Jan. 1 at the established price of 23½c a pound which may be distributed in small lots to the smaller consumers at 24.675c per pound. The dealers propose to sell copper which they hold and which costs them more than 23½c at an advance over the original cost to them. It is figured that after January the smaller consumers may look for a price which must not exceed 23½c a pound plus 5% commission. About that time it is expected that the high priced copper will have disappeared. The local price is unchanged and market quiet. Lake and electrolytic are quoted at 32c and castings at 31c per pound.

Tin.—An improvement in the tin situation in New York is expected shortly as the Sub-Committee on tin, at Washington, has been given power to control the distribution of tin in the United States and has taken steps to supervise tin importations. The U.S. Navy Department has commandeered all tin in New York warehouses. The Navy Department action was prompted by the intense competition for tin, which has resulted in forcing up the price within a month from 54 cents to 80 cents a pound. Tin cannot be bought on the open market, because of British export restrictions, and it is said that firms having government contracts requiring the use of tin, including those manufacturing tinned foods for export to the Allies, will be in serious straits unless some action is promptly taken to remedy the situation. Local price firm and unchanged at 80c per pound.

Spelter.—The differentials for the U.S. Government prices between prime Western and the grades A. and B. have been fixed at an advance of ¼c to ½c for brass, 2c for grade B, and 3c to 3½c for grade A. The base price or the price of prime Western however has not been established. The market is dull and quotations unchanged at 10½c per pound.

Lead.—Prices are unchanged although there is a slightly easier tone to the market which is quiet. The position of lead will likely improve with the placing of further shrapnel contracts. Lead is quoted at 8½c per pound.

Antimony.—The market is showing more signs of lift due to heavier buying and the position of antimony has improved. The price is unchanged at 18c per pound.

Aluminum.—The market is firmer and dealers are expecting higher prices. There is no scarcity of metal on the outside market. Quotations are unchanged at 62c per pound.

FOUNDRY SUPPLIES AND CHEMICALS

The principal feature in the market for foundry supplies continues to be a general shortage of raw materials with a reduction in output of equipment and products not required for war work. Prices have not as yet shown any sign of coming down, being steady and firm with an upward tendency in some lines.

The chemical market is quiet with values unchanged. Manufacturers have very little material for delivery and consumers are almost entirely dependent upon resellers who, especially for acids, ask premiums over prevailing quota-

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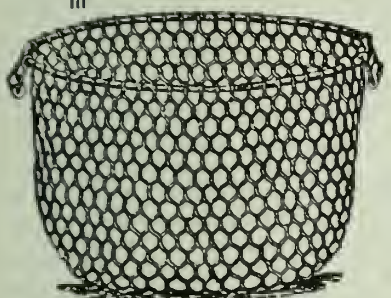

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It has behind it our experience of 25 years, and having been tested in competition has proved its superiority.

Imperial Black Core Compound

It is 100% pure.

Imperial Parting

We guarantee it under the most severe tests, and our repeat orders prove what it has done. Let us send you a sample.

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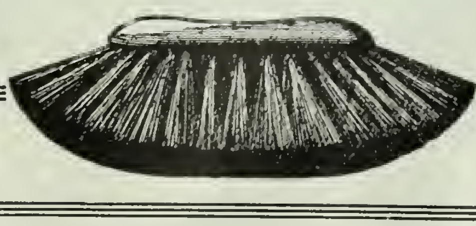
THE HAMILTON FACING MILL CO., LIMITED

HAMILTON, ONTARIO, CANADA



tions. A heavy export business in blue vitriol is reported in the primary market, which is strong. In view of the scarcity of tin, producers of tin oxide and other tin derivatives are proceeding with extreme caution and values are hardening all around. The principal producer of tin oxide forecasts the possibility of higher prices in the near future.

TRADE GOSSIP

Moncton, N.B.—The forge shop owned by P. Melanson, was destroyed by fire with a loss of $30,000.

Lethbridge, Alta.—The City Council contemplate the installation of power plant equipment costing $63,000.

B. J. Lanigan, secretary-treasurer of the Calgary Iron Works, was married recently to Miss Winnifred Colgan.

Vancouver, B.C. — The Canadian Metals, Ltd., will equip a scrap yard and is in the market for shears, acetylene cutters and a magnet for lifting iron.

H. M. Lee has been appointed manager of the Bond Engineering Works, Ltd., Toronto. This new concern is a subsidiary of the Bond Foundry and Machine Co., Manheim, Pa.

McLain System, Inc., 906 Goldsmith Building, Milwaukee, Wis., has changed its name to the McLain-Carter Furnace Co. Oil fired open-hearth and metal melting furnaces will be the company's specialties.

U.S. To Control Tin Imports.—The American Iron and Steel Institute has at the request of the United States Government undertaken the control of the importation of tin from foreign countries into the United States.

Brantford.—Fire destroyed the brass foundry of Charles Lake, 46 West Street, at an early hour on November 30. The cause of the fire is unknown. The foundry, a frame and brick building, was burned to the ground.

U.S. Coke Prices Are Fixed.—Basic prices for by-product coke have been fixed by the United States Fuel Administration as follows: Run of ovens, $6; selected foundry, $7, and crushed over one inch, $6.50. Prices for beehive coke already have been announced.

Toronto, Ont.—The Bond Engineering Works, Ltd., who have recently taken over the Queen City Foundry, will make a line of power transmission specialties and will continue to make grey iron castings. The company contemplates making additions to the plant.

Drummondville, Que.—The Aetna Explosives Co. are again operating their plant which has been closed down for some months. The acid departments are being operated at capacity to manufacture sulphuric and nitric acids, and the output is at the rate of 3,000 tons monthly.

Niagara Falls, Ont.—The building at Niagara Falls, jointly occupied by the Davis-Bournonville Co. and the Davis Acetylene Co., has been taken over by the former company and will be operated exclusively for the manufacture of oxy-acetylene apparatus for the Canadian trade.

Eagle Smelting & Refining Works, Ltd., have been incorporated at Ottawa by Peter Bercovitch, E. Lafontaine and N. Gordon, all of Montreal, to manufacture, smelt, refine babbitt, solder, brass, lead and zinc etc. The company is capitalized at $40,000 and the head office is in Montreal.

G. D. Perley, son of Vice-President Ward B. Perley, of the Canadian Steel Corp., Ltd., Ojibway, Ont., will become assistant on Jan. 1 to W. H. Knox, of the firm of W. H. Knox & Co., New York, importers and exporters. Mr. Perley has been connected with the Carnegie Steel Co., Youngstown, O., for several years.

Ottawa. — Assistant City Engineer Askwith has been given permission to call for tenders on the supply of an apparatus for thawing out city water pipes. The style of apparatus the engineer desires is gasoline-driven and mounted on sleighs. The estimated cost is $3,500.

Armagh, Que.—Gouvin & Beauchemin, civil engineers, Quebec, are preparing plans and specifications for power development at Armagh, County Bellechasse, on River Fourche-du-Nord-Ouest, and will receive tenders for water turbines, dynamos, sluice-gates, penstock and wooden pipes, etc.

J. Frater Taylor, president of the Algoma Steel Corporation, Sault Ste. Marie, Ont., will retire from this position at the end of the present year. Mr. Taylor will still retain his association with the Soo industries in an advisory capacity as chairman of the Lake Superior Corporation. It is understood that W. C. Franz will succeed Mr. Taylor as president of the Algoma Steel Corporation.

Butterfield and Co., Rock Island, Que., have recently completed the erection of one of the most complete factories for the production of small tools in the Dominion of Canada, and are now in a position to take orders for all styles and kinds of twist drills and milling cutters, in high-speed or carbon steel, and are especially equipped to handle promptly any class of orders for drills, milling hobs, etc., used in the making of shells and other munitions.

The Canada Machinery Corporation will erect a steel and brick extension to their plant on Water Street, South. In view of the present high cost of structural steel and the difficulty of obtaining such material, the company are utilizing the building owned by them in Hamilton, this structure being dismantled and re-erected in Galt. The extension will give the company about 24,000 square feet additional floor space and will give employment to one hundred additional workmen.

Hamilton, Ont. — The Robert H. Hassler Co., of Indianapolis, Ind., manufacturers of the Hassler shock absorber, have decided to locate their Canadian factory in Hamilton. Fred. Morris of the F. G. Morris, Ltd., Canadian distributors of the Hassler shock absorber, and Mr. Marsh, the Industrial Commissioner for Hamilton, have been instrumental in securing this new industry for the city. J. C. Piper will be managing director of the new company who have leased a building on Sherman Ave. N. for a factory.

Flight-Lieut. Lloyd M. Archibald, Royal Flying Corps, No. 100 Squadron, France, is now a prisoner of war in Germany. He was formerly reported missing since Oct. 24. He went overseas in October, 1916, completing his training with the R. F. C. in England. For a time he was a night pilot, patrolling the North Sea, and about the 1st of October this year left for France, where he was a pilot, bombing at night. He is twenty-four years old, was born in Nova Scotia, but was educated in Toronto, and before enlisting was a coast to coast traveller with the Dart Union Co., Toronto.

CATALOGUES

Air Squeezers.—Bulletin distributed by the Berkshire Mfg. Co., Cleveland, Ohio, illustrates and describes the Berkshire air squeezer operated by hand or power. The machine is illustrated in various operating positions. The Berkshire vibrators, flask fittings and power rotary riddle are also mentioned in this bulletin.

Tumblers and Dust Arresters is the title of a new catalogue No. 132 issued by the Whiting Foundry Equipment Co., Harvey, Ill. The catalogue contains a detailed description covering the construction of one class of tumbler and briefly refers to other types. Dry and water cinder mills and dust arresters are also mentioned at some length. The catalogue is fully illustrated and contains tables of dimensions covering the products described.

The Whiting Cupola.—Catalogue No. 131 issued by the Whiting Foundry Equipment Co., Harvey, Ill., is a new edition of the cupola catalogue presenting new illustrations which show the latest developments in design of the Whiting cupola. The catalogue describes the special features of design of this cupola including the patent tuyere system. Other matter deals with economy of fuel, rapid continuous melting, practical hints on operations, etc., and also contains a table of sizes and capacities, and a useful telegraphic code which will be of great convenience to the company's patrons. The catalogue also contains descriptive matter, with illustrations of charging machines, charging cars and cinder mills, etc.

Bennis Machine Stoker is the title of a catalogue, on cheap steam and machine firing, issued by Ed. Bennis & Co., Little Hulton, Bolton, England. The introduction to the catalogue deals with cheap steam and smokeless chimney followed by a description covering the

construction and operation of the "Bennis" patent machine stoker fitted with patent pneumatic gear and self clearing compressed air furnace. Views are shown of the various parts, and also of installations. The application of the Bennis stoker under various types of boiler is shown by means of reproduction from sectional drawings which show the general arrangement of the stoker and furnace in each case. The catalogue also contains reports of two boiler tests with Bennis machine stockers installed.

BOOK REVIEW

Motor, Marine and Aircraft Red Book, 1917.—439 pages and numerous illustrations. Published by the Technical Publishing Co., London, England. Price 5/6, ($1.40). This is the seventh edition of a year book published under a new name more in keeping with its extended field. This volume contains an abundance of information pertaining to motor cars and their manufacturers, motor cycles, commercial and agricultural motors, marine motors, aircraft, etc., together with full information relating to the legislation necessitated by the war as affecting motor, aircraft and allied industries. The information has been collected and made easily accessible concerning internal combustion engines, steam engines and electric motors. Special attention has also been paid to the use of motors in agriculture and horticulture, and in the municipal and public services. The book contains nine sections and a dictionary of technical terms in five languages, the latter being introduced to further the interests of the export trade. It is not possible to give particulars of all important information contained in this volume which will prove of very great value to those interested in the motor industry and trade.

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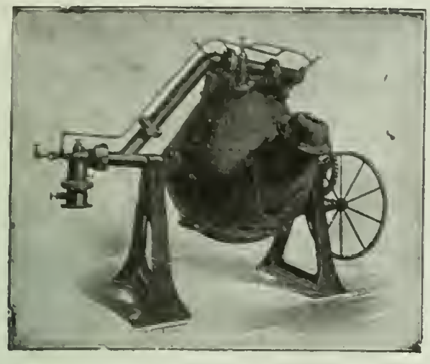

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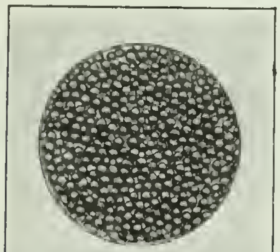

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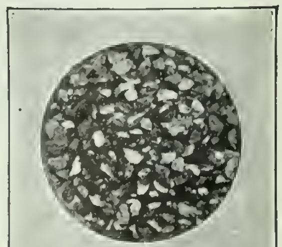

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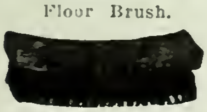
Actual Size

Floor Brush.



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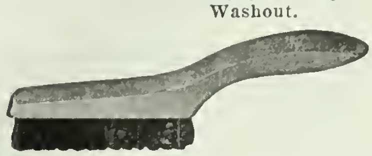
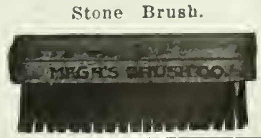


Shoe Handle Washout.

Stone Brush.



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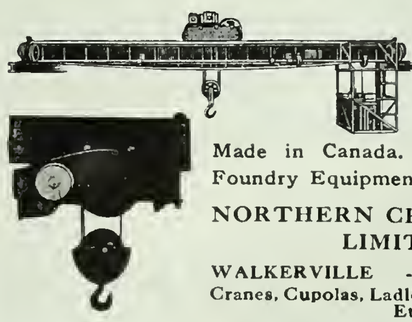

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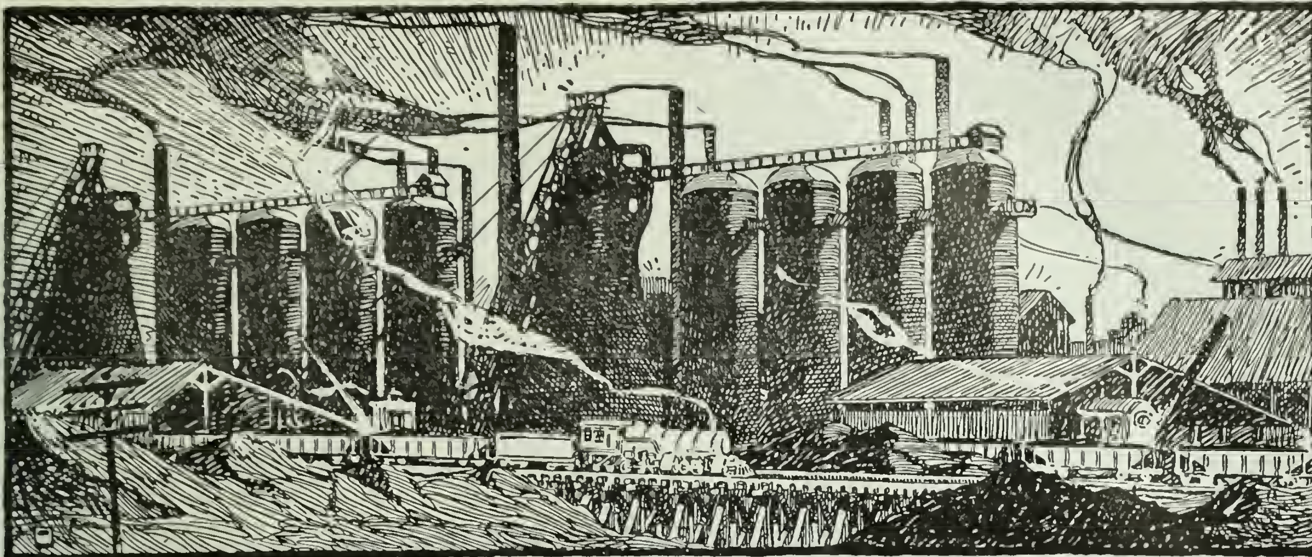

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Monarch Engineering & Mfg. Co., Baltimore, Md.
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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
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Castings of Ottawa, Ltd., Ottawa, Ont.
Davenport Machine & Fdry Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Midland Machine Co., Detroit.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., Montreal, Que.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
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W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Sherbrooke, Que.

PULLEYS, MAGNETIC
Ding's Magnetic Separator Co., Milwaukee, Wis.

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Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RESIN
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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY

Brown Specialty Machy. Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto. Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons. Ltd., Montreal, Que.
Mott Sand Blast & Mfg. Co., Brooklyn, N.Y.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
U. S. Silica Co., Chicago, Ill.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
U. S. Silica Co., Chicago, Ill.

SAND CONVEYING MACHINERY

Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL

Harrison Supply Co., Boston, Mass.

SAND MOLDING

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS

Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SEPARATORS

Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

SHOT

Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
U. S. Silica Co., Chicago, Ill.

SIEVES

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH

Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED

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Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE

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Hyde & Sons, Ltd., 12 Bleury St., Montreal.
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Woodison, E. J., Co., Toronto, Ont.

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Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SPRUE CUTTERS

Can. Hanson & Van Winkle Co., Toronto, Ont.
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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND

Can. Hanson & Van Winkle Co., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Ia.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED

Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT

Can. Hanson & Van Winkle Co., Toronto, Ont.
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Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS

Can. Hanson & Van Winkle Co., Toronto, Ont.
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Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

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Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hart Wheels, Hamilton, Ont.

TALC

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Hyde & Sons, Ltd., Montreal, Que.
E. J. Woodison Co., Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., Montreal, Que.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Hamilton, Ont.
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Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
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Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS

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Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
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Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

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Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hart Wheels, Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Woodison, E. J., Co., Toronto, Ont.

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Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

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Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Hyde & Sons, Ltd., 12 Bleury St., Montreal.
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Woodison, E. J., Co., Toronto, Ont.

ADVERTISING INDEX

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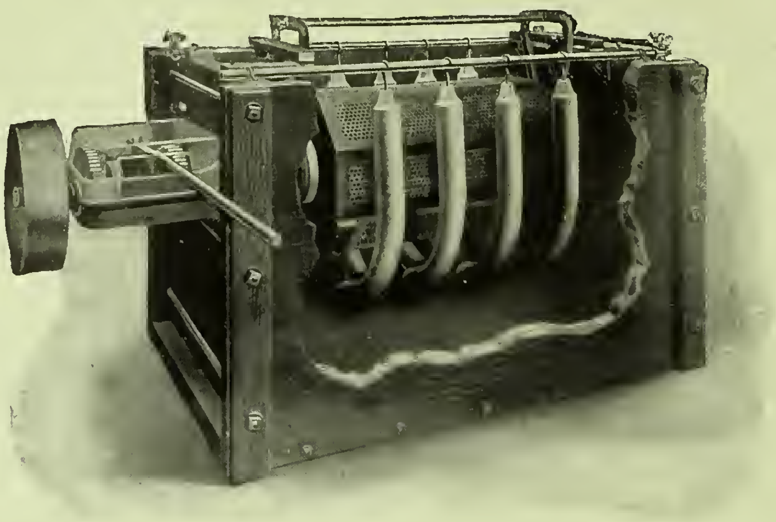

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