CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical, power, foundry and allied fields.
Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg and London, Eng.

Vol. XVIII—No. 13 Publication Office: Toronto, September 27, 1917 Subscription Price $3.00 per Year

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SMALL TOOLS

The Publisher's Page

TORONTO September 27, 1917

THE sales-manager of one of the big steel companies told us a few days ago to book his order for two pages (in two colors), in the

ANNUAL REVIEW AND DIRECTORY NUMBER

Canadian Machinery
December 27th, 1917

Many of the leading manufacturers have arranged for big representation in this important issue.

The Biggest and Best Yet

Our Annual Number has come to be generally recognized as the greatest business influencing agent in industrial Canada. It has grown year after year until in 1916 it broke all records for Canadian publications, containing as it did 432 pages.

One advertiser alone carried twenty-four pages in last year's annual. Another used six pages. Several used four pages, many two pages. Many announcements were printed in colors or on colored paper.

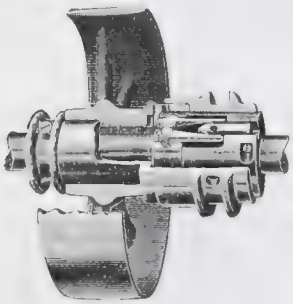
This year we confidently expect our Annual Review Number will run over 500 pages. It will be the best and biggest and most complete Buyers' Guide ever placed in the hands of Canadian buyers. And that's just exactly what our Annual Number is—a Buyers' Guide and reference. Hundreds of copies of last year's Annual are still hanging beside the desks of buyers in the biggest shops in Canada—time-worn and soiled but still influencing business.

It is our intention to classify and group advertising as much as possible for the convenience of buyers and your co-operation is invited. If you will reserve your space at once and let us have your copy and cuts within a reasonable time it will enable us to render a much better service than would otherwise be possible.

Several firms were very much disappointed last year because we were compelled to go to press without their advertisements. Cuts forwarded by express were delayed in transit, some not arriving for two weeks after our Annual Number was in the mails! So we ask you to immediately reserve your space and to let us have copy instructions just as soon as possible. Some forms *must go to press early* and in order to properly arrange advertisements and do them justice it is absolutely necessary to press for immediate action.

If any advertisement interests you, tear it out now and place with letters to be answered.

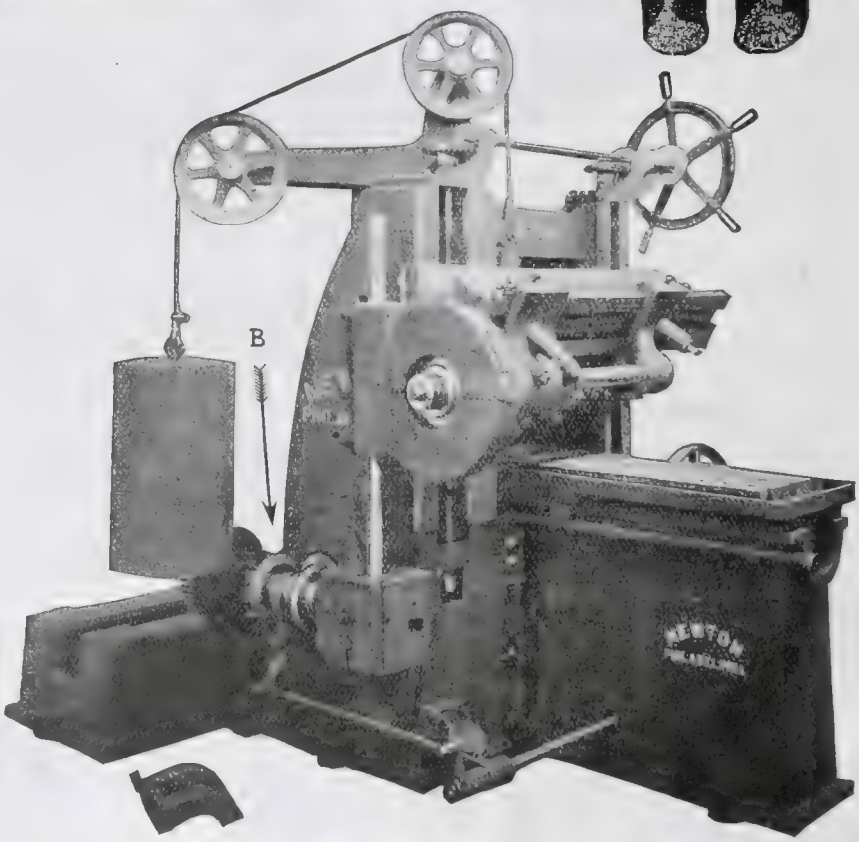
The Johnson Friction Clutch Is Being Used As A Part Of This Machine



Single Clutch with Pulley on Hub.

It's a Newton Miller

Many types of Newton Machine Tools have Johnson Friction Clutches in their make-up. The Milling Machine illustrated has a Johnson Double Friction Clutch incorporated between the gears at the point indicated by the arrow.



Courtesy, Newton Machine Tool Works, Philadelphia, Pa.

Johnson Friction Clutches Are Being Used on All Types of Machine Tools

Designers of all kinds of machine tools and special devices requiring clutches are invited to consult our engineering department for a solution to their problems. We are rendering this service free every day and are able to save you valuable time and many costly experiments. The construction of Johnson Friction Clutches makes them adaptable to all types of machine tools and mechanical devices.

Standard Double Clutch Exterior

If you are a builder of machines, let us show you how a Johnson Friction Clutch will increase its efficiency.

Send for our yellow data sheets and latest free booklet, "Clutches as Applied in Machine Building," now.

THE CARLYLE JOHNSON MACHINE CO.
MANCHESTER, CONN.

England—The Efandem Co., 159 Gt. Portland St., London, W., England. Sole Agents for the British Isles.

Canada—Williams & Wilson, Ltd., 320 St. James St., Montreal. Canadian Fairbanks-Morse Co., Limited, Toronto.

Australia—Edwin Wood, Pty., Hardware Chambers, 231 Elizabeth St., Melbourne, Victoria.

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

6-inch Shell Cutting-off Machine

Cuts both ends at once

Forgings load in one end and discharge out the other end when cut

A Girl can operate it.

New quick power return for saddles

DELIVERIES REASONABLE

Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.

If any advertisement interests you, tear it out now and place with letters to be answered.

Roelofson 6-in. Banding Machine

YOU couldn't imagine a more sturdy, compact, serviceable machine than this! A glance at the illustration will show you for yourself. It has been used in Canadian munition plants since the munition business started, and is still giving absolute satisfaction. It's the machine you need if you make shells.

Look over the following outstanding features of its construction:

Integral (en bloc) construction assures perfect rigidity, permanent accuracy and desirable compactness.

Chucking with spring collet chuck insures accurate and speedy checking.

Graduated feed dial, two cutting tools, and ample belt power insure output of accurate work in least possible time.

Machines are built for 15, 18, 60-pdr. and 6" shells.

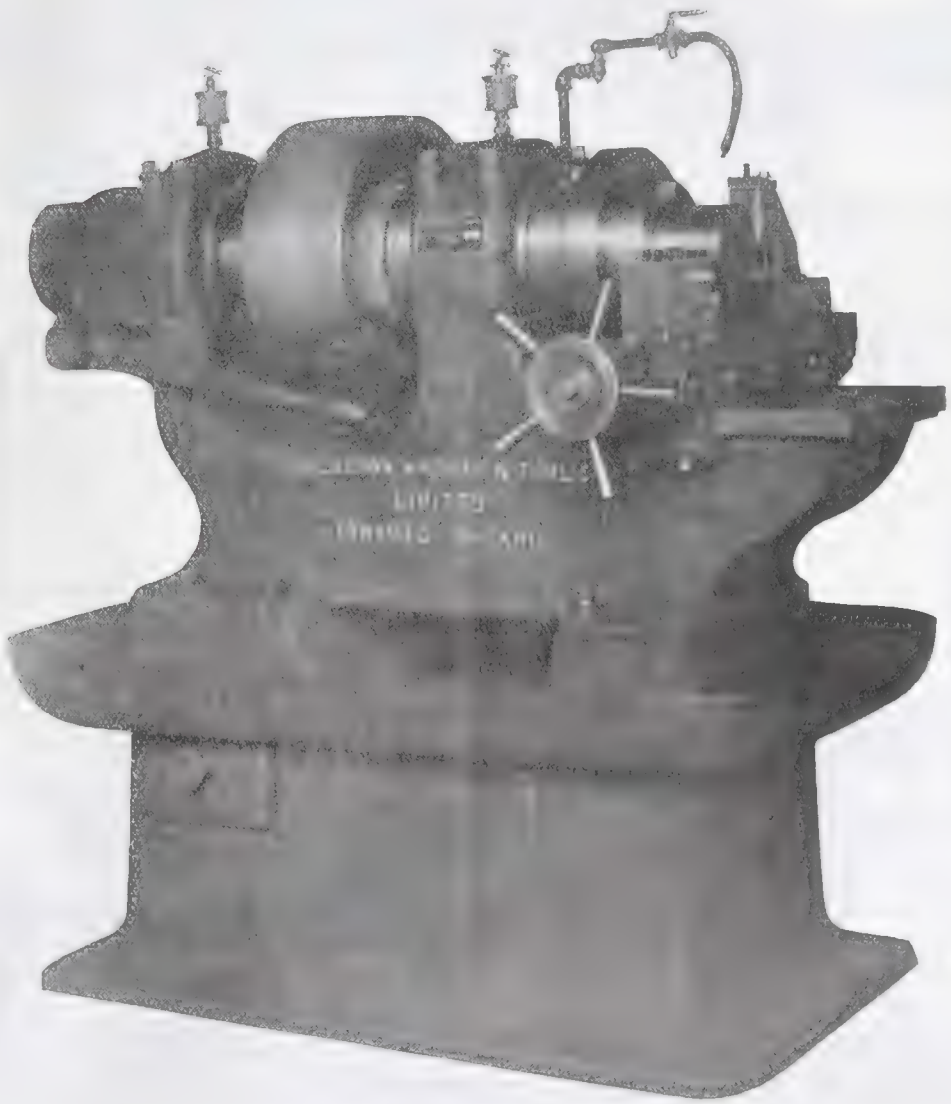
Roelofson Machine & Tool Co., Ltd.

Head Office 1501 Royal Bank Building, Toronto, Canada
Works and Warehouse: Galt, Ont., Canada

Immediate Delivery

To shell plants changing over from the manufacture of the larger sizes to 6" shells, our ability to make **immediate delivery** should be of especial interest.

And remember that the Roelofson is one of the few banding machines that have stood up from the first of the munition game and are still doing duty.



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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.

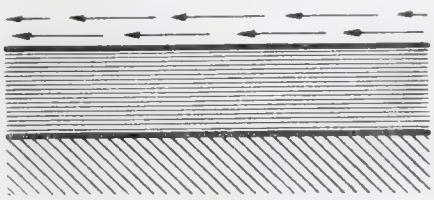


FIG. 2.

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 various 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

*Paper presented at the general meeting of the American Electrochemical Society, Detroit, 1917.

**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.

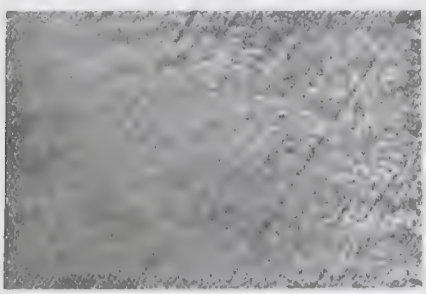


FIG. 3.

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

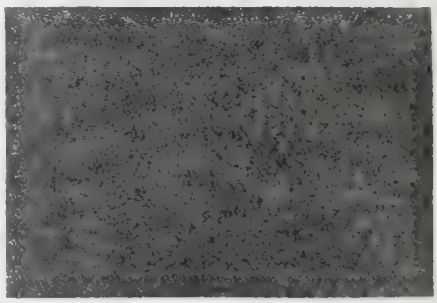


FIG. 4.

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

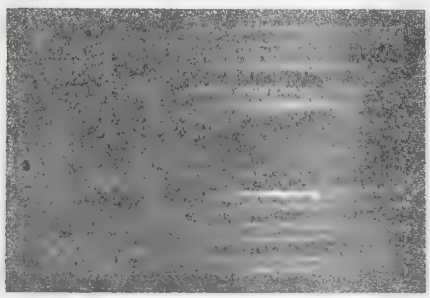


FIG. 5.

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 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.

RAILWAYS' HANDICAP INCREASING

"THE returns of railway revenues and expenses for June and for the first six months of the year 1917," says the Railway Age Gazette, "show that the railways of the United States are still breaking all previous records except in the vitally important item of operating income, which represents what is left, after expenses and taxes are paid, as a return on the capital invested and therefore determines the credit of the railways and their ability to finance improvements or additions to their facilities.

"They are, therefore, in much the same position as the man whose pay has been raised, but not quite enough to keep up with the increased cost of living.

"Total operating revenues for June were greater than in any previous month in history, the total of $349,739,636 being about $4,000,000 greater than for May, in which the highest earnings for a month were previously recorded, and $49,720,256, or 16.3 per cent. per mile greater than for June, 1916, but the figures for six months of the year show a decrease in operating income per mile of 4.2 per cent., as compared with the first six months of 1916. The total revenues for the six months were over $201,000,000 greater than in 1916, but expenses were $207,000,000 greater, taxes were $12.500,000 more, and the operating income was therefore over $18,000,000 less.

"These facts explain clearly why the stocks of some of our best railroads are selling at prices less than when the exchanges closed in July, 1914, and why in the same week that the figures were issued by the Interstate Commerce Commission, Pennsylvania fell below par for the first time in twenty years.

"For the month of June total operating revenues reached the record figure of $1,514 per mile of line, as compared with $1,301 in June, 1916, and $1,498 in the month of May of this year. This was an increase over June, 1916, of 16.3 per cent. Operating expenses, $1.020 per mile, increased 19.8 per cent. per mile over June, 1916, but were slightly less than for May, thereby reflecting the remarkable improvement in operating efficiency being obtained in the way of securing increased tonnage and mileage

for each freight car and locomotive in service. It is a noteworthy fact, however, that the decrease in expenses in June as compared with May is largely accounted for by the expenditure of $10 a mile less for maintenance of equipment.

"Operating income for June was $422 a mile, 8.1 per cent. greater than for June, 1916. Taken by themselves the June figures make the best showing of any month this year, although for the roads in the eastern district operating income per mile decreased 1.4 per cent.

"When the six months' figures are compared, however, the effect which the unprecedented increases in expenses of all kinds are having, in spite of the stupendous increase in the volume of business and in gross earnings, becomes plainly apparent. Total operating revenues were $1,898,210,538 as compared with $1,697,051,238 in the first six months of 1916, an increase per mile of line of 11.6 per cent. Operating expenses were $1,354,295,438 as compared with $1,147,-093,778, an increase for mile of 17.7 per cent. Net operating revenue was $543,-914,600 as compared with $549,957,460, a decrease per mile of 1.4 per cent., while taxes increased from $76,241,598 to $88,-936,624, or 16.3 per cent., and the operating income was $454,661,633 as compared with $473,295,808, a decrease of 4.2 per cent.

"The biggest increase in expenses is naturally found in the cost of conducting transportation, in which wages and the coal bill are the most important factors. This item shows an increase for the six months of $147,000,000. Maintenance of way and structures expenses increased $14,000.000, maintenance of equipment $35,000.000, traffic expenses less than $2,000,000, while miscellaneous and general expenses account for an increase of about $9,000,000. These items make up the total increase of $207,000,000 in expenses, or from $4,977 to $5,761 per mile of line.

"With an increase in earnings of over $200,000,000 over the calendar year and of over $400,000,000 over the fiscal year 1916, operating income for the twelve months ending June 30, 1917, was $20,-000.000 less than in the calendar year and only $40,000,000 greater than for the fiscal year, the increase in what is loosely termed profits being only one-tenth of the increase in earnings."

TORONTO HYDRO REPORT

THE Toronto Hydro-Electric system's total income for the six months ending June 30, was $998,956.40, according to a report made to the Board of Control recently. This was made up as follows: —Lighting, $345,389.91; power, $392,-110.37; street lighting, $183,405.30; bulk supply and other municipalities, $932,-630.91; income from sundry sources, $66,325.49.

The net income from operations of the period was $353,680.65, which is available for fixed charges. The balance available for depreciation was $138,-680.65, being $14,000 over the corresponding period last year. The volume of new business shows an increase of 15,000,000 kilowatt hours, being equal to 23 per cent. The revenue from the sale of current has increased approximately 16½ per cent. The cost of power purchased shows an increase of 28½ per cent.

ONTARIO FIRE LOSSES VERY HIGH

THERE were 852 fires reported in Ontario during the month of July and the total loss during the first seven months of the year is $6,449,435.

The summary is as follows:

Month	No. of Fires.	Loss
January	789	$ 808,419
February	1,020	1,329,369
March	765	1,144,373
April	666	896,461
May	908	1,242,486
June	682	515,936
July	852	512,391
Totals	5,691	$6,449,435

"The record for July is disappointing," saye the Public Service Bulletin. "The number of fires reported (852) is made up largely of lightning fires, which accounts for nearly one-half of the total. The aggregate loss is a little less than June. The chief items are shown above. The monthly aggregate is, however, very much too large."

GREAT INCREASE IN CANADA'S TRADE

TRADE figures for August and the first five months of the present fiscal year, made public on Sept. 19, by Hon. J. D. Reid, shows that Canada's great trade expansion continues unabated. Last fiscal year Canada's trade aggregated two billion dollars, but at the present rate the trade for the present fiscal year should be at least 500,000,000 more than last year's great record. For the first five months of the previous fiscal year our total trade was $768,635,214, while for the corresponding period this year it is $1,128,274,119. The trade balance in n our favor for the first five months of the present fiscal year is $180,000,000.

The total imports for August amounted to $91,931,000, as against $72,331,014 for August last year. For the five months of the present fiscal year, ending with August, our total imports were valued at $474,031,859, and for the same period last year $322,198,881. With this increase in our import trade has come a corresponding increase in revenue for August of $3,075,000, and for the five months, $17,540,000.

The export trade shows a corresponding increase of from $96,832,161 in August last year to $152,563,345 during the corresponding month this year. For five months our export trade totalled $672,-022,649, an increase of $217,291,385 over the same period last year. Fisheries show an increase for the month of $200,000 in export, animals and the produce $8,000,000, agricultural products $25,000,000, and manufactures $27,000,-000. There was a slight decrease in exports of minerals, and $2,000,000 decrease in products of the forest.

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.

GEAR MANUFACTURERS' CONVENTION

THE American Gear Manufacturers' Association held its semi-annual session in Chicago, Sept. 13-15, special Importance being attached to the meeting because of urgency for standardisation in many products due to war demands and conditions arising therefrom. F. W. Sinram, president, opened the sessions at which a number of topical papers were presented by members. Social activities were prominently featured.

Performing Complex Lathe Work by Turret Lathe Methods*

Herbert's Monthly

Extreme urgency of demand coupled with extreme accuracy of dimensions has featured much of the work which in recent months has absorbed the genius and effort of the Allies' technical resources. The accompanying article describes recent English practice, the sequence of operations having been developed to yield results conforming to rigid requirements. The increasing prominence of aeroplane engine manufacture imparts added interest to the data.

IT IS almost an axiom to state with regard to lathe work that the more complicated and involved it is, the greater are the savings when turret lathe methods are adopted.

The economy of the turret lathe is achieved in several ways:—

By the reduction of time required in setting, due to the use of specially adapted chucks and fixtures.

By the fact that a number of cutting tools can be in operation at once, thus reducing the cutting time.

By the saving of the time occupied in changing tools upon an ordinary lathe, all the tools being in position and ready to be brought up to the work.

By the elimination of measurements when the work is in progress by the use of stops.

By the possibility of using different kinds and more efficient forms of cutting

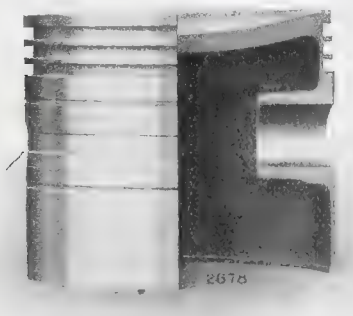
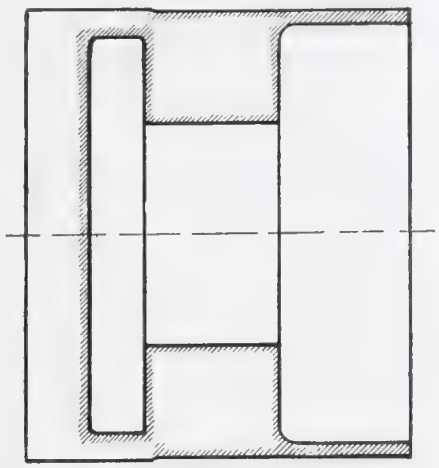


FIG. 1.

tools than can be employed on an ordinary lathe.

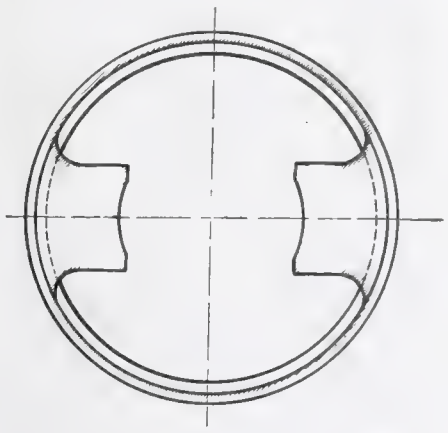
In Fig. 1 is shown an aeroplane engine piston which is made from steel; owing to the necessity of cutting down the weight and ensuring sound construction the ideal way is to make it all in one piece from a solid blank, as designers of aeroplane engines, in striving for the ideally efficient engine cannot allow difficulties of machining to stand in the way of any design which may seem likely to have advantages.

The finished piston is about 5⅛ in. dia. by 4⅜ in. long; in the rough the steel blank, which is of 40 tons tensile strength, weighs 27½ lbs. The machining operations at first sight seem formidable, but by the use of specially designed tools and fixtures this work is being handled without difficulty on a No. 9. Combination Turret Lathe by the following sequence of operations. In the line drawings the shaded portions show the machining at each operation.



FIRST OPERATION.

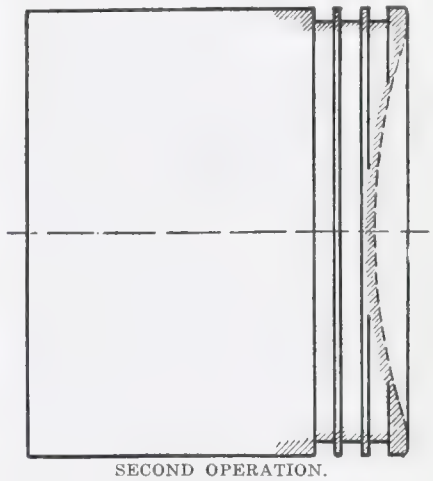
First Operation.—The blank is held in hard jaws of a 15 in. Coventry Chuck, where it is drilled, counter-bored, recessed, and rough turned as far as the chuck jaws. The time for this operation is 35 minutes.



THIRD OPERATION.

Second Operation.—The piston is turned end for end, and gripped by the diameter finished at the previous operation in a draw-back collet chuck, whilst the remainder of the outside diameter is rough turned, the head cupped out, and the grooves rough formed. The collet type of chuck is necessary at this operation, as the walls of the work are thin and a 3-jaw chuck would be certain to distort it. The time for this operation is 15 minutes.

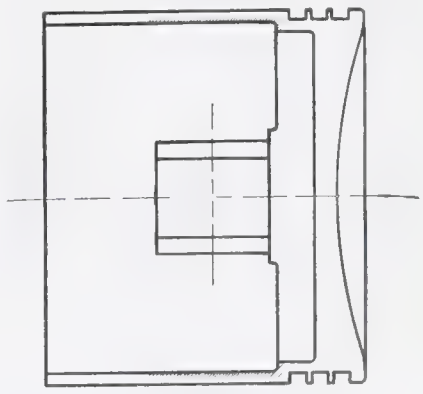
Third Operation.—This is done on a slotting machine or a vertical milling machine, where the ring of metal left at



SECOND OPERATION.

the first operation is removed as shown to form the gudgeon pin bosses.

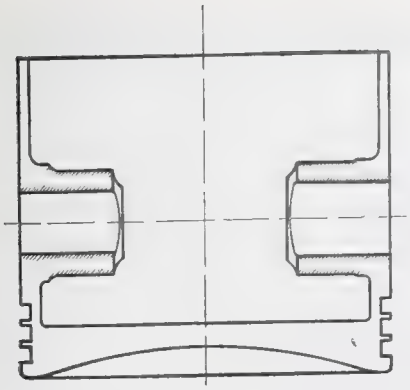
Fourth Operation.—Here the piston is held in a special fixture on the No. 9 Combination Turret Lathe, whilst the gudgeon pin hole is rough drilled, and the bosses rough turned. The latter operation is done by means of hollow mills carried on a cutter bar passed through the hole. This operation takes 15 minutes.



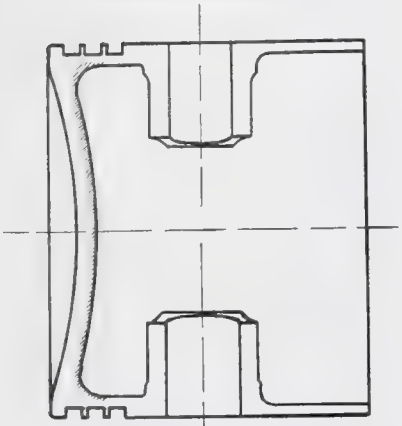
Fifth Operation.—The convex end of the interior is now formed, the piston being chucked with soft jaws gripping on the outside diameter. The machining time is 15 minutes.

Heat Treatment.—Having now been

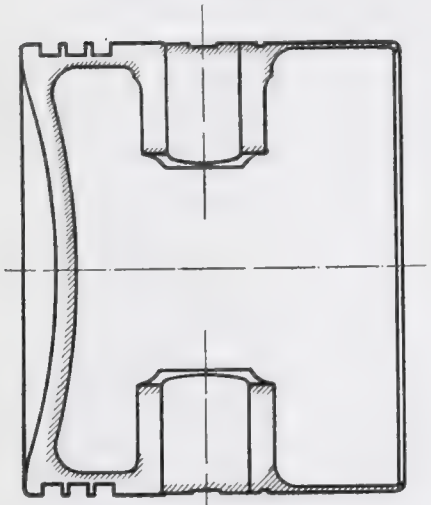
*Reproduced by courtesy Alfred Herbert, Ltd.



FOURTH OPERATION.



FIFTH OPERATION.

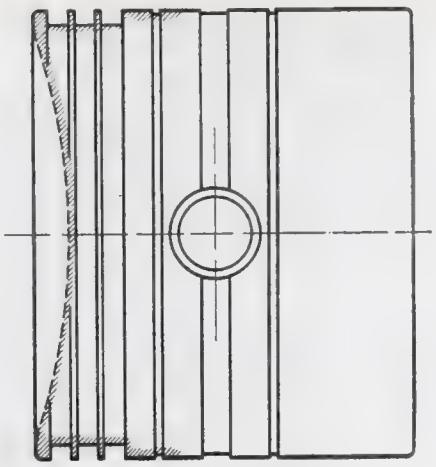


SIXTH OPERATION.

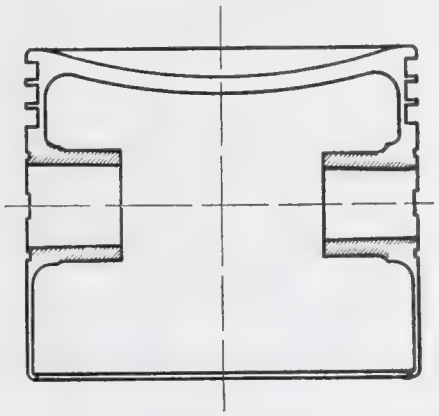
roughed out all over, it is necessary to heat treat the piston in order to normalize the material and remove the machining stresses; after which the machining operations proceed.

Sixth Operation.—The piston is chucked as in the fifth operation; the outside is finish turned as far as the chuck jaws. and grooved; whilst the whole of the interior is rebored, recessed and profiled. This operation occupies 60 minutes.

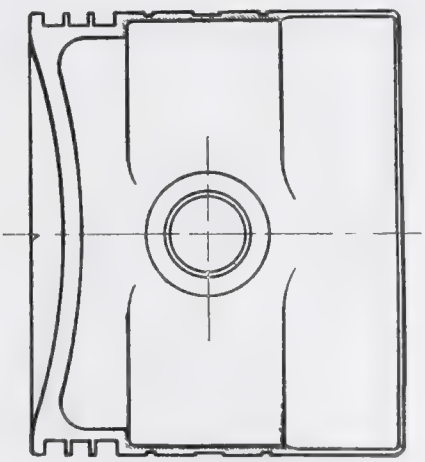
Seventh Operation.—At this operation the piston is held in a draw-back collet chuck, whilst the remainder of the outside diameter is finish turned, the cupped end finish faced, and the grooves



SEVENTH OPERATION.



EIGHTH OPERATION.



NINTH OPERATION.

finish formed. This operation takes 10 minutes.

Eighth Operation.—The piston is now held as at the fourth operation, whilst the gudgeon pin hole is finish bored and reamed taper, the gudgeon pin bosses finish turned with hollow mills as before, and the ends faced up flat. This operation takes 20 minutes.

Ninth Operation.—The lathe operations are now complete, and the last operation is to finish mill the walls around the gudgeon pin bosses. This is done on a vertical milling machine.

There remains a little metal to be removed around the gudgeon pin bosses, which cannot be reached by a straight forward milling machine operation, and this is removed by hand.

The total machining time on the No. 9 Combination Turret Lathe is 2 hours 50 minutes, whilst the finished weight of the piston is 4 lbs.

INTERNAL GRINDING ON HARD AND SOFT METALS

THE efficient and economical production of holes of accurate diameters and with a good finish in such parts as bushings, gears, cylinders, cutters, gauges, etc., is a problem which is solved most satisfactorily by the use of the internal grinding machine.

While it is true that reaming is more or less successful in soft metals, this method involves large expense for reamers which become undersize very quickly, when accurate limits are insisted upon, and with adjustable reamers there will always be continual variation as to size in the different pieces according to the frequency of readjusting and regrinding the reamers.

With the improvements made in internal grinding machines, the field has been developed and extended to such a degree that not only is it considered good practice to grind hardened work, but also parts made of cast iron, soft steel and bronze, whenever accurately round and straight holes of accurate diameters are desired so that proper uniform fits can be secured. In fact, on parts made of bronze, lumen and cast iron, it is often less expensive and far more satisfactory than finishing by reaming.

The internal grinding machine has completely displaced lapping from the rough, so that at the present time lapping as a finishing operation is used only when surfaces of great smoothness, or extreme accuracy, are to be produced beyond the usual limits of commercial work.

A good grinding machine will finish holes day after day rapidly and within a limit of one-quarter thousandth or better as desired, directly from the rough boring, and without any expense for reamers or for keeping such reamers sharp and in proper condition.

This method of finishing holes is doubly valuable when the piece to be finished is difficult to hold for reaming without distortion because of thin walls which go and come under pressure of the reamers, or under pressure of the chuck jaws, resulting in either case in very unsatisfactory work.

Furthermore, the improvements in the character of materials used in the construction of machinery, such as chrome nickel steel, manganese steel and other alloys, have made the use of the grinding machine an absolute necessity, because of the impossibility of finishing these materials satisfactorily in any way other than by the grinding process.

Carbonizing, heat treating and hardening always produce more or less distortion and also make the use of the grinding process imperative to secure accurate diameters and true surfaces.—James N. Heald, in "Grits and Grinds."

EDITORIAL CORRESPONDENCE

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

REMINISCENCES OF A 4.5 in. HIGH EXPLOSIVE SHELL

By W. J. M.

MY trials and vicissitudes, from babyhood, through childhood and youth to mature age, were many and varied. We were an innumerable family, and of rapid growth, millions of us having attained our complete status during the last three years, although some of us were indifferent, and some were of no use at all.

The first thing I remember was feeling fearfully hot and uncomfortable, and while in that state I received a heavy blow. This was my christening—when I received my name, which would go with me to the end of my life, and I would always in future be known as Z × 123. Presently I felt more comfortable and much cooler, and I was placed with some of my brothers and sisters in a quiet corner. I was not allowed much time for thought, however, and just as I was nicely settled, a big rough man suddenly picked me up and placed me on a lot of rollers, on which I was carried—or rather rolled down an incline for a short distance, till I fell off the end into a railway car which was waiting to take some fifteen hundred of us on our journey to a place where we would receive our preparatory education, and the initial formation of our characters.

My First Scare

Eventually the last of us was in his respective place, the doors were shut, locked and sealed, and we commenced our journey. Details of this journey need not be described—suffice it to say that after about two days, the doors were thrown open and we were lifted out one by one, thrown on to another set of rollers or "gravity carrier," and rolled into a large dark building.

In due course, not knowing what was to become of me, I was picked up and put with some of my fraternity in front of an iron door. When the door was raised, a fearful sight met my gaze—a roaring, fiery furnace, heated to 2,160° Fahr. What! Was I to undergo torture? If so, what for? Slowly I rolled down and yet further down an incline, getting hotter and hotter till my whole body became red—first a dull red, then brighter and brighter until I was in a semi-molten condition and writhing in agony. In that state I was seized, swung through the air and dropped into my place in a great "die." What was coming next? Down came a plunger right on the centre of my head, pressing with 350 tons till a hole was made almost right through me and my sides were squeezed and squelched in between the plunger and the die. I fairly screamed in pain and rage that I should be so mauled. At last it was over and after being lifted out and placed in the cooling room, I must admit that the experience, bad as it was, had done me good. I was a better child. I had been through the fire, my shape being changed from "billet" to "forging," and was now fit for further education.

Medical Inspection

I was now placed on a spindle by a government inspector who measured my walls, my length, looked to see if he could find any flaws or cracks in my constitution, and when he found I was perfect, he drove a steel stamp, shaped like the letter C with an arrow in the centre, into my flesh, and I was rolled down another "carrier" into another railway car for transportation to another school, i.e., a shell factory, where I would be further initiated into higher degrees of knowledge, and shaped into the finished article.

After a journey of a couple of days or so, I, along with my brothers and sisters—we were still together, except a few of us who had been discarded as not fit for further training—was lifted or rather thrown out of the car into a well lighted factory, where I was first looked at to see if the C with the arrow in it, was on me. Now came more pain. I was placed in a machine—a sort of vise and a steel saw was laid on one side of my head. I had not noticed an uneven growth which had been there since my release from the plunger of the forging press, and this growth had to be cut off. It was also necessary to cut off a portion of my head to see if there were any little pipe holes which could not be seen from the outside.

This being done, I was removed from the vise and put into a cavity which was called a "chuck." I began to turn round and round till I became quite giddy, and I felt a biting, tearing, pain, which began at my head and slowly travelled towards my base end. They were shearing off my outer skin, and when this operation was completed, I shone with a brightness I had never before felt. My appearance, however, — in spite of the brightness—was very rough, and when I was taken away from this machine and put into another, a little more skin was removed, which made me look and feel much better. I was getting used to being pulled about by now, but when, in yet another machine I felt an instrument cutting into my very bowels, I thought life had ended for me. After this operation I was bright inside and out, which made me feel really good. A bevel was now formed round my head and my name, Z × 123, was stamped on my side. I then had a cut taken from my base and my name was restamped there again.

Shaping My Cranium

Now came another sore trial. I was thrust head first into one more fiery furnace and all my shrieking and writhing was of no avail. As my head got hotter and hotter, I felt myself being turned so that the heat could get at me evenly, and then I was pulled quickly out, my head only being red hot, and placed in a vise which held my body tightly. I then began to rise up bodily, when suddenly—Oh!—my head was squeezed till I thought it would burst. But no, it was merely pressed into a pointed shape like the nose of a bullet.

When I had cooled off, they put another intrument into my breast and formed my "inside profile." Then I was taken and "finish turned," a fine cutting being taken from my entire length. I had a little respite after that while my name was transformed from my base to my body and the C and arrow placed alongside it. I lay on a pile of my brethren for two days, resting and getting back some of the strength I had lost during my rough travels. I had grown much thinner, but was considerably more refined that when I first arrived at the factory.

On the morning of the third day of my vacation, as it were, I was put into a machine that cut a groove in my body close to my base, and at the same time an instrument which wibble-wobbled backwards and forwards, put my "wave ribs" in the centre of the groove. This groove would later on hold a copper band—so I was informed, and those ribs would prevent this band from turning, when—but I am anticipating. At this time I knew nothing of future events, but I was learning fast. I learned that I would very soon have to sit for an examination, which, if I passed, would enable me to go forward to the higher classes of this wonderful, but trying school. Before this, I must have my base "hogged out," and my base recess finished. I remember crying aloud when these things were being done, and afterwards they nearly suffocated me with a mixture of steel shot and sand, which was called "blasting the bore."

On the Carpet

I well remember the excitement we were all under the next morning when we were taken to a bench to undergo an examination for our characters, and knowledge. Men examined us inside and out, gauged our dimensions and "grilled" us from end to end. Some of us had to go back to school for special coaching, others merely required polishing up a bit, but the majority passed with honors. But—this was only the "shop examination." Although we had passed this, we had to go before men who had been sent by the government of the country, who would put us through a stiffer examination. Five hundred and one of us were sent before these men in batches of one hundred. Out of 501,

only 480 passed, and out of the 21 who failed, three were rejected as being no use at all. Poor fellows! They were stamped as unfit and ended their days in the scrap heap.

When I came out of the "preliminary" examination room, I was placed head down in a machine which rivetted my base plate; then another machine "faced off" my base plate and a nice radius was made all round it with a file. Next I had my nose slots cut. These were put in to prevent my timefuse—which would come to me later on — from turning loose. Then my "fuse seat," my "exploder-container" seat, and recess, were put on me and my nose was "tapped."

During one of my earlier operations, a thread was "milled" in my nose, and this it was which was "tapped." Although I suffered a little during these operations, the pain was not so bad, as I was getting more accustomed to the necessity of being trained and formed for usefulness in life. Little did I think, at that time, how short my life would be.

I suffered great discomfort when my "driving band" was squeezed on with forty ton pressure, but when this was "turned," I felt proud of the bright copper ring which enhanced my general appearance, and when after undergoing another shop examination and being washed inside and out, I felt really good and very happy. A coat of varnish was now shot into me and I was placed in an oven for a little over two hours, where the varnish was baked hard. The heat was not very great, being only 300° Fahr., so it did not cause me much discomfort after the extreme torture of the forging furnaces.

I was now informed that I would have to sit for my "final" examination by the government men, and that if I passed this, I would be nicely dressed in a new suit of clothes, and would be taken on a long journey, and possibly have a voyage across the ocean. I did not fully understand what was to become of me, but determined to pass, if possible. Eventually I did, but before passing, had to return to school to have some of my ideas "rectified." I was, however, very proud when I received my "uniform of khaki" paint my threads were greased and I was laid with two others in a "three-round" box.

We Depart En Masse

Nearly two thousand of us left that factory one morning in a railway car on our way to the seaport from which we were to be shipped. In due course, after a rough passage, during which I was very sick, we arrived at our destination, and for a long time were laid aside in a storehouse where we had a thorough rest. I learned, about this time, what my work in life would be, and I made up my mind to do it to the best of my ability: I was told I was a good 4.5 in. high-explosive shell, that I would be filled up with a very high explosive, and that I must ever hold myself in readiness to "burst" whenever I was told to do so by the "time-fuse," which would accompany me. One day I was taken to the loading factory, and after being properly "prepared" was filled with a sticky, harmless-looking stuff which, when slowly stirred, gradually hardened. I was then carefully packed and sent on my last journey but one. Oh how I swelled with indignation when I was informed of the cruelties the Germans had practised! I said to myself that I would kill all I could at one time, and with one great explosion.

Well! Well! I reached the end of this second last journey, and had a little time for thoughts, which were many and varied. All the trouble and expense—the detail and exactness with which I had been made—were to go for nought. I would just die, but in dying I would render a service to my country, and I was proud to think that this service would be of some great and lasting benefit to the world in general and to my own community in particular—to those who had spent so much time and trouble in making me what I now was—a perfect 4.5 high explosive shell.

Finis

To me, Z × 342, has fallen the duty and honor of telling of the last moments of my beloved brother, Z × 123. He was taken behind a howitzer gun, his time fuse was screwed into his head and was "timed." He was placed in the gun, the firing charge was inserted behind him, and the "breech" was closed. With a blow of 200 tons on his base, he left the gun at a speed of 2,600 feet per second, at the same time revolving at 3,000 revolutions per minute. What a majestic "trajectory" he made in the air, when ! ! he disappeared in flame and smoke. He was too far away for us to be able to distinguish his last vengeful cry, but if he were alive, he would be proud to know the damage he did to the enemy. May he rest in "pieces."

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 transit 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 non-magnetic 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

*Presented at the annual meeting of the American Society for Testing Materials.

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.

INVESTIGATING DEFECTIVE MAGNETO

By J. E. McCormack.

A gasoline engine was equipped with a rotary magneto and with batteries also. The idea was to start on the batteries and switch onto the magneto when speed was up, but as the engine failed to operate on the magneto (in fact the magneto was supposed to be of no use) the batteries were used entirely for some months. One day I removed the magneto, coil spark plug and connecting wires and placed the magneto on the stand of an old sewing machine from which the head had been removed. I removed the governor pulley from the magneto and bored out an empty (sewing thread) spool to fit the arbor, then used this for a pulley and a grip strap for a belt, I ran the magneto up to approximate speed by pedaling and kept it going and kept adjusting the vibrator on the coil until I got some buzz, and then found that a half turn of the screw either way would stop the buzz This shows the fineness of the adjustment necessary in that case. The proper point thus located was 3 or 4 turns from where it had been set for use on the batteries. With the new adjustment of the vibrator it was possible to start on the batteries and then run on the magneto, thus greatly saving the said batteries. With the magneto connected up on the engine it had been practically impossible to adjust the vibrator to it, because the engine would not hold up speed sufficiently long, but now with the vibrator set for the magneto, the batteries will work with the same adjustment and it is O.K.

No fastening was required to hold the magneto on the sewing machine stand for testing. Its weight was sufficient to hold it steady and in place. During the testing, I had the ground connection bound to the outer nut of the sparkplug, and the secondary attached to the end of the plug in the ordinary way. This completed the circuit the same as though the spark plug had been screwed into place on the engine and the ground wire attached to the engine frame in the customary manner.

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.

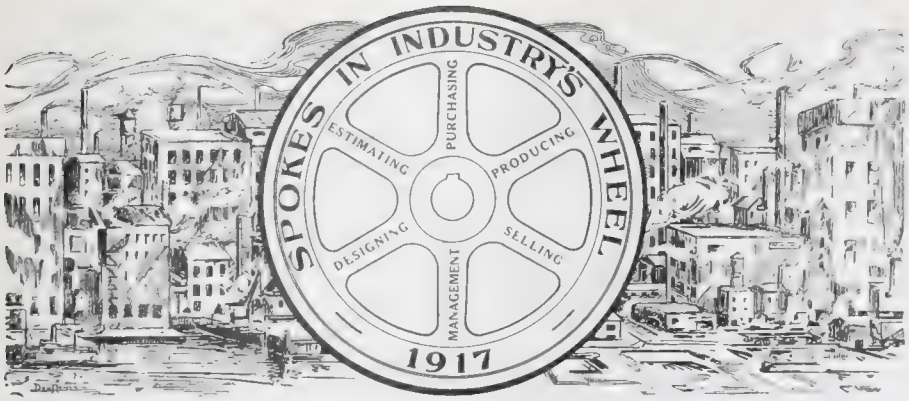
The commercial liquefaction of air had meanwhile been developed by Prof. Linde of Munich, in 1895, and from that time on the ultimate eclipse of the barium process became more and more a matter of time. The actual process of obtaining oxygen through liquefying air is a highly specialized proceeding and 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.

NEW ALLIED TONNAGE

FIGURES of the new tonnage built during the six months from October, 1916, to April, 1917, have been published by the Bureau Veritas. No distinction is made in the figures between steamers and sailing vessels, but the number of the latter cannot be large:

	No. of ships.	Gross tonnage.
Great Britain	261	680,946
United States	150	484,381
Holland	103	190,619
Japan	46	128,913
France	42	61,988
Italy	20	34,051
Norway	42	34,044
Denmark	20	26,348
Sweden	26	20,023
Spain	7	4,422
Chili	3	823
Russia	5	750
Portugal	3	216
Total	728	1,667,524



The constitution of industrial enterprise is largely departmental—"spokes in a wheel." This series of articles has for its object the featuring in a racy, interesting and instructive fashion, the training, experience and achievement of those who to-day are transmitting, effectively, energy in their capacity as 'spokes in the wheels" of our metal-working establishments.

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 prevent them from making a success of the enterprise, for, two years later, in

ROBERT MORTON HAMILTON

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 important points while en route; this being his third trip to the Pacific Coast in recent years. Mr. Hamilton is of the opinion that the shipbuilding industry will be of material advantage to that province, and it will be a more permanent character if raw materials can be obtained readily.

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

(Continued on page 70)

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

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 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.

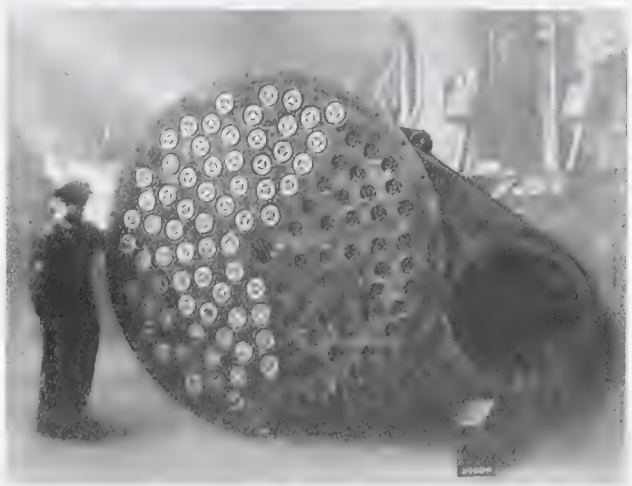


FIG. 3. ILLUSTRATING METHOD OF INSTALLING PLATE VALVES IN PLACE OF EXISTING VALVES IN THE HEAD.

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.

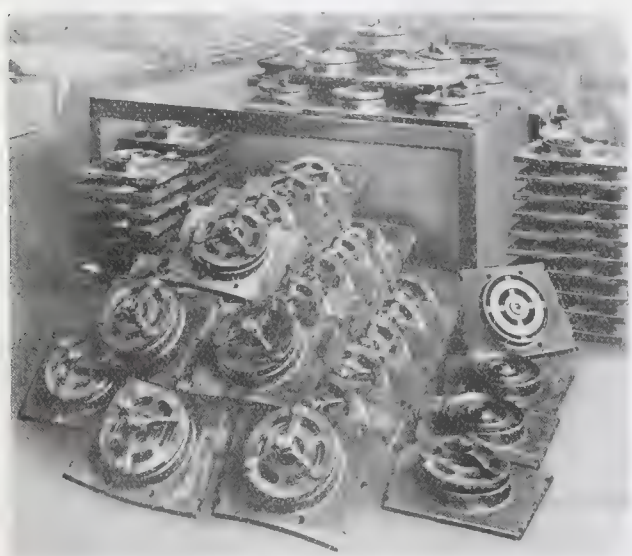


FIG. 2. SHOWING HOW VALVES HAVE BEEN MADE TO FIT A PREVIOUS SEGMENTAL ARRANGEMENT.

FIG. 4. REPLACING OLD AIR HEADS WITH NEW ONES.

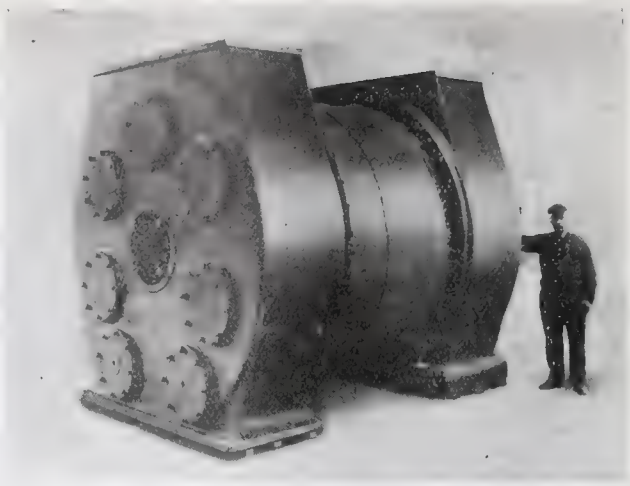


FIG. 5. NEW AIR ENDS WHICH HAVE REPLACED OLD ONES.

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 appearance 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.

PASSING OF THE WOODEN CAR

A REPORT of the American special committee on relations of railway operation to legislation, just issued, shows that only three wooden cars for passenger service were built in 1916, and only ten wooden cars for passenger train service were under construction on Jan. 1. 1917.

"The building of wooden passenger train cars," the report says, "has practically ceased. There were in passenger train service on Jan. 1, 1909, approximately 629 all steel cars and 673 cars having steel underframes. On Jan. 1, 1917, there were in such service 15,754 all steel cars, and 6,136 cars having steel underframes, representing increases of 2,405 per cent. and 812 per cent., respectively. There are now in service 39,169 wooden cars in passenger train service, indicating a retirement of 8,957 wooden cars from service since Jan. 1, 1912, the date of the previous census. Of this number, 2,213 were retired during the calendar year 1916. This record includes a total of 615,309 passenger train cars and covers reports from roads representing 235,406 miles of railway in the United States.

The average cost per car on the first of January varied for the different classes of passenger train equipment from $14,800 for a baggage or express to $37,000 for a parlor, sleeping or dining car.

A class of boys were undergoing an examination in Scripture. The subject was the Good Samaritan. "And why do you consider the Pharisee, after looking at him, passed by on the other side?" "Because he saw he had been robbed already," was the answer given.

FIG. 1. PLATE VALVES ARRANGED IN CAGES TO REPLACE LARGE POPPET VALVES PREVIOUSLY EMPLOYED.

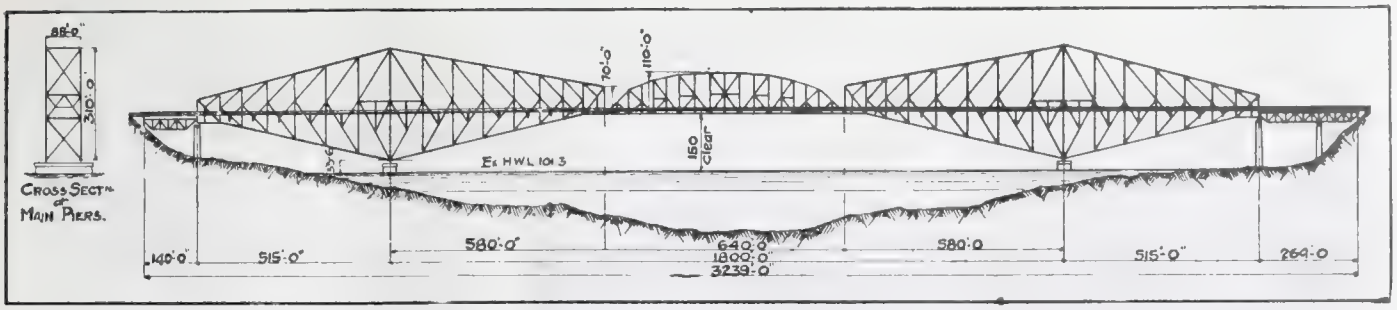


DIAGRAM OF QUEBEC BRIDGE SUPERSTRUCTURE GIVING PRINCIPAL DIMENSIONS.

Elevation of Span Insures Final Success of Quebec Bridge

Staff Article

After eleven years of unremitting toil, painstaking perseverance and overcoming of seemingly insuperable obstacles, the Quebec Bridge is now a unit structure uniting extensive provinces on the south side of the River St. Lawrence with the main portion of the Dominion. Heart-breaking disasters failed to shake the determination of the builders, and for years to come the structure and the men who built it will be the objects of endless eulogy.

LIKE a star passing across the meridian that records an epoch in the movement of the celestial bodies, the final connecting of the centre span of the Quebec Bridge marks an achievement in engineering feats that will stand out as one of the most remarkable of its kind ever attempted. Disappointed but undaunted by the failure of last year, the engineers went about the plans for the next attempt, profiting by their past experience, making such necessary changes and alterations that would entirely eliminate—as far as engineering ingenuity can at present devise—any possibility of a repetition of last year's disaster. Investigation proved that the primary cause of the collapse of last September was the breaking of one of the steel castings supporting one of the four corners of the span upon which it rested during its construction, and also during the actual raising of the span. The fact that this condition had existed for several months previous to September 11, 1916, might indicate to many that some other fault may have developed to result in the failure of the casting. It is undoubtedly true that the variable conditions, be they ever so small, that must subsequently have followed the removal of such a structure from a fixed resting place to the flexible support of the scows, and from there to the elevating chains, would subject the frame work to incalculable stresses, which in the case of these particular steel castings might develop serious defects, and probably early or inevitable disaster.

Satisfied that this feature was the vital weakness in the previous design of the lifting apparatus, the engineers concentrated all their energies on changing and perfecting this detail to avoid a similar occurrence. In some respects the principle of the pivoted support was the same as last year, but the round pins formerly used were eliminated and replaced by forged steel pieces of rectangular cross section, the top or pivot surface being curved to a two-foot radius, thus providing a wider bearing and, consequently, greater distribution of resultant pressure. During erection the span did not rest upon this support, but upon two specially designed rectangular bearings, located on either side of the central support; this construction, of course, being identical at each corner of the suspended span. These bearings were so designed as to allow for lateral movement, due to the expansion or contraction of the 640 feet of steel structure. The surface of the steel bearing piece had a length of 2 feet 6 inches, and the bronze plate upon which it rested a length of 3 feet, thus providing for a lateral movement of approximately 6 inches; the upper or friction surface of the bronze plate was polished and well lubricated. Special guides were provided to prevent side motion in the supports, with two steel plates beneath the bronze plate, the lower one resting on a bed of lead about 1½ inches thick. The side bearings upon which the span rested during its erection were not close fitting on the sides, the side guides in this particular instance being more of an emergency detail should anything happen to the central main bearing. When the bents had been removed from beneath the span previous to floating the scows into position, the entire weight of the structure was supported upon the two outer or sliding bearings, but when the weight was transferred from these bearings to the scow supports, the bronze plates and the top steel plate was removed so that when the hoisting chains were connected the falling of the tide again shifted the weight, which this time was taken by the main or central bearing, this bearing maintaining the weight during the entire lifting process. An additional precaution was provided at this point to prevent the span slipping off should accident happen to any of the main bearings. Whereas last year this detail of construction was entirely exposed, this year each corner was enclosed in a box girder built up of steel plates, and through which the pins that held the lower ends of the fixed links were secured, the upper end of this latter member receiving the lower end of the hoisting chain when the span was finally moored in the desired position beneath the cantilever arms.

THE COMPLETED BRIDGE AND ITS BUILDERS. FROM LEFT TO RIGHT: W. P. COPP, COL. C. N. MONTSERRAT, E. C. KERRIGAN, H. P. BORDEN, PHELPS JOHNSTON, E. H. PACEY.

THE SPAN SUSPENDED FROM THE BRIDGE AFTER SCOWS FLOATED AWAY.

Precautionary Measures

While these main supports were the essential details upon which the efforts of the engineers were concentrated, other minor changes were effected and additional precautionary measures were adopted to assist in the successful accomplishment of this wonderful and historic enterprise. Chief among the other alterations was the strengthening of the hanger chains described in another section of this article. Additional stiffening was provided in the lower top chord member, and in addition to the mooring arms being used for steadying the span during the initial connection of the hoisting chains, they were also utilized for anchoring the partly elevated span during such periods when actual hoisting operations were suspended. Despite the optimistic assurance that was silently expressed by those in control of the proceedings, no workmen were allowed to remain on the span after the scows had been floated from beneath; the only time that anyone ventured upon the hanging structure was when an intrepid engineer was lowered on to the span to inspect the various connections upon which so much depended.

Floating the Span

The actual elevation of the span from its erection supports was entirely dependent upon the weather, and while ideal conditions were not absolutely essential, it was highly important that wind and water be favorable to counteract those agents that tend to make such an undertaking increasingly difficult; namely, the tide and the current of the river, the tide running between twelve and sixteen feet, and the current at this particular part of the river about six or eight miles an hour. Under these circumstances it was necessary, owing to the high wind prevailing on the previous Saturday—the day originally set for the commencement of the final task—to postpone the floating of the span until the wind had abated. Some hopes had been entertained that operation could be started on the following morning, but it was not until late Sunday that the wind had sufficiently abated to insure success. In preparation for the time when the span would be floated, the scows or pontoons were placed in position under each end of the span and allowed to settle with the falling tide on to the cement foundations that had been previously constructed in the bed of the cove. When resting in this position, the valves in the hulls of the scows were left open, so that the water flowed freely in and out as the tide rose and fell each day. As the time required to float the scows, when taking the weight of the span, was nearly five hours, it was necessary to close the valves about midnight on the morning intended for the operation, in order that the span should be lifted clear at the favorable moment for floating up the river.

Towing Span to Bridge Site

Shortly after midnight on the morning of Monday, Sept. 17, the valves in the six pontoons were securely closed, and when the forces of Neptune arrived and failed to find an entrance, they began to exert a pressure on the exterior of the hulls, and after nearly five hours of resisting attack, the mighty forces of the sea god succeeded in accomplishing what would otherwise have been impossible. It was therefore about five o'clock in the morning that the various tugs took up their allotted positions under the directors of towing operations, who were on one of the smallest of the tugs in the fleet, and which was seen to dart from one position to another in order to see that every detail was carefully and accurately carried out. After much manoeuvring, the span was successfully towed to a position in the middle of the river, where the full force of the tide began to propel the massive structure up the river toward the site of the bridge. With the tugs guiding rather than towing the span up the river —the incoming tide being the propelling agent—the procession slowly advanced, followed by a fleet of river craft of every make and description. With the memory of last year's event still vividly impressed

CONNECTING HOISTING CHAINS TO SPAN SUPPORTS AFTER MOORING SPAN.

SPAN PARTLY RAISED. S.S. QUEBEC PASSING BELOW NORTH CANTILEVER.

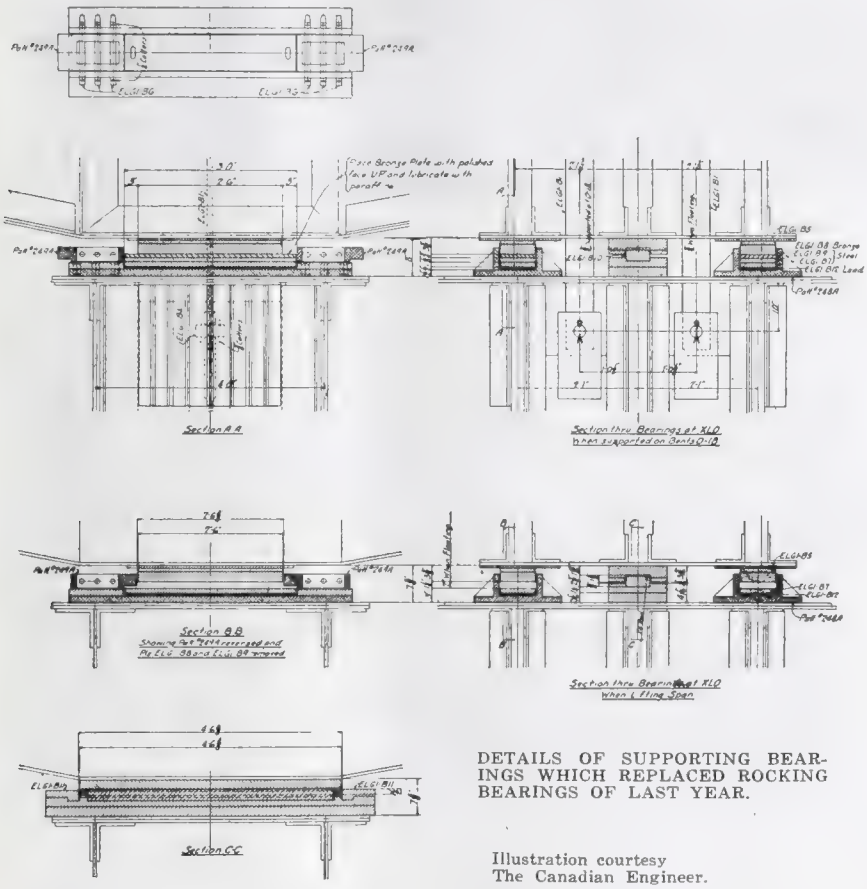
upon the minds of the sightseers, and with a fuller appreciation of the magnitude of the task and the risk involved for the men upon the structure, the enthusiasm, while none the less apparent, was more of the silent character, not only in the trip up the river, but also during the mooring operations and the raising of the span.

Mooring the Span

As the span approached a position below and between the cantilever arms it was necessary to manipulate the different tugs very accurately to bring and maintain the span in a steady position in order that the mooring frame might be properly attached to the four corners of the span. The operations were directed by the "captain" located on one of the four corners, and it was certainly no sinecure to "dock" such a liner with the use of those floating anchors—the tugs. When the mooring lines had been properly adjusted to bring the span to the exact position desired, the long slender plate chains were lowered to a vertical position and the ends bolted to the fixed link that extended up from each of the supporting girders located beneath the four corners of the span. No actual hoisting operations took place while the scows remained under the span, but the weight of upwards of 5,000 tons was gradually transferred from the six pontoons to the eight hanging chains as the outgoing tide lowered the level of the river. As the scows floated freely from beneath the span and the current of the river carried them down stream, tugs steamed alongside and guided them to a location a short distance above the site at Sillery Cove.

Period of Suspense

From the very moment that the scows floated clear of the span a concealed feeling of expectancy predominated throughout the multitudes that were perched upon all available observation points within a considerable distance on either side of the river; but while the average onlooker may have journeyed to the site to see a repetition of last year's tragedy, the attitude of the engineering profession that had carefully followed the events and circumstances surrounding the whole progress of the undertaking, particularly those engineers directly associated with the work of construction, was that of silent but hopeful optimism, coupled, however, with a nervous tension that was unavoidable under such trying and eventful conditions.



DETAILS OF SUPPORTING BEARINGS WHICH REPLACED ROCKING BEARINGS OF LAST YEAR.

Illustration courtesy
The Canadian Engineer.

Changes in the Hoisting Chains

Following the final connecting of the lower ends of the hoisting chains to the fastenings upon the span, the leading engineers of the enterprise—who had ridden up the river on the span from Sillery—were hoisted up to the cantilever arm in a large cage secured to the end of a steel cable. After the men had had breakfast and before the first lift was made, a cage was lowered alongside the several hoisting chains to allow the engineers to examine the different link connections to see that everything was in order for the raising operations. This precaution was adopted at different stages of the hoisting process. It might be here stated that the hoisting chains had undergone some changes over those of last year, the strength being actually doubled. Where those of a year ago were composed of links in pairs, this year this detail has been doubled to four links in series. Each link is composed of rolled steel plate 30 feet in length, 30 inches in width and with a thickness of 2¼ inches, and provided with four hoisting holes located 6 feet apart, and the two holes for the link connections 24 feet apart; thus permitting of 12 lifts of two feet each for every link in the chain. The 12-inch diameter pins that connect the link sections are held in position by means of caps on either end, bound together by a 1¾-inch bolt passing through the centre of the 12-inch pin. In order to obtain a lift of 2 feet with the holes in the chains 6 feet apart, the jacking girders are provided with a series of three holes 2 feet apart, so that each hole in the hoisting chains is engaged three times during the lift of six feet, the locking pins being alternately placed in the three holes in the upper and lower jacking girders. On the central line of the link holes the cross sectional area of each link is (30-12) x 2¼ or 40½ square inches, which gives an area of 162 square inches on each of the eight chains, or a total of 1,296 square inches supporting the total weight of the suspended span

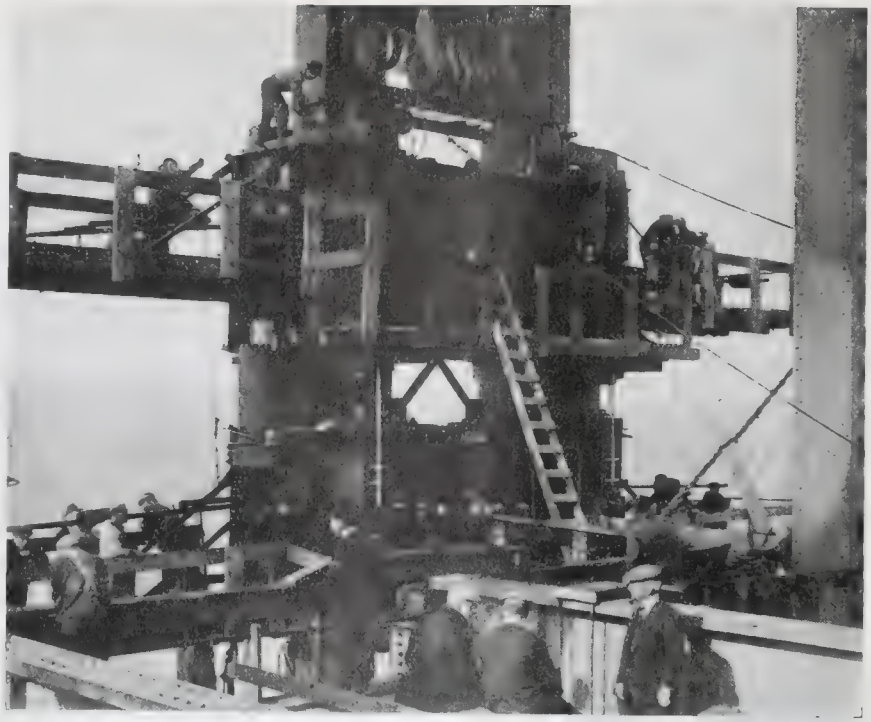
Hoisting Details

It is needless to dwell upon the gradual but successful upward movement of the span during the three and a half days occupied for the complete elevation of 150 feet; it is sufficient to say that nothing of importance occurred to mar the steady progress of the span from its initial position on the scows till the hour on Thursday afternoon when the final pins in the permanent connecting links were driven into position. The total casualties for the four days were confined to a broken nose and a few brusises sustained by workmen slipping on the wet plates of the steel structure.

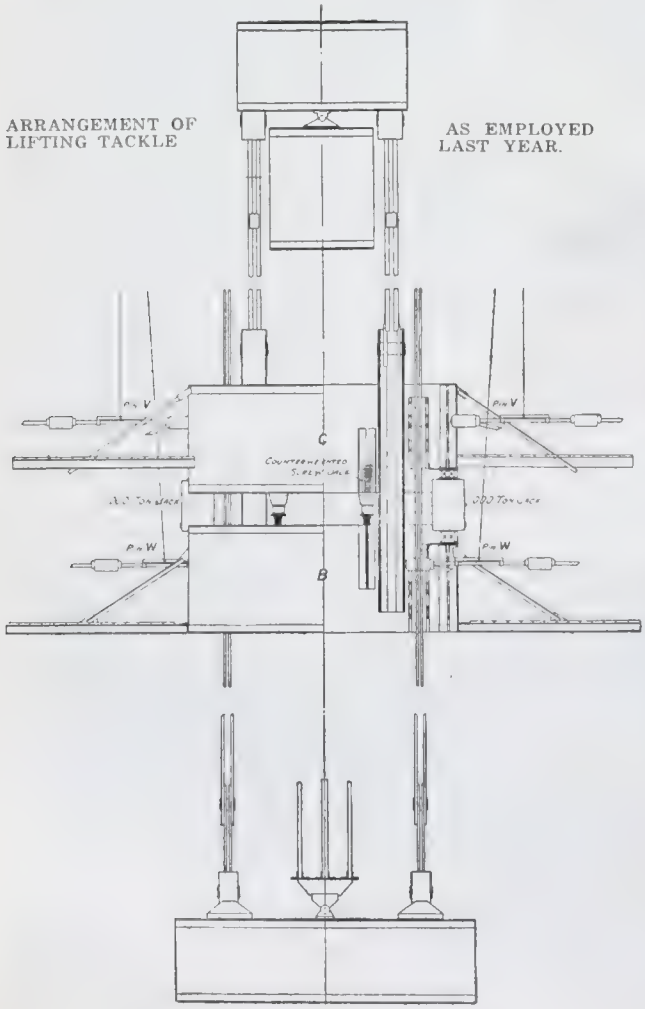
Before describing the actual lifting operation it might be well to give a brief survey of the construction of the various members that makes this feat possible. Dealing with one corner only, all four corners being alike, there is placed across the end of the upper chord of the cantilever arm, vertically over the point of intersection, and supported on a bearing similar to that beneath the suspended span, a heavy cross girder, from either end of which is suspended by means of hanger plates, another cross girder B, known as a fixed girder and placed at about the floor level of the cantilever arm. On each of the outer top ends of this lower girder are placed the hydraulic lifting jacks with a working stroke of slightly over two feet. Resting on the upper end of the rams of these jacks and

operated by them is the third or movable girder C, to which are connected the hoisting chains during the raising of the span. The hoisting chains pass through openings in the lower or fixed box girder, while a similar space is provided for a clearance for the hangers supporting the lower girder. The emergency jacks described in another section are located in a central line with a pair of lifting jacks, but nearer the centre of the girders. The slots in either girder through which the hoisting chains pass are provided with a set of three equi-distant holes, 24 inches apart, to permit of an elevation of two feet at each complete operation of the jacks.

Assuming that the lower ends of the hoisting chains have been connected to the span supports, the upper end of the chains would be connected to one of the holes in the top or movable girder so that with the removal of the scows the weight of the suspended span would be resting upon the rams of the hydraulic jacks. The operation of these jacks was accomplished by water being forced from hydraulic pumps through ⅜ in. copper pipes into the cylinders, which are 22 in. in diameter inside and 33½ in. outside, or a thickness of metal of nearly six in. The air that operated the pumps was supplied from compressors located in a power plant at the shore end of each cantilever; these compressors being electrically driven. The air was delivered to the pumps at a pressure of about 110 lbs. per sq. in., which in turn forced the water into the cylinder of the jacks at a pressure approximately 4000 lbs. per sq. in. As this water was forced into the cylinders of the jacks the rams were slowly pushed upward, in turn raising the top girder that supported the hoisting chains. When the complete lift of two feet had been accomplished and the lower hole in the chain came in line with one of those in the lower girder, the locking pins were placed in. When this had been attained at each one of the four corners of the span, the top pins were removed and the water allowed to drain from the jacks, thus permitting the rams and the top girders to fall to their initial position in readiness for the next lift. When at the lower extreme position the upper pins were inserted through holes in the top girder, and after removing those in the lower girder the process of another lift was proceeded with. In making these connections and also those that joined the various links together, paraffin was used to lubricate the bearings.



JACKS AND UPPER GIRDER BEING LOWERED WHILE LOWER PIN IS IN POSITION.



ARRANGEMENT OF LIFTING TACKLE AS EMPLOYED LAST YEAR.

Locking Pin Details

In order to facilitate the placing of the pins in various holes during many operations, holes in the girders and hanger chains are of an oval shape, thus eliminating the absolute accuracy that would be necessary if the holes were perfectly round. This was a feature that did not detract from the safety of the work, but assisted greatly in the rapidity with which the many connections were accomplished. The locking pins used in the top and bottom jacking girders were of a counter-weighted character, both as regards the horizontal position and gravity action, the latter being taken care of by a balance weight supported on the opposite end of a small steel cable. When in operating position these pins were locked by means of trip levers bearing against the inner edge of the vertical slot, and it was necessary to raise this trip lever before the pins could be removed.

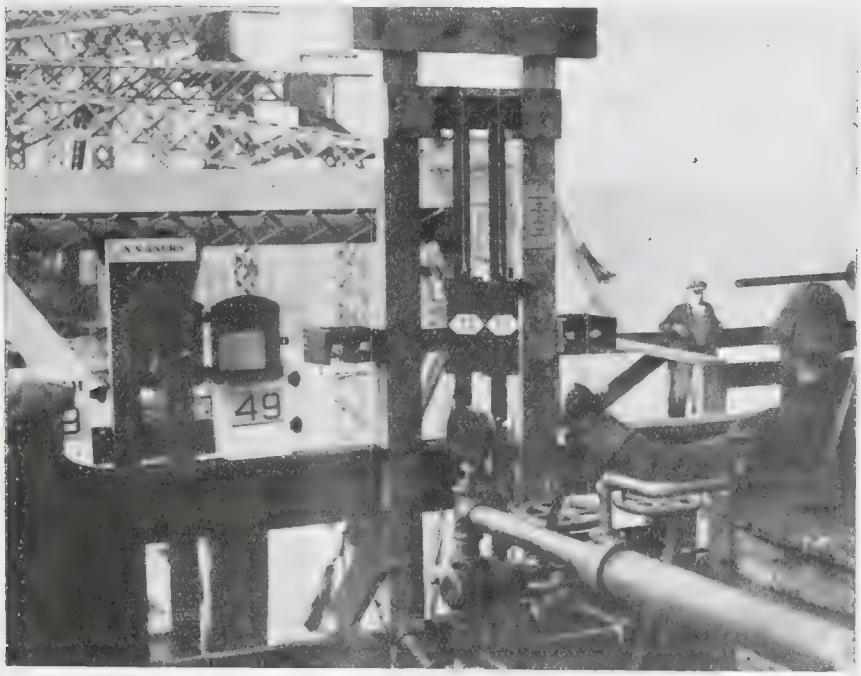
Emergency Jacking Facilities

In order to provide for any emergency through the blowing out of the pump packing or any unforeseen failure of the hydraulic jacks, a system of counterweighted screw jacks was fitted between the two main jacking girders and adjacent to the hydraulic jacks; each corner of both cantilever arms being identically equipped. By means of a large hand wheel these emergency screw jacks, which had an outside diameter of 12 in., were operated through a system of shafts and gearing so as to follow up the upper or movable girder as it was forced upwards by the action of the hydraulic jacks. This feature of construction was not for the purpose of facilitating the elevation of the span, but to maintain at all times a rigid support constantly adjusted to the gradually increasing space as each separate lifting operation pro-

gressed, to avoid any minute but sudden drop that might prove harmful to the enterprise. The counter-weight was a steel pin 12 in. dia., with a length of about 11¼ inches, and had an approximate travel of 16 feet 9 inches; fitted to the hangers was a bracket that supported a wooden block, upon which the counter-weight came to rest when the screw was within ¼ inch of normal high position for driving pin in the lower girder. The weight was supported by a ¼ inch steel cable, the opposite end of which was wound about a small drum secured to one of the horizontal screw jack operating shafts.

Tell-tale System of Indicating

An interesting feature in connection with the operation of the hydraulic jacks so as to control the flow of water, and thus maintain at all times a uniform movement in each set, was the tell-tale system of indicators and telephones; the latter for communicating from one cantilever to the other and checking the progress at either end. An electric tell-tale was provided at the outer end of each cantilever arm to indicate to the central valve operator the vertical position of the safety screws at two critical stages of the lifting operation. First, to indicate that the screws are all bearing against the upper lifting girder before commencing a lift; and second, to show that the screws were lowered far enough to clear the upper girder when transferring the load from the jacks. As shown in one of the illustrations, the tell-tale was placed directly in front of the operator so that he could have an unobstructed view at all times and by a slight movement of either hand could regulate the flow of water to either the right or left hand set so as to maintain a uniform elevation at each corner of the span. This tell-tale consists of four incandescent lamps, each in a separate circuit. Each circuit was arranged with a sliding contact depending on the elevation of a pair of screws geared together and was closed during 23½ in. of vertical motion of the screws, starting at the commencement of the 2 ft. lift, with the screws bearing against the upper lifting girder and ended when the screws had been lifted through a distance of 23½ in. In addition to the tell-tale electric lights for the emergency screw jacks, the proportional amount of lift at any time is shown by the central indicators, directly in front of the chief operator. This indicator consists of a graduated scale attached to a frame work fitted to the lower jacking girder, and a pointer attached to a sliding block hanging on the end of a thin cable, the opposite end of which is secured to the movable or upper lifting girder. Not only for each lift were these tell-tales provided, but one was installed to indicate to the engineers and workmen the number of lifts that had been accomplished, as shown to the right of the communicating telephone.



CONTROL PLATFORM SHOWING ELECTRIC TELLTALES AND ELEVATION INDICATORS.

During the erection of the span at Sillery, the structure rested upon steel bents supported on concrete foundations set in the river bed, these being clear at low tide and entirely submerged when the tide was full. A bent was provided for the main upright between each panel, and to allow for the camber of the lower chord suitable sand jacks were provided at each bent so that the level could be more easily adjusted as the upper members were gradually placed in position. The extreme camber at the commencement of operations was approximately 12 inches at the centre support. When the span had been constructed as far as was necessary for raising into position, the camber had been reduced to a few inches. Previous to the placing of the scows the majority of the bents had been removed to permit of floating the span and towing in to the middle of the stream.

Explanation of the Lift

From the dimensions given of the clearance in the centre of the channel at high tide it may seem ambiguous to some as to why it was necessary to have 75 lifts of two feet in order to raise the span to its final position. The statement that the clearance is 150 feet at high tide is relatively true, but this is only a nominal expression and one that refers to the highest approximate tide during the year. Had the engineers been in a position to float the span at an earlier date the tide would have been more favorable, inasmuch as the actual number of lifts would have been reduced, but the tide at that particular time during which the recent operations were accomplished was about 8 feet lower than the extreme high tide, and the time of arrival at the site and the subsequent delay in making the hoisting chain connections prevented the placing of the pins until the tide had ebbed somewhat, this accounting for the recorded number of lifts of seventy-five, the lower chords of the span being about eight feet above the surface of the river, due to the buoyancy of the scows and the supporting girders.

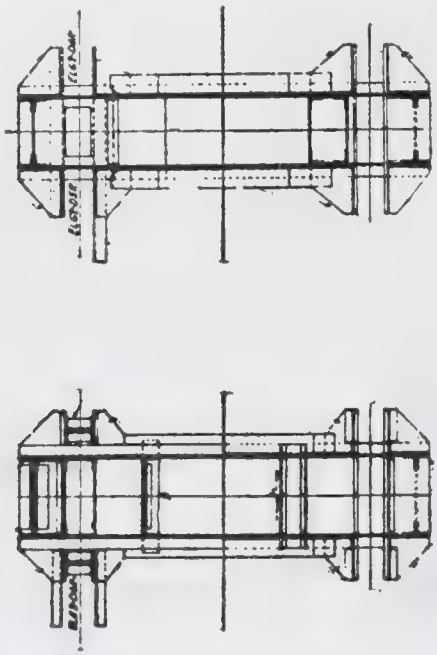
Despite the hazardous nature of the enterprise it is a noteworthy and commendable feature that with the exception of the loss of life that accompanied the falling of the span last year, the fatalities or even serious casualties have been surprisingly few. Boatmen were kept constantly in the river during the whole period of erection, immediately below the bridge so as to rescue anyone who might inadvertently fall into the river. The efforts of the company to provide comfortable and attractive camp life for the men have been greatly appreciated by the many workmen and has doubtless been a restraining and beneficial factor in influencing the character of the men and assisting them to exercise more than ordinary care in the performance of their varied and dangerous duties.

Owing to the climatic conditions, and the wide range of temperature between midsummer and midwinter, which may be anywhere from 100 to 125 degrees F., about 30 inches has been allowed for expansion and contraction throughout the entire length of the bridge. It is expected that three years will be required for the painting of the complete structure, and when the gang of painters have finished at one end they will immediately start at the other, thus assuring a permanent job for several workmen in order that the steel work will be sufficiently protected from the effects of the weather.

Forth Bridge Comparison

In reviewing the Quebec bridge, undoubtedly the greatest achievement of man's genius in the spanning of marine highways, the mind naturally reverts to its nearest rival, the Forth bridge, built over the Firth of Forth near Edinburgh. This is the next greatest structure of its kind in the world and comparisons are, therefore, interesting. Total cantilever of the Quebec bridge, including centre

span, is 2,830; that of the Forth bridge, including two spans, 2,349 feet. Width of channel between the main piers, 1,800 feet for the former against 1,710 for the latter. The Quebec bridge is designed to carry per lineal foot, exclusive of its own weight, approximately 14,000 pounds; the Forth bridge a weight of only 4,480 pounds per lineal foot. The total weight of steel used in the construction of the Quebec bridge is approximately 66,000 tons; that of the Forth bridge 57,000 tons. Weight per lineal foot for the cantilevers, 48,300 lbs. on the Quebec, and 21,360 lbs. on the Forth. Greatest depth of the main piers below high water is 101 feet for the Quebec bridge and 87 feet for the Forth. The weight of per lineal foot of the Quebec bridge is 2.3 times that of the Forth Bridge. The load for which the Quebec bridge was designed is 3.1 times greater



PLAN, SIDE AND FRONT ELEVATIONS OF SUPPORTING AND JACKING GIRDERS WITH HANGER CHAINS IN POSITION.

than that of the Forth bridge, while the prescribed test load for the former exceeds that for the latter about 4 1-3 times. The centre span of the Quebec bridge is the longest in the world and is approximately 100 feet longer than either of the spans that unite the cantilevers of the Forth bridge.

Brief History of Construction

The enormous structure that now spans the St. Lawrence is the successful fulfilment of a vision that has been in the minds of nation builders for nearly three-quarters of a century. As far back as 1852 a project for a bridge over the river at or near Quebec was considered, and again, in 1884 designs were prepared and plans submitted to the Quebec Board of Trade for a bridge at about the present site, but no definite action was taken until about 1900, when the Quebec Bridge and Railway Company located a site near Cap Rouge and took steps for the erection of such a structure; this initial site is vir-

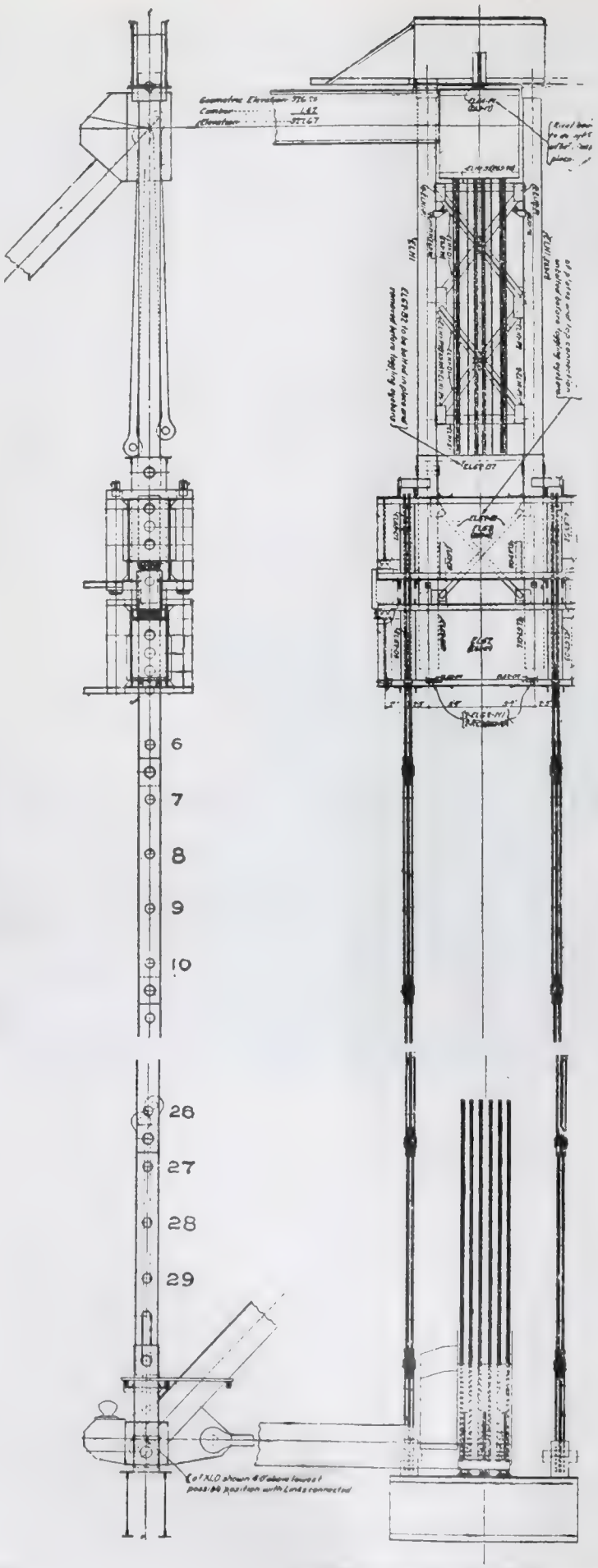


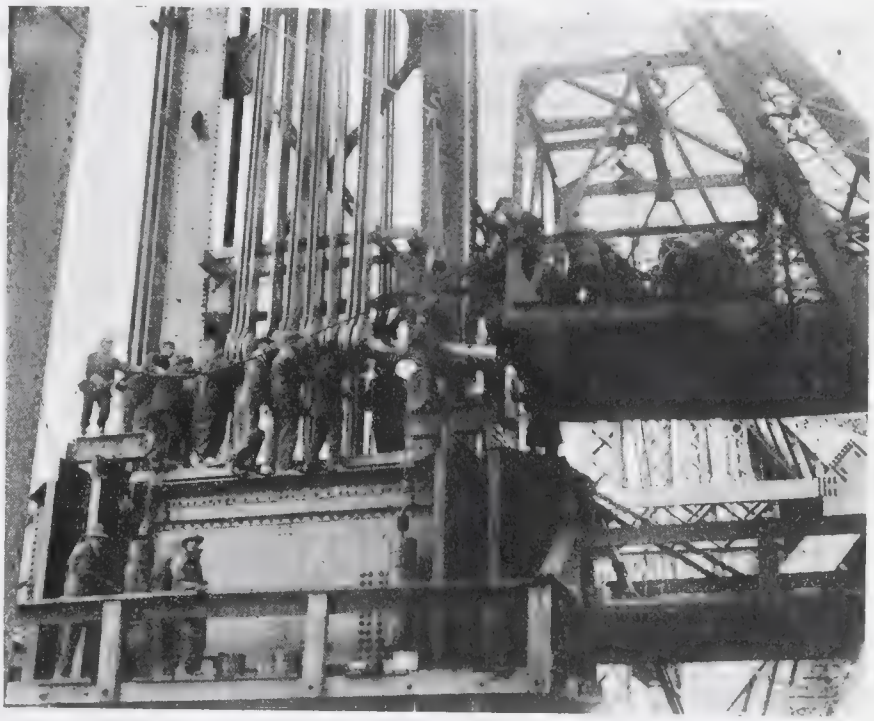
Illustration courtesy The Canadian Engineer.

tually that of the present bridge. The width of the river at this point is the narrowest between Montreal and the sea and is approximately six miles above Quebec; the distance across at mean water level being about 2,000 feet. In 1900 the Company awarded contracts for a structure of the cantilever type, having a span between the main piers of 1,800 feet. After seven years of fabrication and erection, the superstructure, which was then about half completed, collapsed into the river, carrying with it from sixty to seventy of the workmen.

Following this disaster the reconstruction was undertaken by the Dominion Government, then under the leadership of Sir Wilfrid Laurier, and the task was assigned to the Railway Deparment, with M. J. Butler as deputy minister and chief engineer. A commission comprised of such eminent men as Henry Holgate, Professor J. G. G. Kerry, of McGill, and Dr. Galbraith, of Toronto University, were appointed to examine and report on the fallen structure. Following the presentation of this report it was decided to select a commission who would have full charge of this mammoth enterprise. The parties named for this responsible work were H. E. Vautelet, of Montreal, chairman; Ralph Modjeska, of Chicago; and Maurice Fitzmaurice, chief engineer of the County Council of London, England. After a year's studies of the problems involved the last mentioned member of the commission resigned, and for some time difficulty was experienced in agreeing upon a suitable successor to Mr. Fitzmaurice. However, after some negotiations Charles McDonald, formerly of Gananoque, Ontario, was induced to act on the board until such time as a contract had been signed. Tenders were requested, either on the designs then in the hands of the Board or on plans prepared by the tendering companies. Upon the acceptance of the designs submitted by the present contractors of the bridge, the St. Lawrence Bridge Company was organized and the erection of a suitable plant was immediately proceded with at Rockfield, Quebec, situated on the Island of Montreal, this location offering ideal facilities for fabrication and shipment to the erection at the site. Despite the nature and the magnitude of the enterprise the work of construction progressed with remarkable rapidity so that in the summer of 1916 the work upon the two cantilever arms had practically been completed, with the erection of the centre span being accomplished simultaneously with that year's work. The centre span, the link that was to connect the two protruding arms, was erected at Sillery Cove about three miles below the bridge site, and floated into position on September 11 of last year, but after being successfully floated to the site and supported from the hoisting chains, the failure of one of the main castings caused the lower support to slip from its position and within less than 10 seconds the entire centre span had been released from its remaining supports and was resting on the bed of the river a mass of tangled and useless metal.

The final attempt, which has been successfully achieved during the past week, marks the culmination of effort that has taxed the engineering ability and utmost resources of those associated with the work of constructing the bridge from the very date of its inception. To the average layman it is difficult, if not utterly impossible, to conceive of the magnitude of this great and mighty undertaking, and to appreciate, even in a small and unlearned measure, the many problems of design and construction, it would be necessary to view the enormous structure as it now extends from one shore to the other, a fitting monument and everlasting memorial to those engineers whose ability has made this feat possible. There yet remain many minor, but essential, details to complete before the bridge is finally finished and ready for traffic, and it will probably be the spring of 1918 before the structure is officially opened, although it is anticipated that sufficient progress will have been made by November to allow trains to cross over. It is probable that very few of the vast crowds that patiently watched the massive structure mount slowly into position during the early half of last week, fully realized the chief object of the bridge and the inestimable importance that its successful completion would mean to the Dominion and particularly to that portion of the country immediately surrounding the bridge location. In addition to being the last link that will form the unbroken highway of the Transcontinental Railway from ocean to ocean, the bridge will provide communication to either side of the river for ten other converging transportation companies, the transferring of whose freight has until now been accomplished by railroad ferries. With the completion of such terminals as are now under construction and those contemplated, the increased facilities will eventually make the City of Quebec one of the leading railway centres in Canada.

The work has been carried out under the supervision of a Government Board of Engineers, composed of Messrs. C. N. Monserrat (chairman and chief engineer), Ralph Modjeska, and H. P. Borden. The St. Lawrence Bridge Company are the contractors for the superstructure, Phelps Johnston, president; G. H. Duggan, chief engineer; George F. Porter, engineers of construction; W. B. Fortune, superintendent of erection; and S. P. Mitchell, consulting engineer of erection; Works Superintendent Ladd being responsible for the fabrication. For the accompanying photographs we are indebted to Mr. E. N. Finn, bridge photographer; also to Mr. Millar, of the Montreal *Star*.



INSERTING THE FINAL PIN IN THE MAIN HANGERS.

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 squeezed 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.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - President
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PUBLISHERS OF

CANADIAN MACHINERY
AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

PETER BAIN, M.E., Editor. B. G. NEWTON, Manager.

Associate Editors

A. G. WEBSTER J. M. WILSON J. H. RODGERS

Office of Publication, 148-153 University Avenue, Toronto, Ont.

Vol. XVIII. SEPTEMBER 27, 1917 No. 13

FIVE TALENTS OR ONE?

THE turmoil of world affairs during the past three years has been instrumental in bringing forcibly to the attention of the public, more particularly that section directly concerned with engineering activities, the degree of development attained by the various nations of the world, and of no nation can it be truly said that its efforts are in the fierce blaze of publicity so much as of Great Britain.

Born colonizers, successful traders, masterful administrators, the energies of the British people found outlet in every conceivable form of industrial activity, their world-wide markets and methods of merchandizing permitting them to control their own progress in their own manner until the present cataclysmic struggle shook precedent and conservatism to the winds, and drove the nation's engineers to unparalleled efforts in many more or less dormant fields of science and industry.

During the early months of war, many students of historical events drew inspiration from the saying that "history repeats itself," and on every hand one heard forecast after forecast which were all in turn completely upset as each phase of Armageddon unfolded itself to the world's inhabitants. At least one parallel drawn by a writer has been justified by the course of events. He drew attention to the fact, and it has not so far been contradicted, that at the close of the Napoleonic wars, the world was really more civilized, judged from the standpoint of intellectual knowledge and industrial achievement than it was at the beginning of those troublous times. Numerous advances in the arts and sciences, manufacturing developments, and political economy took place, which marked great progress at the time and formed a solid foundation for that phenomenal development of the British nation, the envy of which is not the least of the present war's causes.

Now that the threatened avalanche of militarism has been definitely averted, and seems in a fair way of being rendered harmless, the strain of recent events has found expression in many ways, not the least valuable of which is that of "self-search" as typified by some recently published books by authoritative writers. We refer specifically to the book "Eclipse or Empire," by H. B. Gray and S. Turner. The theme of this book is the subserviency of everything to the industrial national aspect. Extracts received from an English contemporary indicate the exceedingly chastened spirit in which the authors view the industrial placidity of the British nation during the past two or three decades. They state "that during the last twenty to forty years most of the inventions, new ideas and developments have been given to the world by countries other than our own; furthermore, that their value has been more quickly appreciated and put to practical use in foreign lands." As our authority expresses it, "the book, condensed to the point of extreme brevity, is a valuable resumé of alleged national shortcomings, and should be in the hands of every engineer; indeed, just such a compilation, cataloguing and digesting for easy reference a survey of the entire industrial field from one viewpoint was badly needed.

The burden of the foregoing remarks in their bearing on our past, present and future development is sufficiently obvious. We were not able, nor did circumstances give us the opportunity, to benefit industrially, at the time, by events of a hundred years ago, but now every force at the service of mankind is directly engaged in military, industrial and scientific activity, the results of which are, so to speak, immediately at our disposal.

True, the return of peace will see the re-entrance of our present enemies, under due limitations no doubt, into the world's industrial arena, but what of the present? Is the cessation of hostilities to find us where we were at the start? Shall we lack interest for the present, and avoid effort in the future to avail ourselves of the world's advance marked in years instead of decades or centuries as formerly? Amidst the wealth of information being spread almost daily, are we to find no atoms which we may retain and benefit thereby? Shall our record in the present forceful era be one of assimilation only, or one of forceful origination. The future alone can tell, but the making of the answer is in the hands of our manufacturers now. They are in the position of the talent receivers—the point is whether they wish to be known as the man who received five talents and doubled them, or the man who received one—and "hung on to it."

To quote from the work which prompts these remarks "It matters but little what a man is to-day—the great matter is what he desires and intends to be in one, or two, or three years' time. He is not a mere machine with two hands and two feet—but a living pulsating energy. He has a trinity of powers—spirit, mind and hand, and the least of these three is hand. For it is only the spirit to do, and the mind to create, that can make the hand move at all. . . . The progress of our nation will depend on the rate at which we turn the principles and theories of science into terms of ascertained facts."

A CANADIAN MONUMENT

THE final and permanent success of the Quebec Bridge undertaking seems now to be an assured fact. Nothing in the province of the humanly expected course of events can prevent it taking its place in that galaxy of notable accomplishments which have made the names of Canada familiar wherever perseverance and resource are estimated at their true worth. Of its ultimate economic influence on the country's development, it is yet early to more than approximate, but as a symbol of the unity of the confederation it holds a unique place in the hearts of all Canadians. It is the keystone of the Dominion, filling the final gap which geographically and physically has existed, albeit intangibly, as a barrier between the Maritime Provinces and the others.

That it may have a long and useful existence, and serve successfully the purposes and aims which prompted its creation, is the wish of all from now on.

INDUSTRIAL NOTABILITIES

PERCY McCUTCHEON YEATES, president, National Machinery & Supply Co., Ltd., Hamilton, Ont., was born in London, Ont., Oct. 29, 1882, son of William Yeates, and after attending public and private schools of London, completed his education at University of Toronto.

He commenced his business career with the London Machine Tool Co., Hamilton, afterwards with the Baldwin Locomotive Works, Philadelphia; and

PERCY McCUTCHEON YEATES.

later with the London Tool Co. Mr. Yeates organized the present business in 1909 and was vice-president and general manager until 1916 since when he has been president.

On Jan. 6, 1908, he married Emma Gilmour, daughter of Dr. J. T. Gilmour, of Toronto, their family consisting of one son and one daughter.

Mr. Yeates is a member of the following clubs: Hamilton; Tamahaac; Hamilton Golf and Country; Hamilton Jockey; University, Toronto. He also holds membership in Delta Upsilon Society (University of Toronto).

Golf, Motoring, Fishing, and Hunting are his principal recreations, while in politics he is Conservative and in religion, Methodist. His residence is 24 Undercliff Ave., Hamilton, Ont.

Photo, Courtesy British & Colonial Press.

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	$46 95
Lake Superior, charcoal, Chicago	58 00
Standard low phos., Philadelphia	87 00
Bessemer, Pittsburgh	51 95
Basic, Valley furnace	48 00

	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	60 00

FINISHED IRON AND STEEL.

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 25
Steel hoops	7 50
Refined iron	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Band steel, No. 10 gauge	5 75
Chequered floor plate, 3-16 in.	15 20
Chequered floor plate, ¼ in.	15 00
Staybolt iron	8 50
Bessemer rails, heavy, at mill	38 00
Steel bars, Pittsburgh	4 00
Tank plates, Pittsburgh	9 00
Structural shapes, Pittsburgh	4 00
Steel hoops, Pittsburgh	5 25
F.O.B., Toronto Warehouse.	
Steel bars	5 50
Small shapes	5 75
F.O.B. Chicago Warehouse	
Steel bars	5 00
Structural shapes	5 00
Plates	8 00

FREIGHT RATES.

Pittsburgh to Following Points	Per 100 lbs. C.L.	L.C.L.
Montreal	23.1	31 5
St. John, N.B.	35.1	45 5
Halifax	35.1	45.5
Toronto	18.9	22 1
Guelph	18.9	22 1
London	18.9	22 1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS.

	Montreal	Toronto
Lake copper	$31 00	$32 00
Electro copper	31 00	32 00
Castings, copper	30 00	31 00
Tin	63 00	63 00
Spelter	10 50	10 50
Lead	11 00	11 50
Antimony	18 00	19 00
Aluminum	65 00	62 00

Prices per 100 lbs.

PLATES.

	Montreal	Toronto
Plates, ¼ to ½	$12 00	$13 00
Heads	12 30	13 30
Tank plates, 3-16 in.	12 65	13 25

WROUGHT PIPE.

Effective July 5, 1917.

Size	Black Standard Buttweld. Per 100 feet	Galvanized Standard Lapweld. Per 100 feet
⅛ in.	$ 5 00	$ 6 50
¼ and ⅜ in.	5 12	7 16
½ in.	6 46	8 03
¾ in.	8 17	10 29
1 in.	12 07	15 22
1¼ in.	16 33	20 59
1½ in.	19 53	24 61
2 in.	26 27	33 12
2½ in.	42 12	52 94
3 in.	55 08	69 23
3½ in.	69 92	86 94
4 in.	82 84	103 00
2 in.	29 23	35 71
2½ in.	43 88	54 11
3 in.	57 38	70 76
3½ in.	71 76	89 70
4 in.	85 02	106 28
4½ in.	96 52	121 29
5 in.	112 50	141 34
6 in.	145 90	183 36
7 in.	190 40	238 00
8 L in.	200 00	250 00
8 in.	230 40	288 00
9 in.	276 00	345 00
10 L in.	256 00	320 00
10 in.	329 60	412 00

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES.

4" and under, 45%.
4½" and larger, 40%.
4" and under, running thread, 25%.
Standard couplings, 4" and under, 35%.
4½" and larger, 15%.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$20 00	$18 00
Copper, crucible	23 00	20 50
Copper, heavy	23 00	20 50
Copper wire	22 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 turning	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 turn'gs.	8 50	8 50
Cast borings	12 00	8 50
Stove plate	19 00	19 00
Scrap zinc	6 50	9 50
Heavy lead	10 00	10 50
Tea lead	7 00	7 00
Aluminum	30 00	35 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Carriage bolts, ⅜" and less.	10
Carriage bolts 7-16 and up.	net
Coach and lag screws	25
Stove bolts	55
Plate washers	List plus 10
Machine bolts, 7-16 and over	net
Machine bolts, ⅜ and less.	10
Blank bolts	net
Bolt ends	net
Elevator bolts	50 and 5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	add 20
Machine screws, o. and fil. hd., brass	add 25
Nuts, square blank	add $1 50
Nuts, square, tapped	add 1 75
Nuts, hex. blank	add 1 75
Nuts, hex. tapped	add 2 00
Copper rivets and burrs, list plus	30
Burrs only list plus	50
Iron rivets and burrs	17½
Boiler rivets, base ¾-in and larger	$7 60
Structural rivets, as above.	7 50
Wood screws, flat, bright	72½
Wood screws, O. & R., bright	67½
Wood screws, flat, brass	37½
Wood screws, O. & R., brass	32½
Wood screws, flat, bronze	27½
Wood screws, O. & R. bronze	25

MILLED PRODUCTS.

	Per cent.
Set screws	35
Sq. & Hex. Head Cap Screws	30
Rd. & Fil Head Cap Screws	10
Flat ⅞ But. Hd. Cap Screws plus	10
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. and semi-fin. nuts, over 1 in., up to 1½ in.	30
Fin. and semi-fin. nuts, over 1½ in., up to 2 in.	10
Studs	20
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	list plus 20
Collar screws	list plus 30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts	add 40, 10
Cold pressed nuts to 1½ in.	add $4.50
Cold pressed nuts over 1½ in.	add $7.00

BILLETS.

	Per gross ton
Bessemer billets	$ 65 00
Open-hearth billets	65 00
O.H. sheet bars	75 00
Forging billets	100 00
Wire rods	90 00

F.o.b. Pittsburgh.

NAILS AND SPIKES.

Wire nails	5 50	5 45
Cut nails	5 70	5 80
Miscellaneous wire nails		60%
Spikes, ⅝ in. and larger		7 50
Spikes, ¼ and 5-16 in.		8 00

MISCELLANEOUS.

Solder, strictly	0 36
Solder, guaranteed	0 38½
Babbitt metals	18 to 70
Soldering coppers, lb.	0 53
Lead wool, per lb.	0 16
Putty, 100-lb. drum	4 35
White lead, pure, cwt.	19 00
Red dry lead, 100 lb. kegs, per cwt.	15 45
Glue, English	0 38
Tarred slaters' paper, roll	0 95
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls., gal.	0 61
Linseed oil, raw, single, bbls.	1 49
Linseed oil, boiled, 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, cyrstal	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

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

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 25%

CARBON DRILLS AND REAMERS.

	Per Cent.
S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	25
Standard drills to 1½ in.	40
Standard drills, over 1½ in.	15
3-fluted drills, plus	10
Jobbers' and letter sizes	40
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	40
Sleeves	40
Taper pin reamers	20
Drills and countersinks	list plus 30
Bridge reamers	45
Centre reamers	10
Chucking reamers	10
Hand reamers	15

COLD ROLLED SHAFTING.

At mill ..... list plus 40%
At warehouse ..... list plus 50%

Discounts off new list. Warehouse price at Montreal and Toronto.

IRON PIPE FITTINGS.

Canadian malleable, A, add 7½%; B and C, 10%; cast iron, 35%; standard bushings, 50%; headers, 60; flanged unions, 40; malleable bushings, 50; nipples, 55; malleable lipped unions, 50.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$11 00	$11 00
Sheets, black, No. 10	12 00	12 00
Canada plates, dull, 52 sheets	12 00	12 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

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

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.

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

COAL AND COKE.

Solvay Foundry Coke	$
Connelsville Foundry Coke	
Steam Lump Coal	
Best Slack	

Net ton f.o.b. Toronto

BOILER TUBES.

Size.	Seamless	Lap-welded
1 in.	$36 00	$
1¼ in.	40 00	
1½ in.	43 00	36 00
1¾ in.	43 00	36 00
2 in.	50 00	36 00
2¼ in.	53 00	38 00
2½ in.	55 00	42 00
3 in.	64 00	50 00
3¼ in.		58 00
3½ in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 feet, Montreal and Toronto.

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.	0 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

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 95
Leather in sides	1 75

TAPES.

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

WASTE.

White	Cents per lb.
XXX Extra	20
Peerless	20
Grand	19
Superior	19
X L C R	18
Atlas	18
X Empire	18
Ideal	17
X press	16

COLORED.

Lion	14½
Standard	13
No. 1	13
Popular	11¾
Keen	10½

WOOL PACKING.

Arrow	25
Axle	20
Anvil	15
Anchor	11

WASHED WIPERS.

Select White	12
Mixed colored	10
Dark colored	09

This list subject to trade discount for quantity.

RUBBER BELTING.

Standard	40%
Best grades	20%

ANODES.

Nickel	.50 to .54
Cobalt	1.75 to 2.00
Copper	.44 to .46
Tin	.49 to .56
Zinc	.23 to .25

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.

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, seamless	0 58

PLATING SUPPLIES.

Polishing wheels, felt.	3 00
Polishing wheels, bull-neck	1 75
Emery in kegs, American	06
Pumice, ground	05
Emery glue	15 to 20
Tripoli composition	04 to 06
Crocus composition	07 to 08
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 35

Prices Per Lb.

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$18 00	$18 00
Sheets, 3½ lbs. sq. ft.	18 00	18 00
Sheets, 4 to 6 lbs. sq. ft.	17 50	17 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb extra.

PLATING CHEMICALS.

Acid, boracic	$ 15
Acid, hydrochloric	05
Acid, hydrofluoric	.14½
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.40
Ammonium sulphate	.07
Arsenic, white	.12
Copper, carbonate, anhy.	.35
Copper, sulphate	.17
Cobalt sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.12
Nickel carbonate	.35
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.55
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.41
Sodium hydrate	.04
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.14
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

CONDITIONS in the steel trade are becoming more complex on account of the embargo, and indications point to a difficult situation for consumers to contend with. The market is consequently very unsettled and the trade is anxiously awaiting developments. What is likely to happen is difficult to foretell as the outlook is so obscure. The situation, however, will be relieved now that the United States Government has fixed prices on steel, iron ore, pig-iron and coke. The effort made to have the embargo modified does not appear to have met with much success as the situation is as acute as ever. Existing conditions will benefit the Canadian mills to a certain extent, but those consumers who rely on imported steel products will suffer considerable inconvenience. Shipbuilding will not be interfered with, but other industries using iron and steel will be seriously hampered in their manufacturing activities. One effect of the embargo is seen in higher prices on steel plate, boiler tubes and black sheets. The embargo seems to have changed the whole aspect of the situation with regard to prices. Until quite recently recessions were anticipated, but now indications point the other way. The pig-iron situation is unchanged and quotations are holding firm locally, although there is a downward tendency in prices across the line. The embargo and shortage of cars is keeping the market firm here. The scrap metal market is weaker and declines have been registered in copper and brass scrap, although steel and iron prices are unchanged. The non-ferrous metal markets are in a rather chaotic condition. An embargo on copper has been placed by the United States Government, which has also fixed a price to all consumers at 23½c a pound, or 3c below the market. Tin is higher, but lead has declined, otherwise prices are unchanged. The machine tool market is quiet and the general situation unchanged.

Montreal, Que., Sept. 24, 1917.—Renewed interest has developed over the announcement that additional orders have been placed for the six-inch shells, and while nothing definite has been learned as to the extent of this new business, it is believed that enough contracts have been obtained to operate many of the large plants at full capacity for a considerable time, probably well into 1918. A feature of the present situation is the difficulty that promises to become serious in the near future, of securing permission to get such steel from the States as is most urgently required for some domestic purposes. In some respects this material is not required directly for war purposes, but the loss likely to be sustained by certain industries will eventually result in serious disorganization of trade in general.

Pig Iron

The general situation has developed little of interest and the market is still marking time in respect to any alterations in pig iron quotations; apparently awaiting further action on the part of the U. S. Government regarding the regulations that are contemplated. The situation in the States is beginning to reflect the possibilities that may result on the announcement of the investigating committee, and an easier tone is evident in the declining quotations. The Pittsburgh price on basic pig is now quoted at $42.95 per ton, a decline over last week of $6 per ton. The composite price has been lowered during the week to the amount of $1.32 per ton, and is now below the $50 mark. The fuel situation is not so acute, but transportation facilities are still inadequate for all requirements. The Canadian situation is still unchanged, with prices withheld.

Steel

The increasing requirements of the American Government in meeting and filling the many demands that have arisen out of the prosecution of the war have necessitated a readjustment of conditions, so that everyone will realize the importance of any action taken in this connection. It is these conditions that should stimulate production, as there is a possibility of a steel shortage in the States, particularly for purposes other than war necessities. The fact that Canada is entirely dependent on United States mills for certain classes of steel makes the present developments much more serious for domestic consumers in this country, as it is practically impossible to secure supplies unless it is especially certified that they are to be used expressly for war requirements. Unless concerted action is brought to bear on the Governments by those manufacturers suffering under existing conditions, it will eventually result in very serious inconvenience and subsequently disorganize the business of this country. Some provision should be made so as to allow dealers to obtain such steel as might be required for urgent requirements, as certain delays, even in domestic enterprise, might have serious results in the advancement of the cause for which the present conditions are supposed to assist. Producers are apparently offering inducements for the placing of additional future business, as indicated in the easier market that has developed in certain directions. This, however, has not had the desired effect, as the market remains quiet and uncertain. A sharp decline has been reported on the Pittsburgh quotations for rolling and forging billets, the former on a drop of $25 being quoted at $75 per ton; the price of $85 on the latter showing a decline of $40 per ton. Steel bars are lower with the New York price having declined ½c per lb. Tank plates have an easier tendency, but the demand continues very heavy. The situation in blue annealed and galvanized sheets is not so acute, and American quotations have declined. It is not expected that the announcement of the American Government in respect to price regulations will materially affect the demand, although the price to be paid for steel for war requirements is considerably lower than present quotations on the open market. The effect of existing conditions on the Canadian market may well be one to receive the immediate attention of both the manufacturer and the Government, as a famine in domestic supply would seriously handicap many industries throughout the country. Dealers here are not favorably impressed with the outlook for the near future, and are making efforts to have the authorities at Ottawa take some action to relieve the situation. In the meantime conditions are very unsettled and prices continue uncertain and nominal at last week's level.

Metals

The market is beginning to feel the effects of the readjustment, as outlined by the American Government, and in respect to copper and lead, and also antimony the situation has weakened. Copper has declined to meet the price fixed by the Government, and will likely continue steady for some considerable time. Tin has again become stronger after a spell of weakness. Spelter is quiet and unchanged. Lead has been reduced by all interests. Antimony has declined on a quiet market. Aluminum continues firm and strong.

Copper.—The announcement that the American Government has made a statement regarding the copper situation and the fixing of a price to all buyers of 23½c per lb. has relieved the market of much of the tension that has characterized it during the past few months. The price mentioned was agreed upon after extended negotiations between the War Industries Board and some of the leading producers, with the stipulation that it will be subject to revision after a period of four months. One of the chief features of the agreement is that the wages of employees shall not be reduced during the time the agreement is in force; this clause will assure the full cooperation of all workmen and production will likely be maintained at maximum capacity. Unless this is done the small consumer may find himself in as bad a position as before, as the large buyer will possibly have the first call on covering his requirements. Under existing conditions and until further developments are reported, the price quotations for copper will remain constant, even though the market may have an uncertain character. The New York quotation is on the flat price of 23½c. per lb. With local prices set at 31c. for lake and electro, and 30c for castings, dealers here believe that these prices will prevail during the coming four months.

Tin.—This market is kept in a more or less unsettled position owing to the irregular advices that are received from London. The New York market which developed a weakness during the earlier part of the week has shown signs of recovering some of its previous strength, but present quotations of 61½c. are still one cent lower than last wek. It is not likely that this market will be affected by Government regulations unless some understanding can be arrived at between the British and American authorities. Dealers here report a stronger market, with prices up one cent; price quoted being 63c. per lb.

Spelter. — Developments in the States have resulted in again placing the spelter market in a very unsettled state and further complications are apparently making the situation more difficult to define. A misunderstanding has apparently arisen between the investigating committee and the Government which will mean further delay in coming to an agreement as to the price that will be fixed for this metal. The New York market has shown a little increased strength due to a better demand, the current quotation of 8⅜c. being ⅛c. higher than last week. Local spelter is firm and unchanged at 10½c. per lb.

Lead.—The recent rumor that this metal would soon experience another decline has at last materialized, and the drop of 1c per lb. during the week has placed the market at the base figure of 8c. Production has been stepped up so much during the last two months that supplies have been increasing in face of a quiet market, and one that has become rather demoralized owing to existing conditions and the uncertainty that characterized the entire situation. However, it is not to be supposed that this market is due to fall still further, as Government requirements at any time may result in another advance. There are those who think that this recent decline has been made more to stimulate buying than as a fair indication as to the actual condition of the market. So far no increased activity has resulted. Following the lower market in the States, local dealers have declined their quotations 1c per lb., the price asked being 11c per lb.

Antimony.—The market is quiet on light demand, with nothing of interest to report. New York is a little easier, the quotation of 15⅜c per lb. being ⅛c lower than last week. The market here has weakened to the extent of 2c per lb., the price quoted being 18c per lb.

Aluminum.—No change has taken place in the condition of the market, and prices are unchanged at 65c to 70c per lb.

Machine Tools and Supplies

While no pronounced activity has been reported in the machine tool industry, the fact that additional contracts have been placed for the 6-inch high explosive shells has again revived the waning interest throughout the trade. It is not anticipated that the demand for equipment will be very great, as many of the plants are already well supplied with the necessary machinery; others who have been fortunate in obtaining orders have been manufacturing the larger sizes and their requirements will be more for accessory attachments than for unit equipment. In fitting the latter machines for the making of the smaller shells it is expected that the demand for special devices and attachments will be renewed, as the experience gained during the past will result in the adoption of the most efficient devices for the filling of these latest orders. The demands for supplies and machine shop accessories has shown improvement since the placing of the additional business for the 6-inch shells. The difficulties that are still experienced in the securing of raw materials continues to maintain a very firm market and steady prices.

Scrap

All interests are transacting business in a more or less guarded fashion, and little heavy trading is reported. No action has been announced as to what steps will be taken to regulate the scrap situation. It is very likely, however, that this feature of industrial necessity will be subjected to similar regulations as that under consideration in other branches of activity. In view of the possibility that the iron and steel markets will undergo a change on the Government announcement re the fixing of prices, it is anticipated that the market in old materials will be likewise affected. The New York

market has developed a weaker tone, and dealers here report a very unsettled situation, with prices very uncertain and nominal. Local quotations are higher on old copper than that asked for new metal.

Toronto, Ont., Sept. 25.—Trade locally continues in satisfactory volume and many industries are still deriving considerable benefit from war orders. Business of this nature however, depends largely, as far as British Government contracts are concerned, upon the ability of the Canadian Government to finance these orders. As large credits are being, and will continue to be placed at the disposal of the British Government for war supplies, Canadian industries will benefit to that extent. The U.S. Government has also placed large contracts for supplies in Canada and there is a possibility of further development in this respect. While the munitions industry is not as active as formerly contracts for shells are still being placed representing in the aggregate a large sum of money.

Steel

The unsettled situation in the steel market arising out of the embargo on importations from United States continues to cause considerable delay and inconvenience to domestic consumers. Conditions at the present time are such that no one knows what is likely to develop either in regard to the supply of material or prices. The embargo has created unusual conditions in the trade in so far as it affects certain materials not produced in Canada among which may be included boiler tubes, plates, larger size structural shapes. These materials can be obtained for shipbuilding or for marine boilers but for any other purpose or for merchants' stocks it is very difficult to obtain an export license. Indications point to a much tighter situation owing to the heavy demand for steel which will ultimately develop in the United States. The capacity of the mills, although very large, is limited while the demand is apparently unlimited. It is not known publically what action the United States Government may take in regard to its requirements of steel for war purposes but it appears likely that a considerable percentage of the output of steel will be taken over for this purpose. A report is current that the U.S. Government contemplates taking over 95 per cent. of that country's output to be utilized in the manufacture of munitions and war equipment generally. Whether there be any foundation in this report or not, the fact that the Government's needs are increasing is sufficient to indicate that a shortage of steel for private consumers is likely to become more acute than ever before. Developments across the line will benefit Canadian steel concerns who will be called upon to supply considerable more tonnage for private consumers than in normal times. The production of shell steel is still considerable and although there has been some decrease in output of steel for this purpose the demand for this material is still sufficient to keep the mills busy while with the additional tonnage requirements for domestic consumers will in the aggregate represent a large volume of business.

What the future has in store with regard to prices is problematical. The general consensus of opinion for some time has been that the market is due for a decline in values. Conditions prevailing, particularly in regard to the embargo, have changed the aspect of the situation and a continuance of firm prices now appears more probable than it did a few weeks ago. The influence of conditions in the States upon prices in Canada is another factor in the situation about which there is considerable difference of opinion now. The question seems to be, will the embargo neutralize that influence and the Canadian market have its own basis of prices, that is for steel products such as are rolled in Canada. The market is so unsettled and outlook so obscure that it is impossible to predict what will develop. Until quite recently it was generally believed that prices were about to decline or at least remain stationary. This week there has been an advance of about 10 per cent. on seamless and lap-welded boiler tubes, while plates and black sheets have also advanced.

MARKET LETTER DEVELOPMENT

The attention of metal working plant executives is directed to the enlargement of the scope and usefulness of our Market Letter Department. In New York and Pittsburgh, expert correspondents have been engaged, and are already furnishing each week concise reports of production activities, price movements, etc., within the territory served by each of these important centres. During the next few weeks, further additions will be made to the number of our United States correspondents, embracing other industrial centres, and enlarging thereby the scope of the meantime service being rendered.

The tense situation in the trade in the United States has been relieved by the announcement of prices which the Government has fixed on steel products. All prices are considerably reduced from current quotations and are as follows: Steel bars, plates and shapes are prices at Pittsburg and Chicago. Bars are now $2.90 per 100 lbs. recent price being $5.50; plates $3.25 as against $11. Shapes $3.00 now. were $6 per 100 lbs. Pig iron is now $33. per gross ton, the recent price being $58.00 a ton. Connellsville coke is now $6.00 as against $16 a ton. Iron ore $5.05 per gross ton, no change. These prices are subject to revisison Jan. 1, 1918, but will become effective immediately. It will be interesting to see what effect these prices will have on the situation as they are lower than were predicted. Business has been largely confined to Government requirements and private consumers are only buying to fill urgent needs.

Pig Iron

The pig iron market continues unsettled with the trend of prices downwards. There is however so little pig iron changing hands that there is practically no market price at the present time. The embargo and shortage of cars are both tending to keep prices up in spite of the belief that the market will decline. Buying is generally hand-to-mouth and stocks are low both at the foundries and furnaces. Coke production is still being hampered on account of shortage of labor and cars. Lately the labor suuply has been more liberal but the car shortage is more acute. The fact that the U.S. Government has at last fixed prices on pig iron, ore and coke will relieve the situation. Iron ore is unchanged at $5.05 a gross ton, basis lower lake ports. Coke in Connellsville, is $6. net ton, the recent price being $16. a reduction of 62.5 per cent. The price agreed upon for pig iron is $33 gross ton, the recent price being $58. net ton, a reduction of 43.1 per cent.

Scrap

A supervisor will be appointed by the Government to investigate the scrap situation and go into the question of prices and efficient utilisation of all old materials. The market is weaker and there has been a decline in prices of all coppers and brass scrap equivalent to about 3c per pound. The embargo which has been placed by the U.S. Government on the import of all metals has unsettled the local market and it is difficult to say to what extent it will affect the situation. There is only a moderate demand for non-ferrous scrap although there is a fair enquiry for steel and iron scrap at unchanged prices.

Machine Tools

The machine tool market continues dull with no outstanding feature of importance to note. The concerns who have contracts for 6 inch shells are buying a few special tools, but generally speaking the existing equipment will be utilized for the new work. New fixtures etc., will however, be required to suit the size of shell. Canadian machine tool builders are busy but not to the same extent as a few months ago. A number of machine shops are actively engaged on marine work but this will not necessitate new equipment. The Canadian Car & Foundry Co. have purchased some of the new tools for their car works at Fort William, Ont.

Supplies

There has been less activity in machine shop supplies since the shell orders declined in volume, but business is keeping up fairly well in general lines. Prices continue firm but there have been fewer changes of late. An advance in prices of oakum is expected

shortly and is due to the big demand for this material for shipbuilding. For the construction of wooden ships oakum is used in considerable quantities for caulking the seams. Prices of linseed oil have dropped 6c due to the decline in flax seed. Turpentine on the other hand has advanced 3c per gallon at a firm market. An advance of 50c per barrel has been made in resins. Gasoline and coal oil are firm but unchanged.

Metals

Interesting developments are taking place in the metal markets. An embargo has been placed on the export of copper by the U.S. Government and it is expected that it will be extended to include all other non-ferrous metals. This has naturally caused some excitement in the trade and the market consequently is unsettled. It is not clear at present what the full effect will be, but it cannot help but cause much inconvenience and will probably result in higher prices. As in the case of iron and steel a license has to be obtained before metal can be imported into Canada which is difficult to obtain except for certain specified purposes, such as munitions. The U.S. Government has also fixed a price of 23½c per pound, New York, on copper but this has not yet been reflected in the market price. Tin is a shade firmer and has advanced but lead is weaker and lower. All other prices are unchanged.

Copper.—The situation has been cleared up by the U.S. Government fixing a price of 23½c on copper f.o.b. New York. This is 3c below the market price. It has been agreed that sales to the Government, Allies and the public will be at this price. The producers pledged themselves to maintain maximum production and to prevent copper falling into the hand of speculators. What effect this new price will have on the local market is not easy to determine as the embargo has changed the aspect of the situation. Lake and electro are still quoted at 32c and castings at 31c per pound.

Tin.—The market is firmer in sympathy with the London situation and prices have advanced 1c a pound. Tin is now quoted at 63c a pound.

Spelter.—The market is firm but less active at unchanged quotations. Local price 10½c per pound.

Lead.—The Trust has again reduced its price of lead to 8c New York and the independents are quoting the same figure. The price has now dropped to the basis of the U.S. Government price, viz. 8c a pound. Locally the demand for lead has fallen off and there is less activity in the market than formerly. Lead is now quoted at 11½c a pound.

Antimony.—The general situation is unchanged although the market has a weaker tendency. Local price 19c per pound.

Aluminum.—The market is quiet and demand light with quotations unchanged at 62c a pound.

New York, Sept. 24.—Steel manufacturers in the United States are much interested in the report that the British Governmest is about to resume the purchase of shells on a large scale in Canada, through the Imperial Munitions Board. It is estimated that purchases on English account will cover at least 6,000,000 shells running from 4 to 12-in. in diameter. The United States Government is also actively negotiating with various manufacturers for shells of various calibers; in fact, some contracts have already been placed for 3-inch shells and negotiations now cover 6, 8 and 9.2 in. shells. The expectation is that the United States alone, will distribute orders for 9,000,000 shells. The orders placed by the two Governments, it is estimated, will require at least 1,500,000 tons of steel. In the Chicago territory manufacturers expect orders to be placed soon and machinery makers are preparing for a flood of orders for small sizes of tools in consequence.

The Ordnance Bureau of the Army, has recently closed contracts for about 3,000 3-in. field guns which will require about 25,000 tons of steel forgings. The War Department also has ordered 2,500,000 3-in. shells calling for 18,000 tons of forgings. The Ordnance Bureau of the Navy has given a contract for rough machine forgings for 4-in. guns to the Tioga Steel & Iron Co., a subsidiary of the Taylor-Wharton Iron & Steel Co., and the latter has purchased $600,000 worth of tools for installation in the forge and machine shops that are now building at the Philadelphia shops of the subsidiary company. It is understood that 40,000 tons of forgings will be machined.

The Army Department continues to place contracts for structural steel and machinery for export to France. In the last few days, orders have been distributed among ten fabricating shops for 13,000 tons of steel shapes for the building of ordnance stores in France. Orders are also being placed for buildings in which to manufacture 5,000 Liberty airplane motors in the French territory occupied by the American army. To equip these factories, army officials have just closed contracts for $3,000,000 worth of machine tools. Orders were distributed through the J. G. White Engineering Corporation for 1,000 tools, deliveries being demanded in thirty to sixty days. The Government also has awarded contracts for 15,000 Liberty motors to be manufactured in the United States. The Packard Motor Car Co. and Henry M. Leland & Son, Detroit, will each build, 6,000 motors while the Trego Motors Corporation, New Haven, and the Nordyke-Marmon Co., Indianapolis, will each build 1,500 engines. Many automobile manufacturers will also have a share in building parts of the engines which will expedite the filling of the initial contracts.

The Stone & Webster Corporation, that assisted the Government in placing structural contracts for barracks, warehouses and ordnance stores in France, are now placing orders for 359 machine tools for installation in the United States gun repair plant in France. The Army Department has also awarded contracts for 90 cranes among domestic manufacturers to be installed at railway and ship terminals in France. Manufacturers of these cranes are now in the market for 5,000 to 10,000 tons of steel bars, plates and shapes to be used in the building of this machinery.

Many other manufacturers having orders for war munitions from the Army and Navy Departments are actively in the market for machinery of various kinds, The Holt Manufacturing Co., Peoria, building caterpillar tractors, is buying tools in the Chicago market as are also Fairbanks Morse & Co., Beloit, Wis., and the Inland Steel Co., Indiana Harbor. These orders call for the expenditure of $150,000.

Pittsburg, Sept. 22.—While the iron and steel markets have continued stagnant, as regards the volume of transactions, some further, although slight, progress has been made in the price readjustment and there have been some interesting developments besides, as a general 10 per cent. wage increase has been inaugurated and the Government and copper producers have reached an agreement on copper prices such as to suggest what may be done in iron and steel.

Basic Iron Down

A striking development, illustrating how stagnant the market has been, was a sale of 2,000 tons of basic pig iron at $42, valley, when the market had been nominally quotable at $48. There was a sale of 5,000 tons in the closing days of August at $48, and afterwards the market was quotable at that figure, as representing the last sale. When, however, a steel interest in the Mahoning valley which had 16,000 tons stock and desired to reduce the stock by 6,000 tons, offered this tonnage there were no bidders among consumers and a merchant furnace interest agreed to take 2,000 tons at $42. There remains 4,000 tons offered at this price, which may now be quoted as the maximum rather than the minimum of the market. No similar effort has been made to dispose of Bessemer or basic iron, and these grades remain quotable at $50, an occasional lot, a carload to 200 tons, being sold at this figure. Any effort to force a few thousand tons upon the market would undoubtedly result in a much lower price.

Unfinished Steel

Transactions in billets and sheet bars are limited to pressing needs of consumers, for immediate deliveries, and thus involve very small tonnages. The offerings are by middlemen and consumers, mills refusing to quote, and there is a wide range of prices, depending on how closely the offering, as to size and analysis, fits the needs of the prospective purchaser. In general the billet market is $65 to $75, as evidenced by sales in the past ten days, while sheet bars and slabs are $75 and upwards.

Finished Steel

A fortnight and more ago there was some expectation that the finished steel market might be given some life by the buying of jobbers for fourth quarter deliveries, but the demand expected has not materialized and it appears that the jobbers will buy very little. They still have deliveries due them on second quarter and third quarter contracts, and their general policy at this time is to reduce stocks to the lowest possible level. As to manufacturing consumers, all are probably covered fully to the end of the year by contracts, and in some instances for the fore part of next year. Thus the position is that no buyer is forced to buy and the incentive of an expectation of higher prices later is totally lacking. Everyone expects prices to decline rather than advance.

Black sheets have been offered a couple dollars a ton lower, at 8.25c, and there are rumors of 7.75c having been quoted, this not being confirmed. Rumors continue of merchant steel bars being sold on contract at 3.50c, the commonly quoted market being 4.00c. They Carnegie Steel Co. states that it is not offering bars, because it is so well filled with Government orders for plates and shapes that it is diverting crude steel from its bar mills and has all it can do to fill its present bar obligations, but that if it were to sell the price would be 3.50c.

Mill Operations

Furnace and mill operations continue to be conducted with great difficulty owing to shortages of coke and of labor. The coke shortage results in merchant furnaces paying fancy prices for spot Connellsville coke, about $13, while the Steel Corporation, unwilling to buy coke, simply curtails its blast furnace operations, and generally has several furnaces banked, while a few are entirely out of blast. The production of steel is correspondingly restricted, the present rate of output being about 45,000,000 tons per annum, against about 44,000,000 tons in July and August, while the actual capacity is close to 50,000,000 tons. Some of the mills have feared they would be forced to curtail production on account of coal shortage, but thus far they have been able to get along. The danger from the fixed Government price, whereby the operators prefer to ship their output on the higher priced contracts, is less than from the diversion of so much coal to the lake trade.

Wage Advance

The United States Steel Corporation has just announced a general wage advance of about 10 per cent. for its various operating companies, to become effective Oct. 1. In 1916 there were three such advances, effective Feb. 1, May 1 and Dec. 15 respectively. Prior to the previous advance, early in 1913, the wages had been substantially as high as at any time in the history of the steel industry, so that wage rates are now very high, relatively speaking. The independents will necessarily make the same advance as the Steel Corporation. While a wage advance may seem strange at a time when market prices are falling, the real point is that realized prices on shipments have been constantly advancing as older and lower priced orders were worked out, and there is still a wide divergence between the average prices at which shipments are being made and the prices quoted as representing the market. These prices are still in large measure fictitious or nominal. Thus since last June black sheets have been quoted at 8.00c or higher, yet the sliding scale wage settlement with the Amalgamated Association showed that the average price realized on 26, 27 and 28 gauge sheets shipped during July and August lay between 5.00c and 5.05c.

The Copper Agreement

It was announced yesterday that the Government and the copper producers had reached an agreement whereby for the next four months copper will be sold to the Government, its Allies and the general public at 23½ cents. The average quoted price for the ten years ending 1913 was 15.36c, while the existing market was 27 cents. The Government has no authority to fix copper or steel prices, except upon its own purchases, but can reach an amicable agreement with producers and hold them to the agreement by the fact that it can at will commandeer plants to furnish materials for its own use. Washington advices are that an important meeting has just been held with the steel producers and it is possible that an agreement in steel is being reached similar to that just announced for copper. What the steel prices would be, however, is another matter, as the conditions are quite different in copper and in steel. The agreed price on copper is 55 per cent. above the average of the ten years before the war, and 13 per cent. below the market existing at the time of the war but a price for steel 55 per cent. above the ten-year average would be very much below a price 13 per cent. below the existing market.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the Commission headquarters are at Ottawa.

TO HELP EMPIRE TRADE

PROPOSALS of a far-reaching character have been put forward by the British Foreign Office and the Board of Trade for the purpose of improving the scope and completeness of the information placed at the disposal of the commercial community by the Government, according to the London *Daily Chronicle*.

At the present the Board of Trade has a Commercial Intelligence Department—which, by the way, has done excellent work under the guidance of Sir William Clark — and Trade Commissioners for dealing with matters affecting the Mother Country and the Dominion. Working side-by-side with these, and in many cases covering the same ground, the Foreign Office has its Commercial Attaches and its Consular service.

It is proposed to bring all these various agencies under one head in the shape of a Comemrcial Intelligence Department with a Parliamentary Secretary, who is to be appointed jointly by the Secretary for Foreign Affairs and the President of the Board of Trade and who will be responsible to both.

This is a unique departure so far as the Civil Service is concerned, but the question has been carefully considered by the Foreign Office and the Board of Trade. It was felt that this was the only way out of the difficulty, and the solution has received the approbation of the War Cabinet.

There is to be a great extension of the work under the new department. The staffs will be largely increased by the addition of trained men, and it is hoped to cover the whole world with an efficient service so as to give the fullest possible information on all points of interest to British traders. The Dominions have their own services of commercial information, but the British department will be prepared to give every assistance to them and to act as a clearing house between them.

The new department will also be in a position to furnish the Government with the information required before any changes can be made in tariffs or other international commercial relations.

The scheme has been laid before the Commercial Committee of the House of Commons by Lord Robert Cecil. That body has thanked the Under Secretary for Foreign Affairs for the action which has been decided upon, and has taken steps to lay the scheme before the British Chambers of Commerce and the Federation of British Industries. At the same time, the Commercial Committee has expressed the opinion that the agreement arrived at between the Foreign Office and the Board of Trade "seems to make a considerable step forward in the direction desired by the industrial and commercial community."

HOW TO RELIEVE THE CAR SHORTAGE

A WARNING on the facilities of the railroads which cannot be minimized, according to transportation officials in Toronto, has been issued by the Board of Railway Commissioners through the Toronto Board of Trade to merchants, manufacturers and all who do business with the railroads. It says:

"War conditions interfere with car movements. The weather conditions of last winter increased the congestion and the coming winter may repeat this. Additional freight cars can be obtained only with the greatest difficulty. Prompt deliveries of new rolling stock do not exist.

"If each freight car does more work the difficulty can be faced. A freight car saved is a freight car gained for extra service. More service per car equals more cars in service. If all shippers load to full capacity, or better, to 110 per cent., when practicable, the car shortage will largely disappear.

"Railways by cutting out road delays, and by improved handling in terminals, can make each car do more work. Prompt and heavy lading per car gives prompt service per car. So also does prompt release of cars. Consignors and consignees are interested in getting cars. Their co-operation in efficient car handling will help not only others but themselves as well."

WILL TEST LIGNITE

THE Scientific and Industrial Research Commission is arranging for the rental from the United States of a lignite testing plant for use in Western Canada to test some of the immense undeveloped low-grade coal-bearing areas of the Prairie Provinces. A proposal was made to the Government for the purchase by Canada of a complete plant for experimental Government operation of selected areas thought to be commercially feasible, but which private enterprise will not touch owing to the uncertainty as to economic development. This proposal of the Commission was, however, after consideration by the Government, turned down for this year. The Commission will now carry on the work through a rented American plant.

THE production of boron and ferro-boron of uniform quality requires expert study. Cheap and pure chromium is now obtainable; the electrolysis of its fused salts is difficult on account of their high melting points, but perhaps the electrolysis of aqueous solutions of chromium salts could be so controlled that heavy deposits would be produced. Then, too, chromium electro-plating is for many purposes superior to nickel, but the technique of constantly producing perfect plating has not been accomplished.—Dr. R. F. Bacon.

Mr. John T. Tussaud, the present "Madame Tussaud," tells many amusing stories of visitors to his well known establishment.

One relates to a parlor maid who was being interviewed by her mistress just after a recent bank holiday.

"And how did you spend your day off, Polly?" the mistress asked.

"Oh, we went to Madame Tussaud's," was the reply. "We always go there, mum. You see, having an uncle in the Chamber of Horrors, gives the place a family interest, so to speak."

Enlarged Canadian Trade Intelligence Service

Under the arrangement made by the Minister of Trade and Commerce with Sir Edward Grey in July, 1912, the Department of Trade and Commerce, Ottawa, is able to present the following list of the more important British Consulates whose officers have been instructed by the Foreign Office to answer inquiries from and give information to Canadians who wish to consult them in reference to trade matters.

BRAZIL—Bahia, British Consul. Rio de Janeiro, British Consul General.
CHILE — Valparaiso, British Consul General.
COLOMBIA — Bagota, British Consul General.
ECUADOR—Quito, British Consul General. Guayquil, British Consul.
EGYPT — Alexandria, British Consul General.
FRANCE—Havre, British Consul General. Marseilles, British Consul General.
INDIA—Calcutta, Director General of Commercial Intelligence.
ITALY—Genoa, British Consul General. Milan, British Consul.
MEXICO—Mexico, British Consul General.
NETHERLANDS—Amsterdam, British Consul.
PANAMA—Colon, British Consul. Panama, British Vice-Consul.
PERU—Lima, British Vice-Consul.
PORTUGAL—Lisbon, British Consul.
RUSSIA—Moscow, British Consul General. Petrograd, British Consul, Vladivostock, British Consul. Odessa, British Consul General.
SPAIN—Barcelona, British Consul General. Madrid, British Consul.
SWEDEN—Stockholm, British Consul.
SWITZERLAND—Geneva, British Consul.
URUGUAY—Monte Video, British Vice-Consul.
VENEZUELA — Caracas, British Vice-Consul.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

ARGENTINE REPUBLIC—B. S. Webb, Acting Canadian Trade Commissioner, Reconquista, No. 46, Buenos Aires. Cable address, Canadian.
AUSTRALIA—D. H Ross, Stock Exchange Building, Melbourne. Cable address. Canadian.
BRITISH WEST INDIES—E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.
CHINA—J. W. Ross, 13 Nanking Road, Shanghai. Cable address, Cancoma.
CUBA—Acting Canadian Trade Commissioner, Lonja del Commerci, Apartado 1290, Havana. Cable address, Cantracom.
FRANCE—Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.
ITALY—W. Mc. Clarke, c/o H. M. Consul, Milan.
JAPAN—E. F. Crowe, Acting Canadian Trade Commissioner, P. O. Box 109, Yokohama. Cable address, Canadian.
HOLLAND—Ph. Geleerd, Acting Canadian Trade Commissioner, Zuidblaak, 26, Rotterdam. Cable address, Watermill.
RUSSIA—C. F. Just, Canadian Government Commercial Agent, Alexandrinskaia, Plosch 9, Petrograd. L. D. Wilgress, Canadian Government Commercial Agent, Bukhgolza Ulitza No. 4, Omsk, Siberia.
NEWFOUNDLAND—W. W. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.
NEW ZEALAND—W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.
SOUTH AFRICA—W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.
UNITED KINGDOM—Harrison Watson, Sub-division E.C., 2, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London. N. D. Johnston, Sun Building, Clare Street, Bristol. Cable address, Canadian. J. E. Ray, Central House, Birmingham. Cable address, Canadian. J. Forsyth Smith, 31 North John Street, Liverpool. Cable address, Cantracom. F. A. C. Bickerdike, 4 St. Ann's Square, Manchester. Cable address, Cantracom. J. Forsyth Smith, Acting Canadian Trade Commissioner, 87 Union Street, Glasgow, Scotland. Cable address, Contracom.

CANADIAN COMMERCIAL AGENTS

AUSTRALIA—B. Millin, Royal Exchange Building, Sydney, N.S.W.
BRITISH WEST INDIES—Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian. R. H. Curry, Nassau, Bahamas.
NORWAY AND DENMARK—C. E. Sontum Grubbegd No. 4, Christiania, Norway. Cable address, Sontums.
SPAIN—J. F. Roberts, Hotel Cuatro Naciones, Barcelona.

CANADIAN HIGH COMMISSIONER'S OFFICE

UNITED KINGDOM—W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England. Cable address, Dominion, London.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

ENGINEERING

London, Ont.—The London Art Woodwork Co., will erect a factory here.

Granby, Que.—The Miner Rubber Co., contemplate the erection of a $3,000 power house.

Alix, Alta.—A syndicate is contemplating developing coal properties on the Red Deer River.

Rigaud, Que.—It is understood that Curtis & Harvey will not rebuild their plant at Dragon near here.

Sarnia, Ont.—Retails have been completed for the location of a branch of the Mueller Manufacturing Co., in Port Huron, Mich. This concern has also a factory at Decatur, Ill.

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.

Toronto, Ont.—The Imperial Oil Co., contemplate the construction of a large oil tank having a capacity of 1,470,000 gallons, for the storage of gasoline in the Ashbridge's Bay industrial district.

Sydney, N.S.—It is reported here that the Imperial Munitions Board are asking the Dominion Steel Corporation for a monthly output of at least 140,000 blanks which will mean a large increase since 17,000 was the average output for previous months.

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.

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 concrete was reduced to ruins and the machinery badly damaged.

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.

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.

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.

ELECTRICAL

Welland, Ont.—The new hydro substation is now in operation. The voltage in the system has been increased to 46,000 volts.

Brantford, Ont.—The city's terms not being acceptable, Brantford Township will itself go ahead with the construction of a hydro-electric system throughout the township.

Fort William, Ont.—E. F. Espenchied, of the Hydro-Electric Commission, has advised the city to close down the Current River power plant and not spend over $150,000 in repairs to dams, flumes, and equipment.

Kingston, Ont.—It is expected that this town will be connected up with the hydro-electric system on or about Oct. 1. Work on the line from Napanee is almost completed, and it is expected that the hydro will be able to furnish the entire need of the city this fall and winter.

Fort William, Ont.—By a vote of 548 to 82, the ratepayers on Sept. 19 ratified a by-law to enter into an agreement with the Hydro-Electric Commission of Ontario.

MUNICIPAL

Aurora, Ont.—The town has sold $8,000 debentures for installing a waterworks system.

West Lorne, Ont.—It is proposed to grant a loan of $5,000 to Bernard C. Weisbrood who will establish a factory here.

Three Rivers, Que.—The City Council have decided to proceed with the construction of a pumping station and reservoir.

Portage la Prairie, Man.—The Town Council will instal a 100 h.p. boiler with mechanical stoker in its electric station at a cost of $5,000.

Perth, Ont.—A by-law will be submitted to the ratepayers on Oct. 6, to sanction the purchase of the Canadian Electric & Water Power Co's. plant for $130,000.

Perth, Ont.—The Hydro by-law and a by-law to purchase the local electric power company carried here last Monday by a sweeping vote and Perth will have Hydro power before many months.

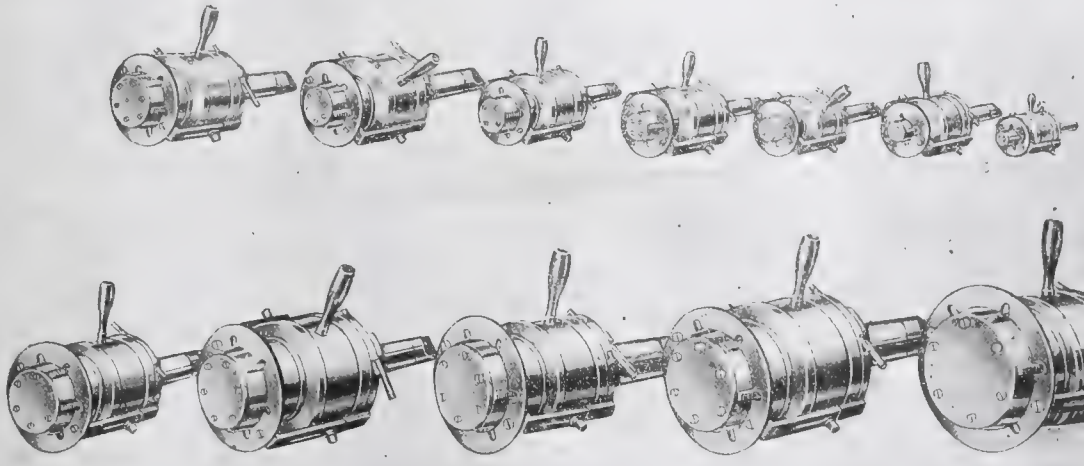
Weston, Ont.—At a special meeting of the Weston Water, Power and Light Commission held recently steps were taken to increase the capacity of the present machinery in the sub-station by exchanging three of the present 50 k.w. transformers for three of 100 k.w. development.

Calgary, Alta.—F. W. Lent, president of the Alberta Automobile League, at a meeting held here last Thursday, stated that the Alberta Legislature would hold a special meeting for the purpose of passing a vote of $30,000,000 to be used on construction of highways in the province.

Hamilton, Ont.—City Engineer Gray and engineer Bain have appealed to the Board of Control to have the proposed turbine pumps installed at the Beach pumping station without any further delay. It appears probable that the matter will be left over until the January elections when a by-law will be voted on to sanction the necessary expenditure

Walkerville, Ont.—The ratepayers by a vote of 231 to 116, passed a by-law giving the Sandwich, Windsor & Amherstburg Street Railway Co. the right to build an extension on Ottawa St. from Walker road to Lincoln road. In the agreement made with the company the town may purchase the entire system on giving one year's notice. The franchise for the extension will expire automatically in 1922, with other franchises held by the company.

GEOMETRIC TAPS



FOR U.S.

SIZES ¾" TO 6"—AT A U.S. ARSENAL

This illustrates only one of the groups of Geometric Collapsing Taps that have gone into United States Arsenals and Navy Yards to bear out the reputation that attaches to all Geometric Thread Cutting Tools.

These taps are equipped with the roughing and finishing attachment, a feature of Geometric Taps that are required for close work.

A micrometer scale adjusts them for a tight or loose thread. Because of the adjustable feature, Geometric Taps always produce accurate threads, no matter how often the chasers have been ground.

When ground beyond further use, the chasers may be replaced, while the tap remains as good as new.

Chasers recede automatically when the required depth of thread is reached.

Geometric Collapsing Taps can be fitted to Screw Machine or Turret Lathe, also live spindle.

Why not put your tapping proposition up to a Geometric?

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Limited, Montreal; The A. R. Williams Machinery Co., Limited, Toronto, Winnipeg and St. John, N.B.

TRADE GOSSIP

The International Harvester Co. of Canada, Ltd. of Hamilton, Ont., has increased its capital stock to $15,000,000.

Painting Quebec Bridge.—It is estimated that it will take three year's to paint the Quebec Bridge. It is figured that the cost will be about $35,000. The work will be continuous, when the men have finished at one end, they will start again at the other.

Limit Export of Steel Rails.—An Order-in-Council has been passed at Ottawa, under the War Measures Act prohibiting the exportation of steel rails from Canada abroad to countries other than the United Kingdom, British possessions and protectorates.

Coal Prices for Vacouver.—Dominion Fuel Controller C. A. Magrath has fixed the price of coal in Vancouver as follows: Screened, delivered in sacks per ton, $8.50; screened, at wharf in sacks, per ton, $7.50; delivered in bulk, wagonside, $8.00; wharf, in bulk $7.00.

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.

Will Fix Coal Price.—At a conference with mine operators at Vancouver last Friday, Dominion Fuel Controller Macgrath intimated that the price of coal would be fixed at an early date by his department. Dealers present at the meeting declared that they would be satisfied with a profit of fifty cents per ton.

Inspecting the C.P.R.—Sir George Bury, vice-president of the C.P.R. accompanied by Grant Hall, western vice-president and general manager have arrived in Vancouver on a periodical inspection trip. Messrs. R. B. Angus and A. Wanklyn, Directors, and J. G. Sullivan, chief engineer, are also at the Coast.

Salonika to Be Re-Planned.—Thomas H. Mawson, the noted English town planner, well-known in Canada, has cabled Noian Cauchon, consulting engineer, of Ottawa, requesting that he collaborate with him immediately in the re-planning of Salonika, the commission for which has just been awarded him by the Greek Premier Venizelos.

Big Lumber Order Lost.—Owing to the lack of bottoms to transport freight to Australia, British Columbia is losing orders for ten million feet of lumber, and the orders will be given to mills in Washington and Oregon States, says Neil Neilson, of San Francisco, California, trade commissioner for New South Wales, who is now in Vancouver, B.C.

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.

Favored Building of Two Drydocks.—That the British Admiralty had recommended the construction of big drydocks at Esquimalt and Halifax and that the British Treasury Department had given favorable consideration to the matter, was made known to the Commons at Ottawa by Hon. Robert Rogers in explaining the steps taken by the Government to secure drydocks at those ports.

Canadian Explosives Ltd., Get Big Contract.—Announcement has been made in Washington, D.C., that the trinitrotoloul contract which the British Government had let to Curtis and Harvey, Canada, Ltd., and which they were unable to fill because of the blowing up of their plant at Dragon, Que., has been turned over to Canadian Explosives, Ltd. of Montreal. The contract is for several million dollars, and the profit will be correspondingly large.

Canadian Coal Imports.—An arrangement has been made with Dr. Garfield, Fuel Controller of the United States, whereby no general licensing system will be instituted as far as Canadian imports are concerned, but the authorities at Washington will call for periodical statements from United States exports showing the daily movements of coal to Canada. No serious inconvenience is anticipated as the result of these arrangements.

Submarine Boat Orders.—The Submarine Boat Corp., New York, has received an order for 90 submarine chasers from the Italian Government. The English Government has ordered 30 vessels of the same type. The English contract is a repeat order. This company completed an order for 550 of these vessels for England not long ago. The boats have given great satisfaction. In addition to these orders, the Submarine Boat Corp. is building 16 motor boats for the United States Navy.

Will Build Fifty Cargo Ships.—The Submarine Boat Corporation of New York has announced that it had entered into a contract with the Emergency Fleet Corporation for the immediate construction of fifty steel cargo ships which will be supplemented later by another contract for one hundred and fifty more vessels of the same type. The ships will be built in the Metropolitan district in a plant which will be among the largest in the country. The first keels will be laid in December it was said and the first launching will be in February.

Warning to Coal Men.—The office of the Dominion Fuel Controller repeats the warning to coal dealers throughout the country that objection will be taken to any advance in the price of coal being made without notification first being sent to the Fuel Controller. The view of the Fuel Controller is that the coal dealers had a liberal profit last summer, sufficiently so to enable them to continue the present prices into the winter, and give the smaller users of coal the same price notwithstanding any increase that the mines make at this time.

U. S. Government Fix Price of Copper. A Washington despatch states that the United States Government has fixed the price of copper at 23½c per pound, about 3c below the prevailing market, by agreement between the Government and leading copper producers, effective for four months. Sales to the Government, the public and the allies will be at this price, f.o.b. New York, and producers agreed not to reduce wages now paid in the industry. They also pledged themselves to maintain maximum production and to prevent copper from falling into the hands of speculators.

Standard Ship Great Success.—A despatch from London, England, states that complete success has attended the trial of the first standardized ships built to the order of the British Government. It was of a most exhaustive nature, and experts are unanimous in their praise of the vessel, which, with its sisters which will now be taking to the water in quick time, is destined to play an important part in the campaign against submarines. The standardized ship has been designed to provide a good style of cargo carrier in the shortest possible time, with the minimum expenditure of material. The keel was laid last February, and in less than the full six months the vessel was fully loaded and ready to go to sea.

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.

Quebec Bridge Span Completed.—The central span of the Quebec Bridge was successfully lifted and secured in position on Thursday, after operations covering approximately four days. The span weighs 5,000 tons, is 640 feet long, and was lifted nearly 150 feet. The principal dimensions of the Quebec Bridge are: Length, from shore to shore, 3,239 feet; width, between anchor buttresses, 1,800 feet; length of central span, 640 feet; height of central span above water, 150 feet; number of railroad tracks carried, 2; street car tracks, 2; and roads, 2. The bridge has a central span 90 feet longer than the Forth Bridge, hitherto the holder of the world's record. The steel used in the bridge weighs 180,000,000 pounds, and cost $11,000,000 without the cost of

the central span. The masonry pier work cost $1,500,000.

Big Glove Contract for Canada.—It is reported that military contracts for twelve million pairs of woolen gloves for the United States army will be placed in Canada. It is believed that one of the principal reasons why the houses in the States could not keep these government contracts from going over the line to English and Canadian firms is the wool scarcity in the United States. It is understood the contract calls for all-wool gloves and this demanded an amount of the fiber greater than the U.S. manufacturers could supply. Under present working conditions in the United States, it is said the best possible price manufacturers could make the government for first grade woolen gloves was from $5.50 to $6 a dozen. The Canadians, with their past experience in filling army contracts for exactly the sort of gloves needed by our men, are able to quote prices as low as $3.50 a dozen.

New Canadian Patents Issued.—The following is a list of Canadian patents recently issued through the agency of Messrs. Ridout & Maybee, 59 Yonge street, Toronto, from whom further particulars may be obtained:—Louis E. Barton, methods of producing composite titanic oxide products; Louis E. Barton, paints or pigments; Titanium Alloy Manufacturing Co., Titaniferous products and methods of producing the same; Wm. T. Graham, means for supplying liquid hydrocarbon to carburretors; Reginald T. Marshall; means for promoting circulation in steam generators and the like; T. Young, arithmetical educational apparatus; Richard A. Ducan, devices for preventing wastage of lubricant in axles of motor cars; James T. King, electrolytic apparatus; Nicolaus Rasmussen, spring bearing for centrifugal separators; Frederick H. Stevenson; attachments for fastening wires to springs; John W. Myatt, loose leaf books; James E. Haines, pneumatic tires; Thomas Rigby, peat gasification.

PERSONAL

J. B. Mussellman, secretary of the Saskatchewan Grain Growers, has been appointed fuel controller for that province.

Thomas Russell, one of the best known mining men in British Columbia, died at Michel, B.C., on September 20. He was mine manager for the Crow's Nest Pass Coal Company.

C. Manning has been appointed assistant to W. D. Robb, vice-president in charge of motive power, car equipment and machinery, Grand Trunk Railway System. Mr. Manning was secretary to Mr. Robb when the latter was Superintendent of Motive Power, and has been more than thirty years in the Grand Trunk service.

John J. Harty has been appointed president of the Canadian Locomotive Co., Kingston, Ont. Mr. Harty was previously vice-president and general manager of

this concern. He is also a director of the Dominion Foundries & Steel Co. He is a son of the Hon. William Harty, who was some years ago president of the Locomotive Works, and is still one of its largest shareholders.

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.

TENDERS

Winnipeg, Man.—Tenders will be received up to Oct. 1, for the plant and properties of the Western Steel & Iron Co. The plant comprises, a foundry, machine shop and blacksmith shop etc. For full particulars apply Harry M. Agnew, Elmwood, Winnipeg.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, Toronto, up to October 2, for the construction and delivery of stop valves, valve operating pump and special castings, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to Wednesday, October 3rd, 1917, for the supply and delivery f.o.b. Lac du Bonnet of quantity of cast iron pipe and specials; valves and accessories; vitrified clay pipe and cable clips. Instructions to bidders, specification and form of tender may be obtained at the office of the City Light and Power Department, 54 King Street.

CONTRACTS

Emerson, Man.—The contract for building a new Town Hall here has been let to Gray & Davidson, of Winnipeg, for $32,307.

Verdun, Que.—The City Council have awarded tenders for sidewalks and sewers to the M. J. Stock Paving & Construction Co.

Ottawa, Ont.—Announcement is made by the Department of Public Works that the contract for plumbing, pipes and fixtures for the new Parliament Buildings has been let to W. J. McGuire, Ltd., Toronto. The contract price $129,900, was the lowest tender received for the work.

BUILDINGS

Toronto, Ont.—The Harris Abattoir Co., will build a one-storey brick addition to evaporation house on St. Clair avenue, near Symes road, to cost $1,500.

Toronto, Ont.—The T. Eaton Co., propose buying a site for a warehouse between Gerard street and the G.T.R. right of way. The property belongs to the city and the purchase price is $30,000.

Winnipeg, Man.—The Dominion Government will erect an explosive store and magazine on the St. Charles rifle range property. Major T. W. Hawker, Great West Permanent Loan Bldg., Winnipeg has the matter in hand.

Fredericton, N.B.—The contract for the erection of the buildings in connection with the Soldiers' Convalescent Home to be established on Old Government House grounds, has been awarded to William J. Scott of this city, and Robert D. Forbes of Devon, who submitted a joint tender. Their tender was in the vicinity of $100,000 and is said to have been the lowest of six or seven submitted.

RAILWAYS—BRIDGES

Montreal, Que.—The Grand Trunk Pacific will purchase 100 refrigerator cars for the fish service from Prince Rupert, B.C., and the Eastern markets.

Campbellford, Ont.—The construction of the Trent Canal has made it necessary for the Grand Trunk to build a new bridge here, to give the necessary clearance for shipping passing through the canal, and work is now proceeding on this new structure. The new bridge will consist of seven spans and have a total length of 269 ft. 9 in.

Guelph, Ont.—Col. Boyce, president of the Toronto and Suburban Railway, arrived in the city recently over the radial line, on a tour of inspection. It is understood that this inspection tour means that the road is being turned over to the operating department for the first time, having been in the hands of the construction department since the line was built.

INCORPORATIONS

Tonsmore Truck Co., has been incorporated at Ottawa by E. D. Girardot, C. A. Smith and J. B. McLeod of Windsor, Ont., to manufacture motor truck and vehicles of all kinds at Windsor, with a capital of $100,000.

The Allied Truck Co., has been incorporated at Toronto with a capital of $40,000 to manufacture motor trucks, Toronto. The provisional directors are J. G. Bankat, C. E. A. Carr and F. W. Burrows all of Toronto.

McKinnon Industries Ltd., has been incorporated at Ottawa by L. E. McKinnon, W. A. Notman and J. W. McKinnon all of St. Catherines, Ont., to manufacture trucks, cars, wagons and metal goods of all kinds at St. Catherines, Ont., with a capital of $1,000,000.

MARINE

Toronto, Ont.—The new drydock of the Toronto Drydock Co., was used for the first time a few days ago when the freighter John Ralph was docked for repairs.

North Vancouver, B.C.—The Steamer Cassiar which was wrecked on Aug. 26, off Privett Island has been salvaged and will be repaired at the Wallace Shipyards.

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.

Little Current, Ont.—The steel steamer Western Star of Buffalo sunk in the fall of 1915, with seven thousand tons of coal, was successfully raised and towed to a sheltered bay on Sept. 17. Captain Alex. Cummings, superintendent for the Great Lakes Wrecking Co., was in charge of the operations.

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.

Vancouver, B.C.—Frames for the second wooden steamer of the six being constructed by the Western Canada Shipyards, Ltd., at Vancouver, for the Imperial Munitions Board, have been hoisted into place. The first vessel has taken shape, the last frame having already been placed in position.

Fort William, Ont.—J. F. Paige, general manager of the Port Arthur Shipbuilding Co., stated a few days ago that the new freighter War-Fish, built to the order of James Playfair, of the Great Lakes Transportation, Co., will be delivered shortly and will be used in the coal trade on the Great Lakes.

Victoria, B.C. — The Cameron-Genoa Mill Shipbuilders will launch the fifth auxiliary schooner contracted for by the H. W. Brown interests shortly and the sixth vessel of the same type will be launched about November 15 thus completing the orders for the ships, which the company now has on hand and leaving it free to give all its attention to the building of the four wooden steamers for which it has been given contracts by the Imperial Munitions Board.

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.

ROBERT MORTON HAMILTON

(Continued from page 352.)

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.

BIG CUT IN STEEL PRICES ANNOUNCED

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 on Monday 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."

ENGINEERING STANDARD LOWER

IT has been decided by the Faculty of Applied Science of Queen's University, Kingston, Ont., that it is advisable during the period of the war to admit students with a lower requirements in mathematics, namely, pass matriculation. This decision was brought about because war conditions have caused a larger demand for men with education in engineering, and it is evident that after the war there will be a call for more such men. It is desirable, therefore, under these circumstances, to take measures to hasten the preparation of men for engineering work and to encourage young men to enter upon engineering courses. The deficiency will be made up the first year by devoting a larger amount of time to mathematics, so that the total requirements for a degree will remain exactly the same.

CLASSIFIED ADVERTISING SECTION

Rates (payable in advance): Two cents per word first insertion; one cent per word subsequent insertions. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

FOR SALE

A PAYING PROPOSITION FOR RAILROADS or manufacturers. Wish to sell our Canadian rights with fixtures. Address Frank Bayless, 311 Fair Street, Springfield, Ohio. c9m

FOR SALE — 1 LEES-BRADNER THREAD miller, equipped for threading nose and base of 6" shells. Apply The Hayes Wheel Co., Chatham, Ontario. c9m

SECOND-HAND 26" NEWTON TYPE COLD saw cutting-off machine, arranged for motor belt drive and complete, with or without motor. Price $600.00, cars Sherbrooke. MacKinnon, Holmes & Co., Limited, Sherbrooke, Quebec. c10m

ONE ARMINGTON & SIMS 10" x 12" HIGH speed engine, belted to one Westinghouse Electric Mfg. Co. direct current generator, 40 K.W., 550 volts, 75 amps.; speed 910 r.p.m.; also 40' 0"-10" double leather belting; all in good condition. Armstrong, Whitworth of Canada, Limited, Montreal, Que. c6m

FOR SALE—1 NEW 25 H.P. HOR. TUBULAR boiler, 1 second-hand 12 H.P. hor. tubular boiler, tested to 150 lbs.; 1 second-hand 50 H.P. loc. boiler; 1 second-hand Leonard 12 x 12 high speed engine; 1 second-hand 500-lb. belt-driven Beaudry power hammer, only in use two months; in perfect condition. Canadian Engineering & Mfg. Co., 128 Bleury St., Montreal, Que. c9m

HYDRAULIC EQUIPMENT FOR SALE.—The equipment listed below is in first-class shape having only been used about three months. Blue prints and specifications and foundations drawings will be furnished. 2—14 x 12 x 5" Fairbanks-Morse duplex steam driven high pressure pumps at 80 gals. per minute capacity each against 600 lbs. pressure, steam pressure 150 lbs. 1—Weighted Accumulator good for 1000 lbs. per sq. inch, 16" diameter, plunger 11 ft. stroke with squeezing water cushion and wooden outside bumper blocks. The tank for the weighting material surrounding the cylinder is 10' 7" in diameter and 11' 0" high. 1—Return Suction Tank for above pumps and accumulator. Height, 9' 0", diameter 8' 0". Capacity, 2700 Imperial gallons. This equipment can be shipped immediately and is open for inspection at the company's plant. Prices on application. The Canadian Copper Company, Copper Cliff, Ont. c8m

PATTERNS

THE BRANTFORD PATTERN WORKS ARE fully equipped to manufacture patterns, large or small, from blue prints, sketches or sample castings. Expert management. Prompt service. Prices reasonable. Brantford Pattern Works, 49 George St., Brantford, Ont. c13m

SPECIAL MACHINERY

H. C. THOMAS, GENERAL MACHINE SHOP, tools, jigs and machine repairs. 801 King St. W., Toronto. Telephone Adelaide 3836. tf

MANUFACTURERS—WE CAN UNDERTAKE work to any specification—munition production equipment or otherwise. Write W. H. Sumbling Machinery Co., 7 St. Mary St., Toronto

SITUATIONS WANTED

TOOL MAKER — ACCURATE, GOOD draughtsman desires responsible position. Box 330, Canadian Machinery. c14m

A PRACTICAL MACHINE SHOP SUPERINtendent of broad experience in Canada and States will be open for position as superintendent or general foreman, July 15th. A1 references. Address Producer, Box 321, Canadian Machinery. c3m

MACHINE SHOP FOREMAN DESIRES change as shop foreman or master mechanic. Acquainted with scientific management; 26 years' experience. Box 328 Canadian Machinery. c11m

A PRACTICAL MACHINE SHOP SUPERINtendent of broad experience in Canada and States wants position as superintendent or general foreman. Large or small shop on ammunition or machinery; A1 references. Address Box 327, Canadian Machinery. c9m

WORKS MANAGER OR GENERAL SUPERintendent open for engagement—28 years' experience as machinist, toolmaker, inspector, superintendent of tool-making and tool-designing, experimental and development work, heat-treating and testing of steel in raw and finished state; shop superintendent, works manager. Experience has been on rifle work, electrical work, typesetting machines, lock-making and bridge-work. Correspondence solicited, and can furnish good references. Address Box 332, Canadian Machinery. c14m

WANTED

WANTED—SMALL SECOND-HAND POWER press, in good condition. Hosmer Stamping & Die Works, Ltd., 831 Dundas St., Toronto, Ont. c13m

WANTED—SECOND-HAND POWER SQUARing shear to cut No. 10 gauge steel up to 24" wide. Must be in good working condition. Packard Electric Company, St. Catharines, Ont. c4m

SITUATIONS VACANT

MAN WANTED TO ACT AS SUPERINTENDent of a fast growing die and stamping plant in City of Toronto. Box 329, Canadian Machinery. c12m

NIGHT SUPERINTENDENT FOR SHELL MAchinery plant in Western Canada; knowledge of four point five shell and good all-round experience essential. Write, stating qualifications, salary and references, otherwise application will not be considered. Box 325, Canadian Machinery. c6m

FOREMAN WANTED—FOR SHOP IN CENtre of Toronto, with up-to-date equipment, employing about thirty men, doing jobbing business and making fine special machinery and tools. When applying state experience and give references, also wages expected. Only first-class men need apply. Box 326, Canadian Machinery. c8m

FOR SALE

4—No. 2 Foster Plain Head Screw Machines and 2—No. 3 Foster Friction Head Screw Machines all completely equipped with air cylinders and air chucks suitable for use on No. 80 Time Fuse Bodies. These machines have never been used. Also one Graduating Machine made by the American Ammunition Co.

For full particulars apply the

Holden Morgan Thread Miller Limited

Toronto, Ontario

c14m

FOR SALE

4—14 x 6 Flather Engine Lathes, C.R., Q.C.G., new.

4—14 x 5 Reed Engine Lathes, R. & F.

3—18 x 8 Davis Engine Lathes, D.B.G.

1—18 x 10 Rahn-Larmon Engine Lathe, new.

1—18 x 12 Rahn-Larmon Engine Lathe, new.

1—22" x 10' Nicholson & Waterman Engine Lathe.

1—No. 13 B. & S. Automatic Gear Cutter.

1—30" Newark Automatic Gear Cutter.

1—5 x 48 Pratt & Whitney Plain Grinder.

1—No. 2 Bath Universal Grinder.

1—12 x 60 Modern Plain Grinder, new.

2—Lees-Bradner Thread Millers.

1—30 x 30 x 8' Powell Planer, new.

Brownell Machinery Co.
Providence, R. I.

If any advertisement interests you, tear it out now and place with letters to be answered.

If any advertisement interests you, tear it out now and place with letters to be answered.

PEXTO TRAVELS MONTREAL

The Home of Williams & Wilson, Limited, and the Pexto Display

WILLIAMS & WILSON, LTD., of Montreal, hold Pexto Sheet Metal Workers' Machines and Tools in such high regard that the Pexto Display pictured above, is a permanent feature with them.

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Petrie, Ltd., H. W., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
A. R. Williams Machy. Co., Toronto

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Parmenter & Bulloch Co., Gananoque.

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Ferracute Mach. Co., Bridgeton, N.J.
Brown, Boggs & Co., Hamilton, Can.
Prest-O-Lite Co., Inc., Toronto, Ont.

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Marsh & Henthorn, Belleville, Ont.
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Dillon Mfg. Co., Oshawa, Ont.

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Prest-O-Lite Co., Inc., Toronto, Ont.

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Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
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Wm. Kennedy & Sons, Ltd., Owen Sound.
Plessisville Foundry Co., Plessisville, Que.
Sheldons, Limited, Galt, Ont.

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Can. Steel Foundries, Ltd., Montreal, Que.
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Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
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Can. Steel Foundries, Ltd., Montreal, Que.
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Victoria Foundry Co., Ottawa, Ont.

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John Bertram & Sons Co., Dundas.
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Hurlbut, Rogers Mach. Co., South Sudbury, Mass.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
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Garlock-Walker Machy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Wright Mfg. Co., Lisbon, Ohio.

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The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Toronto Testing Laboratory, Ltd., Toronto.

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Garvin Machine Co., New York.
Hannifin Mfg. Co., Chicago, Ill.

CHUCKS, AIR
Hannifin Mfg. Co., Chicago, Ill.
Manufacturers Equipment Co., Chicago, Ill.

CHUCKS, COLLET
Hannifin Mfg. Co., Chicago, Ill.

CHUCKS, DRILL, LATHE AND UNIVERSAL
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John Bertram & Sons Co., Dundas, Ont.
Can. Blower & Forge Co., Kitchener, Canada.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Richmond Mfg. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
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Whitney Mfg. Co., Hartford, Conn.
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Richmond Mfg. Co., Toronto, Ont.

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Rivett Lathe & Grinder Co., Brighton, Mass.

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New Britain Machine Co., New Britain, Conn.
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Hardinge Bros., Inc., Chicago, Ill.

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Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

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Hanna & Co., M. A., Cleveland, O.
Zenith Steel & Coal Products, Montreal, Que.

COLLARS
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.

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Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Limited, Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

COLLETS
Becker Milling Machine Co., Boston, Mass.
Hannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Inc., Chicago, Ill.
Manufacturers' Equipment Co., Chicago, Ill.
Rivett Lathe & Grinder Co., Boston, Mass.

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Can. Ingersoll-Rand Co., Sherbrooke, Que.
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Garlock-Walker Machinery Co., Toronto, Ont.
Hinckley Machine Co., Hinckley, Ill.
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Whiting Foundry Equipment Co., Harvey, Ill.

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John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

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Pratt & Whitney Co., Dundas, Ont.

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Baird Machine Co., Bridgeport, Conn.
Foster Machine Co., Elkhart, Ind.
Stow Mfg. Co., Binghampton, N.Y.

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Bernard Industrial Co., The A., Fortierville, Que.

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Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
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Northern Crane Works, Walkerille.

CRANES, GANTRY
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
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Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

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Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.

CRANES, PORTABLE
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Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

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Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto, Ont.
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CUTTER GRINDERS AND ATTACHMENTS
Cincinnati Milling Machine Co., Cincinnati.
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CUTTERS, FLUE
Cleveland Pneumatic Tool Co. of Canada, Toronto

CUTTERS, PIPE (SEE PIPE CUTTERS)

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Becker Milling Machine Co., Boston, Mass.
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Cleveland Milling Mach. Co., Cleveland, Ohio.
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Foss & Hill Machinery Co., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
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Pratt & Whitney Co., Dundas, Ont

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt, Ont.

DIE SINKING PRESSES, HYDRAULIC
Charles F. Elmes Eng. Works, Chicago.

DIES, SELF-OPENING
Eastern Mach. Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven.
Ideal Tool & Mfg. Co., Beaver Falls, Pa.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
Wells Brothers Co. of Canada, Galt, Ont.

DIES FOR SCREW PLATES
Wells Brothers Co. of Canada, Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Illinois Tool Works, Chicago, Ill.
Worth Engineering Co., Toronto, Ont.

DISCS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass

DIES, SCREW AND THREAD
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

DRAFT, MECHANICAL
W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

DISCS, LEATHER
Graton & Knight Mfg. Co., Montreal.

DRESSERS, GRINDING AND EMERY WHEEL
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Standard Machy. & Supplies, Ltd., Montreal.
Stow Mfg. Co., Binghampton, N.Y.
United States Mach. Tool Co., Cincinnati, O.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, BENCH
Bilton Mach. Tool Co., Bridgeport, Conn.
Martin Machine Co., Greenfield, Mass.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn.
Canada Machinery Corp., Galt, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Fox Machine Co., Jackson, Mich
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
A. B. Jardine & Co., Hespeler, Ont.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Mach. Co., Rockford, Ill.

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Aikenhead Hardware Co., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
De Mooy Machine Co., Cleveland, Ohio.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
D. McKenzie Machinery Co., Guelph, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghampton, N.Y.
United States Mach. Tool Co., Cincinnati, Ohio.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Mach. Co., Rockford, Ill.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto, Ont.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Millers Falls Co., Millers Falls, Mass.
Pratt & Whitney Co., Dundas, Ont.
United States Electrical Tool Co., Cincinnati.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cleveland Twist Drill Co., Cleveland.
Foss & Hill Machy. Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.

DRILLS, ELECTRIC AND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machinery Co., Toronto.

DRILLS, HIGH SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Can. B. K. Morton, Toronto, Montreal.
H. A. Drury Co., Montreal.
Eagle & Globe Steel Co., Montreal, Que.
Foss & Hill Machy. Co., Montreal.
Marshall & Co., Geo. A., Toronto, Ont.
McKenna Brothers, Pittsburgh, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
W. F. & John Barnes Co., Rockford, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

DRILLS, MULTIPLE SPINDLE
Henry & Wright Mfg. Co., Hartford, Conn.
Niles-Bement-Pond Co., New York.
Garlock-Walker Machinery Co., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRILLS, OIL TUBE
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Independent Pneumatic Tool Co., Chicago, Ill.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Niles-Bement-Pond Co., New York

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Cleveland Twist Drill Co., Cleveland
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Millers Falls Co., Millers Falls, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Foss & Hill Machy. Co., Montreal
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
A. R. Williams Machy. Co., Toronto.

DRILLS, TRACK
Cleveland Twist Drill Co., Cleveland.
Clark Equipment Co., Buchanan, Mich.
Foss & Hill Machy. Co., Montreal
Morse Twist Drill & Mach. Co., New Bedford

DRILLS, TWIST
Atkins & Co., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago
Armstrong, Whitworth of Canada, Ltd., Montreal.
Canadian Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

DRINKING FOUNTAINS
Puro Sanitary Dk'g. Fountain Co., Haydenville, Mass.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sheldons, Ltd., Galt, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes & Co., Sherbrooke, Que.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

DUST ARRESTERS (FOR TUMBLING MILLS)
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
A. R. Williams Machy. Co., Toronto.

ELEVATOR ENCLOSURES
Canada Wire & Iron Goods Co., Hamilton, Ont.

ELEVATORS AND BUCKETS
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY
Can. Matthews Gravity Carrier Co., Toronto, Ont.

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Stow Mfg. Co., Binghamton, N.Y.

EMERY AND EMERY WHEELS
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Ford-Smith Mach. Co., Hamilton, Ont.
Francis & Co., Hartford, Conn.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

ENGINES, BALANCED VALVE
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Plessisville Foundry Co., Plessisville, Que.

ENGINES, STEAM, GAS, GASOLINE
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.

ENGINES, HORIZONTAL AND VERTICAL
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Sheldons, Ltd., Galt, Ont.
A. R. Williams Machy. Co., Toronto.

ENGRAVERS
Pritchard-Andrews Co., Ottawa.

ESCUTCHEON PINS
Parmenter & Bulloch Co., Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

FAUCETS
Puro Sanitary Dk'g. Fountain Co., Haydenville, Mass.

FENCE, IRON AND FACTORY
Canada Wire & Iron Goods Co., Hamilton, Ont.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Can. B. K. Morton Co., Toronto, Ont.
Delta File Works, Philadelphia, Pa.
Marshall & Co., Geo. A., Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Port Hope File Mfg. Co., Port Hope, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

FILING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Conn.

FILTERS, OIL
Bowser & Co., Inc., S. F., Toronto, Ont.

FILTERS, WATER
W. B. Scaife & Sons, Pittsburgh, Pa.

FIRE ESCAPES
Canada Wire & Iron Goods Co., Hamilton, Ont.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FISH PLATES
Can. Steel Foundries, Ltd., Montreal, Que.

FIXTURES
Illinois Tool Works, Chicago, Ill.
Monarch Brass Mfg. Co., Toronto, Ont.

FLEXIBLE SHAFT COILING MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

FLINT SHOT
U.S. Silica Co., Chicago, Ill.

FORGES, HAND, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Canada
Sheldons, Ltd., Galt, Ont.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE
Can. Billings & Spencer, Ltd., Welland, Ont
Cumming & Son, J. W., New Glasgow, Canada
Dom Forge & Stpg. Co., Walkerville, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont
Williams & Co., J. H., Brooklyn, N.Y.

FORGING HAMMERS, BELT-DRIVEN
Bliss, E. W., Co., Brooklyn, N.Y.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING HAMMERS, STEAM OR AIR
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Erie Foundry Co., Erie, Pa.
Garlock-Walker Machinery Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

FUEL OIL SYSTEMS
Gilbert & Barker Mfg. Co. Springfield, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FURNACES, ANNEALING, ETC.
Bellevue Industrial Furnace Co., Detroit, Mich.
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Mechanical Engineering Co., Montreal.
Rockwell Co., W. S., New York, N.Y.
Tate-Jones & Co., Leetsdale, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES, BLAST
Toronto Iron Works, Ltd., Toronto.

FURNACES, BRASS, MALLEABLE
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES, HEAT TREATING HARDENING AND TEMPERING
Bellevue Industrial Furnace Co., Detroit, Mich.
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Tate-Jones & Co., Leetsdale, Pa.

FURNACES, FORGING
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.

FURNACES FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Can. Hoskins, Ltd., Walkerville, Ont.
Oven Equipment & Mfg. Co., New Haven, Conn.

FUSE BOXES, STEEL
Dominion Forge & Stpg. Co., Walkerville, Ont

FUSE CAP MACHINERY
Noble & Westbrook Mfg. Co., Hartford, Conn.
E. E. T. Pringle, Ltd., Toronto.

GALVANIZING MACHINERY
Erie Foundry Co., Erie, Pa.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GAS BLOWERS AND EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Limited, Galt, Ont.

GAUGES, MERCURY COLUMN, DRAFT
Charles F. Elmes Eng. Works, Chicago.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney Co., Hartford, Conn.
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Worth Engineering Co., Toronto, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal, Que.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Dominion Machinery Co., Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
Petrie, Ltd., H. W., Toronto, Ont.
The Smart-Turner Machine Co., Hamilton.
D. E. Whiton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.

GEAR HOBBING MACHINES
Himoff Mach. Co., Inc., Astoria, L.I., New York.

GEAR TURNING MACHINES, BEVEL
Bridgeford Mach. Tool Works, Rochester, N.Y.

GEARS, CUT, MORTISE, ANGLE, WORM
Baxter Co., Ltd., J. R., Montreal, Que.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Que.
Illinois Tool Works, Chicago, Ill.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
The Smart-Turner Machine Co., Hamilton.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

GEARS, RAWHIDE
Hamilton Gear & Machine Co., Toronto.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

GENERATORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
A. R. Williams Machy. Co., Toronto.

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland, Ohio.
Willson & Co., Inc., T. A., Reading, Pa.

GRAIN FOR POLISHING
Norton Co., Worcester, Mass.

GRAPHITE
Aikenhead Hardware Co., Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

GLOVES, LEATHER AND RUBBER
Hickory Steel-Grip Glove Co., Chicago, Ill.

GLOVES, STEEL GRIP, SAND BLAST
Hickory Steel Grip Glove Co., Chicago, Ill.

GRAVITY CARRIERS
Can. Matthews Gravity Carrier Co., Toronto, Ont.

GREASES (SEE LUBRICANTS)

GRINDER ATTACHMENTS
Rivett Lathe & Grinder Co., Boston, Mass.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, AUTOMATIC KNIFE
W. H. Banfield & Son, Toronto.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Blake & Johnson Co., Waterbury, Conn.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Canada Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
New Britain Machine Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Norton Grinding Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, DIE AND CHASER
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
United States Electrical Tool Co., Cincinnati, O.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.
Rivett Lathe & Grinder Co., Brighton, Mass.

GRINDERS, NAIL DIE

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
United States Electrical Tool Co., Cincinnati, O.
A. R. Williams Machy. Co., Toronto.

GRINDERS, RADIAL
Rivett Lathe & Grinder Co., Brighton, Mass.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blake & Johnson Co., Waterbury, Conn.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wing & Son, J. E., Hamilton, Ont.

GRINDERS, UNIVERSAL, PLAIN
Fitchburg Grinding Machine Co., Fitchburg, Mass.
Modern Tool Co., Erie, Pa.
Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, VERTICAL SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
H. E. Streeter, 623 New Birks Bldg., Montreal, Que.
Wilmarth & Morman, Grand Rapids, Mich.
Wing & Son, J. E., Hamilton, Ont.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Wilmarth & Morman, Grand Rapids, Mich.
Stow Mfg. Co., Binghampton, N.Y.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Carborundum Co., Niagara Falls.
Ford-Smith Mach Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Francis & Co., Hartford, Conn.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto, Ont.

GUARDS, WINDOW AND MACHINE
Canada Wire & Iron Goods Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
New Britain Mach. Co., New Britain, Conn.
Stow Mfg. Co., Binghampton, N.Y.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Ford-Smith Machine Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Millers Falls Co., Millers Falls, Mass.
Osborn (Canada, Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Ltd., Montreal.
Racine Tool & Machine Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Victor Saw Works, Ltd., Hamilton, Canada.
Zenith Coal & Steel Products, Montreal, Que.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto, Ont.
Garvin Machine Co., New York City.
Millers Falls Co., Millers Falls, Mass.
Victor Saw Works, Hamilton, Ont.

HAMMERS, AIR
Erie Foundry Co., Erie, Pa.

HAMMERS, DROP AND BELT-DRIVEN
Beaudry & Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canadian Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
High Speed Hammer Co., Rochester, N.Y.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Plessisville Foundry Co., Plessisville, Que.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
West Tire Setter Co., Rochester, N.Y.

HAMMERS, POWER
Beaudry & Co., Boston, Mass.
Erie Foundry Co., Erie, Pa.
United Hammer Co., Boston, Mass.

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, MARKING
Matthews, Jas. H. & Co., Pittsburgh, Pa.

HAMMERS, MOTOR-DRIVEN
Beaudry & Co., Boston, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

HAMMERS, NAIL MACHINE
United Hammer Co., Boston, Mass.

HAMMERS, STEAM
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.
Hickory Steel-Grip Glove Co., Chicago, Ill.

HANGERS, SHAFT
Baird Machine Co., Bridgeport, Conn.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Can. S K F Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Standard Pressed Steel Co., Philadelphia, Pa.

HARDENING AND TEMPERING
Holz, Herman A., 1 Madison Ave., New York.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEATERS
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Sturtevant Co., B. F., Galt, Ont.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Holz, Herman A., 1 Madison Ave., New York.
Shore Instrument & Mfg. Co., New York.

HIGH SPEED TOOL METAL
Deloro Smelting & Refining Co., Toronto, Ont.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.
Illinois Tool Works, Chicago, Ill.

HINGES
London Bolt & Hinge Works, London, Ont.

HOBS
Illinois Tool Works, Chicago, Ill.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.

HOISTING AND CONVEYING MACHINERY
Can. Matthews Gravity Carrier Co., Toronto, Ont.
Jenckes Mach. Co., Sherbrooke, Que.
Marsh & Henthorn, Belleville, Ont.
Northern Crane Works, Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
Ford Chain Block & Mfg., Philadelphia, Pa.
Independent Pneumatic Tool Co., Chicago, Ill.
Jenckes Mach. Co., Sherbrooke, Que.
Marsh & Henthorn, Belleville, Ont.
Northern Crane Works, Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, ELECTRIC
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Owen Sound, Ont.
Northern Crane Works, Walkerville, Ont.
Winnipeg Gear & Engrng Co., Winnipeg, Man.

HOLDERS, STEEL DIE FOR MARKING
Matthews, Jas. H., & Co., Pittsburgh, Pa.

HOPPERS
Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
General Tire & Rubber Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Wells Bros. Co. of Canada, Galt, Ont.

HYDRAULIC MACHINERY
Charles F. Elmes Eng. Works, Chicago.
Garlock-Walker Machinery Co., Toronto, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
L. S. Starrett Co., Athol, Mass.

INDEX CENTRES
Fred C. Dickow, Chicago, Ill.
Garvin Machine Co., New York.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

IRON ORE
Hanna & Co., M. A., Cleveland, O.

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Petrie, Ltd., H. W., Toronto, Ont.

JACKS, HYDRAULIC
Charles F. Elmes Eng. Works, Chicago.

JACKS, PNEUMATIC
Northen Crane Works, Walkerville.

JACKS, PIT AND TRACK
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.
Homer & Wilson, Hamilton, Ont.
Illinois Tool Works, Chicago, Ill.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Toronto Tool Co., Toronto, Ont.

KEY SEATERS
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich.
A. R. Williams Machy. Co., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Sheldons, Limited, Galt, Ont.

LABELS AND TAGS
Matthews, Jas. H. & Co., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (SEE CHEMISTS)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LAMPS, INCANDESCENT AND NITROGEN
Can. Laco-Philips Co., Toronto, Ont.

LAMPS, TUNGSTEN (Vacuum and Gas Filled)
Can. Laco-Philips Co., Toronto, Ont.

LATHES, BENCH
H. E. Streeter, New Birks Bldg., Montreal, Que.

LATHES, CHUCKNG
Acme Machine Tool Co., Cincinnati, Ohio.

LATHE CHUCKS (SEE CHUCKS)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Curtis & Curtis Co., Bridgeport, Conn.
Hendey Machine Co., Torrington, Conn.
Rivett Lathe & Grinder Co., Boston, Mass.
Williams & Co., J. H., Brooklyn, N.Y.
Winnipeg Gear & Engrng Co., Winnipeg, Man.

LATHES, AXLE
Bridgeford Mach. Tool Works, Rochester, N.Y.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
Blount, J. G., & Co., Everett, Mass.
Can Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hardinge Bros., Chicago, Ill.
New Britain Mach. Co., New Britain, Conn.
Pratt & Whitney Co., Dundas, Ont.
Rivett Lathe & Grinder Co., Boston, Mass.

LATHES, BAND TURNING
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Roelofson Machine & Tool Co., Toronto, Ont.
Warden King Co., Montreal, Que.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Inc., Chicago, Ill.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
John Bertram & Sons Co., Dundas.
Bridgeford Mach. Tool Works, Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Iron & Steel Co., Cincinnati, Ohio.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hamilton Mach. Tool Co., Hamilton, Ohio.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
McCabe, J. J., New York, N.Y.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Rivett Lathe & Grinder Co., Boston, Mass.
Riverside Machinery Depot, Detroit, Mich.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Sebastian Lathe Co., Cincinnati, Ohio.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.

LATHES, JOURNAL TRUEING
Bridgeford Mach. Tool Works, Rochester, N.Y.
McCabe, J. J., New York, N.Y.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
McCabe, J. J., New York, N.Y.
Petrie, Ltd., H. W., Toronto, Ont.

LATHES, SINGLE PURPOSE
Bertram, John, & Sons Co., Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn, John T., Ltd., Toronto.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
McCabe, J. J., New York, N.Y.
Roelofson Mach. & Tool Co., Toronto, Can.

LATHES, SCREW CUTTING
Bertram, John, & Sons Co., Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn, John T., Ltd., Toronto.
McCabe, J. J., New York, N.Y.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Rivett Lathe & Grinder Co., Boston, Mass.
Riverside Machinery Depot, Detroit, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.

LATHES, SPINNING
Bliss, E. W., Co., Brooklin, N.Y.
Ferracute Mach. Co., Bridgeton, N.J.
McCabe, J. J., New York, N.Y.

LATHES, TURRET AND HAND
Acme Machine Tool Co., Cincinnati, Ohio.
John Bertram & Sons Co., Dundas.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn, John T., Ltd., Toronto, Ont.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
McCabe, J. J., New York, N.Y.
Mulliner-Enlund Tool Co., Syracuse, N.Y.
National-Acme Co., Cleveland, Ohio.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
H. W. Petrie, Toronto.
Rivett Lathe & Grinder Co., Boston, Mass.
Riverside Machinery Depot, Detroit, Mich.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.

LEAD BURNING
St. Lawrence Welding Co., Montreal, Que.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, Mass.

LIFTS, PNEUMATIC
Whiting Foundry Equipment Co., Harvey, Ill.

LINK BELTING
Can. Fairbanks-Morse Co., Montreal.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Montreal, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Goods Co., Hamilton, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.

LUBRICATORS
Roper, C. F., & Co., Hopedale, Mass.
Trahern Pump Co., Rockford, Ill.

MACHINERY DEALERS
Baird Machy. Co., W. J., Detroit, Mich.
Can. Fairbanks-Morse Co., Montreal.
Dickow, Fred C., Chicago, Ill.
Garlock-Walker Machy. Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

MACHINERY GUARDS (SEE GUARDS)

MACHINERY REPAIRS
Prest-O-Lite Co., Inc., Toronto, Ont.
Sumbling Mach. Co., W. H., Toronto, Ont.

MACHINISTS' SCALES, SMALL TOOLS AND SUPPLIES
Can. Fairbanks-Morse Co., Montreal.
Frank H. Scott, Montreal.
J. H. Williams & Co., Brooklyn, N.Y.

MANDRELS
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Hannifin Mfg. Co., Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Manufacturers Equip. Co., Chicago, Ill.
Monarch Brass Mfg. Co., Toronto, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Canada, Ottawa, Ont.
Matthews, Jas. H., & Co., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Martin Machine Co., Greenfield, Mass.
Noble & Westbrook Mfg. Co., Hartford, Conn.
Perrin, Wm. R., Toronto.

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURING TAPES AND RULES
James Chesterman & Co., Ltd., Sheffield, Eng.

METALLURGISTS
Can. Inspection & Testing Lab., Montreal, Que.
Toronto Testing Laboratory, Ltd., Toronto.

METALS
Can. B. K. Morton, Toronto, Montreal.
Dom. Iron & Wrecking Co., Ltd., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.

METERS, OIL, WATER
Bowser & Co., Inc., S. F., Toronto, Ont.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.

If any advertisement interests you, tear it out now and place with letters to be answered.

MILLING ATTACHMENTS
Becker Milling Machine Co., Boston, Mass.
John Bertram & Sons Co., Dundas.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Cleveland Milling Mach. Co., Cleveland, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Fox Machine Co., Jackson, Mich.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles Bement Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Tuft-Peirce Mfg. Co., Woonsocket, R.I.

MILLING MACHINES, HAND
Hardinge Bros., Inc., Chicago, Ill.
United States Mach. Tool Co., Cincinnati, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Whitney Mfg. Co., Hartford, Conn.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence.
John Bertram & Sons Co., Dundas.
Cleveland Milling Machine Co., Cleveland, Ohio.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Riverside Machinery Depot, Detroit, Mich.
Steptoe, The John Co., Cincinnati, Ohio.
United States Mach. Tool Co., Cincinnati, Ohio.
Whitney Mfg. Co., Hartford, Conn.
A. R. Williams Machy Co., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Becker Milling Machine Co., Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Steptoe, The John Co., Cincinnati, Ohio.
A. R. Williams Machy. Co., Toronto.

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Riverside Machinery Depot, Detroit, Mich.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Tabor Mfg. Co., Philadelphia, Pa.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Cummings & Son, J. W., New Glasgow, Canada.
Jenckes Mach. Co., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke.
Marsh & Henthorn, Belleville, Ont.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Jenckes Mach. Co., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
A. R. Williams Machy. Co., Toronto.

MITTENS
Hickory Steel-Grip Glove Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
New Britain Mach. Co., New Britain, Conn.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
A. R. Williams Machy. Co., Toronto.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.

NAIL MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews, Jas H., & Co., Pittsburgh, Pa.
Pritchard-Andrews Co., Ottawa, Can.

NIPPLE HOLDERS
Curtis & Curtis Co., Bridgeport, Conn.

NIPPLE THREADING MACHINES
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Montreal, Toronto.

NUTS, SEMI-FINISH AND FINISHED
Canadian B. K. Morton, Toronto, Montreal.
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.

NUT BURRING MACHINES
National Machy. Co., Tiffin, O.

NUT MACHINES (HOT)
National Machy. Co., Tiffin, O.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machy. Co., Tiffin, O.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hall, J. H., & Son, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machy. Co., Tiffin, O.

OIL, DRAWING
Elm Cutting Oil Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Smart-Turner Machine Co., The, Hamilton.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

OIL STORAGE SYSTEMS
Bowser & Co., Inc., S. F., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford, Ont.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford, Ont.
MacKinnon, Holmes & Co., Sherbrooke, Que.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

OVENS FOR DRYING, TEMPER AND UNDER TRUCKS
Brantford Oven & Rack Co., Brantford, Ont.
Oven Equipment & Mfg. Co., New Haven, Conn.

OXY-ACETYLENE WELDING AND CUTTING
Can. Welding Works, Montreal, Que.
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.

OXY-ACETYLENE WELDING AND CUTTING PLANT
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Montreal, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.

OXYGEN (SEE ACETYLENE)
L'Air Liquide Society, Montreal, Que.

PACKINGS, ASBESTOS
Bennett, W. P., 51 Montford St., Montreal, Que.
Cleveland Wire Spring Co., Cleveland.
New Britain Mach. Co., New Britain, Conn.

PACKINGS, LEATHER, HYDRAULICS, ETC.
Graton & Knight Mfg. Co., Worcester, Mass.
William R. Perrin, Ltd., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.

PAPER MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
MacKinnon, Holmes & Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.

PATENT SOLICITORS
Budden, Hanbury, A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PATTERNS
Winnipeg Gear & Engr. Co., Winnipeg, Man.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PIPE CUTTING AND THREADING MACHINES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Foss & Hill Machy. Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Petrie, Ltd., H. W., Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
A. R. Williams Machy. Co., Toronto.

PIPE RIVETED STEEL
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
John H. Hall & Sons, Ltd., Brantford, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hamilton Machine Tool Co., Hamilton, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hamilton Machine Tool Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Steptoe, The John Co., Cincinnati, Ohio.
A. R. Williams Machy. Co., Toronto.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
Niles-Bement-Pond Co., New York.

PLIERS
Aikenhead Hardware Co., Toronto.
Canadian Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington Conn

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Hannifin Mfg. Co., Chicago, Ill.
Metalwood Mfg. Co., Detroit, Mich.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
E. W. Bliss Co., Brooklyn, N.Y.
Ferracute Machine Co., Bridgeton, N.J.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES FOR SHELLS
Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Charles F. Elmes Eng. Works, Chicago.
Ferracute Machine Co., Bridgeton, N.J.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Metalwood Mfg. Co., Detroit, Mich.
William R. Perrin, Ltd., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.

PRESSES, FILTER
William R. Perrin, Ltd., Toronto.

PRESSES, DROP AND FORGING
W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Charles F. Elmes Eng. Works, Chicago.
Can. Fairbanks-Morse Co., Montreal.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Dominion Machinery Co., Toronto, Ont.
Toledo Machine & Tool Co., Toledo.

PRESSES, HYDRAULIC
John Bertram & Sons Co., Dundas.
Charles F. Elmes Eng. Works, Chicago.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo.
West Tire Setter Co., Rochester, N.Y.
A. R. Williams Machy. Co., Toronto.

PRESSES, PNEUMATIC
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Consolidated Press Co., Hastings, Mich.
Charles F. Elmes Eng. Works, Chicago.
Ferracute Machine Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
William R. Perrin, Ltd., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Toledo Machine & Tool Co., Toledo.
A. R. Williams Machy. Co., Toronto.

PRESSES, BALING
William R. Perrin, Ltd., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, SCREW
Barnes, W. F., & John, Co., Rockford, Ill.
Bliss Co., E. W., Brooklyn, N.Y.
Ferracute Mach. Co., Bridgeton, N.J.
William R. Perrin, Ltd., Toronto.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Consolidated Press Co., Hastings, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Mach. Co., Bridgeton, N.J.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ont.

PULLEYS
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Dominion Machy. Co., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Ltd., Toronto.
Standard Machy. & Supplies, Ltd., Montreal, Que.
The Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.

PULLEYS, FRICTION CLUTCH
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Ltd., Toronto.

PULLEY MACHINERY, DRILLING AND TAPPING
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Machy. Co., Cincinnati, Ohio.
Wells Bros. of Canada, Galt, Ont.

PUMPS, AIR
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton.

PUMPS, CENTRIFUGAL
Bowser & Co., Inc., S. F., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.
Smart-Turner Mach. Co., Hamilton.
Sturtevant Co., B. F., Galt, Ont.

PUMPS, FUEL OIL
Bowser & Co., Inc., S. F., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

PUMPS, HIGH PRESSURE
Blake Pump & Condenser Co., Fitchburg, Mass.
Charles F. Elmes Eng. Works, Chicago.
William R. Perrin, Ltd., Toronto.
Smart-Turner Mach. Co., Hamilton.

PUMPS, ALL KINDS
Blake Pump & Condenser Co., Fitchburg, Mass.
Can. Blower & Forge Co., Kitchener, Ont.
Charles F. Elmes Eng. Works, Chicago.
William R. Perrin, Ltd., Toronto.
Petrie, Ltd., H. W., Toronto, Ont.
Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.

PUMPS, HYDRAULIC
Blake Pump & Condenser Co., Fitchburg, Mass.
Charles F. Elmes Eng. Works, Chicago.
Metalwood Mfg. Co., Detroit, Mich.
Smart-Turner Mach. Co., Hamilton.
William R. Perrin, Ltd., Toronto.

PUMPS, LUBRICANT, OIL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bowser & Co., Inc., S. F., Toronto, Ont.
Roper, C. F., Co., Hopedale, Mass.
Trahern Pump Co., Rockford, Ill.

PUMP LEATHERS
Can. B. K. Morton, Toronto, Montreal.
Graton & Knight Mfg. Co., Worcester, Mass.

PUMPS, ROTARY, POWER DRIVEN
Bowser & Co., Inc., S. F., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

PUNCHES AND DIES
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Blower & Forge Co., Kitchener, Ont.
Ferracute Mach. Co., Bridgeton, N.J.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Mulliner-Enlund Tool Co., Syracuse, N.Y.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Toledo Machine & Tool Co., Toledo, O.

PUNCHES, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Consolidated Press Co., Hastings, Mich.
Ferracute Mach. Co., Bridgeton, N.J.
Niles-Bement-Pond Co., New York.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Niles-Bement-Pond Co., New York.
W. A. Whitney Mfg. Co., Rockford, Ill.

PURIFYING AND SOFTENING APPARATUS
Sturtevant Co., B. F., Galt, Ont.
Swan & Sons Co., Wm. R., Pittsburgh, Pa.

PYROMETERS
Bellevue Industrial Furnace Co., Detroit, Mich.
Can. Hoskins, Ltd., Walkerville, Ont.
Holz, Herman A., 1 Madison Ave., New York.
Shore Instrument & Mfg. Co., New York City.
H. E. Streeter, New Birks Bldg., Montreal, Que.
Taylor Instrument Co., Rochester, N.Y.
Thwing Instrument Co., Philadelphia, Pa.

QUARTERING MACHINES
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

RAILING, IRON AND BRASS (SEE GUARDS)

RAIL BENDERS
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Cumming & Son, J. W., New Glasgow, Canada.
Niles-Bement-Pond Co., New York.

RAILS, STEEL
Cumming & Son, J. W., New Glasgow, Canada.

RATCHETS
Keystone Mfg. Co., Buffalo, N.Y.

RAW HIDE PINIONS (SEE GEARS)

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMERS, ADJUUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
H. E. Streeter, New Birks Bldg., Montreal, Que.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McKenna Brothers, Pittsburgh, Pa.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, PIPE, CYLINDER AND LOCOMOTIVE
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist, Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.

RECORDING INSTRUMENTS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

RIVET MACHINES
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Grant Mfg. & Machine Co., Bridgeport, Conn.
National Machinery Co., Tiffin, O.

RIVETS, TUBULAR, BIFURCATED
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

RIVETS, IRON, COPPER AND BRASS
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ot.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York
Petrie, Ltd., H. W., Toronto, Ont.

RIVETING MACHINES, ELASTIC ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport, Conn.
High-Speed Hammer Co., Rochester, N.Y.
F. B. Shuster Co., New Haven, Conn.

ROLLS, BENDING AND STRAIGHTENING
John Bertram & Sons Co., Dundas
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo, O.

ROLLS, CRUSHING
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.

RUBBER MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland

RULES
Brown & Sharpe Mfg. Co., Providence
James Chesterman & Co., Ltd., Sheffield, Eng.
L. S. Starrett Co., Athol, Mass.

SAFETY APPLIANCES
Strong, Kennard & Nutt Co,, Cleveland, Ohio.

SAFETY APPLIANCE GOGGLES
T. A. Wilson, Reading, Pa.

SAND BLASTS
Curtis Pneumatic Machinery Co., St. Louis, Mo.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.

SANDING MACHINES
Canada Machinery Corp., Galt, Ont.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Gardner, Robt., & Son, Montreal
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.
A. R. Williams Machy. Co., Toronto

SAWS, CIRCULAR METAL
Hunter Saw & Machine Co., Pittsburg, Pa.
Napier Saw Works, Springfield, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (SEE HACK SAWS)

SAWS, INSERTED TOOTH
Hunter Saw & Mach. Co., Pittsburgh, Pa.
Napier Saw Works, Springfield, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, BAND AND COPING
Napier Saw Works, Springfield, Mass.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York City
H. E. Streeter, New Birks Bldg., Montreal, Que.

SCREW MACHINE PARTS
Johnson Mach. Co., Carlyle, Manchester, Conn.

SCREW MACHINE PRODUCTS
Galt Machine Screw Co., Galt, Ont.
Eastern Mach. Screw Corp., New Haven, Conn.

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Garvin Machine Co., New York
Himoff Mach. Co., Inc., Astoria, L.I., New York.
A. B. Jardine & Co., Hespeler
New Britain Machine Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Rivett Lathe & Grinder Co., Brighton, Mass.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto

SCREW MACHINES, AUTOMATIC, MULTIPLE SPINDLE
New Britain Machine Co., New Britain, Conn.
Riverside Machinery Depot, Detroit, Mich.

SCREWS
Can. B. K. Morton, Toronto, Montreal
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio
Steel Co. of Canada, Ltd., Hamilton, Ont.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler
Morse Twist Drill & Mch. Co., New Bedford, Mass
Wells Bros. Co. of Canada, Galt, Ont.

SCREW SLOTTERS
Garvin Machine Co., New York
Pratt & Whitney Co., Dundas, Ont.

SECOND-HAND MACHINERY
Davis Machine Tool Co., W. F., New York
Dominion Machinery Co., Toronto
Foss & Hill Machy. Co., Montreal
Hill, Clarke & Co., Chicago, Ill.
McCabe, J. J., New York, N.Y.
New York Machinery Exchange, New York
Petrie, Ltd., H. W., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Strelinger Co., Chas. A., Detroit, Mich.
Stocker-Rumely-Wachs, Chicago, Ill.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto, Ont.
Allen Mfg. Co., Hartford, Conn.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas
Can. Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal
Gardner, Robt., & Son, Montreal
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton, Ohio
Petrie, Ltd., H. W., Toronto, Ont.
Rhodes Mfg. Co., Hartford, Conn.
Steptoe Co., John, Cincinnati, Ohio

SHAFTING
Can. Bond Hanger & Coup. Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Niles-Bement-Pond Co., New York
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Strelinger Co., Chas. A., Detroit, Mich.
A. R. Williams Machy. Co., Toronto

SHAFTS, FLEXIBLE
Stow Mfg. Co., Binghampton, N.Y.

SHARPENING STONES
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

SHAVINGS, SEPARATOR
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas
Bertrams, Ltd., Edinburgh, Scotland
Canada Machinery Corp., Galt, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Montgomery, Smith & Co., Keynsham, Somerset, Eng.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo

SHEARS, POWER
John Bertram & Sons Co., Dundas
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Ferrachute Machine Co., Bridgeton, N.J.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo

SHEARS, PNEUUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Canada

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Peck, Stow & Wilcox, Southington, Conn.
Steel Bending Brake Works, Ltd., Chatham, Ont.

SHEET METAL STAMPINGS
Dominion Forge & Stpg. Co., Walkerville, Ont.

SHELL BANDING MACHINES, HYDRAULIC
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., W. R., Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.

SHELL PAINTING MACHINES
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

SHELL RIVETERS
Grant Mfg. & Machine Co., Bridgeport, Conn.
High Speed Hammer Co., Rochester, N.Y.

SHRAPNEL SHELL MARKER
Brown, Boggs & Co., Hamilton, Canada
Noble & Westbrook Mfg. Co., Hartford, Conn.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. B. K. Morton, Toronto, Montreal.

SIGNS, ENAMEL
Strong, Kennard & Nutt Co., Cleveland, Ohio.

SILVER SOLDER
Geo. H. Lees & Co., Hamilton, Ont.

SKATE SHARPENERS
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

SLOTTERS
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles Bement Pond Co., New York
Rhodes Mfg. Co., Hartford, Conn.

SMOKESTACKS
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke, Que.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
J. H. Williams & Co., Brooklyn, N.Y.

SOCKET HEAD CAP SCREWS
Allen Mfg. Co., Hartford, Conn.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Canada

SOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Banfield, W. H., & Sons, Toronto.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Can. Fairbanks-Morse Co., Montreal.
Charles F. Elmes Eng. Works, Chicago.
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Courtland, N.Y.
Grant Mfg. & Machy. Co., Bridgeport, Conn.
John H. Hall & Sons, Brantford.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
Illinois Tool Works, Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
McClean & Son, F. W., Niagara Falls, Ont.
National-Acme Co., Cleveland, Ohio.
D. McKenzie Machinery Co., Guelph, Ont.
Mullmer & Enlund Tool Co., Syracuse, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rhodes Mfg. Co., Hartford, Conn.
Riverside Machinery Depot, Detroit, Mich.
Sleeper & Hartley, Inc., Worcester, Mass.
Smart-Turner Machine Co., Hamilton, Ont.
T. C. M. Mfg. Co., Harrison, N.J.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

SPRINGS, MACHINERY
Barnes Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal, Que.
Cleveland Wire Spring Co., Cleveland.
Jas. Stock, Ltd., Guelph, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.
Sleeper & Hartley, Inc., Worcester, Mass.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

SPIRAL CONVEYORS
Can. Matthews Gravity Carrier Co., Toronto, Ont.

SPROCKETS, CHAIN
Grant Gear Works, Boston, Mass.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.

SOLDER
Jobborn, Geo. A., Hamilton, Ont.

SPROCKET WHEELS, CAST
Perrin, Wm. R., Toronto.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS
Dillon Mfg. Co., Oshawa, Ont.
Dom. Forge & Stamping Co., Walkerville, Ont.
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CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

Vol. XVIII. TORONTO, SEPTEMBER 27, 1917 No. 13

EDITORIAL CONTENTS

THE MACLEAN PUBLISHING COMPANY, LIMITED

JOHN BAYNE MACLEAN, Pres. H. T. HUNTER, Vice-pres. H. V. TYRRELL, Gen. Man.

Publishers of Hardware and Metal, The Financial Post, MacLean's Magazine, Farmer's Magazine, Canadian Grocer, Dry Goods Review, Men's Wear Review, Printer and Publisher, Bookseller and Stationer, Canadian Machinery and Manufacturing News, The Power House, The Sanitary Engineer, Canadian Foundryman, Marine Engineering of Canada.

Cable Address: Macpubco, Toronto; Atabek, London, Eng.

PUBLISHED 1887.

CANADIAN MACHINERY AND MANUFACTURING NEWS

PETER BAIN, M.E., Editor. B. G. NEWTON, Manager.

Associate Editors: A. G. WEBSTER, J. M. WILSON, J. H. RODGERS.

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CANADA—Montreal, Southam Building, 128 Bleury Street, Telephone 1004; Toronto, 143-153 University Ave., Telephone Main 7324; Winnipeg, 1207 Union Trust Building, Telephone Main 3449.

GREAT BRITAIN—LONDON, The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C., E. J. Dodd, Director. Telephone Central 12960. Cable address: Atabek, London, England.

UNITED STATES—New York, R. R. Huestis, Room 620, 111 Broadway, N.Y., Telephone Rector 8971; Boston, C. L. Morton, Room 733, Old South Building, Telephone Main 1204. A. H. Byrne, 1104-5-6-7 Fort Dearborn Building, 105 W. Monroe St., Chicago, Telephone Randolph 3234.

SUBSCRIPTION PRICE—Canada, Great Britain, South Africa and the West Indies, $3.00 a year; United States, $3.50 a year; other countries, $4.00 a year; Single Copies, 15 cents. Invariably in advance.

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