EDITORIAL INDEX—PAGE 119. BUYERS' DIRECTORY—PAGE 103. ADVERTISING INDEX—PAGE 120.

CANADIAN MACHINERY AND MANUFACTURING NEWS

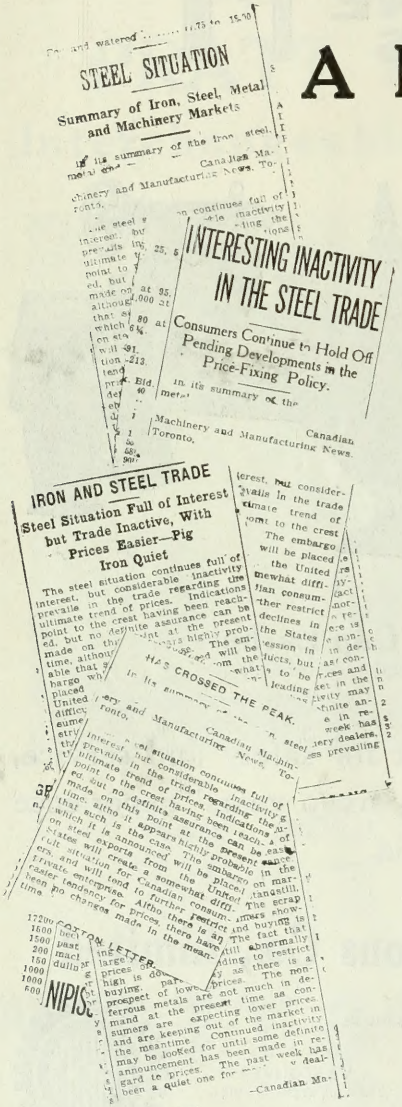
A weekly newspaper covering in a practical manner the mechanical, power, foundry and allied ifelds.
Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg and London, Eng.

Vol. XVIII—No. 9 Publication Office: Toronto, August 30, 1917 Subscription Price $3.00 per Year

SMALL TOOLS

The Publisher's Page

TORONTO August 30, 1917


STEEL SITUATION

Summary of Iron, Steel, Metal and Machinery Markets

INTERESTING INACTIVITY IN THE STEEL TRADE

Consumers Continue to Hold Off Pending Developments in the Price-Fixing Policy.

IRON AND STEEL TRADE

Steel Situation Full of Interest but Trade Inactive, With Prices Easier—Pig Iron Quiet

HAS CROSSED THE PEAK.

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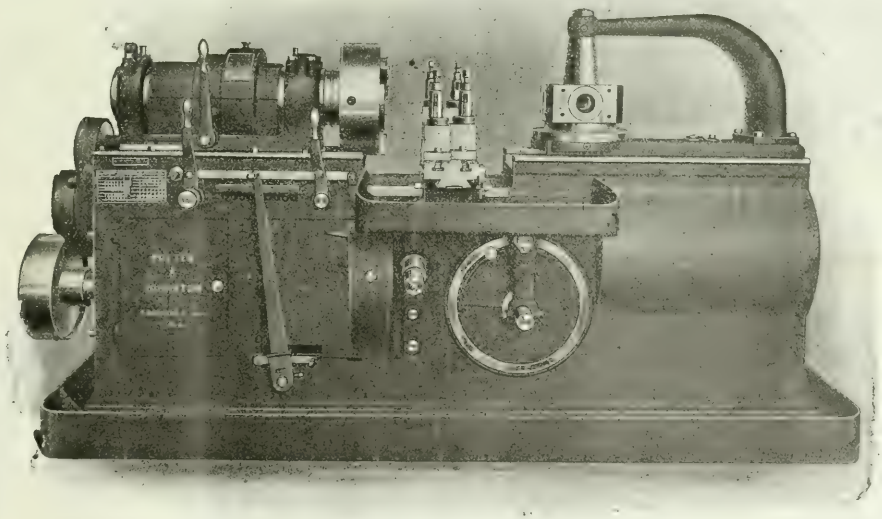

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The Expanding Arbor as a Factor of Production

Staff Article

Quantity production on an efficiency basis is dependent upon the facilities provided for the handling of the product, so that the minimum amount of time is consumed between actual machining operation. Special effort has been centered upon the design and construction of operating appliances for the rapid and economical manufacture of all classes of shells, and some observations of driving appliances form the basis of the accompanying article.

SUITABLE equipment is undoubtedly the chief factor in the production of any manufactured article on a repetition basis. Unprovided with such essentials maximum efficiency is impossible of attainment. In so far as the actual machining operations on a certain piece of work is concerned, the end desired is a question of secondary importance, the principal feature being to minimize the unproductive period that is necessarily incidental to the achievement of any purpose. It was due largely to the design, construction and adoption of special fixtures and attachments upon existing machinery that provided a foundation for the special machine, the effectiveness of which has been amply demonstrated during the past three years. In many respects, however, the life of the special machine will terminate with that of the shell industry, but it is not going too far to predict that many of the primary devices, and their subsequent developments, will find and fill useful roles in the ordinary department of engineering practice.

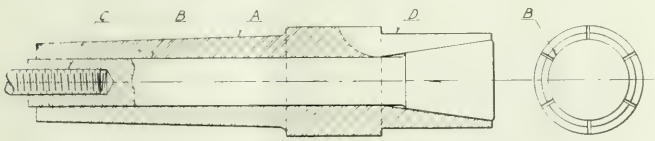


FIG. 1. PLAIN COLLET ARBOR.

Driving Appliances.

The detail in shell making that has contributed largely to the rapid and effective handling during machining operations, has been the facilities provided for holding and driving the shells for both interior and exterior machining. The advantages to be derived by the removal of the outside metal with one or a series of continuous cuts made it almost imperative that the shell be driven from the rough and afterwards the finished bore. Owing to the greater difficulty of interior machining, the general practice on rough foregoings was to use the bore as a base from which to commence operations; the significance of this being further pronounced by the eccentricity of wall thickness due to faulty forging. Under these conditions the uneven cut is taken by the turning tools, which are always in a better position to withstand the variation in stress caused by the irregular forging. Irrespective of the condition of the forging, however, it is necessary that the driving medium be capable of performing its functions under the heaviest of cuts, and experience has been the means of developing and improving on the methods adopted at the inception of the industry. While many of these devices, even at the height of perfection, may find a place only for specific purposes, the principles, while not entirely new, may be economically adapted for general purpose equipment.

Plain Cone Drive

Probably the most common driver used for roughing off the outer surface of the smaller shells, particularly during the experimental stages of munitions manufacture, was the ordinary cone shaped type of solid driver with inserted serrated teeth. Many of these are still in operation, but unless they are properly made and handled, they are a source of inconvenience and annoyance. Slippage, under heavy or irregular cuts, causes the teeth of the driver to chew away the mouth of the shell bore, thus destroying the effective drive and forcing the work away from the tail centre; the latter occurrence requiring the operator to give constant attention to this troublesome detail. Another feature in connection with slippage of work under a heavy cut is that of the tool action. When the force applied by the depth of cut is greater than the driving power of the arbor, the work will invariably slip; that is, the lathe spindle and work arbor will continue to revolve while the work will remain stationary until the cutting pressure is relieved. In the case of the serrated cone, any tendency to slip results in a certain amount of metal being reamed from the mouth of the bore, causing the work to advance slightly, which partly removes the pressure of the cut from the tool, but has the objectionable feature of loosening the work from the tail centre. If, however, the work does not advance, the cutting tool will still be forced into the work in such a manner that, should the driver suddenly resume its duties, there is the probability that the tool will be destroyed under the additional cut. It is, therefore, advisable to so adjust the driver and the depth of cut that slippage will be reduced to a minimum.

Plain Collet Arbor

The drive that has been most extensively used has been the expanding arbor, and the engineering initiative of the country has been reflected in the wide range of design in the arbors that are now in general use. One of the simplest forms of expanding arbors is that illustrated in Fig. 1, where the collet is integral with the body of the arbor. In this particular one the chucking portion is made to fit the nose of the shell after it has been closed and bored. The shank A is turned to ft the taper in the nose of the spindle, and the collet D is expanded by the bolt B, which in turn is operated by the draw rod C that passes through the hollow spindle and controlled by a suitable hand wheel or air operated cylinder attached to the rear.

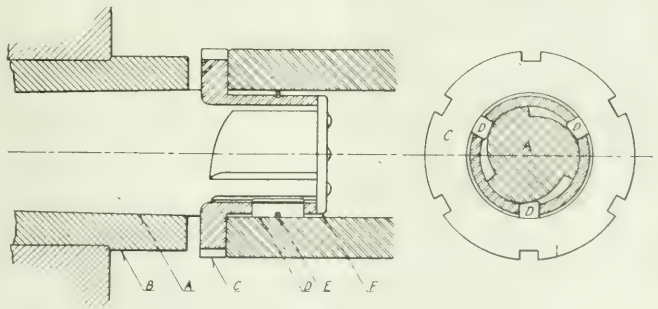


FIG. 2. PLAIN TYPE OF TRIPLEX CAM ARBOR.

The repair upkeep on the arbor shown in Fig. 1 was, however, a factor that worked to its disadvantage, for the constant and heavy service required of it for shell making. It was this feature that was the primary cause of developing

an expanding arbor where the various operating parts could be replaced at little loss of time or expense, and also facilitate the handling of the shells.

Cam Operated Arbor

The arbor shown in Fig. 2 is semi-automatic in its action, inasmuch as any tendency to slip causes the jaws to take a firmer hold upon the work. The operation of this arbor is dependent upon the central triplex cam and the corresponding jaws. Like the one previously described this is constructed upon the shank that fits the spindle nose. The hardened steel blocks D are fitted in slots cut in the cylindrical section of the cage C, the flange of which is provided with six notches for operating, this being done with a hook spanner. The blocks are kept in contact with the cams by the action of a single coil spring E, placed in a groove cut in the centre of the block and also in the cage; the whole being retained in position by the plate F. It might be well to draw attention to the fact that the inner surface of the jaws should not conform to the arc of the cam upon which they move, owing to the radial movement of the jaws and the eccentric movement of the cam.

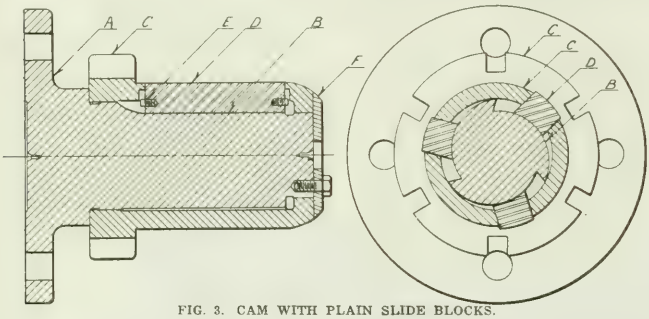


FIG. 3. CAM WITH PLAIN SLIDE BLOCKS.

The bearing surface of the jaws should be reduced so as to bring the thrust as near the centre of the jaw as possible and thus avoid the tendency of the jaws to tilt to one side under the pressure.

The arbor illustrated in Fig. 3 is similar in its action to that shown in Fig. 2, but the central cam is milled upon a piece which has a flange, bolted to the face plate of the lathe, and instead of the jaws being held to their seat by means of a central spring, they are collapsed by two springs that fit over the small pins E, fitted in either end of each jaw.

Arbor With Swivel Block

The expanding arbor shown in Fig. 4 has several points of similarity to the others just described and in addition has a feature that almost eliminates any tendency of side thrust upon the three jaws during the movement of the cam. This attachment is fitted to a lathe having a solid spindle, the cam spindle being screwed to a small chuck that is likewise screwed to the nose of the lathe spindle. When assembled, the cage containing the three jaws is free to move, but without lateral play. The feature of this particular design is the semi-circular block placed beneath each jaw which allows of a rocking motion during the cam action. This permits of a wider bearing surface on the cam and added stability to the entire device.

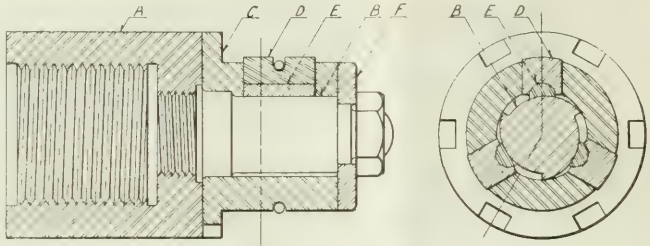


FIG. 4. ROCKING BLOCKS UNDER JAWS.

Arbor With Cams and Rollers

A design that greatly reduces the friction of the operating parts and also the effort required to release the chuck after the work has been performed, is that illustrated in Fig. 5, where the sliding blocks are replaced by rollers. In the particular chuck here shown, the roller cage C has three equi-distant slots for the rollers D, the initial pressure being obtained by means of a suitable wrench in the notches on the roller cage flange, this flange in all cases being slightly below the size of the shell upon which it is being used. The stud G is kept locked in position by the reaction of the spring washer F. To eliminate the necessity of squaring out the slots for the rollers, one firm adopted the design shown in Fig. 6, the sectional view being that drawn through two of the slots in a three slot cage. It was found that much time and labor was saved by leaving the round ends in the slots and turning the rollers as shown at B. This rounding of the corners also assisted in the hardening of the rollers and avoided the chipping of the corners when in operation.

Where the expansion of the arbor was controlled by means of a hand wheel located at the rear of the lathe spindle, it was often found that the semi-revolving cam device had the disadvantage of irregular control owing to the torsion of the operating rod due to its length, which, in the case of the smaller sizes of shells, or arbors operating on the closed nose was often a feature of considerable annoyance to the operators. A design that overcomes this objection to some extent is illustrated in the sketch Fig. 7. The spindle in this case carries on its forward end the usual face plate, to which is fitted the flange cage C, slotted in the usual manner to receive the three jaws D. The radial movement of these blocks is derived by the axial movement of the rod E that passes through the hollow spindle and is operated by the hand wheel at the rear; this wheel may be of any suitable design, the one shown being a hub fitted with four short handles. In some of the elementary applications of this particular design it was necessary to release the grip of the jaws by hammering the rear end of the draw rod, after the hand wheel had been backed off. In the appliance here shown, the hand wheel is fitted with an inner collar that revolves in a space provided on the rear support so that when the wheel is backed off,

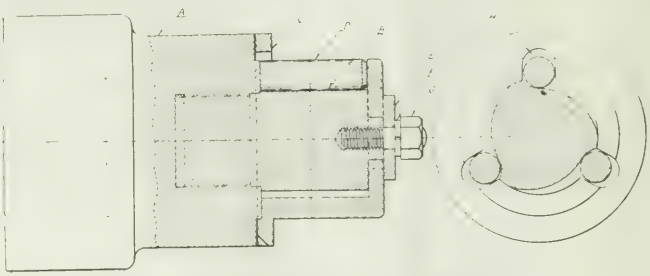


FIG. 5. SLIDE BLOCKS REPLACED BY ROLLERS.

the centre rod is pushed forward and allows the jaws, D, to collapse under action of the spring. By placing a solid ring over the jaws in place of the small spring, and using the bush in the nose

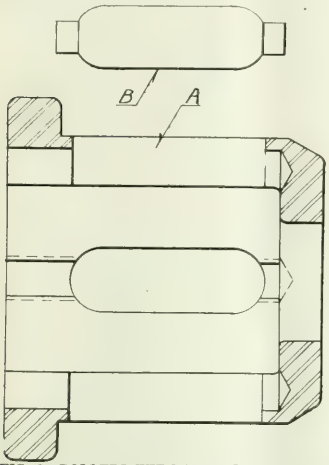


FIG. 6. ROLLERS WITH SPHERICAL ENDS.

of the arbor, the blocks can be turned or reground while in position.

Arbor Operated by Knock Pawl

An arbor that embodies many of the features described in the foregoing, and yet has several additional ones, is illustrated in Fig. 8. The operation of this is also controlled from the rear of the spindle, but a special design of hand

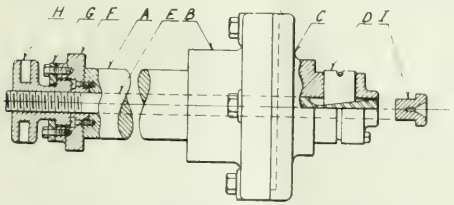


FIG. 7. EXPANDING BLOCKS WITH DRAW-ROD.

wheel is used for tightening and releasing the forward mechanism. The wheel here shown is a development of the notched flange and the spanner wrench, as it was discovered that it was much better to leave the "wrench" always in position than to be continually lifting and laying down the same. The steel hub B is keyed to the end of the operating rod A, and is provided with two notches as shown in the centre section. The hand wheel C is bored out a free fit for the collar B, and through the webs of the centre portion two pins F are placed, these pins supporting two pawls E, located in the central cored portion of the hand wheel, the pawls being forced against the outer surface of the hub by the springs G. Several knocks in either direction are sufficient to tighten or release the jaws of the arbor, which are operated by means of a short cone on the block K; this block being keyed to the forward end of the operating rod. The jaws are kept in contact with the inner bevel by the ordinary ring spring, but have a frictional action on the shell bore due to their movement about the axis. This is caused by the parts being relatively connected to the central block K, the lateral movement of which is controlled by the threaded portion at the inner end. This style of chuck is not satisfactory for use on the shells when cutting the waving ribs in the copper band groove, as any shippage would alter the track of the tool and possibly destroys the waves.

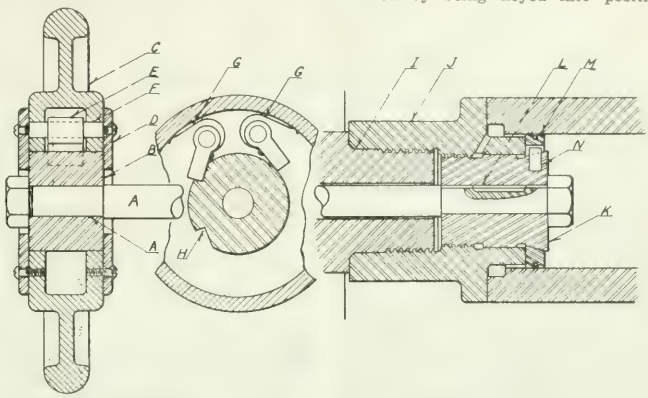


FIG. 8. HANDWHEEL WITH TWO PAWLS FOR RELEASING DRAW-ROD.

Double Expanding Arbor

Where the shells are held entirely upon the arbor, such as for boring and threading of the nose, it was necessary to provide increased support for the shell; this being done by extending the length of arbor and using two separate sets of jaws, located at either end of the parallel portion. Some of these, during the experimental stages of shell making, were designed with a cam action, but owing to the excessive torsion, they did not give the best of satisfaction, and this style of double arbor is generally constructed along the lines of the sliding block principle, similar to that shown in Fig. 9; the accepted method in nearly every case being to design such arbors with three equi-distant jaws, as it is next to impossible to obtain a central control with any other than a three point bearing. In the sketch here illustrated, the cage that carries the sliding blocks E and F, is integral with the portion that fits into the nose of the spindle, and is further secured by being keyed into position. In order to obtain satisfactory operation, it is advisable to operate the two sets of jaws by separate sliding blocks B and C, the former being secured to the tube G for operating the rear set, and the latter secured to the central rod H for controlling the movement of the forward set. Where the arbor is operated by hand, it is necessary to have the rod and the tube secured to different rear supports, and in the case of an air operated fixture, the tube is secured to the cylinder and the central rod to the piston. The plug D is inserted in the nose of the arbor to protect the sliding blocks from the dirt and cuttings.

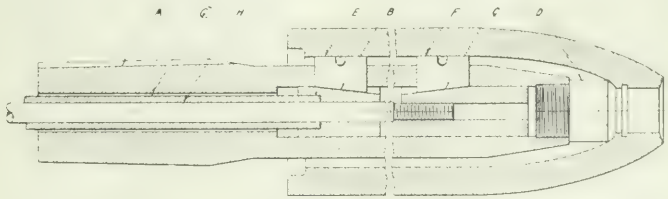


FIG. 9. EXPANDING ARBOR WITH DOUBLE CAM ARRANGEMENT.

BRITISH CONTROL RARE METAL DEPOSITS IN QUEENSLAND

RECENT advices from Australia are to the effect that practically all the big wolfram and molybdenite properties in North Queensland have been sold to the Thermo Electric Ore Reduction Corporation Ltd., whose registered offices are in London and works at Luton. By means of the latest machinery and appliances the new owners propose to work the mines to their utmost capacity. Four 250-h.p. Diesel oil engines and a complete electrical installation will form part of the new equipment, while the present 10 head of stamps will be increased to 40 head. By these means the annual output is to be multiplied several times. The company are also ne-

gotiating for the purchase of the Mount Carbine Wolfram Mines, which, with proper appliances, are estimated to yield 500 tons yearly, or half as much as the properties already acquired. The mines bought by the British company are expected to give 1,000 tons of wolfram per annum instead of 200 tons, as at present, with a corresponding increase of molybdenite and bismuth. During the war all of these rare ores and metals obtained in Australia are sold under agreement to the Imperial authorities.

Wolfram and scheelite are the principal ores of tungsten, and the metal tungsten is chiefly used in the manufacture of high-grade steel, such as is required for lathes and for inner tubes of big guns. It imparts to the steel great density, toughness, and hardness. Molybdenum, the metal derived from the ore molybdenite, is also used for hardening steel as well as for other purposes. All these steel hardening materials have commanded exceptionally high prices since the outbreak of war. As much as £2,000 per ton has been paid by Germany for molybdenite, so it is said, but the British Government fixed the price delivered in London at £525. For wolfram up to £1,000 per ton has been paid in the United States, but the price is now about £200.

SCHEME TO CONTROL FACTORIES AFTER WAR IS AUSTRALIAN PLAN

THE Australian Commonwealth Government is engaged in drawing up a schem for controlling national industries after the war along the lines of Socialism. It is intended as a first contribution to spend $50,000,000 in the establishment of certain factories under the joint control of private and Government supervision.

A national industrial department is to be created, which shall be in close contact with the Commonwealth Bank, and a specially selected group of "experts," upon whose advice the operations of the department will very largely depend. This department will have very wide powers with respect to the investigation, creation and maintenance of new or expended industries. If a proposition is made to the Government, the experts of the Government would advise as to capitalization, tariff, aid required and the best technical methods of organization. The industry established, they would report from time to time upon its progress. Assisted industries would be required to provide for the presence of a Government representative upon the board of directors and to agree to a limitation of profits.

The shareholders' proportion of the profits would not be permitted in any given year to exceed 7 per cent. on the capital. If the profits went beyond this, the success would go into the Government revenue funds or be used to finance a reduction of the commodity to the public. If the promoters of the new industries agreed to the scheme of control and profit limitation, they would obtain advances from the Government to 75 per cent. of the capitalization value, at 5 per cent. interest for the loan moneys. If the industry's operations resulted in a loss after a reasonable and fair trial, and the loss was found to be due to inadequate tariff protection, the industrial department would advise the Government at once to raise the duties. If the industry was really vital to the nation's safety and well-being, the loss would fall on the Government until such times as the new higher duties had enabled the industry profitably to secure complete home market.

It is thought that the first experiments in this direction will be made as follows: $5,000,000 in the development of the wool industry, $2,500,000 each in the chemical and tin-plate industries, $500,000 in glass works, and $5,000,000 in special iron and steel process works.

BRITISH FIRM BUILDS MAGNETOS

THE dependence of Britain on foreign manufacturers for the supply of magnetos is now definitely a thing of the past. Several firms have been producing this apparatus for some time and the latest addition to their ranks is the British Lighting & Ignition Co., Ltd., formed by Vickers, Ltd., to produce articles of the very highest grade. The name chosen for the new magnetos is "B.L.I.C." from the initials of the Co. Hundreds of magnetos are at present being produced weekly to meet the needs of the authorities, and all possible preparations are being made to meet the large demand expected after the war. The address of the new company is 204 Tottenham Court-road, London, W.C.

BRITAIN COMMANDEERS IRON ORE

AN order issued by the British Minister of Munitions went into effect July 24, under which he takes possession of all iron ore mines in the counties of Cumberland and Lancaster, all mines and quarries to which the regulation applies passing into the possession of the Minister of Munitions. The owner, agent, and manager of every such mine or quarry, and every officer thereof, and, where the owner of the mine is a company, every director of the company must comply with the directions of the Minister of Munitions as to the management and use of the mine or quarry, and if he fails to do so will be guilty of a summary offence against the Defence of the Realm Regulations.

CONCRETE SHIP SHOWS LONG SERVICE

THE first reinforced vessel was in the form of a small boat built in 1849 by a Frenchman named Lambot, at Miravel, and the boat is still in service after a practical test of 68 years. Toward the end of last century the possibilities of reinforced concrete for all kinds of structural work began to be more widely recognized and the material was applied to the construction of vessels of various classes in different parts of the world.

One of the first examples was a floating chalet supported by a reinforced concrete pontoon, measuring 67 feet long by 21 feet wide, built in Rome in 1897. Other barges, lighters and pontoons followed in fairly rapid succession, a Roman firm being most enterprising in the new branch of the work. By the end of 1912, they had constructed at least 20 vessels of the lighter class and over 60 pontoons for floating bridges. In Germany reinforced concrete vessels of the motor launch and barge types have been constructed. In North and South America, a good many barges and pontoons have been made in reinforced concrete during the last ten years. Typical examples are furnished by a barge in Ontario, 81 feet long by 24 feet beam by 7 feet deep; a fleet of lighters, 100 feet long by 30 feet beam, built at San Francisco for the coasting trade; several lighters and pontoons on the Panama Canal; and some scows 112 feet long by 28 feet beam built at Farrfield.

From the examples cited it is evident that reinforced concrete has earned a definite claim to be regarded as a real shipbuilding material, particularly for vessels of moderate size. The material possesses obvious advantages for the building of many useful types of craft. Apart from ships, barges and pontoons, there are other types of floating structures in which reinforced concrete can be employed with advantage. The most interesting example of the caisson class is furnished by the "Batterie des Maures," a torpedo testing station which at present forms a kind of artificial island in the Mediterranean. The structure was built partly in a dry dock, and completed at moorings outside the dock. The battery was then towed by a couple of steam tugs for a distance of some 30 miles through the sea and sunk upon a prepared bed in deep water. When in readiness for its voyage across the sea, the battery had a displacement of 2,600 tons and drew 26 feet of water.

While of less striking character than this structure, reinforced concrete caissons for pier and jetty construction are of practical interest.

It is frequently contended that saline substances in solution damage the concrete. Authorities state, however, that while badly made concrete has suffered deterioration in a few cases, there is ample evidence of the fact that correctly proportioned and carefully prepared concrete is not injured by prolonged immersion in sea water.

THE first artesian well to be bored in Europe, of which data are available, is the tube well at Grenelle in France, which was sunk by the French Government between 1834 and 1841 in the hope of obtaining a sufficient supply of water for Paris. The depth is 179 ft., at which level a prolific supply of water was reached, giving an overflow at the surface of 600 gallons per minute. In Upper Silesia there is a bore-hole 6,572 ft. deep.

PRODUCTION METHODS AND DEVICES

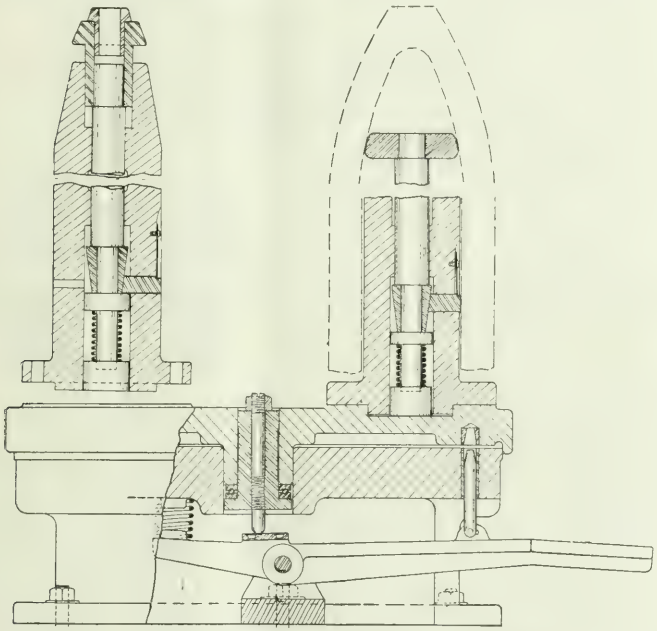
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

AUTOMATIC ARBOR FOR SHELL NOSE DRILLING

By W. D. Powell.

THE accompanying sketch shows two interesting applications of an automatic self-centring arbor for accurately locating shell forgings and similar work in a vertical position so as to insure that nose operations will concentrate with the main bre within a high degree of accuracy.

The main part of sketch shows the



AUTOMATIC SHELL DRILLING ARBORS SHOWING ARRANGEMENT OR REVOLVING TABLE.

device as used on the revolving table of a drilling machine in which the nose of the rough forging was drilled and faced. The arbor column is of cast iron, recessed and bolted in place. The arbor spindle is of machine steel, fitted with a hardened steel disc on its upper end, and of such a diameter that it makes contact with the inner surface of the nose about midway down the tapered portion. The lower end carried a hardened tapered cone, which contacts with three hardened steel dogs, and as the arbor descends under the weight of the forging the dogs expand equally and locate the main body of the forging centrally from the inside. Small plate springs return the dogs, as the arbor spindle rises when the work is lifted off, this movement of the spindle being caused by a heavy coil spring at its lower end pressing against a collar as shown. The upward movement is limited to that point where the cone comes in contact with the lower spindle bearing.

Duplex Arrangement

Two arbors are fitted to the one table, so that unloading and loading proceeds simultaneously with the work. The table is located in the two positions by a tapered locking pin situated below, and operated by a foot lever, which is also arranged to lift the revolving table clear off the base so as to allow easy turning. In order to do this, the foot lever is provided with a flat cam plate at its fulcrum end, which operates against a ball pointed stud carried in the bushing which supports the ball thrust bearing. The stud extends up to the top of the bushing so that adjustment can be made to allow of the locking pin being drawn down clear of the table before the latter is lifted clear off the base.

The locking of the pin is insured by providing a compression spring on the other side of the lever fulcrum from the pedal.

Truing Application

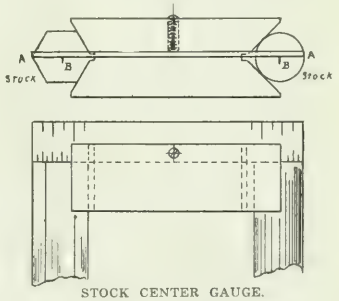
The small sketch to the left shows the same arbor with a special drill bushing in the end. In this case the locating disc is replaced by a hardened bushing with a formed flange to fit the finished interior of the nose near the point. This bushing is pressed in place as shown. arbor column, and is pressed on a shouldered diameter of the spindle. Drill bushing E is pressed in place as shown. The other details of the arbor are identical with that already described.

The second arbor is also revolvably mounted in a vertical drill press, which takes a light boring cut out of the nose hole after the main bore has been finished, and thus makes the two bores truly concentric, so that the shell may be supported by the internal surfaces at either end in order to turn the outside true with the bore.

STOCK CENTER-GAUGE

By E. Bailey

IN the enclosed sketch is shown an interesting gauge for finding the center of stock to be center punched previous to its being centered. It consists of a piece of square stock beveled vee-shaped on each end, 30 deg. and 45 deg., respectively. A narrow slot is milled along its length into which can be placed a steel scale. The method for using it, is to place the gauge against the stock, then the scale is moved so that its outer end coincides with the edge of the stock. It is then fastened with the headless screw. A line is then scratched in the direction of A, A, along the edge of the scale across the stock. A short scratch as B, is next made just half way or half the diameter of the stock measured on the scale. The exact center being



STOCK CENTER GAUGE.

where line B meets line A. The gauge is serviceable both for round, square, and hexagon stock.

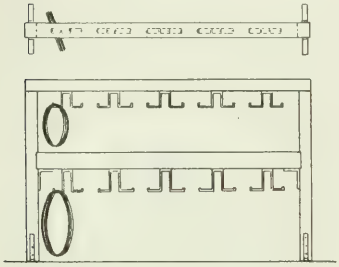
A WIRE HANGER RACK

By A. M. Y.

WIRE that is used for making springs and rivets, etc., usually comes wound in coils of various diameters. Bessemer spring wire coils being considerably larger of course than music wire. It is the usual practice to store these coils either on top of one another, or stand them endwise one against the other near a wall. In this manner they are hard

to get at, besides, the ends become entangled with other coils and considerable difficulty is experienced in trying to separate them.

In the accompanying sketch is shown a wire hanger rack which is a very neat and convenient arrangement for hanging wire separately on books, whereby the coils are kept free from each other and are easily accessible when wanted. The rack is made from two by four lumber about 10 feet long, and 5 feet high. The lower rail is supported on the end by a forged bracket, and also four brackets support and hold the two up-



A WIRE HANGER RACK.

rights to the floor. The top rail is used for holding coils of small diameters, and the lower rail for larger diameters. The rack occupies very little space. The coils when placed on the hooks are turned slightly inward as shown in the top view of the sketch.

PRACTICAL GRINDING HINTS

By J. Davies.

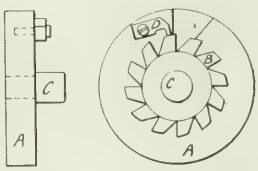
IN repetition cylindrical grinding, that is grinding plain round pieces, first rough out the work within 2/1000 of an inch of size with a coarse wheel, taking light cuts with a quick feed. Let the pieces cool down and then put back and finish with a fine soft wheel, still maintaining a rapid feed. A small wheel must not be expected to do the same amount of work as a large wheel in the same time; finer feeds and slower table speeds must be employed for smaller wheels. The faster the emery wheel runs the less it wears; a glazed or a filled wheel can often be remedied by slowing down the speed and thus causing it to wear away more rapidly.

Avoid heating the work as much as possible, don't have your centers too tight, and be sure there is no looseness or end motion, but at the same time leave the job free to revolve. All grinding wheels heat more or less and it is uneven distribution of heat that causes the trouble. Water is only used on grinding wheels for its cooling qualities; therefore to distribute the heat quickly, employ coarse feeds and light cuts; above all you must have a free cutting wheel for satisfactory grinding. Driving belts should be treated with neat's-foot oil and kept soft and pliable.

Grinding a Gear Cutter By Hand

In many small shops there is no universal grinder, or if there is one it may be occupied with another job, hence it becomes necessary to grind gear cutters by hand. While it is no easy matter to grind a gear cutter correctly by this method, in the hands of a competent mechanic a satisfactory job can often be obtained and much time saved. The main thing to keep in mind is to have the tops of the teeth all an equal distance from the center of the cutter. This can be done by measuring the distance from the edge of the hole to the top of the teeth with a micrometer; this however, has its disadvantages owing to the fact that, the anvil of the micrometer touches the hole at two points. This may be overcome by boring a piece of round stock to fit the anvil, and rounding the piece at the end where it comes in contact with the inside of the hole, or cutting a piece off the end of a round bar and attaching to anvil block as shown in sketch; or by boring a piece of stock to fit the anvil and drop in a small steel ball such as is used in common ball bearings.

A simple and efficient hand grinding device is made and operated as follows: Take a piece of round plate, or a slab cut off the end of a round ball, a little larger than the cutters to be ground; cut or grind a notch in it to allow the emery wheel to reach the face of the cutter, put a stud in the center to suit the hole in the cutter and clamp an index finger on the side of the plate near the edge; a glance at sketch will show how it works. A is the plate, B is the cutter, C the pin upon which it is mounted and D the index finger held to the plate by a small screw. To operate, place the cutter upon stud C and grind one tooth in the usual way, selecting the



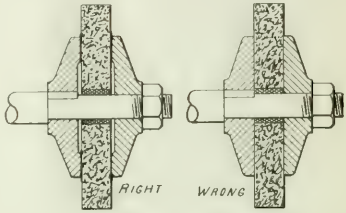
SIMPLE AND EFFICIENT HAND GRINDING DEVICE.

tooth that is worn most or requires the most grinding; adjust the index finger D so that it will just touch the ground tooth as it passes. Clamp the index finger in position, then continue to grind the face of all the rest of the teeth until they will pass in the same manner.

Care in Wheel Mounting

Keep a record of your jobs and the kind of wheel that give the best satisfaction; it only takes a little time and it may be of inestimable value on future occasions. You would not expect to do all your lathe work with tools of one size and shape. The grinding wheel is a cutting tool; different shapes of works and different kinds of material require different grades and grains of wheels. Never mount the wheels without flanges. The size of the flanges should not be less than 1-3 the diameter of the wheel. Washers made of some compressible material such as rubber or paper slightly larger than the flanges

METHODS OF ADAPTING MICROMETER ANVIL TO MEASUREMENT OF CUTTER TEETH.



THE RIGHT AND WRONG OF WHEEL MOUNTING.

should be used between the flanges and the wheel; these distribute the pressure evenly when tightened up and overcome any slight imperfections in the wheel or flanges. The hole in the wheel bushing should be large enough to permit the wheel to slide on the spindle freely, to ensure a good fit against the inside flanges. Clamping nut should be tightened only enough to hold wheel firmly.

Flanges should always be relieved. The sketch shows the wrong and the right method of mounting emery wheels. When the inside of the flanges are not relieved and the nut is tightened on the spindle, it causes the flanges to become slightly convex and instead of the pressure being distributed evenly over the entire bearing surface of the flanges, it is greatest near the hole, causing a dangerous condition. The inner flange should not be loose on the spindle but should be shrunk, pressed or keyed on. Sound wheels before mounting to detect any possible defect or injury. Don't start to work with a new wheel until you know that it runs true; to grind cylindrical work true, the face of the wheel must be true. Always true up with a diamond if one is available.

Minor Troubles

Speed is an important factor; speed up the spindle as the diameter of the

wheel is decreased. To increase the speed of a grinding wheel gives the effect of a softer wheel. Wheels are run in actual practice at from four thousand to six thousand feet per minute. Transferring worm wheels from one machine to another helps to maintain the speed, as in most shops the grinder has one speed only. Don't use the wrong wheel on the job because you are too lazy to change it and humor yourself that you are saving time. Make the feed as nearly the width of the wheel as practicable. There are three grinding troubles:—the operator, the wheel and the machine, but the greatest of these is the operator. An unbalanced grinding wheel often causes chatter marks in the work. White lead makes a good lubricant for work centres. If you want the best results true the wheel between the roughing and finishing operations. It is false economy to use a hand wheel because it doesn't wear out so fast. Sometimes the glazing of a wheel can be remedied by simply reversing the wheel, so that the work will come against the opposite side of the cutting grains.

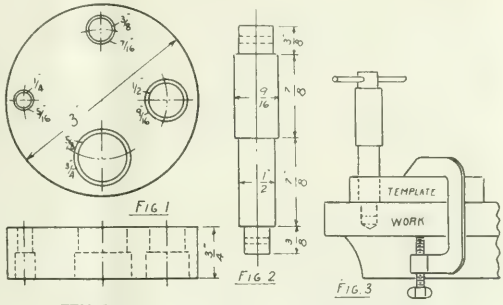
To examine the condition of a ground hole don't look through; let the light shine into it and look down at the hole as near right angle as possible. The use of the lubricating compound improves the cutting and prolongs the life of the wheel. A modern grinding wheel used on an up-to-date machine by a skilled operator is just as surely a milling cutter as if it were made of steel. Its cutting edges consist of millions of sharp cutting teeth, and each tooth as it comes in contact with the work cuts off a chip in the same manner as the tooth of a milling cutter. The chips are very small but when they are cut off at the rate of some millions per minute they soon begin to amount to something.

TEMPLATE AND PLUGS FOR TAPPING HOLES.

By J. WRIGHT.

WHEN tapping out holes in a vise or otherwise than with a tapping fixture, it is necessary to use a plug and template over the work in order to guide the tap straight. The template used for this purpose is generally made from a long piece of square stock, having several holes drilled in a line for the different taps used. The plugs are made in various lengths, the end being made tap-size to fit the work, and the shoulder end full-size.

A more compact arrangement, eliminating the need of a long template and several plugs for each size tap, is shown in the accompanying sketch. In Fig. 1, is seen a round disk in which are full-size holes drilled on each side, half the thickness of the template; these range



TEMPLATE AND PLUG FOR TAPPING HOLES.

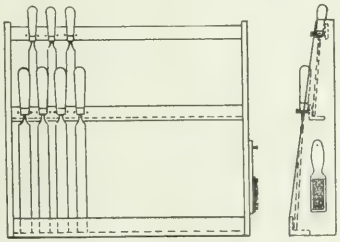
from ¼ in. up to ⅝ in. dia. The full-size ¼ in. and 5/16 in. holes are together, as are ⅜ in. and 7/16 in., etc. The template takes up less room than the kind generally used. The plug, Fig. 2, is turned so that both ends can be used for two size taps; in this case the shoulder ends are ½ in. and 9/16 in. respectively. Where eight plugs formerly were used, only four are required of this type.

A small hole is drilled in each end of the plug for inserting a piece of 1/16 in. stubs steel wire, to be used for a handle to draw out the plug with, as seen in Fig 3.

A VERTICAL FILE RACK

By G. Elliot.

IT is seldom one sees files arranged in any proper order on a workman's bench. This is because that there is no way that they may be kept so, for the reason that they require considerable room, and it is necessary to stack them together in order to save space. When they are arranged lengthwise with ends resting on the back partition of the work-bench, they become knocked down by jarring such as hammering work in a vise, etc. In the enclosed sketch is shown a file rack that can be easily constructed of light wood, in which the files are placed vertically and rested on the cross-piece as shown. The larger



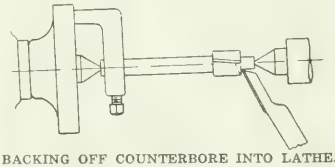
CONVENIENT FILE RACK FOR BENCH.

files are placed below and the smaller files above. Nails are driven in the cross-pieces for the handles to fit into and to prevent the files falling sideways.

BACKING OFF COUNTERBORES

By J. E. C.

AN accurate and quick method for backing off for the clearance on a counterbore is shown in the enclosed illustration. The usual method in doing this is to file the flutes in a vise, which is generally guesswork, as it is not possible to file them alike. As shown, the counterbore is placed on centres in a lathe. The lathe is then geared up to cut 1/16 in. or ⅛ in. pitch, or whatever clearance is desired. The edge of the flutes are first squared off, then the gears thrown in. The side tool as shown is set on an angle against the back edge of the flute; then, taking hold the belt with the hand, the spindle is turned sufficient to remove a chip from the back of the flute. This is repeated till the necessary stock is removed to the extreme cutting edge. The tool moves inward at each operation, cutting the edge off evenly around the guide. Each flute edge is cut separately. By this method the clearance on several counterbores can be backed off in the time formerly required in filing one in a vise.



BACKING OFF COUNTERBORE INTO LATHE.

THE SCREW MACHINE FEED

By D. A. Hampson.

"JUST how does that feed work?" That is the invariable question asked by new men when they go to work on an automatic screw machine and by persons watching the operation of the machine. The drawings show the construction of the parts and their relation.

The operation may be explained in brief as follows:—The bar of stock is controlled in its movements by a feed tube, at the inner end of which is screwed a feed finger or shell which grips the bar tight enough to move it under any ordinary circumstances, but not so tight that it will fail to slip if the bar is held in a more vise-like grip, and the feed tube pulled along. This tighter grip is furnished by the chuck, of collet type. When the chuck is opened the feed tube is given a forward movement, and the bar goes with it because there is no resistance beyond the friction of the bar. After the chuck is closed and the tools have begun their work, the feed tube is drawn back and the finger simply slides along to a position further back on the bar ready for the next feeding.

Fig. 1 shows a section of the spindle of an automatic with the above parts in place. The collet is operated by a tube that surrounds the feed tube; both of these tubes have grooved collars at their outer ends and movement is imparted through forks working in the grooves. The collet is forced into the hardened nose piece which, being tapered, causes it to close when moved forward (in one type of chuck, the collet itself is sta-

tionary and the movement of a surrounding piece causes it to close). Cams on drums or arms mounted on the cam shaft engage the forks that work in the grooved collars and impart movement to the tubes.

The two tubes are a regular part of the machine; the collets and feed fingers are equipment, and have to be purchased or made. On larger machines, one collet and one feed finger, or shell, is made to answer for several sizes of stock by the insertion of jaws which reduce the bore at the working point; aside from this, each size and shape of bar requires a collet and feed finger—always the pair together.

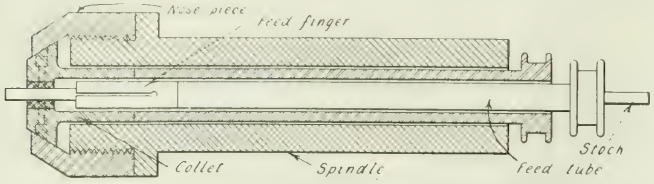


FIG. 1. SECTION OF SPINDLE SHOWING COLLET AND TUBE.

If these parts are to be made in the shop, they should be carefully made and hardened. A crooked hole in either piece will result in trouble in feeding the stock. Poorly tempered parts will be an endless source of trouble and delay. After turning in the lathe, both collet and feed finger have to be split as shown in the drawing. The collet should be sawed to make a three-pronged or four-pronged end and the finger the same, though the latter will work just as well if it is divided by a single saw cut as shown.

The same size hole is put in both collet and shell, but the hardening is so done that their final size differs. The feed finger is sprung together and wired so while being hardened, the idea being to so give that spring tension on the jaws that grips the stock. The collet, on the contrary, is wedged apart and wired so, and is then hardened, leaving the working hole so much oversize that the bar of stock passes very freely through it. The outside tapered part of the collet and the inside that works on the bar should be almost glass hard—the rest a spring temper. The working surface of the nose

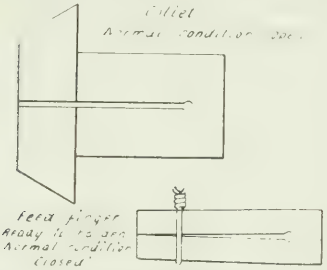


FIG. 2. NORMAL CONDITIONS OF COLLET AND FEED FINGER.

piece must also be very hard. Properly hardened and smooth these two pieces slide with practically no friction and the spring of the collet is sufficient to open it against the weight of the tube. The feed finger should be spring tempered with a hard end.

The nominal size of the machine is the size bar that will go through the feed tube and finger. No part of the feed tube should be a tight fit in the collet closing tube or the feed will not work or it will feed short. It will be noticed that the feed finger is partly within the collet; by making it this way, a minimum of stock is wasted. A short piece—about 1½ in.—cannot be fed up, and is always wasted.

Mention has been made of the hardened nose piece. Because it and the collet are hard and smooth, they are "slippery" and the collet opens readily. Anything that interferes with this condition is detrimental to free action—a little rust formed over Sunday has been the cause of the chuck not opening properly, and much time was spent in going over a machine in otherwise perfect shape until this was discovered as the only trouble.

TURBINE SPEEDS AND APPLICATIONS

By T. J.

IN the earlier stages of its development the steam turbine was considered in many quarters to hold great possibilities, not so much from high epxectations of thermal efficiency, as by reason of an assumption that it must prove an ideal prime mover for coupling to electric generators in power stations and propeller shafts in steamships. But mechanical arrangements seldom work out in practice along the line of the ideally simple and direct; and the speed of the large turbine units now in use has proved to be too high to permit of the satisfactory direct coupling of turbines either to propeller shafts or to generators.

Turbine speeds can, of course, be reduced by increasing the size of the motor, but only at the price of greater weight, higher initial cost and reduced efficiency; and consequently the present trend in both electrical and marine engineering is all in the direction of introducing some form of reduction gear between the turbine and the propeller shaft or generator.

The difficulty confronting the marine engineer is that the most efficient speed for a screw propeller is only about a quarter or a fifth of the most efficient speed of a steam turbine, and if he decides upon reduction gear his choice is between helical gearing, electric reduction drive and hydraulic reduction drive. The power station engineer is up against the fact that a direct-current generator running at 2,500 or 3,000 rev. per min. is subject to commutator troubles which, in spite of many ingenious devices, such as the radial commutator, are not easily overcome; so that a 5,000 kilowatt set in a single machine appears to be the limit for safe and efficient operation with a direct coupled turbo-generator.

If a larger power from one set is required, resort must be made to one of two alternatives. The first is to use a turbo-alternator, running at 3,000 or 3,600 revolutions per minute, in conjunction with a rotary converter. This forms a combination which, in certain cases, has distinct advantages.

Advantages of Turbo-Alternator

This combination is particularly suitable when direct-current power must be supplied to several points some distant apart, when the transmission losses and cost of mains can be kept to a minimum by generating at a moderate or high voltage, and transforming down at the sub-station where the rotaries are installed. In many instances direct current is essential for a part of the system only, while the remainder can be served more efficiently by an alternating supply, a case for which the rotary converter plant is peculiarly suitable. With such a mixed system of distribution the rotary has the further advantage that it can be inverted, taking direct current from sets with which it works in parallel, or from a battery, and supplying alternating current into the mains, thus helping out the alternating current sets in case of a breakdown. A further advantage arises if there is a linking up of several generating stations, because small direct current stations will receive alternating current from the trunk mains and convert it into direct current by means of a rotary, thus having their main-turbo-alternator sets as a stand-by; whereas, in the case of either the direct connected or geared direct-current generator, it will be necessary to use rotaries.

The other alternative is to use double helical turbine gearing to reduce the speed of the turbine to that most suitable for an engine type direct-current generator; the speed of the former is usually between 3,000 and 4,000 revolutions per minute for units of moderate size. The turbo-alternator rotary plant does not suffer from the limitation in desirable size which applies to direct coupling, and also, to a lesser degree, to the use of mechanical reducing gears.

THE first submarine boat of which history makes any record was built by a Dutchman, named van Driebel, in 1640. The boat was built in England with money said to have been advanced by King James I. According to reports the vessel had a unique ballasting system. There was a number of goatskin bags placed under the deck between two large planks. These bags, when filled with water, caused the vessel to sink. To cause it to rise again the bags were pressed together again with a windlass arrangement, forcing the water out, and thus giving the boat reserve buoyancy.

FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

REFLECTIONS FROM THE FETTLING SHOP OF A STEEL FOUNDRY*

By John Watson.**

IT is important at the outset to note that I am speaking from the standpoint of a jobbing steel foundry using open-hearth acid steel, for although first principles remain the same in jobbing as in repetition shops, cause and effect vary. For instance, we all recognize that one of the factors in foundry efficiency is a regular daily cast of a certain tonnage of castings. In a repetition shop this is a comparatively easy matter, as charges can be made up easily and small melting units are usually employed. In a jobbing shop the run of work may involve a variety of test specifications with their corresponding variety of analyses, and often it is a matter of great difficulty to assemble a daily cast to take the output of the large furnaces working in a jobbing foundry using acid open-hearth steel. This is a point on which close collaboration between the selling and manufacturing sides can greatly help the foundry efficiency.

Fettling Shop in Cinderella Role

The fettling shop in the Cinderella to its more favored sister, the moulding shop, and its open face is the mirror that reflects all the blemishes of that sister's vaunted superiority. I once heard a fettler say that if it wasn't for fettlers half the moulders would be out of a job. He did not mean the ordinary dresser, but the super-dresser, who, in Sheffield, is paid 18 cents per hour, plus extras, and is known by the euphonious name of the "knocker-up." This particular gentleman, coupled with the electric welder, is a standing monument to the inefficiency of the moulding shop.

Most of you will have heard of Euclid's famous axiom, "A straight line is the shortest distance between two points." Now in a steel foundry we have two such points—the order book and the loading bank—and the efficiency of our foundry depends on how near we can approximate to that straight line between these two points; but as we are not crows we have to modify our axiom by the consideration that the shortest distance may be round a corner, and to keep that curve efficient we must always keep before us the factor of continuity of direction—there must be no doubling back over the first track. Just as in our argument a straight line may be a curve, so a curve may be a straight line, and the application of the straight line curve is, in my opinion, the basis of success in manufacturing.

Value of Production Curves

It is surprising that the plotting of curves, and the correct solution of their meaning, is not more studied by managers than it is. I know of nothing more illuminating. Take, for instance, the curve of daily production plotted out, say, in tons delivered for each day worked; if you plot such a simple curve you will most probably get something like Fig. 1. Here is a curve showing the fluctuation of daily output, and the problem is to find out why the curve looks like a contour of the Himalaya Mountains, and how it can be made a straight line showing an equal daily distribution of output, as shown by the line A.

Suppose we have a fettling shop designed to finish and deliver 55 tons per week, then on an evenly-balanced output we should deliver 10 tons per day for five days, and five tons on Saturday, and our theoretical full efficiency line will be the straight line M.T. and diagnose it. You will find great difficulty in plotting this curve, but assuming that we have succeeded, in our datal work jobbing foundry, it will appear like Fig. 2. Here is plotted down the curve of daily effort expended by a hand fettler scaling an annealed steel casting. We will assume that his maximum effort is at the rate of 8 sq. ft. per hour, then his theoretical line will be the line A. His actual effort, however, only produces the shaded lines shown on each period, and this curve is worth studying.

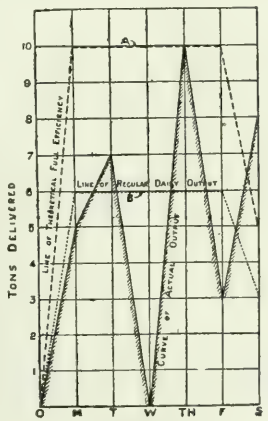


FIG. 1.

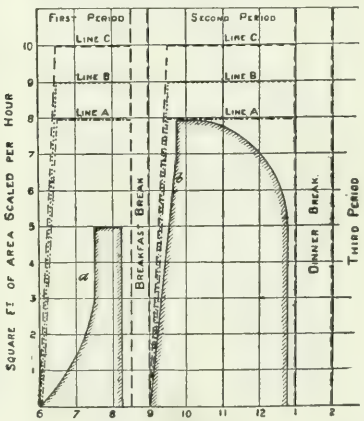


FIG. 2.

Factors in the Varying Daily Output

Let us follow it from 6 o'clock and trace its teaching. The straight line A is the theoretical full efficiency. It is a winter's morning, and the worker moves sluggishly; he is cold and most probably hungry, and his effort curve crawls slowly up to the point *a* about 7.30, when a sharp rise takes place in a few minutes. You will find that at this point the foreman has emerged from the warmth of his cabin, and the solace of his morning pipe and paper, and work goes on steadily with a straight curve to, say, 8.15, when the foreman goes back to his warm cabin and our curve drops sharply to the base line as our worker wanders off to warm his tea can. Then the breakfast break intervenes, and now see the change. The man is fed, he is warm with his hot tea and a smoke in front of the furnace, and his efficiency curve rises sharply to its maximum at about 9.45 a.m., and continues for an hour or so while he is feeling the benefit of his meal. His curve then droops, and again sharply drops when he wanders off to look for his dinner basket. The afternoon curve is a reproduction of the after-

line A. Our actual deliveries, however, are:—Monday, 5 tons; Tuesday, 7 tons; Wednesday, 0 tons; Thursday, 10 tons; Friday, 3 tons; Saturday, 8 tons. We get, on plotting, the shaded line or curve of actual output.

The manager's first problem is to reduce this irregular line to the line B showing regular daily output, and his next to make the line B coincide with the line A; that is what is meant by "push and go" in a steel foundry. An excellent education lies before the man who has never tried to solve this problem.

Let us see how in the solution of this simple curve we can utilize another not quite so simple, but vastly more illuminating. Let us try to find out what is happening between two points on our curve, say, during Tuesday's working hours, by plotting down a curve of the human effort expended in that day's production. In other words, we take the

*From a paper read before the Sheffield Branch of the British Foundrymen's Association.
**Steel Foundry Manager, Cammell, Laird & Co., Sheffield.

breakfast curve, except that it droops earlier and faster as the operator tires. The point *b* where there is a short, sharp rise about 9.45 o'clock, marks the manager's advent in the shop.

It needs no very hard thinking to read the lesson of this curve. The section No. 1 is absolutely inefficient and wants cutting out, so that our 6 o'clock start is damned to commence with. I consider it a relic of barbarism, and is, I believe, at the root of a great deal of bad timekeeping. In the man's most efficient stage covered by sections 2 and 3 of the curve, there is only one break in a period of 7½ hours. This curve then shows that a one-break day, allowing the operator to start warm and well fed and to finish without exhaustion, is the correct system.

If we are to give practical effect to a lot of the loose talk that goes on about educating the operators, then the question of physical exhaustion due to early starting and long hours must be considered. You cannot get good results from a tired body. I have taken it out, and I find the average hours worked apart from overtime are not more than 49 per week, so that you are really working a very badly balanced 48-hour week, and by readjusting the distribution of that time on the one-break system you must, in my opinion, get more efficient working.

It is often remarked that men lose very little time when they are on night shift because they are paid more money. I do not agree with that reason. I believe that it is mostly due to the fact that a man's household have time to prepare a decent hot meal for him and get him away in good time for his night's work. I find that men work on the night shift not from a love of it, but because it enables them to average up their wages which are low on the day shift through the often intolerable conditions of our six o'clock start. The great majority of men who lose time on the day shift are not slackers.

We have seen that efficiency rises when the foreman gets going—we have seen that efficiency rises when the manager gets going—and from this we reflect that the highest efficiency will be obtained by making this working period common to all who have anything to do with the business, i.e., manager, clerks and operators should start at the same time.

Efficiency Curve for Managers and Foremen

Before I pass from this curve I would suggest that it would make a bit of useful education to any foreman or manager to plot out this curve of his own efficiency. If he has the usual amount of self-conceit prevalent in foundries, he will get his curve away up above the theoretical maximum line (as shown by line C in Fig. 2). Of course, as the manager or foreman is supposed to be on top of his job, his theoretical efficiency line will be above the operator's line, as shown by line B. Now, if he is an honest thinker he will quickly recognize that the super-height of his curve is the measure of his amount of swelled head, and when he examines the same period of time on the production curve he will most likely find a V-shaped depression as we have on the first curve at W—the rut that the moulder is in. This curve of swelled head is one of the contributory causes to the rut. Erode the peak, and the rut will begin to fill up. By efficiency I mean a high rate of production of good quality castings, at a relatively low cost rate, from a body of well-paid, contented operators and staff.

Proper Sequence of Operations

I mentioned that we must always keep before us the factor of continuity of direction. How rarely one finds this in a jobbing steel foundry. There is rarely any idea of a proper sequence of operations. The furnace is often in the wrong place, drying stoves in the wrong place, making it incumbent on the travelling cranes to be continually shifting moulds backwards and forwards. If the furnace is at one end of the shop and the drying stoves at the other, you

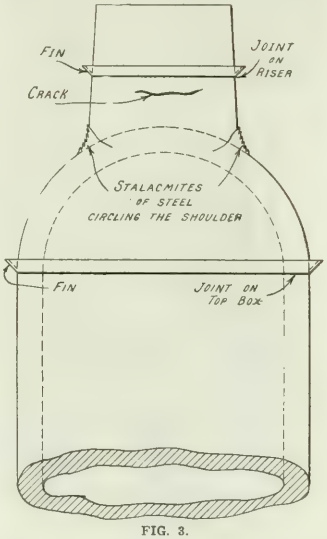


FIG. 3.

close and set the moulds at the stove end, the steel has to travel over the moulding area to the pit, and the moulders for an hour, say, are left craneless. That interferes with output.

Let us look at the sequence of operations in the foundry:—Moulding, coremaking, drying, closing, casting, knocking out, sand blasting, riser removal, annealing, fettling, testing, finishing, loading. I have left out pattern-making, for in jobbing-shops most of the patterns are sent in and the pattern-maker's chief business is to keep the moulder right (if he can), in his closing. With the exception of hand moulding, core making and melting, the whole business is purely mechanical, and the speed of production largely depends on the balance of output from each operation, the perfection of the means of transit from one operation to another, and the efficacy of the machinery for performing each operation.

What a misnomer the term moulding shop often is in the jobbing foundry. How often one finds it a conglomeration of moulding area, box park, knocking-out shop, fettling shop, scrap-heap, and goodness knows what. The moulding shop should be a place to mould in; the dirty work should be done in other shops fitted for the purpose. Then a bit more of the valleys in the first curve will be found filling up.

There is no secret in a steel foundry; there is plenty of delusion, and the whole question of "quantity" resolves itself into an engineering problem of the application of the straight line. It is, however, when we come to consider quality in a steel foundry that we are confronted with the real problem. Quality is that condition in a casting that enables it to pass through all the successive stages from the casting pit to the loading bank with a minimum of trouble and cost and strengthens the salesman's hand by making the buyer (like Oliver Twist), ask for more.

Factors in Quality Output

Quality depends primarily on two factors:—1—The foreman moulder; 2—the molten steel. I put the steel last, because, in my experience, it is the least important of the two. The instructions given to the operating moulder by the foreman, such as the position to place the runner, the right way to mould the job, the position and size of risers, the use or abuse of core irons, and the putting on of brackets in 99 cases out of a 100 determine whether the job will be good or not, and it is in these points that the weak spot in our steel foundries lies. The great majority of foremen moulders are not properly trained.

It is a most melancholy reflection that such a fine body of men should be handicapped by what is a serious defect in our shop training. I mean that education of foremen to think on correct scientific lines, enabling them to rise above the "hit and miss" methods so prevalent in our shops. Employers of labor will have to face this question, and its solution starts with the apprentice moulder. A foreman must come from the operating moulders; he must go through the mill of the apprenticeship drudgery, but employers must insist that mental training proceeds with the manual training, and part of that mental training should, I think, be carried out in the works, so that lads can be taught to appreciate the co-ordination between manual effort and technical training, not as a thing apart from their daily toil, but as a powerful weapon to enable them to make that toil more productive in earning capacity for themselves, and for the man or corporation that employs them.

The excessive use of brackets, core irons and risers are, in my opinion, the distress signals of the foreman moulder. He is too often so obsessed by the fear of what the steel-maker is going to give

him that his mind is incapable of analysing his difficulties correctly. It is always good policy for a manager when the foreman tells him that last night's charge was like "bull muck" to examine the charge sheet, and get busy in the fettling shop. He won't take long to find which casting has worried the foreman. You'll usually find it by the number of brackets on it—a kind of steel hedgehog. Tell a foreman a casting is a "ship casting," and he'll go bracket mad. Tell him it's a furnace door, and you'll get a better casting with no brackets on it at all. I firmly believe that the blaming of the steel-maker for bad or cracked castings is the greatest piece of bluff ever put up in a workshop. For many years now I have never failed to get correct test results from the steel supplied, except where it has been contaminated in the mould or spoilt by mechanical action in the mould. I do not think it reasonable to suggest that 30-ton steel, giving an elongation of 30 per cent. on 2 in. and 180 deg. bend (a steel being made daily in our Sheffield foundries), is a bad steel or a steel responsible for the cracks in castings.

Critical Period of Steel Castings

Foreman moulders do not fully recognise or believe that the critical period of a steel casting is just at the point of change from the liquid to the solid state, not only because the metal is then in a pasty condition, but because the main contraction comes on that moment, and the casting will crack if the mould and cores are not sufficiently friable to allow that sudden movement to be unrestricted. This contraction is so fast that in a job cast vertically you will frequently find that part of the steel near the base of the riser has lagged behind the mass and appears as a row of small stalagmites on the cold casting. I have repeatedly found them 5-16-in. long on the top end of a cylinder whose contracting length was 4 ft.

Fig. 3 illustrates the point. A dome-ended cylinder was cast with the dome end up and the feeding riser placed as shown. The joint of the top box and the riser box are shown. In cases where no fin formed at these joints the stalagmites of steel were much in evidence, but when fin did occur through bad jointing the stalagmites were absent, and the fins were bent almost vertical, and in one case, although the fin o nthe riser was only ¾ in. wide by 1/16 in. thick, a crack 9 in. long occurred on the riser just below the fin. Examples such as this show the speed of contraction, and the danger of cracking through even a very slight resistance to contraction at the critical point of solidification.

You can always tell whether a foreman grasps this question of contraction by watching if he slackens a job after it is cast. All slackening should be done when the mould and cores are being made and dried, and with the exception of easing round a riser the casting should not be disturbed until it is cold enough to lift, and I want to see foreman moulders so trained that, without a thought to the steel, they can produce a sound steel casting by scientific moulding methods.

A great deal has been talked about the excellence of German steel castings. I have examined every German casting I could get hold of, and I have not found one made of better steel than we are daily supplied with in our Sheffield foundries, but I believe I am right in saying their methods of moulding were superior. I have seen a German 12-ton ship casting, and it had been made with only eight brackets on it. I have seen a similar British casting made of better steel with 200 brackets on it, and the German casting was the more saleable article—"it had quality." My experience forces me to the conclusion that method of manufacture in the moulding shop and not the steel is the main factor in securing quality in steel castings.

FOUNDRYMEN'S CONVENTION AND EXHIBITION

THE success of the exhibition of foundry supplies and equipment, machine tools and accessories, to be held in Boston, Mass., during the week of September 24, concurrently with the annual conventions of the American Foundrymen's Association and American Institute of Metals, is already assured, since nearly 150 manufacturers have made reservation of 45,000 square feet of floor space, an amount well in excess of that occupied at Cleveland a year ago. Judging from the convention programme scope as regards subjects to be discussed, it is quite apparent that the development of foundry practice along right lines continues to expand and grow in importance. Program details follow:—

A. F. A. Programme, Monday, Sept. 24

10 a.m.—Registration, Mechanics' Building.

1 p.m.—Opening of Exhibition, Mechanics' Building.

3 p.m.—Joint opening session, American Foundrymen's Association and American Institute of Metals, Paul Revere Hall, Mechanics' Building.

Address of welcome, by Hon. James M. Curley, Mayor of the City of Boston.

Response to the address of welcome, by R. A. Bull, Duquesne Steel Foundry Co., Coreopolis, Pa.

Annual address by J. P. Pero, Missouri Malleable Iron Co., East St. Louis, Ill., president, American Foundrymen's Association.

Annual address by James L. Jones, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., president American Institute of Metals.

Report of Executive Board of the American Foundrymen's Association.

Report of the Secretary-Treasurer of the American Foundrymen's Association, by A. O. Backert, Cleveland.

"Fire Prevention in Large Industrial Establishments," by C. Johnson, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Appointment of Nominating Committee and Committee on Resolutions.

Tuesday, Sept. 25, 10 a.m.—Paul Revere Hall

"The Foundry from the Viewpoint of the Sales Engineer," by H. R. Atwater, Osborne Mfg. Co., Cleveland.

"The Relationship of the Engineering Department to the Pattern Shop and Foundry," by F. J. McGrail, Struthers-Wells Co., Warren, Pa.

"How Character Analysis Solves the Men Problem," by William Judson Kibby, Employment Specialist, Cleveland.

Report of A. F. A. Committee Advisory to the U. S. Bureau of Standards, by Richard Moldenke, Chairman, Watchung, N.J.

"Efficiency in the Foundry," by James A. Fitzgerald, Reno, Pa.

"Co-operative Shop Training," by W. B. Hunter, Fitchburg, High School, Fitchburg, Mass.

1.30 p.m.—Boat ride in and about Boston Harbor. Luncheon will be served on board.

Wednesday, Sept. 26, 10 a.m., Paul Revere Hall

"Improving the Relationship Between Employer and Employee," by J. F. Kent, American Cast Iron Pipe Co., Birmingham, Ala.

Report of A. F. A. Committee on Safety, Sanitation and Fire Prevention, by Victor T. Noonan, Chairman, Industrial Commission of Ohio, Columbus, O.

Report of A. F. A. Committee on Foundry costs, by B. D. Fuller, Chairman, Westinghouse Electric and Mfg. Co., Cleveland.

Report of A. F. A. representatives on the Conference Board on Training of Apprentices, by Frank M. Leavitt, Chairman, University of Illinois, Chicago.

"The Labor Situation as Relating to Co-operation Between the Employer and Employee," by G. B. MacIlwain, Babaon's Statistical Organization, Wellesley, Mass.

"Micro-Metallography for the Foundry," by Robert J. Anderson, Cleveland Metal Products Co., Cleveland.

Report of nominating committee and election of directors.

Malleable Session, 10 a.m., Mechanics' Building

"The Theory of the Modern Waste-Heat Boiler and Possible Application of Such Boilers to the Malleable Melting Furnace," by A. D. Pratt, The Babcock & Wilcox Co., New York.

"Application of Waste-Heat Boilers to the Malleable Melting Furnace," by C. D. Townsend, Danville Malleable Iron Co., Danville, Ill.

"Application of Pulverized Coal to the Air Furnace," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

"The Application of Pulverized Coal to Malleable Melting Furnaces," by Joseph Harrington, Advisory Engineer, Chicago.

"How Malleable Iron Has Improved," by Enrique Touceda, Consulting Engineer, Albany, N.Y.

"Troubles Encountered in Machining Malleable Iron: Causes and Remedies," by A. T. Jeffery, Dayton Malleable Iron Co., Dayton, O.

"Comparative Carbon Losses in Malleable Iron Annealing by Muffle and Pot Oven Methods," by Joseph B. Deisher," The T. H. Symington Co., Rochester, N. Y.

The Effect of Iron Oxide in Moulding Sand," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

3 p.m.—Baseball game, Fenway Park, Boston and Cleveland American League Teams.

8.15 p.m.—Theatre party.

Thursday, Sept. 27, 10 a.m., Paul Revere Hall—Gray Iron Session

"Note on Fine Molding Sands," by C. P. Karr, Associated Physicist, U.S. Bureau of Standards, Washington, D.C.

Report of A. F. A. Committee on General Specifications for Gray Iron Castings," by W. P. Putnam, Chairman, Detroit Testing Laboratory, Detroit.

"Briquetting Foundry Borings," by A. L. Stillman, General Briquetting Co., New York.

"Cast Iron Shells in Permanent Molds," by Edgar Allen Custer, Consulting Engineer, Philadelphia, Pa.

"The Seasoning of Gray Iron Castings," by L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R.I.

"Factors in the Economical Production of Small Cores in Large Quantities," by R. E. Kennedy, University of Illinois, Urbana, Ill.

"Modern Centrifugal Cupola Blowers," by J. W. Shugg, General Electric Co., Schenectady, N.Y.

"The Effect of High Sulphur in Gray Iron Castings," by T. Mauland, International Harvester Co., Chicago.

Steel Session, 10 a.m., Mechanics' Building

"Molding and Casting Large Slag Pots," by C. J. McMahon, Illinois Steel Co., Chicago.

"A description of a Small Open-Hearth Furnace," by David McLain, McLain's Systems, Milwaukee.

"Small Steel Castings for Ordnance Purposes," by Major C. M. Wesson, Watertown Arsenal, Watertown, Mass.

"A New System of Burning Crude Oil," by W. A. Janssen, Chairman, Davenport, Iowa.

"The Use of Vanadium in Steel Castings," by J. Lloyd Uhler, Union Steel Castings Co., Pittsburgh.

Report of A. F. A. Committee on Steel Foundry Standards, by W. A. Janssen, Chairman, Davenport, Iowa.

12.00 noon—Luncheon for the ladies followed by an automobile trip.

12.30 p.m.—Visit to the West Lynn Plant of the General Electric Co. Luncheon will be served at the works.

7.00 p.m.—Annual banquet, Copley-Plaza Hotel.

Friday, Sept. 28, 10 a.m., Paul Revere Hall

"Solution of Foundry Transportation and Conveying Problems," by Robert E. Newcomb, Deane Works, Worthington Pump and Machinery Co., Holyoke, Mass.

"Sand-Blasting in the Foundry," by H. L. Wadsworth, Sand Mixing Machine Co., Cleveland.

"Results of Tests in Blending and Mixing Sand by Means of Mullers," by R. F. Harrington, Hunt-Spiller Mfg. Co., Worcester, Mass.

"Factors Contributing to the Economical Use of Grinding Wheels in the Foundry," by Wallace T. Montague, Norton Co., Worcester, Mass.

"Refractory Materials Employed in the Metallurgical Industries," by H. C. Arnold, University of Illinois, Urbana, Ill.

Steel Session 10 a.m., Mechanics' Bldg.

"Electric Furnace Design," by John A. Crowley, John A. Crowley Co., Detroit.

"Recent Developments in the Application of the Electric Furnace to the Melting Problem," by Douglas Walker, Booth-Hall Co., Chicago.

"Comparison of Electric Furnace and Steel Converter for the Manufacture of Small Steel Castings," by C. R. Messinger, Sivyer Steel Casting Co., Milwaukee.

"The Electric Furnace From the Central Station Standpoint," by E. L. Crosby, Detroit Edison Co., Detroit.

"The Electric Furnace in the Iron and Steel Foundry," by Max Trembour, Metallurgical Engineer, Ludlum Steel Co., Watervelt, N.Y.

Plant visitation.

Program American Institute of Metals

Monday, Sept. 24

10 a.m. — Registration, Mechanics' Building.

3 p.m.—Joint opening session American Foundrymen's Association and American Institute of Metals, Paul Revere Hall, Mechanics' Building.

Tuesday, Sept.25

9.30 a.m.—Hotel Somerset. Melting and Casting Nonferrous Metals.

"Raw Materials Used for Crucibles," by Prof. A. V. Bleininger, Bureau of Standards, Washington, D.C.

"Melting Yellow Brass in New Form of Induction Furnace," by G. H. Clamer, Ajax Metal Co., Philadelphia.

"Casting Bearings in Sand and Metal Molds," by R. R. Clarke, Pennsylvania Lines West of Pittsburgh, Pittsburgh.

"Negative Experiments on Waste Core Sand," by Dr. H. W. Gillett, Bureau of Mines, Ithaca, N.Y.

"The Crucible Situation." by M. McNaughton, Jos. Dixon Crucible Co., Jersey City, N.J.

"The Electric Furnace, and Nonferrous Metals," by Dwight D. Miller, The Society for Electric Development, New York City.

"My Experience with Metal Melting Furnaces," by W. H. Parry, National Meter Co., Brooklyn, N.Y.

"The Briquetting of Nonferrous Light Metal Scrap," by A. L. Stillman. General Briquetting Co., New York City.

1.30 p.m.—Boat ride in and about Boston Harbor. Luncheon will be served on board.

Wednesday, Sept. 26, 9.30 a.m., Hotel Somerset—Uses of Nonferrous Metals for Munitions, Etc.

"The Present Status of Tin Fusible Plug Manufacture and Properties," by Dr. George K. Burgess, Bureau of Standards, Washington, D.C.

"Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

"The Use of Die Castings in Munitions," by Chas. Pack, Doehler Die Casting Co., Brooklyn, N.Y.

"Shrapnel Bullets," by Harold J. Roast, The Jas. Robertson Co., Ltd., Montreal, P.Q.

"A Few Points on Alloy Patents,'" by Wm. J. Rich, Patent Office, Washington, D.C.

Address by a representative of the United States Tariff Commission.

"The Use of Bronzes in Railroad Turntables and Movable Bridges," by O. E. Selby, Big Four Railroad, Cincinnati.

"Recent Industrial Uses of Aluminum," by F. G. Shull, Aluminum Co. of America, Boston.

"The Consumption of Copper and Its Varied Uses," by H. D. Hawks, United Metals Selling Co., New York City.

3 p.m.—Baseball game, Fenway Park, Boston and Cleveland American League teams.

8.15 p.m.—Theatre party.

Thursday, Sept. 27, 9.30 a.m., Hotel Somset—Testing of Nonferrous Metals.

"Comparative Tests on Test Bars and Actual Castings," by W. M. Corse, Titanium Bronze Co., Niagara Falls, N.Y.

"Analysis of Babbitts and Brasses," by E. W. Hagmaier, Buffalo.

"Standard Test Bars of 88-10-2 and 88-8-4, Being the Result of Co-operative Work of Six Foundries; a new series of Tests," by C. P. Karr, Bureau of Standards, Washington, D.C.

"The Expansion of Co-efficients of Alpha and Beta Brass," and "The Corrosion of Manganese Bronze Under Stress," by Dr. Paul D. Merica, Bureau of Standards, Washington, D.C.

"Corrosion of Brasses of the Muntz Metal type," by H. S. Rawdon, Bureau of Standards, Washington, D.C.

Address by Richard C. Maclaurin, President, League to Enforce Peace.

"The School End of the Job in Training Foundrymen," by Dean C. B. Connelley, Carnegie Institute of Technology, Pittsburgh.

"The Flux and Cleaner Question of Brass," by E. D. Frohman, S. Obermayer Co., Pittsburgh.

"Pyrometers—Their Construction and Application," by John P. Goheen, Brown Instrument Co., Philadelphia.

"Electrically-heated Core Ovens," by Dr. C. F. Hirshfeld, Edison Illuminating Co., Detroit.

"Brass Rolling Mill Alloys," by Roy A. Wood, Cheshire, Conn.

12 m.—Luncheon for the ladies, followed by an automobile sight-seeing tour.

12.30 p.m.—Visit to the West Lynn plant of the General Electric Co. Luncheon will be served at the works.

7 p.m.—Annual banquet, Copley-Plaza Hotel.

Friday, Sept. 28, 9.30 a.m., Hotel Somerset—Metallurgy and Metallography

"The Electrolytic Production of Antimony," by Prof. D. J. Demorest, Ohio State University, Columbus.

"The Electrical Properties of Some High Resistance Alloys," by Prof. M. A.

Hunter, Rensselaer Polytechnic Institute, and F. M. Sebast, Troy, N.Y.

"The Amorphous Theory in Metals," by Zay Jeffries, Aluminum Castings Co., Cleveland.

"The Volatility of Zinc and Cadmium," by John Johnston and Edward Schramm, American Zinc, Lead and Smelting Co., St. Louis.

"Surface Tension and Deoxidizing of Metals," by W. J. Knox, Metals Deoxidizing and Refining Co., New York City.

"Antimony—Its Metallurgy and Uses," by K. C. Li, Wah Chang Mining and Smelting Co., Inc., New York City.

"Development and Reabsorption of the Beta Constituent in Alloys Which Are Normally of the Alpha Type," by Prof. C. H. Mathewson, Department of Mining and Metallurgy, Yale University, and Philip Davidson, New Haven, Conn.

"The Swelling of Zinc Base Die Castings," by H. M. Williams, National Cash Register Co., Dayton, O.

Plant visitation.

IS THERE A SUBSTITUTE FOR IRON FOR PERMANENT MOULDS?

IT IS generally acknowledged that the labor costs on sand and other moulds run up the prices of castings to what is often nearly a prohibitive figure, and for this reason iron moulds are used for many things which have to be made in large numbers, and while these iron moulds are good up to a certain point, they still leave much to be desired. For instance, they are not in any way porous, and for this reason gases can only escape at points specially arranged instead of from any part of the casting (by absorption) as in sand moulds. This renders special care in dealing with the metal in very many cases, while in some instances it is not safe to attempt casting in iron moulds. Naturally, iron moulds in suitable cases prove economical, but in such instances as they are unsuitable they are merely a waste. What is wanted is a refractory material which can be made up into porous moulds having a capacity of holding up to 100 or more castings without alteration, and which can be recovered for remanufacture into moulds. Costs being a very important item, and the total expenditure having to be less than that of sand moulding, probably the matter is one that offers many difficulties, but such that probably could be overcome with patience and practical experimental work. For instance, grained emery or corundum would probably stand the wear incidental to casting; but could they be cemented in such a way as to remain porous, and be capable of being broken down and remain in good condition for making other moulds; and could this be done in a way that could be used in ordinary foundry practice? If this or a similar material could be adapted for the work, and show a saving of, say, 10 per cent. reduction in the cost of actual moulding, there would be from 15 per cent. to 20 per cent. savings to be made in the melting and pouring of the metal, the saving in time in dealing with the moulds after they are made being an important item. There is a good opening for inventiveness in the direction pointed out.—The "Practical Engineer."

PROFITABLE DISPOSAL OF METAL CUTTINGS

By D. Street.

METAL chips, in the shape of borings, turnings and planing scrap, often amount to 10 per cent. of the total production of the machine shops, and it is not altogether an easy matter to dispose of this waste material to advantage. It is apparent that the most economical way to deal with it is to use it in place of other materials in furnace mixing, but here there is a difficulty in charging a furnace with loose chips. The forced draught blows a large proportion away, and a further big percentage is subjected to violent combustion and goes at once into slag as ferric oxide. When loose chips are charged into a furnace it is safe to say that at least one-half of the total weight is wasted and the large amount of viscid slag that is produced seriously interferes with the efficient working of the furnace.

Proposed Methods

Some years ago it was suggested that the metal chips might be packed in wooden or cast metal cases before they were added to the furnace mixture, but, taking everything into consideration, this method is far from economical. Another method which was advocated was that the chips should be exposed in large volume to the atmosphere, so that they might rust into a solid form; but here again the method in practice is expensive. The proposal to feed the chips into the furnace with a low power blast has also been found to work unsatisfactorily. Some engineers have added binding material to the chips and pressed the mixture into bricks, but in almost every case it has been found that the binder disintegrated the moment it was exposed to heat and the briquettes simply broke into free metal dust. There was not only a great loss, due to oxidation under the action of the binder, but the furnace loss had also to be taken into account.

For many years past German engineers have done their utmost to develop the use of low-grade ore and waste metal in their country. They have been the largest users of waste steel plate, and the problem of utilizing metal chipings to the best advantage was tackled some little time ago with almost complete success.

Present Practice

In all German metal workshops the chips are saved and sheltered as far as possible from atmospheric influence. If the shop has not the necessary facilities for dealing with the chips itself, storage of them is made until a sufficient quantity has accumulated to justify despatching them to works which can deal with them efficiently. The method adopted is to load the metal scrap into a press and subject it to a very high pressure. The chips are thus compressed into briquette form without the aid of any binding material. The blocks can be loaded into the furnaces and practically no loss results through burning or through particles being blown away, and these blocks are used as a substitute for expensive grades of pig iron in the production of high-grade cast metal.

In steel foundries it has been pointed out that these briquettes might serve as a substitute for the low phosphorous white iron that is now in such demand. In fact, they can be economically used in any place where steel scrap is used, whether it be in the foundry or the steel mill, as briquettes of steel or wrought iron are a good charging material.

Chips from hard rolls, projectiles, and the like, may be mixed with grey iron chips, so as to make a uniform charging material. Chips from copper, brass, bronze and white metal have also been pressed into briquettes, and a considerable saving in cost has been effected. This is due to the fact that the cost of pressing the chips is much less than the value of the savings that are effected in other ways, such as in the oxidation of the metal in remelting, the easier methods employed in handling the chips and the less space that is required in which to store them.

BLOW AND GAS-HOLES IN IRON CASTINGS

By L. E.

IT sometimes happens in places where really good iron and coke are used in cupola melting, that holes under the skin of the castings cause trouble, and it may very well happen that the cause cannot be found by analysis of the metal and fuel. At the same time, it usually happens that the furnace man complains that his furnace burns away at points opposite the tuyeres, while the machinemen grumble at the hardness of the mettle, the whole thing appears somewhat incomprehensible on account of the good quality of the material used. In reality the fault is caused by the air blast being too high in pressure and too low in volume, there not being sufficient oxygen supplied to melt the iron rapidly by the high rate of combustion of the fuel. So long as the air pressure is enough to enable the whole of the fuel to get its supply of oxygen it is ample, but the quantity of air supplied must also be ample, and in all cases at least 6½ lbs. of air—roughly, 85½ cubic feet of air—is needed for each pound of coke used in the cupola if the best results are to be secured. To get this air the propeller, whether called a fan or blower, must be of sufficient size, there must be as nearly a straight passage for the air from the propeller to cupola, and this passage must be free from angles and sharp bends, and, last of all, the tuyeres must be of sufficient area.

The main air passage from the propeller apparatus should be larger than the exit orifice of the fan or propeller, owing to the friction of the walls considerably reducing its effective area, and the shorter the distance from the propeller to the cupola, the more efficient will be the work done.

EDITORIAL CORRESPONDENCE

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SWEDISH IRON AND STEEL INDUSTRY

FROM time immemorial mining and the manufacture of iron have been industries of very great importance. The principal reason for this is that Sweden possesses one of the greatest supplies of iron-ore in Europe. According to a valuation of the supplies of iron-ore of the world at present known, which was published at the International Geological Congress of 1910, Germany's supply was reckoned at 3,607 million tons of iron-ore, France 3,300 million tons, and England 1,300 million tons, while the Swedish deposits of iron-ore are calculated at 1,150 million tons. It must also be observed that Swedish iron-ore is unusually rich. According to the above-mentioned extensive international investigation it is calculated that the whole world possesses 1,300 million tons of iron-ore which has 60% or more of iron; of this quantity Sweden owns no less than 1,035 million tons. The Swedish iron-ore supplies are found in two separate districts, one in the midlands, north and west of Lake Malar, and another in the far north of Sweden, a little beyond the Polar circle.

Increased Production

According to figures published by "Swedish Export," the total annual production of iron-ore in Sweden first exceeded one million tons during the period 1891-95 when the average annual output was 1,519,325 tons, rising in 1912 to 6,699,226 tons, the increase being very marked from 1910 on. In the year 1911 the whole world produced 136 million tons of iron ore, Sweden, with 6,150,718 tons occupying seventh position. Since 1871, Sweden and the United States have increased their production of ore almost ten-fold, Great Britain remaining almost stationary in this respect until recently.

The great bulk of the ore is exported, Germany taking by far the greater portion, followed by Britain, Belgium, France, and America in the order named. The chief reason for such exportation is the fact that Sweden lacks a natural supply of fuel.

High Quality Ore

As regards the quality of Swedish iron-ore it has been shown that no other country possesses a similar supply of ore with such a high percentage of iron; besides which the greater part of the ore mined in the midlands is unusually free from phosphor and sulphur, and consequently is an excellent material for the production of steel of the highest quality. Statistics show that the average quality of ore from the midlands contains 0.005—0.020% phosphor and 0.007—0.050% sulphur. During recent years the Swedish iron manufacture has obtained a further addition of ore free from phosphor and sulphur since the magnetic concentration of low grade ores has become more general, and as a consequence the production of briquettes. The development of the manufacture of concentrates and briquettes is shown by the following figures:

Year	Concentrates, Tons	Birquettes, Tons
1906	131,407	78,205
1907	178,567	88,532
1908	296,400	193,216
1909	225,983	148,380
1910	365,985	247,946
1911	381,190	255,948
1912	520,710	288,553

The total quantity of concentrates, which is manufactured according to the methods invented by Mr. Grondal, a Swedish engineer, has a percentage of iron of 50—70, and the percentage of phosphor only exceptionally exceeds 0.010%, although the raw ore which is refined has in certain cases contained more than 1% of phosphor. With the object of making the concentrates in piece-form and at the same time reducing its percentage of sulphur it is briquetted according to the Grondal method by heating up to 1,200—1,400 degrees C. without the addition of any binding substance, whereby the concentrate is softened by the heat and becomes a coherent mass. The briquettes thus obtained seldom have a percentage of sulphur of more than 0.010%. In 1912 the Swedish iron-ore mines employed 10,500 workmen and the value of the iron-ore produced was 49.6 million Kr.

Manufacture of Iron and Steel

The Swedish iron industry is of very ancient origin. According to the authority already quoted, as early as prehistoric times iron was manufactured in Sweden from hydrated ores, collected at the bottom of the lakes and marshes. The smelting was done by means of holes made in the ground and with the aid of wood as fuel. These holes were lined with slabs of stone. The inhabitants soon learned how to use the rich metals found in the ore, and small ironworks began to appear near the watercourses. Our ancient documents bear witness of a considerable mining industry. In a deed of exchange dated 1288 Stora Kopparberget is already mentioned and a deed of sale concerning certain interests in the Norberg mining fields bears the date 1303. In 1347 Stora Kopparbergs Bergslag obtained their first royal privileges. Several of our steel works still in existence were founded in the sixteenth and seventeenth centuries. An abundant supply of rich and pure ores, wealth of charcoal and more than sufficient water-power soon enabled Sweden to play an important part in the international iron market, and at the commencement of the eighteenth century Sweden was the country that produced the largest annual supply of pig-iron. At that time, however, several metallurgical inventions were made which very greatly neutralized the aforementioned advantages regarding the natural supplies upon which Sweden based her pre-eminence as an iron-manufacturing country. In the year 1730 cokes replaced charcoal as fuel for blast-furnaces in England, and very soon afterwards manufacturers learned how to eliminate phosphor from highly phosphoric pig-iron by means of puddling. Thus as soon as the discovery of the extraction of iron suitable for ordinary purposes from low quality ores with the aid of coal was made, the extent of the manufacture of iron in England, Germany and France soon exceeded that of Sweden.

Charcoal Versus Coke

The supply of very high quality ores and first class fuel in the form of charcoal has enabled Sweden to maintain her prominent position as the producer of the finest quality of steel in the world. As regards the manufacture of Swedish pig-iron it is, as has already been mentioned, chiefly based upon ores containing a minimum of phosphor, and charcoal as fuel. The supply of ore free from phosphorus can nowadays, especially through the introduction of Grondal's method, be said to be unlimited and the price of pig-iron is determined in the first place by the price of charcoal. Since, however, the waste wood obtained from the forests and saw-mills is becoming more and more used for the manufacture of cellulose, the supply of charcoal is being reduced and consequently its price has risen. The charcoal question is therefore of the greatest importance to the iron industry, and the most energetic efforts are being made to reduce the price of charcoal on the one side and to spare its consumption in the blast furnaces on the other. The coaling of the waste wood in furnaces instead of producing charcoal in heaps may be mentioned as an effort in the former direction. Charcoal heaps produce less coal than furnaces, besides which furnaces enable one to collect the by-products of tar, methylated spirits, wood-vinegar, etc.

On the other hand, as has already been mentioned, efforts are being made to reduce the consumption of charcoal at the iron works. Previous to the year 1900 all steel, even the simplest implements for home use, was produced from charcoal pig-iron whereas nowadays coke is beginning to be used as fuel at iron-works that manufacture steel for the Swedish market only. Thus in the

year 1912, 86,000 tons of coke pig-iron were manufactured.

Electrical Developments

The most important step taken for the reduction of the consumption of charcoal dates, however, from the year 1910 when the electric blast-furnace, invented by three Swedes, Messrs. Lindblad, Stalhane, and Gronwall, was technically worked out at the expense of "Jarnkontoret", (The Institute for the advancement of the Swedish Iron Industry) so that it was then possible to introduce it into several Swedish ironworks. In this furnace only so much charcoal is consumed as is necessary for the reduction of the ore, while all the heat essential for smelting is supplied by electric power. About 1-3 h.p. is used per ton of pig-iron with an electrode consumption of 3 kg.

The consumption of charcoal at Swedish iron-works has, owing to the aforementioned measures, been constant during the last few years, while the manufacture of pig-iron has rapidly increased. The pig-iron, which is of the highest quality guaranteed to contain a maximum percentage of 0.020 phosphor and 0.010 sulphur, is used as raw material for tool-steel and especially for war-material (armor-plate, guns, etc.). Of the export of 1912 103,348 tons were shipped to England, 41,818 tons to Germany and 20,698 tons to France. Smaller quantities were exported to The United State of America, Italy, and Japan. As charcoal pig-iron of such an excellent quality cannot be produced in any other country, Sweden enjoys a certain monopoly of this special branch of the iron market.

Production of Wrought Iron and Steel

In Sweden, as in other countries, the production of wrought iron has for ages only been carried on in hearths with charcoal as fuel. The metal was prepared according to old German and Belgian principles after a system which is still to be found in Dannemora, where the world-renowned so-called Walloon iron, the purest wrought iron in the world, is manufactured. But at the commencement of the nineteenth century a new kind of blooming was introduced into Sweden from England, called the Lancashire hearth process, which compared with the Walloon process was characterized by a considerable reduction in the consumption of charcoal. These two processes are still used in Sweden for the production of large quantities of wrought iron known for its toughness, malleableness, and, in general, for its unusual low percentage of phosphor and sulphur. This wrought iron is chiefly sold for export, partly in the form of blooms, and partly in the form of rolled or forged bars. The highest qualities are used in England and Germany as raw material for the production of finest tool-steels.

KEROSENE AS MOTOR FUEL

By C. T.

IT is evident that the day is not far distant when kerosene will be as commonly used in engines of motor cars and tractors as gasoline is at present. The search for another substitute than that of some petroleum product has been an utter failure. It began with the high price of gasoline some four years ago, and has been continued ever since. Various suggestions have been made and numerous times it has been reported that a substitute had been found which would furnish cars with a cheap fuel and drive gasoline out of business. It will be remembered that English inventors were sure a few years ago that they could substitute benzol for the American article, but they never carried the demonstration beyond a few cars, because the article was too scarce and too costly. An American inventor drove cars round the race track in Indianapolis for several weeks with a fluid that could be produced at the small cost of a few cents a gallon. It was a failure in the end. Last year a Long Island chemist had a green fluid, which, added to water produced at any pump or creek, promised relief from high-priced gasoline. He drove cars with it, or with something, and even deceived several noted inventors. The green fluid suddenly disappeared from public prints, and the auto owners waited for some other inspired article.

Meanwhile inventors turned their attention to the use of the cheaper kerosene as a substitute. Engines have since then been run on kerosenes with the introduction of small amounts of water in the cylinders. This has been practically demonstrated in a factory in Allegany County, New York, and two years ago a car crossed the Continent with no other motive power than kerosene. A few months ago a car was taken from Warren, Pa., to New York over heavy roads and through bad weather, and with no other fluid than was obtained from the kerosene stores along the route. The facts prove the possibility of the use of the heavier article for autocars and other engines.

It is now recognized that only slight changes are needed in the carburetter to make the use of kerosene as common as that of gasoline. This is also proved by the fact that much of the gasoline now used in the same specific gravity as the lighter grades of kerosene of the past years. The gravity of gasoline has been gradually lowered to meet the demand for more motive power for automobiles, aeroplanes and motor boats, and the engines built at present handle it freely. Necessity has brought this about, and with the awakened interest in the heavier article the demand will be met.

MARINE DIESEL ENGINE PROBLEMS

THAT some departure of a radical nature in type or arrangement of marine diesel engines is necessary if maximum powers are to be profitably increased above the present figures is the opinion of a writer in The Engineer.

Success is one of those human qualities to which it is rarely possible to assign an absolute value, and in engineering progress one might almost say that there are no such things as failure and success, but only stepping stones. When, therefore, we speak of the relative failure of the marine Diesel engine, it will be understood that the phrase "relative success" would be almost as appropriate. We have to look at the matter from the point of view of how much was expected from the Diesel type in the past; how few, comparatively speaking, of those expectations have been realized, and try and imagine what progress is to be expected in the future.

We can recall the time when the Disel engine first came to be talked about; when it was anticipated by some that its progress would be so rapid as to leave no room for any other type. And truly, if the overwhelming superiority in fuel economy had not been attended by corresponding disadvantages, there was no reason why these high expectations should not have been realized. It took about a decade for the land type Diesel to get through the period of its infantile troubles, and this type naturally had to be perfected before attention could be turned to the marine type. We do not propose now to enter upon the history of the marine Diesel engine—the various "stepping stones" in the development of the type have been from time to time described and illustrated in our pages—but rapidly casting our mind's eye over the experience gained in the last ten years, we are forced to the conclusion that the progress has been in the direction of perfection of detail and increase of reliability, rather than in any big advance in the sphere of its application.

Two Types Only

Broadly speaking, the marine Diesel is limited to two types—the high speed, which has its main application in submarines, and the low speed, which has been successfully applied to the ocean tramp. Of the former type it would be inadvisable to speak at length, but the limitations of the size of the high-speed Diesel were pointed out in a paper read by Lieut.-Commander Anstey at the Institution of Naval Architects eight years ago, and experience since has confirmed the conclusions arrived at in that paper. Speed of revolution, on which low weight per horsepower mainly depends, cannot be maintained as the size of the cylinder is increased, with the result that bigger powered units must be heavier, or else the increase of power must be obtained by the multiplication of cylinders.

In the type which has been developed for the tramp, weight is not a primary consideration, and here the limiting condition has been the size of cylinder. We have heard of experiments being made with very large cylinders of the order of 1,000 horsepower, but so far the results have been maintained in reserve. We are not handling an ordinary engineering problem when we come to deal with Diesel engine cylinders of, say, 50-inch diameter, which may be exposed to a pressure of anything up to 900 pounds or 1,000 pounds per square inch.

The problem is more one for a gun designer than a marine engineer, and one begins to wonder whether the game is worth the candle. If we arrived at such dimensions, it is fairly obvious that the weight of the installation would probably exceed that of a steam set of equal power. Not that that would be a great consideration if counterbalancing gains could be proved, but experience has shown that the larger the unit the less the balance of advantage of the Diesel engine over steam, and there must be some point at which the credit balance disappears entirely.

Nature of Present Limitations

An argument with some who have not studied the question is that improvements are daily being made, and will still further be made, which will make further progress possible. The answer is, of course, that it is not a question of making improvements; it is that we are up against mechanical principles and laws which cannot be altered. In all questions of engineering progress similar conditions may arise. Take, for example, the question of obtaining a high speed in a vessel of a given size. Imagine that we had got to the point of progress in the design of the hulls represented, say, by an old-type, 30-knot destroyer, but imagine at the same time that our steam machinery was at the stage represented by the compound engine at 90 pounds pressure, and that the lightest form of boiler known was the locomotive type. Imagine such machinery installed in our boat, and we might probably reach 20 knots. We trace our steam machinery through its subsequent development, changing it from time to time in accordance with the improvements, but keeping the boat the same. Through all these changes we will suppose we have had an ideal in view, to obtain, say 33 knots. We arrive eventually at the highest power we can possibly cram into the boat, and we find we can just reach 30 knots, and it has been the last two knots which have taken all the trouble to get. Probably, by making supreme sacrifices in weight, we could even get another knot, but is it worth it? The time has now come when it is necessary to abandon an unpractical though possible solution, and to find a way round it. We have imagined the hull unchanged through all this previous development; now we turn our attention to it and we find that, by lengthening the ship and increasing the displacement, we can practically begin in speed where we left off in the old type. The curve of horsepower and speed which was getting so steep as to be almost vertical at the top has, under the newer conditions, a reasonable slope, and shows us that we can still get an increase of speed with a reasonable addition of horse-power. This question of the relation of speed of vessel and power required to produce it, is a parable of a large number of problems of engineering progress. Development begins on certain lines and proceeds satisfactorily up to a certain point; beyond that progress becomes increasingly difficult, until at last the advance made is not commensurate with the expenditure of energy required.

The Diesel Situation

Some such situation has now arrived with the marine Diesel engine. Engines up to 250 horsepower per cylinder, and up to eight cylinders on one shaft, are now fairly common. The difficulties increase progressively as we pass the 250 horsepower mark, and at some point—we hesitate to give an exact figure—it will not be worth while to attempt more power per cylinder. The system then breaks down unless a larger number of cylinders is accepted, and shipowners and engineers will be reluctant to accept this solution, the former on account of cost and space, and the latter on account of complication. The problem of complication is one that has to be got round if further advance is to be made. Now, it is well to fix in our minds what we mean by complication. Multiplication of parts does not in itself constitute complication. The steam turbine, for example, has an enormously larger number of parts than a reciprocating engine, considering each blade as a separate part. It is when those parts are dependent upon one another, or form working "pairs" liable to get out of adjustment, that the objection arises to their multiplication. If it were possible to simplify valves and their gears, which are the principal sources of trouble and anxiety, we could go on multiplying small cylinders almost indefinitely to obtain the desired power. In any case, some break from the reciprocating type is necessary if we are to see high speed, or even moderate speed, vessels propelled by internal combustion engines.

PAINTING STEEL CEILINGS

By O. C.

THE manufacturers of steel ceilings prepare the sheets with a gloss as follows: After the sheets are stamped, they are dipped in a thin liquid, composed of a little zinc white and varnish, thinned down with benzine. Not enough zinc white is added to make the finish opaque, though this is hardly material, since the finish is applied by a painter, who would much prefer a different prime coat, one quite dead or flat; a coat of two of this will make a finish. If the steel sheet has not been primed or coated in the factory, it is for the painter to cleanse it of grease and dirt with benzine, or with some alkaline solution. When dry, there should be a coat of raw or boiled oil given, adding a little drier to the raw oil. While the makers of steel ceilings who prime the sheets use a primer with a pigment base, zinc as a rule, it is yet true that the best primer is the simple pure oil, raw or boiled. After priming with the oil, and after it has become dry, any desired paint may be applied; although a gloss paint is given preference, many prefer a soft rather flattish effect.

Galvanized iron should not be painted until it has stood to the weather for a year or so, or before it has been treated with a liquid to cut the so-called grease or galvanizing. In many instances galvanized work looks well enough without paint, and in such cases it is a waste of time and money to apply paint to it. But when the finish demands the painting of the galvanized work it may be prepared with this formula: Take 2 ozs. each of copper chloride, copper nitrate, and sal ammoniac, all to be dissolved in one gallon of soft water, preferably. Then add 2 ozs. of muriatic acid. Mix in a wooden vessel and apply with a broad bristle brush one coat. When dry, it may be painted.

GRAVITY vs. FORCE-FEED LUBRICATION

By R. Wood.

IN A recent issue of an American engineering journal, a correspondent recommends the old style gravity feed lubricator in preference to the oil pump. The writer presumes he refers to the automatic oil pumps which are stated to be wasteful.

Considerable experience with modern automatic force feed lubricators has shown them the exact opposite of wasteful and in my opinion they possess many points of superiority over the gravity lubricator. Some of these points are as follows:—

It it is desired to introduce a quantity of oil prior to starting a unit, all the operator has to do is to give the ratchet wheel a few turns by the handle placed on the wheel for this purpose.

The oil chamber can be filled and refilled while the unit to which it is attached is in operation and while the pump itself is in operation. If a small piece of sediment finds its way into the oil passage it can be forced out by giving the ratchet wheel a few quick turns.

When the unit is started the pump starts feeding. When the unit stops the oil flow stops; there are no valves to open or close, no water to be drawn from the oil chamber.

The pump can be set to feed one drop a second or one drop a minute, that is, any speed of flow desired by the operator, and to regulate this flow all that is required is a turn or two on a regulating screw. This screw is the only thing the operator has to move. It requires about the same amount of work to install an automatic oil pump as it does to connect up a gravity automatic lubricator.

A messenger from the stores which held a Government contract hailed a vessel in dock at Liverpool.

"What do you want?" growled the surly mate.

"Got some vegetables for the ship," was the reply.

"All right. You needn't come aboard. Throw them up one at a time," said the mate, as he stood ready to receive the vegetables.

"Ahoy there, look out!" shouted the lad as he threw a small dried pea towards the mate. "I've got a hundredweight of these!"

PROGRESS IN NEW EQUIPMENT

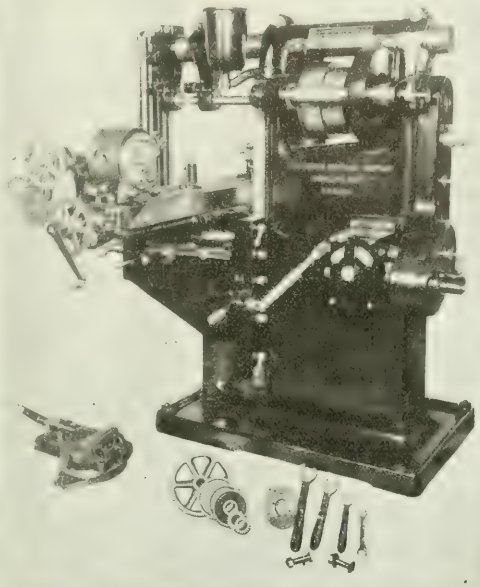
A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

UNIVERSAL MILLING MACHINE

THE accompanying illustration shows a universal milling machine which is a recent addition to the line of milling machines built by the Ford-Smith Machine Co., Hamilton, Ont.

The capacity of the machine is 25 in. by 8 in. by 17 in. Longitudinal, cross and vertical power feeds are provided, all feeds being direct gear-driven from the back of the machine. Special attention has been given to the convenient arrangement of feed levers within easy reach of the operator.

Circular movement of the table extends through 50 degs. to either side, which enables all operations to be performed as are usually undertaken in milling machines. Every care is exercised during manufacture to insure accuracy in all vital features, while ample rigidity and strength are insured through the adoption of liberal proportions throughout.



25 x 8 x 17 IN. UNIVERSAL MILLING MACHINE.

MOTOR-DRIVEN WIRE POINTERS

FOR those wire-drawing shops which prefer individual motor drive, the Morgan Construction Company of Worcester, Mass., has arranged to supply its wire-pointing rolls with Westinghouse motors mounted on the frame. This makes the unit very compact, since there is no external apparatus and no overhead connections. It is also easy to start and stop by means of the conveniently located starting-box handle.

The wire-pointer consists simply of a pair of rolls revolving so as to feed material toward the operator. There are a number of grooves to care for various sizes of wire. The cross-section of these grooves diminishes around the circumference, so that the end of a wire placed in the open part of a groove is pushed back by the rolls and reduced into a tapering end. This pointed end is then threaded through the die in which the wire is to be drawn down.

The motor illustrated is a type CS induction motor of 3 h.p., 1,700 r.p.m. It is made by the Westinghouse Electric & Mfg. Company of East Pittsburgh, Pa.

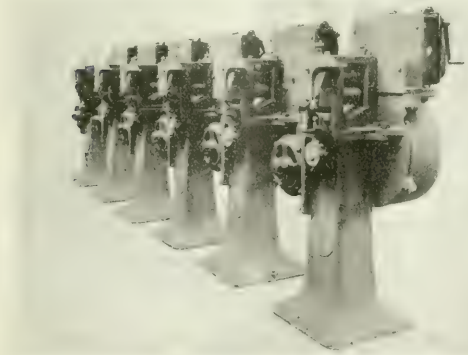
MOTOR-DRIVEN BULL FRAME

FOR drawing wire of sizes from 7/16 in. to 1 in. diameter, the two-block horizontal spindle bull frame shown in the accompanying illustration is made by the Morgan Construction Company of Worcester, Mass. It will handle square, hexagonal, and round sections, with pull at the die of from 10,000 lbs. to 20,000

A special feature of this line of machines is a winding block so arranged that, while the pull is always close to the main bearing, the coiled wire moves out to the end of the block in a regular helix without bunching or crowding. In addition to the safety afforded by quick stopping characteristic of individual drive, a friction clutch is contained in each block, which instantly disengages the block from the mechanism. Thus by the movement of the clutch lever, the drawing may be stopped at any time regardless of the strain on the block.

This machine, which is intended for heavy work at high speeds, is equipped with a 150 h.p. type CS induction motor made by the Westinghouse Electric & Mfg. Company at East Pittsburgh, Pa. Other sizes are driven by motors down to 50 h.p.

Fundamental principles are the foundation of an engineering education. Surprising what costly structures some men build on flimsy foundations.



MOTOR-DRIVEN POINTERS FOR WIRE-DRAWING SHOPS.

MOTOR-DRIVEN WIRE-DRAWING BULL FRAME.

SHELL HANDLING EQUIPMENT AT A BRITISH NATIONAL FACTORY

THE text and illustrations refer to a plant for handling heavy shells, the equipment specially featured being supplied to an important national shell factory by Messrs. Babcock & Wilcox, London, E.C. The machine shop, to which the figures refer, consists of two bays, each about 50 ft. wide and 400 ft. long. In each bay there are two rows of machines and two sets of gantries, carrying the travelling cranes by which the shells and billets are lifted and transported. These cranes are of the so-called single-rail type, the whole of the weight being, as shown in Fig. 1 and 2, transmitted to a single rail riveted to the I-beam which forms the top bar of the gantry. Tipping over is prevented by two pairs of rollers at the top of the crane post which abut against one side or the other of a rolled joist secured to the roof of the shop. The whole arrangement is clearly shown in Fig. 2. The top of the gantry is about 7 ft. above floor-level, and the space underneath is utilized for storing shells and blanks. Each crane has a jib of 10 ft. 6 in. radius, which is sufficient to extend to the centre of each line of machines served, and the cranes pass between the driving shafting and pulleys. The maximum load they are designed to lift is 1,680 pounds.

As will be seen from Fig. 1 and 2, the cranes are electrically driven, separate and independent motors being provided for the three operations of lifting, slewing and travelling. The controls are arranged so as to be operated from the attendant's platform shown to the right in Fig. 2. The motors are of the slip-ring type, designed to operate with three-phase current supplied at 440 volts, the periodicity being 25 cycles per second. The hoisting and travelling motions are transmitted by ordinary spur gearing, and are fitted with the usual magnetic brakes. For the slewing motion, worm reduction gearing is used, the worm running in an oil bath and a slipping clutch fitted to take up any shock due to sudden starting or stopping.

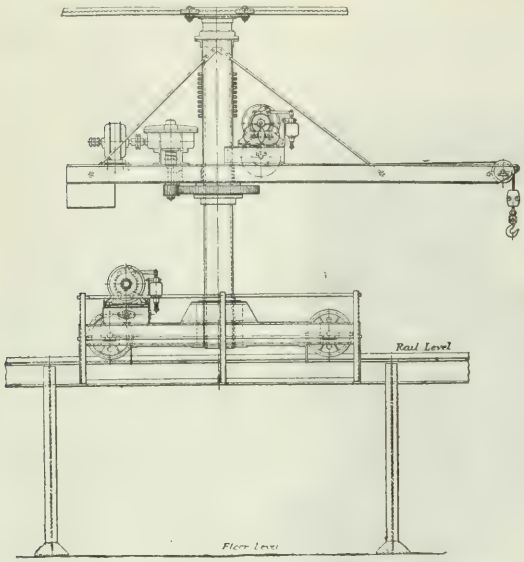


FIG. 1.

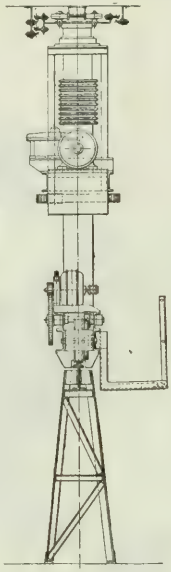


FIG. 2.

In view of the special character of the materials to be handled, various lifting tackle mechanisms have been designed and installed. In Fig. 3 and 4, there is illustrated a cradle built up of inverted channel irons and fitted with slings, and designed to carry eleven 12-in. shells.

A gripper for lifting the unforged billets is illustrated in Figs. 5 and 6, whilst another type, intended for lifting heavy shells from the floor and turning them into a vertical position, is represented in Figs. 9 and 10. This consists of two heavy crossheads fitted with levers, which give a very powerful grip on the shell. The gripping parts are pivoted on the ends of the levers, thus allowing the shell to swing into the vertical position. The grips are lined with ferodo, to reduce the liability to slip.

An apparatus designed to lift from the floor four finished shells is illustrated in Figs. 7 and 8. The prongs are shaped to pass between an adjoining pair of shells, each of which is thus supported by two prongs. For lifting the billets after forging, the apparatus illustrated in Figs. 11 and 12 is employed. Its method of use is obvious. A similar system is used for handling shells at other stages of manufacture, as shown in Figs. 13 and 14. The tongs illustrated in Figs. 15 and 16 are suitable for lifting short shells up to 8 in. in diameter, whilst for larger shells the double tongs represented in Figs. 17 and 18 are employed.—*Engineering.*

FIG. 3.

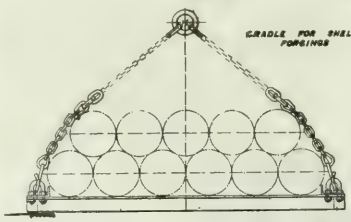


FIG. 4.

FIG. 9.

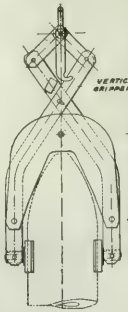


FIG. 10.

FIG. 5.

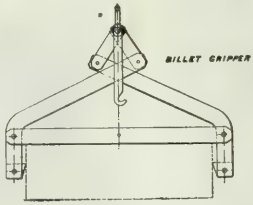


FIG. 6.

FIG. 7.

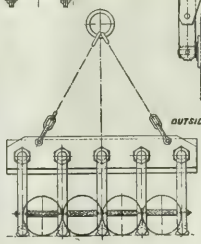
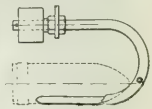


FIG. 8.



ADVANCES IN FRENCH INDUSTRIAL PRACTICE

RECENT improvements in French industrial establishments have been very marked according to "La Metallurgie." The ingenuity of each and every one has had free scope, old traditions have been set aside, and the collective effort of all has yielded new processes of particular interest. Improvements cover every branch of industry, but are more striking in metallurgy and engineering. Scientific processes are now in constant use in place of empirical methods which

hitherto were held in honor. The smallest factory now owns a testing machine, generally a Brinell machine. No steel bar is now taken for the manufacture of a piece of some importance without being submitted first to a Brinell test. The same applies to the heat treatment of steel, and every operative who has charge of quenching and annealing now carries out the work with the aid of an optical or a thermo-electrical pyrometer.

FIG. 11. FIG. 12. FIG. 13.

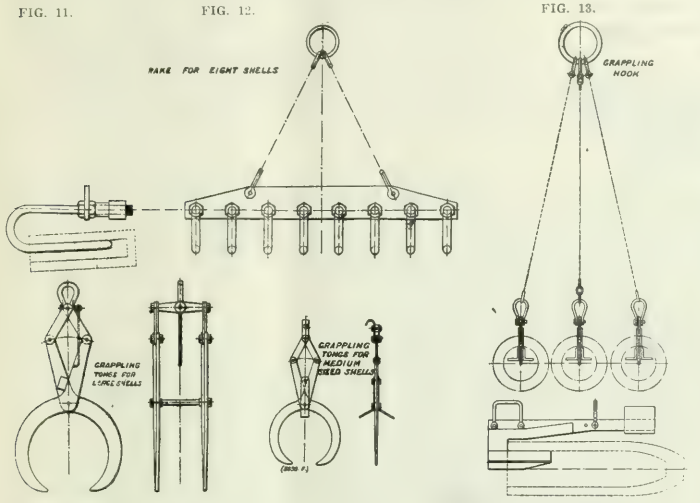


FIG. 15. FIG. 16. FIG. 17. FIG. 18. FIG. 14.

MACHINERY HALL EXHIBITS AT CANADIAN NATIONAL EXHIBITION, 1917.

INDUSTRIAL tendencies are noticeably evident in the character of the exhibits displayed. Established manufacturers and dealers in machine tools are ably represented, while the development of efficiency and scientific equipment, as represented by anti-friction devices, heat treating apparatus, and small tools is well sustained by the displays arranged by the exhibitors in these lines. More detailed descriptions of outstanding exhibits will appear in due course.

L'Air Liquide Society, Toronto.—Exhibit of liquid air, transformer casing of welded sheet steel construction, oxy-acetylene welding apparatus and welded gas containers. Representative, A. M. McDougall.

Boiler Repair & Grate Bar Co., Toronto.—Firebrick linings and furnace equipment. Representatives, C. W. Andrews, A. H. Hetts.

Baines & Peckover, Toronto.—Display of high-speed steel, crucible, vanadium and cold rolled steel. Exhibit of concrete reinforcing material in course of application, and Feralun non-slipping stair treads. Representatives, C. R. Peckover, W. M. David, J. A. Steven, D. J. McSweeney, W. Goodwill, W. Miller.

Canada Machinery Corporation, Galt, Ont.—Comprehensive exhibit of machine tools and wood-working machines: 16-in. tool-room lathe, 18 in. and 32 in. by 12 ft. gapped lathe, 26 in. new type shaper, 42 in. revolving bed, 3 drum sander, No. 611 straight edging and jointing machine, No. 110 planer and matcher, No. 504 single end tenoning machine, No. 617 variety saw bench, No. 636 double mitre saw. Representatives, D. King, P. D. Burton, W. J. Irving, M. Preston, M. Blain.

Canadian Hoskins Co., Walkerville, Ont.—Special exhibit of Chromel heat-resisting castings; standard lines of electric, gas and oil furnaces, and Hoskin pyrometers. Representatives, Messrs. Freeman and Cunningham.

Canadian Ice Machine Co., Toronto.—Full line of refrigerating machinery and supplies. Representatives, C. H. Bower, C. E. Allison, C. M. Kirby, H. Diemler.

Carter Welding Co., Toronto.—Complete exhibit of Davis-Bournonville oxy-acetylene welding and cutting apparatus and machines, emergency outfits and supplies. Demonstrations of equipment in use. Representatives, H. W. Carter, P. Sorley, C. Steadman.

Chapman Double Ball Bearing Co., Toronto.—Transmission equipment, ball bearings and transfer trucks. Representatives, W. J. Murray, W. C. J. Hockin.

Cleveland Pneumatic Tool Co., Toronto. — In addition to display of Cleveland apparatus, hammers, drills, grinders, riveters, couplings, etc., show pneumatically operated wood-boring machinery for shipyard use. Representatives, C. D. Garner, H. F. Olrich, K. R. Friedley, Geo. W. Hall.

Climax Baler Co., Hamilton.—Waste paper baling machine. Representatives, H. Robinson, Melville Moore.

Geo. W. Cole Co., Toronto.—Steam specialties, including Cole boiler feeders, heaters, etc. Representative, Geo. W. Cole.

Cowan & Co., Galt, Ont.—Selected types of modern wood-working machinery. Representatives, W. Cowan, S. F. Barrows, W. C. Clark.

Canadian Automatic Wrench Co., Toronto.—Pipe wrenches, etc.

Consumers' Gas Co., Toronto.—Display of gas-fired furnaces and industrial equipment of all kinds.

Canadian S K F Co., Ltd.—Ball bearing transmission equipment, with demonstration line shaft in operation, showing self-aligning features of product. Representatives, Gordon Janes, Toronto, and A. G. Norris, transmission expert from Hartford, U.S.A., factory.

Dominion Belting Co., Hamilton, Ont.—Display of stitched cotton duck belting, Maple Leaf brand, for power transmission and conveyor equipment. Belt dressing and accessories. Representative, J. Scott.

Dodge Mfg. Co., Toronto.—Dodge wood pulleys, shaftings, bearings, hangers, and other transmission equipment. Representatives, T. F. Gary, J. F. Haas.

Elliot Wood Worker, Toronto.—Elliot combination woodworker, floor sander, scroll saw and shaper. Representatives, W. A. Elliot, Frank Elliot.

Deloro Smelting and Refining Co., Toronto.—Exhibit of Stellite cutting tools and Champion tool holders, expanding mandrils, vises and shop equipment. Representatives, H. Southworth, W. Kitts. and J. Z. Wells, of Western Tool & Mfg. Co., Springfield.

Foster, W. L., Toronto.—Carbonic system of oxy-acetylene lighting. Representatives, A. E. Haigh, M. V. O'Neill.

Garlock-Walker Machinery Co., Toronto.—Special lanter slide display of machine tool manufacture; 18 in. by 8 ft. Garlock-Walker lathe, Hepburn single bar shell boring lathe, Leisy-Patton screw machine, Racine hack saw, Thor pneumatic tools, and Falls feeding attachment for buzz planers. Machinery in operation. Representatives, W. Garlock, Jr., A. B. Walker.

Gravege Mfg. Co., Toronto.—Boiler cleaner, cutting compounds, belt dressings and engine room supplies. Representatives, W. J. Sanderson, John Morris.

Goodyear Tire & Rubber Co., Toronto.—Heavy duty belting for power transmission and conveyor purposes, extra service air hose, packing and similar supplies. Representatives, W. H. C. Crosby, R. F. Fox.

Hutchinson Woodworking and Contracting Co., Toronto.—Hutchinson woodworker in operation. Representative, A. D. Matthew.

Jones & Moore Electric Co., Toronto.—Electric motors and generators.

McLaren, D. K., Ltd., Montreal. — Leather, balata and canvas belting for transmission and conveyor purposes, woolen and knitting mill supplies. Representative, W. S. Hamilton.

Main Belting Co. of Canada.—Leviathan and Anaconda belting for transmission, conveyor and elevator work. Representatives, S. R. Walsh, B. Vogel.

Morrison, J. L., Toronto.—Bookbinders' and paper machinery. Representatives, D. Brown, W. Duncan, C. Leake.

Positive Clutch & Pulley Works, Aurora, Ont.—Power transmission equipment. Representatives, R. A. Fraser, Norman Beard, W. Crawford.

Pratt & Whitney Co., Toronto.—Display of Canadian-made fine tools, cutters, taps, shell tools and gauges. Representatives, J. Ferguson, J. T. Crowley, H. C. Thomas.

Shell-Bar, Boico Supply, Ltd., Toronto.—Boiler grates, gaskets, packing and engine room supplies. Representative, Mr. Downes.

Small Bros., Smith's Falls, Ont.—Evaporators and supplies for the maple sugar industry. Representative, Len Edmonds.

Phillips, V. O., & Sons.—Measuring pumps, feed crushers.

Toledo Scale Co., Toledo.—Scales.

United Shoe Machinery Co., Toronto.—Shoe machinery in operation.

Williams Machinery Co., A. R., Toronto.—Machine tools and shop equipment are displayed on a wide scale. Stationary and marine gasoline engines are also exhibited, while a special demonstration of Stellite tools is made on LeBlond lathes. Representatives, W. Branscombe, W. Hunter, E. Cronk.

Mrs. Exe.—Do you mind when your husband brings a friend home to dinner?

Mrs. Wye—No: what I mind is having a friend bring him home after dinner.

The temperance reformer was justly proud of having converted the biggest drunkard in the little town of P——, and induced him—he was the local grave-digger—to get on the platform and testify. This is how he did it: "My friends," he said. "I never thocht to stand upon this platform with the Provost on one side of me and Toon Clerk on th' ither side of me. I never thocht to tell ye that for a whole month I havena touched a drop of anything. I've saved enough to buy me a braw oak coffin wi' brass handles and brass nails, an' if I'm a teetotaller for anither month, I shall be wantin' it."

A Scotchman born and bred, Sir Henry Oliver, the new Deputy-Chief of the recently reorganized Admiralty, has a rare fund of Scotch stories.

One of the best concerns a certain beadle whose duty it was to show visitors over the remains of an old abbey, "somewhere beyond the Tweed."

On one occasion he had performed this service for a lady who, on leaving him at the churchyard gate, rewarded him only with barren thanks.

Whereupon the canny Scot remarked:

"Weel, my leddy, when ye gang hame, if ye fin' out that ye have lost your purse, ye maun recollect that ye hav'na had it oot here."

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President
H. V. TYRRELL - - - - - - - General Manager

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, 143-153 University Avenue, Toronto, Ont.

Vol. XVIII. AUGUST 30, 1917 No. 9

RESTORING THE WORLD'S SHIPPING

IT has been said that we will win the war if we can successfully combat the submarine menace, but the latter, to all appearance, will only be accomplished by concentration on merchant shipbuilding. Without doubt a fair percentage of enemy submarines have been destroyed, trapped and captured, but these when assessed at their proper value are little more than incidentals in the whole big struggle for ultimate supremacy. The weekly report of vessel sinkings indicates only too clearly to which side the mass of the victims belong, and bears witness to the fact that nothing of worth-while effect has been devised, or at least is yet operative, that will deal the death-blow to the undersea boat activity.

Among men who have been watching the shipping situation closely, there is a disposition to believe that we are not keeping pace with Germany's submarine construction and equipment development as we ought, particularly in the arming of our merchantmen. The steadiness or even lowering of the weekly sinking record is not in their estimation the real criterion; rather is it the apparent paucity in number of vessels that successfully resist submarine attack. It is believed that the power of offensive of Germany's U-boats has been materially increased as regards their gun equipment over that of our armed merchantmen; in consequence, not a little concern is evident lest the destruction waged by these pirate craft become immediately or in the early future still more intensified.

There is to-day less disposition to talk of shipbuilding achievement than there was a few months ago, it having been realized in the interval that suiting action to words is less easy than at first sight appears. It is estimated that the Allies began this year with 20,000,000 gross tons of merchant shipping. Britain's losses for the period elapsed are believed to be at the rate of 5,000,000 tons per annum, against which the total of 2,000,000 tons for the last completed year of the world's shipbuilding makes a rather unfavorable comparison, and seems to dispose of the possibility of the immense new construction programmes launched a while ago reaching anything like the figures aimed at.

Britain's best shipbuilding performance in pre-war days was around 2,000,000 tons per annum; nevertheless, Premier Lloyd George has promised that 4,000,000 tons will be produced this year. Again, stupendous figures of tonnage output are being credited as likely to come from the United States. In the minds of those in close touch with the shipbuilding industry, irrespective of its nationality location, and who are able to gauge with a substantial degree of accuracy the whole situation with its myriad accessory disabilities, the opinion exists that in the coming year a deficit of 5,000,000 tons of shipping will have to be made good, and that its detail participation by the Allies will call for 2,000,000 tons from Great Britain, 1,500,000 tons from the United States, and a like total from France, Italy, and Japan combined. We consider even the foregoing a pretty tall order, and shall look forward expectantly to its fulfillment.

It is a good idea, however, to set a figure of achievement, if same be reasonably and judiciously determined, and be made the absolute minimum. Britain's four million tons for this year is to our mind a particularly rash estimate of her shipyard capacity, aside altogether from its being war-time; yet there is no disposition to believe that, although her achievement for the period is likely to be much under the figure quoted, her safety and that of the world's civilization will be jeopardized.

The transfer of skilled, semi-skilled, and unskilled labor, from munitions making, should both stimulate and accelerate new tonnage output in Canada, besides enabling metal-working plant executives to concentrate their attention more on what gives promise of being an industry both substantial as well as permanent in character. There is reason to believe that plans are being developed for a much enlarged shipbuilding effort in Eastern Canada in the coming months, the relief from shell-making admitting now of greater freedom of action. If we choose, shipbuilding, with its accessory industries, for the next decade in this Dominion may readily surpass in proportions the munitions activity of these past thirty months or more.

MUNITIONS MAKING FURTHER RESTRICTED

CURTAILMENT of Canada's shell industry is being accepted as immediately probable, although it would perhaps be more correct to say that its further enlarged restriction has become quite imminent. Needless to say, the conditions which have operated to bring about this latest development in our metal-working plant activities are in every sense satisfactory, thereby eliminating all opportunity to cavil at the action taken by the Imperial Munitions Board.

That the initiation and development of munitions making in Canada required the display of much administrative tact and foresight, and that each was forthcoming in generous measure, few will be found to dispute; but what of the final passing of the industry? It seems to us that to a still greater degree will the executive ability of our Munitions Board be taxed if our industries generally and our metal-working plants particularly are to be spared a succession of jars and jolts, and their operators be immune from even a moderately extended period of unemployment.

It is worth while noting that the inception of our shell industry was accomplished in the most unspectacular manner, and its subsequent growth to immense proportions was also so realized. Why not let its decline be equally unspectacular, and its final passing out of the least possible moment. Judging by the procedure being adopted by the Imperial Munitions Board, and the efforts of our manufacturers to co-operate with them as regards stopping the gaps created by taking hold of other lines of product, we are constrained to believe that the absolute minimum of business dislocation will ensue as shell-making disappears; in a word, it is more than possible that there will be no dislocation at all.

INDUSTRIAL NOTABILITIES

GEORGE DUNCAN DAVIE general manager Davie Shipbuilding & Repairing Co., Ltd., Lauzon, Levis, Quebec, was born at Levis, August 19, 1873, son of George Taylor and Mary Elizabeth (Patton) Davie.

After being educated at Berthier Grammar School, Eleeb, and Quebec High School, Mr. Davie started in 1890 with Carrier, Laine & Co., shipbuilders and engineers, of Levis, Que., where he learned the business and developed into

GEORGE DUNCAN DAVIE.

mechanical and salvage engineer, ultimately occupying the position of general manager to the Quebec Salvage & Wreckage Co., Ltd. In 1913, Geo. T. Davie & Sons sold their shipbuilding and repairing plant at Lauzon to the Davie Shipbuilding & Repairing Co., Mr. Davie continuing as general manager of that firm, which position he had previously with his own firm. Mr. Davie's ability is indicated by the fact that he was the recipient, in December, 1916, of a gold watch bearing the following inscription: "Presented by the Directors of the Submarine Boat Corporation, U.S.A., as a token of appreciation for the great energy shown by him in the construction of 325 80-foot motor launches for the British Admiralty at Lauzon, Levis, Que., during 1915 and 1916.

A study of shipbuilding methods on the Clyde and also in American yards has enabled Mr. Davie to impart a high degree of efficiency to his plant and practice, he being further a member of the Naval Architects' Institute of Great Britain.

Protestant in religion, Mr. Davie's society affiliations include I.O.O.F. and Royal Arcanum. His residence is Lauzon, Levis, Quebec.

—Photo. courtesy *International 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	53 95
Basic, Valley furnace	52 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 00
Chequered floor plate, ¼ in.	18 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 50

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	$34 00	$34 00
Electro copper	34 00	34 00
Castings, copper	33 00	33 00
Tin	61 50	64 00
Spelter	10 50	11 00
Lead	13 50	13 00
Antimony	20 00	20 00
Aluminum	65 00	64 00

Prices per 100 lbs.

PLATES.

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

WROUGHT PIPE.

Effective July 5, 1917.

Standard Buttweld.

Size.	Black Per 100 feet	Galvanized 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

Standard Lapweld.

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	$22 00	$22 00
Copper, crucible	25 00	27 00
Copper, heavy	25 00	25 50
Copper wire	25 00	25 50
No. 1 machine composition	20 00	22 00
New brass cuttings	16 00	19 00
No. 1 brass turnings	14 00	16 00
Light brass	12 00	10 50
Medium brass	16 00	16 00
Heavy brass	18 00	18 00
Heavy melting steel	21 00	17 00
Steel turnings	11 00	8 00
Shell turnings	12 00	12 00
Boiler plate	18 00	10 50
Axles, wrought iron	25 00	24 00
Rails	20 00	18 00
No. 1 machine cast iron	27 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	8 00	9 50
Heavy lead	11 00	10 75
Tea lead	7 00	7 00
Aluminum	35 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.	35
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	$ 80 00
Open-hearth billets	80 00
O.H. sheet bars	85 00
Forging billets	115 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, ¾ in. and larger	7 50	
Spikes, ¼ and 5-16 in.	8 00	

MISCELLANEOUS.

Solder, strictly	0 37
Solder, guaranteed	0 40
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, 11	50	11 50
Canada plates, dull, 52 sheets	11 00	11 00
Canada plates, all bright	12 50	12 50
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	13 75	12 70
Premier, 10¾ oz.	13 85	13 00
Zinc sheets	20 00	20 00

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	$13 05
Connelsville Foundry Coke	14 00
Steam Lump Coal	7 25
Best Slack	6 50

Net ton f.o.b. Toronto

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$33 00	....
1¼ in.	36 00	....
1½ in.	38 00	32 00
1¾ in.	38 00	32 00
2 in.	45 00	33 00
2¼ in.	48 00	35 00
2½ in.	50 00	38 00
3 in.	58 00	45 00
3¼ in.	....	53 00
3½ in.	70 00	55 00
4 in.	82 00	67 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 75
Leather in sides	1 60

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, bullneck	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	.14¼
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	.06

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

THE outstanding feature this week is the official announcement that the production of munitions will be considerably reduced. For some time past there has been a steady reduction in output, but now a further restriction is advised. Such a situation was expected and an effort will doubtless be made by the firms affected to readjust their affairs to meet the new conditions. One beneficial result will be to increase the tonnage of steel available for domestic purposes and thereby help to relieve the shortage which has prevailed for some time. On account of the embargo on steel from the United States the situation has become serious, but hopes are entertained that some way out of the difficulty will be found. The matter is at present engaging the attention of the authorities at Ottawa and Washington. Prices of steel products continue stationary, but the market has a weaker tendency and some shading of prices is possible in the near future. A pronounced recession in prices, however, is not likely in the meantime. The pig-iron market continues firm at unchanged prices. Business is quiet as consumers are holding off pending developments in the price-fixing situation. The output of coke continues limited, owing to labor shortage, and prices are still high as a result. The non-ferrous metal markets continue quiet and prices have a weaker tendency, copper and lead having declined. There is no change in the scrap metal market and prices continue stationary with a tendency to weakness. There is no change in the machine tool situation except that deliveries are getting more backward. There have been a number of advances in prices of machine shop supplies.

Montreal, Que., Aug. 27, 1917.—It is now almost a certainty that future operations in the production of all classes of munitions will shortly be curtailed in Canada, if this condition has not already developed. The recent announcement that the manufacture of the large shells would be discontinued was expected to be followed by a similar action in connection with the smaller sizes but it was not anticipated that this would materialize so soon. The action has been deemed advisable for two possible reasons, that of Britain being able to cope with the present requirements, and the necessity of Canadian funds to maintain the maximum activity in the new industry of shipbuilding. With the new developments will come a surplus of labor for the time being, at least, this is however, expected to be quickly taken care of by the necessities of shipbuilding.

Pig Iron

Like other markets, that of pig iron is unsettled owing to the uncertainty that dominates the situation due to the delayed announcement of the American authorities in connection with what the future war policy will be, regarding the price regulation and distribution of such materials as are now in urgent demand. It is interesting to note that after a considerable period in a stationary position, the tendency of this market is to lower levels, as indicated in the composite price of pig iron being now $51.86 per ton, a decline of $1 per ton on the high price of a few weeks ago. Canadian pig is very scarce and few quotations are available.

Steel

No material change is reported in the

general situation, as much uncertainty is still prevalent in all circles regarding the early future. In addition to the unsettled conditions arising out of the proposed adjustment of prices and the control of production and distribution, the market has been somewhat affected by the recent overtures for peace originating from Rome. No early negotiations are expected but the market is nevertheless influenced by these and other developments. Here in Canada the situation has taken a turn that will no doubt add to the past nervousness of the market, as it is almost certain that the production of munitions will be further curtailed, resulting eventually in placing on the market a number of men who have been employed in this industry. It is more than probable, however, that many of these will be quickly absorbed in other lines of activity, particularly that of shipbuilding and companion industries.

While the present announcement appears to indicate only a partial further reduction in the shell requirements it is at the moment uncertain to what extent this will be increased in he near future. It has been reported that the reason, or one of them, is that additional funds are necessary to finance the construction of the shipping that is and will be required. The production of small forgings has already been discontinued in some sections and this will shortly be followed by a corresponding decline in the manufacture of the finished product. This development in the steel situation will not however have much effect on price conditions as little of the present output can be changed over to other requirements. The bar and small shape market may experience some relief owing to the change, as the mills in Canada may be able to increase production on these lines.

The position in the States is becoming more acute as the demand for steel increases, but the market is still influenced by the uncertainty as to what the attitude of the Government will be in connection with the regulation of prices on the various materials. This adjustment may not be made on a basis of present production costs, as there is a possibility that some change may be made in the wages of labor before a decision is arrived at, as in some respects these are lower than living conditions warrant. The Pittsburgh quotations on billets and wire rods has been subjected to a decline of $5 per ton, the present prices being $80 and $90 respectively. The base price on refined iron rods has been reduced to 4¾ cents per lb., a decline on the week of $10 per ton. In some of the American markets the quotation on iron and steel bars has been advanced approximately 50 cents per ton. All markets are generally unchanged with a steady demand. The Canadian situation is virtually the same with the exception of the shell industry which is undoubtedly declining. One local dealer is figuring on an order for 2000 tons of plates for the Imperial Munitions Board for the construction of boilers for wooden vessels now under construction and others are contemplated. Local conditions are unchanged with prices comparatively firm.

Metals

The metal market is still affected by the political situation in the States and active buying is practically at a standstill with the exception of what may be required for immediate needs. Investigation is still proceeding into the cost of production but no definite announcement has been made as to the possible prices that will be set for the various commodities. This inaction is having the tendency to create or rather maintain an uncertainty that is reflected in a general dullness throughout the markets. Copper is quieter and also easier. Tin is in less demand and weaker. Spelter is very dull and lower. Lead is firm but with an undertone of weakness. Antimony and aluminum are both comparatively quiet and unchanged.

Copper.—Nothing has as yet developed to relieve the tension of the market and provide a basis on which the trade can resume normal activity. Many rumors are current as to what the intentions of the American Government are in connection with the setting of prices but nothing definite has been officially announced and the entire situation is one of decided uncertainty. Under these conditions consumers are taking no active interest in the market and buying is only for immediate requirements. Responding to rumors that the regulation price would be lower than previously anticipated, the American market weakened during the week, the decline being 1½ cents on lake, ¾ cent on electro and ½ cent on castings, the quotations being 28 cents, 26½ cents and 26 cents respectively. The London market is easier by £5 per ton. The local situation is featureless with quotations firm at 34 cents for lake and electro, and 33 cents for castings.

Tin.—The tin situation has been more or less affected by delayed cable reports, but the present tendency appears to be towards a weaker market. Buying is close to normal but no special activity is reported or expected until some announcement is made regarding the price that the American Government may fix for fixture trading. The latest reports from London indicate an easier situation and New York has declined ⅞ cent during the week. The local market is not active but business is steady. Prices however are easier on a decline of ½ cent per lb., the week's quotation being 61½ cents per lb.

Spelter.—The market in this metal is comparatively speaking unchanged, and no immediate prospect of improvement is looked for. The feature of the situation, whicr has been the influencing factor for several months, has been the total absence of export demand, and it is not thought that any material change will be noted in the situation in the States or Canada until this demand is resumed. Following the continued dullness, the situation in the New York market has developed an easier tone, a decline of ¼ cent placing the nominal quotation at 8¼ cents per lb. Dealers here report a dull market with prices easier, on a decline of ½ cent, quotations are 10½ cents per lb.

Lead.—This market is still influenced by the political situation and the delay in the action of the American Government in fixing and announcing their decision regarding the price regulations that are expected to control future business. Producers are content to await developments before further adjustment of prices as their present output is well taken care of. Under these conditions the New York market is relatively steady with prices quoted at 11 cents per pound. Independents are however, endeavoring to increase the demand and have lowered their prices ¼ cent per lb., the present quotation being 10⅝ cents per lb. Prices are firm locally but with an undertone of weakness.

Antimony. — No improvement has developed in this market and the absence of any marked demand has created an easier tendency which is reflected in a drop on the New York quotation of ⅛ cent per lb., the prices this week being 15¼ cents per lb. The local market is steady and unchanged at 20 cents per lb.

Aluminum.—The demand continues steady with an undertone of weakness. The situation here is quiet with prices firm at 65 cents per lb.

Machine Tools and Supplies

The situation this week has been the quietest that the market has experienced for some time and with the exception of light inquiry for general equipment the demand is very listless. The possibility that munitions manufacture is nearing the closing stages, or at least is showing a great falling off in general production, makes it very unlikely that much additional equipment will be required for shell making purposes. What little business is passing is generally for such machinery as will be used for ship and accessory construction, and additions to repair plants. The activity in the States continues to be the feature of present situation, as every plant is working to near capacity in

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.

meeting the requirements of the abnormal situation. No appreciable decline is noted in the demand for supplies, but it is anticipated that the near future may see a falling off in this connection. Prices continue to hold firm despite the future prospect.

Scrap

Activity in old metals has been somewhat halted by the United States embargo which has had the tendency to create easier prices but to increase the difficulty of securing material. The New York situation has experienced a set-back owing to recent developments, and the market is weaker in nearly all lines. Iron and steel scraps in the Pittsburgh district are from $2 to $5 lower per ton; heavy melting steel and No. 1 wrought iron being featured at the latter figure. The local situation has not yet been seriously affected by the recent developments but dealers are anxiously watching the trend of the market; with the exception of coppers, the market here is well maintained. Old coppers have declined one cent on the week, the local prices being 22 cents for light and 25 cents for crucible and heavy.

Toronto, Ont., August 28.—Although the decline in activity in the munitions industry has been obvious for some weeks the official statement recently issued has brought the matter to a climax. The fact that production has been steadily declining for some time, and that there are still some contracts to complete, will not disorganize conditions in the industry to the some extent as if the stoppage had been more sudden. Some firms have already turned their attention to other classes of work which will help to relieve the situation. Such a situation as now prevails has been anticipated and there has been time to make such preparations to meet the new conditions. It is understood that the Dominion Government is making advances at the rate of $35,000,000 a month for munitions which will be continued until the end of the year, so the activity has not entirely ceased. An enormous sum of money has been expended in Canada in munitions. To date the Dominion Government has advanced to the Imperial Munitions Board for the purpose of munitions in Canada $285,000,000. In addition to this the chartered banks of Canada have advanced $100,000,000. For many months past the Government has been making advances at the rate of $25,000,000 monthly, and during July and August this has been increased to $35,000,000. The arrangement will be continued to the end of the year.

While strict economy in the use of coal has been advocated so that there will be less chance of a shortage this winter, there is some hope that prices will be kept within reasonable limits. The United States Government has fixed a price of $2 a ton on soft coal at the mines, which it is hoped will be reflected in lower prices in Canada. It is understood that prices of anthracite coal have also been fixed. The coal situation is thus improved and the outlook is brighter.

Steel

No definite progress has been made so far in regard to the adjustment of the embargo on steel from the United States. The matter has been taken up with the authorities at Ottawa, who in turn are negotiating with Washington, and it is hoped that some relief will be obtained. As the matter stands at present, a license has to be obtained from Washington for each shipment, which entails a great deal of trouble and delay, and even then a permit may not be issued. The steel merchants are in a difficult position at present, for when booking an order they never know whether they can obtain the material or not, which often results in disappointment to customers. The decline in the production of shells will likely release considerable steel for other purposes for domestic use, although no official statement has as yet been made in regard to this matter. It is possible that some shell steel will still be exported, but even if this is the case there is little doubt but that there will be a considerable increase in available tonnage for domestic purposes. The marked increase in business of a general nature during the past year has resulted in a material improvement in demand for steel. Considerable of this demand has not been filled as the steel companies have been too busy on war orders.

With the decline in the munitions orders the mills will be in a better position to look after their domestic business and a much easier situation should result. The Steel Company of Canada have already closed down their bar mill at Hamilton, which had been rolling shrapnel bars, and the Nova Scotia Steel & Coal Co., have discontinued making shrapnel forgings. The increase in tonnage now available will help to relieve the shortage in some steel products such as bars and small shapes rendered more acute by the embargo on steel from the United States. The supply of plates, sheets and large structural shapes will, however, not be increased and semi-finished material such as billets and wire rods will still be in short supply. There have been no further developments in regard to prices and the market continues stationary. Recent developments in the trade will tend, however, to further weaken prices, although no pronounced recession is likely in the meantime. The situation is intensely interesting and it is difficult to tell what will happen with any degree of certainty. Developments at Washington are being followed closely, no official statement having as yet been issued with regard to prices of steel.

Prices of black sheets are showing a weaker tendency, although no changes have as yet been made from current quotations. The market is dull as consumers are not placing orders to any important extent as they are looking for lower prices. Nearly all the new business in the U.S. is coming from the Government, leaving comparatively little tonnage available for private consumers.

In the United States, Government buying continues to dominate the market. There is very little new demand for finished steel of any kind because of the uncertainty as to what action the authorities will take in regard to steel prices. It is generally expected that another big loss in unfilled tonnages will be shown for August owing to the tendency of consumers to hold off on their orders. An improvement in the market is expected as soon as the Government price-fixing has been settled. Prices continue to show a weak tendency, billets have again declined while steel bars and shapes are a shade lower at Pittsburgh.

Pig Iron

Locally there is no material change in the pig iron situation, although the embargo on American iron is causing considerable inconvenience and is tending to stiffen prices. There is very little domestic foundry iron available except on contracts, as the furnaces are booked up for the remainder of this year. In the States the market is quiet, but increased activity is looked for as soon as the policy of the government with regard to price fixing is determined.

Scrap

The market continues dull and prices generally are weaker in sympathy with the declining tendency of the new metals. There have been no price changes this week, although a decline in copper and brass scrap is anticipated. Cast iron scrap continues firm at unchanged prices, while steel scrap is also holding steady. The reduction in output of munitions means a falling off in supply of shell turnings which will tend to stiffen prices on this material. Consumers continue to keep out of the market in anticipation of lower prices.

Machine Tools

The reduction in munitions orders will not materially affect the machine tool trade, any more than was anticipated, as buying of this class of equipment has for some time been comparatively negli-

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.

gible. There will be considerable second hand equipment thrown on the market, but this was expected and is the natural result of conditions surrounding the industry. Some of this equipment, except special tools will doubtless be utilized for other purposes, but even so there will be no scarcity of second-hand tools for some time to come. Those firms who have turned their attention to other forms of activity will help in the general readjustment and so relieve the labor situation. The principal demand now is for a heavier class of tool and a fair business is being done. The increased activity in the States is making it more difficult to obtain equipment from that country and deliveries are consequently getting more backward.

Supplies

Notwithstanding the fact that prices of iron, steel and metals are weaker, machine shop and mill supplies continue to show an upward tendency. The reason is doubtless due to the fact that there is still a shortage of raw materials and that supplies and small tools, etc., are still being made from high priced materials. The market is unsettled owing to the uncertain situation resulting from the falling off of munitions contracts. There has been during the past few weeks a decline in the volume of business as a result of decreased activity in munition plants. All transmission equipment has advanced in price; the change in discount on wood pulleys was mentioned last week. The Fairbanks Co. have withdrawn all prices on brass and iron valves. Wire rope thimbles have advanced 10 per cent. Higher prices have been made effective on malleable fittings and bushings. New prices that have been issued on plunger leathers, valve leathers and cup plungers provide for an increase of 12½ per cent. No. 1 plunger leathers are now quoted at $1.45 per doz., No. 2 at $1.65 per doz., and No. 3 at $2 per doz. In valve leathers No. 1 is quoted at $1.45 per doz., No. 2 at $1.65, and No. 3 at $2 per doz. Cup plunger leathers, 2½ in., are quoted at $1.85 per doz.; 3 in., at $2.35, and 3½ in. at $2.70 per doz. Solders have declined one cent a pound. Turpentine is up one cent a gallon, while linseed oil is also higher at $1.49 for raw and $1.52 for boiled oil.

Metals

The announcement relative to the falling off of munition contracts has created an unsettled feeling in the metal markets and the outlook consequently is somewhat uncertain. The effect of the decline in shell orders will not be serious, however, as general business has for some time been gradually increasing in volume and readjustment taking place more or less gradually. In spite of this it is hardly likely that business will be as active in the future as during the past two years or so, but if it does not go below the level of normal years it is as much as can be expected. Prices have a weak tendency and the outlook in this regard continues unsettled owing to lack of information as to what the American Government intends to do in regard to its price-fixing policy. Copper and lead have declined, otherwise prices are unchanged.

Copper.—The market is unsettled, and weaker owing to the uncertainty regarding the action of the U.S. Government. Consumers continue to show a lack of interest in the market and buying is in light volume in the meantime. Copper prices continue nominal and are quoted locally one cent lower than last week. Lake and electrolytic are now 34c. and castings 33c. per pound.

Tin.—There is nothing of interest to note in the tin market, which continues dull at unchanged prices. The tin committee at Washington have not yet made any announcement as to progress of plans for adjusting distribution of tin in the U.S. Local price, 64c. per pound.

AUXILIARY MACHINERY REQUIRED.

Tender forms and specifications have been received from D. H. Ross, Canadian Trade Commissioner, Melbourne, for supply and delivery of auxiliary machinery for the Flinders naval base, via Melbourne, Victoria, and are open for inspection at the Department of Trade and Commerce, Ottawa (refer to File No. A-1901). Tenders addressed to the Director of Navy Contracts, Navy Office, Melbourne, close on October 24, 1917. The particulars are as follows:

Two electrically-driven air pumps, with complete set spare parts.

One steam driven air pump, with complete set of spare parts.

Two small circulating pumps.

One large circulating pump.

One large feed pump, with complete set of spare parts.

One small feed pump, with complete set of spare parts.

One oil fuel pump with complete set of spare parts.

Lead.—The situation in the lead market is unchanged and business is held back by the general feeling of uncertainty in regard to prices. The fact that American Government purchases for the last two months have been at 8c. a pound, while the outside market has ranged around 11c., has a deterring effect. Those consumers who can hold off are doing so, and those who must buy limit their requirements to the barest necessities. Lead has declined locally and is now being quoted at 13c. per pound.

Antimony.—No improvement is noted in the demand for antimony, which has been quiet for some time. The market, however, shows no sign of weakness and quotations are unchanged at 20c. per pound.

Aluminum.—Little interest is being shown in the market which has weakened although quotations are unchanged at 60c. per pound.

Spelter.—The market is a little firmer owing to some improvement in demand, but prices are unchanged at 11c. per pound.

New York, Aug. 27.—Manufacturers of machinery have received contracts, amounting to several million dollars, from concerns that have been awarded additional orders for war munitions by the United States Government. Additional contracts for machine tools and for cranes calling for the expenditure of $3,000,000 are pending, most of which will probably be closed before Sept. 1.

The Ordnance Bureau of the War Department, which has been quietly perfecting plans for the rapid building of big guns in the United States outside of the plants of the Bethlehem and Midvale Steel companies, which have long manufactured heavy ordnance, has completed satisfactory arrangements by which large forgings will be made by forging and casting shops at Columbus and Cleveland, Ohio, and at Pittsburgh, Pa., as well as at Tacony, Pa. These forge shops have been installing additional machinery and work on Government contracts will begin early in September. The plan is to have the gun forgings machined at various plants, the selection of which was noted last week. The American Radiator Co., which is now equipping a plant at Bayonne, New Jersey, has been added to the list previously given. The 3, 6 and 9.5-inch guns to be manufactured are designed for equipping the United States army in France. The Bullard Machine Tool Co., which will machine some of these forgings, has just placed a contract for ten 10-ton cranes, and the American Radiator Co. has ordered several hundred thousand dollars worth of shop equipment.

Other manufacturers who have received Government contracts are buying machinery as rapidly as the present condition of the market permits. Walter Scott & Co., of Plainfield, New Jersey, is receiving bids on 200 machines needed to manufacture gun carriages. The Wagner Electric Mfg. Co., St. Louis, and the American Car & Foundry Co., who will manufacture hubs for caisson and gun carriages, are buying shop equipment to execute these orders. The Wagner Co. is also to manufacture $3,000,000 worth of 8-inch shells and one thousand 4-inch guns for the Government. The Goss Printing Co. of Chicago has bought equipment in that market to manufacture sights for 4-inch guns. Stone & Webster are now buying $1,500,000 worth of tools through its Boston office, to equip the machine shop at the Rock Island Arsenal. The Poole Engineering & Machine Co., of Baltimore, and the Worcester Mfg. Co., of Worcester, Mass., are to manufacture one pound projectiles for the Navy Department. The Government has also placed orders with the Bausch & Lomb Optical Co. for periscopes and gun-sights, and with the Sperry Gyroscope Co., of Brooklyn, for

compasses, searchlights, and airplane apparatus. Both of these companies are now purchasing tools to execute Government contracts.

Increased activity is evident in the airplane industry. The Curtiss Aeroplane & Motor Corporation is buying $1,000,000 worth of machine tools for its Buffalo plant. This corporation is said to have orders for airplanes from the Government, amounting to $200,000,000. The Simplex Automobile Co., New Brunswick, New Jersey, a branch of the Wright-Martin Aircraft Corporation, has issued a list for 100 machines, and will probably buy 200 tools to manufacture airplane engines for the Government; the order received calls for the delivery of 50 engines per day.

The Quartermaster-General of the army has purchased a number of machine tools, including belt-driven hammers, forging and bolt machines, to equip motor and tractor repair shops in France. The Government is still buying travelling cranes for railroad shops and locomotive cranes for railroad construction in France through the Pennsylvania Co. and machine tools through the Phoenix Construction Co. French railroads also are buying 50 locomotive cranes. Agents of Australian manufacturing plants are placing orders for power and shop equipment.

Pittsburgh, Aug. 25.—It has been a week of rather interesting developments pertaining to the iron and steel trade, but unfortunately the developments are only interesting rather than conclusive. They do not tend to clarify the prospects of the market. Foremost was the fixing of coal prices by the Government at 50 cents a ton less than had been expected, and thus indicating that the Government has ideas of lower prices in general than had been surmised. Then there were declines of $5 a ton in billets and $2 a ton in Bessemer pig iron, maintaining the general declining tendency in raw and intermediate products. Offerings of plates appeared at lower prices and for earlier deliveries than formerly, while otherwise finished steel showed no distinct change. Finally, statistics leaked out indicating that the production of steel ingots in July was 6 per cent. greater than the average output in 1916, yet 11 per cent. under the capacity, as lately increased. The developments served to make the prospect still clearer that there is to be a general decline in the finished steel market, and perhaps a greater decline than had been expected; but there is no light on the question when the readjustment is to occur or how far it is to extend.

The Coal Price

The schedule of coal prices was announced August 22, prices varying in different districts, but except for the higher prices assigned to some far western districts, averaging approximately the Pittsburgh district prices, which are: $1.75 for slack, $2 for mine-run, and $2.25 for screened coal, per net ton at mine. The lowest forecast had been $2.50 for mine-run. The coal operators now speak as if they would have been content with a $2.50 price; but as it is, they have called a general meeting of soft coal operators all over the country, to be held in Pittsburgh August 27, evidently for the purpose of making representations to the Government that the price is too low. They are justified in this by the observation in the price announcement that the prices were tentative.

It is expected that coke prices will be announced shortly, perhaps within a fortnight, and if $2 stands as the Pittsburgh district coal price, the Connellsville coke price can hardly be over $4, as with their lower mining costs the Connellsville operators would fare well to be allowed $3 for the ton and a half of coal required to make a ton of coke, with $1 for conversion.

Pig Iron and Steel Easier

Resale offerings of Bessemer pig iron, arising chiefly from the export embargo, resulted in sales at not over $53, valley, when the furnace quotations, although practically nominal, had been $55. Billets that had been offered freely in the market were marked down $5 a ton, resulting in small sales of both Bessemer and open-hearth at $80, the top price last June having been $95 to $100. Sheet bars offered at $85 find no takers, although last June $105 was pair in several instances.

The blast furnaces have not marked down their quotations, chiefly because it would not help them to do so, as there is no disposition to buy at any price. They no longer advise their customers to purchase, and frankly admit that all the indications are for a decline.

The continued decline in billets and sheet bars is important only as illustrating a general trend in values, for at prices above $60 to $70 there have been no purchases except in small lots, by consumers peculiarly situated. The regular consumers receive their steel on long term contracts, the settling price at present being probably in the neighborhood of $60.

Finished Steel

There are reports of several offerings of plate down to 8.00c, and for earlier deliveries than mills formerly admitted were possible, while until now the plate market has been described strong at 9.00c to 10.00c. Doubtless the offerings arose through the shutting off of exports by the embargo. The common report has been that the embargo on shipbuilding material was established for the purpose of making an arrangement with Japan whereby that country would receive material already ordered in return for sending some ships to engage in the transatlantic trade, but whether designedly or otherwise, the embargo is softening the market.

A curious fact is that while domestic demand for sheets has dropped to almost nothing, buyers being committed to a policy of waiting for lower prices, foreign buyers are bidding as eagerly as ever, and sales have been made for both Japan and South America at 9.25c, and perhaps even higher. Some of the mills have two months or more of unsold capacity to the end of the year, but they are not reducing quotations.

Government Buying

A fortnight ago the Government distributed orders for 6,000 standard gauge freight cars, and 2,997 narrow gauge cars for its operations in France, and 3,000 standard gauge cars have now been added to the orders, while 5,000 more are under advisement. The interesting statement is made by steel producers that an absolute price has been agreed upon for the steel involved, but no information is vouchsafed as to what the price is, apart from the observation that it is "satisfactory." Prices on steel for the merchant ships are still to be arranged. The mills are less opposed than formerly to the Government's proposal of 2.90c for plates, and 2.50c for shapes and bars.

A careful summary indicates that the Government purchases up to date do not indicate that as much as 15 per cent. of the capacity will be engaged at any time, but when the shipbuilding program is in full operation the total may possibly be a trifle more than 15 per cent., and any large buying of shell would effect a slight further increase. The increase in capacity over the average of last year is more than 15 per cent. Accordingly, the statement may be made that the full steel making capacity will be engaged next year provided domestic consumption is as great as in 1916, that the Government absorbs steel equal to the increase in capacity, and that the purchases of the European Allies are as great as they were in 1916. As to the last named item, there has been practically no buying at all to date, while as to the first, it seems altogether improbable that domestic consumption will not decrease.

FLAX INDUSTRY HAS BEEN REVIVED

Dominion Government officials report a great revival in the industry throughout Canada. Fifty years ago flax was a very important crop on many farms and there were about 100 mills in Ontario turning the plant into articles of commerce.

The new generation of farmers drifted into other lines of production when foreign competition became too keen and when war was declared three years ago there were at best six or seven mills in Ontario. War, however, has put the industry back on its feet in Canada and in addition to a tremendous acreage in the West Ontario farmers have planted 8,000 acres to the crop this year. As a result it is expected that there will be between thirty and forty flax mills in operation in this province next winter.

In order to give both the agricultural and industrial side of the industry every encouragement the Government has established an experimental flax mill at Ottawa, where experts are testing it.

INDUSTRIAL AND CONSTRUCTION NEWS

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

ENGINEERING

Swift Current, Sask.—The Imperial Oil Co., will erect a distributing plant here.

Toronto, Ont.—The Cluff Mfg. Co., are rebuilding their factory on Sterling road.

Toronto, Ont.—The Willys-Overland Co., will build a new machine shop at their factory on Weston Road.

Vancouver, B.C.—The Pacific Metal & Galvanizing Co., Seattle, Wash., proposes to establish a plant at Vancouver, B.C., to cost $35,000. Henry Gray is secretary.

Toronto, Ont.—Gunns Ltd., will make alterations to their abattoir at West Toronto, at a cost of $12,000. The John V. Gray Construction Co., of Toronto are the general contractors.

Shawinigan Falls, Que.—The Shawinigan Water & Power Co. is preparing designs for a 5000 ft. clear conductor span for the transmission of electric energy over the St. Lawrence River at Three Rivers, Que., which will supplement the submarine cable transmission line already installed. Each of the steel towers on which the line will rest at the extreme ends of this long span will have a concrete base, set some little distance from the bank of the river. The towers will be 350 ft. high, so as to provide a clearance of 160 ft. in the centre of the span. The three conductors will be placed approximately 50 ft. apart. The transmission line will not be anchored to but merely supported by the towers and anchored to concrete blocks situated some distance to the rear of the towers.

ELECTRICAL

Waterloo, Ont.—Representatives of the Hydro-Electric Commission have been in this district inspecting electric threshing outfits on three farms in Waterloo County. Steps will be taken to develop hydro power more extensively for this purpose.

MUNICIPAL

Kingsville, Ont.—The Town Council contemplated installing a pumping plant.

London, Ont.—The Board of Control will call tenders shortly for sludge pumps for East End sewage disposal works.

Portage la Prairie, Man.—The Town Council contemplates installation of one 100 h.p. boiler with mechanical stoker costing about $5,000, for electric station.

Winnipeg, Man.—Tenders for rubber boots and rubber hose for the fire department have been opened by the Board of Control and referred to J. E. Buchanan, Fire Chief, for tabulation and report.

Woodstock, Ont.—The Town Council will install a filtration plant and build an addition to the pumping station. Tenders have been called for the above and also for a boiler and pumping equipment.

Rosthern, Sask.—The Town Council will build an electric light plant and will instal oil engines and electrical equipment. Tenders must be in by Sept. 1. Full particulars may be obtained from K. A. Reeder, town clerk.

London, Ont.—The Board of Control decided not to purchase a motor fire engine, as suggested by the Underwriters' Association, owing to the cost ($8,000) being too high. The city will retain the present fire engine and buy a motor ladder truck.

Winnipeg, Man.—One hundred and fifty tons of reinforcing steel is to be purchased by the city for the big extension being carried out at its electric plant at Point du Bois. On account of the embargo on steel by the United States, the Board of Control, on the recommendation of J. G. Glassco, have decided to call for tenders returnable in one week.

Montreal, Que.—In a report signed by Messrs. H. E. Vautelet and A. St. Laurent, consulting enginers, the Board of Control is advised that the city proceed with the hydraulic development of the aqueduct along the lines suggested by them in Scheme 2 of their original report; they also recommend that the foundation of the power house be built as early as possible to insure the water supply of the city, while it is also suggested that the balance of the work be proceeded with along the lines recommended by them as circumstances will allow.

GENERAL

Hamilton, Ont.—The American Can Co., will build an addition to their factory here to cost $125,000.

Guelph, Ont.—It is reported that a prominent oil concern have leased an extensive tract of land at Rockwood, near here, and that drilling will be commenced at once.

Montreal, Que.—Damage to to the extent of about $50,000 was done by fire on Aug. 20, in the establishment of H. Gray & Co., cotton waste and wipers, 25 Common street, the top floor being completely burned out.

Woodstock, Ont.—This city is to have a new factory before the winter. Ground has been broken adjoining the textile works and a factory to cost $40,000 will be erected, and when completed will be occupied by the Woodstock Cotton Spinning Co.

St. Lambert, Que.—The by-law covering the agreement between the town of St. Lambert and the Dominion Textile Co., providing for the establishment of a large manufacturing plant in that town has become operative without the necessity of a poll of the ratepayers. Under the terms of the agreement the town provides bonds to the amount of $95,000 which are to become the property of the company on the expiration of ten years if the company has carried out its agreement with the town. The company is also granted exemption from taxation on its works for a period of twenty years. The company is not compelled to begin construction for some time after the end of the war but there is a feeling that it will not wait long before taking some steps.

TENDERS

Hamilton, Ont.—Tenders are being received until September 4 by the engineer, E. R. Gray, for pumping equipment for Beach pumping station. The cost is estimated at $130,000.

Cobalt, Ont.—Tenders will be received up to Sept. 18, for the supply of material and labor necessary in the installation of a complete telephone system in the Town of Cobalt, and in part of the adjoining Township of Coleman. Further particulars will be furnished by R. L. O'Gorman, Town Clerk.

Sudbury, Ont.—Tenders will be receivde until noon September 4, for supplying material and constructing a reinforced concrete bridge in the Town of Sudbury. Approximately 470 cubic yards. Plans, specifications and other information may be obtained at the Town Clerk's office, Sudbury. W. J. Ross, Town Clerk.

Oakshella, Sask.—Tenders are required for the supply of material and constructing thirteen miles of bracket line, also placing two circuits on the Government lead on six-pin crossarms. For plans and specifications, apply to James Wiggins, secretary-treasurer, Last Chance Telephone Co., Oakshella, Sask.

Vancouver, B.C.—Tenders will be received by James Stuart, City Purchasing Agent, until September 4, for one automobile combination hose wagon and gasoline pump, with a capacity of not less than 750 gallons per minute at 120 pounds pump pressure. Parties tendering to supply their own specifications, blue prints or photographs.

Hatley Center, Que.—Tenders for the construction of a concrete bridge and making the necessary grade and fills at the Lowery Brook, 1½ miles east of North Hatley, on the Capelton Road,

will be received up to Sept. 4. Plans and specifications of this work may be seen at the office of the W. E. Greer, Secretary-Treasurer, Hatley Center, Que.

PERSONAL

Prof. J. C. McLennan of Toronto University, has been created an officer of the newly instituted Order of the British Empire.

George M. McLeod, one of the best known men in railway circles throughout Eastern Canada, died at St. John, N.B., on Aug. 21 aged 65 years.

Harry S. Burrell, owner and manager of the Burrell Rockdrill industry, Belleville, Ont., died last Sunday, after a brief illness. Deceased was 48 years of age.

E. C. Richardson, who has been connected with the St. Lawrence Welding Co., Montreal, has resigned from his position to join the United States forces for overseas service.

Dr. J. O. Orr, manager of the Canadian National Exhibition since 1903, died on Aug. 21 at his residence, 83 Spadina road, Toronto, of heart trouble. He had been in failing health for a long time.

Geo. A. Kingston, of Toronto, Ont., was elected vice-president of the International Association of Industrial Accident Boards and Commissions at the fourth annual convention held in Boston, Mass., last week.

Percy Wilkins, formerly chief inspector with the St. Lawrence Machinery Co., Montreal, has accepted a position with the St. Lawrence Welding Co., Montreal, and has been appointed secretary-treasurer of the company.

Charles Blair Gordon, Montreal, business man, former vice-president of the Imperial Munitions Board, and now representing the Imperial Munitions Ministry in the United States, has been made Knight Commander of the newly created Order of the British Empire.

Professor K. Birkeland of the University of Christiania, Norway, who died recently at Tokyo, Japan was the originator of the first successful process for the oxidation of atmospheric nitrogen by electric discharges. He was a member of the British Association and vice-president of the Faraday Society.

TRADE GOSSIP

To Promote Trade.—The British Government has appointed a Belgian Trade Committee to investigate the means of promoting trade and commerce between the British Empire and Belgium.

The Damp Bros. Welding Co., 848 Dupont street have established a plant for welding and cutting all kinds of metal by the oxy-acetylene process. This concern will specialize in welding broken parts of machinery and automobiles.

Potash From Waste.—The Curtis Bay Distilling Co., a Baltimore, Md., concern, is preparing to manufacture potash from waste material, and will utilize one of its recently closed down plants for that purpose. The company has developed a method of turning waste from the distillery into potash.

Rock Island, Que.—The board of directors of the Union Twist Drill Co. of Athol, Mass., were in town recently to visit their plant here. W. Putnam, Manchester, Mass., J. A. McGregor, L. L. Starrett and Simon Mackay of Athol, Mass., W. B. McKinnon, Arlin Ward and J. A. Druary of Boston constitute the board of Directors, and these gentlemen spent the day looking over the plant.

Ottawa, Ont.—Potash has been discovered at Muskoka Lake, Ont., and the Salts and Potash Co. of Canada (of Toronto) have been granted permission on the application of J. Ogle Carss, to divert water from the lake to extract the potash, and also to lease vacant Dominion lands abutting on Muskoka Lake in connection with the recovery and utilization of the potash and other minerals.

Acquire New Plant.—Owing to the increasing volume of business, the St. Lawrence Welding Co., of 138 Inspector Street, Montreal, have acquired a new plant at 39 Olier Street, where they intend to handle all their heavy work, a feature that is now a large portion of their general output. The shop at 138 Inspector Street will be retained to take care of small welding repairs. In addition to the new plant of 100 by 24 feet, a new section, 25 by 40 feet, has been built, to be used as a brass foundry, work in this portion to be commenced in the near future.

U. S. Shipbuilding Programme.—The United States Government's shipbuilding programme calls for a total of 1,270 ships of 7,968,000 tonnage, it was revealed last Friday in estimates the Shipbuilding Board has sent to Secretary of the Treasury McAdoo, on which to base a request for a new billion-dollar appropriation. This is in addition to nearly two million tons of shipping now building in American yards, which has been commandeered by the Emergency Fleet Corporation. A large part of the Government fleet and of the commandeered fleet will have been completed by the end of the fiscal year, June 30, 1918. Building, commandeering and purchase of vessels will total about two billion dollars.

Allies Purchasing Committee in U.S.—A report from Washington, D.C., states that the Allied purchasing committee in the United States is now a fact. The Allies have signed an agreement to make their purchases through the new war industries board. America's loans to the Allies will be protected against huge prices which heretofore, the Allies have been willing to pay with Uncle Sam's money in order to get badly-needed war materials. B. M. Barcus, Robert S. Lovett and R. S. Brookings of the war board will be actively in charge of the Allied purchases. Barcus and Brookings will handle raw material and finished supplies, respectively, while Lovatt will decide priority questions between the Allies.

Standard Wooden Ship Dimensions.—The wooden standard ship as adopted by the Canadian Government and of which a considerable number have been contracted for in British Columbia yards is dimensioned as follows: Length 250 feet, beam 43 feet 6 inches and depth 25 feet, with a deadweight capacity of 2,800 tons on a 21-foot draft. The vessels are considerably heavier in construction than the United States Shipping Board's standard wooden hull. They will be fitted with box girder keelsons, have a deep tank forward for water ballast and be propelled by triple expansion engines of about 950 horsepower. They will be constructed of Douglas fir and built to Lloyds' requirements for A1 classification.

Embargo on Sulphur by U. S. Government.—A report from Washington, D.C., states that sulphur classified with explosives is included in the list of commodities for which export licenses are required. No shipments will be licensed, officials said to-day, until Canada has presented complete estimates of the requirements of Dominion newsprint makers and of the needs of explosive factories. The impression was given by officials at Washington that while there is every desire that the newspaper industry suffer no embarrassments, war needs will be given first consideration and it was suggested that sulphur may be permitted to go to Canada in limited quantities only even after the issuing of licenses is resumed.

Dominion Government Orders Cars.—Hon. Frank Cochrane announced in the House, that the orders for rolling stock would include six thousand cars, four thousand of which would be required for the Government system. The remaining two thousand would be needed by the C.N.R., the Grand Trunk, and other companies. Coal shippers in the United States were now anxious to have their cars returned immediately, which meant they could not be used in Canada for carrying sand and gravel. The Minister said four thousand of the cars would be supplied by the Canada Car Company, one thousand by the Eastern Car Company, and one thousand by the National Car Company. Deliveries were to be made between October 1 and February 1.

Marine Insurance Increase.—In connection with increase in Washington insurance rates on estimate of ship values at $1,000 to $2,000 a ton gained currency in many newspapers. It is difficult to establish a foundation for such high estimates. The highest price paid for a vessel was $310 a deadweight ton. This vessel had oil-burning equipment and refrigerators, was modern in every respect and delivery was prompt. Average price at present is $250 a deadweight ton. Before the war a good price would have been about $65 a deadweight ton. The present market is considered enormous, and intimation that Washington is valuing ships at $2.000 a ton is regarded as absurd. At least, New York shipping men do not pay such

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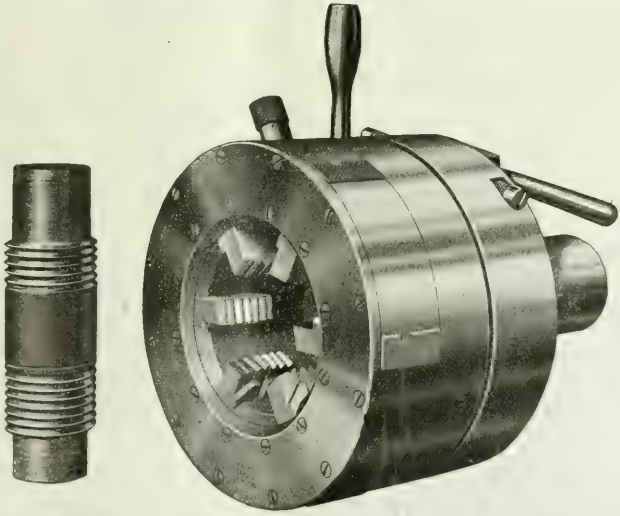

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Concrete Ship Built in Norway.—The first Norwegian iron and concrete boat has been launched at the Porsgrund Cement Works, Christiania in the presence of Prime Minister Knudsen. The boat is built entirely on a new system, with the bottom up, from which extraordinary position the launching took place. The underlying sledges glided out with the ship. When the water was reached the hull was detached from the sledges. It gradually sank to a certain point and slowly righted itself. This ship of 200 tons was built in three weeks, but the next will only require about half that time. The frame can be used with each subsequent ship of the same size. It is intended to start wholesale building of iron and concrete boats of from 200 to 500 to 1,000 tons. The last can be completed in six weeks.

Asbestos in Northern Quebec.—What promises to be more or less important discovery of high-grade asbestos has been made in the unsurveyed portion of Quebec, about twenty-five miles north east of Ville Marie, on the shores of Mackenzie Lake. A number of veins which are said to average about four feet in width, have been traced for a considerable distance, and have been found to contain asbestos of a similar grade to that which is being worked at the Slade Forbes property in the Porcupine district. The discovery was made in the latter part of June and efforts are being made by prominent citizens of Ville Marie to induce the Government to build a road into the district which at the present time is reached only by trail from Ville Marie via Lorraineville, from which point it is about eighteen miles to the scene of the discovery. Upwards of a dozen claims have been already staked, on all which it is said the showings on the mineral are very encouraging.

U. S. Company for Greaves-Etchells Furnace.—T. H. Watson & Co., Sheffield, England, who control the patents of the Greaves-Etchells Electric Furnace, announce the formation of an American company to handle the furnace business in the United States and Canada. The new company will be known as the Electric Furnace Construction Co., with head offices in the Finance Building, Philadelphia. The Greaves-Etchells furnace is well known in the Sheffield district, and other parts of England, and over thirty furnaces ranging in size from ¼ ton to 12 ½tons capacity have been contracted for, including special Government equipments. Frank Hodson, a partner of the T. H. Watson & Co., is now in the United States arranging the details of the new company, and will act as its president. F. J. Ryan, who resigned as Eastern manager of the Snyder Electric Furnace Co. on June 1, will be general manager. The two inventors, Mr. Greaves and Mr. Etchells, will act in associate capacity to the company's technical staff and when necessary will take charge of actual installation.

BUILDING

Toronto, Ont.—The City Architect has issued to the Harris Abattoir Co. a permit for an addition to their cattle pens on St. Clair avenue, near Symes road, $15,000.

Kingston, Ont.—In the supplementary estimates recently tabled in the House at Ottawa $150,000 is included for the enlargement of the Educational Block of the Royal Military College, and $100,000 to complete the new dormitory at the R.M.C., by adding two wings.

New Toronto, Ont.—The town is to have an up-to-date moving picture theatre, which will accommodate 400 people, at a cost of $20,000, at the corner of Fifth street and Lake Shore road. C. J. Peart is the builder, and it is expected that the theatre will be opened before Christmas.

CONTRACTS

Toronto, Ont.—Wells & Newton of New York, have been awarded the plumbing and heating contract for the new Union Station.

Shawinigan Falls, Que.—Church, Ross & Co. of Montreal, have been awarded the contract for erecting a factory for the Canadian Aloxite Co., F. T. Tone is manager of this concern.

Pointe Claire, Que.—The Town Council have awarded a contract to the Turbine Equipment Co., Toronto, Ont. 2-motor driven De Laval single stage pumps, for the municipal filtration plant.

Weston, Ont.—A special meeting of the Town Council was held last Monday to open tenders for the heating of the Town Hall. There were four tenders, and the contract was awarded to George Keyes, of Weston, at a price of $1,795.

Oshawa, Ont.—The Turbine Equipment Co., Toronto, have secured a contract from the Town of Oshawa, for 2-De Laval single stage, motor driven centrifugal pumps, for the new filtration plant which is being constructed here.

Toronto, Ont.—A contract for the completion of the carpentry work at the new Park School was awarded by the Board of Education recently to William Williamson, whose tender was for $19,950. The work is to be completed by Jan. 10.

Dundas, Ont.—The Canadian Engineering & Contracting Co. of Hamilton has been awarded the contract for repairing the waterworks reservoir. The tender was $2,808, the lowest received. The work will be commenced in two weeks' time.

Brantford, Ont.—The City Council have awarded a contract to the Turbine Equipment Co., Toronto, for 2-De Laval single stage, motor driven pumps, for the booster pumping station. This is the second order within the last three years for De Laval pumps for this city.

Toronto, Ont.—The Board of Education has let the contracts for inter-departmental phones for the Regal Road and Strathcona Schools. The Regal

Road contract goes to the Canadian Electric Company at $896, and A. Rice, tendering at $620 was the successful bidder for the Strathcona School contract.

The Turbine Equipment Co., Toronto, have received an order for a 125 h.p. motor driven De Laval 2 stage pump, from the city of Belleville, Ont. This is the fourth De Laval unit purchased by this city.

Quebec, Que.—The C. P. R. has let contracts for additions to the Palais Station at Quebec, which will cost $50,000. The contractors are the Deakin Construction Co., and E. T. Byers, both of Montreal. It is the intention of the company to increase the terminal trackage very materially; but for immediate betterment the addition mentioned is to be undertaken at once.

John Watson & Son of Montreal, Ltd., Montreal, Que., have recently secured contracts for metal and architectural iron work for the following buildings. The new Toronto Terminal station; C.N.R. station at Montreal; American Can Co.'s factory, Montreal; Power house at Lennoxville, Que.; John Aird's bakery at Montreal; Consumers Cordage Co., Montreal, and the new office building for the greater Montreal Land & Investment Co.

The Turbine Equipment Co., Toronto, have recently secured the following contracts. One motor driven Multistage De Laval pump for operating against 400 feet head, for the mining corporation of Canada, Cobalt, Ont. A similar unit for operating against 450 feet head for the Casey-Cobalt Silver Mining Co., New Liskeard, Ont. Two De Laval steam turbine driven centrifugal pumps for the new Union Station, Toronto.

MARINE.

Kingston, Ont.—The Dominion Government has made an appropriation of $33,000 for the Kingston dry-dock for renewal of the revetment wall.

North Vancouver, B.C. — The Janet Carruthers, the fifth auxiliary schooner built in this province will leave soon on her maiden voyage to Australia with a cargo of lumber.

Port Arthur, Ont.—Private advices are that the Government has appropriated $130,000 for dredging at the new Saskatchewan Co-operative and Richardson elevators on the north water-front.

Cobourg, Ont.—It is understood that the Grand Trunk ferry dock here is to be rebuilt and that plans are already on hand for a covered dock to replace the one built here twelve years ago.

Three Rivers, Que.—Contracts for the building of two wooden ships have been given by the British Admiralty to the Three Rivers Shipyard, Ltd., at a cost of $900,000. It is expected that further contracts will be obtained for the company, and will provide a new industry for this city.

Victoria, B.C.—The Foundation Co. of British Columbia, Ltd., who have contracts from the Imperial Government for

five wooden steamers, have completed all their preliminary work in the way of laying down their plant, and of the four keels already in place, one has a number of square frames set up.

Victoria, B.C.—The Whalen Pulp & Paper Co., which is engaged in establishing the largest industrial plant on Vancouver Island at the new town of Port Alice, near the head of the Southeast Arm of Quatsino Sound, will lay down two keels at a time and will keep on building ships until it has enough of them to handle its export trade.

Ottawa, Ont.—In the House on Saturday, a vote of $600,000 was discussed for two wooden ships of 3,500 tons each, to be built by the firms of Wallace & Harrison of Vancouver, at a cost of $230,000 each, the vessels to be equipped with Diesel oil engines. The item was allowed to stand over, because the shipbuilding firms had cancelled their tenders, and had offered to go ahead on a cost plus ten per cent. basis.

Vancouver, B.C. — The twin-screw motor vessel Chiralite built by the Taylor Engineering Co., for the International Petroleum Co., for service in Talara, Peru, was launched on Aug. 15. It is the present intention of the owners to have the Chiralite proceed to Peru under her own power, in charge of Captain Jones. The Chiralite was christened by Mrs. M. Rolston daughter of C. M. Rolston local manager of the Imperial Oil Co.

Midland, Ont. — Contracts for the buildings in connection with the McDougall-Smith Shipbuilding Co.'s plant in which Capt. Alex. McDougall, is interested will be let shortly. The size of the buildings are as follows. The carpentry shop will be 50 by 200 feet, two storeys in height. There will be two one-storey workshops, each 32 by 300 feet; a two-storey office building, 65 by 50 feet; a building in which will be rest rooms and other conveniences for the men, and a boiler house and oil house. All the structures will be of frame. It is intended to rush construction and have the plant ready for operation by late fall.

Vancouver, B.C.—The Canadian Fishing Co.'s newest vessel, the Tartoo, ran her trials on Aug. 16. This concern now has three boats, the Nesto, Tasso and the Tartoo, the last-named being the most modern and up-to-date type of seine craft. The Tartoo is 60 feet long, 15 feet beam and 5½ feet draft. A 50-horsepower gas engine gives the vessel a speed of ten miles per hour. The hold has a capacity of 10,000 sockeye salmon or its equivalent, 72,000 pounds. The boat was built by Ferrier & Lucas, costing about $9,200. The plans for this new vessel were furnished to the Royal Commission on Fisheries, which has suggested them for a standard seine craft.

Victoria, B.C.—With the launching of the Malahat, the fourth schooner to take the water from the Cameron-Genoa Mills Shipyard, Victoria, and the schooner Mabel Stewart from the Wallace Shipyard No. 2, North Vancouver, the fifth schooner to be launched for the latter concern, only three more vessels of this type remain to be launched by these yards under the present programme, two of which are nearing completion at the plant of the Cameron-Genoa Shipbuilders, Ltd., and the other being well along at the Wallace yard. After completing the fleet of twelve ships, all of which are of the auxiliary schooner class, and half of which were ordered here and half in North Vancouver, both of the yards mentioned will give all of their attention to the building of wooden steamers for the Imperial Munitions Board.

INCORPORATIONS

British Dyes, Ltd., have obtained an Ontario provincial license to carry on business as dyers and manufacturers of dyes and chemicals, with capital not to exceed $40,000. G. G. Thwaites, of Toronto, is the company's attorney.

The Smith Motor Truck Corporation has obtained an Ontario provincial license to manufacture motor cars and trucks in this province, with a capital not exceeding $40,000. M. A. Stratton, of Toronto, is the company's attorney.

The Three Rivers Shipyards, Ltd., has been incorporated at Ottawa, with a capital of $49,000, to build ships of all kinds at Three Rivers, Que. The incorporators are: T. M. Kirkwood, of Toronto, also A. Chouinard and L. Heyman, of Montreal.

Canadian Hession Tillers & Tractors, Ltd., has been incorporated at Ottawa by H. D. Petrie, T. Crompton and F. C. Petrie, all of Hamilton, to manufacture tillers, tractors and farm implements, at Hamilton, Ont., with a capital of $5,000,000.

Midland Shipbuilding Co. has been incorporated at Ottawa by Norman L. Playfair, Marcus Smith, and Thomas C. Luke, all of Midland, Ont., to carry on the business of shipbuilders in all its branches at Midland, Ont., with a capital of $1,000,000.

The Yamachiche Electric Light Co. has been incorporated at Ottawa with a capital of $100,000, to operate an electric light and power plant at Three Rivers, Que. The incorporators are: J. E. Marier, J. E. Cadotte and E. Cherette, all of Montreal.

Fruit Machinery Co. has been incorporated at Ottawa, with a capital of $40,000, to carry on the business of machinists and iron founders, and to build special machinery at Belleville, Ont. The incorporators are : R. J. Graham, of Sidney, Ont.; also G. K. Graham and J. Bone, both of Belleville, Ont.

The Graham Development & Contracting Co. is the name of a new company which has just been incorporated with a capitalization of $100,000, the head office to be situated in Fort William, Ont., the provisional directors being W. A. Dowler, K.C., A. H. Dowler and Edith Brown. This company has been organized for the purpose of conducting a general lumbering, mining, contracting, and prospecting business.

RAILWAYS—BRIDGES

Kincardine, Ont.—The Town Council have decided to call for new tenders for three bridges on Broadway and Durham streets.

Kincardine, Ont. — The Township Council of Kincardine will be put to an expense of about $14,000 this year for new bridges and culverts, to replace those washed out. It means an assessment of about $12 extra on every 100-acre farm. The Council will put it in this year's taxes.

BOOK REVIEW

Pulpwood Production. — One of the Canadian industries which has gone on increasing rapidly during war time is the production of pulpwood and the manufacture of pulp. The total quantity of wood manufactured into pulpwood in Canada in 1916 was over a million and three-quarter cords, as compared with one million four hundred thousand cords in 1915. The value of the pulpwood made into pulp in Canada and exported for making pulp abroad was nearly twenty million dollars. Very much more wood is now manufactured into pulp in Canada than is exported in the log form to be manufactured in other countries. A few years ago the reverse was the case. All the essential facts about the pulpwood and pulp industry in Canada in 1916 are shown in a bulletin issued by the Forestry Branch of the Department of the Interior. Copies of the same may be had free upon application for the "Pulpwood Bulletin for 1916" to the Director of Forestry, Ottawa.

CATALOGUES

Electric Travelers.—Catalogue No. 130, issued by the Whiting Foundry Equipment Co., Harvey, Ill., describes the various types of cranes built by this firm, showing the latest improved construction. While this catalogue deals chiefly with electric traveling cranes, a variety of other types are also featured, which includes cranes for every service. Crane trolleys, bridge trucks and other parts of the electric traveller are illustrated and described covering the principal features while details of other types of crane are also dealt with. A large number of excellent half tones show the several types of crane in operation featuring the wide field of application for this company's products. The concluding pages 74 to 79 are devoted to the Whiting line of foundry equipment and railroad specialties. The catalogue contains 81 pages and includes a list of some recent users of Whiting equipment.

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

FOR SALE—THE TORONTO ELECTRIC COMmissioners have for sale a quantity of second-hand 60-cycle meters and transformers recently in service, also quantity of electrical supplies. List of material and full particulars may be obtained on application to the Purchasing Agent, 15 Wilton Avenue. The quantities are not guaranteed, and all are subject to prior sale. No tender necessarily accepted. Toronto Hydro-Electric System, 226 Yonge St., Toronto. c7m

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

SPECIAL MACHINERY

H. C. THOMAS, GENERAL MACHINE SHOP, tools, jigs and machine repairs. 301 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

WANTED

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 WANTED

PRACTICAL WORKS MANAGER AND MEchanical expert with years of experience in United States and Canada, a specialist in munition work, open for engagement. Best of references. Apply Box 304, Canadian Machinery. c4m

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

EMPLOYMENT AGENT OR EMPLOYEEinterviewer position. Lady, middle-aged, possessing keen discernment, educated above the average, good correspondent (shorthand writer, typist), desires position as above with large firm of engineers or any factory, to interview employees and referees. Moderate salary desired. Toronto Engineering Agency, 57 Queen W., Toronto.

FOR

IMMEDIATE DELIVERY

No. 28—17" x 96" Brown & Sharpe Plain Grinder.

Pratt & Whitney Vertical Surface Grinder, 36" Table.

No. 1½ Bath Universal Grinder, complete tool room equipment.

No. 1½ Landis Universal Grinder, for Internal and External Grinding.

36 ft. Niles Plate Planer.

Lynd-Farquhar Co.

Boston, Massachusetts

SITUATIONS WANTED

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

SITUATIONS VACANT

MECHANICAL DRAFTSMAN WANTED. Experienced on engines or turbines, capable of working out engine details. Apply giving full particulars as to experience, salary required, and enclose references, to Henry Hope & Sons of Canada Limited, Peterborough, Ont. c6m

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

WANTED — ASSISTANT SUPERINTENDENT for six-inch shell factory. Must be capable of getting maximum production from an established plant and have good mechanical experience. Duties to consist chiefly in supervising production. Give full particulars in writing of previous experience, age, references, and salary required, to Henry Hope & Sons of Canada, Ltd., Peterboro. All information will be treated in the strictest confidence. c5m

PRESS EQUIPMENT FOR SALE

50—No. 18 Bliss Type Inclinable Presses.

6—No. 19 Bliss Type Inclinable Presses, with roll feeds.

1—Double Acting (Michigan) Press.

1—Double Acting (Rhodes England) Press.

1—Brown-Boggs Multiple Power Shears.

A large number of these presses are equipped with Dial Feeds. Have only been used for a few months—good as new. Will be sold at a bargain if purchased at once.

Apply 702 Excelsior Life Building TORONTO

c10m

FOR SALE

Equipment used for making 18-pr. Shells.

1—Warner & Swasey Turret Lathe, 2" x 24", with attachments.
1—Linderman Double Spindle Boring Machine, with attachments for finish boring shrapnel and nose turning H.E.
1—Flather & Co. 14" x 5' 0" Lathe, with chuck and countershaft.
1—Fosdick 16" x 6' 0" Lathe, with collet chuck and countershaft.
1—Braopose 16" x 6' 0" Lathe, collet chuck and taper attachment.
1—Goldie & McCulloch Nosing Press with Dies.
1—Beatty Accumulator.
1—Lees-Bradner Thread Miller, with attachments and countershaft.
1—Jones & Lamson Turret Lathe, 2" x 24".
1—40-gallon Bowser Tank and Pump; good as new.
1—Cold Saw, with variable speed motor, 60 cycle, 220 volt, cuts up to 9" stock, complete with three saws.
1—4-Connection Pyrometer with Rheostat, made by Taylor Instrument Co.
1—Thermo Couples, 39" long, bent 12½" from nose.
1—Thermo Couples, 39" long, straight.
1—One-Connection Tycos Pyrometer, made by Taylor Co.
1—Bertram Band Turning Attachment, for 24" Lathe, Ball-bearing Centre.

All the above located at Welland. Prices, Delivery and full particulars gladly furnished.

M. Beatty & Sons, Limited
Welland, Ont.

c11m

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.

NOW!

You've been going to send in that ad for weeks, so why not mail it now for next week's issue?

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Ave. Toronto

H. W. PETRIE of MONTREAL Limited Montreal, Que.

LIST OF NEW AND USED MACHINERY IN STOCK FOR IMMEDIATE SHIPMENT

ENGINE LATHES

New 13" x 5' Lancaster Sgl. B.G., Geared Feed.
New 15" x 6' South Bend, Sgl. B.G., Stan. Change Gears.
New 16" x 6' South Bend, Sgl. B.G., Stan. Change Gears.
New 15" x 7' Oliver Dbl. B.G., Q.C. Gear, Oil Pump and Pan.
New 16" x 24" x 10' South Bend Gap Sgl. B.G., Stan. Change Gears.
S.H. 17" x 8' Greaves Klusman Sgl. B.G., Geared Feed.
New, 18" x 8' Greaves Klusman Dbl. B.G., Geared Feed.
New 18" x 8' Giddings & Lewis Dbl. B.G., Geared Feed.
New 16" x 8' Stevens Sgl. B.G., Standard Change Gears.
New 18" x 8' South Bend Sgl. B.G., Stand. Change Gears.
S.H. 18" x 10' Muller Sgl. B.G., Standard Change Gears.
New 18" x 12' South Bend Sgl. B.G., Stand. Change Gears.
S.H. 20" x 10' Flather Sgl. B.G., Standard Change Gears.
S.H. 36" x 10' Fay & Scott Sgl. B.G., Stand. Change Gears.

HEAVY DUTY MANUFACTURING LATHES

New 20" x 8' Petrie Heavy Duty Manufacturing Lathes.

TURRET, SPEED AND BRASS LATHES SCREW MACHINES

New 13" x 7' Putman Speed Lathe.
S.H. 15" x 5' 6" Fox Brass Lathe with Chasing Attachment.
S.H. 30" x 10' Vilter Lathe, Friction B.G., Geared Feed with 18" Hex. Power Feed Turret.

DRILLS

New 20" Excelsior, Back Geared Wheel Lever, Power Feed.
New 20" Silver, Back Geared Wheel Lever Power Feed.
New 14" Leland Gifford Single Spindle Sensitive.
S.H. 14" Avey Spingle Spindle Sensitive.
S.H. 14" Foote-Burt Four.
New No. 1 Emco Bench Single.

HACK SAW MACHINES

New Peerless High Speed.
New No. 1 Rapid.

GRINDING AND BUFFING MACHINES

New 20" Ford Smith Water Tool Grinder.
New 18" Ford Smith S.O. General Purpose Pedestal Grinder.
New 16" Ford Smith S.O. General Purpose Pedestal Grinder.
New 12" Ford Smith S.O. General Purpose Pedestal Grinder.
New 12" Ford Smith S.O. Combination Grinder and Buffer.
New 12" Ford Smith S.O. Buffing Machine.

MISCELLANEOUS

S.H. No. 22 Garvin Vertical Milling Machine.
S.H. No. 0 Burke Hand Milling Machine.
New 1¼" National Bolt Cutter with Lead Screw Attachment.
New No. 1 Grabo Metal Saw Table.
New D4 Rock River Slitting Shear.
New No. 4 Chicago Steel Bending Brake.

Telegraph, Phone or Write for Prices and Further Particulars

H. W. PETRIE of MONTREAL
LIMITED
MONTREAL, QUEBEC

PETRIE'S LIST

Of New and Used Machine Tools Stock for IMMEDIATE DELIVERY

TURRET LATHES AND SCREW MACHINES

2" x 24" Stevens, flat type.
12" x 42" Foster, plain head.
15" x 5½" American, fox.
16" x 6' Pratt & Whitney, turret.
18" x 6' Prentice, high speed.
22" x 8' Pratt & Whitney.
24" x 10' Conradson, D.B.G.
24" x 8' Lodge & Shipley.
26" x 8' Fay & Scott, B.G.
No. 2 Warner & Swasey, plain head.
No. 6 Warner & Swasey, friction head.

ENGINE LATHES

13" x 6' Filssmith, D.B.G.
14" x 6' Lodge & Shipley.
15" x 8' Sebastian, back geared.
16" x 8' McDougall, back geared.
17" x 8' Blaisdell, back-geared.
18" x 6" New Haven.
18" x 10' Putnam, back-geared.
20" x 8' Fifield, back geared.
21" x 8' Bawden, heavy duty.
24" x 11' Pond, back-geared.
30" x 10' Ames, back geared.
31" x 16' Fifield, back-geared.
18" x 32" x 12' C.M.G. gap.
24" x 40" x 20' Dundas, gap.
28" x 50" x 24' Bertram, gap.

DRILLS

13" Perfect, 2-spindle.
14" Excelsior, sensitive.
16" Barr, sliding head.
18" Buffalo, post drill.
20" Perfect, lever feed.
20" Silver, back-geared.
22" Barnes, back-geared.
24" Kerkhoff, sliding head.
40" Bickford, back geared.
64" Canedy-Otto, wall radial.
No. 10a Baush, 16-spindle.
No. ½ Avey, ball-bearing, bench.

GRINDERS

No. 1 Wilmarth & Morman.
No. 1 Cincinnati, universal tool.
No. 2 Landis.
No. 2 Sellers, universal.
No. 3 Modern, universal.
No. 14 Besly, with shell holder.
26" Gardner, disk.

IRON PLANERS

20" x 20" x 5' Bertram.
24" x 24" x 6½' Bertram.
25" x 25" x 12' Lodge & Davis.
36" x 36" x 10' Sellers, 4 heads.
40" x 40" x 12' New Haven, power feed.

MILLING MACHINES

No. 0 Burke, hand feed.
Bertram, plain.
Brown & Sharpe, power feed, plain.
Fitchburg, geared, plain.
No. 2 Ford-Smith.
No. 6 Whitney, hand feed.

SHAPERS.

16" Canada Mach. Corp.
16" Hendey.
16" Queen City, back geared.
20" Cincinnati, back geared.
24" Gould & Eberhardt.
30" Morton, draw cut.

MISCELLANEOUS

6" and 12" Racine Hack Saws.
4" and 6" Robertson Hack Saws.
6" Kennedy Cutting-off Machine.
12" Hall Pipe Machine.
No. 2 Colburn Keyseater.
No. 5 Grant Rotary Riveting Hammer.
Nos. 1 and 3½ Greenerd Arbor Presses.
No. 2 Bliss Foot-power Press.
No. 3 West Tire Setter Banding Press.
Brown-Boggs Punching Press.
Bertram Single-end Punch and Shear.
No. 3 Dundas Double-end Punch and Shear.
7' Geared Bending Rolls.
1500-lb. Toledo Drop Hammer.
450-lb. Williams Drop Hammer.

H. W. PETRIE, LTD.
FRONT STREET WEST, TORONTO

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

LOOK—HERE THEY ARE

BORING AND TURNING MACHINES—VERTICAL.

1—30" Bullard, 1 turret head.
1—30" Pratter, one turret head.
1—36" Bansch, 2 swivel heads.
2—36" Brown & Sharpe, one turret head; Dec delivery.
1—42" Niles, two swivel heads, motor drive.
1—New 42" Gisholt, 2 heads.
1—42" Niles, two swivel heads.
1—80" Niles, two swivel heads, slotting attachment.
1—84" Sellers, one head.
1—96" Vertical Cylinder.
1—New 8' Bickford; December delivery.
10' Niles, 2 heads; December delivery.

BORING MACHINES—HORIZONTAL.

1—Lucas, 2¾" bar.
1—No. 1 Barrett Cylinder Borer, 3¾" bar type.
1—Newburgh 4" bar, 84" swing, 72" feed.
1—No. 2 20" Barrett, 2 facing heads.
1—Betts Table Type, 4" bar, 8' spindle to bearing.

BULLDOZERS.

1—New No. 4 Garrison (same as No. 4 Williams-White).
1—No. 7 High-speed Ajax, 16" stroke.
1—No. 9 Williams & White, belt drive.
2—No. 23 Williams & White, belt drive.
1—No. 26 Williams & White, belt drive.

COMPRESSORS—AIR.

1—Ingersoll-Sargent Duplex, 8 x 14½ x 8".
1—Cincinnati Cross Compound, two-stage, 790 cu. ft.
1—10" x 12" Chicago Pneumatic, belt-driven.
1—10" x 10" x 10" Single Cylinder Smith-Valle, steam driven.
1—22" x 15" x 16" Ingersoll-Rand, motor driven.

CRANES.

2—10-ton Electric, 47' span.
1—30-ton Nile, 61' span.
1—Locomotive, 35' boom, standard gaged, steam driven.

CUTTING-OFF MACHINES.

2—No. 00 Brown & Sharpe.
1—2" capacity Warner & Swasey.
4—3½" Hall.
10—4½" Williams.
3—4" Curtis & Curtis.

DRILLING MACHINES—RADIAL.

2—New 2' American, cone drive.
1—3' Bickford, semi-Universal table.
1—3' Bickford, gear drive.
3—New 3' Americans, sensitive tapping attach.
1—New 3' Mueller, plain speed, box drive.
1—New 3½' Western Drill, 86" circle.
2—4' Mueller, plain, speed box drive.
1—5' semi-universal American.
1—6½' American full Universal.
1—6' Baush Plain, cone driver.
New 6' Triumph, motor drive; September delivery.

DRILLING MACHINES—HEAVY DUTY.

2—New No. 2 Colburn.
3—No. 14 Colburn, 24" swing, capacity 2" in solid steel.
2—103 Colburn, plain table.
4—No. 310 Baker, single pulley drive, late type.

DRILLING MACHINES—MULTIPLE SPINDLE.

4—New Leland-Gifford, sensitive, four spindle.
1—No. 30C Baush, 12 spindle, capacity 1⅛" holes, 30" circle.
1—14-spindle Baush, capacity 1" holes, 36" circle.

GEAR-CUTTING MACHINES.

1—No. 1 Whiton.
1—No. 3 Bickett Gear Rack Planer, delivery 60 days.
1—No. 3 Brown & Sharpe Auto. Gear Cutter, Spur.
1—New 6" Standard Gear Cutter, Spur.
1—12" Gleason Bevel Gear Planer.
1—16" Gleason Bevel Gear Planer.
1—16" Bilgram Bevel Gear Generator.
1—20" Grant-Lee Gear Hobber.
1—No. 1 20" Schuchardt & Schutte Gear Hobber.
1—22 x 8 G. & E. Spur and Bevel Cutter.
1—24" Fellows Gear Shaper.
1—24 x 8" G. & E. Cr Spur and Bevel.
1—24" Becker Brainard.
1—New No. 10 Whiton, Bevel 32", Spur 34".
3—36" Fellows Gear Shapers.

GRINDERS—UNIVERSAL FOR CUTTERS, DRILLS, REAMERS, ETC.

1—No. 1 Cincinnati.
1—New Norton No. 1.
1—New Walker No. 1, outfit B.
1—New Walker No. 2, outfit K (capacity 9" x 36").
1—New Wilmarth & Morman, style B.K.
5—No. 190 Wells.
1—Gisholt No. 5, 12".

GRINDING MACHINES—CYLINDRICAL—PLAIN.

1—New No. 12 Brown & Sharpe, 8" x 25", Sept. delivery.
1—New 10 x 36" Landis; immediate.
1—New 10" x 36" Norton, Sept. delivery.
1—New 10" x 60" Norton, Sept. delivery.
1—10" x 60" Landis.
1—New 10 x 72 Norton, Plain.
20—12" x 24" Modern, self-contained.
1—12" x 32" Landis, rebuilt.
6—12" x 36" Modern, self-contained, motor or belt driven.
2—12 x 42" Landis, self-contained.
6—12" x 48" Modern, self-contained, motor driven.
1—16" x 66" Landis, with crank grinding.
1—18" x 96" Brown & Sharpe.

GRINDING MACHINES—CYLINDRICAL—UNIVERSAL.

1—Brown & Sharpe No. 13, 8" x 24".
1—New No. 2 Bath, 9" x 20".
1—No. 2 New Walker, 9" x 26".
1—No. 1½ (10" x 30") Landis.
1—New No. 2½ (10" x 36") Bath.
1—10" x 42" Modern.
9—New No. 2 Morse, cap. 12" x 30", Universal. Nov. delivery.
1—No. 3 (12" x 40") Brown & Sharpe.
1—12" x 42" Landis.
2—New No. 3 Modern, 13" x 4'. Sept. delivery.

GRINDERS—INTERNAL.

1—No. 1½ Landis.
1—No. 70 Heald.
1—No. 75 Heald.

GRINDERS—CYLINDER.

1—No. 27 Brown & Sharpe.
1—No. 60 Heald, single pulley drive.

GRINDERS—PROFILE.

1—New Cleveland.

GRINDING MACHINES—RING.

1—New No. 14 Beasley, two-ring chucks.
1—No. 200 Heald.
1—No. 210 Heald.

GRINDING MACHINES—SURFACE.

1—New No. 1 Wilmarth & Morman.
1—No. 1 Diamond, capacity 12" x 12" x 24", automatic.
2—New No. 1½ Walker's, complete.
1—New No. 2 Reid (same as B. & S.).
1—New No. 2 Brown & Sharpe.

HAMMERS—POWER—FORGING.

1—40-lb. Bradley Helve.
1—150-lb. Bradley Helve, upright.

HAMMERS—BOARD LIFT—DROP.

1—900-lb. Billings & Spencer.
1—2,000-lb. Chambersburg.

HAMMERS—STEAM—FORGING.

1—Used 600-lb. Niles Single Frame.
1—18" Morgan & Williams, 600 to 800 lbs., 21" gap.
1—New 2,000 lbs. Morgan Single Frame.
1—3,000 lbs. Morgan Double Frame.

KEYSEATERS.

2—No. 0 Mitts & Merrill.
1—No. 2 Mitts & Merrill.
1—60" stroke Compton Knowles Broacher.

LATHES—MANUFACTURING—NOT SCREW CUTTING.

2—New No. 3 Harding Brothers Bench Lathe.
14—Reed-Prentice Shell Lathes, for 4" or 18 lbs. American shells.
70—New Simplex, 15" x 8'.
15—No. 3X Reed-Prentice, semi automatic.
40—14" x 6' Reed Stud and Bolt.
5—16" x 8' Fairbanks-Morse, heavy duty.
14—16 x 8 Simplex, Cone Pulley Drive.
22—18" x 8' Battle Creek, heavy duty.
5—20" x 8' Merschon.
50—20" x 10' Hindman, high duty.

LATHES—ENGINE.

1—8" Wade Precision; September delivery.
1—14" x 6' Bradford, taper attachment.
1—New Harding Brothers 15" Precision Lathe, quick-change gear, page 35, third catalogue.
3—New 16" x 6' Cleveland Tool Room Lathes, complete equipment.
2—16" x 6' LeBlond, pan bed, quick-change gears, taper attachment.
1—New 17" x 8' National, quick-change gears.
1—18" x 8' Lodge & Shipley, geared head, taper.
2—18" x 9' Chant.
1—18 x 10 Hendey, quick-change gear, 14" chuck.
1—New 19" x 8' LeBlond, heavy duty.
22—20" x 8' Lodge & Shipley, quick-change gear.
7—New 20" x 8' American, heavy duty.
1—New 20" x 10' Cleveland, geared head.
25—New 21" x 10' Porter, single back geared.
5—New 22 x 10' Monarch, double back geared, Q.C.G.
9—22" x 10' Putnam, oil pan turrets.
3—24" x 10' Reed.
2—24" x 12' S. & B.
4—24" x 14' American, quick-change.
1—24" x 11' Lodge & Shipley, patent head.
1—24" x 24' Perkins, single back geared, raising blocks to 40", 18" chuck.
1—24" x 10" x 22' Monarch, double spindle.
1—27" x 24' New Haven.
4—27" x 14' Patent Head Lodge & Shipley, double back geared.
1—28" x 18' New Haven, single back geared.
1—28" x 18' Schumacher & Boye.
3—New 32" x 12' Pittsburg pattern.
8—New 36" x 24' Putnam triple geared.
1—38 x 19' Steptoe, single back gear.
1—71" x 20' Fifield, triple geared.

LATHES—TURRET.

1—7" x 24" James & Lamson, geared sliding head.
4—2 x 24 Jones & Lamson.
18—6A Potter & Johnson.
1—New 21" Gisholt.

MILLING MACHINES—KNEE TYPE—UNIVERSAL.

1—No. 2 Kempsmith, 13", dividing head.
1—No. 2 Kempsmith, vertical attachment.
1—New Kempsmith.
1—No. 2 Kempsmith, back geared.
1—No. 2 Cincinnati.
2—No. 3 Cincinnati, late model; almost new.
1—New No. 3 Kempsmith.
2—New No. 3 Becker, August delivery.
1—New No. 4 LeBlond, heavy duty; immediate.
1—No. 4 Cincinnati, with vertical attachment.

MILLING MACHINES—KNEE TYPE—PLAIN.

1—No. 0 Pratt & Whitney.
1—New No. 1 Brown & Sharpe.
2—New No. 1 Kempsmith.
2—New No. 1½ American, back gear.
1—New No. 2 Rockford.
2—New No. 3 Kempsmith.
1—No. 3 LeBlond.
1—No. 3 Cincinnati.
1—No. 4 Garvin.

MILLING MACHINES—VERTICAL.

1—New Bickett, No. 0.
4—New No. 4B Becker.
2—No. 5 Becker.
1—New No. 6 Becker.

MILLING MACHINES—PLANER TYPE.

1—No. 2 Beaman & Smith, vertical spindle, open side.
2—Ingersoll Slab Millers, working surface of table 60" x 20".
1—No. 4 Beaman & Smith, vertical spindle, open side, working surface of table 120" x 24", removable housing on one side.

PLANERS.

1—24" x 24" x 6' Gray, one head on cross rail.
24" x 24" x 8' Cincinnati, one head; used three months.
1—26" x 26" x 8' Gray, one head on cross rail.
1—30" x 30" x 8' Gale Planer, one head.
1—30" x 30" x 12' Cincinnati, two heads.
1—36" x 36" x 12' New Haven, one head.
New 36" x 36" x 12' Bickett, one head; January del.; additional heads if desired.
2—New 36" x 36" x 12' Woodward & Powell, two heads on cross rail, one side head; Oct. delivery.
1—36" x 36" x 12' Gray, two heads.
1—36" x 36" x 14' Sellers, four heads.
1—40" x 40" x 11' Niles, four heads.
1—Gray, 42", widened to 56" x 42" x 16, two heads.
New 48" x 42" x 16' Bickett, one head; January delivery; additional heads if desired.
1—48" x 48" x 16' Sellers, one rail head, two side heads.
1—50" x 14' Powell, one head.
1—52" x 52" x 16' Betts, two heads, right angle drive.
1—52" x 42" x 16' Woodward-Powell, 2 heads.
1—54" x 42" x 16' Graves, two heads.
1—60" x 60" x 18' Niles, two heads.
1—72" 6 Niles Plate Planer.

SCREW MACHINES—AUTOMATIC.

5—No. 51 National Acme.
1—No. 515 National Acme.
2—No. 52 National Acme.
2—No. 53 National Acme.

SHAPERS.

1—New 18" Springfield.
1—16" Motor-driven Rockford.
2—New 24" Milwaukee.
1—New Barker, 24".
1—30" Walcott, gear drive.

SLOTTERS

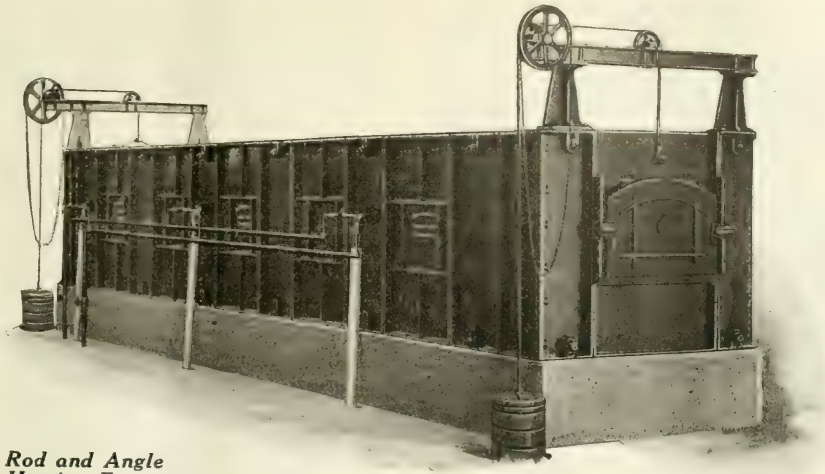
1—18" Betts, adjustable stroke.
1—12" Bement, Gear.
1—9" Bement Gears.

W. F. DAVIS MACHINE TOOL COMPANY

CHICAGO, ILL. 549 Washington Blvd. | **CINCINNATI, OHIO** 1018 Union Central Life Bldg. | **CLEVELAND, OHIO** 508 Leader News Bldg. | **NEW YORK CITY** Singer Bldg.

WRITE OR WIRE OUR NEAREST OFFICE FOR QUOTATIONS
THIS IS ONLY A PARTIAL LIST OF AVAILABLE MACHINES

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



Rod and Angle Heating Furnace

Rapid Heats—Uniform Temperatures

WITH THIS

TATE-JONES

Rod and Angle Heating Furnace

"Rapid heats" means a saving in time—but not at the expense of the work.
"Uniform temperatures" means a uniform finished product.

In these days, where every minute and every ounce of material must be utilized to the fullest, the two facts mentioned above prove of vital importance.

Some of the Other Features of this Tate-Jones Furnace

This furnace can be fired with either oil or gas and can be operated on high or low pressure system. A very economical and convenient burner is our combination oil and gas burner which permits the use of either fuel at the will of the operator. This is especially valuable in districts where the fuel supply is likely to be delayed or discontinued from any cause, or where fluctuations in price of either fuel have to be considered.

Different temperatures in the heating chamber can be produced at the same time. Where a long furnace is used on short work, the short section needed can be used instead of firing up the whole length. This is especially valuable when heating angles for bending, etc.

The burners fire on both sides of the furnace and are placed in staggered positions. Baffles distribute the heat uniformly over the arch and radiate it uniformly on to the hearth.

By arrangement of vents and flues, a considerable portion of the heat is recovered and utilized in heating the hearth from below.

If the work your plant is engaged in consists of any of the following or similar operations, it will prove decidedly to your advantage to write for Bulletin—giving further particulars.

For heating angles, bending and forming work in shipyards and structural shops. Also for heating rods for continuous bolt, rivet and spike machinery.

We make furnaces of all types and kinds for the heat treatment of metals.
In making requests for information, mention the particular work so that the proper literature can be sent.

TATE-JONES & CO., INC. *FURNACE ENGINEERS* **PITTSBURGH, PA.**

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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.

HINTS TO BUYERS

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

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Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Montreal, Que.
Carborundum Co., Niagara Falls, N.Y.
Foss & Hill Machy. Co., Montreal.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Norton Co., Worcester, Mass.
H. W. Petrie, Toronto.
H. W. Petrie, of Montreal, Ltd., Montreal.

ACETYLENE
Carter Welding Co., Toronto, Ont.
Commercial Acetylene Welding Co., Inc., Toronto
L'Air Liquide Society, Montreal, Toronto
Prest-O-Lite Co., Inc., Toronto, Ont.

ACETYLENE GENERATORS
Commercial Acetylene Welding Co., Inc., Toronto
L'Air Liquide Society, Montreal, Toronto
Prest-O-Lite Co., Inc., Toronto, Ont.

ACCUMULATORS, HYDRAULIC
Canadian Fairbanks-Morse Co., Montreal
Charles F. Elmes Eng. Works, Chicago
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York
Smart-Turner Mach. Co., Hamilton, Ont.
William R. Perrin, Ltd., Toronto

AIR RECEIVERS
Can. Ingersoll-Rand Co., Sherbrooke, Que.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke, Que.

AIR WASHERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

ALUMINUM
Canada Metal Co., Toronto
Tallman Brass & Metal Co., Hamilton

ALLOY, STEEL
Can. B. K. Morton, Toronto, Montreal
H. A. Drury Co., Ltd., Montreal
Hawkridge Bros. Co., Boston, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Standard Alloys Company, Pittsburgh, Pa.
Vanadium Alloys Steel Co., Pittsburg, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

ARBORS
Canadian Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland
Garlock-Walker Machinery Co., Toronto, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
H. W. Petrie, Toronto
H. W. Petrie, Ltd., Montreal
Pratt & Whitney Co., Dundas, Ont.

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

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Dominion Machinery Co., Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal
McClean & Son, F. W., Niagara Falls, Ont.
Riverside Machinery Depot, Detroit, Mich.
H. W. Petrie, Toronto
H. W. Petrie, Ltd., Montreal
Pratt & Whitney Co., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Can.
A. R. Williams Machy. Co., Toronto

BABBITT METAL
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Ltd., Toronto
Can. B. K. Morton, Toronto, Montreal
Foss & Hill Machy. Co., Montreal.
Hoyt Metal Co., Toronto
Jobborn, Geo. A., Hamilton, Ont
Magnolia Metal Co., Montreal
H. W. Petrie, Toronto
Tallman Brass & Metal Co., Hamilton

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Charles F. Elmes Eng. Works, Chicago, Ill.
Monarch Brass Mfg. Co., Toronto, Ont.
Niles-Bement-Pond Co., New York

BELT LACERS
Clipper Belt Lacer Co., Grand Rapids, Mich.

BELT DRESSING AND CEMENT
Baxter Co., Ltd., J. R., Montreal, Que.

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal
Graton & Knight Mfg. Co., Worcester, Mass.

BELTING, BALATA
Baxter Co., Ltd., J. R., Montreal, Que.
Can. B. K. Morton, Toronto, Montreal
Federal Engineering Co., Toronto, Ont.

BELTING, CHAIN
Canadian Fairbanks-Morse Co., Montreal
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
H. W. Petrie, Toronto
H. W. Petrie, Ltd., Montreal
Whitney Mfg. Co., Hartford, Conn.

BELTING, CONVEYOR
Goodyear Tire & Rubber Co., Toronto, Ont.

BELTING, LEATHER
Canadian Fairbanks-Morse Co., Montreal
Can. B. K. Morton, Toronto, Montreal
Dominion Machinery Co., Toronto
Graton & Knight Mfg. Co., Worcester, Mass.
Goodyear Tire & Rubber Co., Toronto, Ont.
McLaren, J. C., Belting Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
H. W. Petrie, Ltd., Montreal
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BELTING, STITCHED COTTON DUCK
Baxter Co., Ltd., J. R., Montreal, Que.
Bennett, W. P., 51 Montford St., Montreal, Que.
Dominion Belting Co., Hamilton, Ont.
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto

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New Britain Mach. Co., New Britain, Conn.

BENCH DRAWERS, FRICTIONLESS
New Britain Mach. Co., New Britain, Conn.

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John Bertram & Sons Co., Dundas
Bertrams, Limited, Edinburgh, Scotland
Bliss, E. W., Co., Brooklyn, N.Y.
Brown-Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Canada
Dominion Machinery Co., Toronto
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
Charles F. Elmes Eng. Works, Chicago
Jardine, A. B., & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York
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H. W. Petrie, Ltd., Montreal
Steel Bending Brake Works, Chatham, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

BILLET MARKERS
Matthews, Jas. H., & Co., Pittsburgh, Pa.

BINS, STEEL
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke
Toronto Iron Works, Ltd., Toronto, Ont.

BLASTING MACHINES, SHOT AND STEEL GRIT
Gray Mfg. & Mach. Co., Toronto, Ont.

BLOWERS
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Sheldons, Ltd., Galt, Ont.
Garlock Walker Machinery Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal
R. E. T. Pringle, Ltd., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Sturtevant Co., B. F., Galt, Ont.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
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Prest-O-Lite Co., Inc., Toronto, Ont.

BLUE PRINTING MACHINERY
Mollinger-Enlund Tool Co., Syracuse, N.Y.

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Francis & Co., Hartford, Conn.
Geo. A. Joyce Co., Ltd., New York, N.Y.

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The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
Riverside Machinery Depot, Detroit, Mich.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt, Ont.

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
Cumming & Son, J. W., New Glasgow, Canada
Galt Machine Screw Co., Galt, Ont.
London Bolt & Hinge Works, London, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

BOLT AND NUT MACHINERY
John Bertram & Sons Co., Dundas
Canada Machinery Corp., Galt, Ont.
Dominion Machy. Co., Toronto, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
Riverside Machinery Depot, Detroit, Mich.
A. R. Williams Machinery Co., Toronto

BOLT THREADING MACHINERY
Landis Machine Co., Waynesboro, Pa.
Victor Tool Co., Waynesboro, Pa.

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Cleveland Pneumatic Tool Co. of Canada, Toronto
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
Stow Mfg. Co., Binghampton, N.Y.

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John Bertram & Sons Co., Dundas
Canada Machinery Corp. Galt, Ont.
Dominion Machinery Co., Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Hill, Clarke & Co., Chicago, Ill.
Niles-Bement-Pond Co., New York
H. W. Petrie, Ltd., Montreal
Roelofson Machine & Tool Co., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Stow Mfg. Co., Binghampton, N.Y.

BORING MACHINES, STOVE AND COAL
Cumming & Son, J. W., New Glasgow, Canada

BORING AND TURNING MILLS
John Bertram & Sons Co., Dundas
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal
Niles-Bement-Pond Co., New York
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
R. E. T. Pringle, Ltd., Toronto, Ont.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland
New Britain Mach. Co., New Britain, Conn.

BRAKES
Brown, Boggs & Co., Hamilton, Can

BRASS AND COPPER BARS, RODS AND SHEETS
Brown's Copper & Brass Rolling Mills, New Toronto

BRASS WORKING MACHINERY
Dominion Machy. Co., Toronto, Ont.
Foster Machine Co., Elkhart, Ind
Garlock-Walker Machinery Co., Toronto, Ont.
Warner & Swasey Co., Cleveland
Niles-Bement-Pond Co., New York
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
Prest-O-Lite Co., Inc., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
A. R. Williams Machy. Co., Toronto

BRIDGES, RAILWAY AND HIGHWAY
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke

BRONZE RODS AND SHEETS
Brown's Copper & Brass Rolling Mills, New Toronto

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Pure Sanitary Dk'g Fountain Co., Hardenville, Mass.

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Ford Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal
Garlock-Walker Machinery Co., Toronto, Ont.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Ltd., Montreal
R. E. T. Pringle, Ltd., Toronto, Ont.

BUCKETS, CLAM SHELL, CRAB, DUMP
Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

BUCKETS, ELEVATING AND HOISTING
Banfield, Edwin J., Toronto.

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John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.

BURNERS, OIL AND NATURAL GAS
Bellevue Industrial Furnace Co., Detroit, Mich.
Gray Mfg. & Mach. Co., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Oven Equipment & Mfg. Co., New Haven, Conn.

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Wells Bros. Co. of Canada, Galt, Ont.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

CANNERS' MACHINERY
Bliss, E. W., Co., Brooklyn, N.Y.
Ferracute Mach. Co., Bridgeton, N.J.
Brown, Boggs & Co., Hamilton, Can.
Prest-O-Lite Co., Inc., Toronto, Ont.

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Cumming & Son, J. W., New Glasgow, Canada.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Belleville, Ont.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

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Dillon Mfg. Co., Oshawa, Ont.

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Blackall, Fred. S., Woolworth Tower, New York.
Prest-O-Lite Co., Inc., Toronto, Ont.

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Alexander Fleck, Ltd., Ottawa.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Tallman Brass & Metal Co., Hamilton.

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Bernard Industrial Co., The A., Fortierville, Que.
Brown, Boggs Co., Ltd., Hamilton, Canada.
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Gardner, Robt., & Son, Montreal
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Ford Chain Block & Mfg. Co., Philadelphia, Pa.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Wright Mfg. Co., Lisbon, Ohio.

CHEMISTS
Can. Inspection & Testing Lab., Montreal, Que.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Toronto Testing Laboratory, Ltd., Toronto.

CHESTS, TOOL
Union Tool Chest Works, Rochester, N.Y.

CHUCKS, AERO, AUTOMATIC
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.
Millers Falls Co., Millers Falls, Mass.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Richmond Mfg. Co., Toronto, Ont.
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H. W. Petrie, Toronto.
Skinner Chuck Co., New Britain, Conn.
Thomas Elevator Co., Chicago, Ill.
D. E. Whiton Machine Co., New London, Conn.

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Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Canada.
Whitney Mfg. Co., Hartford, Conn.
Richmond Mfg. Co., Toronto, Ont.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

CHUCKS, GEARED SCROLL
Richmond Mfg. Co., Toronto, Ont.

CHUCKS, MAGNETIC
H. E. Streeter, 503 New Birks Bldg., Montreal.

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, SPLIT
Rivett Lathe & Grinder Co., Brighton, Mass.

CHUCKING MACHINES
Garvin Machine Co., New York.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto, Ont.
Warner & Swasey Co., Cleveland, O.

CLOCKS, WATCHMAN, PORTABLE
Hardinge Bros., Inc., Chicago, Ill.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Ltd., Toronto.

COAL HANDLING MACHINERY
MacKinnon, Holmes & Co., Sherbrooke, Que.
Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

COILING MACHINERY, WIRE AND SPRING
Sleeper & Hartley, Inc., Worcester, Mass.

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

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

COLLECTORS, PNEUMATIC
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.
Stone Tool & Supply Co., J. R., Detroit, Mich.

COMPRESSORS, AIR
Can. Ingersoll Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Garlock-Walker Machinery Co., Toronto, Ont.
Hinckley Machine Co., Hinckley, Ill.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
Smart-Turner Machine Co., Hamilton, Ont.
Taylor Instrument Co., Rochester, N.Y.

CONTROLLERS AND STARTERS, ELECTRIC MOTORS
Dominion Machy. Co., Toronto, Ont.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
A. R. Williams Machy. Co., Toronto.

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

CONVERTERS, STEEL SLIDE-BLOW
Whiting Foundry Equipment Co., Harvey, Ill.

COPING MACHINES
Can. Blower & Forge Co., Kitchener, Ont.
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Lundas, Ont.

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

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

COUPLINGS, PLAIN AND FLEXIBLE
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Gardner, Robt., & Son, Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES, LOCOMOTIVE
Northern Crane Works, Walkerville.

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

CRANES, GOLIATH AND PNEUMATIC
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

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

CUPOLAS
Can. Blower & Forge Co., Kitchener, Ont.
Northern Crane Works, Walkerville.
H. W. Petrie, Toronto.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

CUPOLA BLAST GAUGES & BLOWERS
Sheldons, Ltd., Galt, Ont.

CUTTER GRINDERS AND ATTACHMENTS
Cincinnati Milling Machine Co., Cincinnati.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Monarch Brass Mfg. Co., Toronto, Ont.
Norton Grinding Co., Worcester, Mass.
H. W. Petrie, Ltd., Montreal.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co. of Canada, Toronto

CUTTERS, PIPE (SEE PIPE CUTTERS)

CUTTERS, MILLING
Becker Milling Machine Co., Boston, Mass.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Mach. Co., Cleveland, Ohio.
Cleveland Twist Drill Co., Cleveland.
Dominion Machy. Co., Toronto, Ont.
Foss & Hill Machinery Co., Montreal.
Garvin Machine Co., New York.
Goddard Tool Co., Chicago, Ill.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining & Mfg. Co., Toronto.
Elm Cutting Oil Co., Toronto.
Racine Tool & Machine Co., Racine, Wis.

CUTTING-OFF MACHINES
Armstrong Bros. Tool Co., Chicago.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Foss & Hill Machinery Co., Montreal.
Galt & Walker Machinery Co., Toronto, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hurlbut, Rogers Machy. Co., South Sudbury, Mass
John H. Hall & Sons, Brantford, Ont.
Wm. Kennedy & Sons, Owen Sound, Ont.
Peerless Machine Co., Racine, Wis.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Racine Tool & Machine Co., Racine, Wis.
Standard Mchy. & Supplies, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

CYLINDERS, AIR
Manufacturers Equipment Co., Chicago, Ill.

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Hinckley Machine Co., Hinckley, Ill.

CUTTING AND WELDING PLANTS
Prest-O-Lite Co., Inc., Toronto, Ont.

DAMPER REGULATORS
Canadian Fairbanks-Morse Co., Ltd., Montreal.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

DIAMONDS, BLACK AND ROUGH
Geo. A. Joyce Co., Ltd., New York.

DIAMOND TOOLS
Francis & Co., Hartford, Conn.
Geo. A. Joyce Co., Ltd., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Banfield, W. H., & Son, Toronto.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rickert-Shafer Co., Erie, Pa.
Standard Machy. & Supplies, Ltd., Montreal.
Wells Brothers of Canada, Galt, Ont.

DIES FOR BIT BRACE USE
Wells Brothers Co. of Canada, Galt, Ont.

DIES, NOSING
Marsh & Henthorn, Ltd., Belleville, Ont.

DIES, PIPE THREADING
Landis Machine Co., Waynesboro, Pa.

DIE SINKERS
Becker Milling Machine Co., Boston, Mass.
Garvin Machine Co., New York.
H. W. Petrie, Ltd., Montreal.

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.
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.
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.
Dominion Machy. Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., 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.
Dominion Machy. Co., Toronto, Ont.
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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.
Dominion Machy. Co., Toronto, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Hill, Clarke & Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

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.
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.
Dominion Machy. Co., Toronto, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Ltd., Montreal.
Pratt & Whitney Co., Dundas, Ont.
R. E. T. Pringle, Ltd., Toronto, 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 & Machine Co., New Bedford.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.

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

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

DRILLS, ELECTRIC AND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Dominion Machy. Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
R. E. T. Pringle, Ltd., 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 & Mach. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
W. F. & John Barnes Co., Rockford, Ill.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Ltd., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRILLS, OIL TUBE
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. 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.
R. E. T. Pringle, Ltd., Toronto, Ont.

DRILLS, PNEUMATIC CORNER
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 & Mach. Co., New Bedford.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Dominion Machy. Co., 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 & Mach. Co., New Bedford.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
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.
R. E. T. Pringle, Ltd., Toronto, 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.
Dominion Machy. Co., Toronto, Ont.
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
Banfield, Edwin J., Toronto.
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.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., 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.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.

ENGINES, HORIZONTAL AND VERTICAL
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Johnson Mach. Co., Carlyle, Manchester, Conn.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
R. E. T. Pringle, Ltd., Toronto, 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.

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

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
Monarch Brass Mfg. Co., Toronto, Ont.
FLEXIBLE SHAFTS
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
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
Bliss, E. W., Co., Brooklyn, N.Y.
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
J. H. Williams & Co., Brooklyn, N.Y.
FORGING HAMMERS, BELT-DRIVEN
Bliss, E. W., Co., Brooklyn, N.Y.
J. H. Williams & Co., Brooklyn, N.Y.
FORGING HAMMERS, STEAM OR AIR
Erie Foundry Co., Erie, Pa.
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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, TEES
Dom. Forge & Stpg. Co., Walkerville, Ont.
FUSE CAP MACHINERY
Noble & Westbrook Mfg. Co., Hartford, Conn.
R. 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.
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.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
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, BEND
Bridgeford Mach. Tool Works, Rochester, N.Y.
GEARS, CUT, MORTISE, ANGLE, WORM
Baxter Co., Ltd., J. R., Montreal, Que.
Gardiner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Que.
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.
Dominion Machinery Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Toronto.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
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.
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W. H. Bandell & Son, Toronto.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
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Blake & Johnson Co., Waterbury, Conn.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Canada Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Dominion Machy. Co., Toronto, Ont.
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 & Machine Co., New Bedford.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
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United States Electrical Tool Co., Cincinnati, O.
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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.
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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.
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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.
R. E. T. Pringle, Ltd., Toronto, Ont.
Rivett Lathe & Grinder Co., Brighton, Mass.
GRINDERS, NAIL DIE
GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
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Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
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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.
Dominion Machy. Co., Toronto, Ont.
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., Toronto, Ont.
United States Electrical Tool Co., Cincinnati, O.
A. R. Williams Machy. Co., Toronto.
GRINDERS, RADIAL
Rivett Lathe & Grinder Co., Brighton, Mass.
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Blake & Johnson Co., Waterbury, Conn.
Blount, J. G., & Co., Everett, Mass.
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Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
National-Acme Co., Cleveland, Ohio.
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Tabor Mfg. Co., Philadelphia, Pa.
Wing & Son, J. E., Hamilton, Ont.
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Garvin Machine Co., New York City.
Millers Falls Co., Millers Falls, Mass.
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Erie Foundry Co., Erie, Pa.
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Beaudry & Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N.Y.
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Canadian Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
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Niles-Bement-Pond Co., New York.
Plessisville Foundry Co., Plessisville, Que.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
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Canada Machinery Corp., Galt, Ont.
West Tire Setter Co., Rochester, N.Y.
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Erie Foundry Co., Erie, Pa.
United Hammer Co., Boston, Mass.
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Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
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Erie Foundry Co., Erie, Pa.
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Whiting Foundry Equipment Co., Harvey, Ill.

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Jenckes Mach. Co., Sherbrooke, Que.
Marsh & Henthorn, Belleville, Ont.
Northern Crane Works, Walkerville, Ont.
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L. S. Starrett Co., Athol, Mass.

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

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JACKS, PIT AND TRACK
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Northern Crane Works, Walkerville.

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W. F. & John Barnes Co., Rockford.
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Foss & Hill Machy. Co., Montreal.
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Hardinge Bros., Chicago, Ill.
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Foss & Hill Machy. Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
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Foss & Hill Machy. Co., Montreal.
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The quality and finish of the work is perfect, and steady production can be maintained at an average rate of 5 per minute.

The discs are faced with abrasive at the outer part only, where the work is done.

All that is best in material and workmanship goes into Gardner Grinders. They last long, do the work as it should be done, and do it economically.

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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.
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Hill, Clarke & Co., Chicago, Ill.
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H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
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.
Dominion Machinery Co., Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
H. W. Petrie, Ltd., Montreal.
R. E. T. Pringle, Ltd., Toronto, Ont.
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.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
NUT MACHINES (HOT)
National Machy. Co., Tiffin, O.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machy. Co., Tiffin, O.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
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.
Petrie of Montreal, Ltd., H. W., Montreal, Que
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.
Toronto Welding Co., Toronto, Ont.
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)
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.
H. W. Petrie, Toronto.
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
Build & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Dominion Machinery Co., Toronto, Ont.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Ltd., Montreal.
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.
Dominion Machinery Co., Toronto, Ont.
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.
Hill, Clarke & Co., Chicago, Ill.
Morton Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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.
PLUG MILLERS
Banfield, Edwin J., Toronto.
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.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.
PRESSES FOR SHELLS
Atlas Press Co., Kalamazoo, Mich.
Charles F. Elmes Eng. Works, Chicago.
Dominion Machinery Co., Toronto, Ont.
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
West Tire Setter Co., Rochester, N.Y.
PRESSES, FILTER
William R. Perrin, Ltd., Toronto.
PRESSES, DROP AND FORGING
W. H. Bonnell & 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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Toledo Machine & Tool Co., Toledo
PRESSES, HYDRAULIC
John Bertram & Sons Co., Dundas.
Charles F. Elmes Eng. Works, Chicago.
Dominion Machy. Co., Toronto, Ont.
Ferracute Machine Co., Bridgeton, N.J.
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.
H. W. Petrie, Toronto.
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.
Garlock-Walker Machinery Co., Toronto, Ont.
William R. Perrin, Ltd., Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
Toledo Machine & Tool Co., Toledo.
A. R. Williams Machy. Co., Toronto.

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

PRESSES, BALING
William R. Perrin, Ltd., Toronto.
PRESSES, SPRING FOOT
Brown, Boggs & Co., Hamilton, Ont.
Consolidated Press Co., Hastings, Mich.
Toledo Machine & Tool Co., Toledo.
PRESSES, SCREW
Barnes, W. F., & John, Co., Rockford, Ill.
Ferracute Mach. Co., Bridgton, N.J.
William R. Perrin, Ltd., Toronto.
PRESSES, TRIMMING
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Positive Clutch & Pulley Works, Ltd., Toronto.
Bernard Industrial Co., A., Fortierville, Que.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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. R. Jardine & Co., Hespeler, Ont.
Mullmer-Enlund Tool Co., Syracuse, N.Y.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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
Scaife & Sons Co., Wm. B., 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.
R. E. T. Pringle, Ltd., Toronto, 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.
H. W. Petrie, Toronto.
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. R. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Ltd., Montreal.
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, Ont.
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
H. W. Petrie, Toronto.
R. E. T. Pringle, Ltd., 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.
Dominion Machy. Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal
Curtis Pneumatic Machy. Co., St. Louis, Mo.
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto.
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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
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
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
Strelinger Co., Chas. A., Detroit, Mich.
Stocker-Rumely-Wachs, Ltd., 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 of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto
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
H. W. Petrie, Toronto
Pratt & Whitney Co., Dundas, Ont.
Strelinger Co., Chas. A., Detroit, Mich.
A. R. Williams Machy. Co., Toronto
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., 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
H. W. Petrie, Ltd., Montreal
H. W. Petrie, Toronto
Toledo Machine & Tool Co., Toledo

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

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

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

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

SHELL BANDING MACHINES, HYDRAULIC
Chapman Double Ball-Bearing Co., Toronto, Ont.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
The Jenckes Machy. 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.
Morton Tool Co., Erie, Pa.
Mossberg Twist Drill & Mfg. 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, Edwin J., Toronto.
Bertram, 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.
Gray Mfg. & Mach. Co., Toronto, Ont.
Himoff Mach. Co., Inc., Astoria, L.I., New York.
Hyde Engineering Works, Montreal, Que.
A. B. Jardine & Co., Hespeler, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacLean & Sayward, Niagara Falls, Ont.
National-Acme Co., Cleveland, Ohio.
D. McKenzie Machinery Co., Guelph, Ont.
Mulliner & 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
Jobbom, 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
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Brown, Boggs & Co., Hamilton, Canada
Canada Machinery Corp., Galt, Ont.
Ferracute Mach. Co., Bridgton, N.J.
Noble & Westbrook Mfg. Co., Hartford, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Matthews, Jas. H. & Co., Hartford, Conn.
Noble & Westbrook Mfg. Co., Hartford, Conn.
Pritchard-Andrews Co., Ottawa, Can.

STAPLE MACHINES
Sleeper & Hartley, Inc., Worcester, Mass.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.
Can. Morehead Mfg. Co., Woodstock, Ont.
H. W. Petrie, Toronto
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Sturtevant Co., B. F., Galt, Ont.

STEEL ALLOY (SEE ALLOY STEEL)

STEEL BENDING BRAKES
Steel Bending Brake Works, Ltd., Chatham, Ont.

STEEL FOR AXES, PLOWS, SAWS, DRILLS, ETC.
Crucible Steel Co., Pittsburgh, Pa.

STEEL, CARBON, FERRO-TUNGSTEN
Can. B. K. Morton, Toronto, Montreal
Crucible Steel Co., Pittsburgh, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.
Zenith Coal & Steel Products, Montreal, Que.

STEEL, COLD ROLLED
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

STEEL DRUMS
Smart-Turner Machine Co., Hamilton, Ont.

STEEL PRESSURE BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Sturtevant Co., B. F., Galt, Ont.

STEEL, HIGH SPEED
Armstrong Whitworth of Canada, Ltd., Montreal
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Century Steel Co. of America, New York
Crucible Steel Co., Pittsburgh, Pa.
H. A. Drury Co., Ltd., Montreal.
Eagle & Globe Steel Co., Montreal, Que.
Fairley Davidson Steel Co., New York, N.Y.
Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Marsden & Co., Guelph, Ont.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Toronto
Stndard Alloys Company, Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.; represented in Canada by Norton, Collard & Co., Montreal, Que.
Zenith Coal & Steel Products, Montreal, Que.

STEELS, HIGH STRENGTH, HOT-WORKING, DIE, MAGNET
Fairley Davidson Steel Co., New York, N.Y.

STEEL, VANADIUM
Drury, H. A., Co., Montreal, Que.
Standard Alloys Co., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

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

STOCK RACKS FOR BARS, PIPING, ETC.
New Britain Machine Co., New Britain, Conn.

STOCKS FOR DIES
Wells Bros. Co. of Canada, Galt, Ont.

STOCKS, PIPE
Butterfield & Co., Rock Island, Que.
Wells Bros. Co. of Canada, Galt, Ont.

STOOLS, STEEL, SHOP
New Britain Machine Co., New Britain, Conn.

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TACK (DOUBLE POINT) MACHINES
Sleeper & Hartley, Inc., Worcester, Mass.

TANKS, GASOLINE AND OIL
Bowser & Co., Inc., S. F., Toronto, Ont.
Dominion Forge & Stamping Co., Walkerville.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes & Co., Sherbrooke, Que.

TANKS, STEEL, WATER PRESSURE
Bowser & Co., Inc., S. F., Toronto, Ont.
Can. Welding Works, Montreal, Que.
Jenckes Machine Co., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke.
Toronto Iron Works, Ltd., Toronto.

TANK WAGONS
Jenckes Mach. Co., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke.
Toronto Iron Works, Ltd., Toronto.

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

TAPPING MACHINES (PENUMATIC)
Cleveland Pneumatic Tool Co. of Can., Toronto.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John, & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto
Rickert-Shafer Co., Erie, Pa.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPS, ADJUSTABLE
Baxter Co., Ltd., J. R., Montreal, Que.
Geometric Tool Co., New Haven.
Manufacturers Equipment Co., Chicago, Ill.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.

TAPS, COLLAPSIBLE
Geometric Tool Co., New Haven.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss & Hill Machy. Co., Montreal.
Geometric Tool Co., New Haven.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Wells Bros. Co. of Canada, Galt, Ont.

TAP EXTENSIONS
Allen Mfg. Co., Hartford, Conn.

TESTING INSTRUMENTS METALLURGICAL
Shore Instrument & Mfg. Co., New York City.

THERMOMETERS, ALL KINDS
Taylor Instrument Co., Rochester, N.Y.
Bellevue Industrial Furnace Co., Detroit, Mich.

TESTING LABORATORIES
Can. Inspection & Testing Lab., Montreal, Que.
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machine Co., Tiffin, Ohio.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

THREADING TOOLS
Landis Machine Co., Waynesboro, Pa.
Rivett Lathe & Grinder Co., Brighton, Mass.

THREAD MILLING MACHINES
Gray Mfg. & Mach. Co., Toronto, Ont.
Taft-Pierce Co., New York, N.Y.
T. C. M. Mfg. Co., Harrison, N.J.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Peck, Stow & Wilcox, Cleveland, Ohio.

TIRE SETTING MACHINES, HYDRAULIC
William R. Perrin, Ltd., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Union Tool Chest Works, Rochester, N.Y.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Armstrong Bros. Tool Co., Chicago.
Can. B. K. Morton, Toronto, Montreal.
Deloro Smelting & Refining Co., Toronto, Ont.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOL STEEL
Atkins & Co., Wm., Sheffield, Eng.
Armstrong, Whitworth, Ltd. of Canada, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Colonial Steel Co., Pittsburgh, Pa.
Deloro Smelting & Refining Co., Toronto, Ont.
H. A. Drury Co., Montreal.
Eagle & Globe Steel Co., Montreal, Que.

Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall A. Co., Toronto, Ont.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Ltd., Toronto, Ont.
Sleeper & Hartley, Inc., Worcester, Mass.
Swedish Steel & Importing Co., Montreal, Que.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago, Ill.
H. W. Petrie, Ltd., Montreal.
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
A. R. Williams Machinery Co., Toronto.
United States Elec. Tool Co., Cincinnati, O.

TOOLS, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TORCHES, STEEL
Armstrong, Whitworth of Canada, Ltd., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.

TRACK SYSTEMS
Dillon Mfg. Co., Oshawa, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
A. R. Williams Machinery Co., Toronto.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Morse Chain Co., Ithaca, N.Y.
H. W. Petrie, Ltd., Toronto, Ont.
The Smart-Turner Machine Co., Hamilton.

TRANSMISSION TOWERS
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Wright Mfg. Co., Lisbon, Ohio.

TRUCKS, FACTORY, FREIGHT, ETC.
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS, LUMBER AND KILN
Sheldons, Ltd., Galt, Ont.
Northern Crane Works, Walkerville.

TUBING, SEAMLESS, BRASS & COPPER
Standard Tube & Fence Co., Woodstock, Ont.

TUBING COILERS, FLEXIBLE METAL
Sleeper & Hartley, Inc., Worcester, Mass.

TUMBLING BARRELS
Baird Machine Co., Bridgeport, Conn.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

TUNGSTEN FILAMENT COILING MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

TURNBUCKLES
Canadian Billings & Spencer, Ltd., Welland.

TURNTABLES
Whiting Foundry Equipment Co., Harvey, Ill.

TURRET MACHINES
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto, Ont.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Ltd., Toronto, Ont.
Pratt & Whitney, Hartford, Conn.
Riverside Machinery Depot, Detroit, Mich.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURBINE WATER WHEELS
Jenckes Mach. Co., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.

UPSETTING AND BENDING MACHINERY
John Bertram & Sons Co., Dundas
Brown, Boggs Co., Ltd., Hamilton, Canada.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Jenckes Mach. Co., Sherbrooke, Que.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Ltd., Toronto, Ont.
A. R. Williams Machy. Co., Toronto.

VACUUM PUMPS
Can. Blower & Forge Co., Kitchener, Ont.
Smart-Turner Machine Co., Hamilton, Ont.

VALVE LEATHERS
Can. B. K. Morton, Toronto, Montreal.
Graton & Knight Mfg. Co., Montreal.

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

VALVES, FOOT
Smart-Turner Machine Co., Hamilton, Ont.

VALVES, HYDRAULIC
Charles F. Elmes Eng. Works, Chicago, Ill.
Metalwood Mfg. Co., Detroit, Mich.

VALVES, BACK PRESSURE, STEAM
Sheldons, Limited, Galt, Ont.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Limited, Galt, Ont.
H. W. Petrie, Toronto.
Sturtevant Co., B. F., Galt, Ont.
A. R. Williams Machy. Co., Toronto.

VISES, AIR OPERATED
Hannifin Mfg. Co., Chicago, Ill.

VISE STANDS, PORTABLE
New Britain Machine Co., New Britain, Conn.

VISES, BENCH
Aikenhead Hardware Co., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Foss & Hill Machy. Co., Montreal.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.

VISES, PIPE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Wm. Bros. Co. of Canada, Galt, Ont.
J. H. Williams & Co., Brooklyn, N.Y.

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
Barnes, Wallace, Co., Bristol, Conn.
Dillon Mfg. Co., Oshawa, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
Leyden Bolt & Hinge Works, London, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WATER PURIFYING AND SOFTENING APPARATUS
Wm. B. Scaife & Sons Co., Pittsburgh, Pa.

WATER CINDER MILLS
Whiting Foundry Equipment Co., Harvey, Ill.

WATER JACKETS
Can. Welding Works, Montreal, Que.

WATER TOWERS
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

WATER WHEELS
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Sleeper & Hartley, Inc., Worcester, Mass.

WAVING AND UNDERCUTTING MACHINES AND ATTACHMENTS
Gray Mfg. & Mach. Co., Toronto, Ont.

WELDING MASKS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

WELDERS, ELECTRIC, SPOT, BUTT, ETC.
National Electric Welder Co., Warren, O.
Tabor Mfg. Co., Philadelphia, Pa.
Thomson Electric Welding Co., Lynn, Mass.
Winfield Electric Welder Co., Warren, Ohio.

WELDING, WORK AND SUPPLIES (Autogenous and Oxy-Acetylene) see OXY-ACETYLENE

WINCHES
John H. Hall & Sons, Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
Northern Crane Works, Walkerville.

WIRE COILING AND POINTING MACHINERY
Bond Machine Co., Bridgeport, Conn.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

WIRE CLOTH AND PERFORATED METALS
Canada Wire & Iron Goods Co., Hamilton.

WIRE FORMING AND STAMPING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Canada.
McClean & Son, F. W., Niagara Falls, Ont.
F. B. Shuster Co., New Haven, Conn.

WIRE NAILS
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.

WIRE STEEL, BRASS, COPPER, BRONZE
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE RAILS
Sleeper & Hartley, Inc., Worcester, Mass.

WOOD BORING MACHINES
Canada Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.

WIRE STRAIGHTENERS AND CUTTERS
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Canada.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

WOODWORKING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Toronto.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
R. E. T. Pringle, Ltd., Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machy. Co., Toronto.

WOOD LATHES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
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CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

Vol. XVIII. TORONTO, AUGUST 30, 1917 No. 9

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.

CHIEF OFFICES:

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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