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SMALL TOOLS

The Publisher's Page

TORONTO September 6, 1917

On Optimism

THE cessation of munitions orders has caused our manufacturers to look with redoubled attention to their old lines and to such of the new ones as the requirements of present needs indicate as best.

Admittedly, things are unsettled. They always are in the period of transition. Yet everywhere we go we find unbounded optimism. For it is obvious that the needs of the war while it lasts are such as to tax the entire productive facilities of Canada and the world. So if we are not to make munitions, certainly we will make other things.

The munitions period just ended has been a liberal education to the Canadian manufacturer. He now has an organization, funds and experience to tackle anything in reason.

His interests have broadened with the present need and opportunity.

It is not his alone. It is everybody's who buys from him or sells to him.

He is in the market now for bigger things and more things than he has ever been.

And this is where our service in Canadian Machinery comes in. We will put each manufacturer in touch with the other, so that all their needs will be supplied.

Our services as pioneers in the education of manufacturers in munitions making are well known. And so, as in the past, we will endeavor here to offer you the broad service of reflecting the needs and opportunities of the moment, as fast as they occur, and how best to profit by them.

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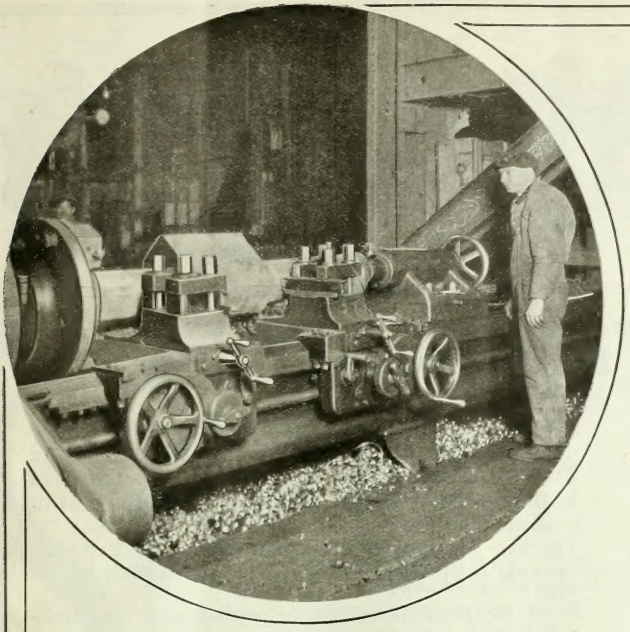

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One Way of Increasing Production.

EARLY DELIVERIES on these Heavy Forge Lathes.

27″ Bridgeford Heavy Forge Lathes

With any length bed for rapid and accurate production on heavy shafts and forgings.

Full Swing - - - -	27″
Swings over Carriage - -	13½″
Distance between Centres, 12′ Bed	6′

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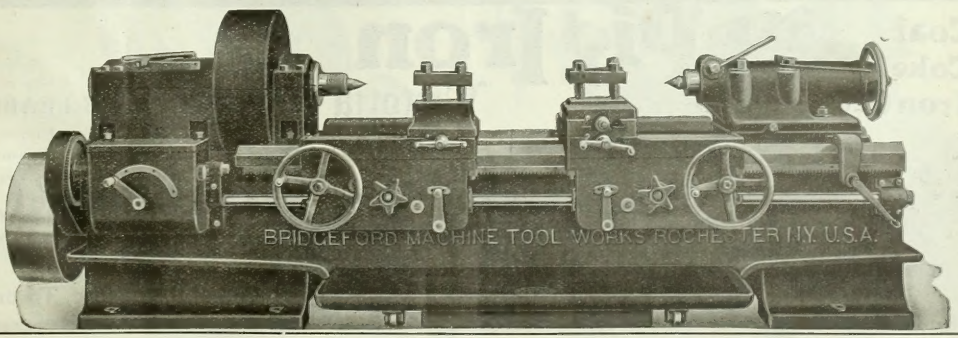

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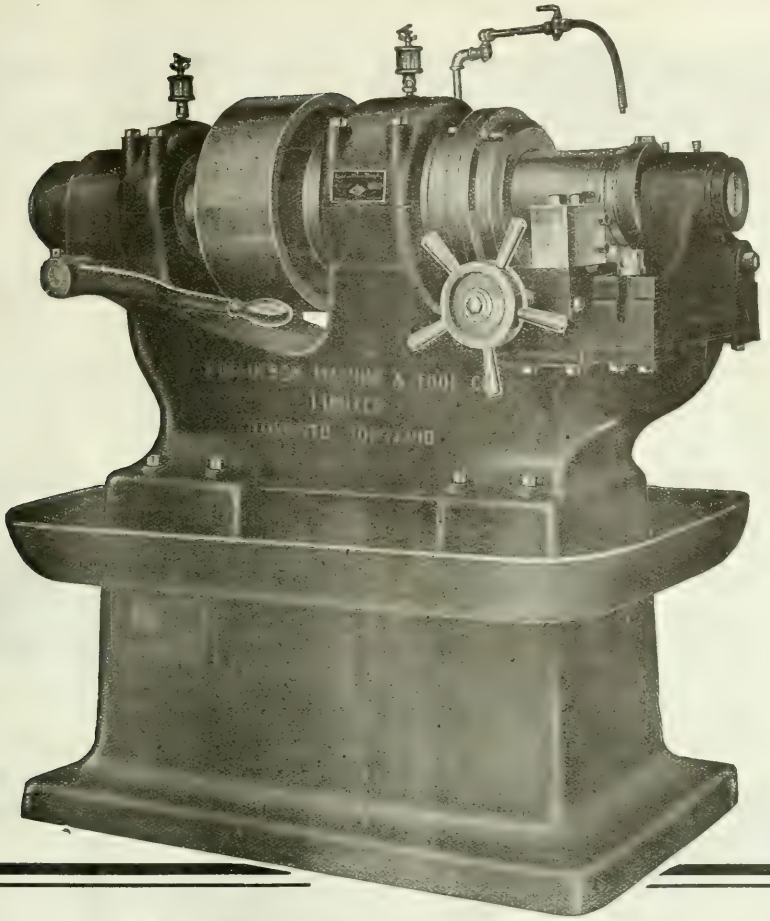

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we have two 4.5 machines ready for immediate delivery

THIS Band Turning Machine, by its ability to perform efficiently month after month under exceptional production strains, has proved its worth to munition makers. It is being used by many Canadian munition plants, where it is giving absolute satisfaction.

A glance over some of the features will interest you.

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

Chucking with spring collet chuck insures accurate and speedy chucking.

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

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

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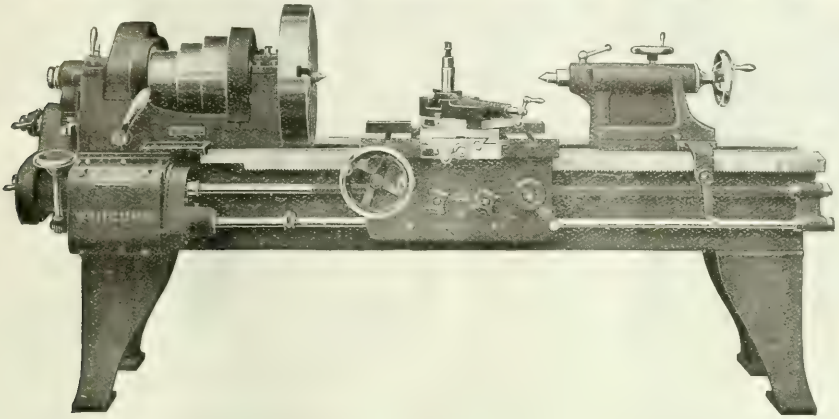
Whitcomb-Blaisdell Lathes



With Ample Power for the Heaviest Cuts

In the Whitcomb-Blaisdell Lathe *increased power* is obtained by the use of double-back gears and a three-step-cone driving pulley carrying an extra wide belt.

Nine changes of spindle speed are readily obtainable. Ratios of gearing are unusually large. The smallest step of cone is of sufficient diameter to give ample belt contact.

So throughout the transmission—from the pulley to cutting tool—the Whitcomb-Blaisdell has an excess of power. No cut that high speed steel can take is too heavy for the Whitcomb-Blaisdell.

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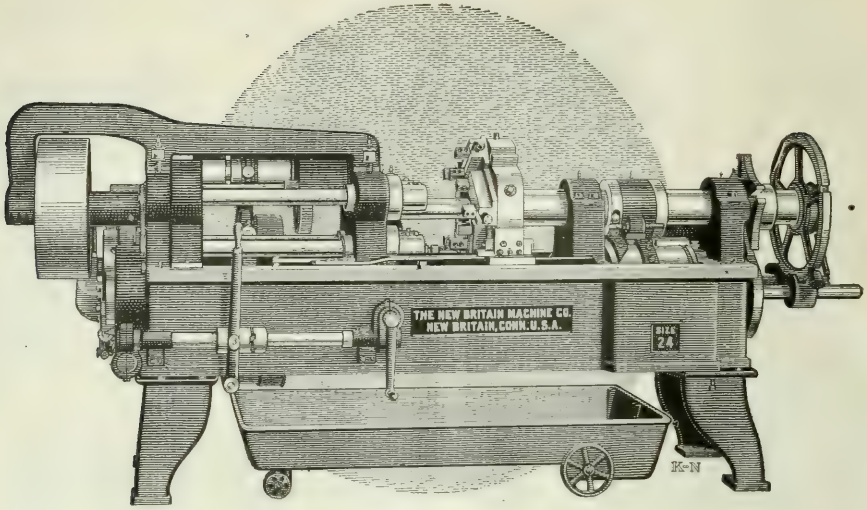

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Its ability to perform all operations simultaneously and automatically gives it a production capacity three to five times that of other machines designed for handling similar work.

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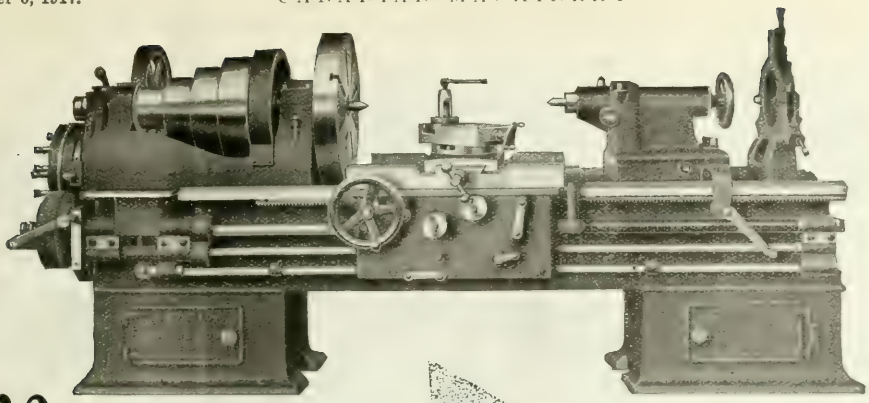

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Speeds Production

INSTALL the most modern machinery in your plant to meet the new conditions of to-day. You get it in Hamilton Lathes.

We are living in the greatest speed-up, cut-the-cost-of-production period of modern times. War time conditions demand speed and economy in the machine shop as well as in other institutions of commerce. Shops everywhere are now producing more work with the same force of men than before the war. The war has created a demand for the utmost efficiency and brought out the resourcefulness of the country in new machinery.

Hamilton Lathes represent the conditions in the machine shop and the spirit of the times with their speed, durability and accuracy.

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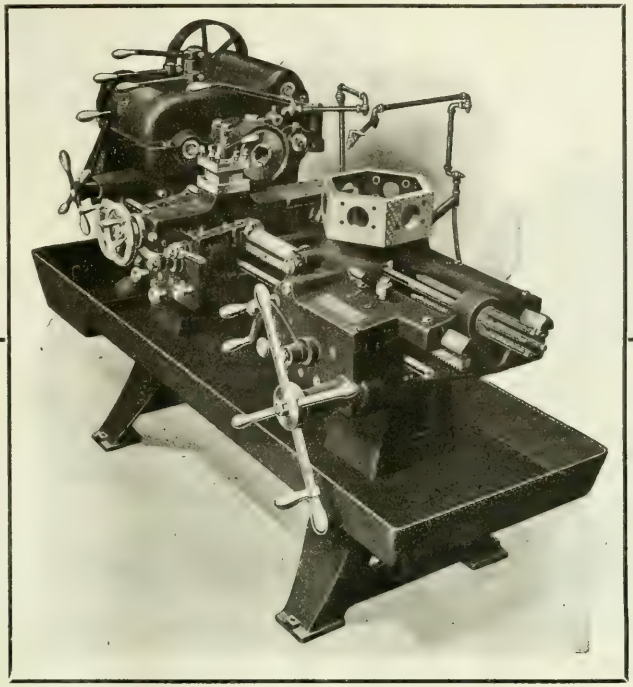

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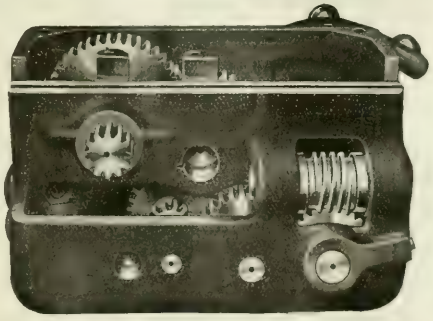
The rack pinion and all sliding gears and other gears subjected to heavy strain or wear are made of chrome-nickel steel. But this is not all. Behind the quality steel is our new modern and strictly up to the hour heat treating department, and behind this is the knowledge of how to treat the steel to get the result.



Saddle Apron

Please note, however, that this applies to all of the several sizes of machines built by the

FOSTER MACHINE COMPANY

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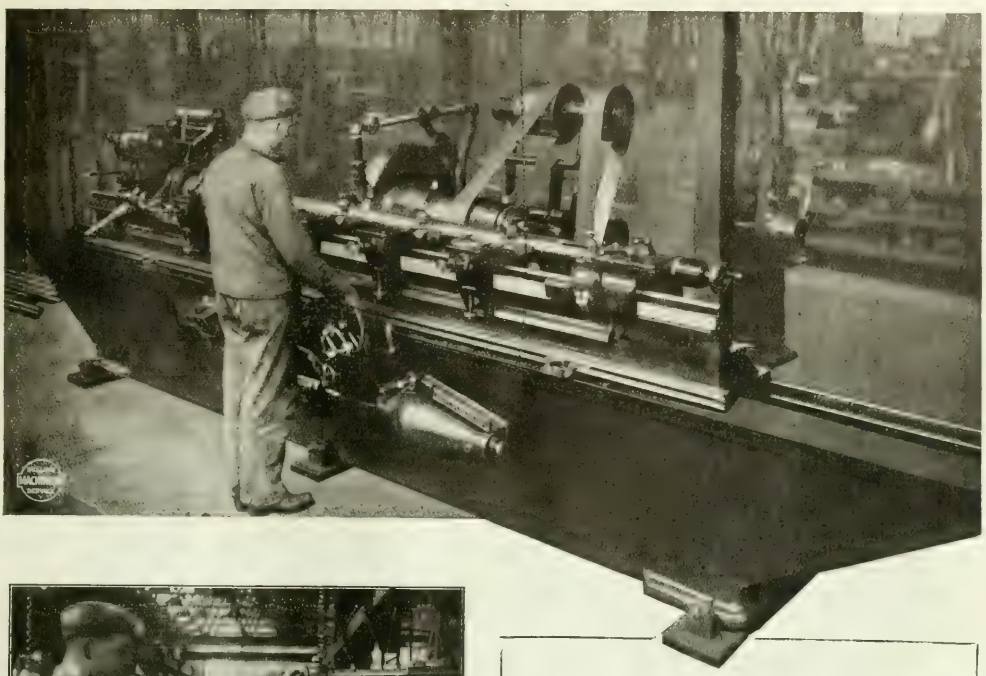

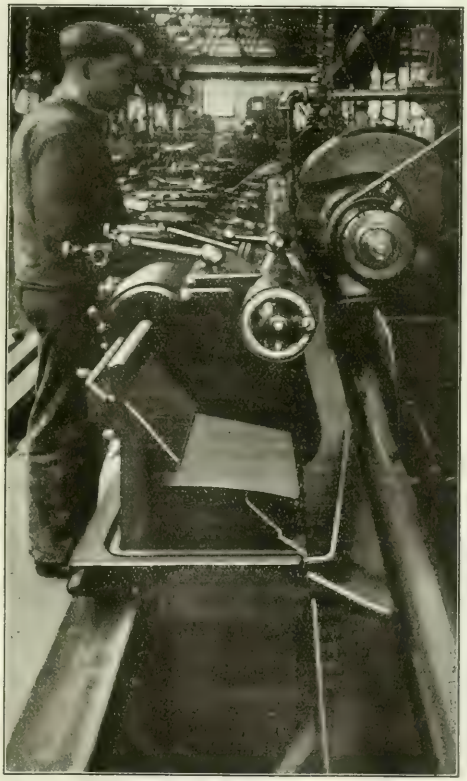

This NORTON Grinding Machine Works within Limits of 0.0001"

Impossible? No! Somewhat out of the ordinary perhaps; but you can do it, too, if you require work within that limit.

Of course the machine, a Norton 16" x 120", is kept in the pink of condition. It is used for rough and finish grinding; 60 days for seasoning the work being allowed between the operations. The spindles are 3¾" diameter by 8' long; 0.005" stock is left for the finish grind. This machine is owned and operated by the Lucas Machine Tool Company, Cleveland.

For accuracy when you need it; production when you need production only; and the proper proportions of both for the usual run of work—use Norton Grinding Machines.

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Recent Developments in Chucking Appliances

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.

IN a previous issue we described at some length, a few of the developments that have taken place in the adaptation of the expanding arbor to to the manufacture of shells, and the advantages to be derived by cutting down the unproductive factor of repetition production. Where articles are to be made in large, or comparatively large quantities, it is very desirable if not absolutely necessary, that accessory equipment such as special chucks, jigs or fixtures, be provided to handle the work more accurately and rapidly, and consequently with increased efficiency and economy. What was true in the case of the expanding arbor for exterior machining, is equally true in the development of equipment, either as special machines or attachments, for holding the work while metal is being removed from the bore. While the expanding arbor is essentially an attachment to machine tool equipment, and offers little opportunity for incorporation in special machinery of the unit type, the collet or split ring compression chuck has many features that provide ideal conditions for the single purpose machines; so much so, that the developments in this class of equipment, while highly desirable for shell making purposes, will leave an excess of "ornamental" tools on the market at the close of the munitions activity. It is very unlikely that any line of domestic enterprise will attain the magnitude of recent shell making, and there will be little need for the bulk of the existing equipment of a special character, but the varied experience of the past three years may enable the different engineers to adapt many of the designs to a wider use in ordinary machine shop practice.

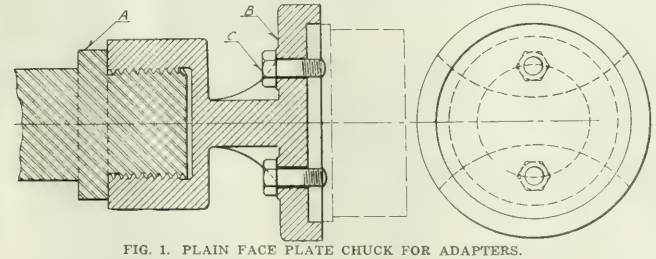


FIG. 1. PLAIN FACE PLATE CHUCK FOR ADAPTERS.

Chucks for Adapters

Before going into the chucks that have been developed for the shells proper, we will just touch on two that have done effective work on the large size adapters. Fig 1 illustrates a plain solid face-plate chuck for finishing adapters. The adapter is first held in an independent jaw chuck and the large diameter turned to fit the recess in the solid chuck B; the diameter of this recess corresponding to that of the counterbore of the shell base. After facing the back, the adapter is placed in chuck and secured by the cap screws C, holes having been previously drilled and tapped in the proper position. This method is very satisfactory for machining, but has the disadvantage that considerable time is required for placing in and removing the work from position; this being the chief reason against its general adoption.

The chuck shown in Fig. 2 does not offer any better machining facilities than that of Fig. 1, but has the distinct advantage of rapid operation, a feature that is all essential in this particular class of work. It will be seen from its construction that it is a unit in itself and with a few modifications could be readily adapted for certain classes of general chucking work. In the design here shown, the steel piece B was shrunk on the end of the lathe spindle A, but for ordinary purposes these could be made of one piece and secured to the spindle or face-plate by any convenient method. The steel bush C, that controls the radial movement of the sectional ring I, is threaded to the piece B. Fitted to the outer diameter of the bush C, is the hand wheel D, cored out to receive the two pawls, F and F_1; the former being the releasing and the latter the tightening pawl, the springs being provided to insure the pawls entering their respective notches.

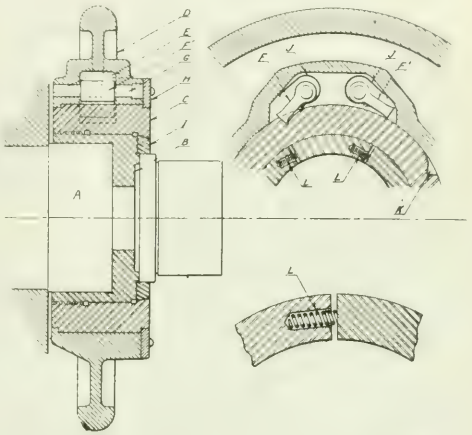


FIG. 2. KNOCK PAWL RING CHUCK FOR ADAPTERS.

Shell Chucks

During the incipient stages of munitions manufacture, considerable experimenting was necessary before equipping the various machines with such attachments as are now in general practice. Before shell making could be proceeded with in any large quantities, it was very essential that the different machining operations be given a try-out on a few shells so that some basis could be arrived at for series production. The chuck illustrated in Fig 3 is one that was designed primarily for experimental work, but several of these are still in active service. The greater number of the machines in the plant where these chucks are used, were of the standard type of engine lathe, and owing to the fact that the firm was one of the first to engage in the industry, much of the auxiliary equipment was of home-made design and construction. In the plain pot chuck shown, B is the portion bolted to a special face plate on the lathe. The outer portion of the body is turned in position and is afterwards supported by a steady head located between the clamping screws; these are six in number, four at D being set permanently to a certain position for a forging or rough turned shell, the two screws E-E being used for locking the shell in the chuck. When facing the base end the gage rod C is secured centrally to the rear end of the chuck.

A knock pawl type of split ring chuck designed for gripping the base end of

the shrapnel shells, is shown in Fig 4. This is of the unit design; that is, it can be removed from its position without dismantling any of the parts. The central

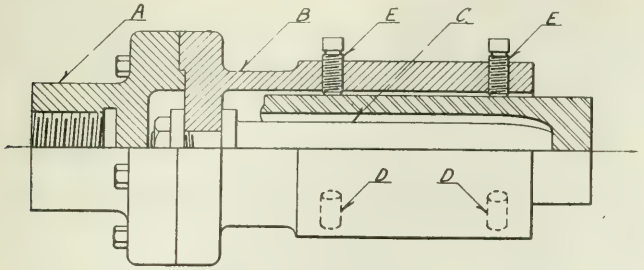


FIG. 3. PLAIN POT CHUCK.

portion A, that carries the chuck proper, is made with a shank that fits into the nose of the hollow spindle B. Fitted to the outer diameter of A is the steel bush C, that controls the radial movement of the hardened steel split ring D, the ring spring keeping the sections in contact with the conical bearing. On the outer surface of the piece C, the operating hand wheel E, is fitted freely and locked in a lateral position by means of the ring H; this ring is of the piston type and sprung over the shoulder shown. The pawl G is fitted in the body of the hand wheel and operates the ring C by its action against the notch shown. To prevent the fixture from turning in the spindle, the pin I is driven in the shank and locks the same in slot J. An interesting feature of these chucks, especially on light work, is their semi-automatic action; as the shell can be placed in the chuck so that the starting of the machine causes the inertia of the heavy hand wheel to close the chuck, and when stopping the opposite effect takes place, as the momentum of the wheel is sufficient to release the chuck when hand or mechanical friction is applied to the shell or the cone pulleys.

A special compression chuck having the controlling hand wheel fixed to the operating cam, is illustrated in Fig. 5. In this device, the body or containing ring A is bolted to the face plate and encloses the cage B that retains the three jaws C in their respective positions, 120 degrees apart. The hand wheel D is locked to the cage ring by the tapered key F. The jaws, as illustrated, have teeth for gripping the forging, but where a turned shell is being held, these can be replaced by others having smooth surfaces.

The heavy collet chuck shown in Fig. 7 is somewhat cumbersome, but very efficient. The main casing of the chuck is a large casting cored out as shown in order to provide lightness with size. The casing A is secured direct to the nose of the spindle and locked in a permanent position by means of the key C, the front end of the chuck being supported in the steady rest D; this support is secured to the lathe bed and is fitted with three adjustable blocks E that can be accurately secured to a central position by means of the screws F, two retaining screws being used in the top block to prevent the same from falling out of position when assembling the head. The three blocks H that control the radial movement of the jaws J, are secured to the centre spider of the head by the screws shown. The gripping jaws are relieved in the centre as shown at K, to provide a better means of holding the shell. The forked collar L which is connected to the draw rod M, engages with the offset on the end of the three jaws. The operation of the device can either be obtained by hand wheel or pneumatic appliance, suitably located at the rear of the lathe spindle. No springs are required to control the release of jaws after the pressure has been removed, as the jaws are positively controlled in a radial direction by the dove-tailed connection shown.

Chucking Shells for Thread Milling

Some interesting attachments have been developed for regulating the lead of the chuck and likewise the shell, while the threads are being milled in the base or the nose. Owing to the nature of the machining operation, it is necessary to advance either the work or the milling cutter while the thread is being cut. A general arrangement of one of these devices showing the chuck and also the operating mechanism is illustrated in Fig. 8. While the attachment shown is not directly a chucking proposition, a description of its construction and operation may be of considerable interest. The machining of the base is entirely ac-

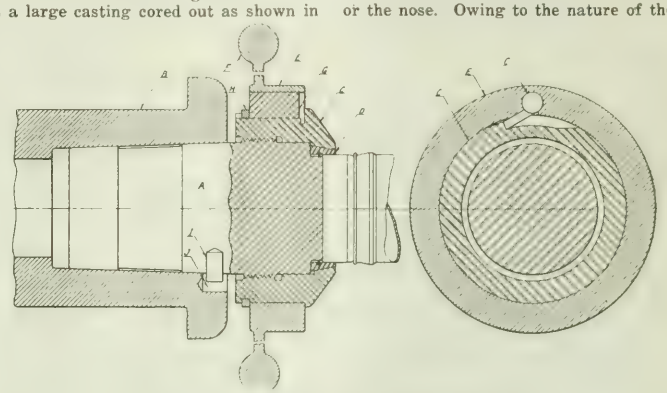


FIG. 4. KNOCK PAWL RING CHUCK WITH SHORT GRIP.

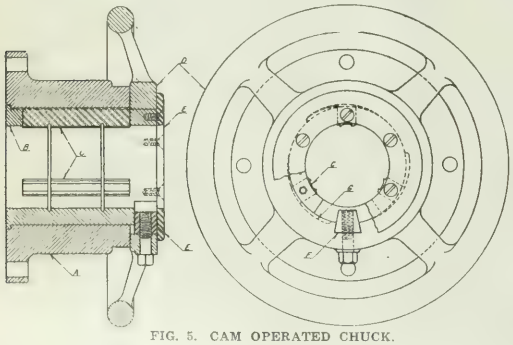


FIG. 5. CAM OPERATED CHUCK.

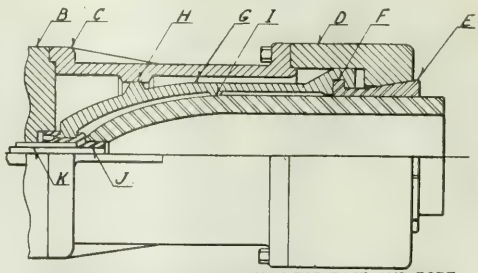


FIG. 6. HEAVY COLLET CHUCK FOR BASE AND BORE OPERATIONS.

complished by the milling process, the spindle and the shell being revolved at a constant speed by means of a train of gears. The pulley A, which is driven from an overhead shaft, is keyed to a worm shaft, the worm of which is held in the casing B, and engages with the

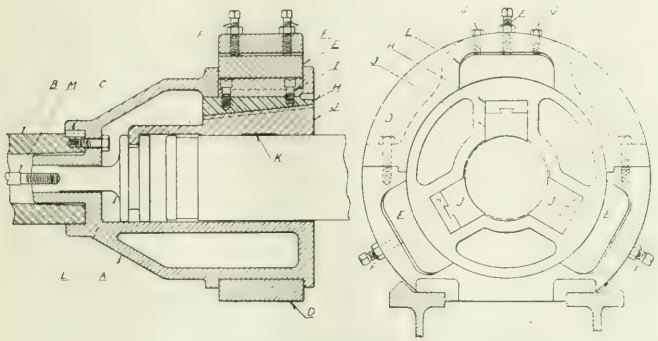


FIG. 7. HEAVY COLLET CHUCK FOR NOSE OPERATION.

worm wheel C, the latter being secured to the shaft of which D is an integral pinion; this pinion engages the intermediate gear E, which in turn drives the main spindle in the centre of which the gear G forms an integral part. Secured to the forward portion of the spindle is the chuck support I, upon which is mounted the chuck mechanism. The ring J that controls the split ring K, is operated by tightening and releasing pawls located in the web of the hand wheel L. When in a working position, the inner or nose end of the shell is centrally supported on the bush O, fitted to the stud P, that is threaded to the rear spindle C_1 which is firmly pinned to the

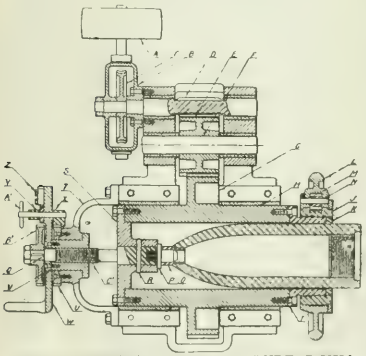


FIG. 8. SPECIAL CHUCK FOR THREAD-MILLING OPERATIONS.

back support of the main spindle. The idea of the bush O is to accommodate the two different sizes of nose threads.

The mechanism that controls the advance of the work is shown to the extreme left of the cut. Fitted to the rear housing is the bracket T that supports the lateral feed shaft Q, and the operating gearing. The ratchet wheel U is bolted to the bracket T, and always remains stationary in relation to the machine frame. Bolted to the nut V is the arm W, one end carrying the two pawls X and Y, the other provided with a handle for returning to the initial position. The pocket Z contains the spring that keeps the pawls to their respective positions, these being set by the handle A_1. The ratchet wheel B, is keyed to the end of the shaft Q, the threaded portion C, fitting the nut V, which is of the same pitch as the thread to be cut. When the counterbore and recess are being milled, the pawl Y is engaged with the wheel B, causing the shaft and the nut to revolve together, with no lateral movement in shell position.

After the base is prepared for the thread, and the thread milling cutter brought into working position, the handle A_1 is moved to disengage pawl Y and engage pawl X with wheel U; this keeps the arm W and the nut Y stationary, resulting in the shaft Q revolving in the nut, thus slowly drawing the spindle and shell backwards equal to the pitch on the thread C_1 during the milling of the work thread. On this particular machine a warning bell is attached to warn the operator of too much over travel of the mechanism.

PRECAUTIONS IN PICRIC ACID WORKS

IN the hospital attached to the works of the New England Manufacturing Co., Woburn, Mass., the following routine treatment is carried out in all cases of gassing with nitric fumes, and it has given so far the best results. Foremen are instructed to send their men at once to the hospital even in the slightest case of gassing. The patient is then at once treated by the inhalation of ammonia, by means of a modified lung motor, the air used being passed over aromatic spirit of ammonia. This air may, if needful, be forced into the lungs without causing a great deal of inconvenience to the patient—the relief given being immediate. When cough and substernal distress are relieved, the patient is kept under observation; sal volatile and occasional inhalation of smelling salts is the treatment, with the saline purgative. Bed treatment is insisted upon in all severe cases. No deaths have been recorded out of 398 cases treated, although twenty-nine were serious. Acid burns in the eye are treated with prompt first-aid washing with lime water. At the hospital the eye is irrigated with 16 oz. of lime water and then with warm boric acid solution. Hot compresses of boric acid are applied until the inflammation subsides. After this treatment only one case of permanent injury to sight has been recorded.

WELDED SHIPS

By T. J.

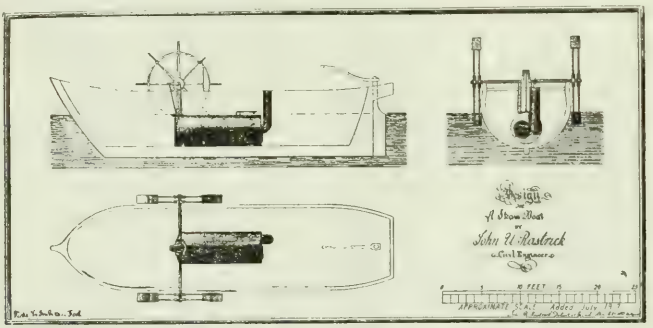
WELDING cast steel sections together into ships is one of the latest propositions for speeding up shipbuilding. Briefly the idea is to build a hull in sections, each a casting as large as the conditions will allow, and to weld the castings together electrically by an arc method. One casting might constitute the bottom of the vessel for a section eight feet in the dimension lengthwise of the ship; another casting would form practically one side of the hull for that section, and a third the corresponding side opposite; a fourth casting would form part of the deck framework or the stiffening between the upper parts of the sides. The scheme is thus to build a large number of substantially identical sections, so that the work may be carried out in duplication in many centres and at the same time it is intended to afford a means of adding rapidly to shipbuilding capacity without depending upon the rolling mills, which are already fully engaged. Midship sections would, of course, be duplicated to a large extent, and then for the corresponding parts of standardized ships the identical castings would be used.

The abutting edges of castings would be bevelled to form the V-shaped grooves used in electric welding, and by means of interlocking lugs and overhanging ends the cast sections would be drawn together to bring the edges into exact registration, to be welded electrically. In the size of the castings section 8 ft. by 30ft. might be used or even larger if the plant permitted it. The grooves are on the inside of the hull, leaving the outside of the ship without projections other than the minute ones corresponding to the surface of a steel casting untouched from the sand. The only work contemplated necessary on the outside would be the removal of chipping of the steel fins following the use of built-up forms of mould, which may be used for the large castings.

The inner skins of the vessel to form bulkheads, ranks and bunkers, may be composed of rolled-sheet metal welded to the decks, beams, frames and plating. There would be the necessity in this type of construction for the castings to be reinforced to secure strength to the hull itself as well as to provide for satisfactory casting results. On a close examination of this method it cannot be said that there is a great likelihood of its having much success, as the work involved might very possibly be lengthened through broken castings, and riveting by pneumatic power is not yet out of date or superseded by any more successful method.

AN EARLY STEAMBOAT

THE present advanced state of marine engineering causes peculiar interest to attach to the accompanying illustration of a design for a steamboat by John U. Rastrick, who built engines for Richard Trevithick in the beginning of the 19th century. The illustration, signed by John U. Rastrick, March 27, 1813, Bridgnorth, is reproduced by courtesy of our contemporary *The Engineer* which publishes the following letter from the owner, Arthur L. Johnson, Limited, of Middlesborough, England, who wrote: "I picked up at a country book-shop the large folio volume of plates to Tredgold's Works, dated 1839, London, John Weale, which contained, stuck in a back page, a drawing which must surely be of interest to all engineers, as it is signed by John U. Rastrick, March 27, 1813, Bridgnorth, and is a plan, sectional elevation and end elevation of a design for a steamboat. The engine is set in the end of the boiler, and is high-pressure, and directly connected to the crank shaft, on which are mounted a pair of paddle-wheels. The workmanship of the draughtsman is admirable, and the shading would probably not be worth the trouble to-day. The picture is of interest, as Rastrick was the founder who built the engines of Richard Trevithick, and it would please me to know if Trevithick ever had such a ship constructed, and if he planned it himself. The scale of the drawing is ¼-in. to a foot, and the ship was intended to be about 40 ft. long, 11 ft. 6 in. beam, and 5 ft. 6 in. draught."



EARLY DRAWING OF STEAMBOAT DESIGNED BY JOHN U. RASTRICK IN 1813.

Commenting on the picture our contemporary says: "Simple as it is, it is an extraordinarily interesting link in the history of steam navigation. The Trevithick influence is obvious. The engine is a high-pressure one—there is no condenser—and all the complication of side-levers or overhead beams is avoided. The whole design is as direct and simple as could be desired. The cylinder is apparently single acting, and we gather that a trunk piston, with the connecting-rod coupled to a gudgeon pin, was proposed. It is almost buried in the domed end of boiler, which has a fire-flue at one side and a return flue at the other. The counterbalance weights in the paddles will be observed. The whole thing is excellent in its simplicity and directness of purpose."

"We are quite unable to say whether this "ship," as Mr. Johnson calls it, though pinnace is probably a better name, was ever constructed, and if any of our readers can give any clue to it, we engineers would be greatly indebted to them. Trevithick, as readers of his "Life" know, was deeply interested in steamboats, and in Vol. I, page 352 of his "Life," a letter by him to Hazeldine, Rastrick and Co., Bridgnorth, dated November 13, 1815, Penzance, may be found. In it he says, "Enclosed you have a drawing for the towing engine for London, which you will execute as soon as possible." It is clear from the context that the engine in question was meant to drive a screw propeller, so that even if it were not two years later than the Rastrick drawing, it would be obvious that the same vessel is not referred to."

"It may be of interest to recall that Fulton's steamboat, the Clermont, was completed in 1807, and that John Robertson's "Comet" was built in 1812. Hence Rastrick—or Trevithick—could not be regarded as a pioneer; but it must, at the same time, be admitted that the simplicity of the design, and the obvious intention to use high-pressure steam, are matters of the highest interest."

SOME NEW AND GROWING BRITISH INDUSTRIES

By Mark Meredith.

SINCE the struggle between Britain and Germany for military supremacy began, British industrial concerns have been by no means idle, and quite a number of new industries have been started, and there is very reason to hope that they will continue long after the clash of arms has ceased. One of the most important steps in the struggle for wresting the supremacy from Germany in many important trades was the exhibition of Austrian and German goods exhibited in the Midlands, for at this collection of samples it was possible for manufacturers to examine and handle the actual products of the central empires. It is no use laying down rules and regulations and giving all manner of hints to a manufacturer, for he wants to see the actual article and take it to pieces and reconstruct it his own way. Until he has done that he has not much knowledge.

Municipal Encouragement

One immediate outcome of the Exhibition held under the auspices of the Board of Trade was that the Chambers of Commerce of Birmingham and Wolverhampton adopted a forward policy and a scheme involving research work has been inaugurated, and several municipalities and local authorities have set themselves the task of attracting new industries within their borders. A new factory will shortly be completed at Wolverhampton for the manufacture on a large scale of wrought enamelled hollowware, and a factory is to be built within the borough for the manufacture of artificial silk. In another part of the Midlands a brush-making machine, made formerly in Germany, is being manufactured, and a welcome stimulus has been given to the flint-glass industry and other departments of the glass trade. Considerable developments have been made in the Sheffield district with the heavy steel industry, and electrically melted steel is likely to play an important part in the future struggle for industrial supremacy. At the present moment a large number of electric furnaces are in use and are used chiefly for the production of alloy steels for constructional purposes, and to an increasing extent they are replacing the crucible for carbon and high-speed tool steel. For a number of purposes electrically melted steel is proving an efficient substitute for the scarce and more expensive Swedish brands.

The war produced a boom in high-speed tool steel which would appal the imagination if the figures relating to the value of the material produced and sold could be given. Every crucible furnace in Sheffield has been given up to its manufacture, and there has been no pause in the consumption or the demand. Yet at the beginning of the war the steel trade had no source for the supplies of tungsten metal, without which high-speed steel cannot be made—than Germany. It was no light task to set about creating a home supply, as the making of tungsten involves intricate chemical processes, accompanied by much patient research and experiment, and it must be taken into account that the German makers had passed the experimental stage years ago. Here again Britain rose triumphantly to the occasion, and at the present time there is an ample supply for home needs and for export as well. At least half of the ores are found in the British Dominions and the whole of this will doubtless be reserved in the future for British makers.

Dyes and Optical Goods

Again, in the dye industry great progress has been made and the British chemist has succeeded in producing what is known as indanthrene blue, a dye which the Germans declared could never be produced by any one but themselves; but not only has the firm of British Dyes, Ltd

produced this useful color, but a Carlisle firm has done so as well.

Users of gelatine in sheets were often of the opinion that Germany was the only source of supply for this, but for many years a Belfast firm has made sheet gelatine, and in addition made great use of it for enamelling and imparting a washable surface to showcards.

Although German opticians have obtained a high reputation for their goods, and this reputation has been considerably helped by the fact that photographers and others thought that a lens of German design and make was ipso facto better than anything which the British optician could turn out—actually that belief, as the more expert photographers know, will not bear examination. The two factors which determine the quality of a photographic lens are: first, its optical formula, and second, the perfection of workmanship by which the curves, etc., prescribed in the scientific formula are given to the separate glasses and the latter polished and centred in their metal mounts. It was a British optician, Mr. H. Dennis Taylor, who in the early 'nineties of last century first showed in the "Cooke" lenses that the very highest optical qualities could be obtained with very simple glasses by means of suitable air spaces between them, a principle which the Germans, in common with opticians in other countries, adopted, with variation. In workmanship, too, official tests in Great Britain by the National Physical Laboratory, constantly made in pre-war days, have shown that of two lenses made according to the same German formula, one in Germany by the parent firm and the other in London by the workmen of a licensee, the British-made objective was optically the better of the two. Again, the British have succeeded in evolving an improved type of lens for the special work of photographing from aircraft, which has enabled observers of the Royal Flying Corps to obtain photographs which were superior to any work which the Germans could execute.

THE ENGINEERING COUNCIL OF AMERICAN ENGINEERING SOCIETIES

THE formation of Engineering Council is the outgrowth of a real need for proper consideration of questions of general interest to engineers and to the public, and to provide the means for united action upon questions of common concern. Many such questions have come up in the past and will arise in greater number in the future. This war has brought out very impressively the actual need for united action of some kind. At present the Council is concerned only with four societies because that seemed the most practical way of getting a group of men together to answer the immediate needs, but these societies do not assume to speak for all engineering societies in the country. Criticism that they are exclusive in any way is utterly mistaken. There is the hope that such a council by proving itself effectively may lead to much wider co-operation in a strictly representative body for all engineers, and thus pave the way for a very much larger union in the future.

How can the council be enlarged? By a union of all societies either as the outgrowth of the present council or by a congress of engineers leading to united action by all societies. The first method will be the most natural one because many local societies and national societies also have a large membership in the four societies at present concerned. We have three classes of engineers to reach: first, those who are members of local societies and not members of national societies; second, those who are members of national societies and not members of local societies; and third, those who are members of no society. The last named class constitutes a very large number in our profession. We are almost as mixed as American citizenship and we suffer therefrom just as much as America with a population representing every race and every people in Europe. There can be no question of the enormous advantage of union. That union should be completed by strengthening the existing agencies and not by the formation of new societies. The national societies are thoroughly national notwithstanding an occasional complaint that they are run by New York. If they have not been able to express the democratic spirit of our country as fully as might be desired it is the fault of the members in all the states and not of the city in which the principal offices are located.

The four societies concerned at present are the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. They have come together in pairs from time to time in the past for special purposes and there have been general conferences on subjects requiring immediate settlement, but until the council was definitely organized in June there was no permanent body to advise all the societies. We have had many fruitful discussions in the past leading to useful action. The Standardization Committee which has been organized to represent five societies has passed upon commercial standards of all kinds. This committee has great possibilities and it should be enlarged enough so that its influence may become very widespread.

Many problems have already been presented before the council. Its personal made up of twenty-four men representing equally the four societies is well balanced and judicial. The first duty was necessarily the organization and appointment of standing committees which have already been reported in the press.

Certain questions relate, however, to the war and the assistance that engineers can render. A committee to be called the American Engineering Service Committee was appointed with instructions to invite the co-operation of all engineering societies. Its present duty is the tabulation and listing of the members of the five societies represented, in order that we as a profession may be in a position to take a larger part in the industries after peace is declared. This tabulation has already in part been done, but in a rather unsystematic and unequal way. It is hoped that the new committee by having additions from other societies may make a final and lasting tabulation of all the engineers in the United States. The list is to be kept in the Engineering Building for general use in Government problems and in the industries. At present the committee is devoting its attention to the immediate need of the hour, namely, the procurement of men for special service in the Government. A list of specialists in the societies has already been completed. There are three methods by which engineers may enter United States Service: first, through some organization; second, through individual application to a department of the Government; and third, through selection by the Conscription Law. But this is War Service wholly and not Civil Service which is the same now as it has always been. As a matter of fact a great many engineers have already entered through the engineering societies, through colleges and through various special boards in Washington.

Another committee is called the War Committee of Technical Societies. It was appointed to assist any organization in Washington, such as for instance, the Council of National Defense, the National Research Council and the Naval Consulting Board, in any way in which it can bring to the attention of the engineers of the country the necessity for thought and help in the numerous problems that arise.

A council organized by the enlargement of the present Engineering Council can be very effective in many ways, without interfering with the autonomy of any individual society. Every society has some definite purpose of its own and also some which it holds in common with all other societies. One of the latter purposes relates to public service and to co-operation. To the end that all societies may understand full their opportunity, communications will be sent out inviting co-operation and it is hoped that the council may be successful in arousing sufficient interest to bring about a larger and better council for all engineers.

In organizing the council provision was made for the election to membership of other national engineering and technical societies. There is no doubt that rules can be made which these societies may become members. This will involve consultation and discussion in the future. The office of the council will be in the Engineering Building, 29 West 39th Street, New York City.

PROCESSES IN MANUFACTURE

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

WELDING WITH APPLICATION TO AUTOMOBILE ENGINEERING

By Herbert L. Towns.

THE evolution of the methods employed by manufacturers in the industrial world is undoubtedly a source of wonder, and probably one of the greatest advances is that of welding. Along with welding has come the cutting of metals by the application of heat, and so great has been the development of these means of manufacture, that the welding and cutting apparatus has become an ideal and absolute necessity to the engineering trade. In dealing with this subject it will be advisable to make some classification, and the best method to adopt will be to deal with the process of welding in a general sense, and then consider the possible applications to automobile industry.

Welding is the process of joining two pieces of metal by melting the adjacent edges of the metal together, and the methods of producing the necessary heat have varied; among them are the oxy-hydrogen, the oxy-acetylene, and the electric arc methods. The oxy-hydrogen flame is very rarely, if ever, used, as the heat produced by this flame is not nearly so intense as the heat produced by the oxy-acetylene flame or the electric arc, and as the oxy-acetylene flame is more extensively used, it will be as well to confine all consideration to this method in order to devote the limited time at our disposal to a single subject.

Oxy-acetylene welding is classed as an autogenous welding process in which two parts of the same metal, or different metals, are joined by the melting of the adjacent edges of the two parts and causing them to become joined without the use of hammers or any form of compression the melting of the edges of the pieces of metal being performed by the heat produced by an oxy-acetylene flame. It may be well to mention that the term "autogenous welding" is often used as being the method of welding performed by the heat of the flame produced by the combustion of a mixture of gases, but the correct meaning of "autogenous welding" is the joining of pieces of metal without the aid of any foreign material.

The oxy-acetylene flame is very small in size, and results from the combustion of a mixture of oxygen and aceytlene, which mixture has been made in a special burning torch or blowpipe.

Acetylene

Acetylene is a gas, and may be quoted approximately as 92½ per cent. of carbon and the balance hydrogen, this only being approximate on account of certain small percentages of impurities that may exist; for instance, a certain proportion of the hydrogen may be phosphuretted and sulphuretted.

The presence of hydrogen retards the combustion of carbon in oxygen, so in order to get a more rapid combustion, oxygen is mixed with acetylene, which mixture generates the hottest flame for welding, a heat of up to about 7,000 deg. F. being obtainable. This heat is greatly in excess of the heat produced by the oxy-hydrogen flame, the heat generated by the oxy-hydrogen flame being only about 4,000 deg. F.

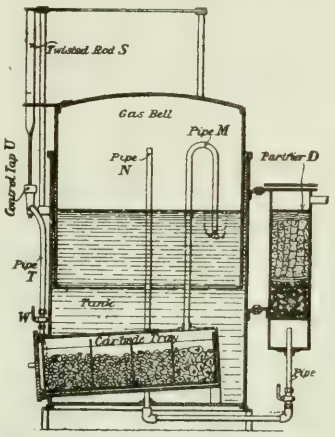


FIG. 1. PORTABLE ACETYLENE GENERATING PLANT.

Two important methods of supplying acetylene to a shop in which the welding of metals is performed are largely adopted these being either to have portable welding outfits which include the generator, oxygen cylinder, flexible pipes, blowpipe, etc., or to have the generator fitted in a special shed or house built outside of the shop. In the case of the portable outfit each operator has one of these appliances, which can be moved to any part of the shop as required. It will be seen that this method is most useful in shops where welding is not too frequently to be done. In the case of the fixed generator the whole supply of acetylene for the use in the shop can be produced and led into the shop through pipes, the size of the generator being arranged to suit the size and requirements of the shop.

Acetylene Generators

There are various types and makes of generators now on the market, and it will be very interesting and I hope instructive to devote some attention to one or two of these types. A type of generator suitable for attaching to a portable welding plant is shown in Fig. 1. This generator is very compact, light in weight, and has the advantage of being adaptable to almost any portable framework, as it requires no fixing. Adjustable chains can be fitted to the side of the tank for the purpose of carrying the oxygen cylinder, in which case it is unnecessary for the generator to be fitted on a framework; it can stand on the floor and be moved from place to place as required. The following table shows the size of the generator in comparison with the output of acetylene.

Table I.

Height		Weight			Output of Acetylene per Hour	Charge of Carbide
Ft.	In.	Cwt.	Qr.	Lb.	Ft.	Lb.
4	9½	3	2	0	50	20
6	6	4	1	14	70	30
7	3	4	3	0	100	50
8	9	6	2	0	150	75

A generator of this description is automatically controlled, and, therefore, requires little or no attention save the charging of the carbide tray and the filling of the water tank. It will be seen

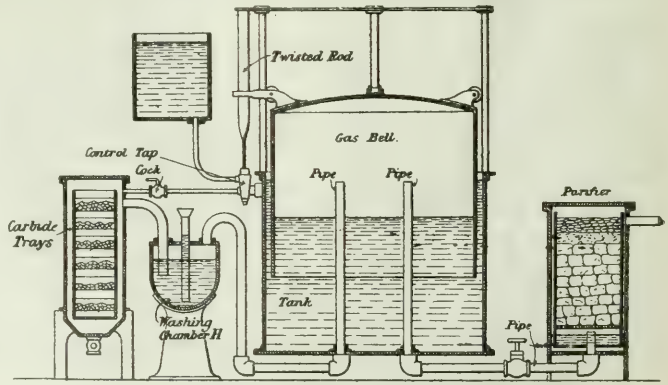


FIG. 2. FIXED ACETYLENE GENERATING PLANT.

This paper read before the Coventry (England) Branch of the Institution of Automobile Engineers.

from Fig. 1 that the carbide chambers are actually contained in the water tank, which makes the generator very compact. The plant is worked as follows: Carbide is placed in the carbide trays or generators (the sketch only shows one, but two are fitted side by side) and the tank is filled with water. The cock W, which is fitted to the pipe T, connecting the water tank with the generators is then opened, and water flows from the water tank to the generator; acetylene is then produced, and passed through the pipe M into the water, through which it bubbles into the gas bell; as the gas bell fills with acetylene it rises, being steadied by guide and pillars. One of the guides on the gas bell has an extension fitted, which engages with a twisted vertical bar S, this bar controlling the water cock U. Now, as the gas bell fills and rises the bar S is automatically operated to shut off the water cock U, this preventing further flow of water from the tank into the generator. The acetylene is taken from the gas bell through the pipe N and is passed through the purifier D to the burner. It should be noted that the acetylene is first purified by being passed through the water, from the pipe M into the gas bell. As the acetylene is used, the gas bell falls, and the cock U is again opened to allow water to pass into the generator, and the process repeats itself.

Table II.

Height		Weight			Output of Acetylene per Hour	Charge of Carbide
Ft.	In	Cwt.	Qr.	Lb.	Ft.	Lb.
6	-	13	2	0	100	36
-	-	16	3	0	140	50
6	8	19	0	0	160	60
9	3	22	2	0	175	75
9	3	27	0	0	250	100

A type of fixed generator is shown in Fig. 2, which type of plant does not differ in principle from that shown in Fig. 1. In this type of plant the generators and the purifying chambers are independent of the gasholder. It will be noticed that a special washing chamber H is provided through which the acetylene is passed from the generators to the gasholder. The table in the preceding column shows a comparison of the size and output of these types of plant.

In each of these types of plant the generators can be recharged with carbide without in any way disturbing the supply of acetylene, as the gas cannot get back from the holder into the generators. These types of generating plants are manufactured as standard articles in various sizes.

A method of supplying acetylene to the welding torch, which is not commonly used in practice, is that of having the gas stored in tanks or cylinders, instead of generating it. The acetylene contained in these tanks or cylinders is dissolved in a liquid called acetone, this being the only known liquid that will dissolve acetylene to any appreciable extent. Acetone will dissolve 24 times its own bulk of acetylene at ordinary atmospheric pressure, and also possesses the strange feature of destroying the highly explosive nature of acetylene while they are mixed together. This feature has the extreme advantage of rendering cylinders of dissolved acetylene safe for handling and transporting, an advantage which is worth consideration. Acetylene is probably more useful in this form for purposes other than welding, for instance, the lighting of automobiles and ships, where generators would be a more dangerous fitment. Also there is the possibility of drawing the acetone out of the cylinder with the gas, if the rate of discharge of the gas becomes excessive, the result of this would be a reduction in heat of the flame.

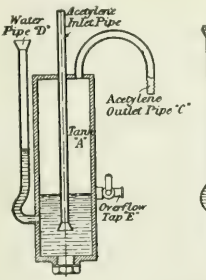


FIG. 3. BACK PRESSURE SAFETY VALVE.

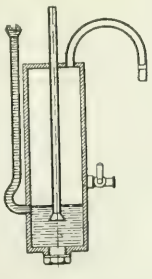


FIG. 4. B.P. SAFETY VALVE SHOWING WATER UNDER PRESSURE.

Oxygen

The oxygen which is used to support the rapid combustion of the acetylene is not as a rule manufactured by the consumer, and there is actually only one firm in this country at present which manufactures this gas in any appreciable quantities. The supply of oxygen is by no means adequate enough to meet the demand for industrial purposes, and some idea of the demand can be gathered from the fact that the British Oxygen Company alone, who are at present making additions to the oxygen-producing plant, hope when this is completed to have an output of approximately 375,000,000 cub. ft. per annum, or about 1,250,000 cub. ft. daily.

The pressure and consumption of oxygen is governed by the size of the blowpipe used to suit various thicknesses of metals, as will be seen from Table III.

Table III.

Thickness of Metals to be Welded In.	Approximate Oxygen Pressure Required Lb.	Approximate Consumption per Hour Oxygen Cub. ft.	Acetylene Cub. ft.
1-32 to 1-20	5	2	1½
1-20 to 1-16	6 to 7	3½	3
1-16 to 3-16	7 to 8	8	6
3-16 to 5-16	13 to 14	14	11
⅜ to ½	21 to 22	35	28
⅝ to ¾	27	55	42
¾ to 1	30	78	63
1 to 1½	37	100	80
1½ to 2	40	125	100

Oxygen cylinders are made in sizes varying to contain from 10 to 200 cub. ft. of the gas, the size most commonly used being the 100 cubic feet. If the welder knows the actual or water capacity of the cylinder, he can determine the approximate volume of gas remaining in a cylinder. This information is very useful, and in reality essential, in the case where a welder has a partly spent oxygen cylinder and a somewhat lengthy piece of welding to do, in order that it may be ascertained if sufficient oxygen is available to complete the work. As an example the following may be taken. Say a piece of welding work is required on metal of ⅝ in to ¾ in. thick, for a length of, say, 2 feet. This will necessitate the use of a blowpipe, which will consume 42 cub. ft. of acetylene per hour, and the work would require about half an hour in which to be completed, as will be seen from Tables III. and IV.

FIG. 5. FLAME SHOWING EXCESS ACETYLENE.

The consumption of oxygen for this work would be approximately 27½ cub. ft. Now if we assume that the welder has one 100 cub. ft. cylinder, which is indicating a pressure of 36 atmospheres, would it be possible to execute the work? The welder, knowing the actual or water capacity of 100 cub. ft. cylinder, say, 0.833 cub. ft., can easily estimate the possibilities of being able to complete the work with the use of this cylinder. Knowing the pressure of gas in cylinder (36 atmospheres) and the capacity of the cylinder (0.833 cub. ft.) the volume of gas at his disposal is equal to $36 \times 0.833 = 30$ cub. ft. (approximately). If we deduct, say, 2 cub. ft. or 3 cub. ft, which remain in the cylinder when the pressure has fallen to about 2 atmospheres, and allow for the possibility of a slightly larger consumption of oxygen by the blowpipe, we are left with approximately 26 cub. ft. or 27 cub. ft. of oxygen, and it would probably be possible to finish the work if it were done rapidly.

Installation

Having considered the production of the necessary gases for oxy-acetylene welding, the next point to note is the carrying of the gases to the place for burning. Where a fixed generator is used it is necessary to have fixed pipes for the service of the acetylene to the place (or places where more than one blowpipe is being served) of welding, and the gas fed to the blowpipe by a flexible tube connection from the service pipe. Just as the use of copper is prohibited in the manufacture of acetylene generators, the use of copper tubes is prohibited for serving the gas to the blowpipe: therefore, iron pipes should be used for this purpose, and these should preferably be galvanized, as the presence of any moisture in the gas would tend to form iron oxide, which may leave the pipe and accumulate in some more vital part of the installation. These fixed pipes should be fitted to the wall of the shop, and should be arranged with a slight upward run, so that any moisture forming in the pipe would tend to run back to the generator.

The size of the pipes fitted depends entirely on the number and size of the blowpipes to be used, and this should receive careful consideration in arranging for the fitting of an oxy-acetylene welding installation in any establishment. There is a danger of the pipes being too small in size, which results in the acetylene arriving at the blowpipe in insufficient quantities and probably at a considerably re-

duced pressure, hence the welder may have to increase the pressure of the oxygen he is using, with more or less disastrous results, as will be seen later in the consideration of the proportions of the gas mixture. It should be remembered that the length of the piping should be taken into account, as well as the size of the blowpipes to be used, when fixing the diameter of the piping, in order that the loss of pressure of the acetylene may not be excessive.

The Safety Valve

There is an apparatus that is absolutely

FIG. 6. NORMAL FLAME.

indispensable in the welding installation, this being the safety valve. As a matter of fact each blowpipe must have a safety valve which, in the case where a portable acetylene generator is used, is fitted to the generator, and where a fixed generator is used the valves are fitted to the fixed service pipes, in each case the acetylene passing through the valve, which is also connected to the blowpipe by flexible tubing. A type of safety valve is shown in Fig. 3, a description of which is as follows: The apparatus consists of a chamber or tank A, which is fitted with a filling pipe D, by which the tank is partly filled with water, the level of the water being regulated by the drain cock E. The pipe B is connected to the acetylene service pipe, and an outlet pipe C, to which the flexible tube is connected, is provided.

The object of fitting this safety valve is to prevent any oxygen from getting into the acetylene pipes, as would happen in the case of the blowpipe becoming temporarily choked up due to the splashing of molten metal or other causes, if a device of this description were not fitted, as the oxygen is always fed at a greater pressure than the acetylene; hence this safety valve prevents the formation in the pipes of a mixture of the two gases,

FIG. 7. FLAME SHOWING EXCESS OXYGEN.

which would be of an explosible nature, and consequently dangerous in case of the flame back-firing.

The acetylene is passed from the service pipe into the water, through which it bubbles, and passes through the outlet pipe to the blowpipe. In case of a stoppage in the blowpipe the oxygen passes through the flexible tube into the tank A, and as the pressure in the tank is increased due to the oxygen not being able to gain an outlet, the water-level in the tank becomes lower, by the water passing into the filling pipe and the acetylene pipe, until the level of the opening into the filling pipe is reached, then the oxygen bubbles up through the water in the filling pipe and escapes into the air, as shown in Fig. 4. These valves require very little attention, save the checking of the water-level by the drain cock when the system is in use, this being preferable to getting the correct level under working pressure.

The feeding of the oxygen to the blowpipe is done through flexible tubing of three-ply rubber, which is preferable to metallic flexible tubing, owing to the increased danger arising from the deterioration of metallic tubing not being so noticeable as that of the rubber tubing.

Blowpipe

The blowpipe is an instrument requiring careful consideration and thought from first to last, in the first place in the designing and lastly in the handling during operation—the consideration in design being partly to make the instrument absolutely safe in case of careless handling on the part of the welder, and consideration on the part of the welder partly to allow for bad design. The blowpipe, if properly designed, built up and handled, is an instrument of simplicity and safety, being light, compact, and easy to handle. The work to be performed by the blowpipe, namely, that of mixing the two gases, is of extreme importance, as the obtaining of a good sound weld to a great extent depends on the mixture of the gases.

In theory, for the total combustion of one volume of acetylene 2½ volumes of oxygen are required, but in actual practice the proportion of acetylene to oxygen varies between 1 to 1¼ and 1 to 1¾. The result of a weld obtained by the use of a mixture of gases in incorrect proportions, may be of a very unsatisfactory nature, as if a superabundance of oxygen be admitted the flame produced will have oxidizing effects, whereas if a superabundance of acetylene be introduced the flame produced will have a carbonizing effect, in which case a hardening of the metal in the immediate vicinity of the weld will result, and the finished work will, consequently, be of a brittle nature.

The correct flame for welding is, therefore, half-way between an oxidizing and a carbonizing one. An experienced welder can readily estimate the proportions of the mixture of gases he is using by a glance at the flame produced. Some idea of the flames produced by different mixtures is given in Figs. 5, 6 and 7. Fig. 5 shows the flame produced by a mixture having an excess of acetylene, and all blowpipes should be able to produce such a flame by having the oxygen admitted at normal pressure and the acetylene at full pressure, although this flame should not be used. If a blowpipe is not capable of producing a flame of this description, either it is faulty, or the system for carrying the acetylene from the generator is in some way out of order, causing the passage of the acetylene to be obstructed.

When a blowpipe is producing this type of flame the acetylene cock on it, or the outlet cock on the safety valve, should be partly closed, till a flame similar to that shown in Fig. 6 is produced, which is the correct flame to use. The centre white light which appears in Fig. 5, as a some-

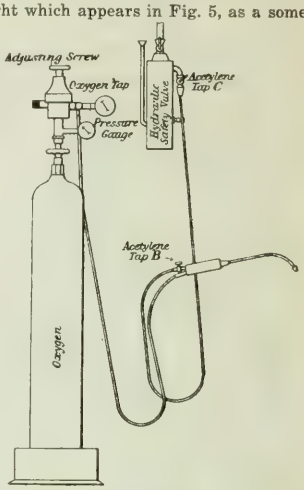


FIG. 9. INSTALLATION CLOSE TO OPERATOR.

what indefinite form has now become smaller and more definite. If a further reduction in the supply of acetylene be made by closing either of the cocks in the acetylene system already mentioned the centre white light becomes much smaller, as shown in Fig. 7, which is an oxidizing flame, produced by a mixture of gases having an excess of oxygen.

There are many different forms of blowpipes in use, but the general principle is the same in each case, and they vary in length from about 1 ft. to 2 ft. The blowpipe as shown by the outline sketch, Fig. 8, consists of a handle through which pass two tubes, each fitted with a regulating cock. These tubes carry the gases to a mixing chamber, from which the mixture is passed to the nozzle. In the design of a blowpipe an essential point for the consideration is the distribution of weight, as the instrument should as nearly as possible balance when held by the operator, for ease of manipulation.

Blowpipes are divided into three distinct classes, which are named according to the pressure at which the acetylene is being used, namely: (1) low pressure, (2) medium pressure, (3) high pressure. The pressures at which the acetylene is used are approximately: (1) for low pressure, 0.1 to 0.25 lb. per square inch, which is the pressure at which the acety-

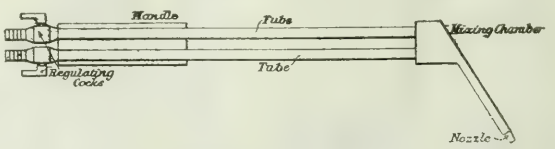


FIG. 8. OUTLINE SKETCH OF BLOW-PIPE.

lene is generated; (2) for medium pressure, 1.5 lb. to 5.5 lb. per square inch; (3) for high pressure, 4.5 to 7 lb. per square inch.

High-pressure blowpipes are not commonly used in practice, in consequence of which blowpipes are often referred to as being of two classes, high pressure and low pressure, the high pressure class being what in reality is the medium-pressure class. The real high-pressure blowpipe is only adaptable in cases where dissolved or compressed acetylene is being used, all other forms of acetylene having insufficient pressure for the mixing of

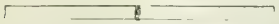


FIG. 10. WELD FOR METAL LESS THAN 1-16" THICK.

the gases. Low-pressure blowpipes are also uncommon as far as being used is concerned. In this type of blowpipe the gases flow at a very low speed, and backfiring is experienced, however, safety devices are usually fitted, which render them safe to handle. The medium-pressure blowpipe is the type that is most commonly used, and has very few disadvantages. In this type of blowpipe back-firing is very unlikely, due to the pressure of the gases, which keeps the speed high.

The only real danger experienced in the use of the blowpipe is due to backfiring, and this is provided for by the fitting of safety devices. Attempts have been made to cut out this small piece of the installation, but the results have been far from satisfactory.

The blow-pipe is usually made of brass, and is constructed in such a way that it is impossible for the gases to mix before they reach the welding head or mixing chamber. The nozzle is usually a detachable piece, so that the size of the orifice can be varied to suit the consumption of gases required for different classes of work. Blowpipes are usually supplied with a series of nozzles, which vary according to the consumption of the gases required for the different classes of work to be done. The size of the nozzle is determined by the consumption of acetylene per hour, and the sizes have a large range, being made to use acetelyne at rates varying from 1 cub. ft. to 100 cub. ft. per hour. These nozzles are made of copper, which metal withstands the heat much better than other less suitable metals. The size of nozzle suitable for welding various thicknesses of metal may vary slightly

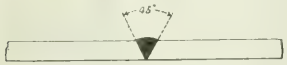


FIG. 11 WELD FOR METAL BETWEEN 1-16" AND 3-16" THICK.

according to the make of blowpipe used, but some idea of the consumption of acetylene can be gathered from Table III. and the approximate rate at which the various thicknesses of metals can be welded by using nozzles to give the consumptions shown therein is given in Table IV.

Table IV.

Thickness of Metals to be Welded. Inches	Approximate run per Hour. Feet.
1-32 to 1-20	30
1-20 to 1-16	38
1-16 to 3-16	20
3-16 to 5-16	10
5/16 to 1/2	6
1/2 to 3/4	
3/4 to 1	3
1 1/4 to 1 1/2	2
1 1/2 to 2	1

Some idea of the variation in costs of welding various thicknesses of metals can be gathered from Tables III and IV. To take a comparison, say 1 ft. of welding is to be done on a metal having a thickness of 1/20 in., and also a similar length on a similar metal having a thickness of 2 in. In the first case the consumption of oxygen and acetylene is 0.051 cub. ft. and 0.038 cub. ft. respectively, while in the second case the consumption of oxygen and acetylene is 125 cub. ft. and 100 cub. ft. respectively. Hence, the proportion for the costs of the gas alone is as 1 to 2,500; on top of this the time taken for the operation is 39 times greater in the second case than in the first case.

It has already been mentioned that the blowpipe is an instrument of simplicity and easy to handle, but also being an instrument of precision, very great care is called for in its maintenance if a perfect and economical working is to be experienced. The cleaning of the nozzles should be attended to at regular intervals, and great care is required here, as the size and shape of the orifice should not be altered, because any change in this direction will cause more or less serious results when used again. Any increase in the size of the orifice of a nozzle would tend to decrease the velocity of the mixture at the exit, and the tendency to back-fire would be increased. It is, therefore, advisable in cleaning a nozzle to use some instrument which is not harder than the material of which the nozzle is made, and a suggested suitable instrument is a piece of brass wire, which should be run through the opening.

In order to ensure that the interior of the blowpipe is kept free from any obstruction, the blowpipe should be disconnected from the feeding tubes and the nozzles connected up to the oxygen tube, then the opening for feeding oxygen into the instrument should be temporarily closed, and a current of oxygen blown through the acetylene passage. By playing on the end of the acetylene passage with the finger a fluctuation in the exhaust of the oxygen is caused, and the clearing of the interior of the blowpipe is accomplished.

It is advisable to avoid the dismantling of a blowpipe by any except persons thoroughly experienced in this class of work, as the putting together of the parts requires a certain amount of skill, the accuracy of which governs the correct working of the instrument.

The starting up and stopping of the working of blowpipe should be done in a methodical manner, and the following are suggestions for doing this, references being made to Fig. 9 which shows an outline of the apparatus in the vicinity of the operator. First, the checking of the hydraulic safety valve for water-level should be done, by opening the overflow cock, and recharging with water if necessary, and the overflow cock closed. Now, with the lower acetylene tap B closed, the tap C should be opened then the oxygen valve should be closed and the cylinder opened by means of the key. The adjusting screw should then be adjusted so the required working pressure is registered by the gauge. The tap B should be

FIG. 12. WELD FOR METAL BETWEEN 3-16" AND 5/8".

opened, and when the acetylene is smelt at the nozzle it should be ignited, then the oxygen tap should be opened to admit the oxygen to the blowpipe. It will be necessary to correct the oxygen pressure, which will have dropped, as will be seen by the gauge, due to the opening of the tap. By means of the tap B the acetylene should be shut down until the flame is normal as shown in Fig. 6. On stopping work the acetylene tap C should be closed first, then the oxygen tap D, and in case of work being completely stopped the oxygen cylinder should also be shut off and the pressure released from the regulator.

In case of a back-fire the tap C should be immediately shut off, and the blowpipe should not be relighted for a few seconds. Before the lighting up of the blowpipe, in the morning, it may be necessary to disconnect the acetylene pipe from the blowpipe, in order to drain out any accumulated moisture.

Properties and Welding of Different Metals

The use of welding instruments is a comparatively simple task which can be easily acquired by very short tuition or practice, but to become an expert welder is something much more difficult. In order to be able to execute welding in a manner worthy of the term welding it is necessary for the executant to have some knowledge of the properties of the metals which are to be welded. The knowledge of the properties of metals is useful in the preparation of parts to be welded, and

FIG. 13. WELD FOR METAL OVER 5/8" THICK.

it is often due to the lack of adequate preparation that comparatively simple operations in welding prove to be failures. The metals commonly used in the engineering industry are the only ones we need consider, these being: cast-iron, malleable iron, wrought iron, steels, copper, brass and aluminum.

Welding Rods

Welding rods are used to replace any metal that has been taken away, either due to damage or due to preparation of the article to be welded. Welding rods should be used, except in cases where very thin metal, say less than 16 gauge, is being welded. Care should be taken in the use of welding rods that no impurities are introduced into the weld—for instance, the rods should be kept free from dirt or rust. Rods having rust on them are oxidised, and it has already been stated that an oxidised weld is not satisfactory. It is advisable to use welding rods supplied by firms who specialise in the manufacture of this class of goods.

In welding cast-iron work a welding rod of alloy iron should be used, known as silicated cast-iron rod. These rods have a fair percentage of silicon in them, which tends to take the brittleness out of a weld by reacting with the carbon in the iron.

In welding steels a rod of Swedish iron is almost invariably used, which, on account of its purity makes a weld of very even grain, and easily machinable. In cases where special classes of steels are being welded, such as "high carbon steel," "nickel steel," etc., rods of special composition should be used—for instance in high carbon steel there is the possibility of the carbon burning when the metal is being fused, and the welding rod should contain an excess of carbon in order to replace that which is burnt, so that the finished weld will be as nearly as posible similar to the metal being welded.

Rods of phosphor-copper are used for adding to welds made in copper, while for brass a rod of brass is used. In the case of these metals being welded in the form of sheets, the welding rod is really in the form of a wire. In welding aluminium a rod of aluminium should be used. These rods are specially alloyed, in order to give the necessary even flow of metal.

In all cases the welding rod should not be added until the metal being welded is melted, and for this reason the rods are alloyed to give them a lower melting-point than the metals being welded, so that the filling rods can be added without allowing the metal to cool down, for if molten metal comes in contact with cooler metal the result is simply an adhesion, and not a weld.

Fluxes

Flux is used in welding as a cleansing agent, and is usually in the form of a powder. In the melting of metals it often happens that impurities will be left solid after the metal has reached fusing-point, also it often happens that oxides form which have a higher melting-point than the actual metal—for instance, in aluminium, as already mentioned, alumina forms, which has a melting-point much in excess of the melting-point of the aluminium (about 1,000 deg. F.). The purpose of using flux is to float off these impurities, or to produce a deoxidising effect which will retard the forming of oxides, and therefore keep the metals clean for welding together. These fluxes, like welding rods, form a speciality in manufacture, and include various mixtures. Samples of flux for iron and flux for copper and brass are here shown. Fluxes should not be used by spreading on the weld, but should be used by dipping the welding rods into them and transferring to the weld.

Preparation of Parts to be Welded

It is important to make some preparation to the pieces to be welded, and in this, there is a certain amount of scope for sound judgment on the part of the welder to make the most suitable preparation for the nature of the weld to be made. However, for straightforward work there are one or two points which apply generally. Plate work of a thickness of less than 1/16 in. can be welded with straight edges (Fig. 10); then for thicknesses between 1/16 in. and 3/16 in. the edges of the pieces should be bevelled slightly (Fig. 11). With plates or pieces of thicknesses between 3/16 in. and ⅝ in. the angle of the bevel should be increased (Fig. 12.) and for thicknesses exceeding ⅝ in. the pieces should be double-bevelled (Fig. 13). In all cases the bevelled edges should be cleaned to remove any oxide that may exist. This bevelling is necessary so that the operator can reach the far side with the flame and welding rod, as in cases where attempts have been made to weld pieces of metal of a reasonable thickness without first bevelling the edges the metal has melted throughout the whole thickness at the same time, and the small white flame has swept the molten metal away on the near side, thus spoiling the weld.

Incidentally it may be worth mentioning here that the small white portion of the flame should never come into contact with the metal.

Preheating

One of the sources of trouble in welding is the liability to develop cracks, which result in a broken weld, but this liability can be greatly reduced by the practice of preheating. In the welding of metal it is necessary to raise the temperature of the metal from that of the surrounding air to the melting-point of the metal, and one of the advantages of preheating is that whole piece of metal to be welded can be expanded, so that after the weld has been made a uniform contraction will take place, and prevent breakage of the weld. It is not the expanding of the metal that is the cause of damage so much as the contracting, for a weld may appear to be good and satisfactory after completion, but unless some allowance has been made for the contraction, a break is more likely than not to occur.

Applications to Automobile Engineering

Welding is not a practice that is adopted to any great extent in the production of automobile parts. One of the outstanding features of welded parts is the fact that comparative lightness can be obtained, where the part is not subject to much stress, by the use of thin metal. This fact should be taken advantage of in the manufacture of light cars as much as ever possible. Of course without considering light car design it is impossible definitely to state which parts should be built up and welded. In general automobile practice the extreme lightness which is characteristic of the light car is not required, hence, the practice of welding is not adopted to so great an extent as would be done in case of necessity; however, cases of necessity do occur.

Rear axles can be built up of steel tubes, with a central bronze casting, by welding, this being the only method of making a sound permanent joint. Parts such as water pipes should be built up by welding, all flanges being welded to the pipes, and branch pipes welded to the main pipe. Flanges can be welded to exhaust pipes, and silencers can be completely built up by welding, but this is not altogether practicable, on account of the difficulty of dismantling if it becomes necessary for cleaning inside. Brackets of various description can be built up by welding, but where thin metal is required pressings become a reasonable competitive proposition; however, where different thicknesses are required on a part pressings are impossible for the complete part. Radiators made up of pressings welded together are quite a commercial proposition, especially for commercial vehicle work, and can be turned out in quantities quite easily by an intelligent operator. For touring car work cast radiator tanks and brackets are preferable on account of a better appearance being obtainable.

In the experimental department of an automobile manufacturing works welding can be applied with some advantage, for the cost of patterns for castings might be eliminated to a great extent. Alterations to the compression of an engine can be carried out by cutting the connecting rod and welding up to make it either longer or shorter as required. Lugs or bosses can be welded to castings or other existing parts; in fact the practical use of welding in the experimental department is almost unlimited.

In foundry work the practice of welding is also applicable, as in the trimming of castings slight breakage frequently occurs, and repair by welding is preferable to scrapping the casting.

Repair Work

Breakages are more or less frequent in almost every detail used in the construction of automobile work, and previous to the adoption of oxyacetylene welding for the repair of such breakages the parts had to be replaced at some considerable expense to the owner. Now that the art of repair to breakages has become a satisfactory proposition, the parts thrown over to the scrap heap by the automobile owner are less numerous. However, to the automobile manufacturer, the carrying out of repairs is a much more satisfactory

proposition by replacement than by patching up the existing part, as regards both finance and labour, except in cases where the part is of ancient design and some difficulty would be experienced in getting a single part through the works.

A common breakage in cylinders is in the water jacket, often caused by the freezing of the water, and such breakages can be repaired satisfactorily by welding. One point worth noting is that all damaged metal should be cut away in order to make a clean surface for welding.

Base chambers and gear cases are among the parts requiring careful handling and preparation in repair work, the main difficulty in these parts being the liability for error in the alignment of the bearing. However, by careful preparation in the way of adjusting the broken parts and preheating, this difficulty should be overcome. Where the metal is damaged, the damaged parts should be cut away and a new piece welded in. No satisfactory result can be obtained by pouring molten metal into a crevice, as adhesion takes place instead of the new and old metals becoming joined as one piece, with the result that when the new metal cools down, cracks are almost certain to appear. Parts such as base chambers and gear cases are mostly made in aluminium, and in repairing aluminium the work should invariably be preheated to about 600 deg. F.

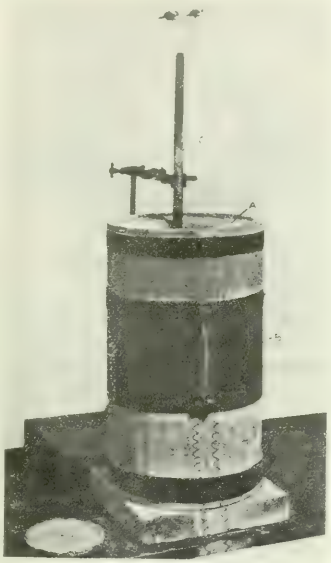
Breakages in frames can be satisfactorily repaired by welding, but as a rule it is advisable to back up the portion of the frame in the vicinity of the repair with a plate, because a breakage in a frame is a sign of weakness due more often than not to unfair distribution of the load on the part of the owner or owner's representatives.

Teeth can be welded to broken gear wheels, but this work should be carefully adjusted and clamped, then preheated before actually welding. The tooth or teeth to be welded in should be positioned by a plate, having slots cut in at the correct pitch of the teeth, so that the plate fits to portions of each of the two pieces to be welded together.

ELECTRIC STEEL-HARDENING PROCESS

THERE has been recently patented and developed a method of hardening steel by means of electricity known as the Wild-Barfield process, which, while following recognized practice in the fact that the steel is hardened by heating and quenching, exhibits its principal departure from customary practice in the manner in which the correct temperature of the steel is determined.

The process is carried out by means of the electrical furnace, shown in the accompanying engraving, which contains an electrical heating coil embedded in the lining A; the cylindrical shell is of suitable heat insulating material. The actual furnace temperature is measured by a thermo-couple in the usual way, being maintained above the decalescent point of the steel to be hardened. The manner in which it is ascertained when the steel has reached this point involves recognition of the phenomenon that steel loses its magnetic properties when its



SELF-INDICATING ELECTRIC FURNACE FOR HARDENING STEEL.

temperature reaches the decalescent point.

Solenoid Principle

The heating coil when in use, acts in a similar manner to a solenoid coil, radiating magnetic flux which is increased when a core of magnetic material, i.e., the gauge or other steel body to be hardened, is inserted. The presence of liquid salt as a heating medium in the furnace slightly reduces the influence of the core on action of the coil.

On the exterior surface of the furnace is wound a coil of insulated wire B, connected to a reflecting galvanometer, whose spot of light is arranged to move on a scale in the usual way. When the piece of work is being inserted in the furnace, the increase of the magnetic flux from the heating coil induces a current in coil B and deflects the light spot. As soon as the piece of work is in position, the magnetic flux from the solenoid remains steady at the increased value so that the external current in coil B ceases and the light spot goes back to zero. These actions however are meanwhile irrelevant to the final determination of temperature.

The influence of the work during heating on the magnetic flux from the solenoid coil is stationary, until the temperature is reached at which the steel becomes non-magnetic, i.e., the decalescent point. The loss of magnetism by the work takes place in a comparatively short space of time, and affects the flux of the solenoid coil in a manner equivalent to withdrawing the core when magnetised. The decreasing magnetic flux of the solenoid coil brought about by this state of the work induces an external current in coil B in the opposite direction to that previously induced, deflecting the light spot accordingly, and if the work remained in place in this demagnetized condition the spot of light would return to zero when conditions became constant again. This second movement of the light spot is therefore the indication that the magnetism of the work is vanishing due to its assuming that condition which will enable it to harden when suddenly quenched.

Rapid Operation

Rapidity of operation is a feature of the apparatus, a 1 in. plug screw gauge being raised to quenching temperature in 1½ minutes, the use of a salt bath being also conducive to uniformity of results. Results of tests carried out at National Physical Laboratory, London, for the Hardness Tests Research Committee are given below. The steel experimented with was ordinary tool steel, containing 1.5 per cent. carbon. Two specimens were hardened in the usual way by quenching in water, and two others were treated by the Wild-Barfield process, as applied to screw gauges. The scleroscope and resistance-to-abrasion figures for these four specimens were as follows:—

	Scleroscope	abrasion
Water quenched	81-110	560, 560
Water quenched	78-112	420, 530
Wild-Barfield	68	710, 710
Wild-Barfield	70	710, 560

In connection with these figures it is to be noted that in the opinion of most the scleroscope, whatever property or combination of properties it may precisely measure, does not give a figure which is a just measure of that property which it is desired to confer on steel by "hardening" it. It does not necessarily follow, therefore, that the scleroscope figures quoted above imply that the Wild-Barfield process yields a softer material than the water quenched. On the other hand, the scleroscope figures do establish the fact that water quenching does not give a uniformly treated product; the figure obtained varies, it will be senn, over a wide range for different parts of the same specimen. Methods of directly testing resistance to abrasion are not yet wholly satisfactory, and it is quite probable that the figures 420 for the water quenched specimen and 560 for the Wild-Barfield are due to irregularities in the testing machine.

COAL DUST IN MOULDING SAND

By F. J.

THE inclusion of coal dust as an ingredient in moulding sand has three main objects: first the heat of the molten metal carbonises the coal dust and so makes the mould porus to the gases given off by the metal; second, the gas

from the coal dust prevents in some measure the fusion of the sand by the iron, and thereby results in a casting with a much smoother face than would otherwise be the case; and, thirdly, the effect of the carbon in the coal is to make the skin of the casting soft and dark in color. Opinion and practice with regard to the selection, grading and proportioning of coal dust in moulding sand varies widely and though the subject of coal-dust has been by no means neglected, there is still room for a comprehensive study of the whole question, one embracing not only experimental research but also the gathering of information in regard to current practice in the best foundries.

In selecting a suitable quality of coal four points have to be watched: the bituminous quality of the coal, the ash content, the volatile content, and the proportion of fixed carbon. Hitherto, too much importance has been attached to low ash content and high percentage of carbon, without due regard for the fact that such a coal must necessarily prove low in bituminous qualities, and be altogether of too refractory a character to fulfil the four ideals. A good working coal dust for general foundry use should show about 12 per cent. ash, 37 of volatiles and 51 per cent. of fixed carbon. This ash allowance will seem high, but the volatiles have to be taken into consideration, and it has, in fact, been found that scabbed castings with harsh, uneven skin, have resulted from the use of coal dust in which the ash content was much lower. Especially was this the case in some experiments made with good class anthracite, in which the percentage of ash was under 4, and the conclusion arrived at was that the coal dust had resisted the heat so much, owing to the presence of a high percentage of carbon, that it had acted as a refractory, and actually prevented the escape of gases from the mould by closing up the pores. As regards the fineness of the coal dust, the grade must, of course, vary according to the class of work and the grade of the sand.

For very light castings a coal dust of exceedingly fine grade must be used, especially if the sand has an open tendency, while a slightly coarser, though still fine grade should be used for less light work. For the larger class of castings, in which it is necessary for a considerable volume of gases to escape quickly, the medium and coarse grades of coal dust are more appropriate, blackings or facings being used to secure a smooth, even skin on the casting. Where coal dust of too coarse a grade for the size of the casting is being used, the error is often evinced by the appearance of small pits on the face of the casting, which are easily distinguishable by their formation from the indentations caused by the presence of coarse grains in the sand, and are caused by gas from the carbonized coal grains pressing into the molten metal instead of escaping through the sand. As to the proportions, much depends upon local circumstances—class of casting, sand used, thoroughness of mixing and quality of coal dust, etc., but two mixtures which have been used with excellent results are as follows:—one, 55 parts old sand, 30 parts new sand and 15 parts coal dust. This is for heavy castings, and the other, which is suitable for light work is 70 parts old sand, 25 parts new and 5 parts coal dust.

A HANDY SAFETY VALVE CHART

By N. G. Near

A FORMULA which I believe is worthy of working into chart form is presented herewith. This is the formula:

$$A = \frac{0.2074\ W\ G}{P}$$

Where A=the area of the safety valve in square inches;

P=the absolute pressure in pounds per square inch;

W=pounds of water evaporated per square foot of grate surface per hour;

G=the grate area in square feet.

To use the chart simply lay a straight edge across the chart twice as shown by means of the dotted lines drawn across this chart and the area is immediately found in column C without doing any pencil or mental figuring at all.

First connect the evaporation per sq. ft. of grate surface per hour (column A) with the grate area (column D) and locate the intersection with column B. Then run a line through the absolute pressure (also in column A) and the intersection which has already been located and the intersection of this line with column C gives the area.

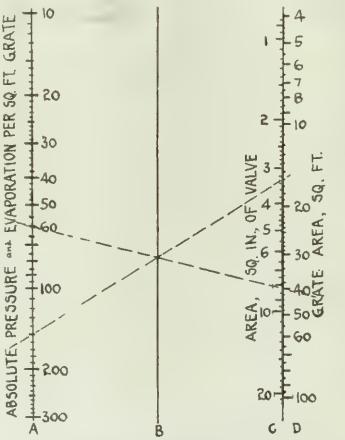


CHART FOR ASCERTAINING SAFETY VALVE RATIOS.

For example, what area of safety valve is required where 60 pounds of steam are evaporated per square foot of grate per hour, where the grate area is 40 square feet, and where the steam pressure is 150 pounds absolute?

The dotted lines show how this particular problem is solved. Connect the 60 (column A) with the 40 (column D) and locate the point where the line cuts column B. Then run a line through this point and the 150 (column A) and an extension of this line cuts column C at the point 3.3. The area of the safety valve should therefore be at least 3.3 square inches.

I believe this method of making double use of column A will interest readers. It serves both for the pressure and the evaporation. The first line connecting the 60 and 40 represents a multiplication as is evident by inspection of the formula. The second line performs the division.

TESTS FOR OILS AND VARNISHES

By C. T.

ONE of the most reliable tests for raw and boiled oils is the flash test, the temperature at which linseed oils usually flash being 470 deg. Fahr., whilst mineral oil, which is the chief adulterant of linseed oil flashes at about 400 deg. F., and resin oil still lower, so that the flash test is a simple method of detecting adulterants.

If the amount of the adulterant in the oil is to ascertained weigh a portion and place it in a beaker or any suitable vessel, and add a small quantity of caustic soda, alcohol, and a little water. The contents of the vessel should be then boiled for some time, with constant stirring, after which the oil will be found to be saponified, whilst the adulterants will be unchanged. The mass is then poured into a separating vessel, and agitated with benzine until it takes up the mineral oil, which afterwards comes to the surface of the vessel. The bottom layer is then run off and the top portion is well washed with warm water until all traces of the saponified oil have disappeared. The residue, which is mineral oil, is placed in a vessel and weighed.

Common resin is also used as an adulterant, and may be easily detected, if in any considerable quantities, by painting some of the oil on any glass surface, and when, it is thoroughly dry, rubbing well with the finger. If the oil contains much resin the film will leave the glass and crumble, whilst a good oil will not be affected.

The only reliable test for turpentine is distillation. The chief adulterants are shale spirits, Russian turpentine, resin spirit and coal-tar naphtha. The determination of the proportion of the adulterant would require special chemical apparatus, but a simple method is to warm a sample of the suspected turpentine and a sample of pure American turpentine. Should the suspected turpentine contain any of the above adulterants they may be easily detected by the odor, which is entirely different from the pure American turpentine.

EDITORIAL CORRESPONDENCE

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

CO-PARTNERSHIP

By Mark Meredith.

THE great war in which the world is now engaged has brought about the solution of many interesting and serious problems in British national, business and social life; but there are numerous others which call for grave consideration, amongst the most important of which is what is generally termed the labor problem. That this problem will become more acute so long as the war continues and that it will undoubtedly attain its climax when the war is over and millions of men are relieved from military service, are conclusions to which the most intelligent and shrewd business men are being forced.

From a close study of the relations of capital and labor from within, many authorities are agreed, from a study of the abilities, habits, intelligence and prejudices of working men as a class, that co-partnership is the one means of bringing capital and labor into more friendly and satisfactory relationship, and whilst it also affords a practical solution of the labor problem, it ensures a return to the supremacy in the industrial world which Britain once held.

No Universal Scheme

Whilst this may be accepted as the verdict of expert judges and practical business men there is no universal scheme of co-partnership which is applicable to all industries, for each scheme should be the result of careful and serious consideration, and may conceivably differ very definitely, both in detail and administration from some of those in operation in many works that recognize the stimulus the sharing of profits gives to the workpeople. There are, of course, certain broad principles which must be kept in view in this endeavor to secure a higher efficiency in the worker, of all business men who have studied this, Lord Leverhulme (till recently Sir William Lever) has given it most careful thought and consideration, and the following principles have been evolved from his experiences and also many others, based upon actual experience.

Co-partnership, or profit-sharing, must be kept from degenerating into charity or philanthropy, and its object must be increased efficiency of the undertaking adopting it, with increased prosperity of all connected therewith. It must not place management in the position of servant to labor, but it must ensure absolute freedom to labor from interference of managements in the enjoyment of the benefits to be derived from profit-sharing. There must be greater stability than a mere cash payment bonus system, and there must be an elevating tendency on management and labor, raising them in the social and industrial scale, and increasing their power of enjoyment and happiness, as well as their power of usefulness. It is eminently desirable that the workers' wives and families should feel the benefits of the system, but that system must be such that it is not antagonistic to the legitimate rights and privileges of the working man, whether the brain or the hands are the means of work. It is advisable that control remain with those who find the cash capital.

In considering the adoption of the principles of co-partnership every firm must carefully consider the scheme which it proposes to adopt, in relation to the class of workmen who form the majority of the employees, and careful study will have to be given to the calibre of work, *i.e.*, whether skilled, unskilled or semi-skilled, and schemes must be thought out which will fit in with all the conditions obtaining in any works. As a matter of fact very few co-partnership schemes have been found to be successful, and those that have been have been governed by special circumstances, as in the case of the Port Sunlight Works. The trade unions may be taken for granted as opposing—at least at first—any scheme of co-partnership, because it would seem that their attitude does not aim at efficiency and increased production on the part of their members, but it may be well that, if a proposal is made, which is manifestly an honest attempt to improve the status and earning capacity of the workman, by dividing fairly with him the products of his labor, the whole view of trade unionism may change in regard to this question after it has been convinced that the proposal is genuinely in the actual interests of capital and labor.

Labor More Than a Tool

Further, capital must be educated to understand and to admit that labor is something more than merely its paid tool; and it must also be recognized that capital, as represented by a large body of shareholders, is no longer any more of a partner in production than is labor, but is merely an investor, or, in other words, a money lender. Capital, as such, is dependent on labor and management for its results, and has no right under present day conditions to allocate to itself all the gain that may accrue from intelligent and shrewd management and efficient labor. Whole-hearted loyalty in the efficient production of his work by the intelligent and industrious worker can never be obtained from the mere drawer of wages. It is equally necessary that labor be educated in connection with its new responsibilities in relation to a sound co-partnership scheme which is based on business principles and not on philanthropy. No profit-sharing scheme will be of any use if the workman does not feel that he is interested in the losses of the business as well as the profits.

No co-partnership scheme can hope for success which attempts to interfere with standard wages. The latter must in all cases be at least as high as they would be in works where ordinary conditions prevail, whilst alterations must only follow the customs and necessities of the trades, so that the co-partners may receive real pecuniary benefits promised, which is their full share of the profits over and above the standard wages of the district. On the other hand, if there be no profits, the partners will receive nothing but their wages.

WOMEN BUILDING AEROPLANE WINGS IN A BRITISH FACTORY.
Illustration, Courtesy Engineering.

MANAGEMENT EFFICIENCY AND CAPACITY LOSSES

By O. C.

AN interesting method of forcing upon the notice of managements the losses occasioned by working plant at less than full capacity has recently been evolved in one industrial concern and it consists of a monthly chart, upon which is marked diagramatically the percentage of maximum output achieved in each department, with a series of columns for inscribing the total cost to the firm of the idle plant and for allocating that cost under the several heads of lack of orders, lack of material, bad material, breakdowns and poor planning. The regular presentation of such a chart constitutes a recurrent challenge to the management. If the cause of particular or general idleness of plant is lack of orders, either the selling department is at fault, and needs waking up, or the plant is larger than it should be, and the excess should be disposed or distributed to better advantage.

If heavy losses appear as due to lack of labor, their magnitude will indicate the amount of effort to be directed towards remedying that deficiency. If lack of material is the assigned cause of undue expense, something is wrong at the purchasing end or in the material store. If in any case the expense of idleness is greater than can be attributed to all these causes together, then the balance must go down to bad planning or defective management in general. It may be said that any manager worthy of the name knows without telling what plant is standing idle, and why; but it is very easy for a busy manager to overlook the fact and the significance of idle plant, until something happens to bring it sharply under his notice, and very few managers have any but the vaguest notion of the actual cost in cash incurred when machinery is not working at its full capacity.

The data used in constructing the chart is based on the fact that simple ownership of a machine costs money, inasmuch as it takes away from available assets. For instance, if a machine costs $500, the interest on that money, say at 5 per cent. per annum, is lost: then there are taxes on the machine at say 2 per cent., and insurance at 1 per cent. Further the machine probably depreciates at a rate of 20 per cent. per annum, and perhaps $25 per year or more must be paid for the rent of the space it occupies. All these expenses, say $100, go on whether the machine is used or not. Thus the simple fact of having bought this machine and kept it takes from the firm's assets practically 25 cents a day. The chart gives an indication of the efficiency of the management as distinct from the efficiency of the workmen.

WOMEN WORKERS MAKING CORES IN A FOUNDRY.
Illustration, Courtesy Engineering.

Charts of this nature cannot but have a very educational influence on the managers of those plants. They show that idle machinery which cannot be used should be disposed of, and the money received and the space occupied put to some useful purpose. In several cases the issue of the first of such charts resulted in the scrapping of machinery which had been idle for years. The space thus saved was used for a purpose for which the superintendent had felt needed a new building. In another case it resulted in the renting of temporarily idle machinery at a rate which went far towards covering the expense of carrying that machinery.

METRIC SYSTEM PROS AND CON

THE persistency with which pro-metric enthusiasts advocate the adoption of that system throughout the world is apt to be overlooked or not recognized by the great body of engineering manufacturers who, because of the fact that such a change would affect them financially in a markedly adverse degree, should be fully aware of just what such a revolution would mean to them, necessitating a re-education of the rising and risen generation of technical men.

Mr. W. R. Ingalls, president of the American Society of Weights and Measures, recently submitted a paper to the Institution of Mining and Metallurgy in London, entitled "Shall Great Britain and the United States adopt the Metric System?"

The author, who is also editor of the Engineering and Mining Journal, and president of the Mining and Metallurgical Society of America, said the subject was of vastly greater importance than was commonly comprehended and the people of Great Britain, her colonies and the United States should be roused to the importance of preserving their interests.

Metric Not the Only Decimal System.

The advantages of the decimal system are so manifest in many cases that the pro-metric party is wont to cloud the issue by making it appear as if the metric system were the only decimal system, Really, there is the fundamental difference that the decimal system per se is merely arithmeic, while the metric system involves the basic units of weights and measures. Another source of confusion will be dispelled if we can eradicate the chimerical idea of establishing uniformity. From a project that would manifestly put the weights and measures of the greatest industrial nations of the world at sixes and sevens it must be evident that the result would be more discord instead of more uniformity. The substitution of metric weights for English weights would create relatively light disturbance. Of course, the changing of all our weighing scales would cost a huge sum, and the recalculation of schedules—such as railway rates—must come to something like the ransom of an empire, but after these were done, we might get on pretty well.

Let us consider the conditions that have been established in the railway business. The tracks are marked with mile posts. The railway gauge is 4 ft. 8½ in. We might in course of time get in the habit of thinking of the latter as 1,435 mm., but manifestly it would never be convenient to refer to the mile posts as being 1.60935 km. apart, and either we should have to continue to think of miles, or else pull up the posts and replant them at km. intervals, which would be something of a job. Incidentally, our posting of highways would have to be revised, and the automobilist would mourn the day when metric legislation was enacted.

Question of Gauges and Standards

In machine shops the measures would be done with the aid of standard gages, conforming to the requirements of practice and convention. These gages are based on the inch. If the metric system were made compulsory, it is obvious that there would be but two alternatives, viz., to restamp the gages with strange and unhandy figures, and wait until people became accustomed to them as, for example, to ask for a 6.35 mm. rod when they wanted a 1-4 in. rod; or else to change the standards so as to make them

conform to metric units. Either horn of the dilemma is bad, but the second one—the changing of gages—would be calamitous. Some large American manufacturers have estimated that such a change would cost them individually from $500,000 to $750,000. So it is with all our affairs. Our entire system of manufacturing, of building and of doing things is based on standard units, which cannot be changed except under conditions that would mean nothing less than calamity.

Does anybody imagine that a 2x4-in. joist could be anything else but a 2x4, although it might be called a 50.8x101.6 mm.; and after we were given specifications in metric measures, should we not have to translate them back into English measures, in order to make use of our tables of board measure for easy computation? Of course, we all know that a 2x4 is seldom of those exact dimensions, and we should probably call it a 50x100 mm. after we had learned the rules of the new game. But sometimes it is necessary to figure closely in connection with joists S4S, and then we know that the 2x4 is reduced to 1¾x3¾ in. How we should conveniently arrive at the exact dimensions of a nominal 50x100 mm. joist deponent sayeth not.

Benefits Not Commensurate With Inconvenience

Any change of standards in either metric or non-metric countries is preposterous, unthinkable. We have all gone too far. Besides the colossal expense of substituting gauges the result could not be anything but a mixture. The man who needed some ½-in. bolts for the repair of his automobile would not relish the information that they were no longer made, but that he could have 10 mm. or 15 mm. bolts.

Non-Metric Tables

We have volumes of tables of figures devoted to the properties of structural steel. Similarly as to mechanics, hydraulics, surveying in brief all the branches of engineering. With the metric system these would be all but useless. The compulsory adoption of the metric system would be no less preposterous than an edict that after a certain date all business in the United States—all buying and selling, all engineering, all figures—would be illegal unless done in French.

English Foot Greatest World Standard

The prime argument advanced for the metric system is to have international uniformity. It is stated that a long list of the countries of the world have adopted the metric system, **only** the United States, Great Britain and her **Colonies**, and Russia (of the Indo-European nations) having failed to do so. I have emphasized the words **only** and **Colonies**, for therein is concealed the speciousness of this argument. If with "Colonies" we equate Canada, Australia, New Zealand, Tasmania and South Africa, we have a longer list of non-metric countries, and it comprises not only the most populous, but also the most industrial nations of the world. A correct statement of this theorem would be: Considering the Indo-European race alone, there is a much larger population that does not use the metric system than does; and their nations are far superior in industrial development, measured by iron production, let us say, to all other nations combined. The foisting of the metric system upon them would be, therefore, like letting the tail wag the dog.

If uniformity be the objective, it would be better to institute a propaganda to induce Germany, France, and the Latin countries to adopt the English system. In this connection is may be remarked that, although Russia has a system different from either, the fundamental Russian measure of length, which is the most important of all measures, is the foot, and the Russian foot is the same as the English.

Present Tendency Toward Uniformity

Another argument on the ground of uniformity relates to the confusion existing in the English system owing to the different kinds of tons, pounds, gallons, etc. That there is such confusion, with its inherent dangers, is true; but it is also true that the confusion is much less now than it was twenty years ago, that it is bound to experience further reduction, and that it may be eliminated entirely in a way far easier than by the introduction of the metric system. In Great Britain there is but one kind of ton, viz., that of 2,240 lbs. In the United States the English, or long ton, is employed to far less extent than formerly, and in the main we have standardized the ton of 2,000 lbs. That we should have two pounds—the avoirdupois and the troy—is annoying, but the annoyance is now more academic than practical, for the troy pound is seldom used. Similarly have the differences among gallons, bushels, etc., lapsed in the main into innocuous desuetude. But with respect to confusion, the skirts of the metric system are not clean. As a statistician of nearly thirty years' experience I may say that I have fallen into more errors over the zentners and doppel-zentners of metric Germany, and the quintals and metric-quintals of Chile, than I have over the pounds of England and America and the poods of Russia.

The third metric argument is the ease of the calculations, especially the correlation among measures of length, volume and weight. It may freely be admitted that there is some merit in this, but the English system is not quite helpless in this respect; and the superior merit of the metric system is far short of being a determining factor, quite apart from its calamitous effect in overthrowing existing standards and upsetting the mode of thought of the people, which, of course, are the major considerations.

HEAT TREATMENT OF STEEL FORGINGS

By T. E.

HEAVY steel forgings are supposed to undergo a "normalizing" heat process after suffering the drastic treatment involved in bringing them to the desired shape; but in fact the annualing temperatures to which they are subjected vary greatly, being as low as 650 deg. C., and in others as high as 927 deg. C., and the results obtained from the forging naturally vary accordingly. Some authorities question these temperatures and one is told that there is little need to trouble, as the forgings as a rule pass test, but unfortunately forgings, machine parts of all descriptions, break down prematurely, due to fatigue, and it is possible to locate fatigue failures at the manufacturer's works before such forgings are put into service.

Unless the critical temperature of 650 deg. C., is exceeded comparatively little change is effected in the structural condition. A forging which has been finished at a high temperature, or parts which have been raised to a forging heat and have received little or no subsequent work, on cooling retain a very coarse structure. As an example of what may occur if such forgings are not properly annealed it may be mentioned

TUBING A MARINE ENGINE CONDENSER.
Illustration, Courtesy Engineering.

that quite recently a double intermediate shaft actually cracked in the lathe during the turning operation. The shaft in question was cut through the defective area and subjected to microscopic examination, which revealed a structural condition not unlike that of an unannealed steel casting. The shaft was then subjected to a prescribed heat treatment, after which it was again examined, and showed the entirely different structure of a properly annealed forging with nearly double the elongation, whilst physical tests showed more than double the area of reduction and bending angle than were shown by the metal in its badly annealed condition. Such cases of inadequate annealing are found not only in large forgings but equally the whole way down the scale, even to drop stampings.

As an example of the same thing in smaller forgings a case may be mentioned of a heavy bolt which was of a special type and made by heating to forging temperature for the full length pieces of round bars and "upsetting" a portion at one end to form the head. These forgings were subsequently normalized in heat at 677 deg. C., but when they were subjected to a shock, it was by no means uncommon for the head to come off. The reason for this will be readily understood when one examines what had taken place in the forging operation; the only portion which had received any work was the material forming the head, and where this adjoined the body one had two entirely different structures. After these forgings received a proper heat treatment a uniformity in structure was obtained together with the disappearance of any further shelling of the head when subjected to the same repeated shock stress.

A misconception more or less common in heat treatment of steels is that full advantage can be taken of the initial forging heat, and that forgings or stampings finished at a high temperature will on cooling regain a fine structural condition. This is entirely wrong, and if it is desired to obtain the best normal structural condition, the heat in such forgings must be allowed first to fall below its recalescence temperature and then reheated somewhat above its calescence temperature, and preferably cooled in air.

CONSTRUCTING AEROPLANE NOSES WITH WOMEN WORKERS.
Illustration, Courtesy Engineering.

DEVELOPMENTS IN HEATING AND BOILER FURNACES

By D. Street.

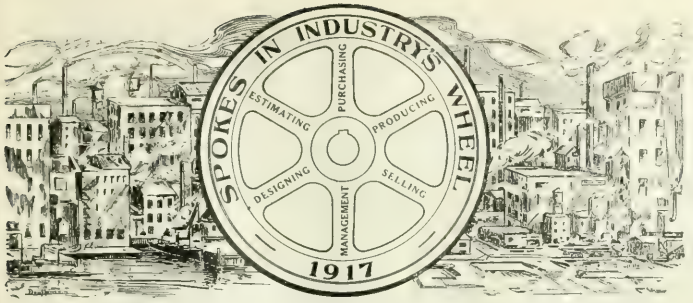
A GOOD deal of attention is being directed at the present time to the securing of fuel economy in reheating furnaces at steel works and for the elimination of smoke from their operation. For the secondary reheating of some slabs, blooms and billets some four or five times more fuel is required than for the preparation of an ingot from hot-open-hearth steel, and the operation, in the case of large steel works, affords scope for some very considerable saving. By-product gas from blast furnaces and coke ovens is coming into increasing use for the purpose; producer gas is in some cases being substituted for coal; and experiments are going forward in some quarters with tar and powdered coal as fuel and with crude oil.

Even where there is no departure from the use of coal for heating the furnaces much experimental work is being done with mechanical stokers, with a view to securing economical heating and smokelessness. At one of the Carnegie works a great improvement has been made by substituting air for water as the cooling medium for the pipes of a flat-roofed continuous furnace and carrying the heated steam to the combustion chamber. The cooling of the roof, though much reduced, is still sufficient, and the pre-heated chamber for combustion is a great advantage.

The performances of different heating furnaces as recorded over the past five years at another works have yielded some very interesting data. With coal fuel the efficiency of the furnaces (percentage of heat in fuel actually absorbed by the steel) ranged between 13 and 15 per cent.; with natural gas average efficiencies of 20, 27, 35, 40 and 42 per cent., were obtained; and there were individual furnaces that averaged month in and month out between 60 and 70 per cent. At Clairton, near Pittsburg, Pa., the Carnegie Steel Company is now building what will be the largest plant of by-product ovens in the world, producing 65,000,000 cubic feet of surplus gas per day. This will be used for furnace heating, and will give the equivalent of 1,600 tons of coal per day. Coke-oven gas, after being scrubbed and freed of its tar and light-oil vapors is a clean fuel, and can be burned more easily without smoke than either raw coal or any other gas and will furnish a higher surface temperature than producer gas. Where producer gas is used for heating billets or small slabs in the continuous type of furnace, two points in particular have to be watched—the gas must be supplied regularly to the furnace, and air must be supplied at a high temperature.

If hand-fired, hand-poked producers are used, the gas goes to the furnace irregularly, and at times there will be a large surplus of gas which chokes the furnace and makes excessive smoke. These defects are overcome by using a modern-type mechanically-fired and mechanically-poked producer; and if the secondary air be sufficiently pre-heated, quick and complete combustion is secured in the furnace. There are regenerative types of continuous heating furnaces, in which the air is preheated to 1,000 or 1,200 deg. Fahr., and in these all combustion takes place in the first third of the furnace, the remaining two-thirds being almost as clear as the outside air. Under such conditions there is, of course no smoke whatever. The elimination of smoke from coal-fired furnaces has been secured by applying to furnace heating the knowledge gained in the study of highly efficient boiler firing. Mechanical under-feed stokers are used in conjunction with forced draught, and furnaces 70 ft. long by 20 ft. wide are being operated by these means without smoke. In records taken of five plate-heating furnaces and two billet-heating furnaces equipped with underfeed stokers, all of which were practically smokeless some facts were gleaned of interest.

From the billet furnaces about three tons per hour were obtained. These furnaces were 26 ft. long by 7 ft. wide. The five plate furnaces averaged 18 ft. by 7 ft. hearth surface, and were used for heating plates and shapes such as were required in car construction. Smoke rarely issued from the chimney stacks of those seven furnaces for more than five minutes at a time, and that very rarely, and a uniform temperature of 2,300 deg. F., is possible at all times.



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

CHAS. W. A. MOORE.

THE successful achievement that Canadian manufactures have attained in the production of all classes of munitions, would never have been possible but for the able co-operation of the machine tool builder, and those associated with that branch of the industry that supplies the link between the producer and the consumer; namely, the distributors or machine tool agencies. Prominen among those whose efforts have been a pillar of support to many shell plant executives, and upon whom much reliance has been placed for the selection of suitable equipment, has been the subject of this sketch, Charles W. A. Moore, assistant manager of Foss & Hill Machinery Co., of Montreal, Que.

Charlie, as he is generally called by his more intimate friends, is a Canadian by birth, having been born at Toronto, Ontario, on Oct. 17, 1880, of Irish-Canadian parentage. When Charles was only two years old the family removed to Lachute, where the boy received his early training, and what little education he could acquire when not at work on the farm. At the age of sixteen, our "Spoke" started on his engineering career, entering the plant of the Canadian Linotype Co., of Montreal, as an apprentice machinist. After serving most of his time with this firm, he engaged himself as an improver with James Cooper, machinist; Cooper's shop, at that time, making the machinery required for the Canadian trade of the Ingersoll-Rand Co. From this time until the year 1906, he was employed in various capacities with different engineering firms in Montreal and vicinity. For the next three years he was foreman at the Allis-Chalmers-Bullock plant, following which he accepted the position of superintendent of the International Steel Co., of Montreal. In 1911, he went with the Canadian Buffalo Forge Co. as superintendent, remaining there until 1913, afterwards becoming associated, in a similar capacity, with the Hall Engineering Co., of Montreal. In 1915, he accepted a position as salesman with the Foss & Hill Machinery Co., and his present position is ample proof of his ability and success in the selling end.

In 1906, Mr. Moore married Maud Earle, daughter of the late William James Earle, of Valleyfield, P.Q. The

CHAS. W. A. MOORE.

union having been blessed with four children, two daughters and one son living, and one son deceased.

The activities of the past few years have confined our "Spoke" closely to his task and little opportunity has been available for relaxation. Hours of recreation, however, are necessary, and these are generally spent in lawn bowling, he being an ardent supporter of the Outremont Bowling Club. Mr. Moore is a member of the A. F. & A. M., and although his business activities occupy the greater portion of his time, he still finds it possible to take an active interest in the Ancient Craft, and is associated with the Blue, the Chapter, the Preceptory and the Shrine.

Mr. Moore attributes much of his success to the fact that he has devoted considerable time to study. "Unless a young man endeavors to acquire a wider knowledge than that of actual contact with his daily labor, he must of necessity drift along with the tide; the great need of the present day is for men who are not only capable of successfully accomplishing what is required of them, but who are willing (by hard work) to cultivate that faculty of observation and application, that will better fit them for the larger opportunities that arise daily. They should keep in close touch with their particular line of business, making themselves conversant by practical observation or by published mediums, of the many developments that are continually taking place throughout the trade. Big things are only possible by those who are ready to accept and able to fulfil the larger responsibilities."

DEVELOP BRITISH MINES

THE development of the mineral resources of Great Britain and Ireland, now being undertaken by a department of the Ministry of Munitions, under the direction of Sir Lionel Phillips, is likely to lead to far-reaching results. Sir Lionel Phillips is well known for his life's work in developing the mineral resources of South Africa, and is bringing his knowledge and experience to his task. A number of engineers of outstanding ability and position are also assisting the efforts of the department, and already considerable work has been done in furthering war purposes.

Control Wolfram Mines

Steps are being taken to control and expand wolfram mines, from which it is expected to produce a home supply of tungsten powder, an essential ingredient in the manufacture of high-speed steel. A complete survey of the lead resources of the country is also being carried out; new sources of supply being investigated and old working reopened. In one instance steps have been taken to assist in the drainage and development of an important lead mine from which there is a prospect of an immediate increased output.

Other Developments

Action is also being taken with regard to the production of zinc. A sulphur pyrites mine has been acquired, and certain low-grade copper deposits of considerable extent and promise are being carefully watched with a view to giving assistance in their working.

In the course of its immediate operations the department is gaining valuable information which will allow it to offer future suggestions as to the prospect of the normal base metal industry of the United Kingdom. It will also be enabled to report on the relative cost of home production against importation, and to advise as to the placing of the industry in the best position to meet emergencies.

William H. Cunningham, a member of the firm of Kurtz Bros., bankers, Philadelphia, Pa., has been elected president of the Lake Superior Corporation, Sault Ste. Marie, Ont.

Influence of Recent Developments on Apprenticeship Training*

By Neil J. Maclean

The apprenticeship question is a live issue in British Industrial circles at all times, and while it has long been a subject of controversy between employers and employees, indications abound, in view of the utterances of numerous important officials, that the apprentice of the future will be trained and appreciated as an essential factor towards national industrial success. Plans for future activity in Canada must include a consideration of this subject.

AMONG the many problems connected with the engineering industry upon which experience gained during the war has shed fresh light, is that of the workshop training of apprentices, and with a view to promoting a clearer understanding of its different aspects I set forth my views below in a series of axioms, supported by some notes on the application of these axioms to a system of apprentice training, as worked out in detail in the factory with which I am connected. The more advanced training, which should include a university engineering course, is not dealt with, as this must necessarily be planned on different lines throughout; only the regular workshop training which will enable a man to qualify as a skilled workman, a draughtsman, or a junior shop executive—foreman, underforeman, inspector, etc.—is under consideration.

It will make a good starting-point in trying to sort out one's thoughts on this subject, to remember that the raw material in question, when we begin work with him, is the boy, a wayward, unstable, light-hearted, elder child, a dreamer of dreams, eager, easily interested and easily tired; that during his period of training he passes through the critical point of development from boy to man, at about the age of eighteen; that we are dealing with man in his seedtime, and, hence, largely according to our sowing so shall the reaping be; and that the habits that are formed during this period will have a determining influence on the character developed during later years.

Among the habits that will most surely promote his success later on is the habit of industry, of steady, constant and intelligent labour, and this brings me to the statement of my first axiom: **The aprentice must be always busy.** It sounds simple and looks obvious, but in practice it is a condition neither easy to bring about nor to maintain. To begin with, the boy altogether lacks skill and must be shown how to do his work; this occupies the time and attention of a trained man; work suitable to his inexperience must be found for him; his interest in this work, easily roused, is easily tired, while his ingenuity—when tired of the job—in escaping from control is ever alert and watchful of its opportunity. And yet if, during his training, there are frequent spells of idle time, the habit of industry has but a poor chance to form itself, and if not formed then, permanent harm to the boy's character must surely result.

The requirements of industry are growing more exacting, more complex; there is more ground to cover before one can be considered trained, even in a single department of the many trades comprehended within the term "engineering;" for the apprentice there is, therefore, much to learn, a wide country to explore. This brings me to my second axiom: **The apprentice must be always learning.** He must be taught to do a certain thing properly and must then be moved on to a different kind of work. The thing he is given to do first must be easier to learn than what follows. In this way confidence in his ability to perform specified tasks will gradually be acquired, whilst the range of the different kinds of work with which he is intimately familiar will be steadily widened. At the same time, by ensuring a sufficient variety in the work, attention and interest are maintained; for it must be repeated with insistence, a boy's interest is easily tired, and if lost, mischief is an inevitable result.

The engineer of a century ago was an empiricist, a cut-and-try man. He depended almost entirely on his previous practical experience; he worked to sketches, simple drawings, or models. If his first attempt to get a certain result did not succeed, he felt his way forward gropingly by practical experiments to a more successful conclusion. It is different to-day. Now he must appreciate exactness in size; he must easily read complicated drawings; he must be able to think in three dimensions, and have some knowledge of physics and chemistry; which brings me to my third axiom: **Engineering is an exact science, and the apprentice must develop the scientific mind.**

I use the term "engineer" in its broadest sense throughout, not limiting it to the director of great enterprises, the executive in charge of factories, or the workman actually carrying out a given task. Of course the training given to a group of boys in any workshop will vary individually to suit their prospective positions, but the fundamental principles are common to all, and if these are not understood and observed, successful results cannot be expected.

During apprenticeship the schoolboy of from fifteen to seventeen years of age must be turned into a young man able to think exactly, to observe accurately, and to note down clearly his results. He must develop the quantitative sense, the ability to appreciate instantly and without conscious effort the magnitude of the quantities he is at the moment dealing with. To obtain such a result the training must involve an intimate mingling of practical and theoretical work, of shop experience and study, of things seen and done, things noted and written down.

Now, it must never be lost sight of that since an apprentice is trained in a workshop or factory whose business it is to make things for sale, he is hedged round with commercial conditions and considerations which may conflict with the requirements of his training. A nice balance must be struck between interests which will not always or obviously work together for a common end; and long views of what will ultimately benefit the firm, or the trade, or the nation, must be considered along with the more immediate needs of factory output and organisation; in view of which we arrive at my fourth axiom: **The apprentice's course of training must not be determined by the shop foreman or manager responsible for output.** If it is, then considerations of output will weigh too heavily and the apprentice will not get the variety of experience which is essential to fulfil axioms (2) and (3). A member of the firm having authority must determine the course of training of each apprentice in detail and must ruthlessly override any objection to necessary changes advanced by department foremen on the grounds of interference with output. This condition is more imperative as industry becomes specialised and departments more highly organised, so that variety of experience within any one department is more and more curtailed.

We have heard and read much recently of the ca' canny policy, of its mistaken basis and its harmful results. It is chiefly founded upon the idea that there is not enough work to go round. The trade unionist knows that fellow-members are out of work; therefore, says he, "I will do a little less and some of them will get a job." But this line of reasoning is not confined to the trade unionist; it crops up in other forms among other classes. The educated man says to himself, if too many highly educated men are turned out, there won't be enough comfortable berths for us all. Ergo, says he, put the brake on the education wheel; avast there, turning out too many B. Sc.'s. I think I have even read leading articles in the engineering journals voicing this view in more polished phrases. Now, the prinicple on which this conclusion

*Contributed to a recent number of "Engineering," London.

is based has been thrown on the scrap heap. Let us make sure that the different conclusions themselves find their way to the same well-merited destination; which leads me to my fifth axiom: **There cannot be too many highly trained apprentices.**

There must always be forces at work that will keep back some of the starters from being finishers; ill-health, family trouble interfering with apprenticeship, decay of ambition, these will interfere with the successful completion of training courses in many cases. Against these, employers must always pit all the forces and influences at their command to turn out as many highly trained, highly educated apprentices as they possibly can, confident that the supply cannot outrun the demand. The more that are turned out, the more useful energy and creative force has been added to the nation's stock.

The industrial lesson of the past two years that has bitten most deeply into thoughtful minds, I think, is this—that, given good executive direction, high-class work can be turned out by comparatively untrained labor. But the executives must be good, very good. Now, the training that is required by a good engineering executive is so elaborate, thorough and comprehensive, that it cannot begin too early, or be too carefully planned and directed; which enables me to state my sixth and last axiom: **Special training must be given to those apprentices who show marked ability.**

A reasonable time after starting work must elapse before selection is possible; then some form of thorough test should be applied to divide the apprentices into those who can be expected only to turn into competent workers and those who may one day take the lead and rise to responsible positions. Opportunities of specially varied training and of higher study in connection with it can then be provided for the selected boys, with confidence that such facilities will not be wasted.

Having examined some of the fundamental principles that must underlie any system of training for apprentices to the mechanical trades and reduced these to simple axiomatic form, it may be of interest if their working out, as applied to a particular factory, is described in some detail. Such a system of apprenticeship has been under trial in the works of Barr and Stroud, Limited, Glasgow, for the past 12 years, a period long enough to enable an opinion to be formed of its results. A large number of apprentices have graduated under it and have proved themselves able to do good work in other factories in this country and abroad, while the junior executive positions throughout the factory are now in many cases filled by men trained under the system.

At the present time over 300 apprentices are employed, engaged in all branches of the fine mechanical trades, fitting, machining, tool-making, electrical engineering, pattern-making, moulding, joiner-work, instrument-making, and optical prism polishing. Apprenticeship is for five years, commencing at fifteen or sixteen years of age. The boys are not indentured, but they are expected to spend the full training period with the firm. No boys not apprenticed are employed.

Considering the axioms in order, the first—that an apprentice must always be busy—is not easily reduced to any definite rules; it depends largely on the general atmosphere throughout the shops. The pratice is closely followed that at each stage of training, a boy is under the supervision of a man expert in his own branch of the trade, whose duty it is definitely to show the boy how to do the work, and also to see that he is kept constantly employed. Where difficulty is met with in developing in a boy a habit of steady work, special steps to overcome it are taken. He is put on to work in which the day's task can be very exactly measured and his performance closely watched. This is not done only in a disciplinary spirit, as it must be clearly recognised that if a worker in the mechanical trades fails to acquire habits of regular industry, he can never earn any useful place for himself in organised industrial work.

The second axiom—that an apprentice must always be learning—is applied by arranging in sequence a series of different kinds of operations which he successively undertakes, commencing with the simplest. A change of work is arranged for about once every six months. During the first half of apprenticeship the training for most of the trades follows the same general lines, including fitting and machining; during the second half of the training each apprentice specialises in his own particular craft. Pattern-makers spend some months in the foundry, opticians some months in the machine shop, and so on. A special feature is made of the fourth-year training for instrument-makers, which is carried on under a qualified instructor, the work consisting as far as possible of the building of complete instruments of odd types.

The fourth year of any system of training is, I think, the critical period. It coincides with that difficult age when a boy is unsettled, whimsical, discontented, groping about uncertainly in search of the larger powers and responsibilities of manhood. It often happens, too, to be the time at home when the difficulty which his parents find in supporting him at a comparatively low wage presses hardest; he is still earning little and the end of his training period seems a long way off. His early interest in the work may have flagged, while he is still not master enough of his trade to find pleasure in working at it. For these reasons I think the fourth-year apprentice should receive particular attention. Care should be taken to make the work as interesting as possible, to appeal to his growing sense of craftsmanship by varied and carefully selected work, to see that he works under a wise and competent guide who will watch for signs of insubordination and deal with these in a proper and understanding spirit.

The third axiom—that engineering is an exact science—is applied by bringing all possible pressure to bear on the boys to attend regularly suitable technical classes in the evenings. As the day's work does not begin till eight o'clock there is less objection—if, indeed, there is any at all—to the boys being expected to study at night than in cases where the work starts at six or six-thirty. Each apprentice is interviewed by the manager at the beginning of the evening class session, and the classes he decides to attend are entered on a card. The school is notified, and if he fails to enrol the matter is dealt with as a breach of condition of apprenticeship. An increase of pay from 6d. to 2s. per week is granted for evening class attendance, graduated in accordance with the record of work done. Early leave to attend classes is arranged for when necessary, and in no case is an apprentice allowed to work late in the factory on one of his class nights. It has not been found possible even with this considerable amount of persuasion and insistence to induce more than about 70 per cent. of the number of apprentices in the factory each year to attend evening classes regularly. Sickness, home disabilities, and temperamental repugnance to any form of book-work prove too great obstacles to the remaining 30 per cent.

The fourth axiom—that the apprentice's training must not be determined by the foreman—is met by all changes of apprentices from one stage to the next being arranged for by the works manager. A list of these changes is sent to the department foremen about once a fortnight, and must be given effect to forthwith, no matter at what inconvenience to the work in hand. It is necessary to be explicit on this point, as otherwise the competent boy will be kept on one kind of work, to the detriment of his all-round training. In arranging for a change of work regard is had, of course, to the boy's special aptitude, more particularly in the later stages of training; and there is no objection to the foreman giving boys special experience of particular machines or processes when opportunity offers, without receiving instructions to do so. The danger to guard against and overcome is the reluctance of those in charge of the work to make changes which advance the boy's training, but at a temporary cost in output. This reluctance can only be overcome by the issue of definite instructions from headquarters.

The fifth axiom—that there cannot be too many highly-trained apprentices—is certainly true in my experience. The tendency to settle down, to give up any definite attempt to make progress, manifests itself early in the life of very many young men, and I do not thing that the most strenuous efforts to persuade larger numbers to steadily advance themselves in knowledge and experience

will ever produce more than—or even as many as—there are vacancies waiting for them to fill. It may happen at times that a number of ambitious and capable young men finish their training together, and they may think themselves that there is not a good prospect of their finding scope for their abilities, but it is a temporary effect, and the average over a period of years certainly proves, I think, that the demand for highly trained men is well ahead of the supply.

The sixth axiom—that special training must be given to the more able—is, I think, worth particularly careful study. It is met in the factory by a selective annual examination in subjects relating to shop practice, the result of which is combined with the result of evening class attendance, with timekeeping in the works, and with a report on conduct submitted by the shop foreman. Every quality of the boy's ability and character is therefore included in determining his place in the list which is prepared of those having the promise of executive ability. Apprentices who win a place on this list are promoted to the drawing office, are given four hours' day tuition during working hours in the winter months, and are put through a wider practical training in the factory. In certain cases they receive a set of tools, which becomes their own on completion of apprenticeship. Since it is felt that to take full advantage of this training a good day-school education is essential to start with, the firm have recently instituted scholarships to enable boys to attend a suitable course of instruction for one year at a secondary school before starting their workshop training. It is hoped that by this means it will be possible to ensure that every boy will have spent at least one year in a secondary school before commencing his apprenticeship.

In conclusion I may express the hope that these propositions and the short description of their application to one particular factory may be of use to those who just now are considering the question of the higher training of their apprentices, a question among the most important in relation to that general industrial betterment which we hope may result from the many changes of these troubled times.

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.

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.

SEEKING to imitate klingerite, a German packing for steam-pipe joints, French chemists have found a specimen of the material about a sixth of an inch thick to consist of fifteen thicknesses of thin asbestos, says the Chemical Trade Journal. These layers were a compact felting of the best long fibres, mixed with 2 per cent. of flax threads to give strength and pliability, and each side was coated with an agglutinant containing sulphur, designed, it is supposed to increase impermeability and resistance by slow vulcanisation. Analysis showed 80.5 per cent. of asbestos, 2.2 of cellulose (flax), and 17 of rubber and balata, with a small proportion of sulphur.

IN his annual report on the trade of Denmark, the U. S. Consul-General remarks that the chief hindrance to the industrial development of that country has been the lack of coal deposits. Denmark produces no coal, and is, therefore, placed at a competitive disadvantage. The country's industries and railways consume annually about 3,000,000 tons, most of which comes from England and Germany. A Danish syndicate was formed in 1916 to investigate and exploit the coalfields of Iceland, a report of which has already appeared in The Syren and Shipping. During the past two years it was hoped to purchase coal from the United States, but freight rates prevented this being done.—*Syren and Shipping.*

THE demonstrated advantages of electric motor drive as applied to steel mill service are rapidly making its use universal in rolling mill work, while as regards reversing mills, substantial evidence of the exceptional superiority of electric drive has been given during the past two years. Less than two years ago there were two electrically-driven reversing mills operating in the United States and one in Canada. In November-1916, there were fifteen mills of this type either in operation or being constructed, whilst in Britain, according to the "British Westinghouse Gazette," there were two.

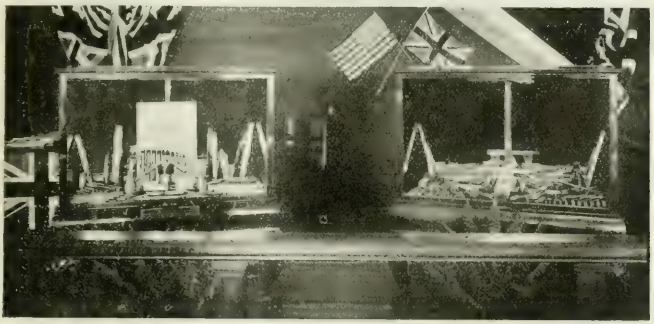
VERY good results are said to have been attained in the experimental manufacture of square and bar steel, etc., at the Kawasaki Dockyard Company's branch factory at Hyogo, where two 15-ton smelting furnaces were installed last year. Encouraged by these results, the company has decided to establish a steel works on an extensive scale for the manufacture of steel plates and rails. According to "Eastern Engineering," a suitable site is being sought in Fukuoka Prefecture, Kyushu. When the site is fixed, a large works, with five 30-ton smelting furnaces to begin with, will be erected on a capital of 5,000,000 yen, for manufacturing steel plates, rails, square and bar steel, etc., the same as the Government Steel Works at Edamitsu.

Engineering Exhibits at the Canadian National Exhibition

Staff Article

The value of Canada's premier annual affair as an occasion on which to gain publicity is again justified by a visit to the Machinery Hall, while any doubts regarding the mechanification of the farmer are instantly dispelled by an examination of tractors, electric light plants, and other aids toward a labor-saving and luxurious existence for sons of the soil.

DESPITE the absence of a few notable exhibitors of former years, the engineering features of the exhibition, both in the Machinery Hall and elsewhere, have aroused probably a more wide-spread interest than for many years past. The fact that many people, brought in contact with engineering practice through the temporary activity of munitions production, are now earnestly endeavoring to find a permanent outlet for their efforts is one, if not the main reason for the great general interest displayed by visitors this year.



PART OF PRATT & WHITNEY 'S EXHIBIT OF SMALL TOOLS.

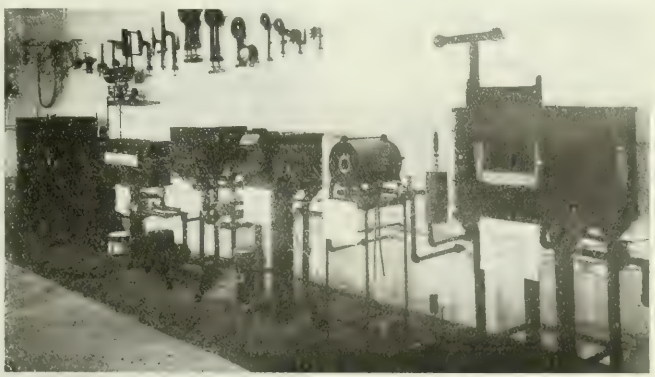
Present conditions, of course, have postponed any improvement in the facilities afforded exhibitors, but had proper and deserved encouragement been given in a timely manner, the machinery display would not be handicapped by comparison with certain annual events in the States, which are noted for the facilities offered exhibitors in such important matters as steam, gas, air and electricity supply, especially in the matter of reasonable charges for the latter service. As matters are now, it is only through the loyalty and patriotism of exhibitors, who annually face the expense and inconvenience of two weeks' dislocation of regular business, that the standard of the show has been maintained at its present level. In view of the services rendered to the Empire, and the great degree of confidence with which the industry is regarded as a mainstay of the country in the future, no excuse short of absolute lack of funds can justify a continuance of the present lukewarm attitude of the authorities toward engineering exhibitors. The thanks of the industry are indeed due to those who continue to "carry on."

The general state of affairs is indicated by one noticeable change in the aspect of the show—munitions have disappeared and manufactures are returning. Machine tools are the heavyweights, as always, but developments largely due to the recent munitions activity are indicated by several of the exhibits. One of these is the increasing appreciation of the benefits of heat treatment in certain classes of work, and in this field much initiative has been displayed by the Canadian Hoskins Co., the well known pioneers in electrical furnace and pyrometer development. Their product now includes also gas-fired furnaces, ovens for enamelling, etc., and a unique product in the shape of Chromel, a non-ferrous alloy, which possesses marked non-corrosive properties, especially under the influence of heat. These properties are due to the high melting point of chromium combined with the great resistance of nickel to oxidization. This metal does not soften appreciably under heat like iron and has a life approximately 40 times as long. Applications already proven include carbonizing boxes, cyanide crucibles, lead pots, barium pots, pyrometer protecting tubes, etc.

It is of especial interest at this time to know that this alloy is made in Canada in the Hoskins factory, an important part of the process being played by a special type of carbon resistance furnace which is also exhibited. Its simplicity of construction and efficiency of operation render it particularly useful in high temperature work.

Further interest in the combustion field is stimulated by the extensive display of manufacturers furnaces exhibited by the Consumers' Gas Co. of Toronto. Apparatus and equipment for the convenient use of gas as a heat-producing agent in many lines of industry are shown in operation, gas and air being piped to most of the exhibits. High temperature furnaces for special steel hardening, tool room furnaces, ovens, brazing benches and blow pipes demonstrate clearly the adaptability of gas to many processes. The effect of several furnaces at white heat is very marked from a display viewpoint, the entire exhibited being markedly effective.

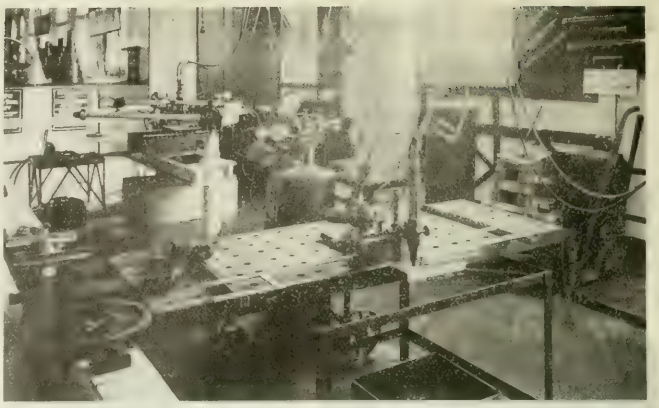
Of similar interest to visitors is the demonstrations of oxy-acetylene welding work. L'Air Liquide Society show the use of their apparatus in the manufacture of storage tanks for acetylene gas, to withstand 975 lbs. pressure per sq. in. A sample of liquid air, which is produced during the manufacture of oxygen was an item of more than ordinary interest, in which one could test the effects of 350 deg. below zero on the human flesh. Mechanical apparatus for the application of the oxy-acetylene flame to manufacturing operations were featured by the Carter Welding Co., who showed the well known Davis-Bournonville apparatus cutting steel plates of any thickness and shape. The radiograph is an ingeniously arranged machine on the pantograph principle, which enables patterns to be copied



THE CONSUMERS' GAS CO. EXHIBIT ED GAS FURNACES IN OPERATION.

on large or small scales, the flame cutting the outline as determined by the master design; the roughing out of dies and similar work is a particularly useful field for this device.

Special appeal is made to the skilled mechanic and fine tool maker by the Pratt & Whitney exhibit of Canadian-made cutters, reamers, taps, drills, shell tools and special articles of a similar nature. The prestige attached to the name is well upheld by this exhibit, which is convincing evidence of the possibility of producing such goods on a commercial scale within the Dominion. Complementary to the foregoing are the machine tool exhibits of Canada Machinery Corporation, Garlock-Walker Machinery Co. and A. R. Williams Co. Both wood and metal-working machines are displayed on a large scale by the former, whose annual appearance is looked forward to with interest by a wide circle of acquaintances. A feature of Garlock-Walker is the showing of numerous views in lantern slide form, illustrating iron machinery from the raw state to the finished product. The entire history of iron is shown from the blasting of the rock by the miners, through railroad yards, ore docks, blast furnaces, steel mills and foundries, pattern shops and machine shops till it assumes the form of a lathe, shaper or other machine tool, and demonstrates most convincingly the absolute dependability of modern manufacturing on this one metal more than any other. Suitable types of modern tools are on view to complete the exhibit.



THE CARTER WELDING CO. SHOWED MECHANICAL APPARATUS FOR CUTTING AND SHAPING PLATES WITH OXY-ACETYLENE FLAME.

CLEVELAND PNEUMATIC TOOLS INCLUDED SPECIAL DESIGNS FOR WOOD SHIPBUILDING.

A feature of the Williams exhibit is the demonstration of Stellite cutting tools on heavy forging machining. This wonderful alloy depends for its existence entirely on the Canadian deposits of cobalt, and during recent times has earned a wonderful reputation as a metal-cutting material. Numerous samples showing its application to tools for a wide range of operations are displayed by the Deloro Smelting & Refining Co.

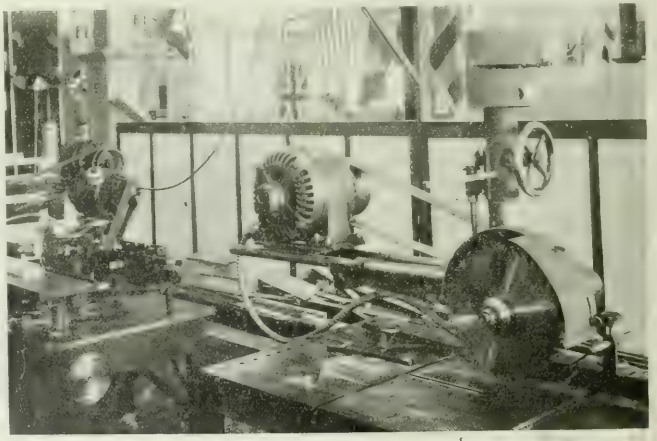
Pneumatic tools and accessories possess considerable interest in view of their labor-saving and cost-reducing ability. The development of shipbuilding both in wood and steel has been carefully studied by the Cleveland Pneumatic Tool Co., and special wood-boring machines and drifting hammers are featured by them in addition to their latest types of regular hammers and accessories.

Transmission equipment and apparatus is featured by the Dodge line, one of the items of interest being an exhibit showing their wood pulley in different stages of construction, from the plain board of selected lumber to the perfectly finished wood-split pulley seen on the shafting. Ball bearing developments are also well shown, the increasing recognition of this apparatus as an efficiency factor being evidenced by the presence of the Canadian SKF Co., Ltd., which makes a convincing demonstration of the extreme accuracy and high grade of workmanship in their product. The exclusive feature of self-alignment which is an inherent part of the design is shown by means of bent shafts, which revolve as freely in a fan draft as if they were straight and true. The Chapman Co. makes an effective display

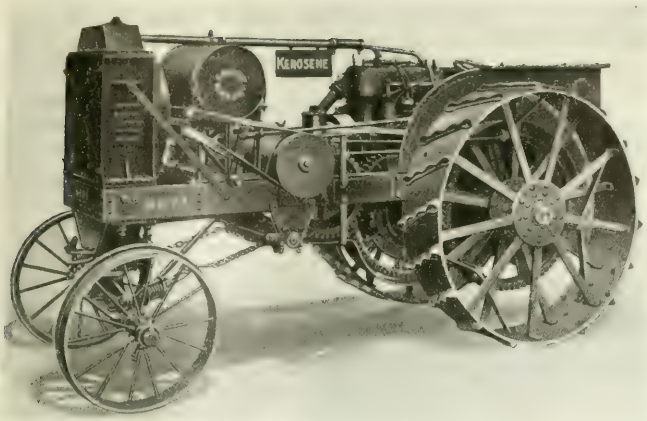
Belting exhibits are quite noticeable especially as most of the displays represent made in Canada goods. Of the four firms showing, each makes a distinctive type of product. Leather, rubber, and two varieties of stitched belting are available in weights, strengths, and finish for any kind of industrial need. Considerable local interest attaches to the two displays of that modern development of the saw bench known as the combination woodworker, one firm in particular having developed considerable business across the line.

Agricultural Enginering

Either engineers or farmers desirous of investingating farm apparatus which is the direct product of the machine shop find more than ample opportunity in the section devoted to this display. The present question of food control has thrown the production end further into the spotlight than might have happened in years, and the fierce blaze of criticism is turned loose on the numerous specimens of tractors, oil engines, pumps, electric lighting plants, along with other quasi-machine shop products such as



THE HUTCHINSON WOOD-WORKER PERFORMS LARGE VARIETY OF OPERATIONS.



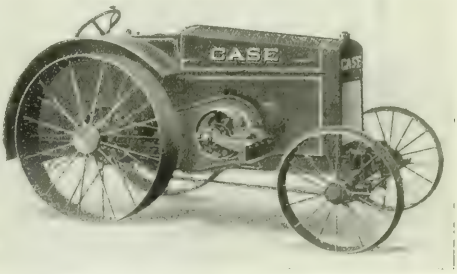
SAWYER-MASSEY 12-22. 4 CYLIND ER. KEROSENE DRIVEN TRACTOR.

milking machines, and similar products.

As a Canadian built product, the Sawyer-Massey line of tractors makes a special appeal. Simplicity of construction has been combined with convenience and efficiency of operation in a markedly successful degree. The 4 cyl. vertical automobile type of motor is placed near the rear axle to give maximum adhesion, and allows the transmission case and jack-shaft to be placed amidship in a most accessible position. The clutch likewise benefits thereby, while the train of reducing gears to the driving wheels is also made very accessible. Approved design of steering gear with spring buffers is fitted to front wheels. Water cooling with fan radiator is incorporated in the design in a suitable manner the radiator construction being exceptionally robust. The motor is 4 in. bore by 6 in. stroke running 700 to 1,000 rev. per min., and gives 22 horse power at the belt pulley and 12 at the draw bar. Two speeds of 2¼ and 3½ miles per hour are provided, while weight of 5,200 lbs. enables three to four plows to be operated.

Allis-Chalmers are showing a 10-18 horse-power machine of the three wheeled type, the single front wheel following the furrow automatically and relieving the operator of much of the steering effort. It is operated by a 2 cyl. opposed type motor, 5¼ by 7 inch at 720 rev. per min. and weighs 4,800 lbs. The frame is a one-piece steel casting, heat treated, while the radiator is of the automobile type with centrifugal pump.

The 9-18 lease tractor was shown by the Fairbanks-Morse Co., and attracted attention through its compact design and wonderful hill climbing ability demonstrated on a 35 deg. incline. As illustrated the motor which is 8 cyl. vertical, is placed athwartships so as to obtain straight spur drive to rear axle. The front axle is pivoted vertically at the centre, with steering knuckles on the wheels. A truck type of radiator is fitted in conventional manner and has gear driven fan, and centrifugal pump circulation. Heavy duty roller bearings are used wherever desirable, including the transmission, and rear axle, and an oil tight housing encloses the bull pinion and gear. Two speeds are obtainable, along with ample power to pull two 14 in. plows.



CASE 9-18 AUTOMOBILE TYPE TRACTOR WITH 4-CYLINDER MOTOR PLACED TRANSVERSELY.

ALLIS-CHALMERS THREE-WHEELED TRACTOR IN OPERATION ON A FARM.

PASSING IT ALONG

"The neat and even elegant appearance of the American soldier isn't maintained," said United States War Secretary Baker in an address, "without hard work. Yes, the work is hard, but doesn't the result more than justify it?

"On the train the other day a private sat with his tunic unbuttoned, for the temperature was high. A sergeant strode up to him and said:

" 'Button up that tunic! Did you never hear of by-law 217, sub-section D? I'm Sergt. Jabez Winterbottom!'

"A gentleman in the seat behind tapped the sergeant sternly on the shoulder. " 'How dare you issue orders with a pipe in your mouth?" he asked 'Go home and read paragraph 174, section M, part IX. I'm Major Eustee Carroll.'

"Here a gentleman with a drooping white moustache interposed from the other side of the aisle:

" 'If Major Carrol,' he said coldly, 'will consult by-law 31 of section K, he will learn that to reprimand a sergeant in the presence of a private is an offence not lightly to be overlooked."

GOT HIM INTO A ROW

Foreman (to workman whom he has "sacked" on Saturday and then finds him at his job again on Monday)—Hey, young fellow-me-lad, I thought I sacked you on Saturday.

Workman—So you did. An' a nice blinkin' row you got me inter wi' the missus, too.

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A weekly newspaper devoted to the machinery and manufacturing interests.

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SKILLED MECHANICS A POST-WAR NECESSITY

THERE is a growing disposition to recognize that the peace-time essential of this or any other manufacturing country will be its muster of skilled mechanics. Shell-making has not, as is perhaps too generally believed, contributed materially to Canada's pre-war quota of the latter for, with the exception of a fair percentage increase, comparatively, in the ranks of her tool-makers and equipment designers, the abnormal activity of the past thirty months has done little more than demonstrate the possibility of rapidly training as attendants men who to all intents and purposes were in the rough so far as machine tool operating knowledge was concerned.

Shell manufacture was highly specialized, but in the nature of things was quite temporary in character. Urgency of production by the most direct means available was the keynote of the whole enterprise, as a consequence little opportunity was afforded for a widespread development in the training of expert mechanics, men who in the coming time would give our metal-working industries the degree of backbone and vigor which will undoubtedly be required if we are to procure and maintain a foothold in the world's markets. With the cessation of shell-making, attention is naturally being focussed on lines of product that will provide capacity activity for our now enlarged plant establishment, while giving at the same time assurance of there being retained in steady and continuous employment the skilled men now possessed, as well as providing opportunity for materially supplementing their numbers.

It should be borne in mind that, despite the war activities now so pronounced in the United States, and those no less in evidence in Great Britain and elsewhere, the keenest interest is being displayed in the matter of post-war trade preparedness, and that recognition as never before is being taken of the thoroughly trained and expert mechanic as the principal factor in the conditions with which we will be confronted. As an indication of how the subject is viewed in the Old Country, the following paragraphs culled from a recent editorial in our contemporary, *Engineering*, may not be without interest to our metal-working plant executives:

The deficient supply of skilled men is acutely realized and is exercising the minds of all who employ mechanics.

A man having the mentality, dexterity and character taken for granted or implied in the term skilled mechanic, or competent all-round craftsman, is prima facie a competent individual in a much wider manner than in a purely trade sense.

Natural aptitude, large mentality, resource, initiative, grit, character—all matters which make a man worthy of respect—are the inalienable possession of the man who becomes an expert mechanic.

Good mechanics were never plentiful, but present-day conditions have separated all men into two classes, those having skill and those without. Consequently, there has been a remarkable appreciation in value, the intrinsic worth of real skill has never been so realized as now. It is contended that, unless steps are taken to enable men to acquire real skill, invention will be paralyzed, improvement will be forfeited, and business some time or other will have to be rebuilt upon its old foundations.

How can we have mechanics unless we deliberately set out to produce them. Modern tendency is to commit industrial suicide. There are two outputs going on simultaneously from any business, products and men; the former earns profits, the latter serve a national as well as an industrial end. Plant can be extemporized more rapidly than skill, but if the result is to materially reduce the production of skilled craftsmen, then the industry must ultimately be penalized.

Academic training alone is no substitute, since it cannot produce the practical man of experience nor can it give manual dexterity of a high order. If the industry takes no steps to foster one of the most inherent of human desires—skill in the use of tools—it is going to decay and not to progress. Moreover, the nation which does not produce skilled craftsmen is going to forfeit industrial pre-eminence.

CONSTRUCTIVE DISCONTENT

PROGRESS is only possible where the spirit of dissatisfaction prevails; not the dissatisfaction that tends to indifference to or breeds irritation with conditions or environment, but that feeling of discontent that haunts and impresses the mind with the thought that one is not living up to and making the most of the opportunities that arise from day to day. Knowledge is acquired when we begin to study the why and the wherefore of our surroundings. Gravitation was realized long before Newton appeared on the scene, but it was to the fact that he was not content to take the falling of an apple as a mere incident that resulted in the establishment of the law which defines to us the attraction of the earth for other and smaller bodies.

Discoveries are seldom a matter of chance; they are more often the culmination of many weary hours, or perhaps days and weeks of ceaseless thought and observation. It is unquestionably true that worth-while achievements are the work of a few individuals; these and these only being responsible for the various departures from time-worn precedents.

Despite the fact that all are endowed with the same faculties, the great majority are content and willing that a few only shall develop these faculties to the point where an enlarged imagination becomes the source of dissatisfaction that eventually results in the attainment of ideals which are the foundation stones of success. The man who is content with his present condition has lost all initiative. Breaking new ground, as it were, is expressive of discontent with things as they are. When uneasiness of mind is of a constructive nature, the consequence cannot be other than progressive; on the other hand, dissatisfaction that hinges on indifference is destructive and an obstacle to progress rather than otherwise.

INDUSTRIAL NOTABILITIES

LAWFORD GRANT, C.E., manging director and treasurer, Eugene F. Phillips Electrical Works, Ltd., electric wire and cable manufacturers; director, E. M. Sellon & Co., Ltd., was born in Swansea, Eng., Aug. 30, 1878, son of Alexander and Eunice Maria Grant.

After completing his education at Winchester House, Clifton, Eng., he was an articled pupil with Arthur Powell, M.I.C.E., Bristol, 1895-1899; civil

LAWFORD GRANT, C.E.

engineer with T. J. Scoones, Bristol, 1899-1901; superintendent engineer and agent for British Insulated & Helsby Cables, Ltd., at H.M. Dockyard, Malta, 1905-1907; came to Canada in 1907 as president and managing director of the Canadian British Insulated Co., Ltd.; became assistant manager of the Eugene F. Phillips Electrical Works, Ltd., Montreal, 1913; appointed president, May, 1917.

Mr. Grant is a member of Montreal Board of Trade; member of Canadian Manufacturers' Association; Honorary Secretary for Canada, Institution of Electrical Engineers (London); his technical attainments being indicated by membership of the latter body, as well as M.A.I.E.E.

On Nov. 4, 1905, he married Nancy Nelmes Grant, daughter of John Grant, England, their family consisting of three sons and three daughters. Mr. Grant is Protestant in religion and Liberal-Conservative in politics.

His clubs include: Montreal; Engineers'; Royal Montreal Golf; Automobile Club of Canada. Golf is his principal recreation.

Mr. Grant's residence is 593 St. Joseph Street, Lachine, Que.

Photo, Courtesy British & Colonial Press.

SELECTED MARKET QUOTATIONS

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

PIG IRON.

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

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

FINISHED IRON AND STEEL.

Per lb. to Large Buyers.	Cents
Iron bars, base, Toronto	5 25
Steel bars, base, Toronto	5 50
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	7 00
Iron bars, base, Montreal	5 25
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 25
Steel hoops	7 50
Refined iron	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	7 00
Band steel, No. 10 gauge	5 75
Chequered floor plate, 3-16 in.	15 20
Chequered floor plate, ¼ in.	15 00
Staybolt iron	8 50
Bessemer rails, heavy, at mill	28 00
Steel bars, Pittsburgh	4 00
Tank plates, Pittsburgh	9 00
Structural shapes, Pittsburgh	4 00
Steel hoops, Pittsburgh	5 25

F.O.B., Toronto Warehouse.

Steel bars	5 50
Small shapes	5 75

F.O.B. Chicago Warehouse

Steel bars	5 00
Structural shapes	5 00
Plates	8 00

FREIGHT RATES.

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	23.1	31.5
St. John, N.B.	35.1	45.5
Halifax	35.1	45.5
Toronto	18.9	22.1
Guelph	18.9	22.1
London	18.9	22.1
Windsor	18.9	22.1
Winnipeg	64.9	85.1

METALS.

	Montreal	Toronto
Lake copper	$33 00	$34 00
Electro copper	33 00	34 00
Castings, copper	32 00	33 00
Tin	61 50	64 00
Spelter	10 50	11 00
Lead	13 00	13 00
Antimony	20 00	20 00
Aluminum	67 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.

Size.	Black Standard	Galvanized Buttweld. 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 38	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 24
6	in.	145 90	183 36
7	in.	190 40	238 00
8	L in.	200 00	250 00
8	in.	230 40	288 00
9	in.	276 00	345 00
10	L in.	256 00	320 00
10	in.	329 60	412 00

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES.

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

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$20 00	$22 00
Copper, crucible	23 00	27 00
Copper, heavy	23 00	25 50
Copper wire	22 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	16 00	18 00
Heavy melting steel	21 00	17 00
Steel turning	12 00	8 00
Shell turnings	12 00	12 00
Boiler plate	22 00	10 50
Axles, wrought iron	30 00	24 00
Rails	25 00	18 00
No. 1 machine cast iron	25 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	19 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	30 00	30 00
Mach. shop turn'gs.	8 50	8 50
Cast borings	12 00	9 50
Stove plate	19 00	19 00
Scrap zinc	6 50	9 50
Heavy lead	10 00	10 75
Tea lead	7 00	7 00
Aluminum	30 00	35 00

BOLTS, NUTS AND SCREWS.

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

MILLED PRODUCTS.

	Per cent.
Set screws	45
Sq. & Hex. Head Cap Screws	30
Rd. & Fil Head Cap Screws	10
Flat ⅞ But. Hd. Cap Screws plus	10
Fin. & Semi-fin. nuts up to 1 in.	25
Fin. and semi-fin. nuts, over 1 in., up to 1½ in.	30
Fin. and semi-fin. nuts, over 1½ in., up to 2 in.	10
Studs	20
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws...list plus	20
Collar screws ....list plus	30, 10
Thumb screws	20
Thumb nuts	65
Patch bolts ..... add	40, 10
Cold pressed nuts to 1½ in.	add $4.50
Cold pressed nuts over 1½ in.	add $7.00

BILLETS.

	Per gross ton
Bessemer billets	$ 75 00
Open-hearth billets	95 00
O.H. sheet bars	80 00
Forging billets	100 00
Wire rods	90 00

F.o.b. Pittsburgh.

NAILS AND SPIKES.

Wire nails	5 50 5 45
Cut nails	5 70 5 60
Miscellaneous wire nails	60%
Spikes, ⅝ 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%; beaders, 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.

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
@ 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
5-16 in.	11 70
¼ in.	8 40
9-16 in.	7 40
⅝ 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	Lap-welded
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
Royallte, per gal., bulk	16
Paraline	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	4[illegible]
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	30½
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	15
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 55
Cobalt	1 75 to 2 00
Copper	44 to 46
Tin	49 to 5[illegible]
Zinc	23 to .25

Prices Per Lb.

COPPER PRODUCTS.

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	55 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 70
Rouge, powder	20 to [illegible]

Prices Per Lb.

LEAD SHEETS.

	Montreal	Toronto
Sheets, 3 lbs. sq. ft. cask	00	$28 00
Sheets, 3½ lbs. sq. ft.	18 00	28 00
Sheets, 4 to 6 lbs. sq. ft.	17 50	17 50

Cut sheets, ½ per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS.

Acid, boracic	$ 15
Acid, hydrochloric	05
Acid, hydrofluoric	14½
Acid, nitric	.10
Acid, sulphuric	05
Ammonia, aqua	08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	40
Ammonium sulphate	07
Arsenic, white	.12
Copper, carbonate, anhy.	.35
Copper, sulphate	.17
Cobalt sulphate	.70
Iron perchloride	20
Lead acetate	.16
Nickel ammonium sulphate	.12
Nickel carbonate	35
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide (substitute)	26
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	.80
Zinc sulphate	08

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

NOW that the munitions industry is definitely coming to an end, the engineering trade enters on a period of readjustment. Concerns hitherto engaged in manufacturing munitions are turning their attention to other work and in some cases have already been successful, particularly in the introduction of marine engines. This field of activity is necessarily limited, but will serve to relieve the situation to some extent. No developments have materialized in the iron and steel trade and the outlook continues somewhat unsettled on account of the embargo and also because of the uncertainty surrounding the price-fixing policy of the United States Government. It is believed that an announcement will be made at Washington in the near future. Prices of steel products are showing a weaker tendency, although the only important decline so far has been in semi-finished material. This, however, foreshadows recessions in other lines. The domestic pig-iron situation continues unchanged, the market still being unsettled and quotations practically nominal. In the States the pig-iron market is somewhat easier in spite of the continued heavy demand. The coke market is unsettled, owing to the possibility of Government control. Prices in the meantime are holding firm and the output is increasing in volume. The non-ferrous metal markets are dull and featureless, due to the uncertain outlook. Consumers continue to show lack of interest in the market in view of possible price recessions. There is nothing of particular importance to note in regard to machine tools, the situation being unchanged.

Montreal, Que., Sept. 1, 1917.—The chief topic of interest of the past week has been the total closing of certain munition plants and the partial closing of others, owing to the recent orders issued from the Imperial Munitions Board to the effect that the production of shell would in future be greatly curtailed. Many of the smaller plants have already discontinued operations while some of the larger establishments have released large numbers of their employees, with the prospect in the near future of letting out many more. Numbers of these will undoubtedly be absorbed in other lines of activity. Many firms are now working on their pre-war activity while others are contemplating engaging in other lines of domestic enterprise. Certain sections of the country are more or less disturbed owing to the near approach of conscription, but this is expected to have slight effect upon the enforcement of the Act. The general activity in this territory is well maintained and with the exception of the munition output no appreciable difference is as yet pronounced.

Pig Iron

The greater difficulty in obtaining raw material from the United States is partly offset by the falling off in the requirements owing to the curtailment necessary resulting from the recent developments in the Canadian shell producing activity. Domestic conditions, however, are still comparatively unchanged, as Canadian producers are still able to consume the bulk of their own production. Quotations on Canadian iron may again be available in the near future.

Steel

What effect the recent developments will have upon the steel situation here in Canada is at present problematical, as conditions are such that it is very diffi-

cult to foretell what may take place in the near future. The curtailment in the production of the various classes of munitions will undoubtedly result in a falling off in the output of such steel as has been required to maintain this industry at the abnormal activity of the past years. No doubt considerable raw material will still be produced and exported for shell-making purposes abroad but the bulk of previous activity will be largely discontinued. Owing however, to the demand in other directions, it is not thought likely that the market in general will be much affected. The American situation continues more or less unsettled due to the fact that no definite understanding has yet been arrived at in connection with a stated price that will regulate early market conditions. The decline in the production of steel billets and bars that have been used for the manufacture of shells may relieve to some extent the domestic situation in small bars and shapes, as the mills in this country will be in a position to handle this class of material, but as regards plate work of every description it is not likely that recent developments will have a bearing on this commodity, owing to the inability of the local mills to roll the necessary material. Under these conditions there is a possibility that a certain proportion of structural work may be resumed, but ship building and car interests will reap little benefit from the change, in so far as the production of material is concerned. The American situation is still dominated by the uncertain attitude of the Government in the delayed announcement of a definite policy regarding the action they propose taking in connection with the regulation of prices. Price changes on the American market are very few, those noted showing a slightly weaker tendency. Local dealers report unchanged conditions with quotations well maintained. Much difficulty is still experienced in getting delivery from points in the States.

Metals

With the decline in the production of munitions, it is expected that the metal market, especially in Canada, will experience a period of readjustment as far as war requirements are concerned; no sharp decline is looked for in prices as conditions in the States will more than balance the absence of activity in this particular direction. Copper is easier. Tin has a firmer tendency on better demand. Spelter is steadier but quiet. Lead is fairly active but easier. Antimony and aluminum are both steady and unchanged.

Copper.—Developments in the States have shown no material improvement and general conditions are still more or less unsettled. Strikes at some of the mines have disturbed the American market and consumers still show a reluctance to active interest under existing conditions. With the exception of electro, which has declined ½ cent per lb., the American market has remained firm. The local market on a lighter demand has declined 1 cent per lb., the current quotations being 33 cents for lake and electrolytic, and 32 cents for castings.

Tin.—The market is firm on better demand and inquiries seem to indicate that consumers are taking a more active interest in the situation. These conditions have had the effect of steadying the market and prices have been well maintained. The New York market is stronger with prices ⅛ cent higher than last week. Local dealers report a featureless situation with prices firm and unchanged at 61½ cents per lb.

Spelter.—Unsettled conditions continue to influence the spelter situation and dullness is still a factor of the present market: The American market is quiet and dealers here report unchanged conditions at last week's price of 10½ cents per lb.

Lead.—With the prospect of a better supply, products are satisfied that the time has arrived for some readjustment of the market, and this has been reflected in the announcement of the leading interests to lower their quotation to 10½ cents per lb.; on a quiet market dealers here have declined their prices to 13 cents, this being ½ cent lower than last week.

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.

Antimony.—The situation is dominated by pending developments and absence of demand, but prices continue firm; 15 cents is quoted in New York, a decline on the week of ¼ cent. Locally the market quiet with prices firm at 20 cents per lb.

Aluminum.—Despite an easier market in the States the local situation is firm and unchanged with quotations ranging from 65 to 67 cents per lb.

Machine Tools and Supplies

The machine tool market has experienced another week of comparative inactivity with a slight improvement over the business of last week. Inquiries are still coming in for general line of equipment but the sales are not heavy. With the falling off in munitions it might be expected that considerable second hand machinery would be placed on the market, but in view of the unsettled condition of the industrial situation it is not likely that this will be effected for some little time. The feature of the present market is the marked decline in the demand for supplies, particularly such requirements as were necessary for carrying on the extensive shellmaking operations of recent months. The market in these accessories is however comparatively quiet, no appreciable decline having as yet been reported in price conditions.

Scrap

Owing to the prevailing conditions in the industrial field at the present time the market in old metals is very unsettled and prices are correspondingly uncertain. The tendency in the old metals is towards lower levels, but the situation in iron and steel scrap is well maintained in spite of the decline in shell requirements. American iron and steel markets are very firm while metal scrap is weaker. The local situation is featured by a certain nervousness as a result of recent developments; old coppers are easier on a decline of 2 cents, the quotation this week ranging from 20 cents for light to 23½ for heavy and crucible. Heavy brass is 2 cents weaker at 16 cents. Steel turnings are stronger, having advanced one cent. Five cents per lb. records, the advance on boiler plate, W. I. axles and rails, and also malleable scrap, the present quotations being 22 cents, 30 cents, 25 cents and 25 cents respectively. Scrap zinc has declined 1½ cents per lb., the prince quoted being 6½ cents per lb. Heavy lead is one cent lower at 10 cents per lb. Aluminum at 30 cents shows a decline of 5 cents per lb.

Toronto, Ont., Sept. 4.—The machinery exhibit at the Canadian National Exhibition, now being held here, is in general character similar to that of pre-war years. There are no exhibits showing munitions machinery or equipment exclusively, and in this respect it is in line with the last developments in the machine tool business. An interesting feature, and one showing possibilities of considerable development, is the exhibition of farm tractors. These are being used extensively now, and are bound to become more popular as they improve in design and workmanship.

Steel

The situation in the iron and steel trade is practically unchanged from last week, and prices continue stationary, with a weaker tendency. It is understood that some progress is being made in regard to the adjustment of the embargo on steel from the United States, but no announcement has been made regarding the progress of negotiations. No official statement has been given out from Washington concerning the U.S. Government price fixing policy, although a public announcement of maximum prices for various grades of steel from certain mills is expected shortly. It is believed that steel prices will be fixed by the War In-

dustries Board on a cost-plus-profit basis, but whether or not this will be extended to include steel for private consumers is not known. In the meantime the market is unsettled, with new business almost at a standstill. Consumers are buying as little material as possible in the hope of lower prices, and are waiting until the situation clears up. There is still a shortage of steel, but some relief is looked for now that the mills have more tonnage available for domestic requirements. This will also to some extent relieve the tight situation caused by the embargo. The Canadian mills with their increased capacity will be in a better position than ever before to supply the demands of the home market. Production has shown an increase lately on account of the cooler weather, but the coke situation continues to cause considerable anxiety and the steel output may be curtailed because of this unless supplies of coke can be steadily maintained, which at the present moment appears rather doubtful.

In the United States market, demands for war purposes, and particularly for shipbuilding, are more than sufficient to keep all steel producers working at the limit of capacity. There is not enough steel to meet all demands, and with Government and Allies requirements having to be filled before the private consumer can participate, the latter has to take what he can get. Private enterprise is consequently considerably restricted. For this reason, and because of the prevailing high prices, domestic business is slow. The trade is waiting developments at Washington, and until the price fixing policy is settled no important change in the situation is anticipated. Prices continue to show an easier tendency, particularly on semi-finished material, and further declines are looked for. Production is being curtailed because of lack of men and shortage of raw materials. There is a serious deficiency in supplies of pig iron and semi-finished steel at some important plants. The sheet market continues active, with buying principally for U. S. Government account. Prices in the home market are unchanged.

Pig Iron

The situation in the domestic pig iron market is unchanged, and prices of foundry iron continue nominal at $60 a ton. Considerable difficulty is being experienced in getting coke in sufficient quantities owing to the scarcity of cars. On the other side of the line there is a heavy demand for pig iron, and the furnaces are having difficulty in completing contracts. Deliveries are somewhat delayed, but production is improving with cooler weather. Coke production is increasing, but shortage of cars is holding prices firm. The trade is expecting an announcement from Washington within a short time as to the price at which coke is to be sold. In view of possible Government control of the coke market, lower prices are anticipated.

Scrap

The market for old materials continues quiet at unchanged prices, but a moderate recession in values is likely, particularly in copper and brass. Steel and cast iron scrap are in good demand and the prices have been well maintained on the basis of last week's quotations. Supplies of shell steel turnings now considerably reduced in volume are being readily absorbed with prices showing a firmer tendency. The new steel plant at Ashbridge's Bay is using considerable of this material and dealers' stocks are not by any means, as heavy as they were a few months ago.

Machine Tools

The past week has been fairly quiet in the machine tool trade in regard to sales, although the Machinery Hall at the local exhibition has been the centre of considerable activity. The trend of events in the trade is reflected in the exhibits as there is comparatively little machinery or equipment being shown that would be required exclusively in the manufacture of shells. In this respect the exhibits follow more along the lines of pre-war times than last year.

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.

Supplies

Although there has been lately some falling off in demand for machine shop supplies, business continues in steady volume. The difficulty now is to obtain goods promptly and dealers are obliged to place their orders well ahead which means carrying considerable stocks. Prices on all lines are holding very firm with advances on some goods. Due to recent advances in the price of Mid-Continent oil to $2.00 a barrel, there is a firm situation in the refined products such as gasoline, benzine, and coal oil. The heavy consumption is an additional factor that is giving firmness to the market. Prices of gasoline and benzine are unchanged.

Metals

Comparatively little interest is being displayed by consumers in metals and the markets are quiet. The reason for the lack of interest is the uncertainty surrounding the United States Government's attitude with regard to prices. There is some apprehension in the trade in regard to future developments and the markets are consequently easier although prices are unchanged in the meantime. The local situation is unchanged from last week and the market continues somewhat unsettled.

Copper.—The market is neglected and no business of consequence is now offering. Production is the U.S. is being seriously interfered with by labor troubles at the mines, some of which are said to have closed down. The larger producers are practically out of the market and there is some fear that the supply will be insufficient to permit copper to be used for any purpose other than for munitions and war equipment. Prices are entirely nominal and unchanged, lake and electrolytic being quoted at 34c and castings at 33c per pound.

Tin.—The market is quiet with no feature of particular interest to note. Business is dull owing to uncertainty in the situation in London, where the market has been subject to considerable fluctuation. Local price 64c per pound.

Spelter.—The spelter situation continues unsettled and the market has an easier tendency. It is said that production has fallen off considerably on account of the inability of producers to sell spelter at a profit at current prices. Local price 11c per pound.

Lead.—The market is very quiet but has a fairly strong undertone and prices are holding steady. Consumers are keeping out of the market pending developments at Washington. Local situation at 13c per pound.

Antimony.—The market is still quiet and prospects are not too bright for immediate improvement. Prices are unchanged at 20c per pound.

Aluminum.—Little interest is shown in aluminum and the market is rather unsettled with an easier undertone. Price 64c per pound.

Sydney, N.S., Aug. 31.—The coal production at the Glace Bay collieries of the Dominion Coal Company during August reached only 296,000 tons, this being the smallest tonnage recorded in August since 1904, with the exception of August, 1909, when the output was reduced by the U.M.W. strike. Indications are that the Dominion Coal Co. production for the whole year 1917 will not exceed 3,950,000 tons, which will compare with 4,440,000 tons in 1916, and is at least 1,500,000 tons below the capacity of the collieries for output with a full working force. This is the chief reason for the shortage of soft coal deliveries in Montreal. It is true that great, almost insuperable, difficulties have been encountered in transporting to Montreal even the negligible quantity of Cape Breton coal that has gone up the river this season, but presumably, if the coal had been available, it would have been carried to Montreal by one means or another. As some indication of transportation conditions, it may be mentioned that coal is being sent in cars by rail from Cape Breton to St. John, N.B.

The slackening in munitions manufacture has affected Nova Scotia. The stoppage of orders is chiefly for shrapnel steel and forgings for shrapnel shells. The Nova Scotia Steel & Coal Co. laid off some one thousand men on this account at New Glasgow, although it is understood that most of them can be given work of a different class at lower wages. The Dominion Iron & Steel Co. have temporarily discontinued work at the sixteen

inch mill, where shrapnel steel was rolled, and orders are slack in other departments. It is evident that a readjustment period has been entered upon. Under present conditions there will be no difficulty in finding employment for all the workmen in Nova Scotia, but they will have to be prepared to take other work and usually at much lower wages than the high rates that have been paid during the past year and a half. There seems to be no doubt that the Admiralty is concentrating its energies on supplying foodstuffs to Britain and her Allies, and the necessity for munitions now takes second place. The control of shipping by the Admiralty prevents the export of munitions if foodstuffs are to be given preference, and this seems to be the real explanation of the slackening in munitions orders.

The rules recently promulgated by the United States requiring licenses for all exported materials is temporarily rendering difficult construction work in Canada, which depends on the supplying of material from the United States, and this is affecting the extension plans of the steel companies. It is rumored the Nova Scotia Steel Company intends to enlarge its coke-oven plant at Sydney Mines. The coke-oven plant now under erection at the works of the Dominion Iron & Steel Co. is making fair progress.

New York, Sept. 3.—Business in the steel industry continues to be confined mainly to the filling of Government contracts. Thus far the steel mills have received orders amounting to 3,200,000 tons from the Government either directly or indirectly; approximately 75 per cent. of this tonnage has been accepted by the United States Steel Corporation. The subsidiary companies of the Corporation will furnish the steel for 11,000 cars to be built in this country for the double track railroad in France which is being built and equipped in the interest of the United States army. The Corporation is also rolling 90,000 tons steel rails for this road and 10,000 of light sections of the 20,000 tons purchased for portable tracks in France. The corporation will also furnish 800,000 tons of the steel to be used in the construction of war ships by the United States Navy and by merchant yards.

The United States Government is also endeavoring to place steel orders for 10,000 additional cars to be built here and exported to France, most of the material for which will be distributed among independent steel companies that thus far have not accepted their full share of Government work. Several independent mills in the past few days have received orders for a large tonnage of steel plates and shapes required in the building of cargo boats by the Emergency Fleet Corporation and this steel will be shipped to the plants of the American International Corporation who will build 200 steel ships; to the Submarine Boat Corporation who will build 28 standardized steel ships, and to the plants of the Chester Shipbuilding Co. and to the Merchants Shipbuilding Corporation. The building of these boats will require 432,000 tons of plates and shapes. Only a portion of this tonnage has been placed; but the balance will probably be distributed early next year.

The United States Shipping Board has now closed contracts for 701 ships—steel, wood, and composite. The Emergency Fleet Corporation of the Board now has ships of 3,250,000 tons burden either building or under contract, which will call for the expenditure of nearly $600,000,000, and additional contracts for 571 ships are under negotiation. As noted early last month, the full program of the Emergency Fleet Corporation calls for the building of 1,727 ships of 7,968,200 tons displacement to cost $1,234,500,000. The Shipping Board's commandeering program of ships already on the ways at merchant yards, calls for the expenditure of $515,000,000. Ships bought or to be purchased call for the expenditure of $150,000,000. Shipyards to be built by or for the Government in which to build standardized ships will require the expenditure of $35,000,000. Congress thus far has appropriated $800,000,000 for the use of the Shipping Board, but as nearly $2,000,000,000 will be needed, the Board has now asked for an additional appropriation of $1,134,500,000 of which $915,000,000 is to become available this year.

The various shipyards that received contracts from the Government on the last day of August have been anticipating this work by the purchase of cranes and machine tools in the last few weeks. The Federal Shipbuilding Co. has also made additional tool purchases, and the Pusey & Jones Co. is about to issue a list of tools for a new machine shop to be built at Wilmington, Delaware.

Orders for about one million dollars worth of machinery have been placed in the last week in the New York market, and lists have been put out by various manufacturers of airplanes and airplane engines calling for the expenditure of $3,000,000 including $1,000,000 worth of tools for the Inter-Continental Machinery Corporation. The Standard Aero Corporation, Plainfield, N.J., is in the market for $300,000 worth of metal and wood-working machinery to be used in equipping an airplane factory. The Simplex-Automobile Co., is closing for 100 machine tools to be used on Government work. Several manufacturers of automobiles who have accepted contracts for aviation motors have been buying tools in the New York, Chicago, Detroit, and Cleveland markets. The United States Aircraft Production Board and the French and Russian Governments are also buying tools to build airplane engines.

Pittsburgh, Sept. 1.—Further progress towards a general readjustment in iron and steel prices has been made in the past week, although the surface evidences are not spectacular in character. Billets are off another $5 a ton, Bessemer iron is down, say, $1 a ton and basic iron is lower by about $4 a ton, while plates have been eased off by about a cent a pound, other finished steel products not being quotably changed. Under the surface, however, the forces are working out, the mills having filled additional obligations and having so much less ahead of them, while the export embargo is making steel more plentiful and there is constant sentimental pressure from Washington in the direction of lower prices.

The New Export Embargo

The first export embargo, which became effective July 15, applied to all countries and included, as to iron and steel, the following items; scrap, pig iron and ferromanganese, billets, ship plates and structural steel. The new embargo, dated Augst 27, to become effective August 30, is in two sections, the first applying to the Central Powers and the countries adjacent, the latter to the rest of the world, including the Entente Allies and their dependencies, protectorates, etc., and the neutrals not contiguous to the Central Powers. The list as to the former includes practically everything, certainly all iron and steel, there being the comprehensive wording, metals and their derivatives and manufacturers. The list as to the latter includes scrap, pig iron, ferrosilicon, spiegeleisen, ferromanganese, ingots, blooms, billets, slabs and sheet bars, plates, structural shapes, tool steel, alloy steel and machine tools." This would apply to Canada, of course. The important omissions are wire products, pipe, sheets, tin plates and merchant bars. The Exports Administrative Board has been organized to grant licenses, licensing under the former embargo having been in charge of the Department of Commerce.

The object of the first part of the embargo is, of course, to prevent any material going, directly or indirectly, from the United States to the Central Powers. The object of the second is to conserve the supplies of the United States, permitting material to go out only in case it is to be used directly in prosecuting the war.

The Coal Situation

As noted in last report, the bituminous coal operators were much dissatisfied with the schedule of prices fixed by President Wilson on August 21, and had called a general meeting of operators to be held in Pittsburgh August 29. Evidently they concluded on second thought that a general meeting, at which there would probably be explosive utterances, would not be a good path into the good graces of the Government, hence the meeting was called off and the executive officials of the recently formed Coal Producers' Association have been meeting in Washington to formulate plans for making representations to the Government.

No announcement has yet been made regarding the fixing of coke prices. Connellsville furnace coke for spot shipment is strong to-day at $13.50 per net ton at ovens.

Pig Iron

A pig iron producer has bought several odd lots of Bessemer iron at $50 and $52, valley, the market a week ago having been quotable at $53. Basic iron, which was quotable at $52, valley, can probably be

secured without difficulty at $48. Foundry grades are nominally unchanged. In other districts there is a generally softer tone, but as a rule there is not enough doing to place actual declines on record.

Billets Decline Again

This week billets were offered at $75, finding few, if any, takers, and it is thought that a firm bid of $70 would bring out some material. Last week's market was $80, while the top, reached at the beginning of June, was $95 to $100. The decline is likely to go farther, but it can hardly continue long at the rate of $5 a week, because it is now approaching the level at which large contracts are being filled, say, $50 to $60. These are long-term contracts, with a quarterly fixing of prices. Rods are easier at $90 and forging billets can be had at $95, whereas a few weeks ago they were strong at $125.

A Decline in Plates

While scrap started to decline late in June, pig iron softened a trifle in July and billets began declining in August, there has been no quotable decline in any finished steel product until this week, when the distinction can be accorded to plates. Until very lately it has been difficult to buy even ordinary tank plate at 9c., the more common quotation being 10c., Lloyds' specifications commanding about 12c. In the past week there have been rather free offerings of tank plate at 8c., and in a few instances at a shade less. Thus an eastern mill sold 400 tons, ¾-inch and heavier, 60 to 80 inches wide, at a delivered price equal to 7.85c., Pittsburgh, but as the freight was against the mill the price realized at mill was only 7.70c.

The softening in plates is commonly ascribed to the export embargo, which has shut in some large tonnages, particularly in the case of Japanese orders. However, there is probably a contributory influence, in that mills can now make a better appraisal of how much plate tonnage the shipbuilding program will absorb. The requirements of the next few months are much smaller than those expected when various shipyards have been completed. At that time there will be additional plate rolling capacity. Then there is a new element in the situation, the Secretary of the Navy insisting upon the building of 150 destroyers as quickly as possible, even to the detriment of the merchant shipbuilding programme. It is stated this is on the advice of Admiral Simms, in charge of United States naval operations abroad, and in considerable measure it would serve to reduce the consumption of plates for a time.

Government Price Fixing

Another week has passed without the Government fixing the prices it is to pay for steel, but an early announcement is promised with more assurance than formerly. Then there will be the question of prices to be accorded the Entente Allies, on which matter the steel makers have not yet formally yielded. When the prices are fixed, it may prove to be the signal for the beginning of a general decline in finished steel prices for the ordinary trade. While the steel makers have never subscribed to the "one price for all" doctrine enunci-

Enlarged Canadian Trade Intelligence Service

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

BRAZIL—Bahia, British Consul. Rio de Janeiro, British Consul General.

CHILE — Valparaiso, British Consul General.

COLOMBIA — Bagota, British Consul General.

ECUADOR—Quito, British Consul General. Guayquil, British Consul.

EGYPT — Alexandria, British Consul General.

FRANCE—Havre, British Consul General. Marseilles, British Consul General.

INDIA—Calcutta, Director General of Commercial Intelligence.

ITALY—Genoa, British Consul General. Milan, British Consul.

MEXICO—Mexico, British Consul General.

NETHERLANDS—Amsterdam, British Consul.

PANAMA—Colon, British Consul. Panama, British Vice-Consul.

PERU—Lima, British Vice-Consul.

PORTUGAL—Lisbon, British Consul.

RUSSIA—Moscow, British Consul General. Petrograd, British Consul, Vladivostock, British Consul. Odessa, British Consul General.

SPAIN—Barcelona, British Consul General. Madrid, British Consul.

SWEDEN—Stockholm, British Consul.

SWITZERLAND—Geneva, British Consul.

URUGUAY—Monte Video, British Vice-Consul.

VENEZUELA — Caracas, British Vice-Consul.

Canadian Commercial Intelligence Service

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

CANADIAN TRADE COMMISSIONERS.

ARGENTINE REPUBLIC—B. S. Webb, Acting Canadian Trade Commissioner, Reconquista, No. 46, Buenos Aires. Cable address, Canadian.

AUSTRALIA—D. H. Ross, Stock Exchange Building, Melbourne. Cable address. Canadian.

BRITISH WEST INDIES—E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

CHINA—J. W. Ross, 13 Nanking Road, Shanghai. Cable address, Cancoma.

CUBA—Acting Canadian Trade Commissioner, Lonja del Commerci, Apartado 1290, Havana. Cable address, Cantracom.

FRANCE—Philipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

ITALY—W. Mc. Clarke, c/o H. M. Consul, Milan.

JAPAN—E. F. Crowe, Acting Canadian Trade Commissioner, P. O. Box 109, Yokohama. Cable address, Canadian.

HOLLAND—Ph. Geleerd, Acting Canadian Trade Commissioner, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

RUSSIA—C. F. Just, Canadian Government Commercial Agent, Alexandrinskaia, Plosch 9, Petrograd. L. D. Wilgress, Canadian Government Commercial Agent, Bukhgolza Ulitza No. 4, Omsk, Siberia.

NEWFOUNDLAND—W. W. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

NEW ZEALAND—W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

SOUTH AFRICA—W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

UNITED KINGDOM—Harrison Watson, Sub-division E.C., 2, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London. N. D. Johnston, Sun Building, Clare Street, Bristol. Cable address, Canadian. J. E. Ray, Central House, Birmingham. Cable address, Canadian. J. Forsyth Smith, 31 North John Street, Liverpool. Cable address, Cantracom. F. A. C. Bickerdike, 4 St. Ann's Square, Manchester. Cable address. Cantracom. J. Forsyth Smith, Acting Canadian Trade Commissioner, 87 Union Street, Glasgow, Scotland. Cable address, Contracom.

CANADIAN COMMERCIAL AGENTS

AUSTRALIA—B. Millin, Royal Exchange Building, Sydney, N.S.W.

BRITISH WEST INDIES—Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian. R. H. Curry, Nassau, Bahamas.

NORWAY AND DENMARK—C. E. Sontum Grubbegd No. 4, Christiania, Norway. Cable address, Sontums.

SPAIN—J. F. Roberts, Hotel Cuatro Naciones, Barcelona.

CANADIAN HIGH COMMISSIONER'S OFFICE

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

ated by President Wilson, the steel buyers think the idea is an excellent one and will be disposed to bide their time awaiting the market to carry it into effect.

YEAR'S WORK OF LAKE SUPERIOR CORPORATION

THE net earnings from operations of all of the subsidiary companies of the Lake Superior Corporation for the year ended June 30th last were $5,323,004.86, compared with $3,503,471.18 in the previous year, an increase of $1,819,533.68. To the net earnings mentioned there was added a balance of $340,087.33 brought forward from 1916, giving $5,663,092.19 available for distribution. Interest on bonds of subsidiary companies took $1,419,071.20. An amount of $586,485.12 was set aside for Magpie Mine Reserve and for sinking fund payments in respect of Helen, Carmelton, Lake Superior Mines, Fiborn quarries, etc. The losses and expenses in connection with the sale of miscellaneous assets reached the sum of $145,036.01. The amount of $1,243,155.14 was appropriated as reserves for depreciation, renewals, etc., of special assets (including renewal of coke ovens and docks, as also abnormal capital cost of construction and equipment), and $1,500,000 was set aside for general depreciation. These items totalled $4,893,747.77, and left the sum of $769,344.42 to be carried forward by all companies.

The Algoma Steel Company showed an increase both in the production of pig iron and unfinished steel as follows:

	1916-17	1915-16
Pig iron	348,519	258,504
Finished steel	280,296	215,466

The output consisted of shell steel together with rails and merchant bars.

The Algoma Steel Corporation has completed the two 75-ton open hearth furnaces which it had under way at the opening of the year and has carried through a third furnace of the same size. With a possible production of about 50,000 tons ingots per month, the directors consider that they have provided all the steel making capacity necessary for some time to come, and that subject to certain modernizing of the older furnaces, they will have a satisfactory open hearth plant.

Opportunity was taken to acquire the modern blast furnace built at Midland, Ont., a few years ago, by the Canada Iron Corporation. This furnace has been already moved to Sault Ste. Marie and when erected and improved will have an approximate capacity of 400 tons per day. With the addition of the blast furnace plant and with the ultimate possibility of operating four blast furnaces, the Algoma Steel Corporation should have a well balanced plant as between its pig iron and steel producing possibilities.

Satisfactory progress is being made with the development of the water power by the Great Lakes Power Company and the supply of power, which will be greatly helpful to the steel plant, is expected to commence about 1st January next.

Mr. Wilfrid H. Cunningham, the president, says in the course of his report:

"So far as the finances of the Algoma Steel Corporation are concerned, it is gratifying to be able to report that the position of the company has been much improved, especially through its having pair off, in March, its three-year note obligations ($2,432,000). A satisfactory sale was made during the year, of the steamship J. A. McKee, and of certain office buildings and adjoining lands. The price realized for steamship and lands approximated $750,000, all of which is or will be deposited with the trustees and will be available for further capital expenditure.

"Favorable reports have been received as to the coal mines. In view of the growing importance of these, the Lake Superior and Cannelton Coal Companies have opened an office in Cleveland, from which Mr. W. C. Franz, the president of those companies, will conduct operations.

"The present Helen Iron Mine is still producing, but the operation cannot be prolonged much further on account of the exhaustion of the Hematite ore. A considerable amount of diamond drilling has been done on the property during the year, with the result that a substantial tonnage of Siderite has been proved up. There are no further developments at Magpie Mine. Labor conditions have been unsatisfactory.

"Beyond progressing with their plans the Algoma Steel Corporation directors have not yet committed the company to construction work in connection with either structural or other mills. They consider that prices and deliveries are adverse to such work at present. The necessity for further mill development is, however, again very strongly emphasized.

"In the disposition of earnings for the year, the board of the Algoma Steel Corporation has deemed it wise, especially under the present conditions, to pursue a thoroughly conservative policy. In addition to the necessary sinking funds, care has been taken to provide for such as the inevitable rebuilding of the bi-product coke ovens, the extra depreciation caused to rolling mills through the class of material now being rolled, part of the abnormal cost of new construction, as well as further provision for Magpie Mine, general depreciation, etc."

CANADIAN CONCERN SHARES IN AEROPLANE ORDER

AN agreement has been reached between the British and American Governments by which half the capacity of the Curtiss plants will be devoted to aeroplane requirements of our European Allies. This agreement applies no matter how great capacity the Curtiss Company finally attains.

The Curtiss Company will complete an order within the next two weeks for 200 biplanes for Great Britain, work on which was started last year. These biplanes are of the training variety and the cost to Great Britain is $30,000 each. In other words, the order amounted to $6 000,000.

The Willys-Overland Automobile Co., which now controls the Curtiss concern, has received some large orders for aeroplane parts. These include bolts, nuts, turnbuckles, etc. These orders for the Willys Company will be manufactured at the Willys Morrow plant in Elmira. The orders aggregate probably close to $25,000,000, and must be completed within 28 weeks. These large orders are over and above an order for 1,000 of the Sunbeam motors, now being manufactured by the Canadian subsidiary of the Willy-Overland Company.

NEW PROCESS OF SULPHUR PRODUCTION

THE drain on the world's sulphur supply for the manufacture of munitions and fertilizers has prompted the United States Government Bureau of Mines to make an investigation of various processes for recovering sulphur from the sulphur dioxide in smelter gases. A report just issued by the bureau states that sulphur has been produced in extensive experiments with a new process, and that it can be produced on a commercial basis for $12 to $13 a ton. Crude sulphur is now selling in this country for $55 a ton, and refined sulphur for about $80.

An increase in the sulphur supply of the world would tend to lower the cost of munitions, fertilizer, commercial sulphuric acid, and newsprint paper, in the manufacture of which sulphur is an important agent.

ALLIES BUY HEAVILY IN U. S.

WHETHER or not the Allies who are now purchasing various supplies in the United States in enormous quantities will be gratified if the Government fixes the prices at which American commodities are to be sold, is a question yet to be determined.

For one of the reasons why high prices for commodities of all kinds have been established and a tendency to an increase in prices has been noticed is to be found in the imperative pressure which the representatives of the Allies who are now in the United States have brought to bear upon manufacturers and others so that they can secure their supplies and get them as rapidly as possible.

Upon excellent authority it can be stated that there are now in the United States several thousand representatives of Great Britain and France as well as representatives of other Allied nations seeking to secure commodities, although some of them are occupied with inspection of commodities already purchased. There is, therefore, intense competition in American markets between representatives of other nations who are here for the purpose of buying American products.

On excellent authority it is reported that representatives of Great Britain who are now in the United States are purchasing commodities the aggregate money value of which each week is from $18,000,000 to $20,000,000. The money by mean of which payment for these commodities will be made will be obtained by loans made by the Government of the United States.

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

INDUSTRIAL AND CONSTRUCTION NEWS

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

ENGINEERING

Thre Rivers, Que.—The Three Rivers Shipyard Co. are buying equipment for their new plant here.

Hamilton, Ont.—The Acme Stamping & Tool Co. are building an addition to their factory on Sidney Street.

Niagara Falls, Ont.—Work is progressing satisfactorily on the new factory for the Herbert Morris Crane & Hoist Co. of Toronto.

Toronto, Ont.—The directors of the Canadian National Exhibition may decide to build an auxiliary electrical power plant of their own in the near future.

Kingston, Ont.—It is reported here that the making of shells at the Canadian Locomotive Works will be continued for the next six months, or until the present order is completed.

Copper Cliff, Ont.—The Canadian Copper Corporation will increase its capital stock to $10,000,000. The new capital will be used to develop the property, and will include the erection of a 3,000-ton mill.

Sarnia, Ont.—It is reported that a new concern to manufacture automobile parts in Sarnia will start building operations in a few days on a site in the North Ward. The main promoter of the plant is Senator Lyman Holmes of Michigan.

Regina, Sask.—The Canadian Nu-Fuel Co. has been recently formed here to manufacture a high-grade fuel out of garbage and waste rags, etc. The process of manufacture is the secret of Edgar L. Culver, of Chicago, who has been manufacturing fuel at Austin and San Antonio, Texas.

Nelson, B.C.—A new light and power corporation has been organized known as the Northport Power and Light Co., to supply light and power to this district. Its principal place of business will be Northport, and branch offices will be maintained both in the United States and Canada. One of the directors is Lorne A. Campbell, of the West Kootenay Light and Power Co.

St. John's, Nfld.—R. H. Reid, vice-president of the Labrador Pulp and Paper Co., is credited with saying that the undertaking would mean the development of one of the most important water powers in the country, the falls on the Hamilton River are second to those of Nagara. The bonds of the company will not be placed on the market, and the increased capitalization will all be met by private subscription.

Flesherton, Ont.—The oil prospects here are improving and continue to attract oil men. A company from Midland delivered four carloads of machinery last week, and will commence drilling in a few days on Reeve McTavish's farm adjoining the town. On the Lever farm drilling is down over one thousand feet, going through Hudson shale with oil signs increasing. In the Karstedt well experts from Detroit are pleased with the prospects.

Rigaud, Que.—It is reported that the Curtis & Harvey trinitrotoluol plant at Dragon, destroyed by an explosion on August 18, will not be rebuilt on the same scale as before. Negotiations are still under way with the American Government regarding contracts which would have kept the plant destroyed busy for months to come. These contracts cannot be carried out under present conditions, and it has not yet been agreed whether they shall be carried out in part.

ELECTRICAL

Picton, Ont.—The Town Council contemplates installing hydro-electric system. A by-law will be voted on.

Thorold, Ont.—The Town Council are considering the advisability of installing hydro-electric system here.

Picton, Ont.—The Hydro by-laws voted on last Friday by the municipalities of Picton, Wellington and Bloomfield were carried by a large majority.

Thessalon, Ont.—The Hydro-Electric Power Commission of Ontario are investigating the possibilities of power development in the vicinity of Thessalon, Ont.

St. Thomas, Ont.—The Hydro-Electric Commission and the Council have reached a tentative arrangement for the improvement of the lighting system on Ross Street, St. Catherine Street and Wilson Avenue. The cost of the change from the old plan will reach some thousands of dollars, and will be borne by the commission.

Toronto, Ont.—The Ontario Hydro-Electric Commission is about to demand for use of municipalities and industrial establishments on this side of the international boundary, 80,000 horse-power of electric energy which private companies at Niagara Falls have been exporting to the United States. The Ontario Government has passed an Order-in-Council authorizing the commission to expropriate the power now exported.

Sarnia, Ont.—The motor generator purchased by the Sarnia Street Railway Co., to generate the power for the line has arrived in the city, and is being installed at the hydro-electric plant in the North End. The outside construction in connection with the installation of hydro in this city is about completed. The work on the line, which will serve the South End manufacturing concerns, the Imperial Oil Co., the Mueller Mfg. Co., the Perfection Co., and other industries, will be commenced shortly.

GENERAL

Elmira, Ont.—The Great West Felt Co. will build a factory here to cost $5,000.

Fort William, Ont.—The N. M. Patterson Co. are building a reinforced concrete elevator to cost $200,000. The Fegles Bellows Co. have the contract.

Montreal, Que.—Twenty thousand dollars damage was done last Friday by fire and water to the plant of Holmes, Hogue & Co., box manufacturers, 235 Chatham Street.

Moosomin, Sask.—The Saskatchewan Co-operative Elevator Co. have purchased from J. Sharpe, Moosomin, his large elevator. The elevator is being remodelled, relined, and made ready for business October 1.

MUNICIPAL

Rosthern, Sask.—The town will instal a 50-k.w. gas engine and generator, and switchboard, etc.

Mitchell, Ont.—The electric light plant at Brussels has been purchased by S. Wilton for $3,500.

Port Dover, Ont.—The waterworks by-law, voted on here was carried by a large majority. The figures were: For, 151; against 74.

Owen Sound, Ont.—At the regular meeting the Town Council unanimously endorsed the new steel industry by-law after several amendments had been proposed. It was also decided to hold the election on the by-law on Sept. 15.

Tilbury, Ont.—The ratepayers voted almost unanimously on Aug. 27, to endorse the by-law agreement with the Hessco Electric Co., the vote standing 209 for and 8 against. The town will furnish a free site of five acres to the company, will exempt them from all taxes except school and local improvements for ten years, and will furnish free water for ten years, and will guarantee the company's bonds for $35,000 for 15 years.

TENDERS

Cobalt, Ont.—Tenders will be received until September 18 for installing a complete telephone system. R. L. O'Gorman, town clerk.

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.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, Toronto, up to Tuesday, October 2nd, 1917, for the construction and delivery of stop valves, valve operating pump and special cast-

ings, for main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

London, Ont.—Tenders will be received by the City Clerk until September 7th, 1917, for the following:—(a) One sludge pump, 100 gallons per minute capacity, head 30 feet, with valves and connections; (b) one single phase motor to operate pump. For specification and further information address the engineers, Chipman & Power, Mail Building, Toronto.

Ottawa, Ont.—Tenders will be received by the undersigned until Sept. 10, 1917, for ribbed corrugated or dovetailed plate and expanded metal concrete reinforcing steel. All tenders to be based on one hundred thousand (100,000) square feet (more or less) of 24" gauge expanded metal with combined reinforcing and centering properties: and fifty-seven thousand (57,000) square feet (more or less) of 24 in. gauge ribbed expanded metal as above, or 24 in. gauge ribbed, corrugated or dovetailed steel plate, delivered on the site, to be in conformity with the samples submitted, and to comply in physical properties and tests with the specifications of the American Society for Testing Materials. Deliveries to commence on or before Oct. 1, 1917, and to continue as directed in such quantities as to ensure complete delivery by Dec. 31, 1917. John A. Pearson and J. O Marchand, Architects, Central Block, Parliament Buildings, Ottawa.

TRADE GOSSIP

The Canadian Cartridge Co., of Hamilton, Ont., has increased its capital stock from $750,000 to $1,000,000.

L'Air Liquide Society Toronto has presented to the Toronto Technical School a complete oxy-actelyene welding outfit.

Montreal Customs Receipts.—Montreal August Customs receipts were 3,320,000 for August, an increase of $504,319 over the corresponding month of last year. Inland revenue receipts were $1,361,260, an increase of $190,000.

Sault Ste. Marie, Ont.—The blast furnace which the Algoma Steel Co. have removed from Midland, will when erected have an approximate capacity of 400 tons of pig iron per day. The company have recently installed a 75-ton open-hearth furnace, which will bring the steel making capacity of the plant up to 50,000 tons of billets per month.

Motor Car Merger Announced.—It is announced that the plan of consolidation of the Maxwell Motor Car Co. and the Chalmers Motor Corporation provided for a lease of the Chalmers plant, equipment and facilities for five years on a basis of 50 per cent. of the net profits, the Maxwell Co. guaranteeing upkeep and preservation of good-will, while the Chalmers Co. provides $3,000,000 of new capital.

Staff Changes in G. T. Motive Power Dept.—Roy Battley, formerly of Stratford, becomes master mechanic of the eastern lines. George Wilson becomes master mechanic in the Montreal shops, instead of Mr. Maver. Alex. McDonald, assistant master mechanic at Stratford becomes ssistant master mechanic in the Montreal shops. W. C. Seeley is made foreman of the erecting shops at Stratford.

Where Sulphuric Comes From.—The Bureau of Mines at Washington has compiled some interesting statistics regarding the sulphuric acid situation. Of the 6,250,000 tons of 50 per cent. acid used last year, 2,500,000 tons, or 40 per cent., came from Spanish pyrites; 350,000 tons, of 5.6 per cent., came from Canadian pyrites; 800,000 tons, or 12.8 per cent., came from smelter acid, and 1,200,000 tons, or 19.2 per cent., came from sulphur.

Big Destroyer Fleet for U.S.—Secretary of the Navy Daniels expects to submit to Congress shortly estimates of $350,000,000 for a great fleet of destroyers. The money will be used to expand existing shipbuilding plants and also to build additional engine and boiler factories, as the destroyer programme upon which shipbuilding industry is now engaged, represents the full capacity of the industry.

Marine Insurance Risks Easier.—Marine war risk insurance in New York has a lower tendency. Rates to South America have been reduced from 1¼ to 1 per cent. for River Plate and Buenos Ayres, and from 1 per cent. to ¾ per cent. for Brazil. United Kingdom rates in many cases are easier than a week ago. The minimum on eastbound armed passenger ships is 6 per cent. Rates to France are also down to 6 per cent.

First Standard Ship Commissioned.—The first of the British Government's standardized merchant steamers to replace tonnage lost through submarines, has been commissioned after completing most successful trials. The keel was laid down in February and the hull was launched in June. It is understood that six different types of vessels, varying in size from 8,000 tons downward are being built. Many hundreds of such ships will be constructed.

The Canadian Fairbanks-Morse Co. are showing at the old stand this year at the Canadian National Exhibition, Toronto. A new feature this year is a demonstration of "Chase" farm tractors. A 50-barrel "Midget" mill is in operation and also several gas and oil engines of various sizes. The company are also showing a "Redden" truck attachment for Ford cars. The representatives include G. B. Wheeler, G. Robson, R. M. Wenger and R. Rogers.

August Increase in Customs Revenue.—A report from Ottawa states that complete returns for August are not yet available, but the increase over the corresponding month of last year will be considerably over $3,000,000. For the first five months of the present fiscal year the increase will be over $17,000,000 over the same period of last year. At this rate, the customs revenue should show a $40,000,000 increase over the returns for the previous fiscal year.

Aluminum Pistons for Gas Engines.—On the subject of aluminum pistons for internal combustion engines, Joseph Leopold, an American engineer with much experience of this class of work, advocates a plain-sided piston of normal length, with circumferential grooves in the skirt, as distinct from the hour-glass or narrow-waisted type. It has only two rings above the gudgeon pin, the lower one having its groove bevelled and the bevel drilled through to the interior. A third ring is provided at the bottom end of the skirt.

Contracts to Build 40 Steel Freighters.—W. Averill Harriman, through the Merchants Shipbuilding Coroporation, of New York, which he organized and controls, has signed contracts for construction of the largest amount of steel shipping tonnage so far ordered by the Emergency Fleet Corporation from any single concern. The Merchant Shipbuilding Corporation operates Harriman's new shipyard at Bristol, Penn., and this yard is to construct for the Government forty 9,000 ton fabricated steel freight steamers.

Ore Carriers in Demand.—According to reports from the Northwest, it will be Sept. 15 or 20 when the movement of the new crop gets started, and it will probably be a week or ten days later before the demand for tonnage is very active. Small carriers and line boats will be able to take care of the movement during the first ten days. The market at Cleveland, O., in other lines is without change. Ore carriers are in good demand and some business is being done, but the supply of coal tonnage is in excess of the demand and chartering is light.

Big Demand for Rails.—A despatch from New York states that users of light rails are continuing to call for much tonnage, but the mills are unable to meet their demands and many of them are being disappointed. It is expected that considerable difficulty will be met with in filling the Government's inquiry for 25,000 to 30,000 tons of light rails for France, which has been in the market for several weeks. It is probable that to supply this tonnage some buyers now on the books may be displaced. A 25,000 to 30,000 ton lot for the French Government direct also remains up for consideration.

Sulphur Shipments Require License.—The Trade and Commerce Department, Ottawa, has been notified from Washington that the Burea of Export Licenses has authorized the United States customs collector to pass sulphur shipments to Canada which were already en route on or before Aug. 27, and prior to the coming into effect of the new American export regulations. After Aug. 27, however, all sulphur shipments to Canada will require special licenses. Applications for such licenses must go to the Deputy Minister of Trade and Commerce at Ottawa, who will pass upon them, and, if they are satisfactory, he will send them on to Washington.

Electrical Experts Conclude Conference.—The Ontario Municipal Electrical Association concluded a two-days' session in conference at the Chemistry and Mining Building of the University of Toronto, on Aug. 29. Delegates from all

parts of the province were present for a discussion of matters connected with Hydro engineering plans. W. P. Dobson, Chief Engineer of the Labatory Department of the Hydro-Electric Commission read an interesting paper on "Demand Meters." A motion picture demonstration was also given by E. H. Porte, showing the systems in Ontario supplied with power by the Hydro-Electric Commission throughout the province.

Hydro May Expropriate Power.—Within a month or so the Ontario Hydro-Electric Commission will take steps to expropriate the power which is being exported by the Canadian Niagara Co. and the Electrical Development Co., if the developing companies refuse to supply the Hydro Commission with the amount of power they require. By this means 83,000 h.p. will be available to make up the shortage of power in the province. The Electrical Development Co. is exporting 50,000 of its horsepower, and the Canadian Niagara Co. is exporting 30,000 horsepower. The old Ontario Power Co., which the Hydro Commission purchased and took over a month ago, was exporting something like 40,000 horsepower. Now there is said to be 83,000 horsepower wanted by the Hydro Commission to make up the shortage of power, and this will have to be supplied by the two first companies.

New U. S. Shipyards.—Contracts for construction of three U. S. Government owned shipyards for building fabricated steel merchant vessels have been awarded at Washington by the Shipping Board's Emergency Fleet Corporation. They went to the Submarine Boat Corporation for a plant at Newark, N.J.; the American International Corporation, for one at Hog Island, Pa., and the Merchants Shipbuilding Company, for one at Chester, Pa. The yards will cost $35,000,000, and the builders of the yards are given contracts for building in them two hundred ships. The prospects are that contracts for many more vessels will be let when these are completeed. The Submarine Corporation will lay ways for building twenty-eight ships simultaneously and will have facilities and equipment to turn out one 5,000-ton ship every two days after the first vessel is completed.

Algoma Steel Co.'s Output.—The output of the Algoma Steel Corporation, Sault Ste. Marie, Ont., for the year ending June 30, was 348,519 tons of pig iron and 280,296 tons of finished steel. The output consisted of shell steel, together with rails and merchant bars. Operations have been largely governed by the requirements of the Imperial Munitions Board, which has regulated the distribution of the company's product. Throughout the twelve months somewhat difficult conditions have prevailed, especially as regards labor and materials, the deliveries of the latter having been seriously hampered. Especially was this the case with coal, the bringing in of which on account of car shortage necessitated continued and expensive importation throughout the winter months after the close of lake navigation. Conditions have improved somewhat, but materials are generally and necessarily more difficult to obtain, whilst deliveries are only obtainable far ahead.

Canadian Steel Corporation Plans.—Plans for the erection of the United States Steel Corporation's $20,000,000 plant at Ojibway, Ont., will now be carried forward, according to a statement of Ward B. Perley, vice-president and general manager of the Canadian Steel Corporation, the Canadian subsidiary of the big United States concern. This company was incorporated some three years ago. A tract of land on the St. Clair River, north of Windsor, was purchased, a separate municipality was established, streets were laid out for an ideal town, such as the United States Steel Corporation has at its American plants. Then the war put a temporary stop to construction. The bid for tenders for the construction of a slip and huge concrete and steel docks for the Ojibway Company was the sign for a renewal of construction and further plans of the company will now be proceeded with. The plant is well situated, being on the direct water route from the Lake Superior iron mines to the ocean. Hydro-Electric power will be available from Niagara. The operations of the plant, as outlined by Judge E. H. Gary, chairman of the Board of Directors of the United States Steel Corporation, will include some blast furnaces and mills for the manufacture of wire, rails and bars and perhaps other steel products.

PERSONAL

Paul G. Chase, vice-president of the Port Arthur Shipbuilding Co., has returned from a business trip to New York.

W. H. Sample has been appointed superintendent of motive power of the Grand Trunk Railway, with headquarters at Montreal, in succession to W. D. Robb.

Martin N. Todd, president of the G. P. and H. Railway and general manager of the L. E. & N. Railway, died suddenly at his home in Galt, Ont., on Aug 29, aged 58.

A. M. Barry, who for the past six years has been general superintendent of the St. Lawrence Welding Co., Montreal, has been promoted to the position of manager of the above company.

N. E. Gillen, general superintendent of the G. T. R., at Chicago, Ill., has been appointed vice-president, with headquarters at Montreal, in charge of the operating department. Mr. Gillen entered the service of the G. T. R. in 1901.

Wallace Millichamp, a retired manufacturer of Toronto, died on Aug. 28, at his residence, 237 Poplar Plains Road, after an illness of several months. He was born in Birmingham, England, in 1839, and came to Canada when he was 14 years of age.

W. D. Robb, superintendent of motive power of the Grand Trunk Railway, has been appointed vice-president in charge of motive power, car equipment and machinery, with headquarters at Montreal. Mr. Robb has been in the service of the G. T. R. since 1871, and for the last 15 years has occupied the position which he has relinquished.

Frank H. Crockard, the new president and general manager of Nova Scotia Steel and Coal Co., is in New York, after having spent some time in the Pittsburg district. He went there after a conference with departmental heads in Nova Scotia, and is understood to have framed up a comprehensive plan for the development of the company.

George C. Jones has assumed his new duties as assistant to the president Grand Trunk Railway System, with headquarters in Toronto. Until 1905 Mr. Jones was for many years superintendent of the Toronto terminals for the G. T. R., and left only to go with the Central Vermont Railway as vice-president and general manager.

Alexander Wilson Crouch, vice-president and general manager of the Dearborn Chemical Co. of Canada, Toronto, sailed last Saturday on the S.S. Makura from Vancouver, on a year's trade expansion trip to the Orient, Australia, Korea and India. Mr. Crouch came to Toronto from Pittsburgh six years ago.

George F. Steele, formerly secretary of the American Newsprint Manufacturers' Association, has been appointed general manager of the Canadian Export Paper Co., Ltd., with headquarters at Montreal. The Canadian Export Paper Co., Ltd., was formed by a number of the leading newsprint manufacturers about a year ago to forward the interests of the industry in foreign markets.

William Johnston, head of the Johnston Steamship Co., Liverpool, England, died recently at his home in Woodslee, Cheshire. With his brother Edmund, Mr. Johnston started in the steamship business nearly forty years ago, and they eventually became owners of one of the largest steamship concerns in the world. The company operated a line of steamers betwen Baltimore, Md., and Liverpool, and also in the Black Sea trade and ports in the Mediterranean.

E. J. Chamberlin, who has retired from the position of president of the Grand Trunk Railway, was appointed to that position in the spring of 1912, on the death of the late Charles M. Hays, who lost his life on the Titanic. Previous to that time Mr. Chamberlin was vice-president and general manager of the company, which position he held for two years. In 1896 he came to Canada as general manager of the Canada Atlantic Railway. Mr. Chamberlin was born in Lancaster, New Hampshire.

Howard G. Kelley, vice-president of the Grand Trunk Railway, has been appointed president and general manager, in succession to F. J. Chamberlin, who has retired. Mr. Kelley was born in Philadelphia in 1858, and occupied important positions at different times on several roads in the United States. In 1907 he became chief engineer of the Grand Trunk Railway System, and was appointed vice-president of the road in 1911. Mr. Kelley is a member of several engineering institutes and associations in England, the United States, and Canada, and has held the office of president in two of these societies.

MARINE

Sault Ste. Marie, Ont.—The red lights on spar buoys 4A and 4B marking the channel in the vicinity of the wreck of the steamers Pentecost, Mitchell and Saxona have been discontinued. The unlighted buoys will be continued in commission near Pipe Island.

Halifax, N.S.—The Quebec Salvage & Wrecking Co.'s steamer Strathcona, which arrived here a few days ago with the big steamer which had been ashore on Bryon Island in the Magdelens, has left to make an attempt to salvage the lumber steamer which went on the rocks in the fog on Aug. 26.

Ottawa, Ont.—The S.S. W. H. Dwyer, owned by Forwarders, Ltd., of Ottawa, was sunk by a mine or torpedo on Aug. 26. This steamer was built for the Upper Lake grain trade in Sunderland, England, in 1913, and went overseas September, 1915, and was since engaged in carrying coal from England to France. She had a carrying capacity of 2,500 tons.

Halifax, N.S.—Adam B. McKay of Hamilton, Ont., will be present at the launching of the second large schooner he has had built here this year and will make a contract for the building of a third. The first schooner, the Letitia B. McKay, he has already sold at a profit over the contract price of $70,000. The next one to be launched at Port Greville will be named the Adam B. McKay, the first one being named after his wife.

Collingwood, Ont.—The wooden steamer Windsor was successfully launched at Robert Morrill's shipyard here recently. The ship is being built for the Ontario Gravel & Freighting Co., Windsor, Ont., and has the following dimensions: Length, 105 feet; breadth, 23 feet, and depth 12 feet, while the motive power is fore and aft compound engines, supplied with steam from a Scotch boiler 12 feet by 13 feet, and carrying a working pressure of 155 pounds per sq. inch.

Vancouver, B.C.—J. J. Coughlan & Sons have received the names of five of the six 8,800-ton steel boats they are building for the British Government. Boat No. 2 is to be known as the "War Camp." No. 3 is to go by the name of "War Charger." "War Chariot" is the name to be applied to the fourth boat. "War Chief" is the title assigned to the fifth boat, while the sixth will go by the name of "War Noble." The first boat has not been named yet. Splendid progress is being made at the Coughlan yards, and it is expected that the first vessel will be launched in November. The boats will be the largest ever built in British Columbia, being 100 feet longer than the Princess boats of the C. P. R., and with ten feet more beam.

To Prevent Seamen Deserting.—An Order-in-Council, providing for the apprehension of seamen who desert from any vessel owned or chartered by the British or Canadian Government, or carrying cargo or passengers for any British or Allied Government, has been passed by the Government. The Order authorizes any owner, master, mate, naval or military officer or superintendent to convey such a seaman on board his ship or have him detained in custody until he can be taken back to the vessel. Police officers are required to render such assistance as may be needed to convey men, absent without leave, to their ships. A further section of the Order provides that seamen shall not leave vessels in the classes mentioned without a pass signed by the master, mate, purser or first engineer.

BUILDING

Toronto, Ont.—A building permit has been issued to Drummond McCall Co. for an addition to warehouse, 373 Front Street East, to cost $10,000.

Toronto, Ont.—Work has commenced on the foundations for a new warehouse on King Street for the Canadian General Electric Co. The building will be of mill construction, six storeys high, with a frontage of 47 feet and 185 feet deep.

Dundas, Ont.—Secord & Sons, of Brantford, have secured the contract for the new factory to be built for Pratt & Whitney. Work has already been commenced and it is expected that February will see its completion. The site is on Hatt Street. The building will be 176 by 75 feet, three storeys and basement, of fireproof construction.

CONTRACTS

Drummondville, Que.—The Southern Canada Power Co. have awarded a contract for a 400-h.p. single vertical turbine to the S. Morgan Smith Co.

Dorval, Que.—The Norwood Engineering Co., Cowansville, Que., have been awarded the contract for filtration plant to be installed here at a cost of $35,300.

Fort William, Ont.—Barnett & McQueen have been awarded the general contract for a one-storey, reinforced concrete construction elevator for Davidson Smith Co., to cost $100,000.

Oakville, Ont.—The contract for building the Tansley bridge has been given to Norman McLeod of Toronto at $60,000. The bridge will be over 600 feet long, and the floor 18 feet wide. A. W. Connor of Toronto is the engineer.

RAILWAYS—BRIDGES

Saskatoon, Sask.—Definite plans toward the erection of a union depot in Saskatoon will be made shortly, when H. A. K. Drury and prominent railway officials come to this city for a conference with civic authorities.

INCORPORATIONS

Montreal Motors, Ltd., has been incorporated at Toronto with a capital of $25,000 to manufacture and deal in motor cars, trucks and bicycles, etc., at Hamilton, Ont. The provincial directors are J. M. McGill, H. E. Phillips and W. F. Roney all of Hamilton, Ont.

Bennet Martin Asbestos & Chrome Mines, Ltd., has been incorporated at Ottawa by A. R. Martin, B. J. Bennett and F. Bennett of Thetford Mines, Que., to carry on the business of mining and

manufacturing asbestos at Thetford Mines, Que., with a capital of $1,500,000.

The Collingwood Steamship Co., has been incorporated at Toronto with a capital of $40,000 to build and operate steam and wooden ships of all kinds at Collingwood, Ont. The provincial directors are George C. Coles, Fred G. Moles and M. P. Byrnes all of Collingwood, Ont.

WOODWORKING

Goderich, Ont.—Fire on August 29 destroyed the Goderich Mfg. Co.'s woodworking plant, owned by J. B. Baechler. The loss is estimated at $50,000, including buildings and machinery.

REFRIGERATION

St. John's, Nfld.—The Newfoundland Cold Storage Fish Corporation has completed the installation of a complete 300-h.p. steam-driven refrigerating plant purchased from the Reinhardt Brewery, Toronto.

CATALOGUES

The Vanadium-Alloys Steel Co., Pittsburgh, Pa., have distributed a stock list of "Red Cut Superior" and "Red Cut Cobalt" high-speed steels in stock in their Pittsburgh warehouse, and also at the works at Latrobe, Pa.

The Webster and Perks Tool Co., Springfield, Ohio, have for distribution in the trade a useful pocket calculator for use in connection with grinding operations. The calculator is a celluloid device containing a sliding card with tables on each side. On one side of the calculator is a table of circumferences and a rule for obtaining surface speeds of abrasive wheels. While on the other side is a table of grinding wheel speeds with rule for finding revolutions at a given surface speed.

The Bilton Machine Tool Co., Bridgeport, Conn., have issued a set of loose leaf bulletins dealing with an interesting and varied line of machine tools which they manufacture. The product includes principally automatic gear milling machines, gear hobbing machines, automatic milling machines, drill presses, and riveting machines. The various types of machine are illustrated and described together with specifications giving the principal dimensions. The bulletins are numbered 203 to 221 inclusive and are gotten up in attractive style.

Engine Room Supplies is the title of a booklet recently issued by the Quaker City Rubber Co., Philadelphia, Pa. This booklet is exceptionally complete and comprehensive, and will serve as a useful guide to the engineer in selecting packings, hose and other necessary engine room requirements. The principal lines described include Daniels', P. P. P., rod packing, Ebonite sheet packing, gaskets and steam hose. "Crown" and "Quaker City" packings. The booklet is

pocket size and contains 63 pages with index.

A Chain of Evidence is the title of publication No. 14, dealing with large power drives manufactured by the Morse Chain Co., Ithaca, N.Y. The bulletin illustrates and describes a number of important Morse chain installations in various plants showing the wide field of application for transmitting large powers. The bulletin also deals with the construction of the Morse chain and the advantages obtained by its use for large power drives. Copies of this publication may be obtained from the Canadian agents Jones & Glassco, Montreal.

BOOK REVIEW.

Foreign Commerce and Navigation of the United States for the year ending June 30, 1916; 950 pages, 9 x 11½ in., cloth covers. This publication, compiled by the Bureau of Foreign and Domestic Commerce, Washington, contains statistics covering exports and imports of merchandise of all kinds. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., price $1.50 per copy.

The Canadian Mining Manual 1916-17. by Reginald E. Hore, Editor of the *Canadian Mining Journal*, 448 pages 6 in. x 8¾ in. Published by The Canadian Mining Journal, Toronto. This is the third volume of the new series of this useful and popular handbook of information concerning the minerals and mines of Canada. The publication of the handbook was delayed in order to deal more fully with developments in 1916. Reports covering this period were not available until some months after the close of the year and advantage was taken of this delay to incorporate considerable information covering the early months of 1917. The information contained in the manual will doubtless appeal, to those interested in the subject, more at this period than formerlly owing to the greater interest that is being taken in the minerals of Canada as a result of the war. The need of developing our mineral resources is becoming more apparent and any literature that will assist towards this end will be received with greater interest on this account. The publishers have, as in former years, freely used extracts from government publications, company reports and technical journals, etc., which fact guarantees the accuracy of the data contained in the volume. The manual covers all the various phases of mining activity in Canada and contains much useful information on the various minerals found in this country, including location of the mines, physical properties of the minerals and methods of mining, etc. The sections covering coal, copper and nickel are of particular interest at this time. A list of mining companies and their product is a useful feature of this publication. The manual is fully illustrated and is bound in attractive red cloth covers.

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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 weighing 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.

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

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

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

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

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

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.

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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 18" 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 13" 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.

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LIMITED
MONTREAL, QUEBEC

PETRIE'S LIST

Of New and Used Machine Tools Stock for IMMEDIATE DELIVERY

TURRET LATHES AND SCREW MACHINES

15" x 5½" American, fox.
16" x 5½" Pratt & Whitney.
16" x 6 Pratt & Whitney, turret.
20" x 7' Fay & Scott.
22" x 8' Pratt & Whitney.
24" x 10' Conradson, D.B.G.
24" x 8' Lodge & Shipley.
26" x 8' Fay & Scott, B.G.
2" x 24" Stevens Screw Machine.
No. 2 Warner & Swasey, plain head.
No. 6 Warner & Swasey, friction head.

ENGINE LATHES

13" x 6' Filsmith, 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 8' C.M.C., double back geared.
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.
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.
46" Allfree, upright.
64" Canedy-Otto, wall radial.
No. 10a Baush, 16-spindle.
D-1 Colburn, heavy duty.

GRINDERS

No. 1 Cincinnati, universal tool.
No. 2 Landis.
No. 2 Sellers, universal.
No. 3 Modern, universal.
No. 3 La Salle, plain and surface.
24" Barnes, wet tool.
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

Bertram, plain.
Brown & Sharpe, power feed, plain.
Fitchburg, geared, plain.
Van Norman, bench.
No. 2 Ford-Smith.
No. 6 Whitney, hand feed.

SHAPERS.

16" Canada Mach. Corp.
16" Queen City, back geared.
24" Bertram, 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.

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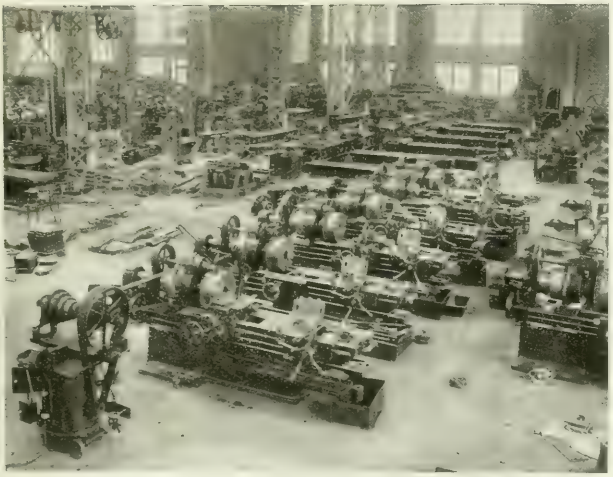

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24—22" x 8' Hamilton, D.B.G., C.R., Semi-Q.C.
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4—22" x 8' Davenport, D.B.G., Turret tool post,
7—22" x 10' Hamilton, D.B.G., C.R., Semi-Q.C.G.,
2—22" x 10' Hamilton, D. B. G., turret tool post, Semi-Q.C.G.,
20—22" x 10' Davis, D.B.G., C.R., Q.C.G.,
6—24" x 10' Lodge & Shipley, D.B.G., C.R., Q.C.G.,
8—24" x 10' Lodge & Shipley, Selective Gd. Hd., C.R., Q.C.G.,
11—26" x 10' American, D.B.G., C.R., and carriage turret, Q.C.G.,
2—26" x 10' American, D.B.G., Carriage turret,
19—26" x 12' Putnam, carriage turret, semi-Q.C.
9—26" x 12' Putnam, C.R., Semi-Q.C.,
2—26" x 12' Wickes, D.B.G., C.R., Semi-Q.C.G.,
10—28" x 10' Niles, Bement, Pond, D.B.G., Q.C.G.
4—28" x 14' Lodge & Shipley, Select. Gd. Hd., motor drive, C.R., turret and taper.
3—30" x 16' Lodge & Shipley, D.B.G., C.R., turret and taper,
10—40" x 18' Pittsburgh, triple geared, Q.C.G.,

TURRET MACHINES—Latest Models.

18—21" Gisholts, 3½" hole, 2-step, 5" belt.
25—21" Gisholts, 3½" hole, for motor.
13—24" Gisholts, 4¼" hole, 3-step, 4" belt.
38—24" Gisholts, 6" hole, 2-step, 6" belt.
37—24" Gisholts, 6" hole for motor.
2—21¼" x 26" Greenlee Flat Turrets.
2—21½" x 26" Pratt & Whitney Gd. Hd. Turrets.
4—3-A Warner & Swasey (bar machines).

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Your money back if you return a machine within 30 days from date of shipment, freight prepaid.

NO EXCUSES NECESSARY.

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3—21½' Fosdick.
2—21½' Mueller.
1—21½' Dreses.
1—3' Prentice.
1—3' Mueller.
1—3½' Gang.
1—4' Niles Full Univ.
3—5' Niles Semi-Univ.

MULTIPLE DRILLS.

1—8-spindle Valley City.
1—12-spindle Baush.
1—24-spindle P. & W.

SHAPERS

1—15" Hendey Friction Shaper.
1—16" Perkins Friction Shaper.
2—16" Barker Plain Crank.
1—24" Gould & Eberhardt Back Geared Crank.
1—24" Queen City Back Geared Crank.
1—48" Morton Draw Cut.

PLANERS

1—22" x 22" x 5' Flather.
1—22" x 22" x 6' American.
1—24" x 24" x 4' Gray.
2—24" x 24" x 5' Gray.
1—24" x 24" x 6' Cincinnati.
1—24" x 24" x 10' Lodge & Davis.
1—26" x 26" x 6 American.
1—26" x 26" x 7' Gray.
1—26" x 26" x 7' Gray, 1 head.
1—30" x 30" x 7' Powell, 4 heads.
1—32" x 32" x 8' Gray, 2 heads.
1—32" x 32" x 10' Gray, 2 heads.
1—48" x 48" x 16' Pond, 2 heads.

MILLING MACHINES

1—No. 3 Brainard.
1—No. 3 Brainard Plain.
1—No. 20 Oesterlein Universal.
1—No. 1½ Brown & Sharpe Universal.
1—No. 25 Becker Plain.
1—No. 2 Cincinnati Universal.
1—No. 5 Schuchardt & Schutte Plain.
1—No. 3 Hendey Plain.
4—No. 2 Pratt & Whitney Lincoln.
1—60" x 48" x 8' Ingersoll Slab.
1—Beaman & Smith, 2 vert. hds., 1 hor. cross bor. hd.
1—No. 2 Beaman & Smith Combination Hor and Vert.

HILL, CLARKE & CO. OF CHICAGO

625 WASHINGTON BLVD., CHICAGO, ILL.

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LOOK—HERE THEY ARE

BORING AND TURNING MACHINES—VERTICAL.

1—20″ Ballard, 1 tool head.
1—30″ Flather, one tool head.
1—36″ Bausch, 2 swivel heads.
2—36″ Brown & Sharpe, one turret head; Dec delivery.
1—42″ N.B.H., two swivel heads, motor drive.
1 New 42″ Gisholt, 2 heads.
1—54″ Colburn 2 swivel heads.
1—72″ Niles, two swivel heads.
1—72″ Bickford, two swivel heads.
1—80″ Niles, two swivel heads, slotting attachment.
1—84″ Selkes, one head.
1—97″ Vertical Cylinder.
1 New 8′ Bickford, December delivery.
10′ Niles, 2 heads, December delivery.

BORING MACHINES—HORIZONTAL.

1—Lucas, 2¼″ bar
1—No. 1 Barnett Cylinder Borer, 3¼″ bar type.
1—Newbaugh 4″ bar, 84″ swing, 72″ feed.
1—No. 2 20″ Barrett, 2 facing heads.

BULLDOZERS.

1—New No. 4 Garrison (same as No. 4 Williams White).
1—No. 7 Hackensack 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 11½ 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—50-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—5½′ American full Universal.
1 6′ Baush Plain, cone driver.
New 6′ Triumph, motor drive; September delivery.

DRILLING MACHINES—HEAVY DUTY.

4 No. 310 Baker Brothers.
2—New No. 2 Colburn.
3—No. 14 Colburn, 24″ swing, capacity 2″ in solid steel.
2—D3 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. 346 Baush, 12 spindle, capacity 1½″ holes, 30″ circle.
1—14-spindle Baush capacity 1″ holes, 36″ circle.

GEAR-CUTTING MACHINES.

1—No. 1 Whiton.
1—No. 3 Barber-Colman Hobber.
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—18″ 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. for Spur and Bevel.
1—24″ Becker Brainard.
1 New Flather, solid pattern, 3″ Automatic Gear Cutter.
1—New No. 10 Whiton, Bevel 32″, Spur 34″.
3—5″ 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.
8—No. 190 Wells.
1—Gisholt No. 5, 12″.

GRINDING MACHINES CYLINDRICAL—PLAIN.

1—New No. 12 Brown & Sharpe, 8″ x 26″, Sept delivery.
1—New 10 x 36″ Landis; immediate.
1 New 10″ x 36″ Norton, Sept. delivery
1—New 10″ x 50″ Norton, Sept. delivery.
1 10″ x 60″ Landis
1 New 16 x 72 Norton, Plain.
36 12″ x 24″ Modern, self-contained.
1—12″ x 32″ Landis, rebuilt.
6—12″ x 36″ Modern, self-contained, motor or belt driven.
2—14 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, 7″ x 36″.
1—No. 1½ (10″ x 30″) Landis.
1 New No. 2½ (10″ x 36″) Bath.
1—10″ x 42″ Modern.
9—New No. 2 Moise, cap. 12″ x 30″, Universal. Nov. delivery.
1—No. 3 (12″ x 40″) Brown & Sharpe.
1—10″ x 42″ Landis
2—New No. 3 Modern, 13″ x 40″, 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.

GRINDERS—RING.

1—New No. 14 Beasley, two-ring chucks.
1—No. 300 Heald.
1—No. 210 Heald.

GRINDERS—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.
4—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—400-lb. Billings & Spencer.
1—2,000-lb. Chambersburg.

HAMMERS—STEAM—FORGING.

1—Used 600-lb. Niles Single Frame.
1 600-lb. Bell Single Frame Hammer.
1—15″ Morgan & Williams, 600 to 800 lbs., 21″ cap.
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, 16″ x 8′.
13—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, Single Pulley Drive.
22—18″ x 8′ Battle Creek, heavy duty.
5—20″ x 8′ Mörschon.
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—15″ 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.
3—18″ x 9′ Chard.
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 24″ 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 16′ 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 14′ Lodge & Shipley, patent head
1—24″ x 24′ Perkins, single back geared, reaming blocks to 40″, 18″ chuck.
1—24″ x 15′ x 22″ McClabe, double spindle.
1—25″ 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
1—New 30″ x 12′ American, Double Back Gears, Quick Change.
3—New 32″ x 12′ Pittsburg pattern.
8—New 36″ x 24′ Putnam, triple geared.
1—36 x 19′ Stentoe, single back gear.
1—50″ x 12′ American, Gear Head, Quick Change.
1—71″ x 20′ Fifield, triple geared.

LATHES—TURRET.

1—3″ x 36″ Jones & Lamson, geared sliding head.
5—3 x 24 Jones & Lamson.
18—6A Potter & Johnson.
1 New 7″ Gisholt.
1—New 24″ Gisholt.
1 24″ Sibley.

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.
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.

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
1 Used No. 4 Brown & Sharpe.

MILLING MACHINES VERTICAL.

1—New Bickett, No. 0.
1 New No. 4B Becker.
2—No. 5 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 30″ 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 42″ x 42″ widened to 52″ x 40″ 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 56″ x 14′ Powell, one head.
1 52″ x 52″ x 16′ Betts, two heads, right angle drive.
1—54″ x 42″ x 16′ Woodward-Powell, 2 heads.
1 56″ x 12″ x 16′ Graves, two heads
1—32′ 6 Niles Plate Planer.

SCREW MACHINES AUTOMATIC.

3—No. 51 National Acme.
1 No. 51 National Acme
1 No. 51 National Acme
2—No. 53 National Acme.

SHAPERS.

1—New 16″ Springfield.
1 16″ Motor Drive Rockford
1 New 17″ Milwaukee
1 New Rahke 22″.
1—30″ Walcott, gear drive.

SLOTTERS.

1—12″ Bement Gear.
1 18″ Betts, Adjustable Stroke.

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

An Interesting Installation of Chapman Double Ball Bearing Transmission

Illustration shows a portion of the installation at the new Dominion Steel Products plant at Brantford, Ontario, where the entire transmission equipment—shafting, hangers and ball bearings—is Chapman Double Ball Bearing Transmission.

This plant was laid down for special war-time manufacturing, but the entire equipment was installed with a view to ultimate economical and efficient production in the general manufacturing field.

That this was an important factor in choosing Chapman Double Ball Bearing Transmission gives us no small amount of satisfaction.

That Dominion Steel Products should instal Chapman Transmission because they were convinced of its efficiency is one reason why you, too, should investigate. We have on file many similar reasons.

The Chapman Double Ball Bearing Company, Limited

339-351 Sorauren Ave., Toronto, Ont.

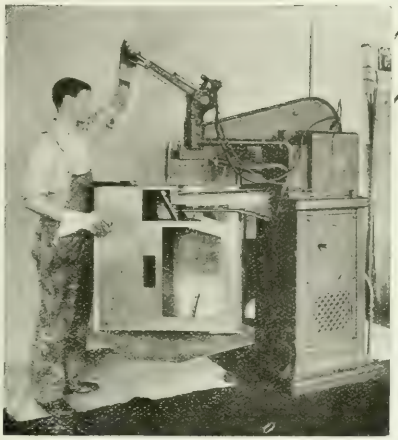
TRANSMISSION BALL BEARING CO., Inc.

1050 Military Road, Buffalo, N.Y.

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

Electric Spot Welding

WINFIELD Welding has taken the place of riveting in a large number of shops. It is electric welding developed to top-notch efficiency, made applicable to all classes of work, and lowered to rock-bottom costs.



Makes Riveting a "Back Number"

ONE man can spot weld more than ten men can rivet, and do it better, too.

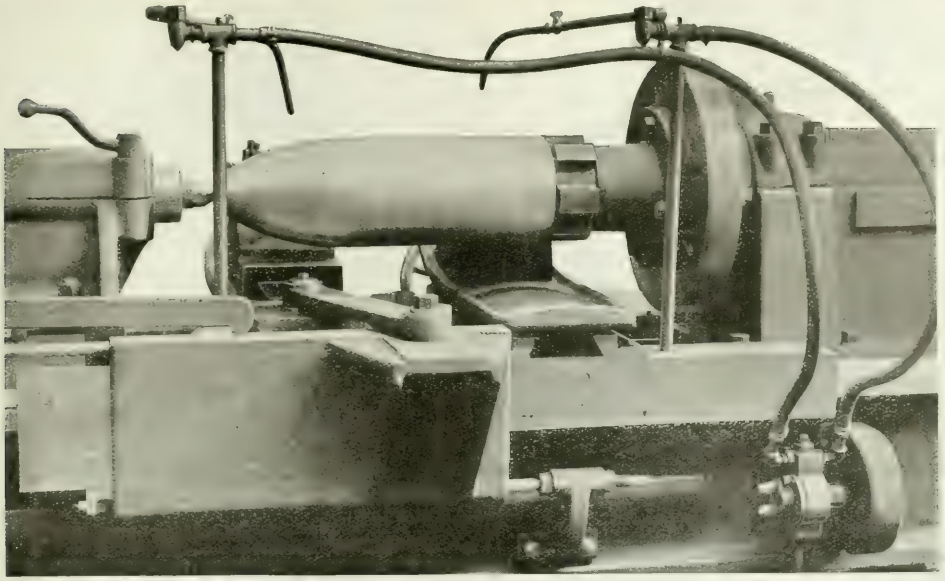
We want the opportunity to show you how it can be done. Send us a blueprint or a sketch of what you make and you'll quickly receive our proposition with facts and figures that convince.

The Winfield Electric Welding Machine Co.

WARREN, OHIO -:- -:- U.S.A.

31 Ottawa Bank Building, Montreal, Que.

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



Bertram Plays Safe By Using Trahern Rotary Geared Pumps

Shell production requires uniform efficiency from operator to lathe—and thence down to the accessories with which the machine is equipped. Bertram uses TRAHERN PUMPS because they will supply a variable stream of coolant ranging from 1½ gallons to 16 gallons per minute. Any amount you require is at your disposal—the Special TRAHERN relief valve permitting shutting off at discharge without stopping pump.

The slow speed at which the pumps can be run, varying from 300 to 500 R.P.M. in accordance with your requirements, conserves the life of the pumps. This is not true of the centrifugal pump, which must be operated at maximum speed to obtain the capacity desired. The accurate machining and assembling of TRAHERN PUMPS renders the danger of loss of prime a negligible factor. The drive shaft is of high grade, cold rolled steel. The Pumps are constructed to prevent excessive wear at stuffing box, a distinctive point of superiority over the centrifugal type.

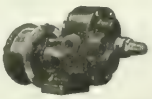
TRAHERN ROTARY GEARED PUMPS will increase the volume of production from your present equipment—write for particulars.

TRAHERN PUMP COMPANY

Rockford, Illinois

Canadian Agents:

A. R. Williams Machinery Co., Toronto, Ontario

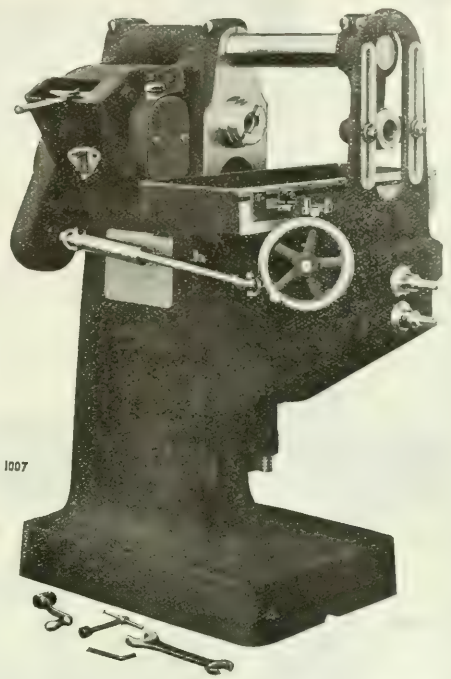


If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

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

The New Cincinnati 12" Knee Type Manufacturing Miller for Repetition Work

Arms manufacturing plants and any other shops turning out great quantities of small parts will find this machine intensely profitable. Capable of standing up to the drive of twenty-four hours a day service, and giving maximum production at all times. It is compact, having only 12" table travel. It is powerful—4 h.p. at the spindle. The drive is by constant speed belt, with a commercial range of feeds and speeds, and for the sake of simplicity, quick change mechanisms have been avoided, the change in feed or speed being made by interposing change gears.



The Cincinnati 12-inch Knee Type Manufacturing Miller

(Patent Rights Fully Reserved)

Single Pulley Drive—4 H.P.—Twelve speeds—Four feeds

It Is Handy

The operator stands at the end of the table. Assume that a new piece has been chucked: He runs the table forward with his right hand at 2¾" per turn of the hand wheel. A dog hits the trip, which automatically disengages the hand movement, and at the same time throws in the power feed. When the piece has been milled, another dog disengages the power feed, and the operator brings the table back by hand, ready to chuck a new piece. *This is quick action. The operator can slam the table forward as fast as he pleases without danger of jamming the work into the cutter.* The trip dog takes care of that, and it can be set so that the work will be close up to the cutter before the power feed engages, thus reducing the power travel of the work to a minimum.

Ask for complete specifications.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI, OHIO, U.S.A.

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

THOMAS A. EDISON INC. KNOWS HACK SAWS

SO thoroughly is the name of Edison associated with the scientific knowledge that comes from exhaustive research and positive proof, it goes without saying that the Edison organization is buying STAR BLADES on facts and not on faith.

If you as a manufacturer lack the Edison research facilities, you can't do better than follow the Edison example and use STAR BLADES.

Remember, it's not the cost of the blades, but the cost of the cuts that counts. The factory that is considering blade efficiency as blade cost or number of cuts or speed of cuts alone is figuring with only part of the facts.

Make a scientific efficiency test on hand or machine blades, that covers all your cost items and you are sure to standardize on

STAR HACK SAW BLADES

Machine and Hand ***Flexible and All Hard***

Star Blades were the first modern blades ever manufactured and the very idea of renewable metal-cutting blades originated in this factory.

Our thirty-year quality supremacy has been maintained at the cost of constant metal-cutting research. Hundreds of thousands of tests have been made to determine exactly what thickness, width and length; what shape and setting of teeth, and what steel composition and tempering would give the best metal-cutting results under all kinds of conditions.

These standards of quality never vary because our blades are manufactured by special automatic machinery to gauges of the finest limits. And this machinery makes possible an enormous quantity production at a minimum of factory cost.

Star Blade quality with all it has meant in the past is higher to-day than ever before. It is an important fact that the standard methods of manufacture used by all the other hack-saw makers were abandoned by us more than twenty years ago for our more efficient methods. The Star line includes blades for every purpose—machine and hand—flexible and all hard.

Whatever metals you are cutting, there is a Star Blade that will give you the greatest cutting efficiency at the smallest cutting cost. Make your own drastic tests to prove this or place the burden of proof on us and we will demonstrate it for you beyond all doubt. Put your cutting problems up to us and we will welcome a chance to help you solve them.

Address Engineering Department, Millers Falls Company, 230 River Street, Millers Falls, Mass.

$500.00 FOR YOUR EXPERIENCE

Our position as authorities on metal sawing efficiency has made us a national clearing house of information on the results blade users are getting under all classes and kinds of conditions. To encourage this clearing house idea, we offer $500.00 in gold for the best articles on "How I Test Hack Saws." Tell us your methods in detail (either on machine or hand blades) and give us your conclusions with absolute truth and frankness, including some of the records of your results. It is not necessary to be a Star user to win a place in this prize award. We want your experience whatever it is. Get your reply in as early as possible. Contest closes November 30th. The best replies will be published in book form and in our advertising

1st Prize	$250.00	3rd Prize	$50.00	5th Prize	$15.00
2nd Prize	100.00	4th Prize	25.00	6th to 11th Prizes	$10.00 each

Manufactured By
CLEMSON BROS.
MIDDLETOWN, NEW YORK

Sole Distributors
MILLERS FALLS CO.
MILLERS FALLS, MASS.

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.

Which Equipment Do You Need?

WHEN the Dumore Portable Grinder first came on the market a few years ago, hardly anybody would believe us when we said it made 30,000 R.P.M. "It can't be done," they said—until we took the little grinder right out in the shop and proved that it could and that it turned out work with the finest degree of accuracy.

Now the Dumore is being used in thousands of manufacturing plants and machine shops, grinding tools, gages, dies and similar work. And the same men who once said this high speed was not practical, now say they can't get along without the Dumore.

Three types of equipment are shown below. All armatures are dynamically balanced. All types are equipped with S K F Ball Bearings and the well-known Dumore Universal Motor, operating on either direct or alternating current.

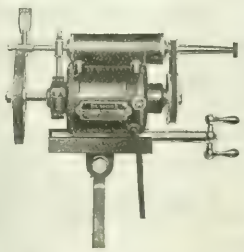
Which equipment do you need?

Let us send you a Dumore Grinder on approval. Be sure to state your voltage. Literature on request.

WISCONSIN ELECTRIC COMPANY
1714 Dumore Building
RACINE, WIS.

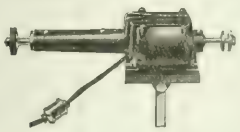
Sold in England by Canadian-American Machinery Co., Ltd.
8 Bouverie Street
London, E.C.
England

DUMORE PORTABLE ELECTRIC GRINDERS



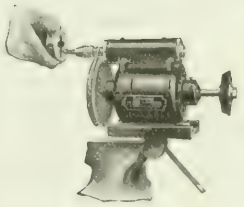
EQUIPMENT A
For General Tool Room Use

Includes High Speed Internal Spindle A, reach, 3", speed, 30,000 R.P.M., motor spindle speed, 10,000 R.P.M. Set of seven wheels, 3/8", 7/16", 9/16", 11/16", 13/16" (for internal work), 2½" and 4" (for external work). Six rubber belts. Cutter grinder rest. Cross feed lever. Cord and plug. Hardwood carrying case. Net weight, 17 lbs. Shipping weight, 30 lbs.



EQUIPMENT B
For Deep Internal Work

Includes Extension Arm B; reach, 10", speed, 10,000 R.P.M. The Extension Arm B is interchangeable with Internal Spindle shown in Equipment A. Two elastic wheels, 2½" and 4". Cutter grinder rest. Cross Feed lever. Cord and plug. Hardwood carrying case. Net weight, 19 lbs. Shipping weight, 32 lbs.

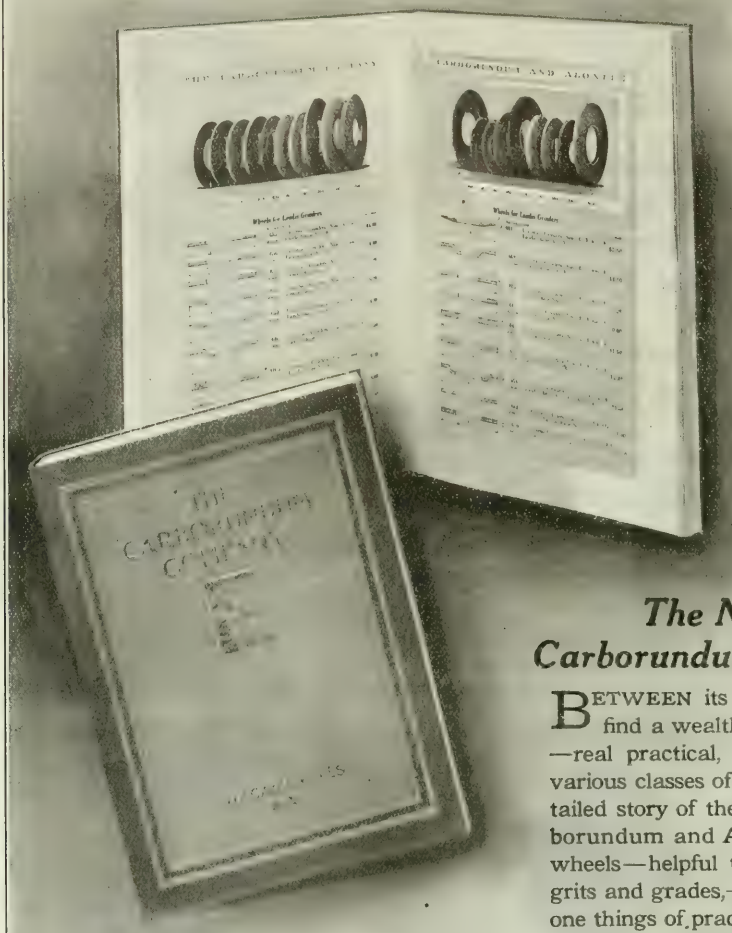


EQUIPMENT C
Button Die Grinder 50,000 R.P.M.

Grinder complete with special spindle and chuck for grinding button dies. Speed, 50,000 R.P.M. This special spindle can be furnished to manufacturers who already have Equipment A or B.

Outfit also includes: 3/8" rd emery pencil, 2½" and 4" elastic wheels. Cutter grinder rest. Cross feed lever. Cord and plug packed in substantial carrying case. Net weight 17 lbs. shipping weight, 30 lbs.

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



Just Off the Press

The New Carborundum Catalog

BETWEEN its covers you will find a wealth of information—real practical, helpful, data on various classes of grinding—a detailed story of the making of Carborundum and Aloxite grinding wheels—helpful tables on speeds, grits and grades,—a hundred and one things of practical value to all wheel users—and the book shows

A Working Drawing and a Photographic Reproduction of Every Shape and Size Wheel Used on all Standard Machines

At the top of each page is a photographic reproduction of the wheels—below is a detailed cross section drawing showing every dimension—as readable as a blue print. It is a simple, practical, entirely new method. The Carborundum Catalog should be in every plant where grinding wheels are used.

A handy miniature copy for shop use can be had upon request.

THE CARBORUNDUM COMPANY

NIAGARA FALLS, N. Y.

NEW YORK CHICAGO PHILADELPHIA CLEVELAND CINCINNATI BOSTON
PITTSBURGH MILWAUKEE GRAND RAPIDS

HINTS TO BUYERS

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

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

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.
St. Lawrence Welding Co., Montreal, 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
Standard Machy. & Supplies, Ltd., Montreal, Que.

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

BENCH LEGS, STEEL
New Britain Mach. Co., New Britain, Conn.

BENCH DRAWERS, FRICTIONLESS
New Britain Mach. Co., New Brita'n, Conn.

BENDING MACHINERY
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
H. W. Petrie, Toronto
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
Can. Blower & Forge Co., Kitchener, Ont.
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
L'Air Liquide Society, Montreal, Toronto
Prest-O-Lite Co., Inc., Toronto, Ont.

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

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

BOILERS
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.

BORING MACHINES, PNEUMATIC CYLINDER
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.

BORING MACHINES, UPRIGHT AND HORIZONTAL
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

BUBBLERS
Pure Sanitary Dk'g Fountain Co., Haydenville, Mass.

BUFFING AND POLISHING MACHINERY
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.

BULLDOZERS
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. & Machine Co., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Oven Equipment & Mfg. Co., New Haven, Conn.

BURRING REAMERS
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.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Can.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
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.

CAR MOVERS
Dillon Mfg. Co., Oshawa, Ont.

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

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER
Cumming & Son, J. W., New Glasgow, Canada.
Alexander Fleck, Ltd., Ottawa.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, GRAY IRON
Bernard Industrial Co., The A., Fortierville, Que.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Steel Foundries, Ltd., Montreal, Que.
Alexander Fleck, Ltd., Ottawa.
Gardner, Robt., & Son, Montreal.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound.
Plessisville Foundry Co., Plessisville, Que.
Sheldons, Limited, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Can. Steel Foundries, Ltd., Montreal, Que.
Dominion Steel Foundry Co., Ltd., Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Wm. Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, MALLEABLE
Can. Steel Foundries, Ltd., Montreal, Que.
Cumming & Son, J. W., New Glasgow, Canada.

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull, Que.

CEMENT MACHINERY
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.
H. W. Petrie, Toronto.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
John Bertram & Sons Co., Dundas.
Gardner, Robt., & Son, Montreal.
Hurlbut, Rogers Mach. Co., South Sudbury, Mass.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co. of Canada, Galt, Ont

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
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
Aikenhead Hardware Co., Toronto, Ont.
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.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Skinner Chuck Co., New Britain, Conn.
Thomas Elevator Co., Chicago, Ill.
D. E. Whiton Machine Co., New London, Conn.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
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, 523 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 & Oplg. 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 & Oplg. 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, Walkerille.

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.

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

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.
Murphey 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 Fulley 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 Fulley Machy. Co., Cincinnati, Ohio.
Dominion Machy. Co., Toronto, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
D. McKenzie Machinery Co., Guelph, Ont.
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 Fulley 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, 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
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Millers Falls Co., Millers Falls, Mass.
Morse Twist Drill & 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.
H. W. Petrie, Toronto.
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.

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, STEEL
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. Elwes 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.
Gardner, 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.
GRINDERS, AUTOMATIC KNIFE
W. H. Banfield & Son, Toronto.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Blake & Johnson Co., Waterbury, Conn.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Canada Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
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.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.
GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Norton Grinding Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilmarth & Morman, Grand Rapids, Mich.
GRINDERS, DIE AND CHASER
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
GRINDERS, DRILL
Aikenhead Hardware Co., Toronto, Ont.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
United States Electrical Tool Co., Cincinnati, O.
Wilmarth & Morman, Grand Rapids, Mich.
GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.
R. E. T. Pringle, Ltd., Toronto, Ont.
Rivett Lathe & Grinder Co., Brighton, Mass.
GRINDERS, NAIL DIE
GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
GRINDERS, PORTABLE, ELECTRIC, HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Bond Hanger & Cplg. Co., Alexandria, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
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.
GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blake & Johnson Co., Waterbury, Conn.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
National-Acme Co., Cleveland, Ohio.
H. W. Petrie, Ltd., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.
Wing & Son, J. E., Hamilton, Ont.
GRINDERS, UNIVERSAL, PLAIN
Fitchburg Grinding Machine Co., Fitchburg, Mass.
Modern Tool Co., Erie, Pa.
Wilmarth & Morman, Grand Rapids, Mich.
GRINDERS, VERTICAL SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
H. E. Streeter, 623 New Birks Bldg., Montreal, Que.
Wilmarth & Morman, Grand Rapids, Mich.
Wing & Son, J. E., Hamilton, Ont.
GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Niles-Bement-Pond Co., New York.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.
Stow Mfg. Co., Binghampton, N.Y.
GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. R. K. Morton, Toronto, Montreal.
Carborundum Co., Niagara Falls.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Francis & Co., Hartford, Conn.
Norton Co., Worcester, Mass.
H. W. Petrie, Toronto.
GUARDS, WINDOW AND MACHINE
Canada Wire & Iron Goods Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
New Britain Mach. Co., New Britain, Conn.
Stow Mfg. Co., Binghampton, N.Y.
HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Ford-Smith Machine Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Millers Falls Co., Millers Falls, Mass.
Osborn (Canada, Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Ltd., Montreal.
Racine Tool & Machine Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Victor Saw Works, Ltd., Hamilton, Canada.
Zenith Coal & Steel Products, Montreal, Que.
HACK SAW FRAMES
Aikenhead Hardware Co., Toronto, Ont.
Garvin Machine Co., New York City.
Millers Falls Co., Millers Falls, Mass.
HAMMERS, AIR
Erie Foundry Co., Erie, Pa.
HAMMERS, DROP AND BELT-DRIVEN
Beaudry & Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canadian Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
Erie Foundry Co., Erie, Pa.
High Speed Hammer Co., Rochester, N.Y.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Plessisville Foundry Co., Plessisville, Que.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Ideal Tire Setter Co., Rochester, N.Y.
HAMMERS, POWER
Beaudry & Co., Boston, Mass.
Erie Foundry Co., Erie, Pa.
United Hammer Co., Boston, Mass.
HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
R. E. T. Pringle, Ltd., Toronto, Ont.
HAMMERS, MARKING
Matthews, Jas. H. & Co., Pittsburgh, Pa.

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

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

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

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

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

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

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

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

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

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

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

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
London Bolt & Hinge Works, London, Ont.

HOBS
Illinois Tool Works, Chicago, Ill.
Oskamp (Canada), Ltd., Sam'l, Montreal, Que.

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

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

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

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

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

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

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

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

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

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

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

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

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

JACKS, PNEUMATIC
Northen Crane Works, Walkerville.

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

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

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

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

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

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

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

LABORATORIES, INSPECTION AND TESTING (SEE CHEMISTS)

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

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

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

LAMPS, TUNGSTEN (Vacuum and Gas Filled)
Can. Ingersoll-Rand Co., Toronto, Ont.

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

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

LATHE CHUCKS (SEE CHUCKS)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.

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

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

MACHINERY GUARDS (SEE GUARDS)

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

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

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

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

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

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

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

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

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

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.

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

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

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

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence.
John Bertram & Sons Co., Dundas.
Cleveland Milling Machine Co., Cleveland, Ohio.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Ltd., Montreal.
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.
St. Lawrence Welding Co., Montreal, Que.
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 ALSO 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
Butterfield & 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. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Charles F. Elmes Eng. Works, Chicago.
Can. Fairbanks-Morse Co., Montreal.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Petrie 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.

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., Bridgeton, 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. B. Jardine & Co., Hespeler, Ont.
Mulliner-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. B. 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, Ont.
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, 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., Ltd., Hamilton, Canada
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Ferrachute Machine Co., Bridgeton, N.J.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York
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
Baird 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 Mach. Co., Ltd., Sherbrooke, Que.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., W. R., Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Banfield, Edwin J., Toronto.
Banfield, W. H., & Sons, Toronto.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Can. Fairbanks-Morse Co., Montreal.
Charles P. 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 Machine 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.
McClean & Son, F. W., 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. Steele, Ltd., Guelph, Ont.

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

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

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

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

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

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

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

STAMPINGS
Dillon Mfg. Co., Oshawa, Ont.
Dom. Forge & Stamping Co., Walkerville, Ont.
Homer & Wilson, Hamilton, Ont.

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Hawkridge Bros. Co., Boston, Mass.
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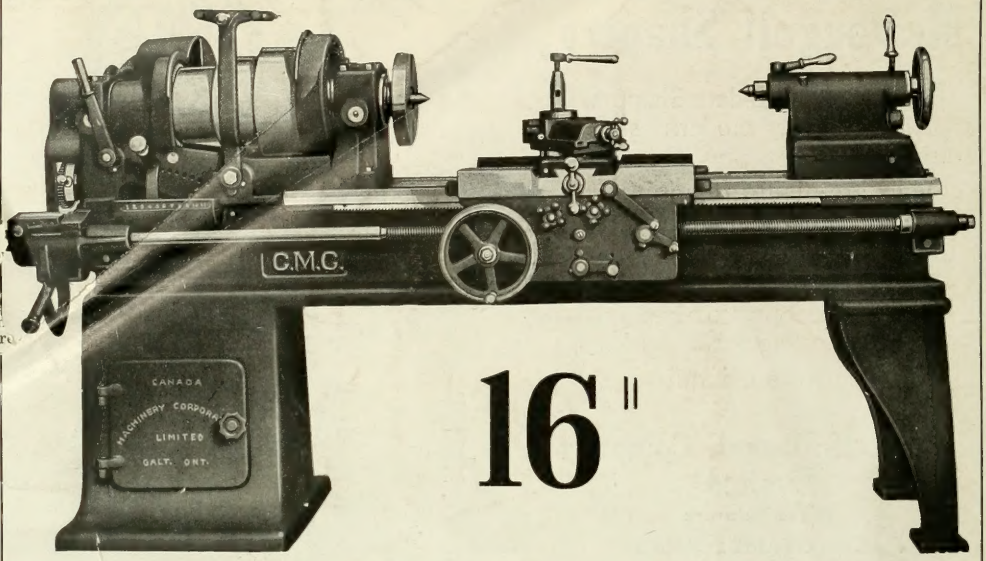

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