CANADIAN MACHINERY AND MANUFACTURING NEWS

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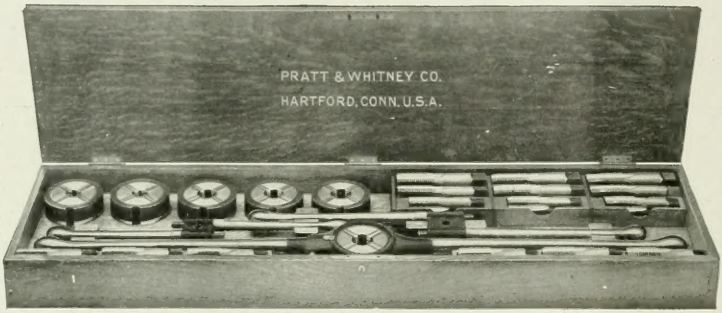
SMALL TOOLS



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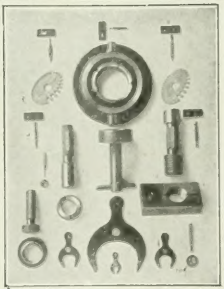

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The Publisher's Page

TORONTO August 23, 1917

On Personal Service

WE cannot all wear uniforms and go overseas to fight with the gallant fellows who have voluntarily sacrificed so much for the sake of freedom and civilization.

We cannot all be soldiers, but we all can be servers. A crisis stares us in the face, clearly discernible in the mists of the future, receding day by day, it is true, but ever present—ever threatening. There is a need for individual response to the call for greater service. We who are not in khaki are apt to feel that after all the efforts of a single individual will not affect the world situation in the slightest. It is this attitude of mind in the individual that retards the progress of the whole. Let us first realize this and the seriousness of it and then go to it with a vigor and a will!

The force of example is strong, and just as our failure to render the very best that is in us has influenced others in hanging back, so will our response to the call for greater service result in speeding up others who look to us for guidance and advice.

The effect of greater individual effort will be tremendous. Let us practise it and preach it, and practise it more than we preach it.

Greater efficiency on the part of the individual will not only help the allied cause, but it will help the individual. We plead for not only greater effort but for effort better directed, and to this end recommend an even closer study of CANADIAN MACHINERY and other technical journals, because they make for greater efficiency and better workmanship, and more of it. We would suggest that each copy of CANADIAN MACHINERY be passed on to mechanics who are not already subscribers, first marking any special articles and items of interest. Do everything you can to encourage study on the part of the carefree and careless. The time may come when they will have occasion to be less indifferent as regards their efficiency; the seriousness of the present situation demands that they be made to shake off this indifference **now.** Pass the good word along. Make CANADIAN MACHINERY 100% efficient by bringing to the attention of the greatest possible number the valuable information it contains.

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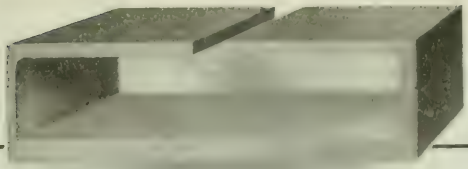
Let us forget petty selfishness when so great sacrifices are being made. Let us sink individual concerns and pool our interests for the common good. Let us really live and work with the fulness which brings satisfaction and which leaves no regrets or room for reproach. Let us serve, and serve with sacrifice.

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



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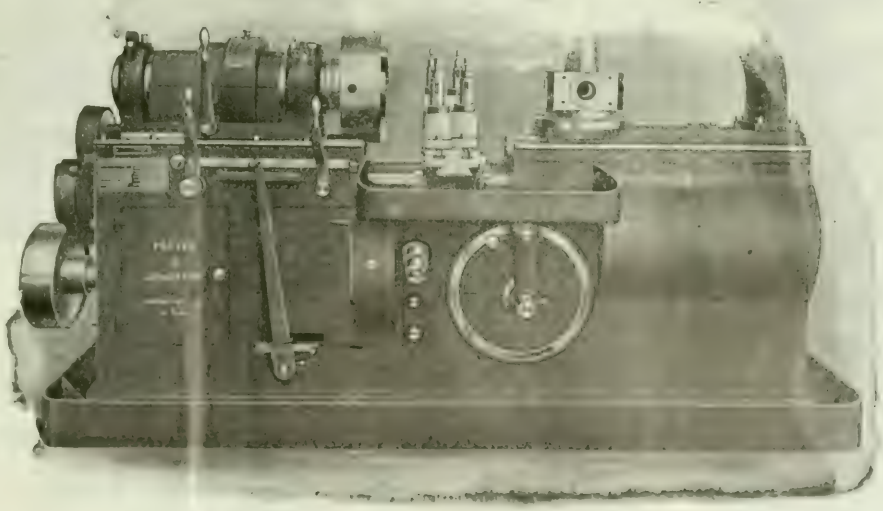

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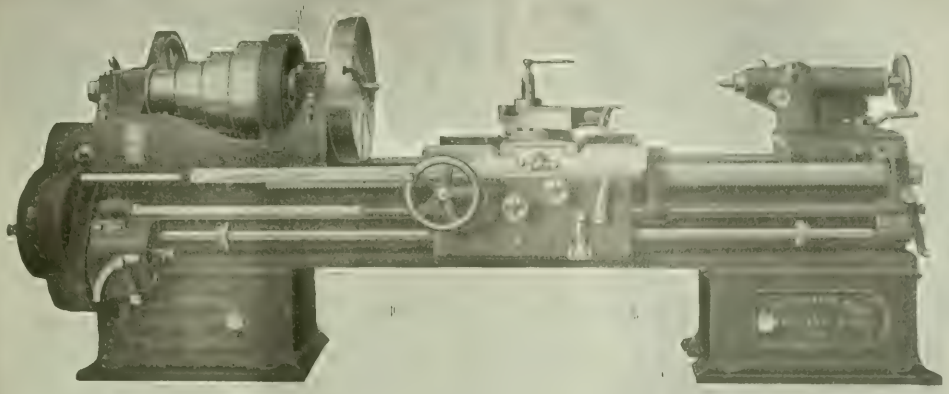

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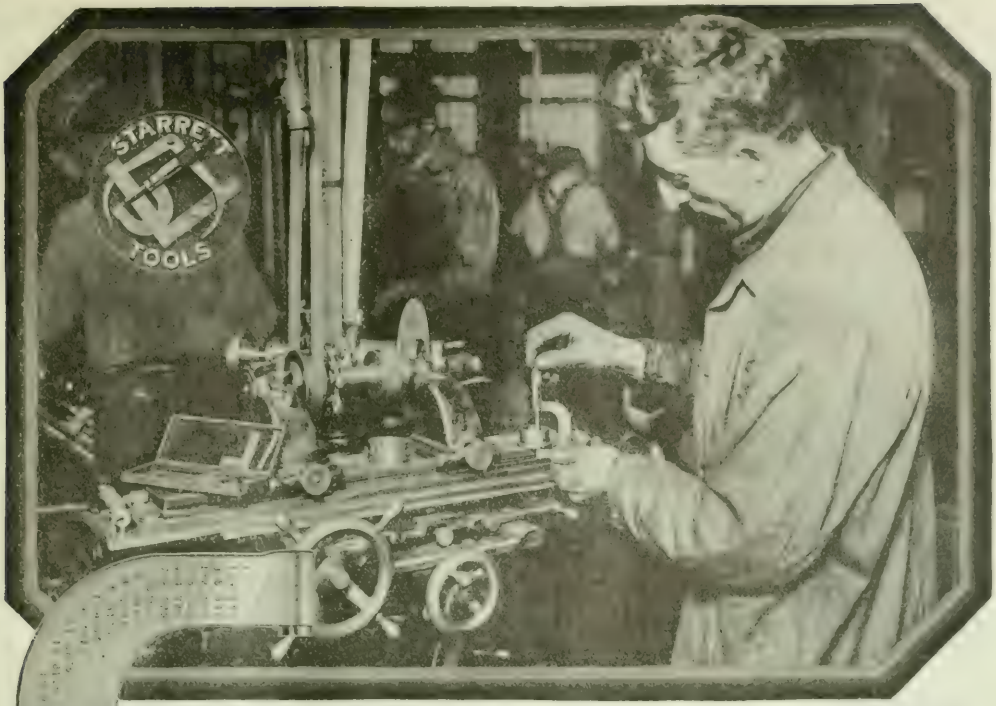

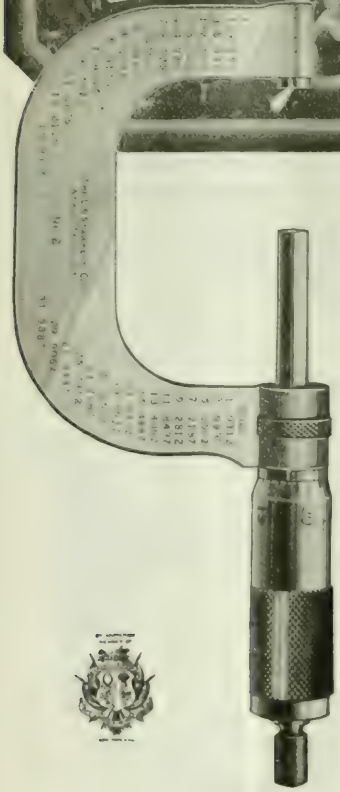

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Brief Historical Sketch of Steam Boilermaking in Canada

By D. M. Medcalf *

The development taking place in our shipbuilding industry, more particularly that of steel construction, and the intimate relationship that exists between it and steam boiler building, make a retrospect of the associated crafts' achievement in Canada peculiarly opportune and interesting meantime. The article embodies the substance of an address delivered before the American Boilermakers' Association at their recent Annual Convention.

WHEN choosing this subject, I hoped to be able to obtain some assistance from the compilations of historians who have linked together the memories of past and present industries in Canada, but have been disappointed because they have overlooked the existence of the black squad who toiled in an unpretentious way, building steam boilers for our early industries. These horny-handed sons of toil appear to have passed away unhonoured and unsung, and their memories have been almost forgotten, save by a few of our old boilermakers and engineers. I have, therefore, decided that, rather than go into the details of construction in this paper, to treat the subject more in a general way.

Doubtless, the first boilermakers in Canada were located around the eastern seaboard. In the early part of the eighteenth century, settlements clung close to river, lake and sea, and the St. Lawrence, the St. John, and their tributaries, besides other lesser rivers, provided inevitably the points of settlement and the lines of travel. The development of water transport in Canada is interesting and furnishes a record of need, invention and enterprise, and not the least among these was the advent of commercially successful steam navigation.

Advent of Steam Navigation

First came the bark canoe, large enough to hold a few voyagers and peltry, and for a long time it held its place for the far journeys. For shorter travels, the canoe was superseded by the larger, but clumsier, bateau. In later years, the increase in river freight led to the introduction of the still larger Durham boats, whilst along the coast and on the great lakes the sailing schooner long filled a notable place. Finally the steamboat came in 1839. Only one year after the Clermont had begun its regular trips on the Hudson, there was built at Montreal the forty-ton steamer Accommodation, and seven years later the Frontenac, of about seven hundred and forty tons displacement, was launched.

It is noteworthy that the first steamship to cross the Atlantic without auxiliary aid was built in Montreal. This vessel was called the Royal William, and left Canada on the 5th August, 1833, for London, and arrived there about one month later. Our early Canadian boilermakers were, therefore, amongst those pioneers who not only developed water transport in Canada, but inaugurated ocean steam navigation. Marine boilers at that period were built rectangular in form of the marine flue type, carrying from 10 to 20 lbs. pressure. Boilers of this type, with certain modifications in design, were in vogue for a considerable time, and gradually developed into the Scotch marine type, with which we are all familiar. The development of these boilers was, of course, due to the efforts of Scotch engineers on the Clyde.

Boiler Types

With regard to the manufacture of boilers in Canada, around 1850, there were quite a few of the old pioneers engaged in this work. A list of names would perhaps be of little interest now,

D. M. MEDCALF.

but I mention the following firms who are still extant:—

E. Leonard & Sons, London, Ont., established 1839.

Waterous Engine Works Co., Brantford, Ont., established 1840.

John Inglis Co., Toronto, Ont., established 1859.

John McDougall, Caledonian Iron Works, Montreal, established 1858.

Goldie & McCulloch Co., Galt, Ont., established 1844.

Besides these, there was a large number of thriving little boiler businesses, long since petered out, like the Dicky Neal and John Perkins boiler works of Toronto, Joseph Hall, Oshawa, etc.

Pioneers in the Craft

In those early days, that is, sixty or seventy years ago, the types of boilers generally in use were externally fired with three to five flues, 8 to 10-in. diameter. There has been little development in this type of boiler, and the H. R. T. in use to-day is typical of the boiler used then. The diameter of these boilers seldom exceeded 54 inches, but what they lacked in girth, they made up in length, as twenty to twenty-five feet was no uncommon stretch for those old stagers. The seams were all of single-riveted, lap construction, and the plates ranged in thickness from ¼ in. to ⅜ in. The shell rings and also the tube rings were telescoped one into the other, like stove piping. They were very strong on domes at that time, and I believe a boilermaker then did not think he was building a boiler at all, unless he had a huge dome on the outfit. Most of these early domes were cast iron, and some of our manufacturers adhered to this style of dome until as late as 1890, in which connection I venture to say a good many explosions have resulted from these castings fracturing, two accidents of recent date coming under my own personal notice.

Materials of Construction

With the exception of the domes of some of these boilers, wrought iron was the material almost exclusively used in their construction. The brands of iron were Lowmoor, Yorkshire, Bowling, Thornycroft, etc., all imported from the British Isles. As a rule, the plates were short and measured about 4 ft. 6 in. square. These sheets were soft and ductile, but blisters or laminations were not infrequently met with, which caused considerable loss and inconvenience. Another imperfection was that of spongey parts, generally due to imperfect puddling, but, notwithstanding these defects, the old iron boilers gave good service, and we have many still in service, after thirty or forty years of general wear and tear. The majority of the boilers then were used in saw mills and flour mills, and were often employed to augment the power of a water wheel. The steam pressures carried were low, and forty to fifty pounds was looked upon as very high pressure indeed. Fuel was cheap, as wood was plentiful, and coal was scarce and seldom used, except by the blacksmith in the smithy fire, and the manner in his tools.

Our plate rolls were originally made of wood and were operated by hand. This, of course, was only made possible by the size and thickness of the sheets

*Chief Inspector of Steam Boilers, Province of Ontario.

used at that time. Punching was done by hand with a screw or bear punch, and sometimes as many as four men were employed at a time to pull on the punch lever. All holes were punched full size, and those that did not come fair enough were usually persuaded into alignment by the gentle assistance of drifts and sledges. Sometimes a taper reamer was used, but this was the exception, rather than the rule, and any holes which could not be reached with the punch were cut with a round-nosed chisel. The head plates were flanged with large wooden mauls over cast iron flange blocks of the required size. It was customary to make the heads a little undersize, so that they could be drawn out gradually to the exact diameter.

Heads were dished in a very crude manner by digging a hole in the ground, somewhat resembling the desired curvature of the head. The circular plate was then heated and beaten down into this hole with wooden mallets, the finishing process being accomplished by flatteners and sledge hammers. It sometimes happened in the case of heads dished to a deep camber that the work could not be done in this way, and a large cast-iron ball was often used to advantage. This ball was hoisted a certain distance, then dropped on the red-hot plate in much the same way as a pile driver.

These—what now appear to us—crude methods of the early boilermakers have undergone a vast change in the last fifty years. The up-to-date machinery now in use for every branch of this industry has almost entirely superseded hand work, and there is just reason to be proud of the modern steam boiler which our manufacturers are turning out today in large quantities. We must not, however, despise the useful work of our predecessors, for they built many good boilers in those good old days.

Boiler Inspection Feature

We have a large number of boilers in Ontario that were constructed before the present Act governing the construction of boilers came into force and took effect, which were built in a thorough workmanlike manner. We also have some that are not so good, and they were not all built in Canada, but since the enactment of the present law, we are quite satisfied that better boilers are now being turned out, and the purchaser is safeguarded as far as workmanship and material is concerned.

No matter how rigid the inspection, it is not a guarantee that the boiler will not explode, because it largely depends upon the care and attention the unit receives when in operation, how long it will remain in useful service. Quite recently, I was requested to make a personal examination of two 66 in. x 16 ft. H. R. T. boilers that had been seriously damaged. The boilers referred to were built from an approved design and inspected during construction; the shell plates were fabricated by one of the largest plate manufacturers in the United States, and were carefully examined before any work had commenced, the heat numbers and tensile strength recorded and passed as being suitable for a steam boiler. The workmanship was also examined during the entire construction, and upon completion, the boiler was passed, and certificates issued in the regular way. After these boilers had been in service six months, they each developed bags on the sheets directly over the fire, extending four inches down, three feet wide and five feet long, and on account of their being practically new, the owner claimed that the cause was poor material and workmanship, and I personally acted as a referee in the settlement.

When I visited the plant, and when trying to squeeze into the regulation inspector's outfit—which is now too small for me—I requested the owners to have the manhead under the tubes removed. The manhole in top of shell was open and ready for the inspector. Immediately the light was flashed on the interior of the boiler, it was quite apparent what caused the trouble. The water that lay in the depression was covered with black spots, and the tubes and shell, as far as could be seen, were coated with oil.

It was at first a difficult matter to convince the owners that oil had caused the trouble; it was a new plant, and oil they claimed could not get into the boiler because they had installed an expensive oil separator in the exhaust line from the feed pump, which was the only steam line returning its condensation to the boilers. A further examination was made by disconnecting the oil separator, which was found quite clean, but beyond the outlet a full handful of grease was collected and shown to them, with the result that they were quite satisfied that they themselves were to blame, and not the poor manufacturer, who made the boilers to comply fully with the requirements of the Province of Ontario. The necessary repairs cost about $2,500 and considerable inconvenience to the operation of the plant.

I could cite a number of cases very similar to this one, but believe there is "nuf sed," and my object in mentioning this fact is because frequently when trouble develops, and the cause of same is not known, it is blamed on the rotten old boiler made by so and so, who is really blameless.

War Effect on Canadian Boiler Making.

Now, in regard to the effect of the war on the boiler-making industry in Canada, I might say that its penetrating influence has affected almost every industry we possess, either directly or indirectly, and the most seriously swayed of these have been engineering and allied trades. Almost since the beginning of the war, or, to be correct, since the Governments of the Allies began to place orders abroad for the supply of munitions, most of our boiler shops have been partly converted into munitions factories, whilst our machine shops are similarly engaged, running night and day.

Besides making shells, however, our boiler shops are turning out boilers in fairly large numbers, not only for domestic use, but for export trade, chiefly to the Allies, and we have orders for many more which cannot be supplied by reason of our inability to obtain the necessary material. It is true, therefore, that the war has increased the output of our boiler works, and it is also true that the war is retarding that output, owing to the scarcity of steel, or, to be correct, owing to this merchandise finding a more ready outlet in another channel; a large number of the mills, I believe, who are working on metals have sold their full production one year in advance for war purposes.

Dearth and Cost of Steel

The dearth of steel, however, is not the only obstacle. The price of steel, as you all know, has been going up with leaps and bounds since the war began. Labour conditions are also very bad, and good boiler makers to-day cannot be had in anything like sufficient numbers to cope with the increase in business. From the beginnig of 1915 to the present time, but more especially in 1915 and 1916, a large number of munition factories and like industries, which were urgently required to meet the existing crisis suddenly sprung into being, and consequently more boilers were required. Our manufacturers having only their usual stock of plates and tubes on hand were very soon unable to supply the goods until more material was forthcoming, and this occasioned much delay. Those factories, therefore, which urgently required boilers turned their attention to the second-hand market, and used boilers were largely sought after. Old boilers of all descriptions were painted up and offered for sale as good boilers, and, needless to say, many were condemned by our department. These scrap boilers have in turn found their way to the furnaces to be melted into shell billets, and latterly shipped to Germany via France. Perhaps a part of one of our old boilers, after undergoing this transformation, may yet find a resting place in the Kaiser or the Crown Prince.

The demand of late has not been so much for stationary boilers, as for marine boilers, and our manufacturers are harder pressed now than ever for steel plates and tubes, and, although they are turning out a lot of work, the demand by far exceeds the supply. If we only had steel plate mills of our own in Ontario, it would have been of great assistance at this period, but unfortunately we are not sufficiently advanced along those lines, and have to depend entirely on imported material.

—⚙—

Instead of Babbit Metals.—As a substitute for babbit metals an inventor proposes to use mixtures of metallic sulphides in widely varying proportions. He considers that the sulphides of copper, lead, tin and antimony make good babbitt substitutes. Metallic sodium is used to improve their casting properties.

—⚙—

It is not commercially possible to burn more than 99 per cent. of bituminous coal fed to the furnace.

PRODUCTION METHODS AND DEVICES

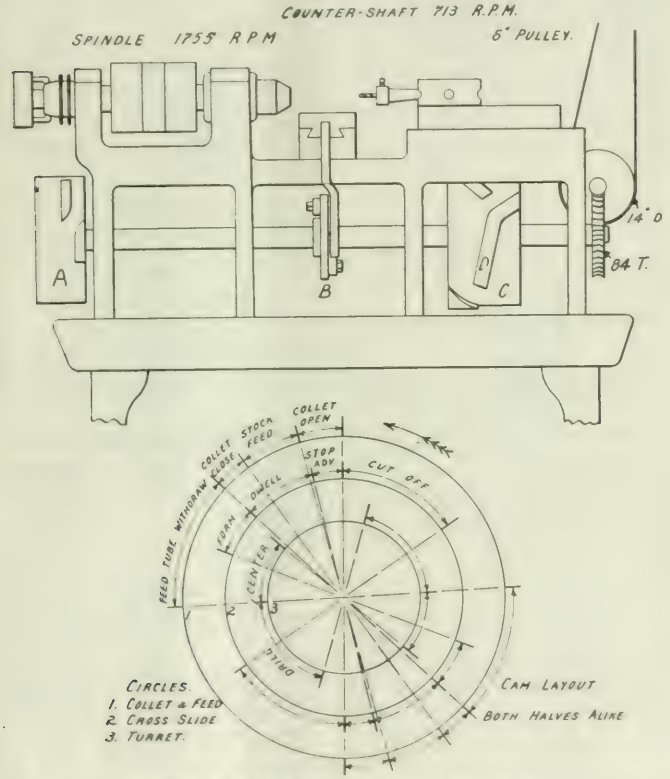
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

AUTOMATIC SCREW MACHINE LAYOUTS

By D. A. Hampson

THE automatic screw machine is found in so few shops outside of the manufacturing centres that men familiar with them are in the great minority. In times like the present, when vast quantities of turned parts are required in a hurry, the automatic screw machine is a most important tool for the production of small parts, such as small arms ammunition components, and other similar equipment. The demand for operators and set-up men has exceeded the visible supply, and, as usual, manufacturers have turned to the country towns for workmen, but this time they found there were practically no men available with screw machine experience—in fact, a goodly proportion of both country and city mechanics had never even seen the machine at all. It, therefore, became a problem of training men, and in this, as always, the man with education gets ahead faster than his brother who has passed up the opportunities so frequent to-day; the most convenient of which is the trade paper.

Given a shop training on the common machine tools, any man should master the operation of automatic screw machines in a short time. That doesn't mean that he would become an expert, but he should be able to handle any plain work and do simple setting up. A person, quick to learn, who has been simply a machine hand should likewise make rapid progress. The automatic screw machine, in its plainest form, is shown by the drawing: with the exception of the Brown & Sharpe, all the principal makes embody the same principles—single cam shaft carrying drums upon which are fastened the cams for operating and closing the collet, feeding the stock, operating the cross slide, feeding and rotating the turret. Threading involves another movement not to be considered here. Study will reveal that the more complicated looking machines are made so by the addition of more spindles and their indexing devices, feed change gearing, and threading and other attachments, but that the operating principles are the same as in our simple machine.



AUTOMATIC SCREW MACHINE LAYOUT FEATURES

Even though it may not be a part of his work to design cam layouts, the ambitious man will find it to his advantage to make a study of them. Normally the cam shaft makes one complete revolution for every piece made. Thus, if that revolution were plotted as a circle, every movement produced by the cams can be located exactly. But as cams on different drums are in action at the same time, the circle becomes crowded and the arrangement shown by the drawing gives more room.

With this layout, each drum has a circle of its own. It is possible by laying out a diameter at any point to tell just what each drum is doing at that time. The outer circle is the drum for the spindle mechanicism, the middle one for the cross slide tools, and the inner one for the turret. The larger the scale used in laying out, the easier the work can be done. The cams on the spindle drum (the drum A in the drawing) always are set close together, so the time spent in opening and closing the collet and feeding the stock—non-working movements—will be as little as possible.

Double Feed

Regardless of the number of holes in the turret, there are often one or more idle ones. When the work can be arranged so but half the turret holes are occupied, it is possible to double the production from the machine by "double feeding," that is, feeding twice for every revolution of the cam shaft and having the otherwise idle turret holes carry another set of tools. The layout shown is for such a job.

The piece to be made on the machine has to be drilled, corners rounded, and cut off, but, owing to conditions of accuracy, a centering tool has to be used, and this is put in one turret hole. The corners are rounded by the back tool on the cross slide and the cross slide carries, besides the tool, a stop to feed the bar of stock against. This combination can be traced on the middle circle, which shows that the cross slide advances, waits for the stock to feed (dwell), and then further advances to round corner (form). The movements for each piece are the same, and consequently both halves of the layout are alike.

An example of the help that a man gets from a working knowledge of [illegible] arithmetic, as applied to shop problems —applications such as appeared in the instruction articles in this journal, may be found in the screw machine job under consideration. A cam (D) is on hand,

and it is desired to know if it is suitable for use in feeding the drill. The drill is a small one, and it is known that it will not stand a feed of over .004 in. per revolution of the stock. Whether or not this is too fast is the question. Of course, it is possible to put it on the machine and try it, but the machine has to be set up to try it and if then the drill breaks, it is not known positively that the cam is the cause of it. All this takes time, and is an uncertain, slow, way of doing. Ten minutes spent in collecting the data required—if it is not already known—and in making the computations, will give a definite answer without any experimenting.

In this particular case, the data obtained by measuring and counting have been put on the drawing. Also it was noted that the cam gave an advance of 7-16 in. in one quarter of a revolution. Figuring speeds we get—

Cam shaft makes 3.63 r.p.m.—1 rev. in 16 sec.

Cam advances 7-16 in. in ¼ of above, or 4 sec.

Spindle makes 117 rev. in 4 sec.

Then the feed per rev. of stock is .437 in.

$\frac{}{117} = .0037$ in., which is well inside our limit.

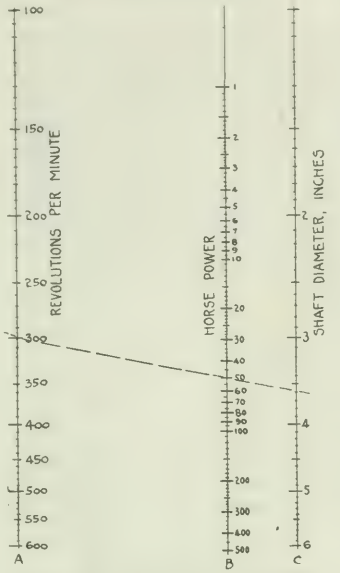
The layout of the cam circles is most readily done by calculating the movements in degrees. This is done directly on new work: for existing cams, they are measured in inches around the drum and this reduced to degrees by making it a proportion of the whole circumference—the value in degrees being used in plotting.

SHAFT DIAMETERS OF HIGH SPEED ENGINES.

By N. G. Near.

A RATHER peculiar thing about steam engines is the varying designs and sizes adopted by the different manufacturers. One manufacturer will use a 3½ inch shaft for a 50 h.p. engine running 300 r.p.m., whereas another manufacturer will use a 4 inch shaft at the same speed. There is no good reason why there should be this difference in size, aside from the fact that one might prefer to use a greater factor of safety than the other. Since the cost of an engine is proportional to the weight, it is evident that the engine having the larger shaft is liable to weigh more than the engine having the lighter shaft and as a result the maker of the light engine can undersell the maker of the other. Inasmuch as both these engines give good dependable service when in actual use, however, it is difficult to tell which engine is "best." Perhaps the heavier engine will last longer, and perhaps not, in spite of its higher cost.

O. N. Trooien of the University of Wisconsin has studied steam engine design pretty thoroughly and has tabulated most of the common dimensions used in current steam engine design. Based on these tabulations he has developed curves or formulas which represent the average practice. It is allowable for us to use curves and formulas of this kind because we can rest assured that they



HIGH-SPEED ENGINE SHAFT DIAMETER CHART.

will "work." They will give us engines and parts of engines that will be heavier than the lightest, and lighter than the heaviest. Mr. Trooien's study covered the best known engines only—not those that give trouble or are doomed to failure. As a result of this investigation, an "average" formula was developed for the shaft diameter of high speed centre crank engines. This is the formula:

$$d = 6.6 \sqrt[3]{(h.p. \div N)}$$

where d = diameter of the shaft in in.
h.p.=the horse power of the engine
N=the revolutions per min. on the shaft.

Based on this formula, I have developed the chart herewith which will be found handy for determining any shaft diameter for any ordinary high speed engine. All that is necessary is to lay a straight-edge across as indicated by the dotted line drawn across the chart and the intersection with the "unknown column" gives the desired result. For example: What should be the diameter of a shaft for a 50 h.p. engine whose speed is 300 r.p.m.?

Connect the 300 (column A), with the 50 (column B), and continue the line until it cuts column C. The intersection with column C shows that the shaft diameter should be 3.6 inches. Should it be desired to make the diameter larger, of course, that could be done, at the same time, it would not be good policy to make the diameter smaller.

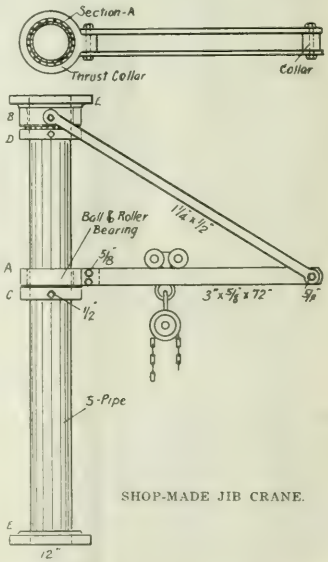
The chart will also be found useful for determining the safe load that can be imposed on your engine. Let us suppose, for instance, that the shaft in your engine is larger than necessary for carrying normal load, and this you can easily find out by using this chart. Thus if your shaft diameter is 3.6 inches, whereas it should be only 3 inches according to this chart, it is evident that little danger will result from increasing the pressure on the piston as far as the shaft itself is concerned. To be sure the other parts of the engine must be considered also before increasing the pressure or endeavoring to make a high-powered engine of it. One must be careful of the piston rod, the keys, the cylinder walls themselves, the head and crank end of the cylinder, etc. Every part that will be subjected to a greater stress must be given a proper examination and reckoning.

The range of this chart, it will be noted, is wide enough to care for almost any high speed engine, delivering all the way from 1 to 500 h.p. and covering all speeds from 100 to 600 r.p.m. It is very seldom that we see an engine with a shaft smaller than 1 inch or larger than 6 inches, and that is why, altogether, the chart can be considered complete and should be handy to keep on tap by engineers, students, designers, etc.

A SHOP MADE JIB-CRANE

By J. E. Cooley

IN the accompanying sketch is shown a shop made jib-crane. It was made for the purpose for handling work such as



SHOP-MADE JIB CRANE.

frames, beds, and other heavy castings on a milling machine, and was placed in the floor space center of four large milling machines facing each other, so that

for the different milling operations on a piece, the work could be swung on the crane and transferred from one machine to another without the aid of a helper.

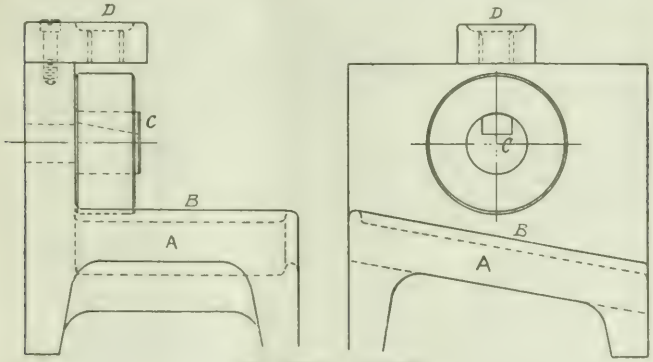
The column is made from 5-inch pipe, fastened to the floor and ceiling by flanges E, which are tight fitting in the pipe. Two thrust collars A, and B, are bored out to take roller bearings, and these rest on fixed collars C, and D, which contain ball bearings. The swing arms holding the trolley wheels are bolted to the thrust-collar A, and are 6 feet long.

This type of crane is easily constructed, and is an economical apparatus for the purpose; it eliminates the need of a helper, and the operator can keep his machines running while removing a piece.

A FEW USEFUL JIG KINKS

By J. E. Cooley

A GREAT many jigs used for drilling purposes are made from standard size knees or angle plates. These, as a rule, entail considerable loss of time in handling, such as putting on and taking off work; cleaning off chips and oil and other operations that necessarily follow in jig work.



A FEW USEFUL JIG KINKS.

In the accompanying sketch, is shown a few useful kinks applied to a jig for drilling collars for set screws, which may be found suggestive when designing jigs for other purposes. Referring to the sketch, the shelf A, on the angle-plate is cast on an angle instead of horizontally as is the usual method, having a rib B, along the upper and front edge, as seen. This is done for the purpose of allowing the chips and oil to fall away on one side of the drill-press table, making less space to clean or brush away, than is now the case where oil and chips fall from all sides.

Another kink is shown in the plug which holds the collar. It is well-known that the burr left in the hole after drilling, causes the collar to stick to the plug, necessitating the use of a screw-driver or similar tool to pry it off. The plug shown here has a deep angular spline C, which allows the collar to slip off easily, and besides, aids the chips that come through the hole to fall downward.

Considerable oil is unnecessarily wasted in drilling. In one particular instance, when this is squirted on the drill, a certain amount of this gets on the piece that holds the drill bushing, and falls away on the sides without being used. If a small well or chamber as D, is cut out, and the top of the bushing is made flush with this, it will catch all surplus oil and fall in the bushing.

SPECIAL VISE JAWS FOR ANGULAR MILLING.

By F. H. M.

A RATHER difficult job of milling to accomplish economically is illustrated by Figs. 1 and 2. The job, as completed, is shown at A Fig. 1, while the appearance of the part after the first operation is shown at B. Both of these operations are accomplished simultaneously on two different parts by gang milling using four cutters and a vise equipped with special jaws, as shown by Fig. 2.

Referring to the illustration Fig. 2, the gang of cutters, consisting of a pair of straddle mills A in the centre and two surface mills B and C, machine the work which is curved and must be held on a 45-degree angle. The work is located by means of two pins D and the vise jaws are shaped to the curvature of the inside and outside of the work. These jaws present the work at the correct angle for milling radial, while the jaw on the moveable part of the vise B is made floating to accommodate slight inaccuracies in the thickness of the work.

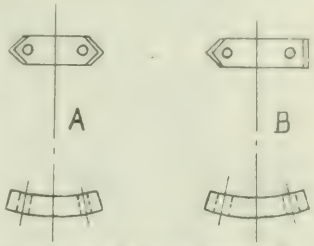


FIG. 1. SHOE MILLED IN VISE FIG. 2. "A," AFTER MILLING BOTH ENDS "B," AFTER MILLING ONE END

In operation, two parts are placed on the pins in the manner shown, and after tightening the vise, the ends are milled in the usual manner by means of the longitudinal feed of the table.

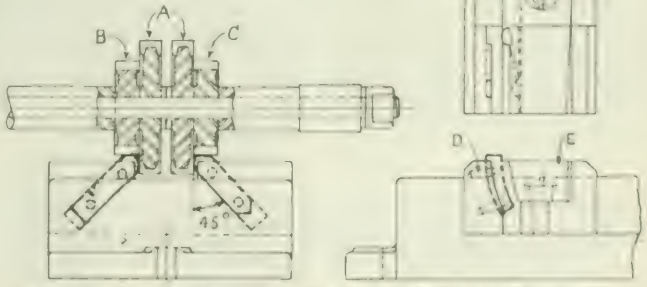


FIG. 2. VISE JAWS IN WHICH PARTS SHOWN BY FIG. 1 ARE MILLED

ACCURATE DRILLING AND REAMING

By F. Scriber

MACHINING holes may be just plain drilling and reaming, or it may be getting results on particular work economically, and, while most any old type of drill will cut, there are a good many ways of improving the cut and getting more accurate holes both for size and alignment. It is well known that a drill will not cut true and to size unless ground correctly, although by drilling a small hole and following this with a drill of the right size, a fair hole close to size may be had. The illustrations and description in this article are intended to show how combinations of plain drills and reamers are used to get the desired result when jig drilling.

Referring to Fig. 1, there is shown a

twist drill and bushing for short holes up to about ⅞ in. dia., and also a reamer for machine reaming the same. The bushing is held in a jig in the usual

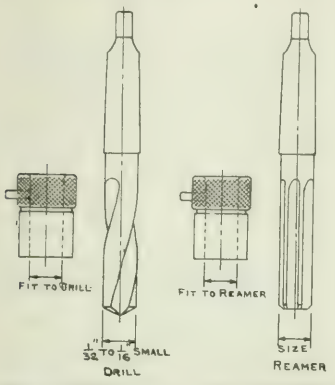


FIG. 1. BUSHINGS AND TOOLS FOR SHORT DRILLING.

manner, while the drill is 1/32 in. to 1/16 in. smaller than the reamer. The bushings are known as the slip type, inasmuch as the bushing which guides the drill is removed from the jig after drilling and the reamer bushing is then slipped in its place.

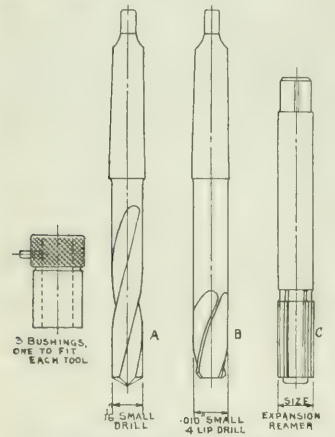


FIG. 2. TOOLS FOR DRILLING LONG OR LARGE HOLES.

The foregoing method of guiding or piloting drills is in quite general use, but for long holes under ⅞ in. dia. and large holes of any length where accuracy is required a much better method is that shown in Fig. 2.

With this combination three slip bushings are used, and three cutting tools, namely, a two-lip twist drill, a three or more lip core drill and a plain, an expansion, or a shell reamer as desired. In making the cut drill A, which is about 1/16 in. small, starts the hole with the proper bushing in place; following this, drill B, .010 in. small, with short flutes, is used, which makes the hole quite true for its entire length. Reamer C is used for finishing the hole.

For drilling long holes where extreme accuracy is required, resource may be had to a combination of tools, such as are shown by Fig. 3.

In using this combination the part held in the jig is first drilled in the usual manner with twist drill A guided by bushing B. In line with the main guide bushing C a pilot bushing D is placed in the jig, as illustrated by Fig. 4. The purpose of this pilot bushing will be better understood from Fig. 4, as the four-lipped drill is thus supported above and below the cut. The drill used is E, Fig. 3, and this is followed by a reamer in like manner.

Drilling and reaming in this manner is a very accurate method, provided the two bushings are in line, and the tools are not cramped in any manner. For this reason it is a good plan to have the line boring and reaming tools driven by a holder in which the shank or driving end of the tool is able to float and a good example of this type of holder is shown by Fig. 5.

Referring to the illustration, A is the reamer and B the holder, the reamer shown being of the shell type mounted on a shank. As will be noticed, the main hole through the holder is bored out slightly large to allow the reamer to float, while a pin C driven into the holder drives the reamer. The hole through the shank of the reamer is opened out, tapering at both ends from the centre, so as not to interfere with the float of the reamer. The floating holder itself is, of course, made in many shapes to fit the particular machines, the type shown being adapted for use in a turret.

IN spite of the various difficulties French shipbuilders are faced with, there were 140,000 tons of new construction on hand in that country at the end of 1916.

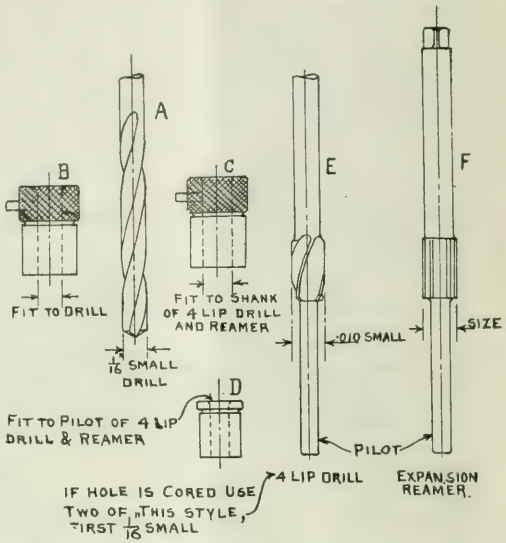


FIG. 3. TOOLS FOR LINE DRILLING AND REAMING.

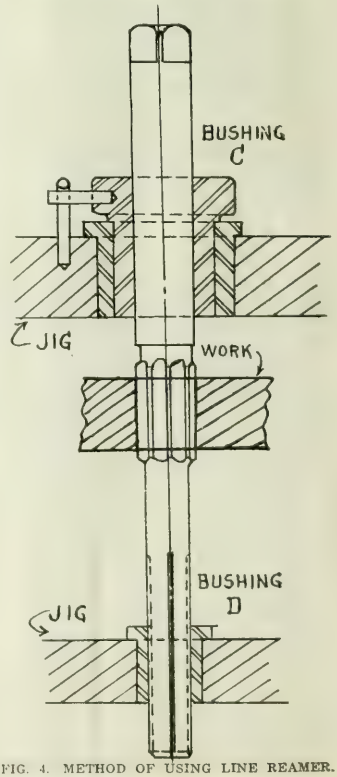


FIG. 4. METHOD OF USING LINE REAMER.

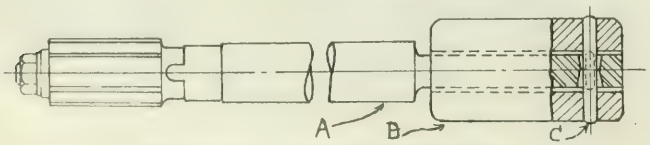


FIG. 5. HOLDER SUITABLE FOR LINE REAMING.

READERS' QUERIES AND ANSWERS

WANTED an alloy for making white metal hollow-ware, such as is used in casting portable reading-lamp stands.—N. A. G.

If the casting is required to be of good colour, strong enough to withstand accidental rough use, and finish to a durable surface chiefly, try the following:—

Copper	49 lbs.
Zinc	36 lbs.
Nickel	15 lbs.
Aluminum	2 oz.

Melt the copper and nickel first with a borax flux, then add the aluminum, and then the zinc. By remelting from ingots, you will obtain better results than otherwise. May be used with heated iron moulds or for sand castings.

If the casting is not required to be stiff and resistant to possibly injury from sudden contact with hard objects, either of the following may answer your purpose.

Lead	75 per cent.
Antimony	10 " "
Tin	15 " "

Tin	91 parts
Antimony	9 "
Copper	2 "

The latter makes a very strong, tough alloy, which is very fluid when melted.

A mold, the composition of which we believe is patented, and which would no doubt serve your purpose for casting the latter alloy is made as follows: Mix 11 parts powdered soapstone with 1 part Portland cement, then wet the mixture with a solution of 2 parts water and 1 part sodium silicate. Form a mixture of the consistency of moulding sand and employ in the same manner. Remove the pattern and heat the mold to 300 or 400 degrees Fah. until well dried. It is then ready for use.

CHART FOR DETERMINING LENGTH OF ROLLED-UP AND BALED STRAP IRON, ETC.

By N. G. Near.

THIS chart, plus a ruler and a pair of scales, will enable you to measure the length of rolled-up strap iron, flat iron, odd lengths in bales, etc. Even though the roll is not uniform, or if there are a number of rolls, or if the material is "all balled up," as the expression goes, it makes no difference to this chart, so long as the thickness and width are uniform. It is obvious that a chart of this kind is possible because the weight of wrought-iron and mild steel per cubic inch is a fairly constant quantity.

For example, if you find that a roll of your strap iron measures .03 inch in thickness and one inch in width and the weight is 22 pounds, what is the length of the roll in feet?

Very simple. Run a line through the .03 (left side of column A), and the 22 (column B), and locate the intersection with column C. Then through that intersection and the 1 (column A, right side), run another straight line and the final intersection with column D gives the answer as 200 feet, which you will find to be pretty accurate. The dotted lines drawn across this chart show how the above problem is solved via the chart. Solve your problem in the same way and it will come out OK.

This method is surely much simpler than to unwind a long roll of metal and measure it and then have to roll it up again. All you have to do here is to lay a straight edge across the c hart twice and the answer is found immediately.

To find the thickness of the metal accurately, if you have no micrometer caliper, measure the total thickness of ten layers, one on top of the other. Then divide by 10. It is always easy to divide

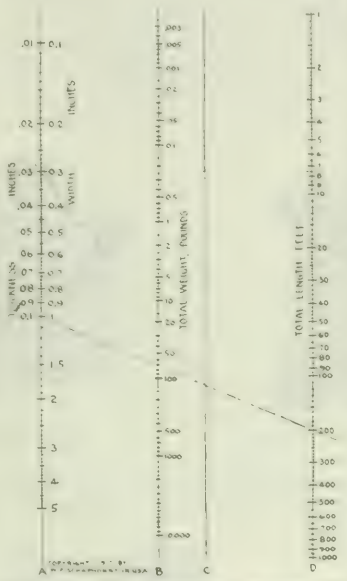


CHART FOR DETERMINING LENGTH OF ROLLED-UP STRAP IRON, BALES OF STRAP IRON, ETC., BY WEIGHING.

by 10. For example, if you find that with any ordinary rule the total thickness of ten layers is ⅜ inch, which is equal to .375 inch expressed decimally, it is a simple matter to point off one place to the left, which makes the thickness .0375 inch. Isn't that easy enough? Your answer is about as accurate as though you had used a pair of micrometer calipers.

The range of this chart, it will be noted, is wide enough to care for any ordinary roll of metal running up to a total length of 1,000 feet.

UTILIZING WASTE HEAT IN BRITAIN

MILLIONS of units of electricity, generated in waste-heat stations in connection with coke ovens and blast furnace plants is the result of developments in the South Durham coal field in the north of England. In 1907 a corporation was formed under the title of The Waste Heat & Gas Electrical Generating Stations, Ltd., to promote the use of waste heat for power purposes, and the problem of using the waste heat from iron and coke oven plants has been solved to the extent where savings estimated at 150,000 tons of fuel per annum are now being effected.

Two of the leading power companies operate in conjunction with the waste-heat stations, supplying a combined total energy of 343,000 horse-power over an area of 1,400 square miles. The waste heat stations are placed close to the larger coke ovens and blast-furnace plants, and operate in parallel with the five main stations of the power companies. They are run at their maximum capacity, and all regulation of the power is effected by the main supply stations.

The main distribution and transmission system is three-phase, and the working pressure is 20,000 volts. The power is utilized chiefly in the engineering shops and shipbuilding yards situated on the Tyne and Wear, and as the purchasing companies have a market for their current many times greater than the output of any individual waste heat station, it is possible to run these stations continuously at their full capacity, and to utilize to the best possible extent the machinery installed in them. Unfortunately for scientific purposes, no figures have been published, or can be obtained, for the thermal or working efficiency of these North-East Coast waste heat stations, and therefore it is impossible to say how the system adopted compares in practical value and economy with the waste heat stations situated in other countries.

FOR PIN HOLES IN BRASS

PIN holes in brass castings may be caused by pouring very hot metal into poorly vented molds, molds rammed too hard, or molds made of sand that is too close which will not allow the vents to come off freely. To avoid them, do not pour any hotter than necessary to run the castings, vent the molds with a fine knitting needle and do not ram them very hard.

If the metal contains no aluminum, try the addition of 2 ounces per 100 pounds, pouring when the metal no longer smokes. If aluminum cannot be used, pour the molds with sufficient force to keep the pouring heads full, even if some of the metal spills when they are filled. Exercise care to have the molds so well vented that when the gases come off, they will explode when the red-hot skimmer is inserted underneath the bottom boards.

Big-head keeps more men from succeeding in this world than lack of education.

A monthly mechanical paper is not what one would call a newspaper, yet there is a lot of news in the "ad" pages.

The Development and Application of Centrifugal Pumps

By H. S. Budd *

Centrifugal pumps by reason of their compactness of design, smoothness of operation, few constituent parts all of which are of comparatively simple and rugged construction, and freedom from shock and water hammer, make a powerful appeal to users of pumping machinery generally; and that their adoption to a wide range of service has in the past been productive of good results, is shown by the growing tendency to broaden their application scope still further, while intensifying their installation where already operative.

CONTRARY to the belief held by some that the centrifugal pump is a modern invention, it is in fact quite an old one and of obscure origin. One authority informs us as follows:—

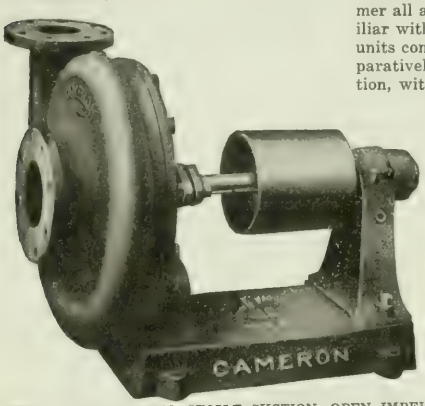


FIG. 1. BELT-DRIVEN, SINGLE SUCTION, OPEN IMPELLER PUMP.

"The first pump of this kind which attracted notice was one exhibited by J. P. Appold in 1851, and its special features have been retained in the best pumps since constructed. Appold's pump raised continuously a volume of water equal to 1,400 times its own capacity per minute. It had no valve and it permitted the passage of solid bodies, such as walnuts and oranges, without obstructing its working. Its efficiency was also found to be good."

For many years the centrifugal pump was considered useful only for handling large quantities of water at low heads and was uneconomical to operate. The development of the steam engine and its application to direct acting steam pumps kept the centrifugal in the back ground where it remained almost forgotten for many years. With the introduction of electricity and motor drives and, later on, steam turbines, however, there arose a demand for a pump that could be direct driven at comparatively high speeds, and the centrifugal pump has been improved and refined to meet this requirement. This development has been along purely scientific lines with quite wonderful results, until these pumps now operate with surprisingly good performance and economy on nearly all classes of both high and low head service for which only reciprocating pumps had formerly been used.

The simplicity and compactness of construction, smoothness of operation and freedom from shock and water hammer all appeal immediately to those familiar with pumping machinery. As these units consist of but few parts, all of comparatively simple and rugged construction, with total absence of reciprocating parts, water valves, etc., they present quite a contrast to reciprocating pumps, both in attendance required and cost of repairs, and in most cases will operate with a considerable saving in power consumed.

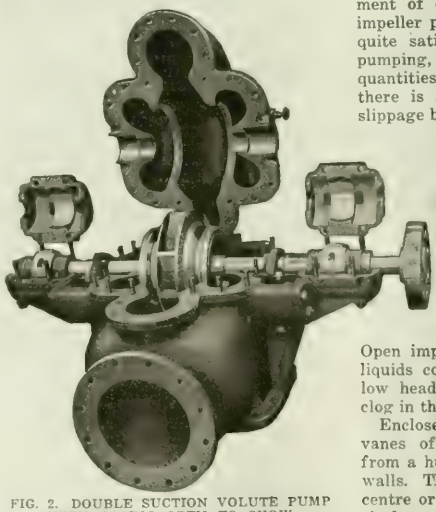


FIG. 2. DOUBLE SUCTION VOLUTE PUMP WITH CASING OPEN TO SHOW ACCESSIBILITY.

Centrifugal Pump Types

Centrifugal pumps as built to-day are of two general classes, namely, open and enclosed impeller types, depending on the type of impeller used.

Open impellers consist of a number of arms or vanes radiating from a hub in the manner of an ordinary centrifugal blower. The sides of the vanes are usually faced off and run close to the walls of the casting on both sides in order to prevent, as far as possible, the slippage of the liquid being pumped. By refinement of design and construction, open impeller pumps have been made to show quite satisfactory results on low head pumping, especially in delivering large quantities at a head of a few feet, but there is always a large percentage of slippage between the impeller and casing, as well as excessive skin friction and internal disturbance which becomes more pronounced as the operating head is increased. These losses are variable quantities and make high efficiency impossible; the designer cannot, therefore, predict with any great degree of accuracy the ultimate performance of the pump. Open impellers are adapted to handling liquids containing some solid matter on low heads that would tend to hand or clog in the inclosed impeller types.

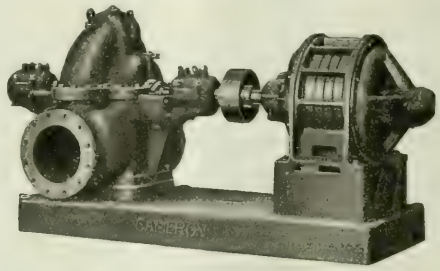


FIG. 3. MOTOR DRIVEN DOUBLE SUCTION VOLUTE PUMP.

Enclosed impellers consist of blades or vanes of suitable currature radiating from a hub and enclosed by two discs or walls. The liquid to be pumped enters at centre or eye of the impeller around the shaft on either one or both sides, pending on whether it is of single or double suction type, and passes through the wheel in channels formed by the walls and vanes. Double suction impellers which

* Engineer, the A. S. Cameron Steam Pump Works, Chicago, Ill.

are subjected to the same pressure conditions on either side, are automatically balanced against thrust along the line of the shaft for all ordinarly operating heads. Single suction impellers are not so comparatively balanced an dtherefore require end thrust bearings.

As the enclosed impeller handles the liquid being pumped through confined passages or channels of definite form with a limited amount of disturbance or leakage, a capable designer can quite accurately control the performance of the pump over a broad range of operation. For this reason the enclosed impellers are used for all medium and high head pumping equipment and when high efficiency is desirable.

Single Stage Pumps

A single stage pump contains one impeller and can be built for almost any capacity and reasonably high head with efficiency results, the larger sizes being more economical, of course, than the smaller. The greater the head created by a single impeller, the greater will be the difference in pressure between the suction and discharge chambers of the pump. This is accompanied by a greater internal slippage and leakage and more rapid destruction of the internal parts, and, therefore, is one of the factors that determine the greatest pressure or head allowable per impeller or stage.

Multi-Stage Pumps

For higher heads, multi-stage or turbine pumps are used. These consist of two or more enclosed impellers on the same shaft, running in a casing with passages so arranged as to lead the liquid through the several impellers in succession, each one adding its equal share of the total pressure desired. By this means, pressures of several hundred pounds may be obtained from a single pump, the limit depending on the mechanical limitations of design, strength of materials used and their resistance to abrasions by the liquid at high velocity. In multistage pumps the liquid discharged at high velocity from all, but the last impeller must be abruptly turned through 180 degs. to enter the eye of the succeeding one, and suitable vanes known as diffusers are provided to reduce the speed of this water as far as possible, and convert it into pressure as soon as it leaves the impeller, so that it may be conducted into the succeeding one with the least disturbance and impact on the walls of the casing.

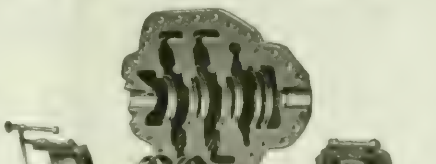


FIG. 4. THREE-STAGE TURBINE PUMP WITH CASING OPEN TO SHOW ACCESSIBILITY.

All multi-stage pumps require some means of maintaining correct alignment of the rotating element with the passages in the casing and of equalizing any end thrust that may be present. In pumps handling clean fresh water, this is best accomplished by means of an internal hydraulic device in which the thrust is carried on a body of water confined by a suitable piston or diaphragm mounted on the shaft. This device is quite simple in construction, yet it automatically and promptly adjusts itself to varying load conditions, and being a water bearing with no metal to metal contact, operates with practically no loss of power. Where the liquid being pumped carries grit or solid matter that would tend to wear the parts of the hydraulic balancing device rapidly, a step bearing of the Kingsbury or marine thrust type external to the casing should be substituted.

Design and Construction

The requisites of a centrifugal pump are, first, that it shall be well and suitably constructed mechanically, and secondly, that its performance shall comply with all the service requirements and show the highest efficiency possible on that service. The pump should be of strong and substantial construction in all parts, free from vibration of the rotating elements with large and well oiled and close fitting bearings, both to insure continuous operation and to preserve the fine running clearness within the casing which serve to prevent internal leakage from the spaces of higher to lower pressures. The material of which the various parts are made should be well selected for the duty to be performed, and the general design thoroughly accessible for inspection of the interior and renewal of parts.

The operating principle of a centrifugal pump is quite simple. The liquid pumped is accelerated by passing it through a revolving impeller, creating both pressure and velocity, the velocity being then converted into pressure in the stationary discharge passages. However, it becomes a very complex problem to design and build a pump to deliver a given quantity of liquid against a specific head at a definite fixed speed and to accomplish same at the highest efficiency. A capable designer can predict within a small percentage of error both the performance and the brake horsepower required not only at the normal operating point, but over a range, from a condition of free discharge against no head, to a closed discharge and no liquid flowing. The solution of these problems requires a thorough knowledge of the theory of centrifugal pumps and an analysis of a very great amount of accurate data obtained experimentally from pumps of similar characteristics.

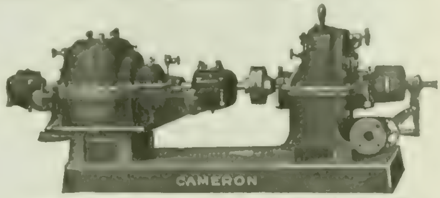


FIG. 5. STEAM TURBINE DRIVEN, THREE-STAGE TURBINE PUMP.

The production of an efficient and altogether satisfactory pump involves not only a correctly designed impeller, but the casing also must be of such mould and cross-section that changes in velocity of the liquid will take place gradually and without shock and disturbance. It requires very careful and accurate shop work to put into effect all these details so carefully worked out by the designer, in order that the finished pump may fulfill all the requirements specified, and it is, therefore, very essential that each pump be subjected to a performance test after completion, in order that any discrepancies may be detected and properly corrected. Each installation is a problem by itself and must be treated as such, if definite results and highest efficiency are to be realized.

Application and Uses

Centrifugal pumps may be driven direct or through belt or gear from electric motor, steam turbine or engine, or other source of power, as best suits the requirements of the particular installation. Direct connected to steam turbines they make highly satisfactory steam operated units. They operate on less steam and require less lubricating oil than ordinary steam pumps. They occupy small space, and their advantages in freedom from [illegible] and [illegible] parts are all too evident to need further comment.

Water Works Service.

Motor driven centrifugal pumps have met with great favor on water works service in small towns and villages. When operated in connection with stand pipe or

elevated tank, they may be arranged to be automatically started and stopped by means of a pressure regulator or float switch. When used with a direct pressure system, the pump or pumps may be run continuously maintaining the pressure and delivering only such water as is drawn from the mains. In localities where a part of the district supplied is on a higher elevation or some distance away requiring an excess pressure, it is found expedient to maintain a domestic pressure at the pumping station suitable for the greatest demand and to insert a centrifugal in the main that supplies the higher pressure. Such an installation is known as a booster pump and it may float on the line continuously adding a fairly constant net pressure irrespective of the amount drawn from that line. It is often the practice to use a moderate pressure in water mains for domestic service and to increase it materially in case of fire. As motor driven centrifugal pumps are preferably constant speed machines and, therefore, suitable for one pressure only, it is quite common in cases of this kind to install two or three duplicate pumps designed for domestic service and operating two in series to obtain increased pressure for fire service.

Quite a large number of turbine driven centrifugal pumps, running condensing, have been installed where in former years only crank and flywheel pumps would have been considered, and the improvement both as to reliability and economy has been so marked that at present their performance rivals the best triple expansion crank and flywheel pumping engines in total yearly operating cost, when due allowance is made for all interest and standing charges on the capital involved. These charges, of course, greatly favor the centrifugal unit on account of its comparative low first cost, together with that of the smaller building, lighter foundation, etc.

Boiler Feeding

Among the many uses of the centrifugal pump, boiler feeding is a service for which it is ideally suited. The pump is usually driven electrically or by steam turbine, whichever is best suited to the particular installation. In operation the motor-driven boiler feeder is generally allowed to run continuously at full speed, maintaining a fairly constant pressure on the feed line for a considerable range of capacity. The amount of water fed to the boiler may be controlled by a throttle valve in the feed line without danger of creating a dangerous increase in the latter, as the centrifugal will not build up a pressure exceeding 15% to 20% above normal pressure, even when the discharge is entirely closed.

Steam turbine driven boiler feeders are sometimes operated in this manner also, but they are more often equipped with pressure regulators of a type similar to those used on ordinary steam pumps to maintain a constant differential between the steam and the feed line water pressures, especially where the variation in steam pressure is considerable. Whether driven by electric motors or turbines, the feed water to the boiler can be regulated without reference to the pump, and further, there are no valves or large packings to be maintained, nor is there danger of water hammer and breakage in case of loss of suction as with reciprocating pumps.

Efficiency.

The efficiency of any centrifugal pump is highest at only one combination of head and capacity for each change of speed, and, therefore, if a pump is operated on a head or at a speed other than that for which it is designed, the amount of delivery and power required can be only approximately predicted. At the same time, the efficiency would likely be very low, making the installation quite unsatisfactory for the work it was intended to do, as well as expensive in cost of power for driving.

Low pump efficiency means increased power required, and even though it be but a few per cent. it must be borne in mind that this excess horsepower is consumed continuously while the pump is in operation and will total up to a considerable sum in a year's time, representing in dollars and cents more than the difference in cost of a well designed as against an inferior pump, or equalling the interest and depreciation on the entire installation for the same period. In like manner, the saving made by the better pump when compared with the common type, will invariably pay back its entire cost in a comparatively short time.

Wearing Parts

There are a few parts of the enclosed impeller type of pump that are subject to wear, namely, that part of the casing which makes a running joint with the impelled, and the sections of the shaft within the stuffing boxes and the bearings. If these wearing surfaces are provided with renewable parts that can be replaced at small expense, the main and more costly parts, being protected, will last almost indefinitely, ensuring a low cost of maintenance. Wearing rings secured in the casing around the impeller inlet protect the case from wear at this point, and a similar pair of rings made of bronze and secured on the impeller protect it from wear also. Bronze sleeves secured on the shaft and passing out through the stuffing boxes relieve it entirely from scoring by the jacking, or rusting. By supplying the bearings with removable ring-oiled split babbitt-lined shells of spherically seated type which may be easily slipped out when worn, and either rebabbitted or replaced by a new set, the alignment of the rotating element will not be disturbed, and the close fit between the impeller and case so necessary to prevent internal leakage, will be preserved. These features will be clearly illustrated by the views that will be shown on the screen a little later on.

Operating Conditions

It will be readily appreciated from the foregoing that in building a centrifugal pump for a particular installation, it is essential that the conditions of head, capacity and speed be accurately determined and furnished to the designer, together with any special requirements involved, especially if the highest efficiency is expected. It is not to be understood from this that the centrifugal pump is an extremely sensitive affair that will be efficient at one particular combination of head and capacity only, and of low economy when these ideal conditions do not obtain. The efficiency will remain nearly constant for a small variation in head both above and below the normal, the capacity varying inversely as the head, consequently it is usually safer to figure the total head a trifle high and design the pump accordingly, and then if the head is actually less, a slight increased capacity will result, which is not usually objectionable. Very often two or more conditions of head or capacity can be obtained from a pump of special design running at constant speed with a satisfactory balance of efficiency, and with provision for some speed variation the possibilities of designing for varying service are greatly increased.

Total Head

The total head on which a pump has to operate is made up as follows: Vertical static suction lift from the level of the liquid in the well or sump to the centre of the pump; static discharge head measured vertically from the centre of the pump to the point of discharge; friction in the piping, valves and elbows of both suction and discharge lines, velocity head, and entrance head. In addition the pump must overcome the loss of head within itself, but the builder only is concerned in this, and the efficiency of the pump is the ratio of the theoretical power required in raising the given quantity of liquid against the total head, to the sum of this power plus the hydraulic losses in the pump, and the friction in bearings and stuffing boxes. This sum is known as pump horsepower.

Effect of Speed Variation.

Both the total head and the capacity of a centrifugal pump are quite sensitive to speed variation, therefore great care must be exercised in determining the speed at which a pump is to operate in order that it may be designed accordingly. This is particularly essential when the pump is to be direct connected to a constant speed afternating current motor of which the speed at full load is several per cent. lower than at no load, and there is no convenient way of altering the speed of such a motor.

Priming

A centrifugal pump cannot raise a liquid to itself from a lower level without first being primed, because it possesses no positive displacement feature and, therefore, both the pump case and suction piping must be entirely filled before starting. Priming may be accomplished either by providing a good valve on the lower end of the suction line and filling the pump and suction piping from the discharge line or other source, or by drawing the liquid up into the pump

through the suction pipe by exhausting the air from the top of the pump case. With this latter method, the discharge must be closed off by means of a gate-valve, and the foot valve may be dispensed with if desired, provided the pump is started while it is primed. The air may be withdrawn from the pump by means of a suction pump, steam injector, or other means of creating sufficient vacuum to entirely fill the pump case.

Suction Lift.

Once in operation, a centrifugal pump will handle water or other liquid of the same specific gravity and character at ordinary temperature on as great a suction life as a reciprocating pump, namely, about 26 feet at or near sea level, and provided the suction piping and pump are entirely free from air and air leaks. Because of the difficulty sometimes encountered in maintaining air-tight suction glands and piping, 18 feet is, however, usually considered the maximum commercial suction lift, and even less is advisable whenever possible.

The limit of suction lift decreases with the rise in temperature of the liquid on account of the increased vapor tension, and it is not advisable to undertake any suction lift with water at a temperature exceeding about 150 deg. Fah., but rather have the pump so located that the water will flow into it by gravity. When handling water at or near the boiling point, as in boiler feeding, the water should flow to the pump under a head of from 6 to 10 feet, and the suction piping should be as direct as possible and of large diameter to eliminate the formation of vapor. Vapor or air or other gas in the pump in considerable quantity will collect within the suction opening of the impeller, being the point of least pressure, and impede the passage of the liquid, reducing the capacity of the pump, and at times causing it to lose its suction entirely.

Size of Piping

Bearing in mind the marked advantage of small suction lift, the intake pipe should be as short and direct as possible, with absolutely tight joints. It is usual to make the intake pipe and foot valve at least one size larger than the pump inlet to reduce friction, which, of course, adds to the suction lift. As the basic principles of the centrifugal pump require the liquid to be handled at high velocity, the suction and discharge openings are much smaller than are usual in reciprocating pumps of equal capacity, and the sizes of both the intake and discharge pipe lines should be determined from the amount of friction in the required length, which can be learned by referring to standard published friction tables.

Installation.

Centrifugal pump installations are usually provided with a gate valve in the discharge to shut the pump off from the line when not in use, or when open for inspection. There is nothing in a centrifugal to hinder the liquid flowing backward through it from the discharge line when not in operation, and consequently in case of a sudden shutting-off of the power, the impeller acting as a water turbine, may be revolved backward at a speed dangerous to both the pump and prime mover. A foot valve on the intake pipe will prevent this occurrence, or if this is not provided, a check valve should be located in the discharge. Where the operating pressure is great and a foot valve is employed, there should also be a check in the discharge to reduce the shock on the pump case when the foot valve seats. The check valve should be provided with a by-pass in order to prime the pump should the foot valve leak.

In placing suction and discharge pipe lines they should be free from high spots or loops forming pockets in which entrained air may accumulate, as the air bubbles thus formed will offer considerable resistance to the movement of the liquid by obstructing its passage, and in case of the suction pipe they are liable to enter the pump in such quantity as to cause loss of suction entirely.

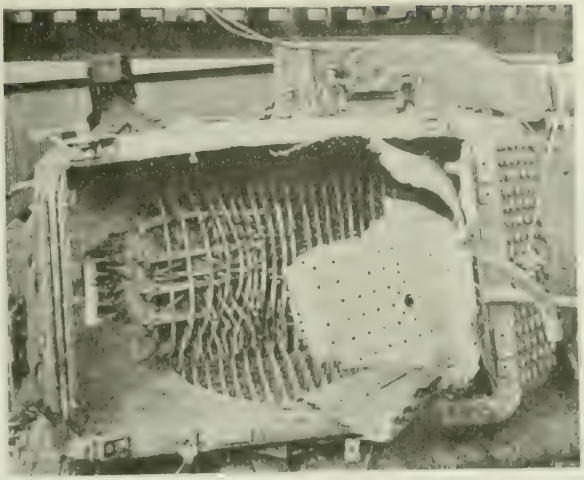


FIG. 1. SHOWING THE FURNACE AND CROWN SHEET.

LOCO. BOILER EXPLOSION

A RAILROAD locomotive boiler exploded recently and caused the death of five men and the injury of another. It will be seen that the crown sheet failed, which is a common method of failure with boilers of this type. The explosion is said to have been due to low water, which caused the crown sheet to become overheated. It is reported that the locomotive had been overhauled not long before, and that it had been in service but a day or two before the explosion occurred.

The boiler was built in 1905. The waist or shell was 69½ inches in diameter, and there were 273 tubes, each 2 inches in diameter and 162½ inches in length. The working pressure was 205

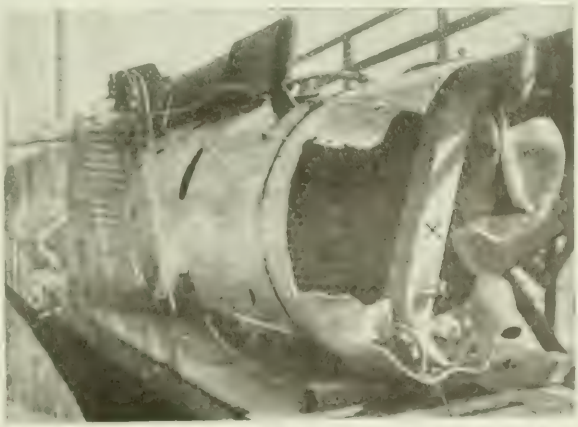


FIG. 2. FRONT END OF BOILER. NOTE RAILROAD TIE X WEDGED INTO SMOKEBOX.

pounds. We are informed says the Travelers Standard, that when the explosion occurred the boiler was torn from the locomotive trucks and was blown over a signal tower about 50 feet distant. It turned over twice during its flight, and landed about 124 feet from the spot where it started. At some time during its journey the front end of the boiler fell upon the right of way and cut off a railroad tie, which is shown wedged between the opposite sides of the front course of the boiler in Fig. 2. It is easy to imagine the extreme havoc that would have been wrought by the explosion if this had been a stationary boiler located in the boiler house of a power plant.

UNITED STATES TO LEAD IN SHIPBUILDING?

IN the recent purchase of 60,000 tons of steel ship plate by the French Commission, through J. P. Morgan & Co., at 6c a pound for hull plate and 8½c to 9c a pound for marine boiler plate, the attitude of the U. S. Government towards its Allies is clearly shown. Washington authorities were not satisfied with charges for plate over these prices, and the mills that have named minimum prices of 7c a pound for hull plate and 13c a pound for marine boiler plate to the Allies, were constrained to accept the Washington view, says the Wall Street Journal.

Plate mills could readily sell maximum capacity for another year on the basis of 12c to 12½c a pound for hull plate and at 10c to 11c for tank plate, so great is the demand at home and abroad; while marine boiler plate for forward shipment would readily command 16c to 17c a pound in the open market. Some mills have asked 20c a pound for boiler plates.

It will be recalled that the Navy Department secured a price of 2.90c a pound for ship plate from the steel manufacturers virtually under duress. The agreement was made between Secretary Daniels and President Farrell of the Steel Corporation, representing the steel makers; but some of the plate manufacturers declared at the time that they could not produce plate at that price and come out even, while others had only a small profit. Since that time, the productive cost has increased. It is claimed that even the Steel Corporation to-day has a profit of only $4 a ton in ship plate at 2.90c a pound. It is estimated that the cost of producing hull plate under present conditions is $60 a ton for some large mills and probably $70 a ton for mills that are dependent upon the open market for raw material.

Labor Cost at Steel Mills

A large percentage of the cost of producing iron and steel at any time is due to labor. Since the first of this year, the wage scale has been increased 40% to 50%, and labor efficiency has decreased 20% to 30% during the same time. Steel companies that have their own supplies of raw material, of course, have a lower cost than plants that must depend on the open market for their pig iron and other raw material. In ordinary times, the cost of converting pig iron into steel ingots ranges from $4 to $10 a ton. The cost is least where molten instead of cold pig iron is used. To-day the minimum cost of conversion is several dollars a ton higher; one authority places the minimum to-day at $7 a ton. To convert ingots into billets, the cost varies from $4 to $16 a ton; the minimum to-day is believed to be not far from $7.50 a ton. Cost of rolling steel varies according to the amount of gas consumed in the reheating furnaces and also depends upon whether gas or oil fuel is used.

Steel plates are rolled from slabs—where the rolling is not direct from ingots—and slabs are made from ingots. There is a loss of 20% to 25% from the ingot to the plate due to the necessary cropping of the ingot. Ship plate costs more than tank plate because of the additional physical and chemical tests that ship plate must meet. The minimum cost of converting ingots into finished plate to-day is fully $20 a ton for ordinary plate and may be as high as $30 a ton for ship plate.

U. S. Plate Mill Outputs

Output of the plate mills to-day is at the maximum in the history of the industry, and more new capacity will soon be active. Jones & Laughlin Steel Co. has just started a new 128 inch mill at the Soho Works with a rated capacity of 15,000 tons of plate a month. Bethlehem Steel Co. will start new mills with a capacity of about 10,000 tons a month, probably in September. The new plate mill of the Carnegie Steel Co. at Homestead is expected to be ready to roll in November, but the two new mills of the Brier Hill Steel Co. and the 84 inch mill of the Youngstown Sheet & Tube Co. will not be ready for 12 to 15 months. Illinois Steel Co., Worth Brothers, Corrigan & McKinnev Co. and the Ashland plant also are building new mills. When all of these mills are in operation, it is estimated that the United States will have a capacity to roll 430,000 tons of plate a month, of which about 230,000 tons will be ship plate. To-day the monthly rolling of ship plate is about 150,000 tons, or approximately 42% of the total output.

In recent weeks the United States Government has been receiving about 50,000 tons of plate a month from the Carnegie Steel Co., and with the Allies has been getting about 40% of the entire capacity of all of the plate mills. The embargo declared by the President against export of ship plate to become effective August 15, of course, is a step to husband plate resources for Government needs.

It is an interesting fact that some of the ship plate bought by the French Commission about two weeks ago, to be used to build war ships and barges to carry supplies on rivers and canals in France, have already been shipped, and the balance will be exported in September or October. It is stipulated in the Morgan contract that if for any reason exports are held up, and it becomes necessary to store the plate, that the mills will receive 90% of the purchase price. One of the mills has asked for an additional payment of $2 a ton a month for storage if warehousing becomes necessary. There are many thousand tons of plate already sold for export that remain at the mills or at the seaboard waiting Government licenses, but shipments to England France, Italy and Russia have gone forward without much delay. New inquiries from Japan and Italy, however, are still going begging.

It should be recognized that the plate mills have taken relatively few orders at the high prices current in the open market recently, but that the bulk of the merchant business has been booked at prices ranging from 4c to 5c a pound, and the large tonnage for the United States Government will be furnished probably between 2.90c and 3.50c a pound. Some mills contend that 4½c would be a fair price for government work.

When the plate mills now building are in commission, the United States will have capacity to produce 230,000 tons of ship plates a month or 2,760,000 tons per annum. This will be sufficient to permit the building of 690,000 tons of shipping a month, or 8,280,000 tons a year. In an emergency, tank plates can be used for the building of small boats, so achievements may be even greater than anticipated. The total capacity to produce all kinds of plate in another year will be 5,150,000 tons per annum. The United States will emerge from the war as the greatest shipbuilding country in the world; not even second to Great Britain, and if the success of the war depends upon ships—as it seems—the fate of the Teuton is sealed.

ADDITIONAL AIR OVER FUEL BED

ADMISSION of air into the boiler furnace through leaks in the furnace wall is undesirable and should be avoided.

The ideal way to supply additional air over the fuel bed is to introduce it as close to the latter and in as large a number of small streams as possible. The nearer the air is introduced to the surface of the fuel bed, the more combustion space is utilized for mixing air with the combustible gases and for burning the mixture. A large number of small streams of air entering the furnace facilitates mixing the air with the combustible gases, particularly if it is forced in at high velocity. When the air is introduced in one large stream at low velocity it tends to flow parallel to the stream of combustible gases without mixing with them, thus causing slow combustion. The rate of mixing determines the rapidity of combustion of the combustible gases. With a perfect mixture and the usual furnace temperature, the velocity of combustion is very great indeed, so that the combustion is almost of the nature of an explosion.

EDITORIAL CORRESPONDENCE

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

ENGINE-HOUSE EFFICIENCY

By L. E.

An important difference is to be observed between the boiler house and the engine house as regards the securing of maximum efficiency. In the boiler house, once the design of the plant is satisfactorily settled, everything depends upon the operator. In the hands of a skilful fireman an ill-designed plant may be made to give quite passable results; in the hands of an unskilful fireman the best plants may show a deplorably poor efficiency. Even with mechanical stokers the personal factor is important; with hand firing it is also important. But when one passes from the boiler-house to the engine-house the order is reversed; the determining factor is here the machine rather than the man. If the engine is well designed for the load, and conditions which it has to meet, if the loads on the cylinder are well proportioned, and the valves correctly set, then the engine when set to work will give of its best without any large amount of supervision or alteration by the engineer. Care must, of course, be exercised in seeing that lubrication is perfect, the cylinder must be indicated regularly, to see that the valves are in correct adjustment, and slight alterations made accordingly; the valves and piston must also be tested regularly for steam tightness.

Generally speaking, however, the operations going on in the engine are entirely automatic, and do not require the constant control of the engineer. The normal operation of the engine on which the steam consumption depends is out of the control of the engineer after he has correctly adjusted the parts. For these reasons, power plant owners, while taking care to have good design and skilled operation in both departments, should give especial attention to the machine in the engine room and to the man in the boiler-house.

Engine Losses.

The efficiency problem in the engine-room is mainly one of installing machinery so designed and constructed as to convert the energy in the steam received from the boiler-house into the greatest measure of mechanical power, which means the least losses of heat between the steam inlet valve and the rim of the flywheel.

It has been determined that of the total heat in the fuel, something like 41 per cent. is lost in the engine. This loss is comprised, as to a very small part, of engine friction and radiation; the bulk of it is accounted for by the heat that passes away in the exhaust steam to the condenser. This latter loss is for the most part unavoidable, being due to the limited range of temperature within in which it is possible to work without resorting to expedients more costly than any economies to be effected. With an average modern engine working under good conditions, using steam at 100 deg. superheat and discharging into an efficient condenser, something like 11½ lb. of steam per indicated horse-power will be used, which means that only 25 per cent. of the heat in the steam is turned to account as mechanical power. But between the absolute minimum of loss necessitated by the nature of the case and the loss which may occur in an engine which is badly designed, constructed and maintained a considerable margin exists, and it is for the power user to reduce this margin to the lowest figure attainable. In a paper read by Mr. John Ingham before the Yorkshire Association of Textile Managers, reducible heat losses in the engine-house were classified under the following heads:

(a) Leakage of steam past valve and pistons.
(b) Cylinder condensation.
(c) Loss due to large clearance.
(d) Loss of heat between the cylinders.

Valve Leakage.

Take first the loss due to leakage past the valve. Theoretically, when the valve has closed on its seating, no steam should enter the cylinder. Practically there is great difficulty in obtaining and maintaining a steam-tight valve. Whether the valve employed be a slide, Corliss, piston, or drop valve, some leakage takes place. Further, whilst the valve might be steam-tight when tested under pressure when stationary, slight distortions are possible when working, which will cause leakage. With well-bedded valve faces in good condition, the loss will not be much, but periodical tests should be made to ensure that all valves are reasonably steam-tight. Some leakage will similarly occur past the piston. Piston rings and cylinder liners will wear, and although many ingenious devices are in use for maintaining steam-tightness under difficult conditions, tests should be made and the parts examined regularly to make sure that the steam does its work without taking a short cut past badly fitting piston rings.

The loss due to cylinder condensation depends on the range of temperature in the cylinder, or the difference between admission and exhaust, and upon the time the cylinder surfaces are subjected to the lower temperature. Consider for a moment what happens in, say, a Corliss cylinder. Steam is admitted to the cylinder, and fills the cylinder up to say, 25 per cent. of the stroke with steam at, say 480 deg. Cut-off takes place, and steam is expanded down, and, at, say ⅞ of the stroke the exhaust valve opens, and the steam passes away to the low-pressure cylinder at a reduced temperature. During the rest of the forward stroke, and up to almost the end of the return stroke, the exhaust valve remains open, and the cylinder walls are subject to the cooling effect of the low-temperature steam. Consequently on the next admission of steam a certain proportion of the heat in the steam is expended in heating up the cylinder walls. The remedy for this is to reduce the temperature range in any one cylinder or to reduce the time during which the cylinder walls are exposed to the lower temperature.

Clearance.

Another factor to which loss may be due is large clearance spaces. The most economical engines, other things being equal, are those with the least clearance. With the piston at one end of the cylinder closed, the space between the back of the pistons and the cylinder cover, and the passages from the valves to the cylinder, must be filled with steam every stroke, and although cushioning after the exhaust valve closes partly affects this, yet much new steam is wasted every stroke from this cause. Any design of cylinder which reduces the clearance space makes for steam economy.

There is, finally, the loss of heat which takes place between the cylinders in compound or triple-expansion engines. An examination of the combined diagrams from such engines reveals that material loss does occur at this stage. It can be reduced considerably by good design and care in covering, and by properly draining the connection between any two cylinders, but it can only be eliminated by allowing the whole of the expansion to take place in one cylinder. In all types of steam engines greater efficiency can be secured by close attention to these four principal sources of heat loss, but in what may be called the standard types of engine there are limiting conditions which prevent improvement beyond a certain point.

Uniflow Efficiency.

There is a type of engine in which piston leakage, cylinder condensation, and clearance losses are reduced to a minimum, and between cylinder losses are eliminated. This type, known as the uniflow type, was introduced into this country some six years ago, and has since steadily increasing recognition. Instead of exhaust valves, it has a ring of exhaust ports round the cylinder midway in its length, and as the piston reaches the end of its stroke it uncovers the port automatically, and

allows a free escape of steam to the exhaust. The cylinder is much larger than in the standard design of engine, and the piston is about three times as deep as the ordinary piston . The steam cycle in the uniflow cylinder is fairly generally understood. The steam valve opens and admits steam expands in the cylinder as the piston moves formard. At a pre-determined point cut-off takes place, and the steam expands in the cylinder as the piston moves forward. When the stroke is nearly completed, the circular exhaust ports surrounding the cylinder are uncovered and the steam escapes to an annular chamber, which is cast round the cylinder ,and thence direct to the condenser. The area of the exhaust ports thus uncovered is many times greater than could be provided by any exhaust valve, and consequently the exhaust steam can be got away to the condenser rapidly. As a matter of fact, the piston only just uncovers the openings, and then closes them on its return stroke.

The period during which the cool temperature of the condenser is in touch with the cylinder walls is consequently about ⅛ of the stroke, as against ⅞ of a stroke in the ordinary form of cylinder. Compression, of course, commences immediately the ports are closed again, and is carried up to almost the initial pressure.

The heat economies in this type of cylinder are due mainly to two things; first, to reduced cylinder condensation resulting from the diminished time during which the cylinder walls are exposed to the condenser temperature, and second, to the elimination of exhaust valves and the clearance spaces which they entail.

High Vacuum Effective.

A further gain, however, results from the fact that the large area of the exhaust ports permits the bringing of a high vacuum into effective use on the cylinder. To make the most of this factor, special condensing plant must be employed. Where an adequate water supply is available, and a suitable type of condenser is used, it is possible to maintain an effective vacuum of 28 in. and even 29 in. on the piston. The uniflow type of engine has also mechanical advantages. It is simpler in construction and has fewer parts. The working friction is, consequently, less than with a cross compound engine, and a mechanical efficiency as high as 94 per cent. can be obtained. The costs of attendance, oil, repairs and insurance are correspondingly reduced; and the first cost of building and foundations is much smaller. Because of its moderate speed the engine is particularly suitable for weaving sheds, since it can be coupled direct to the main line shaft without the interposition of ropes, belts or gears. Mr. Ingham places the overall economy of such an engine and drive at from 5 to 7 per cent. higher than that obtainable from a cross compound engine.

The engine has also the same rate of steam consumption per horse-power over a fairly wide range of load, which is important in the case of mills where the load is variable or in new mills where it is necesary to have a margin of power available against future extensions. As to speed regulations, a maximum variation of 1½ per cent. has been obtained in everyday practice. This tained with first-class cross compound engines, but is quite satisfactory.

ACCURATE MEASUREMENT OF WORK

By Mark Meredith.

IT has been said, and few would be bold enough to deny the substantial accuracy of the statement, that it was not until shortly after the outbreak of the war that the British manufacturer got his first chance of manufacturing parts in large quantities. He was then placed at the additional advantage that he was working in conjunction with those who, under normal circumstances, would have been his competitors,but even so he found himself hampered by a want of knowledge regarding standards and the methods by which interchangeable parts, such as screws, could be produced quickly, accurately, and efficiently. The manufacturer, however rose quickly to the occasion, and, assisted by the skilled workman, placed the production of small parts on a sound footing. It is only fair to admit that a large share of the credit due has to be given to the manufacturers of the light, high speed machinery which has been imported into the country in such quantities since the outbreak of the war.

Previously, most of the work done in that country was carried out by home-produced tools, and as there was comparatively little repetition work there was no inducement for any engineering firm to provide special equipment and appliances. Only a few, highly specialised on account of the nature of their work, paid serious attention to accuracy of measurement and interchangeability of parts. Of these, some even had their own individual standards, which were not in accord with those of other firms producing similar articles. Numerous instances of this will occur to the mind of the mechanical engineer, and the electrical engineer will remember how, a few years ago, lamp holders for incandescent, electric lamps, and lamp tops, both of which parts were being turned out by the hundreds of thousands, were not standardised, and were not interchangeable.

These facts are all the more curious in that it is an admitted fact that forty or fifty years ago Britain held the premier position as regards the production of accurate work, and apparatus by which it could be produced. An instance of this was recently given in connection with screw thread work. eighty or ninety years ago, when screws were used in comparatively small quantities, every maker was a law unto himself over such details as diameter of screw, shape of thread, and number of threads to the inch. With a curious lack of foresight many makers went out of their way to produce screws and other small parts which were out of accord with those made by other firms in order that no parts could be used on his machines other than those which were manufactured at his own works. Whitworth was the first to see the folly of this course of action, and he made a strenuous effort to remedy the state of affairs. Even his great efforts took some time before they met with any marked success, and it may be said that the success reached was only attained because he not only set higher standards, but provided the means by which they could be attained.

It is interesting to note that of the measuring equipment now used in the average British workshop about 90 per cent. is of American make, and almost all the remainder has been produced on the continent, and it is said that not only are very few machines in this country capable of cutting an accurate screw thread, but there is no British-made apparatus available and within the reach of the ordinary manufacturer whereby he can precisely measure the result, and much special apparatus cannot be produced without the use of American-made micrometer heads.

SAFETY IN PIT SINKING

By D. Street

SOME highly interesting evidence as to the value of the cementation process in mining has been adduced by the Midland Institute of Mining, civil, and Mechanical engineers. Among the cases in which the Francois System of cementation had been successfully applied are shaft-sinking, or level driving, underground dams, underground fires, defective boreholes, and defective shaft-lining. Cementation as applied to shaft sinking consists of thorough treatment of the measures through which it is desired to sink, thus rendering them practically watertight by the injection of cement into all the existing fissures or cracks in the ground previous to the commencement of actual sinking operations.

Among various instances of the application of the process, is that at Hatfield Main Colliery, and here cementing was decided upon for sinking through the heavily watered porous new red sandstone, and was commenced on the lands which had so far proved successful in ordinary stratified measures. In this case, however, it was soon discovered that in these measures the ordinary cementation process, alone, was of no service, it being found practically impossible to introduce cement into the ground to any useful purpose, as it was washed out by the pressure of the water. Instead, however, of discarding the process altogether, the work was persevered with, until finally, all difficulties were overcome by the introduction of the mechanical process of precipitation which facilitated the introduction of the

cement into the ground. Two chemical solutions were employed, the properties of which produced, when mixed, the formation of the gelatinous precipitate, which, by sealing the pores of the sandstones in the walls of the fissures and the loose material in the fissures, permitted the introduction of the cement. The chemicals used in this instance were silicate of soda and sulphate of alumina and the most efficient precipitation effect was obtained, by experience, in the degree of concentration of the respective solution. The lining of the two shafts consisted throughout of ferro-concrete.

At Rossington Colliery, cementation was effectively applied during the sinking through water-bearing limestone. A claim which might be justly made for the cementation process was its comparative safety. It made the work of the pit-sinker more secure, and reduced the liability to shaft accident due to a fall of bad ground. The chemical solutions which were employed at Hatfield Main had the effect of lubricating the fissures and allowing the introduction of the cement. In many cases the quantity of water in pit shafts, especially in North Wales was accepted as a necessary evil, but not to a necessity. If colliery managers knew what could be done by the cementation process, they would make efforts to get their mines dry. Very great benefits could be secured, which took a great load off the shoulders of the manager. At Vimy, near where British troops have been fighting, two shafts were sunk through chalk. The ground was very wet, but was cemented to a depth of 130 yards, and they had not one bucket of water.

LOST OUTPUT FROM COAL MINES

THE present wastage of man-power, with a corresponding loss in the national output of fuel, is of such importance as to call for the introduction of measures which will ensure to the nation the full-time service and labor of every mine worker. Thousands of miners have during this year worked only part time, the districts which have suffered most being perhaps the North of England, South Wales, and Monmouthshire and Scotland. It has been stated that the miners in Fifeshire and other districts have had just three days' work per week since the beginning of the present year, and that shortage of trucks has been responsible for laying several pits idle many days recently in the eastern valleys of Monmouthshire. For this state of things there is a remedy, which, though not altogether a profitable one from a pre-war point of view, has much to commend it in present circumstances. This remedy would be secured by giving effect to the following:—

1.—Every working colliery, irrespective of the general demand for coal, should bring to bank the largest pos- [illegible] mine worker should have whole-time employment.

2.—[illegible] or irregular demand for coal, the surplus output should be stored; at some collieries the small coal could be converted into briquettes and stored in this form for future use.

3.—If the stores of coal were likely to become too large (the nation would be the better for having a reserve store of some millions of tons) short time should not be introduced, but specially selected collieries should be closed down and the labor thus released transferred to the ironstone mines or to other industries or works of national importance.

Handling and Weathering

The disadvantages of coal storage are: —(a)—Loss due to cost of handling; (b) —loss due to weathering; and (c)—possibility of spontaneous ignition.

The cost of storing the coal and then removing it from the stock ground will, of course, depend on the facilities provided for handling; but the amount spent in this way will only be a very small fraction of the present national loss due to capital, labor, and plant being employed only part time. Stock grounds or coal stores would be so situated as to suit the requirements of each particular colliery or group of collieries. The coal in most cases would be stored at or near the pit mouth—i.e., at the point of production; but it might also be stored in some cases at or near the docks, and if transport facilities allowed consumers might be given the option of storing against their future demands.

The loss due to weathering need not cause much concern, since it would not be large from the pecuniary point of view. Colliery owners could in many cases select for storage the coals which, owing to their physical properties and chemical composition, are most immune from the effects of weathering or storage. Some tests on the effect of exposure on certain coals yielded the following results:—

Description of Coal	Storage Condition	Effect on Calorific Power
Bengal coal, India	[illegible] exposed for [illegible] months in the open	[illegible]
*Scotch anthracite cobbles	[illegible] England for $2\frac{1}{2}$ years.	[illegible]
*Scotch [illegible] coal	[illegible]	[illegible]

*These coals, if stored in large quantities, would [illegible]

Spontaneous Ignition

Under reasonable conditions of storage, any loss due to spontaneous ignition will be infinitesimal. Coals which are specially susceptible to spontaneous firing are in most cases well known and comparatively few in number. The [illegible]

1.—The depth of the stacks should be [illegible] of coal is more likely to heat than a mass or stack of moderate depth.

2.—The presence of sulphur in the form of iron pyrites may be a source of heat owing to the reaction between the sulphur and oxygen. Thus the coal stacked should be as free from iron pyrites or brasses as is practicable.—Times Engineering Supplement.

LARGE TRADE INCREASE

CANADA'S trade, exclusive of imports and exports of coin and bullion and of foreign merchandise shipped through, increased, according to a statement by Hon. J. D. Reid, Minister of Customs, by almost one hundred million dollars in July last, as compared with July, 1916, and by nearly $290,000,000 in the four months ended July 31, in comparison with the like period last year. The value of merchandise entered for consumption in July, 1917, was $90,181,595, and in July, 1916, was $63,622,687. Goods entered for consumption in the four months of the present fiscal year amounted to $382,100,850, as against $249,867,867 in the like period of 1916. Exports of domestic goods reached $177,366,148 in July last and $507,854, 674 in the four months' period. They were $104,964,270 in July, 1916, and $350,345,305 in the first four months of the last fiscal year.

Exports of foreign merchandise have shown a decided falling off. They were in July only $2,850,372 and in the four months $11,604,620, while in the same periods of 1916 they reached $55,637,340 and $122,627,072 respectively.

Of the imports for consumption, $49,442,400 in July were dutiable and $40,739,195 were on the free list. During the month Customs duties were collected to the amount of $14,241,047, as compared with $11,071,100 in July, 1916. Of the imports in the four months' period $202,470,345 were dutiable, and the duties collected totalled $60,528,738, as compared with $46,063,507 in 1916.

There was a decided increase in exports of animals and their products in the periods covered by the statement. Exports of agricultural products in July about equalled those of July, 1916, but there was an increase of $34,000,000 in the exports of these goods in the four months of the present year as compared with the like period of last year. The greatest increase was in manufactures. Manufactured goods to the amount of [illegible] in July, and to the amount of $237,480,303 in the four months of this year.

In July, 1916, exports of manufactures [illegible] were $119,824,138.

[illegible] at trifles.

[illegible] of expressing the golden rule.

STEEL INDUSTRY DEVELOPMENTS

The War-Created Stimulus given the Steel Industry is Reflected alike in the Nature and Application of New and Improved Equipment being Installed and Developed.

TURBO-BLOWERS FOR BLAST FURNACES—II.*

By R. H. Rice and S. A. Ross.

UNTIL recently there has been a considerable difference in the efficiency of utilization of blast furnace gas as between the steam engine and the gas engine, but the latest types of steam turbines permit a steam plant to be operated with the same output of electric power to the mill, while also furnishing sufficient gas for blowing purposes, as plants containing gas engines, by the use of a very reasonable amount of make-up coal, as will be seen in the accompanying table, under Charges, Dollars per year. Therefore, the cost of fuel is one of the smaller considerations in judging the relative merits of these two types of installation; whether the price of coal is high or low, the comparison rests on other grounds.

Even with less efficient turbines the cost of coal for make-up is only one of the items which enter into the complete cost of operation, and we can make up a proper comparison of gas engine and steam turbine plants by adding both the fixed charges and the running charges in each case, and adding the excess cost of coal in the turbine plant, if any; and that plant which gives the least total with these figures is the better, regardless of its thermal efficiency.

Blast Furnace Cost Accounting

Blast furnace and steel mill plants have established certain arbitrary subdivisions for convenience in cost accounting; blast furnace cost, gas purifying cost, gas power station costs, etc., being kept as independent groups and charges being made from one department to another. These sub-divisions are not used here. The gas from the furnaces is used for the following purposes: Blowing the furnaces, pumping the necessary water for use about the blast furnace and in steel mills, and generating electricity for driving the steel mill and all auxiliary apparatus about the blast furnace plant.

On this basis complete plants have been laid out for a steel mill as an adjunct to four blast furnaces, one of these plants operated by gas engines and the other by steam turbines. These have been called "Typical Gas Plant," and "Typical Steam Plant," respectively. These plants include a blast furnace blowing station, an electric generating station and a pumping station. The figures used for operation, including the amount of carbon burned in the furnaces, gas supplied, electric power produced, water pumped, etc., are all representative of actual blast furnace and mill conditions. The costs have been carefully collected and adjusted to represent prices ruling in November, 1916.

Gas Plant Constituent

In the four-furnace gas engine plant there is included a gas-electric and gas blowing station with the necessary steam spares for emergencies. It also includes a boiler house supplying steam for various purposes and fired by gas when it is sufficient, and by coal when it is not. There are also proper gas washing and pumping stations.

The plant will be of proper size to supply all the blast furnace demands of air, water, steam and electricity. In addition it will supply during week day working hours, 5,000 kilowatts per furnace, and 4,450 gallons of water per minute per furnace for steel mills. During the time when gas is insufficient to enable the full output of the steel mills to be produced, coal will be used for make-up, the cost of which is included in the figures.

The carbon burned or gasified in the furnace is taken at 12,835 short tons per furnace per month. This corresponds to 400 tons of pig per day, with a coke rate of 2,100 pounds per long ton, or 500 tons per day with a coke rate of 1,700 pounds per long ton.

Typical Turbine Plant

The four-furnace steam turbine plant contains boilers and turbo-generators of sufficient capacity to make the output to steel mills of water and electric power equal to that of the typical four-furnace gas plant previously given. The power house will contain six turbo-blowers and three 12,000 kilowatt turbo-generators with the necessary auxiliaries including pumps for supplying all of the water used about the plant, boiler feed pumps, feed water heater, etc.

The steam conditions will be such as are used in modern electric stations, 235 pounds per square inch gauge, 200 degrees superheat and 28.5 inch vacuum. It turns out that no coal is needed on the average, but to equalize poor gas supply and excess power demands, an amount is used to bring the operation on a par with that of the gas engine plant.

It is to be noted, however, that even with 150 pounds and 28 inches vacuum, a steam plant would make a good showing, of course including the cost of the coal, which would then be greater.

Cost Comparisons

Comparisons have been made by others between gas engine and turbine plants using estimated figures for the most part. Such figures started out with an assumed amount of blast furnace gas produced per ton of iron and with a full load test figure for gas engine efficiencies; and practically 100 per cent. volumetric efficiency of reciprocating blowing tubs. All such suppositions are avoided in the present comparison. All of the

COMPARATIVE COSTS FOR TYPICAL FOUR-FURNACE PLANTS

First Costs

	Gas engine	Steam turbine
Primary washers	$ 131,250	$131,250
Secondary washing station	300,000	.....
Gas pipe from boiler house	212,500	.....
Boiler and piping	167,500	609,200
Boiler house	41,250	123,750
Electric station apparatus	3,250,000	745,600
Electric station house	250,000	69,200
Blowers, etc.	1,812,500	726,416
Blowing station house	237,500	69,200
Pumping station, standpipe, conduits	787,500	293,484
	$7,190,000	$2,768,100

Charges—Dollars Per Year

	Gas engine	Steam turbine
Running charges:—		
Primary gas washers	$ 2,100	$ 2,100
Secondary gas washers	42,000	.....
Boilers	12,000	52,750
Electric station	90,000	68,250
Blowing station	49,500	42,000
Pumping station	6,000	4,000
Running charges, total	$201.600	$169,100
Fixed charges at 13 per cent.	934,500	359,800
Coal	21,652	78,352
Total charges	$1,157,752	$607,252

*Abstract of paper read before the Engineers' Society of Western Pennsylvania.

†Of the Engineering and Turbine Research Departments, General Electric Co., Lynn, Mass.

data is secured from plants in actual operation, and this information is used in such a way as to avoid assumptions of fundamental values.

Taxes, interest and obsolescence or amortization are included under the head of fixed charges. (Depreciation is supposed to be divided between repairs, maintenance and obsolescence). Fixed charges are taken throughout at 13 per cent. This is a customary figure for gas engine plants. Steam turbine electric stations often use a lower figure in the neighborhood of 11 per cent.; therefore, the use of a figure 13 per cent. throughout is relatively favorable to the gas engine case. The fixed charges include the following items:—

	Per cent.
Interest (on bonds or capital invested)	5
Taxes	1
Insurance	1
Obsolescence (amount laid by as a sinking fund to retire or amortize the plant)	6
	13

The running charges include operating charges and also charges for maintenance and repairs, so as to keep the plant in first class condition up to the time it is fully amortized. Total charges are found by adding fixed charges, running charges and cost of coal. Make-up coal is used under emergency conditions and the cost of it is included in the total charges mentioned. Coal is taken at $2 per long ton delivered at the fireroom door, with 13,500 British thermal units per pound.

The running charges of the turbo-blowing apparatus are taken from the actual figures of cost of a turbo-blowing station which had been in use seven years—but adjusted by increasing them 25 per cent. to represent November, 1916, conditions. The running charges for the turbo-generating apparatus are representative figures from central power stations, similarly adjusted.

Heat balances of furnace during average week day working hours are given below. There is a margin on the average for fluctuation of gas and load. The figures are as follows:—

Gas Engine Plant

	Million B. T. U. per hr.	Per cent.
Boilers	62	5.8
Electric station	380	35.3
Blowing station	88	8.2
Stoves	323	30.0
Margin	223	20.7
	[illegible]	[illegible]

The figures for British thermal units for the turbine plant are divided proportionally to the steam consumption, allowing 70 per cent. boiler efficiency. These sub-divisions are nearly, but not exactly, comparable with the gas plant, the internal gas washing, electric and steam distribution being different. The figures are as follows:—

Steam Turbine Plant

	Million B. T. U. per hr.	Per cent.
Pumps and miscellaneous	81	7.5
Turbo generators	420	39.0
Turbo-blowers	148	13.8
Stoves	323	30.0
Margin	223	20.7
	1,195	111.0
Deduct heat from coal	119	11.0
Heat from gas	1,076	100.0

This comparison is based on the best gas engine figures for actual performance which have come to the authors' attention. The use of the figures from another and larger installation would render the use of make-up coal unnecessary except under circumstances which require its use in either plant.

The results show that, in the plants under discussion, the gas engine plant will cost nearly $4,500,000 in excess of the steam turbine plant. The operating cost, it is believed, will be about $550,500 per year more in case of the gas plant.

On the usual basis of computation employed in considering the advisability of installing more economical units in our central power stations, the saving to be realized by the use of the steam plant would justify an excess first cost of $5,505,000, whereas the steam plant actually costs $4,422,000 less. No matter what differences of opinion or of fact due to locality or type of installation may be applied to these figures, it may be accepted as certain that wherever fixed charges are assessed against the power plant, the steam turbine will show a balance in its favor.

CANADA'S SUGAR BEET INDUSTRY PROMISING

THE sugar beet is one of the best crops in Western Canada. With the necessary labor and capital, it is stated a most successful industry could be built up.

In Southern Alberta the area suited to the growth of sugar beets is greater in extent than any two of the largest producing districts in the United States. That more has not been heard of the possibilities of this crop in Alberta is due to the success of the farmer in grain growing and stock raising. But, just as a higher quality of grain with larger yields, is produced in Western Canada than in the older districts, so beets grown here generally contain a higher percentage of sugar and yield a greater tonnage to the acre than those grown elsewhere. Beets with a sugar content of 20 per cent. have been grown in successive years, and growers are confident that this percentage can be maintained with large crops.

In 1915 the consumption of sugar in Alberta was approximately 42,000,000 pounds; in British Columbia, 33,000,000; in Saskatchewan, 50,000,000, and in [illegible] total for the western provinces alone of [illegible] tion of sugar in the whole of the Dominion amounted to 37,000,000 pounds. A large market is therefore, right at the door. Alberta alone has an area sufficiently large to produce sugar for the needs of Western Canada, and also to export large quantities.

CANADA'S PULP INDUSTRY

THE progress that Canada is making toward becoming the world's centre for the manufacture of pulp and paper is indicated in figures recently published by the Department of Trade and Commerce. For the year ended July, 1916, the exports of paper amounted to $21,678,868, of which 88 per cent. went to the United States and 5.2 per cent. to the United Kingdom. This total is an increase of 31 per cent. over the figures for the year previous. The first export shipment of paper from Canada was made in 1892. The total exports for 1902 were but $24,000 and for 1913 only $6,327,000.

The total exports of paper, pulp, and pulpwood for the year ended July, 1916, were $40,865,266, of which the United States received 87 per cent. and the United Kingdom 6 per cent. The increase over the previous year was 27 per cent. On the other hand, Canada imported, during the year ended July, 1916, $6,327,398 worth of paper and manufactures of paper.

The foregoing facts, in conjunction with the use by Canadian pulp and paper mills of nearly $9,500,000 worth of pulpwood, indicate the tremendous drain upon Canadian pulpwood resources, according to a statement issued by the conservation commission. This drain is likely to increase rather than diminish, in view of the rapid depletion of accessible supplies of timber suitable for pulpwood in the United States.

If this great source of national wealth is to be perpetuated, much more stringent measures than in the past must be taken to prevent destruction by fire and to insure the restocking to valuable species of cut-over and burned-over areas.—"Monetary Times."

MOVING A BLAST FURNACE

MOVING a blast furnace is something new in the iron and steel industry, but this has been undertaken by the Algoma Steel Co., which has purchased the No. 2 furnace of the former Canada Iron Corporation, Midland, Ont., and is now [illegible] Midland to Sault Ste. Marie, a distance [illegible] purchased this unused furnace because it [illegible] plant and re-erect it in much quicker [illegible] under the present conditions. This is a [illegible] contracting engineers, Cleveland.

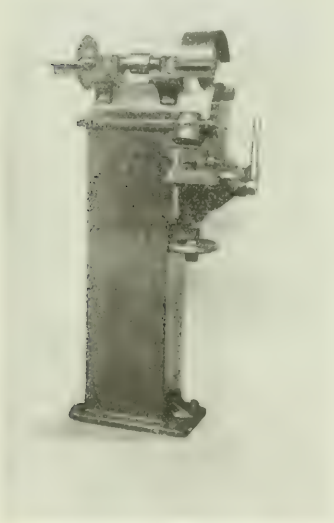
PROGRESS IN NEW EQUIPMENT

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

NAIL DIE GRINDING MACHINE

THE rapid and accurate grinding of nail machine dies, is a pre-requisite in the economical operation of nail machines. In connection with their line of nail machines, sleeper & Hartley, Inc., Coaticook, P.Q., have designed the die grinding machine illustrated herewith, and are now marketing it for use with dies of all kinds.

The machine is provided with two wheels, mounted on a double-ended spindle. One of these wheels is for squaring



NAIL DIE GRINDING MACHINE.

the dies, and guides for this purpose are provided upon the work rest,—the other wheel has a V-shaped, formed edge, and is intended for grinding the pointed dies. Below this wheel a table is mounted on the machine frame for vertical travel, and is adjustable to and from the wheel by a screw and hand wheel. This table carries a support adapted to receive the holder in which the die is mounted for grinding, the support being adjustable laterally, so as to bring the dies into line with the wheel.

The die holder itself may be rotated in the support so as to locate the die at will in any one of three grinding positions. When positioned, the die (together with its holder and support) is reciprocated to and fro past the wheel, while the whole table may be fed to or from the wheel as desired.

Operation of the machine is easily acquired by unskilled labor and accurately and uniformly ground dies can be produced without the aid of a skilled mechanic.

Normal equipment of the machine consists of one die holder to customer's specification, an additional die holder being required for each section of die stock. The machine is furnished with countershaft, weighs 350 lbs. net, and occupies a floor space of 16 in. by 22 in.

OFFSET DRILLING ATTACHMENT

INCREASED refinements in nearly every branch of machine construction and design have made corresponding demands on machine tool designers. One result of this has been to stimulate to the production of subsidiary devices and apparatus whereby not only is the handicap of deficient equipment removed from the designer, but the producer in the shop receives additional facilities, so that many hitherto impossible or troublesome operations are performed conveniently.

A device of this nature is illustrated herewith, the two operations shown demonstrating its applicability to work of a widely varying character not commercially feasible hitherto. The drilling of a hole in a high speed pulley rim in order to fix an oil tube will throw the pulley seriously out of balance. As shown in Fig. 1, the offset drilling attachment enables this objection to be overcome. Numerous applications of a

FIG. 1 DRILLING OIL HOLE IN PULLEY WITH OFFSET DRILLING ATTACHMENT.

like nature will suggest themselves such as drilling holes in engine crank shafts for balancing purposes, or for distribution of lubricant. It further enables designing engineers to embody in their designs ideas which are avoided at the present time due to lack of proper means for drilling in out of the way places.

The method of using shown in Fig. 2 is practically useful in jig and fixture work as well as in straight manufacturing. By using a counterbore or end mill of suitable dimensions, internal bosses

FIG. 2 OFFSET DRILLING ATTACHMENT FACING INTERNAL BOSS ON FIXTURE.

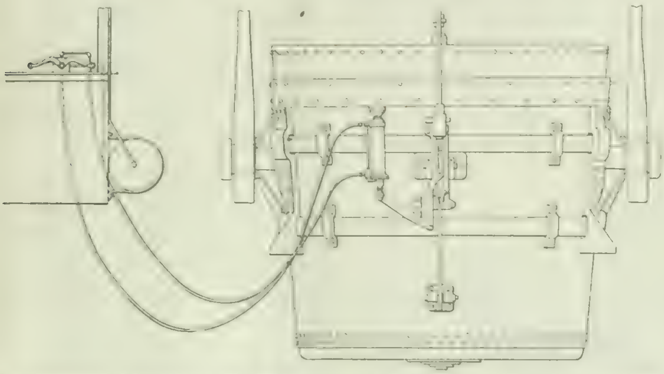
on castings, automobile parts, etc., may be faced off with ease and accuracy, this field of application being greatly widened by the use of a compound slide mounted on the drill press table by which end milling can be down in otherwise inaccessible positions.

This device is built by the H. E. Harris Engineering Co., Bridgeport, Conn., in eight sizes to fit every standard make and size of drill press or similar machine. The entire mechanism is contained in a single casting which is clamped to the lower end of the spindle sleeve by which it is fed down to the work while the spindle imparts motion to the drill through a train of heat treated vanadium steel gears. The attachment can therefore be swiveled among the centre of the drill press spindle to the position which is most convenient for the operator.

One holder is furnished with each attachment and the tool or drill is fitted to this holder, which has a positive drive and means for holding the tool central. Tools are readily changed without disturbing the set up of the attachment in the drill press.

MECHANICALLY-OPERATED LADLE STOPPER

THE disadvantages of operating a ladle stopper in the usual manner in present practice are numerous, owing to the extreme heat of the molten metal, its liability to scatter over the operators and other causes, says the Iron Age. It is apparent that the ladleman and his helper standing on the platform adjacent to the molds, occupy dangerous positions, because the gases escaping, while the mold is filling, keep the metal in motion and eruption, frequently causing some to fall on the operators. Again, the operators are sometimes fatally burned by the metal escaping from a ladle overturning when a rope, chain, hook, or other part of the hoisting mechanism breaks, which is liable to occur at any time. It also occasionally happens after partly emptying the ladle, that the metal violently reacts, the escaping gas throwing the liquid metal to the roof of the building and rendering it extremely dangerous for the operators.



PNEUMATIC APPARATUS FOR MECHANICALLY OPERATING THE LADLE STOPPER WHEN POURING STEEL.

A further serious objection is that not infrequently the stopper will only partially close the nozzle opening, due to imperfect construction, thereby allowing a stream of metal to escape when the nozzle is supposed to have been closed. The nozzle also occasionally breaks, owing to sudden expansion when the hot metal strikes it, causing a leak, so that while the ladle is being conveyed from mold to mold, the metal from a leaky nozzle striking the top edges of the molds, splashes upon the operators and frequently burns seriously.

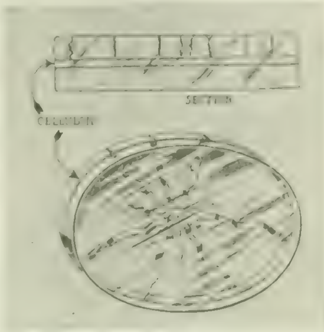
To overcome these objections and obviate the necessity of employing ladlemen, George A. Wettengel has devised an improved stopper operating mechanism in which the operation of the stopper is entirely under the control of the cranemen or the pusher, who is always a sufficient distance away to insure his safety.

According to U.S. patent No. 1,207,251, it [illegible] raising and lowering the ladle stopper. [illegible] the usual stopper mechanism is an air cylinder, as shown by the illustration, the piston rod of which is connected to the sliding plate by means of a link and lever. Mounted in the crane cage is an air valve similar to those used on pneumatic hoists having flexible tube connections to the cylinder and to the air tank. The ends of the tubes have quick detachable hose connections. A tank is attached to the crane and is supplied with air from a motor-driven compressor. The operation of the device is as follows:

After the ladle full of molten metal is in place over a mold, the cranemen raises the lever of the air valve admitting air under pressure to the cylinder which raises the stopper thus admitting the metal to flow through the nozzle into the mold. When the mold is full, the lever is lowered so as to admit air into the opposite end of the cylinder, which lowers the stopper and stops the flow of metal. This is not only a safety device, but it is also a labour saver, no ladleman being required.

UNBREAKABLE GOGGLE GLASSES

A SAFETY glass, which has a wide scope of applicability in connection with protective goggles and masks used by workmen where flying chips, the presence of gas, dust or unbearable light constitute a hazard to the eyesight, has been developed by an optical firm. That it will

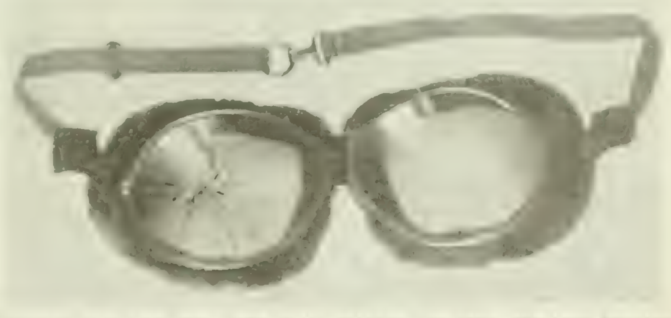


SKETCH SHOWING CONSTRUCTION OF UNBREAKABLE LENS.

appeal to machinists, foundry men, welders, sand blast operators, etc., can be gathered from the fact that, although the glass can be cracked, it cannot be actually broken even by a hammer blow, while in cracking there is no flying of splinters to jeopardize the eyesight of the wearer.

"Resistal" is the trade name of the glass used in the manufacture of these safety goggles and masks, and its construction is made plain by the accompanying sketch. It comprises two layers of perfect optical glass, which may be plain or curved, with a layer of celluloid interposed, the whole being welded—not cemented—into a solid mass. The result is a crystal that has every virtue of the ordinary glass, with none of its dangers and drawbacks; it has at the same time all of the strength and safety features of the celluloid "light," but, unlike celluloid, it is unscratchable, is rigid, and absolutely fireproof. Neither is it affected by water, heat or cold, and the celluloid layer provides a heat-insulating medium which effectively prevents clouding up, due to moisture condensation.

Goggles fitted with these crystals are being offered in a variety of styles to suit individual tastes and needs, and in either clear, amber or euphos colors,



GOGGLES MAY HAVE THE [illegible] [illegible]

by Strauss & Buegeleisen, 37 Warren Street, New York City. The firm also supplies the crystals in special forms for use in industrial masks. It is stated that these goggles have been adopted for the needs of the Aviation Corps, U. S. Army, while from the same quarter the makers have received orders for a large number of crystals for military gas mask purposes. The fact that the glass remains perfectly gas and water-tight even when badly cracked, makes it ideal for use in the latter application.

THE HYDRAULIC RAM

IN response to an inquiry from one of our readers concerning the operation, etc., of the hydraulic ram, we have pleasure in reproducing an article covering same which appeared in our columns some years ago, believing that by doing so the information will be appreciated by others as well.

The principles underlying the construction and operation of the hydraulic ram were recognized as early as 1775 by John Whitehurst, who in that year communicated to the Royal Society a paper describing a machine of a similar type

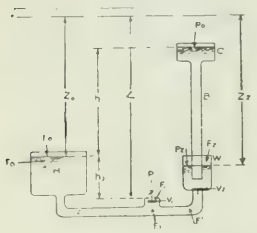


FIG. 1.—DIAGRAM OF OPERATION OF HYDRAULIC RAM.

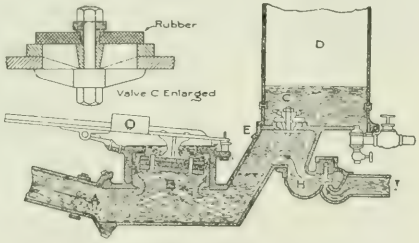


FIG. 2.—SECTION OF DOUBLE SUPPLY HYDRAULIC RAM.

in which the overflow or waste valve was operated by hand. The next improvement was made by a Frenchman, Joseph Michael de Montgolfier. He was the first to see that the variable pressure, produced by changing the velocity of a column of water, could be utilized to operate the valve. Since that time, although numerous improvements have been made in the way of securing quick action of valves by aid of springs and weighted levers, the ram is essentially the same as in its earliest form.

A drive pipe A, Fig. 1, takes water from a source of supply H, to a chamber which contains the valve V. This valve, which opens inwardly, is called the waste or overflow valve. In another part of the same, or communicating chamber, is a check valve V_1 which leads to the tank into which water is being forced and which has a water level considerably above that of the supply tank. When V_1 is opened, the column of water in the drive pipe is set in motion, and will finally attain a velocity which builds up a pressure under V_1 sufficient to close the waste valve. The energy of the moving mass in the drive pipe cannot immediately be dissipated, therefore, the pressure in the chamber rises and lifts the check valve, allowing some of the water to enter the air chamber W, compressing the air and forcing an equal amount of water into the tank C. When the water in the drive pipe comes to rest, V_2 closes, V_1 opens, and the cycle is repeated. The pressure may for an instant be slightly less than atmospheric, and advantage is taken of this to introduce a small amount of air through an air valve. This air replenishes any part of the supply in the air chamber which may be carried out with the water.

Although the ram may have a high efficiency, it is wasteful of water, and the form shown in section in Fig. 2 has been devised to pump pure water with a minimum of waste. Connection is made at A to the source of waste water, which may be any polluted water available. The connection to the potable water should preferably come from a source under slightly greater head than the impure water. In this ram the waste water consists mainly of that entering at A but, in part from that entering at I and, if the capacity of the space between the waste valve B and the check valve C is greater than the amount of water delivered per pulse, no impure water can enter the chamber D. In this ram the air valve is placed at E.

The hydraulic ram lends itself readily to variable demand, which can be met by either changing the weight of the waste valve or adjusting its stroke. Its greatest field is in the water supply for small towns where the cost of maintenance and attendance must be kept as low as possible.

Screenings

They Took Him.—John Humphries is telling this one in his "Home From the Front" scene: "Fellow appealed at the tribunal 'cos he 'ad one foot shorter than the other. They passed 'im for general service abroad. The ground's very uneven in France."

A popular archdeacon whilst out one day with his dog and gun met a parishioner.

"I hope," said the archdeacon, "you attend church regularly and read your Bible?"

"I do read my Bible," replied the parishioner, and added, in a severe tone, "but I nowhere find that the Apostles went out shooting."

"No," said the archreacon, "the shooting was very bad in Palestine, so they went fishing instead."

A man living in a quiet country place invited a neighbor to dine and spend the evening with him. The night being dark, when it was time to go, the guest, who had done himself very well, begged to be allowed to borrow a large lantern in the hall to light him on his way. The next day the host sent his servant round with the following note: "Dear old chap, I shall be glad to have back my parrot and cage if you have finished with it."

"Have you taken anything for your complaint?" asked the doctor of a long, lank, hungry-looking man, who came to him complaining of being "all run down," his appearance verifying his words.

"Well, I ain't been taking much of anything, Doc—that is, nothing to speak of. I tuk a couple o' bottles o' Pinkham's bitters awhile back, an' a bottle of Quackham's invigorator, with a couple o' boxes o' Curem's pills, and a lot o' quinine, and some dandelion tea my old woman made. I've got a mustard plaster on my back, an' a liver pad on, an' I'm wearing an 'lectric belt, an' takin' cod liver oil four times a day, with a dose or two of ginger ev'ry other day; 'ceptin' for that I ain't takin' nothin."

The Theatre Habit.—Two girlhood friends were exchanging confidence over their afternoon tea.

"I saw you in church, dear, yesterday," murmured the younger one.

"Oh, you were there? I didn't see you," gurgled the other.

"Yes. And I was so glad to see that you finally induced your husband to accompany you to divine worship."

"Yes, Frank came along with me. He'd much rather go to the threatre, but the theatres are not showing anything on Sundays now. But he disgraced me."

"Really? In church? How, pray?"

"The minister read four chapters from The Acts of the Apostles, and my husband insisted on going out after every act."

Kind-Hearted Rena.—The wife of a successful young literary man had hired a buxom Dutch girl to do the housework. Several weeks passed and from seeing her master constantly about the house, the girl received an erroneous impression.

"Ogscuse me, Mrs. Blank," she said to her mistress one day, "but I like to say somedings."

"Well, Rena?"

The girl blushed, fumbled with her apron and then replied, "Vell, you pay me four tollars a veek—"

"Yes, and I really can't pay you any more."

"It's not dot," responded the girl: "but I be villing to take tree tollars till—till your hunsband gets vork."

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OUR METAL-WORKING PLANT OUTLOOK CONTINUES BRIGHT

AN interesting feature of the Canadian steel situation during the present week has been the intimation by the Imperial Munitions Board to producers that for the present month shipments to the trade must be of secondary consideration because those of shell steel are running behind schedule. The latter circumstance is of course due to the prevailing hot weather at this season of the year, which militates against maximum output on the part of the men employed in the mills. Taken in conjunction with the U.S. steel embargo, which went into effect on the 15th of the month, the position of domestic consumers requiring more or less immediate delivery, is by no means an enviable one.

Price fixing by the American Government is still under consideration, and, judging by appearances, the undertaking is becoming all the time more impossible. Something approaching two months has now elapsed since the propaganda was inaugurated, and the principal result to date has been the dislocation of the market. In the latter, the tendency has been towards a downward readjustment of prices, and doubtless this will be so accentuated in the near future that the much talked of "fixing" will be forestalled and therefore unnecessary.

The curtailment of finished shell production in Canada has so far had but little effect on the labor situation, which goes to show that a great majority of the metal-working plants have been taking time by the forelock in the introduction of other lines of product. It has always been our view that a grossly exaggerated estimate of the number of men employed in munitions making existed, and does still exist, and that meantime it would be more correct to rate the operator constituent in terms of thousands instead of by hundreds of thousands as seems to be the rule.

The impetus given steel shipbuilding in Canada has been the means of absorbing much of the overflow help from munitions-making, besides creating new opportunities for craftsmen who have not been directly involved in that industry. We do not look to see unemployment develop to any great extent as a result of even the complete cessation of munitions machining, steel shipbuilding and its allied industries for the next five years at least, being of such gigantic proportions as to need all the help—skilled and otherwise that may be procurable.

To what extent Canadian metal-working plants are likely to participate in U.S. Government contracts is meantime problematical, however, private advices from Washington, D.C., indicate that contracts covering a miscellaneous assortment of ship and munitions production equipment are likely to be procurable. Ships' anchors, to mention one line for which contracts are pending, are called for in quantity up to 20,000,000 pounds, and difficulty is anticipated in placing the complete order in the States, plants engaged in the manufacture of these products in the past being under somewhat of a handicap because of each anchor unit being a departure from former practice.

It is understood that some Canadian metal-working interests have already taken action as regards securing American Government war business, with what success, however, we are not at the moment in a position to say. Others are doubtless anxious to bear a part in the work, if they can get opportunity; to which end, information available to this journal is at their disposal.

ACCIDENT PREVENTION

CONSERVATION of life and energy has probably never before been so deeply impressed upon our minds as now. The need of preserving and protecting humanity from the risks of permanent or temporary disablement, arising from industrial activity, has been much emphasized by the knowledge that the past three years has shorn us of much of that man power which is so indispensable to our national development in the arts, crafts and manufactures. What may tend to increase the possibilities of accident, and likewise the responsibilities of the employer and the employed, is the advent of woman labor into the ranks of metal-working plant operators. While the likelihood of accident may be no greater in one case or the other—the female than the male, the fact that the so-called weaker sex must inevitably take a prominent part in post-war development, should be a stimulus to those concerned, to eliminate, or at least constrict the opportunities for injury that have ever been incidental to most phases of manufacture.

While safe-guarding methods and devices are deserving of just commendation they should never be wholly relied upon as an infallible proof of non-liability to injury. No proposed or adopted method of operating or guarding machine mechanisms should be termed fool-proof, even though it has been amply demonstrated that it is practically impossible to tamper with or destroy its intended purpose. The mere statement that a thing is fool-proof implies that it is proof against a fool's meddling, and any fair-minded person would or should resent the implication. It is invariably within the power of the workman to "make" or "mar" any new innovation—providing its effectiveness is being tried for the first time.

It does not pay to "force" protection on factory employees, but it does pay to have them realize the many advantages that are to be derived by adapting themselves to the changed conditions. Some men unfortunately become easily prejudiced, and will for a time do all in their power to deter rather than assist such methods as are advanced for their own welfare and protection. No safety or protective device can be entirely successful without the absolute co-operation of the employees it is intended to serve. If a safety method has any outstanding advantages —and few have not a fair proportion, it should be the duty of the workman to adapt himself as rapidly as possible to [illegible] be the chief beneficiary.

SELECTED MARKET QUOTATIONS

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

PIG IRON.

Grey forge, Pittsburgh		$47 95
Lake Superior, charcoal, Chicago		58 00
Standard low phos., Philadelphia		87 00
Bessemer, Pittsburgh		55 95
Basic, Valley furnace		53 00
	Montreal	Toronto
Hamilton	.....	.....
Victoria	.....	60 00

FINISHED IRON AND STEEL.

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

FREIGHT RATES.

Pittsburgh to Following Points

	Per 100 lbs. C.L.	L.C.L.
Montreal	23 1	31 5
St. John, N.B.	35.1	45 5
Halifax	35 1	45 5
Toronto	18.9	22 1
Guelph	18 9	22 1
London	18.9	22 1
Windsor	18 9	22 1
Winnipeg	64 9	85 1

METALS.

	Montreal	Toronto
Lake copper	$34 00	$35 00
Electro copper	34 00	35 00
Castings, copper	33 00	34 00
Tin	62 00	64 00
Spelter	11 00	11 00
Lead	13 50	13 50
Antimony	20 00	20 00
Aluminum	65 00	64 00

Prices per 100 lbs.

PLATES.

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

WROUGHT PIPE.

Effective July 5, 1917.

Standard Buttweld.

Size.	Black Per 100 feet	Galvanized
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 [illegible]	20 [illegible]
1½ in.	[illegible]	24 61
2 in.	[illegible]	[illegible]
2½ in.	[illegible]	[illegible]
3 in.	55 08	69 23
3½ in.	[illegible]	86 [illegible]
4 in.	82 84	103 00

Standard Lapweld.

Size	Black	Galvanized
2 in.	29 28	35 71
2½ in.	43 88	54 11
3 in.	57 38	70 76
3½ in.	71 76	89 70
4 in.	85 02	106 28
4½ in.	96 52	121 29
5 in.	112 50	141 34
6 in.	145 90	183 36
7 in.	190 40	238 00
8 L in.	200 00	250 00
8 in.	230 40	288 00
9 in.	276 00	345 00
10 L in.	256 00	320 00
10 in.	329 60	412 00

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES.

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

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$23 00	$22 00
Copper, crucible	26 00	27 00
Copper, heavy	26 00	25 50
Copper wire	26 00	25 50
No. 1 machine composition	20 00	22 00
New brass cuttings	16 00	19 00
No. 1 brass turnings	14 00	16 00
Light brass	12 00	10 50
Medium brass	16 00	16 00
Heavy brass	18 00	18 00
Heavy melting steel	21 00	17 00
Steel turnings	11 00	8 00
Shell turnings	12 00	12 00
Boiler plate	18 00	10 50
Axles, wrought iron	25 00	24 00
Rails	20 00	18 00
No. 1 machine cast iron	27 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	19 00	9 00
Car wheels, iron	26 00	25 00
Steel axles	29 00	30 00
Mach. shop turn'gs.	8 50	8 50
Cast borings	12 00	8 50
Stove plate	19 00	19 00
Scrap zinc	8 00	9 50
Heavy lead	11 00	10 75
Tea lead	7 00	7 00
Aluminum	35 00	35 00

BOLTS, NUTS AND SCREWS.

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

MILLED PRODUCTS.

	Per cent
Set screws	35
Sq. & Hex. Head Cap Screws	30
Rd. & Fil Head Cap Screws	10
Flat ⅞ But. Hd. Cap Screws plus	10
Fin. & Semi-fin. nuts up to 1 in.	35
Fin. and semi-fin. nuts, over 1 in., up to 1½ in.	30
Fin. and semi-fin. nuts, over 1½ in., up to 2 in.	10
Studs	20
Taper pins	40
Coupling bolts, plus	10
Planer head bolts, without fillet, list plus	10
Planer head bolts, with fillet, list plus 10 and	10
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws...list plus	20
Collar screws ....list plus 30,	10
Thumb screws	20
Thumb nuts	65
Patch bolts .... add 40,	10
Cold pressed nuts to 1½ in.	add $4 50
Cold pressed nuts over 1½ in.	add $7 00

BILLETS.

	Per gross ton
Bessemer billets	$90 00
Open-hearth billets	[illegible]
O.H. sheet bars	95 00
Forging billets	125 00
Wire rods	95 00

F.o.b. Pittsburgh.

NAILS AND SPIKES.

Wire nails	5 50	5 45
Cut nails	5 70	5 80
Miscellaneous wire nails		60%
Spikes, ⅜ in. and larger		7 50
Spikes, ¼ and 5-16 in.		8 00

MISCELLANEOUS.

Solder, strictly	0 38
Solder, guaranteed	0 41
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 60
Linseed oil, raw, single, bbls.	1 27
Linseed oil, boiled, single bbls.	1 30
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A. ..list plus	20
Emery Cloth ......list plus	33 1-3
Borax crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 03
Rosin "G," per lb.	0 03½
Borax crystal and granular	0 15
Wood alcohol, per gallon	2 15
Whiting, plain, per 100 lbs.	2 20

ROPE AND PACKINGS

Plumbers' oakum, per lb.	.09
Packing, square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila Rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.47

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 25%

CARBON DRILLS AND REAMERS.

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

COLD ROLLED SHAFTING.

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

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

IRON PIPE FITTINGS.

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

SHEETS.

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

PROOF COIL CHAIN.

	B
¼ in.	$12 00
5-16 in.	11 50
⅜ in.	11 15
7-16 in.	10 90
½ in.	10 70
9-16 in.	10 70
⅝ in.	10 50
¾ in.	10 40
@ 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.

1/8 in.	$15 50
3-16 in.	11 70
1/4 in.	8 40
5-16 in.	7 40
3/8 in.	6 [illegible]
7-16 in.	6 [illegible]
1/2 in.	6 35
5/8 in.	[illegible]
3/4 in.	[illegible]

Prices per 100 lbs.

FILES AND RASPS.

	Per Cent
Great Western, American	[illegible]
Kearney & Foot, Arcade	[illegible]
J. Barton Smith, Eagle	[illegible]
McClelland, Globe	[illegible]
Whitman & Barnes	[illegible]
Black Diamond	[illegible]
Delta Files	[illegible]
Nicholson	[illegible]
P H and Imperial	[illegible]
Globe	50
Vulcan	50
Disston	50

COAL AND COKE.

Solvay Foundry Coke	[illegible]
Connelsville Foundry Coke	14 00
Steam Lump Coal	[illegible]
Best Slack	[illegible]

Net ton f.o.b. Toronto

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$33 00	....
1 1/4 in.	36 00	....
1 1/2 in.	[illegible]	[illegible]
1 3/4 in.	[illegible]	[illegible]
2 in.	[illegible]	[illegible]
2 1/4 in.	[illegible]	[illegible]
2 1/2 in.	[illegible]	[illegible]
3 in.	[illegible]	[illegible]
3 1/4 in.	....	53 00
3 1/2 in.	[illegible]	[illegible]
4 in.	82 00	67 00

Prices per 100 feet, Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	40
[illegible]	[illegible]
[illegible]	[illegible]
Machine oil, per gal.	[illegible]
Black oil, per gal.	[illegible]
Cylinder oil, Capital	[illegible]
Cylinder oil, Acme	[illegible]
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	[illegible]
[illegible] thread cutting oil antiseptic	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

BELTING—NO. 1 OAK TANNED

Extra heavy, single and double	[illegible]
Standard	[illegible]
[illegible]	[illegible]
Leather in sides	1 60

TAPES.

Chesterman Metallic, 50 ft.	$2 [illegible]
Lufkin Metallic, 603, 50 ft.	2 [illegible]
Admiral Steel Tape, 50 ft.	2 [illegible]
Admiral Steel Tape, 100 ft.	[illegible]
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 [illegible]
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	[illegible]
Standard	[illegible]
No. 1	[illegible]
Popular	[illegible]
Keen	[illegible]

WOOL PACKING.

Arrow	25
Axle	20
[illegible]	15
Anchor	11

WASHED WIPERS.

Select White	12
Mixed Colored	10
Dark Colored	[illegible]

This list subject to trade discount for quantity.

RUBBER BELTING.

Standard	40%
Best grade	20%

ANODES.

Nickel	[illegible]
Cobalt	1 75 to 2 [illegible]
Copper	[illegible]
Tin	[illegible]
Zinc	[illegible]

Prices Per Lb.

COPPER PRODUCTS.

	Montreal	Toronto
Bars, 1/2 to 2 in.	[illegible]	[illegible]
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x48 in., 14x60 in.	[illegible]	[illegible]
Copper sheet, tinned, 14x60, 14 oz.	[illegible]	54 25
Copper sheet, planished, 14x60 base	64 00	[illegible]
Braziers', in sheets, 6x4 base	[illegible]	[illegible]

BRASS.

Brass rods, base 1/2 in to 1 in. rd.	[illegible]
Brass sheets, 8 in. wide, 20 oz.	[illegible]
Brass tubing, seamless	[illegible]
Copper tubing, seamless	[illegible]

PLATING SUPPLIES.

Polishers' wheels, felt	[illegible]
Polishing wheels, bullnecks	[illegible]
[illegible] kegs, American	06
Pumice, ground	[illegible]
Emery glue	15 to 20
Tripoli composition	04 to 06
Crocus composition	07 to 08
Emery composition	08 to [illegible]
Rouge, silver	[illegible]
Rouge, powder	[illegible]

Prices Per Lb.

LEAD SHEETS.

	Montreal	Toronto
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Cut sheets, 1/2c per lb. extra.

[illegible] extra.

PLATING CHEMICALS.

Acid, boracic	$ [illegible]
Acid, hydrochloric	[illegible]
Acid, hydrofluoric	[illegible]
Acid, nitric	[illegible]
Acid, sulphuric	[illegible]
Ammonia, aqua	[illegible]
Ammonium carbonate	[illegible]
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.)	.65
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	[illegible]
Zinc chloride	.60
Zinc sulphate	09

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

No official announcement has as yet been made at Washington regarding prices of steel, although a report is current that the American Government and the Allies will pay $65 a ton for their requirements. While this is not official, it may prove to be correct, at the same time there may be provisos added to change the character of decision. Questions arising out of the embargo on steel from the United States are under consideration by the leading steel interests in Canada with a view to relieving the somewhat acute situation created. Certain trades, it is hoped, will obtain better treatment than was anticipated in the first instance. With the exception of billets, prices on steel products continue stationary, but with a weaker tendency. The continuance of present price conditions depends largely upon what action the U.S. Government will take in regard to its price-fixing policy. Until something definite is known no material change in the situation may be expected. Pig-iron prices are firm and unchanged. The market continues dull and unsettled, the embargo on iron from the States having caused considerable inconvenience to consumers. Coke [illegible] of coal. The scrap metal market is dull, but prices are stationary with a weaker tendency. Consumers are keeping out of the market expecting lower prices, while sellers are looking for an advance. Nonferrous metals are firmer and the outlook in the market is brighter. Considerable uncertainty, however, still prevails regarding developments in prices. Tin has advanced one cent, this being the only change to note this week. The machine tool [illegible] tools for general purposes, replacing the former demand for [illegible] equipment for ships.

Montreal, Que., Aug. 20, 1917.—The industrial situation has developed no features of interest during the past week, and the markets are still awaiting the announcement of the American Government regarding the finding of the various investigations that have been progressing with a view to adjusting the prices to meet the requirements of the present situation. That these adjustments will affect the present standing of the market is generally understood, but the uncertainty as to actual price figures tends to maintain the market in a very unsettled state. Owing to transportation requirements in America, the recall of rolling stock now on the various Canadian roads, has somewhat disorganized railroad facilities here in Canada, and shippers and consumers are experiencing some difficulty in the delivery of material.

Pig Iron

While any falling off in actual production [illegible] may have on early future conditions. [illegible] templated action on the price fixing and

control of raw and semi-finished materials. While there is an undoubted undertone of weakness, the present market continues comparatively firm with all quotations nominal and unchanged. Conditions here are still the same with Canadian quotations withheld.

Steel.

Added to the seasonal dulness, the general market continues to reflect the uncertainty that prevails in all quarters owing to the price fixing plans of the American Government. It is reported unofficially that a flat rate of $65 per ton is likely to be decided on, as the figure at which steel for war purposes will be supplied to all the Allies, but the impression of the trade appears to be that any adjustment that the Government may make will not be a satisfactory solution to the present situation, as the many plants now working on the production of steel are doing so under greatly varied conditions, which make it very difficult to set a fixed price for steel and iron on the actual cost of production. However, with the steel makers and the Government working hand in hand for the same end, it is possible that some decision will be arrived at that will be agreeable to all concerned. The excessive requirements that have been created by the United States war program have necessitated a partial embargo on shipments of steel into Canada, other than that required for war materials, resulting in a further handicap to the domestic consumer. The demand for steel in Canada for munitions purposes shows a slight falling off and in addition to the stoppage of large shell manufacture, there is a rumor that the production on the 4.5 inch high explosive will shortly be cut, so as to provide increased material and funds for shipbuilding purposes. While the general activity remains the same, the situation is affected by the delay on the part of the U. S. Government in the adoption of the policy that is to control the future sale and distribution of all war materials. The restrictions that have been placed upon the export of steel have recently resulted in an over supply of billets and sheet bars on the American market, and the situation in these commodities has developed an easier tone, aided also by the prevailing uncertainty; the Pittsburgh quotation of $85 shows a decline of $5 per ton. A similar decline is noted in rolling and forging billets, the respective quotations being $100 and $125 per ton. With the exception of Government work, or that authorized by the Government, structural material is almost at a standstill; the Canadian situation is relatively quiet, but that in the States is very active, more particularly on new plants for munitions or ship building. The plate situation is not so active, but continues to be the feature of the market. The wire market, including rods and wire products, is fairly active, but these, like other commodities, are passing through an unsettled period, during the investigation into labor and production costs. The local situation shows little change as the trade is still awaiting the outcome of present developments, both on this and the other side of the line. Transportation difficulties continue to be a feature of the existing conditions.

High Speed Steel.—Nothing of importance has developed to alter the situation in the high speed steel market, although the demand is not as brisk as a few months back; the price is nominally unchanged owing largely to the high cost of all raw materials and the higher expense entailed in manufacture.

Metals.

The metal situation is still influenced by the attitude of the United States Government in connection with the setting of prices on the various metals and the control of the sale and delivery to the many consumers. It is not definitely known whether the prices will be the same to all, but it is anticipated that just consideration will be given to maintain harmony in all directions. Copper is inactive and showing a weaker tone. Tin is also quiet, being affected by the uncertainty of general conditions. Spelter is easing off as a result of increased supply. Lead is a little quieter, but is continuing firm. Antimony and aluminum are both quiet and unchanged.

Copper.—It is anticipated that the American Government will shortly be in a position to announce the prices to be paid for copper and other metals, based on the investigation that has been taking place into the actual cost of production. The near approach to definite action in this direction has left the market in a pronounced state of inactivity, as few are anxious to buy under the present unsettled condition. Nothing is apparently known as to the price set by the Government, but that a figure lower than the present market will prevail seems to be indicated by the weaker tone of the New York market; a decline of ½c being reported on lake, ¾c on electro, and 1c on castings. American quotations are 29½c, 27¼c and 26½c respectively. On a quiet market, prices are unchanged at 34c for lake and electrolytic, and 33c for castings.

Tin.—This market, while not directly in the control of the American Government, has experienced much of the unsettlement that has been so marked in other directions. No active buying has taken place of late as consumers are awaiting developments. It is anticipated and furthermore hoped, that the British Government will reciprocate in connection with tin transactions, in return for the attitude that the American authorities contemplate in the prices that will be set for steel and metals for delivery to the Allies. This uncertainty, however, places the trade in a position where reluctance is one of the features of the present market. Local tin is not active, but quotations are firm at last week's price of 62c per lb.

Spelter—The market is still reflecting the secrecy of the American Government in connection with the announcement of prices paid for recent purchases and those that are expected to be paid for early future requirements. The accumulation of stocks has made the spot price easier, but the future quotations are strong. New York quotations on spelter have declined ⅛c during the week, the price being now a little better than 8½c per lb. Dealers here report a quiet market with a weak undertone; present prices are, however, the same as last week, 11c per lb.

Lead.—The situation is undoubtedly easier, but the apparent absence of heavy supplies continues to retain a relatively firm market. Despite the fact that independents are quoting ⅛c lower than last week, the market has remained inactive; this being accounted for by the general uncertainty of the present situation. Local dealers are quoting last week's price of 13½c on a quiet market.

Antimony.—The market is quiet and inactive and is also developing a weak undertone as a result of a falling off in the demand. The New York market is easier, and has declined ⅛c to the nominal figure of 15⅜c per lb. The situation here is quiet and unchanged with prices steady at 20c per lb.

Aluminum.—The situation in aluminum is undoubtedly easier, but no marked change is reported in current quota-

PUMPING EQUIPMENT REQUIRED

Tender forms, specifications and drawings have been received from D. H. Ross, Canadian Trade Commissioner, Melbourne, for the supply and delivery of pumping plant and equipment for the Commonwealth naval dockyard, Cockatoo Island, Sydney, N.S.W., and are open for inspection at the Department of Trade and Commerce, Ottawa (refer to File No. A-1901). Tenders addressed to either the Director of Navy Contracts, Navy Office, Melbourne, or the Director of Naval Contracts, care Commonwealth Naval Dockyard, Cockatoo Island, Sydney, N.S.W., close on October 10, 1917. The particulars are as follows:

Two main dock pumps with vertical spindle motors and control equipments.

One vertical spindle motor and control equipment.

Four sluice valves with four motors and control equipment.

Two drainage pumps with motors and equipment.

Two air exhaust pumps with motors and equipment.

One enclosed motor and equipment for dock caisson.

tions. Local dealers continue to quote 65c per lb.

Machine Tools and Supplies.

No features have developed in the machine tool situation and dealers report the market much the same as last week, with considerable inquiry still coming in for general equipment suitable for marine work and ship repair. The demand for munitions machinery is almost at a standstill, but the requirements in this direction necessitate a constant demand for all classes of machine shop supplies and small tool accessories; and the prices of such supplies continue very firm and in some instances are still advancing.

Scrap.

The situation has shown little improvement, being still affected by conditions that prevail throughout the general market. No active buying is apparent, the tendency being to await the outcome of pending developments; in the meantime consumers are only buying for their immediate needs. With the exception of heavy melting steel scrap—which is stronger—the trend of American iron and steel scrap is downward. Old metals are comparatively firm. Local dealers report a week of slight fluctuations, but prices at time of writing are relatively the same as last week.

Toronto, Ont., Aug. 21.—There is a decided falling off in activity in the munitions industry. Fewer contracts for shells are being placed, and the output has declined. Machine shops in some cases are turning their attention to other classes of work, with considerable success. Aeroplane motors, marine engines, ship deck machinery, etc., are now being manufactured by several firms, while others are engaged upon general lines. It is possible that Canadian engineering concerns may ultimately obtain orders for work from the U. S. Government. This, however, is not likely to happen except in isolated cases until the plants in the States are filled up with business, which will not be for some time yet.

Steel

According to a report from Washington, a price of $65 a ton has been fixed on the steel required by the American Government and the Allies. Not being official, details are lacking, but the figure is probably pretty near the mark. Until the official announcement is made, no marked change in the market is anticipated, as nothing is known regarding the position of the ordinary consumer, which is perhaps the most uncertain feature of the whole situation. It is taken for granted that prices of all steel for war purposes will be controlled, but how this will affect the domestic consumer is problematical. It appears to be more than likely that prices of steel other than for war purposes will be allowed to find their own level. At the present time the market is stationary. Although prices have a weaker tendency for some steel products, no marked recession is looked for in the meantime. The enormous demand for steel, which is world-wide, will likely tend to prevent any important decline in prices except for Government requirements. Conditions in the iron and steel trade in Canada are undergoing some adjustment.. The effect of the embargo on steel from the States is not yet clear, and its operation is now the subject of considerable discussion among the leading interests concerned. It appears likely that some exception may be made in the case of steel required for specific purposes other than munitions. It is understood that steps are being taken to facilitate the operation of the embargo, so that it will cause a minimum amount of inconvenience to the trade in Canada. Manufacturing users, however, are bound to suffer to a greater or less degree, as little help can be expected from Canadian mills in the meantime. Our mills will have to concentrate on the production of shell steel for an indefinite period and are unable for this reason to look after their old customers except to the extent of comparatively small tonnages.

The sheet market remains in a sold-up condition, and there is little new business being accepted. Government requirements are getting heavier, and the available supply for the ordinary consumer is correspondingly less. The latter are holding off placing orders, as there is an impression that prices have reached the top, and that they will be able to buy lower than obtains at present. This seems to be highly probable, as sheet bars have again declined, although recovering part of the loss, and are now being quoted at $95 Pittsburgh. This material was as high as $105 less than four weeks ago.

A temporary decline in semi-finished steel seems to foreshadow a recession in prices of steel products at no distant date. Bessemer and O.H. billets declined $5 early in the week, but have since recovered, and are now quoted at $90 a ton Pittsburgh. This may be connected in some way with the price fixing investigation now being held at Washington, and may be anticipating Government action. However, no official information has been given out, and the possible effect of the price control is mere guesswork. Prices generally in the meantime are stationary and the market continues unsettled.

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.

Pig Iron

There is no change in the pig iron situation; the market continues dull and prices stationary. "Victoria" foundry iron is still quoted at $60, being both scarce and firm at that figure. The embargo on pig iron from the United States will inconvenience Canadian consumers, as domestic furnaces are booked up for the remainder of this year. Connellsville coke output gains slightly, but is restricted sharply by labor shortage; the price of prompt furnace fuel continues to range from $15 to $16, ovens.

Scrap

The scrap market continues dull and stagnant. Prices are stationary, and have a weaker tendency, but no declines have been made except in heavy copper and copper wire. These materials have dropped one cent, and are now quoted at 25½c a pound. The new steel plant at Ashbridge's Bay is buying steel and shell turnings, and the market for these materials is consequently easier. The cause of the quietness in the market is that consumers expect a fall in prices and sellers anticipate an advance, thus comparatively little business is being transacted.

Machine Tools

The feature of the machine tool market now is an increasing demand for tools for general purposes, which is replacing the former activity in equipment for munitions. . The output of shells has fallen off considerably, and the engineering plants are turning their attention to other classes of work. The building of marine engines and auxiliary equipment for ships is developing steadily and promises to form an important feature. A local machinery house reports a big demand for tractors and farm oil engines, due largely to the scarcity of labor, but also to the increased efficiency obtained by using power on the farm. The Willys-Overland Co. are equipping a factory for building aeroplane motors, and have already purchased a large number of machine tools. The situation in regard to deliveries is practically unchanged, tool room equipment being particularly difficult to obtain.

Supplies

Prices of machine shop supplies are for the present largely stationary, but quite firm. It is anticipated that supplies from the States will be very difficult to obtain owing to the increasing demand in that market. An advance has been made in the price of wood pulleys, the new discount being 20 per cent., as against 40 per cent. formerly. New list prices have been issued on bit stock and straight shank drills. The discount remains at 40 per cent., but the new list prices provide for increases. Grindstones

have advanced 10c per 100 lbs. For those over 40 pounds and 2-inch thick, the price is now $1.90, while those under 40 pounds are quoted at $2 per 100 lbs. Pennsylvania crude oil continues to advance on account of the constantly growing demand for light grade crude oil and increased cost of production. Producers are unable to keep up with the present demand.

Metals

The metal markets continue to be dominated by the attitude of the American Government in regard to its price fixing policy. Although, on this account the markets have been quiet, prices are exhibiting a higher tendency, and the outlook in the trade generally is brighter. The war demand for metals continues very strong, and will be greatly increased as the American Government requirements become heavier. This in itself will tend to stiffen the market in spite of the present high level of prices. There is considerable secrecy regarding the prices the Government are paying for its requirements, which introduces an element of uncertainty into the situation. A recent report states that the Government is willing to pay 22½c for copper, which is about 4c over a tentative price previously fixed. This seems to indicate that the Government action in regard to prices will not be as drastic as was anticipated. The local market is firm, and business continues active. Tin is a shade higher, otherwise prices are unchanged. Babbitt metals now range in price from 18c to 70c.

Copper.—The market continues unsettled, and must remain so until some definite knowledge is obtained as to what the Government intentions are as to price and volume of future purchases. The position of copper, however, is favorable, as the consumption of the red metal for war purposes continues enormous, and is on the increase. The rumor that the American Government has advanced its prices on its purchases of copper to 22½c has improved the outlook in the market, but quotations are unchanged and nominal. Lake and electro are quoted at 35c and castings at 34c per pound.

Tin.—Although prices are firmer, the market continues unsettled owing to the uncertainty regarding future developments in their effect on prices. Because of this, business is light, and little interest is being shown in the market by consumers. Tin has advanced one cent locally, being quoted at 64c per pound.

Spelter.—There is no change in the situation in regard to spelter, and the market is stagnant. Developments in regard to prices are being followed closely by the trade, but no hint has as yet been given out as to what the Government will pay on its latest purchase of spelter. Local quotation unchanged at 11c per pound.

Lead.—The market is a shade easier on account of the continued indifference on the part of consumers, but prices are unchanged. The U. S. Government is not saying what it is paying for lead, which keeps the market unsettled, and consumers consequently are not showing much interest. Local quotation, 13c per pound.

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

Aluminum.—Little interest is being shown in the market, which is a shade weaker, although quotations are unchanged at 64c per pound.

New York, Aug. 20.—Vitality surging through the machinery industry as a result of the gigantic war preparations is expressed in further large purchases of machine tools by shipbuilders, by ordnance and ammunition manufacturers, by airplane and engine builders, and by makers of tractors and of other agricultural implements.

In response to United States Government appeals, several additional steel-working manufacturers have entered the ordnance field, and one of the new concerns—the Symington-Anderson Co., of Rochester, N.Y.—has been awarded a contract for three thousand 6-inch guns; each piece of ordnance will cost $8,000 to $10,000. This company recently purchased $1,000,000 worth of shop equipment. The War Department has awarded a contract for 20,000 Browning machine guns to the Colt Patent Firearms Co. of Hartford, Conn. The contract price is upward of $15,000,000. The War Department is also giving active support to another new manufacturer of big guns—the Tacony Ordnance Co. of Tacony, Pa., in the purchase of forge and machine shop equipment for installation in the new $1,500,000 plant now undergoing construction at Tacony.

In the Central West, two ordnance makers, the Inland Ordnance Co., Cleveland, O., and the Root & Van Dervoot Engine Co., East Moline, Ill., are sounding the market for machinery, and are making imperative calls upon manufacturers of machine tools.

The Federal Shipbuilding Co., the new subsidiary of the U. S. Steel Corporation, has awarded contracts for dredging, pile driving, building of ship ways and construction of shops and other buildings, to cost about $4,000,000, and is now buying $1,000,000 worth of tools for a huge plate and angle shop. The plate mill will be 1,000 feet in length. Inquiries are also out for yard and shop cranes and for machine shop tools that are needed in addition to the tools now being built at the shops of the American Bridge Co. The buildings now under contract will cover ten acres. It is designed to make this plant on Newark Bay the largest shipbuilding plant in the world. Some of the shipways now being constructed—450 to 500 feet in length—will be extended later to 1,000 feet to build the largest craft afloat.

The Foundation Co. which, in conjunction with the Liberty Steel Products Co., is building and equipping a large number of boats, including mine sweepers, for the United States and French Governments, is in the market for $100,000 worth of machinery for a plate shop, and will also buy cranes and machine shop equipment. The Harriman interests, that control the shipyards at Chester and Bristol, Pa., have reorganized the Chester Shipbuilding Co., and organized the Merchants' Shipping Corporation to operate the Bristol yards. Cranes and other machinery are wanted for both of these plants. Twelve shipways are being built at Bristol and six additional ways at Chester. The Newburgh Shipyards, Inc., Newburgh, N.Y., and the American U-Boat & Arms Corporation, which is equipping a yard at City Island, are placing contracts for machinery.

Manning, Maxwell & Moore, Inc., have received a contract from the Curtiss Aeroplane & Motors Corporation for equipment for the new plant now being built at Buffalo. The U. S. Government is reported to have placed a contract for 10,000 airplane engines with Henry M. Leland, who is equipping a plant at Detroit. The Dayton-Wright Aeroplane Co. has given a large order to Cincinnati manufacturers for drilling machines. The Nordyke-Marmon Co., Indianapolis, has an order to build 1,000 airplane engines for training machines for the Government.

Tractor manufacturers are overwhelmed with business and are extending plants and buying machine tools constantly. Henry Ford & Son, with an order for 7,000 tractors for the British Isles, is building an addition to its Dearborn, Mich., plant, as the Cork Island plant construction has been delayed.

AUXILIARY MACHINERY REQUIRED.

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

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

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

Two small circulating pumps.

One large circulating pump.

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

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

One oil fuel pump with complete set of spare parts.

Pittsburgh, Aug. 18.—The week has been singularly devoid of concrete developments suggestive of the future of steel demand and prices. The only definite and important item of news is that since the enactment of the Food Control Law, which was signed by the President on August 10, the coke producers have been required by the Federal Trade Commission to furnish statements of their cost of production, both for the year 1916 and for the month of June last. This is taken to indicate that the Administration intends shortly to fix the price of coke, the food bill giving it authority over prices of coal, coke, petroleum and gasoline. The reports are now being compiled, and preliminary figures indicate costs averaging about $4 per net ton for the Connellsville region. The average of spot sales in May and June, 1915, was $1.50. They were below cost, and costs are higher now. The common idea is that if the Government fixes a price it will be about $4.50 or $5. In the past week the spot market has gone up to $15.

The question is what good the fixing of prices on coke will do the ultimate consumer, for about 81 per cent. of the coke produced is used in the manufacture of pig iron, and the pig iron is sold far ahead, practically all the prospective make for the balance of this year and from 35 to 60 per cent. of the make in the first half of next year, the pig iron contracts on books ranging from $25 to over $50. Doubtless the pig iron market would eventually decline, and that would help some.

The Export Embargo

The export embargo covers scrap, pig iron, billets and sheet bars, structural shapes and plates, and became effective July 15. From then until August 15 it was merely necessary to secure a license to export, but from August 15 the licenses will not be granted unless it can be shown that the material is directly intended for prosecuting the war. This prevents exports of plates and other shipbuilding material to Japan, a large tonnage being under order. The Japanese mission is in Washington, and an arrangement may be concluded whereby the steel will be allowed to go forward in return for Japan diverting a number of ships to the trans-Atlantic trade. The plate mills are in a quandary, as they do not know whether to continue rolling export material or resell it. There have been some offerings of plates in the past week at lower prices than formerly quoted, but not enough to establish a new market level.

Iron and steel exports in June totalled [illegible] the record month for exports. July exports will probably prove to have been nearly, if not quite, as large, but on account of the enforcement of the embargo August will doubtless show a material falling off.

Scrap

Last week the Pennsylvania Railroad System [illegible] all movement of scrap on its rails in open top cars, except under special permit, the permit to be applied for by the prospective consignee. There is very little scrap movement in this district that does not involve travelling part of the journey over Pennsylvania rails and permits do not seem to be obtainable easily. The scrap market has been made still quieter, but prices have not declined, and heavy melting steel is higher, with one or two sales reported at $37 and a number of dealers readily bidding $34, these limits comparing with $32 to $33 quotable as the market ten days ago.

Pig Iron

The pig iron market is absolutely stagnant, there being scarcely any inquiry, and then only for very small lots for prompt shipment. When the market once stopped advancing, about the close of June, prices yielded a trifle from the extreme, but have since held steady, so far as furnace quotations are concerned, at $55 for Bessemer, $52 for basic, and $53 for No. 2 foundry and malleable, f.o.b. Valley furnaces. These, however, can hardly be called even asking prices when there is no inquiry. Some resale lots have been offered for less, particularly in the case of Bessemer.

While production has been curtailed in the past few weeks on account of high humidity, there is less rather than greater pressure for deliveries on contract, and consumers are evidently better supplied than was assumed. Buyers are evidently expecting a very considerable drop in the market, before they have occasion to make further purchases.

> **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.**

Unfinished Steel

A week ago a decline in unfinished steel was recorded, and in the past week there has been a further softening. A lot of 1,000 tons of open-hearth sheet bars has been sold at $85, the top of the market having been $105 to $110. The ordinary market price is paid only on odd lots purchased by mills, or by sheet consumers who wish to have the steel converted. The deliveries to sheet mills, on long term contracts, are at about $60. Wire rods have sold in the past week at [illegible] fortnight ago. There are further offer- [illegible] ed. Until recently the market was all of [illegible]

Finished Steel

While there have been declines in succession in scrap, pig iron, and unfinished steel, the declining tendency has not yet reached finished steel products, and this is in accordance with precedent. The mills fully expect declines, but know that they could not force sales by cutting prices, and are interested in maintaining same as long as possible so as to stimulate specifications on existing contracts. There is no buying in the open market to speak of.

Notes

Production of pig iron in the United States is officially reported at 19,258,235 tons in the first half of this year, against 19,815,275 tons in the second half of last year, and 19,619,522 tons in the first half. The decline is in the face of a material increase in capacity, and is due to shortage of coke.

Production of coke in the United States in 1916 is officially reported by the Geological Survey at 35,464,224 short tons of beehive and 19,069,261 tons of by-product, a total of 54,533,585 tons, representing increases over the 1915 production of 29 per cent. in beehive, 35½ per cent. in by-product, and 31 per cent. in the total.

Production of iron ore in the United States in 1916 is reported by the Survey at 63,735,088 gross tons from the Lake Superior region, and 11,432,584 tons for all other districts, a total of 75,167,672 tons, against 55,526,490 tons in 1915, and 61,980,437 tons in 1913, hitherto the record year.

The Bridge Builders' and Structural Society report fabricated steel contracts let in July equal to 41½ per cent. of a month's frabricating capacity, against 47½ per cent. for June and 57½ per cent. for May.

SUPPLEMENTARY ESTIMATES TABLED IN HOUSE

SUPPLEMENTARY estimates for the fiscal year ending March 31 next, to the amount of $50,542,472.35, were tabled in the Commons, Ottawa, by Sir Thomas White on August 17. They bring the total amount of appropriations for the fiscal year up to $178,824,236.99, exclusive of statutory expenditures aggregating $74,691,001.24. Of the supplementary votes now brought before Parliament, $18,361,930 is chargeable to income and $32,180,542 is chargeable to capital account.

Among the items is $7,500,000 to be loaned to the G.T.P. Railway to meet [illegible] Canadian Government's Railways, $25,- [illegible] steamers McKee and Drummond, acquired by the Government, and now en- [illegible] the building of two wooden ships for use

in connection with the Government Railways system, $600,000 is asked. Among the sums voted at a previous session and now to be revoted are $1,020,000 for the construction of the Quebec, Montmorency and Charlevoix Railway, the Quebec and Saguenay Railway and the Lotbiniere and Megantic Railway.

THE SUBMARINE LOSSES

BELOW will be found the official weekly returns issued by the Press Bureau and compiled by the Liverpool "Journal of Commerce," relating to the war losses of British merchant shipping, and the arrivals and sailings of merchant vessels of all nationalities (over 100 tons net), at and from United Kingdom ports. Fishing and local craft are excluded from the sailings and arrivals. This return invariably includes all mercantile tonnage known to have been sunk by mine or submarine either employed on Government service or otherwise:—

Week ending	All Nationalities		British Merchant Ships Sunk by Mine or Submarine			Fishing Vessels
	Arrivals	Sailings	1,600 tons gross or over	Under 1,600 tons gross	Unsuccessfully attacked	Sunk
Feb. 24	2,280	2,261	16	6	16	5
Mar. 4	2,528	2,477	15	8	15	2
" 11	1,985	1,959	12	4	12	3
" 18	2,528	2,554	18	8	20	21
" 25	2,314	2,433	20	7	12	18
April 1	2,281	2,399	17	14	20	3
" 8	2,406	2,367	17	2	13	7
" 15	2,379	2,331	19	9	13	11
" 22	2,585	2,621	41	15	27	10
" 29	2,716	2,690	39	12	27	7
May 6	2,374	2,499	19	22	30	15
" 13	2,568	2,552	17	5	15	3
" 20	2,664	2,759	19	9	12	3
" 27	2,719	2,768	18	2	22	2
June 3	2,693	2,642	15	3	15	5
" 10	2,767	2,822	24	10	20	6
" 17	2,897	2,993	25	5	37	..
" 24	2,876	2,923	21	6	19	..
July 1	2,745	2,846	15	5	13	12
" 8	2,898	2,798	14	3	13	6
" 15	2,828	2,920	15	4	15	8
" 22	2,791	2,791	19	3	12	1
" 29	2,747	2,776	18	3	*9	..

*Including three attacked during week ended July 22.

Italian Losses

The following are the figures of the movements of merchant vessels of all nationalities in Italian ports during the week ending Sunday, July 29:—

Arrivals	810	412,045
Departures	536	401,168

This is exclusive of fishing boats and coasting vessels.

Losses of Italian ships on all seas were:—Four sailing vessels, only one over 250 tons. One steamer was attacked and damaged, but was able to be saved.

TRAFFIC THROUGH CANADIAN CANALS

J. L. PAYNE, comptroller of statistics, reports that the traffic through the canals of Canada in 1916 showed an increase of 8,384,688 tons. The total volume was 23,583,491 tons, though this tonnage includes duplication, which means that the same cargo quite frequently passes through two or three separate canal systems. After eliminating all duplication, the net tonnage is given as 21,011,905 tons. The distribution of gross traffic in tons was as follows: Sault Ste. Marie, 16,813,649; Welland, 2,544,964; St. Lawrence, 3,368,064; Chambly, 398,977; St. Peter's, 9,629; Murray, 46,680; Ottawa, 237,651; Rideau, 105,430; Trent, 45,000; St. Andrew's, 13,438.

The traffic as analyzed is as follows:

	Tons.
Agricultural products	5,178,806
Animal products	11,342
Manufactured products	834,266
Forest products	1,388,873
Mine products	16,170,204

The total volume of Canadian wheat moved through the canals of Canada and the United States at Sault Ste. Marie in 1916 was 185,003,667 bushels. Of this quantity, 82,807,342 bushels passed through the Canadian canal. Larger accommodation on the American side of the St. Mary's river probably accounts for the preference given that channel.

The growth since 1895 in the volume of Canadian wheat annually carried through the Canadian canal at Sault Ste. Marie is seen from these figures: 1895, 1,087,800 bushels; 1900, 5,573,267 bushels; 1910, 51,774,833 bushels; 1913, 101,066,133 bushels; 1916, 82,807,342 bushels.

Then comparison of 1915 and 1916 is as follows:—

Through the	1915 Bus.	1916 Bus.
Can. canal	48,727,911	82,807,342
Am. canal	121,389,950	102,196,325
Totals	170,117,861	185,003,667

Canadian wheat moved in the form of flour must also be brought into the account. The total quantity brought down in 1916 was 3,805,384 barrels, as compared with 2,215,098 barrels in 1915. At 4½ bushels to the barrel, this would represent 17,124,228 bushels of wheat.

The total volume of water-borne wheat in 1916 would thus be made up as follows:—

Through the Can. canal	82,807,342
Through the Am. canal	102,196,325
In the form of flour	17,124,228
Total	202,127,895

The distribution of Canadian wheat moved through the Canadian and American canals at Sault Ste. Marie from Port Arthur-Fort William in 1916 was as follows:—

To Montreal, 1,233,982 bushels; to Georgian Bay ports, 46,406,749 bushels; to other Canadian ports, 28,029,847 bushels; to Buffalo, 106,349,943 bushels; total, 182,020,521 bushels.

To account for all the Canadian wheat shipped eastward by water in 1916 there must be added the quantity passed through Duluth in bond. The complete statement would, therefore, be as follows:—

From Port Arthur-Fort William and Duluth, to Montreal, 1,686,482 bushels; to Georgian Bay ports, 48,007,361 bushels; to other Canadian ports, 28,029,847 bushels; to Buffalo, 107,279,977 bushels; total, 185,003,667 bushels.

STEEL PRICES FIXED AT $65

A REPORT from Washington states that an agreement between the War Industries Board and the steel interests as to the price of steel for the United States and her allies will be arranged shortly, according to an authoritative source. The terms of the agreement likely will be:

1. The price of steel will be fixed at approximately $65 a ton.

2. The steel interests will agree to furnish material to this Government and the allies for the same price.

3. An informal agreement will be made that, if the steel men furnish their product at the agreed upon price, the excess profits tax will be modified.

4. The steel interests shall retain the right to collect bonuses from allied Governments for early delivery of contracts.

COAL CONTROL PLAN TO BE ANNOUNCED

PRESIDENT WILSON will announce formally in a few days the plan under which the American Government will take over control of the coal supply of the country, fix prices and regulate production and distribution under the powers contained in the food control law.

It is said that the Trade Commission, while not advocating the requisition and operation of mines as an immediate step, believes that the price of $3 a ton at the mouth of the mine for bituminous coal is radically high, and that production and distribution systems are faulty. A system of commandeering and pooling the output for distribution by a Government agency is said to have been recommended.

In connection with anthracite coal, the commission in former reports has indicated that in its belief the price at the mouth of the mine agreed to by operators was not exorbitant, and some of the officials have intimated that high prices to the consuming public were due largely to the middlemen and faults of distribution.

INDUSTRIAL AND CONSTRUCTION NEWS

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

ENGINEERING

Elmira, Ont.—The Elmira Transmission Co. will build an extension to their foundry.

Sidney, N.S.—A report is current here that the steel plant at Trenton, N.S., will be moved to Sidney.

Chicoutimi, Que.—The Chicoutimi Pulp Co. will build an extension to their mill, which will include a machine shop.

Tillsonburg, Ont.—The Maple Leaf Harvest Tool Co. propose building a factory here to cost approximately $50,000.

Toronto, Ont.—The Cluff Ammunition Co. are rebuilding their plant on Sterling Road, which was destroyed by fire some time ago.

Oshawa, Ont.—The Richmond Mfg. Co., of Toronto, have written the Council regarding a proposal to establish a factory here.

Blenheim, Ont.—Five acres of land have been purchased by the Pere Marquette Railway for a reservoir. A new pumphouse will be erected and new equipment installed, and a tank built.

New Westminster, B.C.—H. A. Bayfield, formerly superintendent of dredges here, was in the city recently inspecting possible sites for the assembling shop which the Imperial Munitions Board will probably establish somewhere on the Coast to assemble machinery and engines for the vessels now being built at various shipyards. Sites will also be inspected at Victoria and Vancouver.

Rigaud, Que.—A violent explosion at the powder factory of Curtis & Harvey Co., on Aug. 18, destroyed the entire plant. The monetary loss is placed at $2,000,000. The plant was comprised of a large number of small buildings and the structures alone cost several million dollars. The stock of raw material for making explosive was also particularly expensive. The plant, with adjacent grounds, covered five miles square.

Windsor, Ont.—Plans have been filed with the Canadian Government by a local law firm, acting for the Canadian Steel Corporation, for docks at Ojibway to cost $250,000. It is stated that the plans include a marine slip, harbor, docks, and wharves. A canal running through the corporation's property for 2,500 feet, which will be 200 feet wide and 25 feet deep, will be dredged to accommodate boats. It is proposed to build docks on the banks of the canal, while another dock a thousand feet long is planned for the river front.

ELECTRICAL

Bloomfield, Ont.—A by-law passed recently authorized an expenditure of $8,000 on the development of electric power.

Cookstown, Ont.—The Hydro by-law was passed here Monday by a majority of 91. The enabling by-law was also passed on the same vote.

Toronto, Ont.—The Hydro-Electric Commission have been granted a permit to build an addition to the terminal station on Strachan Avenue, to cost $1,100.

Wellington, Ont.—A by-law will be submitted to the ratepayers on Aug. 31 to authorize the expenditure of $10,000 for the purpose of development, transmission and distribution of electrical power and energy.

MUNICIPAL

Lawrencetown, N.S.—The Town Council are considering installing a hydro-electric power plant.

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

Stratford, Ont.—At a meeting of the Public Utilities Commission, it was recommended, in Mr. Mason's report, that estimates for the proposed storage basin for surplus artesian well water be asked for.

Stratford, Ont.—The Public Utilities Commission have decided to accept the quotation of Petrie's, Ltd., of Toronto, for an air compressor at a cost of $415, and a 15 h.p. gasoline engine at a cost of $400, to be installed in the pump house as soon as possible.

Montreal, Que.—The Board of Engineers, composed of H. E. Vautelet, Arthur St. Laurent and T. B. McRae, have prepared a supplementary report on the aqueduct scheme, in which they recommend that the waterworks improvement be continued along new lines. Upwards of $3,000,000 has already been spent on the aqueduct.

TENDERS

Winnipeg, Man.—The Board of Control are receiving tenders up to August 22 for 3,000 feet of 3½ inch cotton rubber-lined fire hose.

Sherbrooke, Que.—Tenders will be received until August 22 for high-tension line and equipment, costing $150,000, from Weedon to Sherbrooke, for the Gas and Electric Department, City Council.

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

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

Cobalt, Ont.—Tenders will be received up to Sept. 18, for the supplying 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.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to August 28 for the supply of 2,400 feet of 6-in. cast iron water pipe, class "C," delivered f.o.b. cars, city yards. Specification and form of tender may be obtained at the office of the City Engineer, 223 James Avenue.

Toronto, Ont.—Tenders will be received, addressed the Chairman, Board of Control, City Hall, Toronto, up to August 28, for the supply and installation of mechanical stokers, at the Main Pumping Station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to August 24, for the supply and complete installation of one mechanical chain grate stoker for the Municipal Hospital Power House, Morley Avenue. Specification and form of tender may be obtained at the office of the City Engineer, 223 James Avenue.

Toronto, Ont.—Tenders addressed to the Secretary-Treasurer of the Board of Education will be received until August 24, for completion of carpentry work in Park School New Building, local telephones, cabinet work, repair work in various trades. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, 155 College Street.

Monteith, Ont.—Tenders will be received until August 27 for heating and plumbing in the men's residence in connection with the Training School, Experimental Farm, Monteith. Plans and specifications can be seen at the office of the Director of Agriculture, New Liskeard, and at the Department of Public Works, Toronto, Ont.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to August 28 for the supply and delivery of one set high efficiency street lighting equipment. Instructions to bidders, specification and form of tender may be obtained at the office of the City Light and Power Department, 54 King Street.

Toronto, Ont.—By direction of the Hon., the Minister of Militia and Defence, the following Old Stores are for sale by Public Tender at Toronto:

ECONOMY

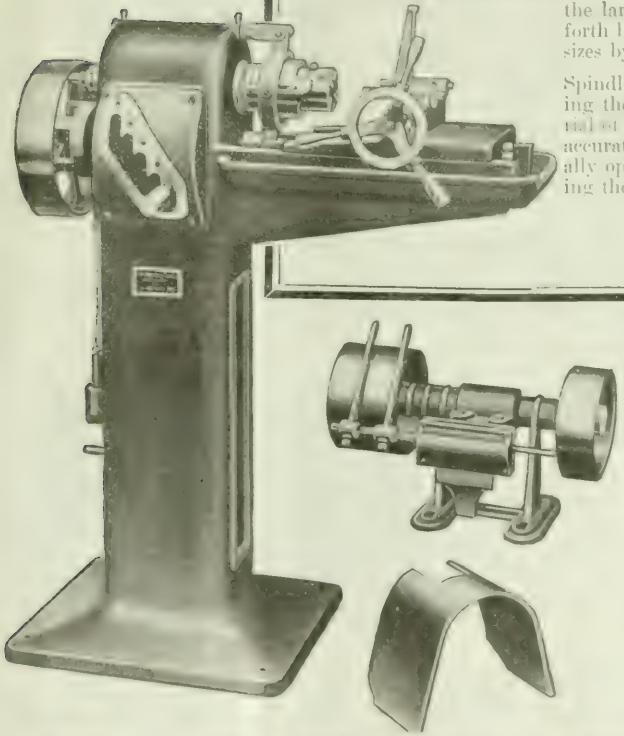
That is the lesson we are slowly learning

Here is a machine—the Geometric Threading Machine—which has been economizing in screw thread production for a number of years. Busy automatic screw machines cannot profitably be slowed down to cut threads when there is a Geometric Threading Machine at hand. Especially since a Geometric Threading Machine costs one-tenth the price of automatics.

Geometric Threading Machines are employed on a large class of small threaded parts that cannot be produced economically on the ordinary screw machine.

Made in three sizes—to cut 1/8 to 1/2 inch, 1/4 to 3/4 inch, and 3/4 to 1 1/2 inch diameter threads. The carriage is mounted on slides and on the largest size machine is moved back and forth by rack and pinion, and in the smaller sizes by hand.

Spindle speed changes readily made, adapting the machine to the diameter and material of the work. An adjustable stop secures accurate length of thread, and automatically opens the die head, permitting of drawing the work straight back.



A line from you brings full details regarding this machine. Tell us your threading requirements — let us recommend the proper Geometric Collapsing Tap or Self-Opening Die.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

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

Leather, old, 21,271 lbs; brass, old, 25,977 lbs. This produce may be seen on application to the Senior Ordnance Officer, Toronto, Ont. Tenders for the purchase of all or any of these lots will be received until Aug. 25.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to August 22, for the following supplies for the Fire Department, namely, 3,000 feet 3½ inch cotton, rubber-lined fire hose, 221 (more or less) pairs rubber boots, 221 (more or less) waterproof coats. Specifications and forms of tender may be obtained at the office of the Chief of the Fire Department, Central Fire Station.

Quebec, Que.—Tenders will be received until August 28, for the construction of a steel bridge (two spans), over sluice ways in St. Charles River, at Quebec, P.Q. Plans and forms of contract can be seen and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers, Shaughnessy Buildings, Montreal, P.Q., Post Office Building, Quebec, P.Q., and Equity Building, Toronto, Ont.

St. John, N.B.—Tenders will be received until August 31, for the construction of an extension of and repairs to the Negro Point breakwater, St. John Harbor, St. John County, N.B. Plans and forms of contract can be seen and specifications and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers at St. John, N.B.; Halifax, N.S.; Shaughnessy Building, Montreal, P.Q., and Equity Building, Toronto, Ont.

Woodstock, N.B.—Tenders will be received until August 28 for the following improvements to the water system:—Mechanical gravity filter plant. Additions and alterations to the pumping station, new boiler, steam turbine-driven centrifugal pumps, gasoline engine-driven centrifugal pump, and sundry machinery and appurtenances. Plans and specifications may be obtained from J. C. Hartley, Town Clerk, Woodstock, N.B., or R. S. & W. S. Lea, 809 New Birks Building, Montreal, or A. K. Grimmer, St. Andrews, N.B.

Ottawa, Ont.—Tenders will be received until August 27 for plumbing pipes and fixtures required in the reconstruction of the Parliament Buildings. All tenders to be based on the execution, erection and completion, including all labor and materials required for the installation of the plumbing system, together with all fixtures, apparatus and appliances as called for in the plans and specifications. Plans, specifications and any other information can be obtained at the office of the general contractor, P. Lyall & Sons, Construction Co., Ottawa.

GENERAL

Gravenhurst, Ont.—The National Potash Co., Toronto, will build a plant here.

Toronto, Ont.—The Canadian National Carbon Co. will build a power house at their factory here.

Hudson, Que.—The Canadian Ice Co. will rebuild their plant, which was destroyed by fire a few weeks ago.

Orangeville, Ont.—Fire last Monday destroyed the Alton Knitting Mills, owned by J. M. Dods. The building and machinery were valued at $110,000 and were fully insured. The mill will be rebuilt as soon as possible.

INCORPORATIONS

The St. Maurice Foundries, Ltd., has been incorporated with a capital of $49,000 to carry on a foundry business at Three Rivers, Que.

Murray Engines, Ltd., has been incorporated at Victoria, B.C., to carry on the business of machinists and engineers at Vancouver, with a capital of $25,000.

The Merchants Shipbuilding Corporation has been incorporated at Victoria, B.C., to carry on a shipbuilding business at Vancouver, with a capital of $500,000.

PERSONAL

John Lang has been appointed superintendent of the factory at Oshawa, Ont., recently taken over by the McClary Mfg. Co., of London, Ont .

W. G. Ross, Chairman Montreal Harbour Commission, has been presented with a special decoration by the Navy League in recognition of valuable services on behalf of the naval service and Navy League.

J. E. McAllister has been appointed vice-president and general manager of the National Street Car Co., Hamilton, Ont., succeeding Basil Magor, who has held the position for several years. Mr. McAllister was born in Hamilton.

A. T. Perrin, assistant chief draughtsman of the Dominion Bridge Co., of Lachine, P.Q., has resigned his position to become manager of the Iberville, P.Q., plant of the Rapid Tool & Machine Co., the head offices of which are located at Lachine, P.Q.

Maj. R. Falshaw Morkill, signal engineer of the Grand Trunk Railway System, and now serving overseas in the British army, has been appointed by the Director-General of Transportation, to take over all signaling work in the area occupied in France and Belgium by the British forces, and is now at general headquarters.

CONTRACTS

Walkerville, Ont.—The Maxwell Motor Car Co., of Detroit, have let the contract for steel work for their new factory here to the Canadian Bridge Co., of Walkerville.

Fort William, Ont.—George McLeod of Winnipeg has been awarded the contract for the new C. N. R. station here. The contract price is in the neighborhood of $50,000. J. Scholfield of Winnipeg is the company's architect.

Brampton, Ont.—The High School Board have accepted the tender of C. M. Sackrider, of Brampton, to erect a new school building at a cost of $65,921. The board has decided to build the school at the south end of the present grounds.

BUILDINGS

Toronto, Ont.—The Swift Canadian Co. have taken out a permit for the erection at the corner of Keele Street and St. Clair Avenue of a reinforced brick and concrete cooling building to cost $120,000.

Ottawa, Ont.—The votes for public buildings in Quebec are: Farnham public building, addition, $5,000; Grosse Isle, quarantine station, $148,000; Three Rivers, new public building, $20,000; Quebec Post Office, $15,000.

TRADE GOSSIP

Oshawa, Ont.—The Canada Malleable Steel Range Co., has been purchased by the McClary Mfg., Co., London, Ont.

The Globe Engineering Co. has been incorporated, with a capital of $100,000, and will take over as a going concern the assets and liabilities of the Globe Electric Machine Co., of Hamilton, Ont.

Hardwood of Canada.—Generally speaking, the hardwoods are produced in the eastern provinces of Canada, Ontario and Quebec being the main sources of supply. The four leading hardwoods—birch, maple, basswood, and elm, have occupied their relative positions for several years, but in the 1916 list poplar replaces ash in fifth plice.

Hamilton, Ont.,—It is reported here that the National Steel Car Co., have recently received substantial orders from the French and United States Governments. The French orders are chiefly for regulation army wagons, while the U. S. orders include freight cars as well as other army equipment.

Appropriation for Industrial Research.—The Dominion Government has appropriated the sum of $91,600 for the Bureau of Industrial Research, to be expended as follows: Salaries and expenses, collection and distribution of information, $43,600; studentships to be established, $12,000; fellowships, $5,000; special problems, $25,000, and forestry studies, $6,000. There is an appropriation of $24,620.

Lower Marine Rates.—It is reported from New York that in spite of the rather less favorable report of the British Admiralty there are indications of lower rates even to Europe. Some houses have lowered their schedules to Spain, Denmark, Norway, Sweden and Holland for neutral steamers by 1 per cent. Rates on off-submarine routes continue to be easier without marked changes. To Great Britain 8 per cent. on outward cargoes remain the general minimum.

Russian Car Order for Canada—The Canadian Car & Foundry Co., Montreal, are negotiating with the Russian authorities for a large proportion of the big Russian order which will soon be distributed to the Canadian companies, to-

talling, it is said, 10,000 freight cars. The Canadian Car Co. is now working on an order for 2,000 Russian freight cars, which will be ready for delivery in October, and the order will be a big help in keeping up the present working capacity of the Canadian Car plants.

Ottawa, Ont.—The appropriations for public works in Ontario include: Elmira, public building, $2,000; Galt, drill hall, grading, paving, etc., $8,000; Kingston, R.M.C., enlargement of educational block, $150,000; Kingston, R.M.C., to complete new dormitory by adding two wings, $100,000; Palmerston, public building, $2,500; Prescott, public buildings, repairs and renewals, $3,000; Stayner, public building, $10,000; Whitby public building, to pay Government's share of cost of local improvements, $2,165.38; Windsor, public building, repairs and improvements, $4,500.

Coal Embargo Now Removed.—Fears of a coal shortage have been dispelled by the announcement that the Lehigh Valley Railroad Company has lifted the embargo against coal cars for Canadian points. The removal of this embargo is of the greatest importance to the City of Toronto generally, and to the Province at large, and was aided by the coal section of the Retail Merchants' Association and the Toronto press, which had fought hard to bring about an understanding whereby coal shipments into Canada could be continued. The embargo was due to the fact that cars were being held for unduly long periods at Canadian points.

Marine Machinery Contracts in B.C.—That since the letting of the winch contracts, nothing definite had been done toward arranging for the manufacture of engines, auxiliary machinery and ships' fittings for the 27 vessels being built in British Columbia for the Imperial Munitions Board, was the news given out on his arrival in Vancouver by Mr. George Bushby, president of the British Columbia Metal Trades' Association, who has been in Victoria for the past two weeks in conference with the British Columbia representatives of the Board, R. P. Butchart and Capt. J. W. Troup. It appears unlikely that any main engines will be built on the coast owing to the high cost of production.

MARINE

British Mercantile Marine Losses.—Since the outbreak of the war, 6,627 officers and men of the British mercantile marine, exclusive of those in the pay of the Admiralty, have lost their lives, according to a statement made in the British House of Commons on August 20 by Sir Albert Stanley, President of the Board of Trade.

St. John, N.B.—J. M. Smith, engineer for the St. John Shipbuilding Co., was in the city recently and surveyed the site for the proposed shipyards. He expressed himself as well satisfied with that chosen, and left for Montreal, where he will prepare blueprints for laying out the yards. In a week or so tenders will be called for the erection of buildings, grading, etc., and the work of getting the yards ready will be rushed as rapidly as possible.

Lake Shipping for Atlantic in Winter.—A report from Washington, D.C., states that the use of 1,000,000 tons of Great Lakes shipping in the Atlantic during the lakes' closed season is under consideration by the Shipping Board. It is planned to cut the larger lake vessels in two, and tow the parts through the Welland Canal, re-assembilng them on the seaboard. The size of the canal locks forbids passing of larger ships through whole. Cutting the big steel freighters has proved practicable in several cases. To replace the tonnage, the Board plans to expedite shipbuilding on the lakes to be ready for use there when the season opens next year.

Concrete Ships Being Built in Montreal.—Concrete shipbuilding has begun in Montreal under auspices which are likely to bring it to a successful issue, if the scheme proves at all practicable. The work of construction is being carried out by the Atlas Construction Co., which has had a great deal of experience in the handling of cement and reinforced steel from which the hulls of the boats will be made. One boat is now under construction at the Montreal Dry Dock Co.'s plant, and will be ready to travel under her own steam about the 15th of October. She is about 200 feet long, the hull having a thickness of 3 to 5 inches.

Port Authorities' Convention Plans.—The annual convention of the American Association of Port Authorities will be held at Cleveland, Ohio, from September 11 to 14. Delegates will attend from every important port and terminal in the United States and Canada. The meeting is regarded as especially important, because it will be devoted almost exclusively to considering definite recommendations for legislation, requiring common carriers to separate their terminal and through charges, and also to require common carriers and steamship lines to use their terminal facilities in such joint manner as will promote the utmost efficiency in the handling of all commodities.

Harbour Appropriations for Ontario.—The Dominion Government appropriations for harbours and rivers in Ontario include: Bayfield, repairs to piers, $10,700; Bruce Mines, dredging, $21,000; Burlington Channel, in full and final settlement of all claims of D. G. Stewart in connection with his contract for construction of revetment wall, $10,441.59; Burlington Channel, repairs to pier, $1,050; Collingwood, harbour improvements, re-vote $72,600, $75,000; Goderich, harbour improvements, $51,000; Kingston, dry dock, renewal of revetment walls, $33,000; Oshawa, repairs to pier, $2,100; Owen Sound, repairs to wharf, $4,000; Port Colborne, repairs to east breakwater, $1,750; Port Dover, repairs to piers, $6,000; Port Hope, harbour improvements, $13,500; Sault Ste. Marie, wharf improvements, $1,500; Thornbury, repairs to pier, $2,000.

Eighty Lake Boats Will Go to Atlantic. A representative of the United States Shipping Board was in Cleveland recently definitely initiating Government plans to commandeer lake freighters for coastwise and trans-oceanic war trade. Figures tabulated by the Government agent, in conference with local shipping experts, owners, builders and tugmen, show that upward of 80 lake boats can be taken to salt water. The Shipping Board's decision will rest upon the report to be made by its representative. The plan is to take every boat posible of passing through the Welland Canal, and thence through the St. Lawrence River to the Atlantic before lake traffic is icebound. The Shipping Board is now making a list of boats under 260 feet length and 43 feet beam, which can pass through the Welland Canal without alteration. Boats up to 520 feet length and not more than 43 feet beam will be cut in two, bulkheaded and towed by tugs through the canal and river.

Harbour Appropriations for Quebec.—The Dominion Government appropriations for harbours and rivers in Quebec include the following: Anse-aux-Gascons, repairs to wharf, $5,000; Anse-aux-Griffon, repairs to piers, $1,500; Baracnois de Malbaie, repairs to approach to the training pier, $1,200; Cap Chat River, improvements, $5,000; Cape Cove, repairs to pier, $500; Cascades Rapids, reconstruction of anchor pier, $1,500; Chaplain, repairs to wharf, $4,500; Chicoutimi, repairs to wharf, $2,500; Cross Point, repairs to wharf, $1,000; Graham, reconstruction of wharf, $3,500; Grindstone, M. I., repairs to wharf, $2,600; Grosse Isle, quarantine station, repairs to wharf, $4,000; Grosse Isle, quarantine station, extension of wharf, $50,000; Isle-aux-Coudres, wharf improvements, $1,200; Laprairie, repairs to wharf and completion of approach, $4,000; Malbaie, repairs to pier, $900; Newport, repairs to breakwater, $1,500; Norway Bay, to repair and improve wharf, $5,000; Point Shea, M.I., repairs in the wharf, $1,500; Riviere - a - la - Pipe, reconstruction of wharf, $5,000; Sabre-vois, repairs to wharf, $1,460; St. Anne de Beaupre, repairs to wharf, $600; Ste. Anne de Chicoutimi, repairs to wharf, $2,800; St. Charles de Caplan,, removing debris and rebuilding outer end of wharf, $2,500; St. Jerome, repairs to wharf, $2,500; St. Ulrich, repairs to wharf, $1,200; St. Zotique, reconstruction of wharf, $2,000; Three Rivers, repairs to wharf, $9,500; Vercheres, partial reconstruction of wharf, $4,700; Woburn, repairs to wharf, $1,500; Yamaska, reconstruction of dam, $1,500; Yamaska, repairs to dam across Little Channel, $750.

RAILWAYS—BRIDGES

Victoria, B.C.—The C. P. R. has asked the Board of Railway Commissioners to approve of the company's plans for the [illegible]

St. John, N.B.—[illegible] the Provincial Government has cancelled the contract for the construction of the northern section of the Valley Railway.

was made by F. B. Carvell, K.C., at the Valley Railway enquiry. The contract was made by the late Government after the last general elections were announced and provided for an increase in the cost of the work of about $76,000.

CATALOGUES

The Canadian S K F Ball Bearing Co., Toronto, have for distribution among their friends a handy pocket rule in English and metric measurements. The rule is 6¼ inches long and will be gladly mailed to anyone interested in ball bearings.

The S. K. F. Ball Bearing Co., Hartford, Conn., have issued a folder containing photographs and statements from a number of prominent machine tool manufacturers giving their opinion concerning the use of S K F ball bearings on the machines which they make.

Feed Water Treatment.—The Dearborn Chemical Co., of Canada ,Ltd., Toronto, are distributing a bulletin describing the Dearborn scientific treatmen of boiling feed waters. The bulletin gives a list of the substances commonly held in solution in feed waters and describes their action either in the formation of scale or corrosion of the boiler plates. The bulletin also deals with the Dearborn method and boiler preparations.

Darling Bros., Ltd., of Montreal, Que., manufacturers of steam appliances, have recently issued a special catalogue for distribution abroad. This booklet is 6 by 9 in. in size, containing 24 pages, and printed in French on high-quality calendered stock. Many of the lines manufactured and handled by this firm are profusely illustrated and described, with the data and prices arranged and compiled to meet the requirements of foreign countries familiar with the French language.

Electric Lamps.—Bulletin No. 78 describes the Cooper Hewitt electric lamps for photographic purposes. The bulletin gives full particulars and prices of the various outfits and different apparatus used in connection, accompanied by illustrations. The bulletin also contains suggestions as to the proper outfit to be used for various purposes in photography with illustrations showing studio arrangements. Copies of the bulletin may be obtained from The Cooper Hewitt Electric Co., Hoboken, N.J.

Steam Specialties—The V. D. Anderson Co., Cleveland, Ohio, have issued a new and well gotten up catalogue entitled "Anderson Steam Specialties," which include steam and air traps, steam and oil separators, water columns, pressure oil filters, copper floats, etc. The construction and operation of each product is fully described, accompanied by illustrations showing exterior and cross sectional views. Tables are also included giving the principal dimensions and other data for each size of trap or separator, etc. The catalogue also contains plates showing three arrangements of the Anderson oiling system.

Mechanical Rubber Goods, Valves.—Catalogue and price list No. 8 deals with an interesting line of valves, packings, and mechanical rubber goods manufactured by Jenkins Bros., Ltd., Montreal. This is a useful catalogue to have on file for reference, as it covers a full line of the above products and contains considerable descriptive matter about each in addition to the price lists. The catalogue is fully illustrated, while the concluding section No. 8, contains a price list of parts, tables of weights, and dimensions, together with diagrams, and also provincial registration numbers for the various types of valve. In this section is also included diagrams in connection with the dimension tables. The catalogue contains 252 pages, including a complete index and is bound in substantial cloth covers.

BOOK REVIEW.

Cold Storage Architecture.—To meet an ever-increasing demand for information respecting the construction of icehouses and small cold storage systems for farmers, country storekeepers, milk producers, hotel-keepers, owners of country homes and others, the Dominion Department of Agriculture has issued Bulletin No. 49, of the Dairy and Cold Storage Branch, entitled "Small Cold Storages and Dairy Buildings," the immediate sponsors for which are J. A. Ruddick, Dairy and Cold Storage Commissioner, and Joseph Burgess, Cold Storage Inspector. The bulletin is a complete handbook on cold storge construction of a comparatively simple and inexpensive kind. Besides minute explanatory details of plans and material required for construction of ice houses and refrigerators, a series of drawings prepared by the Architect's Branch of the Department of Public Works is presented, of which blue prints on a scale of one inch to two feet can be had free on application to the Dairy and Cold Storage Commissioner, while the bulletin itself can be had, also free, by writing to the Publications Branch, Department of Agriculture, Ottawa. If the information herein contained were extensively made use of, not only would much waste be avoided and financial profit accrue, but considerable benefit would be derived in health and the enjoyment of life enhanced. Five different plans are given in the bulletin quantities with complete specifications for each and a statement of quantities of ice that can be stored.

A little Irishman in a state of great excitement and dishabille ran into the lobby of the hotel.

"I want a room," he said to the clerk, "and I want it quick."

"What room do you want?" inquired the clerk politely.

"I want 37."

"But 37 is already occupied—Mulligan has that room."

"I know he has," responded the little Irishman. "I'm Mulligan, and I just fell out of the window."

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

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

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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.

PATENTS

THE PROPRIETOR OF LETTERS PATENT M. R. Matti No. 137,772, "Arrangement for changing the moment of fuel injection into the combustion chamber during the run of the motor and for regulating the quantity of fuel," desires to dispose of the patent or to grant license to interested parties at reasonable terms, with a view to the adequate working of the patent in Canada. Inquiries to be addressed to the patentees, Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. c5m

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WANTED—AIR COMPRESSOR — MUST BE in good condition: give full particulars as to make, size and price. Box 324, Canadian Machinery. c27m

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

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

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

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

FOR

IMMEDIATE DELIVERY

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

Pratt & Whitney Vertical Surface Grinder, 36" Table.

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

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

36 ft. Niles Plate Planer.

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1 No. 3 LeBlond Universal Miller, Double Back Geared, Motor Drive

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1—New 16 x 8 Springfield Engine Lathe.
1—New 14 x 6 Springfield Engine Lathe.
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1—16 x 8 Porter Standard Engine Lathe.
1—14 x 8 Sebastian Standard Engine Lathe.
1—14 x 6 Springfield Engine Lathe.
1—14 x 6 Prentiss Engine Lathe.
1—14 x 6 Sebastian Engine Lathe.
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1—No. 2 Hendey Plain Milling Machine.
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1—No. 0 Brown & Sharpe Plain Milling Machine.
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3—No. 1½ Knight Milling & Drilling Machines.
3—Fox Hand Milling Machines.
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1—3' Mueller Plain Radial Drill.
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20-Ton, 56' 3" span, three motor, 110 volts, D.C.
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Lever Shear (double), cap. 2" sq.
28" throat (single), cap. ⅞x⅞" (belt).
36" throat (single), cap. 1¼x1" (belt).
48" throat (single), cap. 3x1¼" (steam).
36" throat (single), cap. 1½x1½ (belt).
38" throat (single), cap. 1x1" (belt).
36" throat (single), cap. ⅞x⅞" (belt).
17" throat (single), cap. ¾x¾" (belt).
15" throat (single), cap. ¾x½" (hand).
10" throat (double), cap. 1½x1" (belt).
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MISCELLANEOUS.

Bulldozer, No. 12 Ajax, 30" stroke.
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Grinder, No. 13, B. & S. Universal and Tool.
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First-class condition—quick shipments.
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No. 10-K Seneca Falls 9" x 4' Bench Lathe.
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Wisconsin Hand Miller on column, complete.
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H. B. Smith Hand Miller, complete with cshaft.
No. 1 Standard Hand Miller, with oil pump equipment.

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Landis 16" x 66" Crank Grinder with extra plain heads if desired.

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Hamilton, 20" swing x 8' bed, fric. head, eng. tur. lathe, pan bed, power feed turret on bed.
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Jones & Lamson 3" x 36" Grd. Sliding Head Turret Lathe, bar equipment.

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20" Cincinnati Back-geared Shaper.

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Very Latest Models—None Over 2 Years Old

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25—21" Gisholts, 3½" hole, 2-step, 5" belt,
20—21" Gisholts, 3½" hole, motor arrangement,
13—24 Gisholts, 4¼" hole, 3-step, 4 belt,
38—24" Gisholts, 6" hole, 2-step, 6" belt,
41—24" Gisholts, 6" hole, motor arrangement,
2—2¼ x 26" Greenlee Flat Turrets,
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4—3-A Warner & Swasey (bar machines).

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24—22" x 8' Hamilton, D.B.G., C.R., Semi-Q.C.,
5—22" x 8' Hamilton, D.B.G., Turret tool post,
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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.,
8—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,
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.

Our Guarantee

Your money back if you return a machine within 30 days from date of shipment, freight prepaid. **No Excuses Necessary.**

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1—30' x 30' x 7 Powell, 4 hds.
1—26" x 26" x 7 Gray, 1 hd.
1—[illegible] x 26 x 6 American.
1—24 x 24" x 10 Lodge & Davis.
1—24 x 24 x 6 Cincinnati.
2—24" x 24" x [illegible] Gray.
1—24" x 24" x [illegible] Gray.
1—22" x 22" x 6 American.
1—22 x 22 x [illegible] Flather.

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1—P. & W. 2-spindle Rifle Barrel Drilling.
1 2-spindle Beaman & Smith Cylinder Boring.
1 No. 4 Newton 2-spindle, 4"
1 Betts [illegible] bar
1 Bement [illegible] bar
1 Beaman & Smith, 2½" bar.

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1 42" Colburn.
2 [illegible] Colburn
1 [illegible] Rogers
1 [illegible] Bausch

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1 4' Niles Full Universal.
1—3½' Gang.
1—3' Mueller.
1 3' Prentice.
1 [illegible]
[illegible] 2½' Mueller.
[illegible]

MILLING MACHINES

1 No. 2 Beaman & Smith Combination Horizontal and Vertical.
1 Beaman & Smith [illegible] bor. hd.
[illegible]
1 No. 2 Cincinnati Universal.
[illegible]

[illegible]

[illegible]

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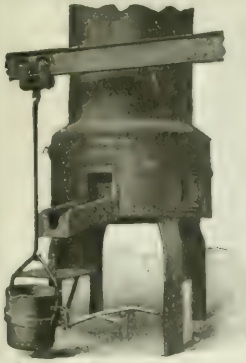

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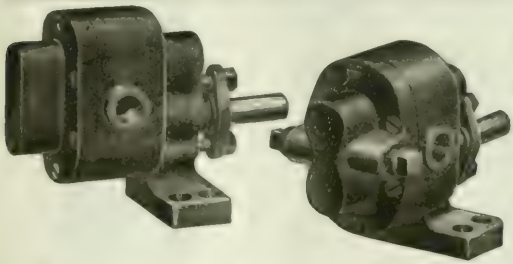
WHITING
FOUNDRY EQUIPMENT CO.
HARVEY-ILL. U. S. A.
CHICAGO SUBURB



Circulating Pumps

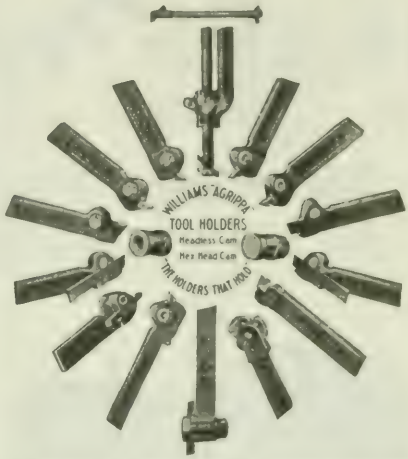
Eliminate the separate relief valve and its necessary piping by installing the Roper Circulating Oil Pump. But, you say, why install a new system when the present is good enough? This "good enough" article may appear to be giving satisfaction, *but*, is it giving the best to be obtained. Can you speed up without any fear? With a Roper you need not have any fear of any kind. The oil flows from it in a steady, even stream, and there you can speed up to full capacity and let her go feeling confident.

Inquire. You will get valuable information anyway.

C. F. ROPER & CO.

Hopedale : Mass. : U.S.A.

WOULD THEY?



Would successful manufacturers squander time and money introducing a new line of tool holders for the dealers and consumers who market and use their older products if uncertain of superior mechanical design?

Unless convinced of increased future demand would the competition for the small volume of tool holder renewals warrant such effort?

Would you afterwards demand other Williams' tools if the tool holders they endorsed failed to succeed?

Do stable companies risk their past reputation and their future prospects on untried or unproven innovations?

No, there is a reason, and their trial proves

Williams' "AGRIPPA" Tool Holders

"THE HOLDERS THAT HOLD"

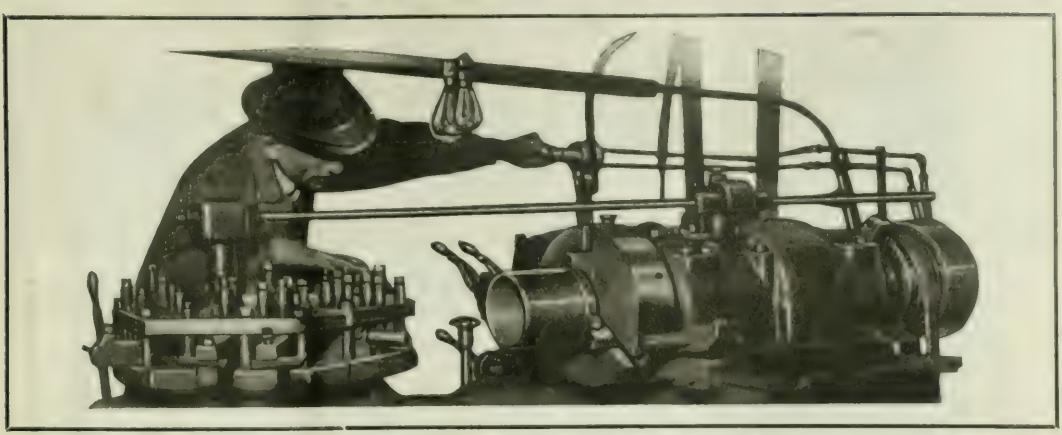
excel and endure

We guarantee all "AGRIPPA" Tool Holders

J. H. WILLIAMS & CO.
THE WRENCH PEOPLE
45 RICHARDS STREET BROOKLYN, N.Y. CITY

Descriptive circulars upon request

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



The Woman in the Shop Has Come to Stay

Thrust into the industrial field by unprecedented world conditions, women have more than made good. Lacking masculine brawn, they have by instinct the deft, sure touch and quick perceptions that go to make a highly skilled operator; aided by modern labor-saving devices they equal, and in many cases surpass, the output of the expert workman.

One of the woman machinist's chief helps is the Hannifin Air Chuck, by means of which work is chucked and rigidly gripped by simply turning a lever. Another turn effects the release. The Hannifin Chuck is almost instantaneous in action, holds securely, cannot slip, saves labor, and saves time to the extent of increasing output 20 to 100 per cent.

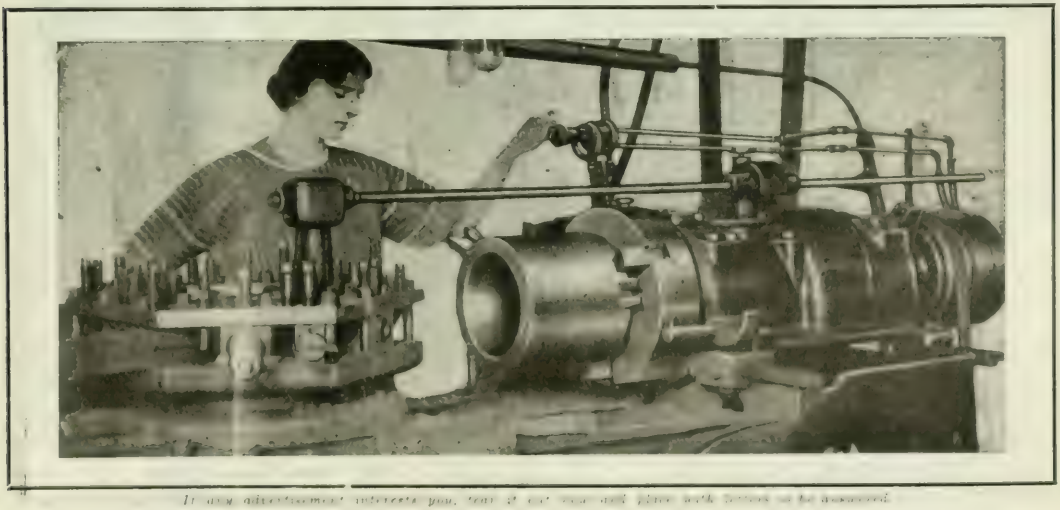
Every argument is in favor of the Hannifin Air Chuck. Order one on trial and let it prove its own case.

HANNIFIN Air Chucks

Write for catalogue covering Air Operated Chucking and Clamping Equipment.

HANNIFIN MFG. COMPANY, Chicago, U.S.A.

REPRESENTATIVES—R. E. Ellis Engineering Co., Chicago; Coats Machine Tool Co., New York City; A. R. Williams Machinery Co., Toronto; Williams & Wilson, Montreal; The Canadian Fairbanks-Morse Co., Montreal. EUROPEAN REPRESENTATIVES: Coats Machine Tool Co., Ltd., London; Fenwick Freres & Co., Paris; Iznoskoff & Co., Petrograd.



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

HINTS TO BUYERS

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

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, wrte us, anid 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
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ACETYLENE
[illegible]
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[illegible]

ACETYLENE GENERATORS
[illegible]
[illegible]
Prest-O-Lite Co., Inc., Toronto, Ont.

ACCUMULATORS, HYDRAULIC
[illegible]
[illegible]
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York
Smart-Turner Mach. Co., Hamilton, Ont.
[illegible]

AIR RECEIVERS
[illegible]
[illegible]
MacKinnon, Holmes Co., Sherbrooke, Que.

AIR WASHERS
[illegible]
[illegible]
[illegible]

ALUMINUM
[illegible]
[illegible]

ALLOY, STEEL
[illegible]
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Vanadium Alloys Steel Co., Pittsburg, Pa.
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ARBORS
[illegible]
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AUTOGENOUS WELDING AND CUTTING PLANTS
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AUTOMATIC MACHINERY
[illegible]

BABBITT METAL
[illegible]

BALL BEARINGS
[illegible]

BARRELS, STEEL SHOP
[illegible]

BASE FACING MACHINES
[illegible]

BARS, BORING
Charles F. Elmes Eng. Works, Chicago, Ill.
[illegible]
[illegible]

BELT LACERS
[illegible]

BELT DRESSING AND CEMENT
[illegible]

BELT LACING LEATHER
[illegible]
[illegible]
[illegible]

BELTING, BALATA
Baxter Co., Ltd., J. R., Montreal, Que.
Can. B. K. Morton, Toronto, Montreal
[illegible]

BELTING, CHAIN
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
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BELTING, CONVEYOR
[illegible]

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.
[illegible]
H. W. Petrie, Toronto

BENCH LEGS, STEEL
[illegible]

BENCH DRAWERS, FRICTIONLESS
[illegible]

BENDING MACHINERY
[illegible]
Can. Blower & Forge Co., Kitchener, Canada
[illegible]
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machinery Co., Toronto, Ont.
[illegible]

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

BINS, STEEL
[illegible]

BLASTING MACHINES, SHOT AND STEEL GRIT
[illegible]

BLOWERS
[illegible]

BLOW PIPES AND REGULATORS
[illegible]

BLUE PRINTING MACHINERY
[illegible]

BOARTZ
[illegible]

BOILERS
[illegible]

BOLT CUTTERS AND NUT TAPERS
[illegible]
[illegible]
[illegible]

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
[illegible]
[illegible]
London Bolt & Hinge Works, London, Ont
[illegible]

BOLT AND NUT MACHINERY
[illegible]
[illegible]
[illegible]
Garlock-Walker Machinery Co., Toronto, Ont.
[illegible]
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
H. W. Petrie, Ltd., Montreal
[illegible]
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BOLT THREADING MACHINERY
[illegible]

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co. of Canada, Toronto
Canadian Fairbanks-Morse Co., Montreal
[illegible]
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BORING MACHINES, UPRIGHT AND HORIZONTAL
[illegible]
[illegible]
Dominion Machinery Co., Toronto
Garlock-Walker Machinery Co., Toronto, Ont
[illegible]
H. W. Petrie, Ltd., Montreal
Roelofson Machine & Tool Co., Toronto, Ont.
[illegible]
Stow Mfg. Co., Binghampton, N.Y.

BORING MACHINES, STOVE AND COAL
[illegible]

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
[illegible]

BOXES, STEEL SHOP AND TOTE
[illegible]
New Britain Mach. Co., New Britain, Conn.

BRAKES
[illegible]

BRASS AND COPPER BARS, RODS AND SHEETS
[illegible]

BRASS WORKING MACHINERY
[illegible]

BRIDGES, RAILWAY AND HIGHWAY
[illegible]

BRONZE RODS AND SHEETS
[illegible]

BUFFERS
[illegible]

BUFFING AND POLISHING MACHINERY
[illegible]

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. & Mach. 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.

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

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.
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
Wells Brothers Co., Greenfield, Mass.
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.

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.
[illegible]
[illegible] 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 & Cplg. Co., Alexandria, Ont.

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

COLLETS
Becker Milling Machine Co., Boston, Mass.
Hannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Inc., Chicago, Ill.
Manufacturers' Equipment Co., Chicago, Ill.
Rivett Lathe & Grinder Co., Boston, Mass.
Stone Tool & Supply Co., J. R., Detroit, Mich.

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

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

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

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

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

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

COUNTERSHAFTS
Baird Machine Co., Bridgeport, Conn.
Foster Machine Co., Elkhart, Ind.

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

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

CRANES, LOCOMOTIVE
Northern Crane Works, 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.
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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Dominion Machy. Co., Toronto, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
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.
The Moore 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.
United States Mach. Tool Co., Cincinnati, Ohio.

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

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

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

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

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

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

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

DRILLS, HIGH SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal.
Clark Equipment Co., Buchanan, Mich.
Can. B. K. Morton, Toronto, Montreal.
H. A. Drury Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Marshall, Geo. A., 70 Lombard St., Toronto.
McKenna Brothers, Pittsburgh, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
W. F. & John Barnes Co., Rockford, Ill.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.

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

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

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

DRILLS, PNEUMATIC CORNER
Independent Pneumatic Tool Co., Chicago, Ill.

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

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

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

DRILLS, TWIST
Atkins & Co., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Armstrong, Whitworth of Canada, Ltd., Montreal.
Canadian Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
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, Geo. A., 70 Lombard St., Toronto.
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, 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.
Cummins & 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.
GAUGES, MERCURY COLUMN, DRAFT
Charles P. Elmes Eng. Works, Chicago.
GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.
GAUGES, STANDARD
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford.
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.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
The Smart Turner Machine Co., Hamilton.
D. E. Whitton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.

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. B. K. Morton, Toronto, Montreal.
Carborundum Co., Niagara Falls.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Francis & Co., Hartford, Conn.
Norton Co., Worcester, Mass.
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.
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.
West Tire Setter Co., Rochester, N.Y.
HAMMERS, POWER
Beaudry & Co., Boston, Mass.
Erie Foundry Co., Erie, Pa.
United Hammer Co., Boston, Mass.
HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
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 Gun Glove Co., Chicago, Ill.

HANGERS, SHAFT
Baird Machine Co., Bridgeport, Conn.
Can. Band Hanger & Pulley 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.
Oelgin (Canada), Ltd., Sam'l, Montreal, Que.

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

HEATERS
Sessle & Sons Co., Wm. B., Pittsburgh, Pa.
Stuttevant 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.

HORS
Illinois Tool Works, Chicago, Ill.
Osborn (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
Mathews, 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.
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., Quebec, Que.
Peters, 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.
Garlock-Walker Machinery Co., Toronto, Ont.
Niles-Bement-Pond Co., New York, 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.

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

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

LATHE CHUCKS (SEE CHUCKS)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Curtis & Curtis Co., Bridgeport, Conn.
Hendey Machine Co., Torrington, Conn.
Rivett Lathe & Grinder Co., Boston, Mass.
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 Mach. Co., New York.
Hamilton Mach. Tool Co., Hamilton, Ohio.
Himoff Machine Co., Inc., New York, N.Y.
Himoff Machine Co., 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.
Gisholt Mfg. & Machine Co., Toronto, Ont.
Hepburn, John T., Ltd., Toronto.
Himoff Machine Co., 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.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
McCabe, J. J., New York, N.Y.
Mulliner-Enlund Tool Co., Syracuse, N.Y.
National-Acme Co., Cleveland, Ohio.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
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.

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.

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.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Taft-Peirce Mfg. Co., Woonsocket, R.I.

MILLING MACHINES, HAND
Hardinge Bros., Inc., Chicago, Ill.
United States Mach. Tool Co., Cincinnati, Ohio.
Whitcomb 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 Mach. 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 & Eklund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
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 & Eklund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington.
Kempsmith Mfg. Co., Milwaukee, Wis
LeBlond Mach. Tool Co., R. K., Cincinnati
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
Alkenhead 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.
Taber 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, Que.
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
Sharpe & Hodge, Inc., Worcester, Mass.

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Verschoyle-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, 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 GROOVING MACHINES
National Mach. Tool Co., Cincinnati, O.

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.

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

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

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

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

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

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

OXYGEN (SEE ACETYLENE)

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

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

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

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

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

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

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

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

PIPE CUTTING AND THREADING MACHINES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
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.
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.

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.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hamilton Machine Tool Co., Hamilton, Ohio.
Morton Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
Petrie 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, Ont.
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, O.

PRESSES FOR SHELLS
Atlas Press Co., Kalamazoo, Mich.
Charles F. Elmes Eng. Works, Chicago.
Dominion Machinery Co., Toronto
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, Ill.
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, Ill.
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.
H. W. Petrie, Toronto.
Toledo Machine & Tool Co., Toledo.
West Tire Setter Co., Rochester, N.Y.
A. R. Williams Machy. Co., Toronto.

PRESSES, HYDRAULIC DIE STAMPING
Standard Machy. & Supplies, Ltd., Montreal, Que.

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, Ill.
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.
Wm. 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 Machine Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
PULLEYS, FRICTION CLUTCH.
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Positive Clutch & Pulley Works, Toronto.
Bernard Industrial Co., A., Fortierville, Que.
PULLEY MACHINERY,
DRILLING AND TAPPING
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Pulley Mchy. Co., Cincinnati, Ohio.
Wells Bros. Co. of Canada, Galt, Ont.
PUMPS, AIR
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton.
PUMPS, CENTRIFUGAL
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 Machine Co., Hamilton, Ont.
Sturtevant Co., B. F., Galt, Ont.
PUMPS, FUEL OIL
Trahern Pump Co., Rockford, Ill.
PUMPS, HIGH PRESSURE
Blake Pump & Condenser Co., Fitchburg, Mass.
Charles W. 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.
The 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, Ill.
Metalwood Mfg. Co., Detroit, Mich.
Smart-Turner Mach. Co., Hamilton.
Wm. R. Perrin, Ltd., Toronto.
PUMPS, LUBRICANT AND OIL
Bellevue Industrial Furnace Co., Detroit, Mich.
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
Trahern Pump Co., Rockford, Ill.
PUNCHES AND DIES
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Blower & Forge Co., Kitchener, Ont.
Ferracute Mach. Co., Bridgeton, N.J.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. R. Jardine & Co., Hespeler, Ont.
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.
Bliss, E. W., 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.
Bliss, E. W., 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.
Uehling, Herman A., 1 Madison Ave., New York.
Shore Instrument & Mfg. Co., New York City.
H. E. Streeter, New Birks Bldg., Montreal, Que.
Taylor Instrument Cos., 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, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
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, Ont.
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.
McKenna Brothers, Pittsburgh, Pa.
Osborn (Canada, Ltd., Sam'l, Montreal, Que.
R. E. T. Pringle, Ltd., Toronto, Ont.
REAMERS, PIPE, CYLINDER AND LOCOMOTIVE
Morse Twist Drill & Machine Co., New Bedford.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
A. R. Jardine & Co., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Tool 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 Cos., 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. & Mach. 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., Sherbrooke, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Garlock-Walker Machy. Co., Ltd., 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.
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
Espen-Lucas Mach. Works, Philadelphia, Pa.
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.
SAW MACHINES
Napier Saw Works, Springfield, Mass.
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.
A. B Jardine & Co., Hespeler.
New Britain Machine Co., New Britain, Conn.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rivett Lathe & Grinder Co., Brighton, Mass.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
SCREW MACHINES, AUTOMATIC, MULTIPLE SPINDLE
New Britain Machine Co., New Britain, Conn.
Riverside Machinery Depot, Detroit, Mich.
SCREWS
Can. B. K. Morton, Toronto, Montreal.
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.
SCREW PLATES
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
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 Machy. 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.
Stephen Co., John, Cincinnati, Ohio.
SHAFTING
Can. Bond Hanger & Coupling 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, SEPARATORS
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.
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.
Ferracute 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, Can.
Peck, Stow & Wilcox, Cleveland, O.
Steel Bending Brake Works, Ltd., Chatham, Ont

SHEET METAL STAMPINGS
Dominion Forge & Stpg. 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 MACHINE
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, Ont.
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 & Machine Co., New Bedford.
J. H. Williams & Co., Brooklyn, N.Y.

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

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

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, Can.
Can. Fairbanks-Morse Co., Montreal.
Charles F. Elmes Eng. Works, Chicago.
Ferracute Mach. Co., Bridgeton, N.J.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Eglund, Inc., Courtland, N.Y.
Grant Mfg. & Machy. Co., Bridgeport, Conn
John H. Hall & Sons, Brantford
Gray Mfg. & Mach. Co., Toronto, Ont.
Himoff Machine Co., New York, N.Y.
Hyde Engineering Works, Montreal, Que.
Jardine, A. B., & Co., Hespeler.
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.
Frost-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. . 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.
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