CANADIAN MACHINERY AND MANUFACTURING NEWS

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

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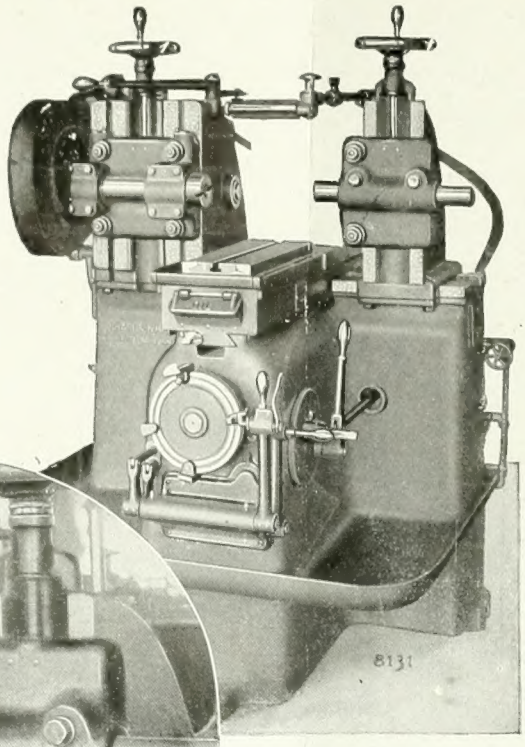
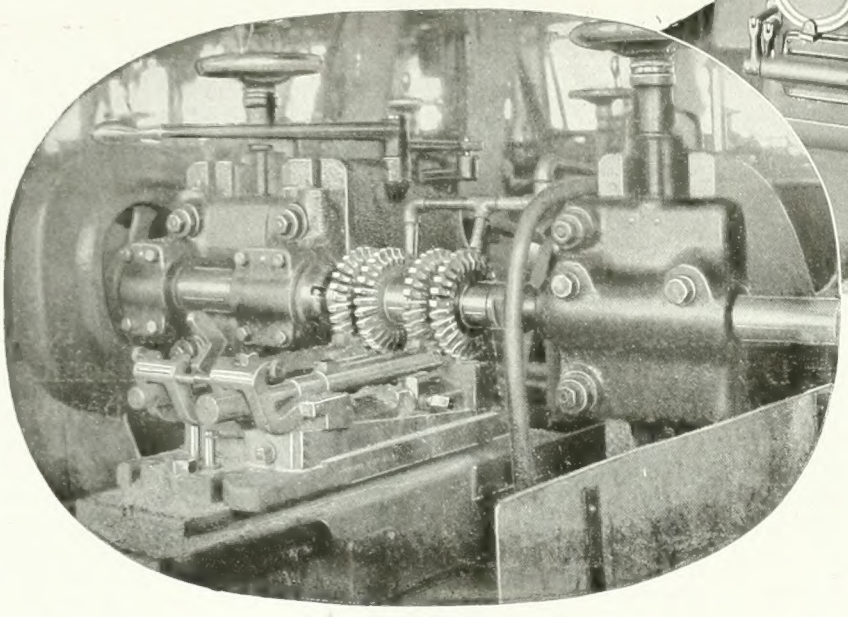
PRATT & WHITNEY

Automatic MILLERS

A high production manufacturing tool of extreme accuracy; automatic in operation and especially adapted to the diversified milling requirements of fire arms production and similar work.





At Work on Military Rifles

Illustration shows straddle milling operation on sides of receivers. Two receivers are handled at one time.

Pratt & Whitney Automatic Millers are built in 5-inch, 8-inch and 12-inch sizes. The table has rapid power traverse in either direction, automatically controlled. The table receding feature operates automatically and permits the work to clear the cutter on the return stroke and, therefore, prevents marring of the finished surface. Automatic features of these machines eliminate usual hand operations. One man can take care of from six to eight machines, depending on the character of the work. Practically all the operator has to do is to supply the machine with work.

Write for Illustrated Circulars.

PRATT & WHITNEY CO.

of Canada, Limited

Works: DUNDAS, ONTARIO

MONTREAL	TORONTO	WINNIPEG	VANCOUVER
723 Drummond Bldg.	1002 C.P.R. Bldg.	1205 McArthur Bldg.	B.C. Equipment Co.

The Publisher's Page

TORONTO July, 1917

An inquiry from a prospective customer 12,000 miles away

THE Canadian Morehead Manufacturing Co., makers of the famous "Back to Boiler" Steam Trap, are advertising in Canadian Machinery. A few days ago Mr. King, general manager of the Can. Morehead Manufacturing Co., very kindly showed us an inquiry which had been received from a prospective customer in Tasmania (Australia), some 12,000 miles away!

The inquiry itself is interesting and we have pleasure in reproducing it, together with the advertisement which prompted it.

Canadian Machinery was the first Canadian journal to publish export numbers. For well over a year the first issue of each month to the extent of well over 1,000 copies, is mailed abroad to a carefully compiled list of machinery importers.

A supply of each export number is also sent to each Canadian Trade Commissioner and excellent work has been done by these officials in bringing our paper to the attention of interested parties.

We have received many letters from our advertisers testifying to the splendid results they are obtaining. We appreciate their frankness in telling us of results secured because such reports encourage and spur us on to even greater efforts.

There are many difficulties in the way of doing a profitable export business at this time. It must not be forgotten, however, that an export connection is not built up in a day or a year, and the full force of the advertising in our export numbers will be felt months and perhaps years hence.

To the foresighted firms who are reaching out into the future we take off our hats. Some day Canada will have a *real* export business to brag about. You will find that the concerns who are getting the thin end of the wedge in now will be in the front row of exporters then.

Our next Export Number is due to appear August 2nd, forms closing July 26. Why not take advantage of it?

F. ROWNTREE & SON,
Consulting Engineers
Telephone 205

37 Montpelier Road,
Hobart, May 26th, 1917
Tasmania, Australasia

The Canadian Morehead Manufacturing Co.,
Woodstock, Ontario.

Gentlemen:—

We have under our supervision the steam plant of the leading "Temperance Hotel" of this city, and seeing your add. in the February issue of "Canadian Machinery"—

"Morehead Back to Boiler System"

we thought your system might be applied with profit to our plant.

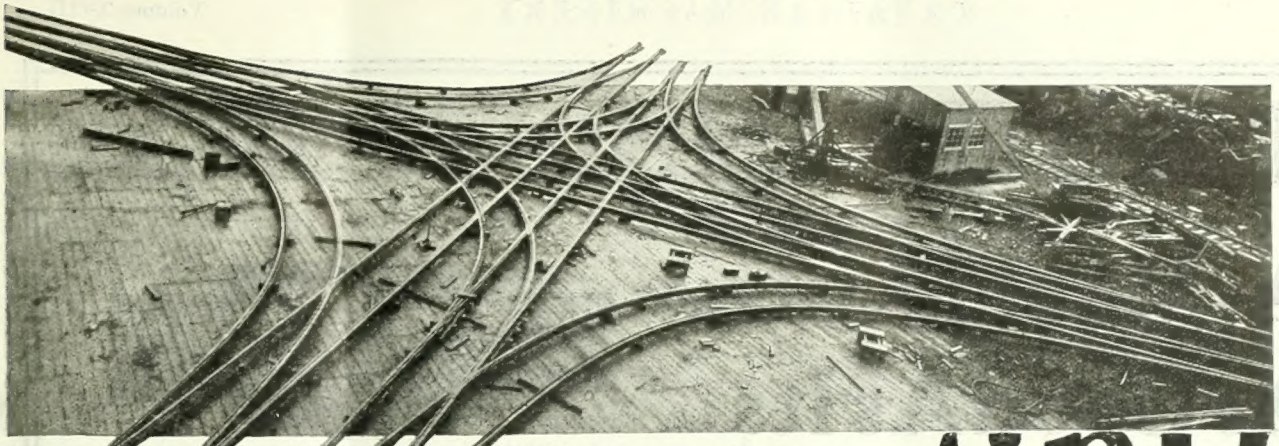
Herewith please find sketch showing relative positions of the various parts in use.

Should you feel disposed to communicate with us at the other extremity of the Grand British Empire we shall esteem it a favor.

Allow us to congratulate Canada on the noble sons she has sent to the "Help of the Lord against the Mighty," and the splendid work they have accomplished; God bless them all.

Yours truly,
F. ROWNTREE & SON,
Per Francis Rowntree

37 Montpelier St.
Hobart
Tasmania, via Australia.



Solid Manganese Steel Intersection for Montreal Tramways Company.

Steel Castings

For Hydraulic, Mill Gear, Locomotive, Rolling Stock, Marine—in fact we make castings of any size and any kind—Manganese, Vanadium, Titanium, Chrome, Nickel, etc. Dependable products always.

Canadian Steel Foundries, LIMITED

MONTREAL WELLAND

SISCO

We guarantee shipment within 24 hours of receipt of order

"Extra" "Special" "High Speed" **Tool Steels**

Made in Sweden from selected Dannemora Ore

We also carry in stock Solid and Hollow Drill Steel, Die Blocks, "SISCO" Welding Wire, Drill Rod and Swedish Iron.

Swedish Steel & Importing Co., Ltd.

MONTREAL, QUE.

The Life of a Thread Miller

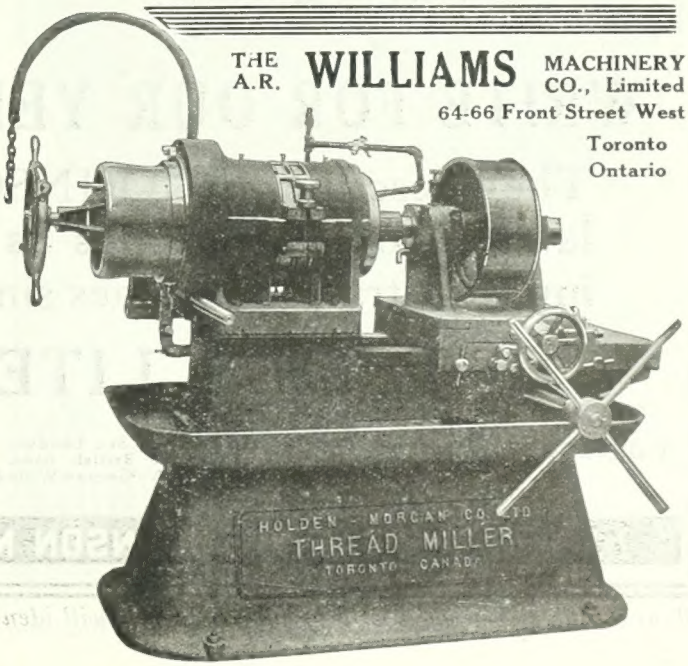
Depends not upon the amount of work it does, but the ease and thoroughness with which the work is done. These Thread Millers are noted for these qualities. Its quality of work is unrivalled. Our Service Department will give you all the particulars. *Write us!*

THE A.R. **WILLIAMS** MACHINERY CO., Limited

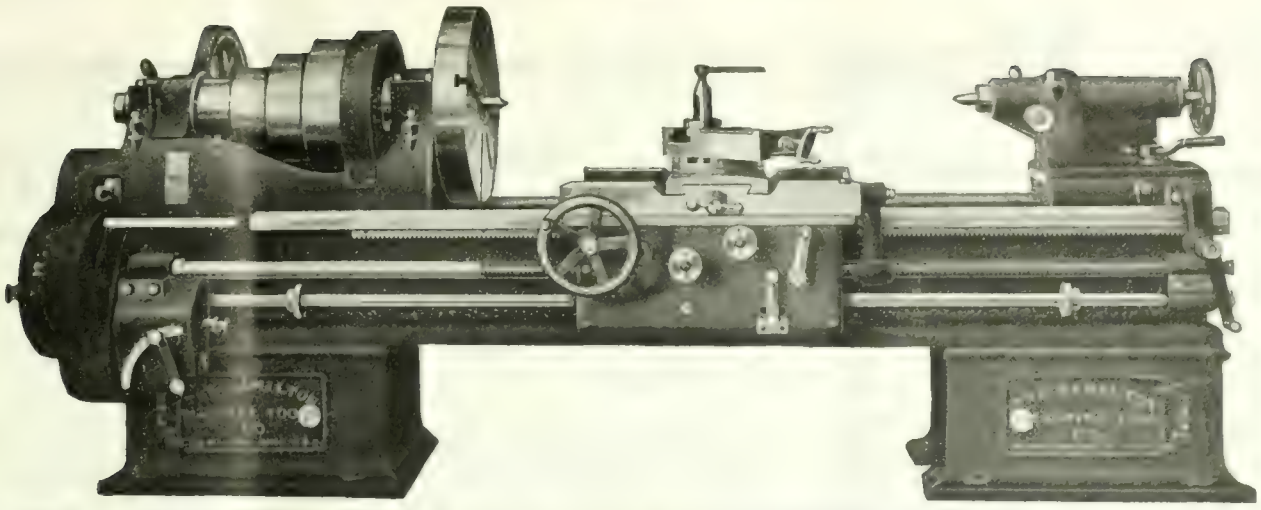
64-66 Front Street West

Toronto

Ontario



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



Hamilton Lathes

Is Your Cost of Production too high?

In the well-managed factory there is no greater loss of time—and therefore of money—than that resulting from the use of old style machinery.

All over the country shops are now running at top speed, and producing more for the dollar than ever before. Why? Because they are installing modern machine tools—tools built to withstand all the strain put upon them by the use of high speed tool steel.

You cannot expect to meet the competition of to-day with the methods of yesterday. To-day your equipment must be of the best, otherwise your costs will go up as your production goes down.

Investigate "HAMILTON" Lathes, put them in your factory—then watch the balance swing the other way. Speed, durability and accuracy are the points that make "HAMILTON" tools indispensable in cutting your cost of production.

Rapid Production
HAMILTON
Machine Tools

For 25 Years Makers of fine Machine Tools

The Hamilton Machine Tool Co.

HAMILTON, OHIO

Sole Agents for Ontario:

H. W. Petrie, Ltd., Toronto, Ont.

FIG. 1. VIEW OF MAIN BAY SHOWING ASSEMBLY BENCHES AND WORK IN PROGRESS. MACHINE DEPARTMENTS ARE LOCATED IN EACH SIDE BAY.

The Chapman Double Ball Bearing Co. in U.S. Territory

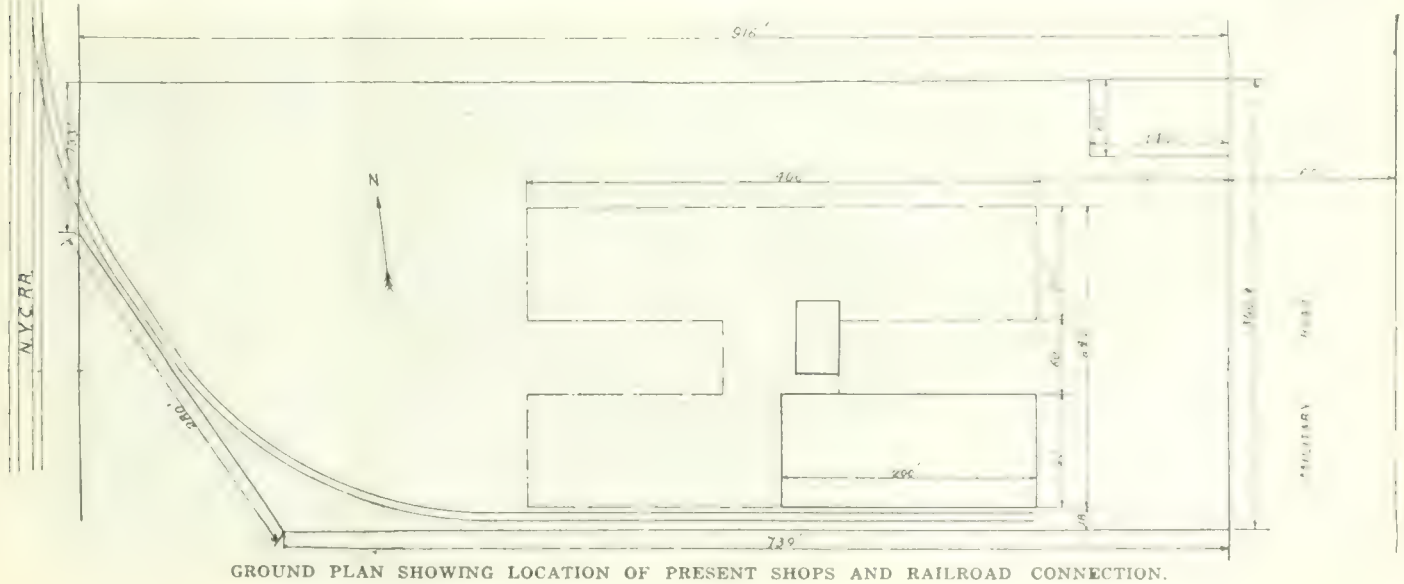
Staff Article

It is a significant fact that the Chapman Double Ball Bearing Co., of Toronto, Ont., have in the past developed and improved and finally exported to the United States a type of ball bearing which originated there, and which according to all expectations should have attained in the hands of its originators a development far exceeding that possible in this country with its limited market, and inherent manufacturing handicaps. As a further indication of what has been accomplished, the accompanying article is ample proof.

A FEATURE of Canadian industrial development during the past fifteen or twenty years has been the continual and, latterly, rapidly increasing influx of branch houses and factories from United States concerns. Few lines, indeed, have been exempt from the attention of our Southern neighbors, and while the influx has, on a whole, been beneficial to this country, there has occasionally been just a tinge of regret that the movement should be so one-sided. The relative degree of development attained by either country was always such that the initiative in many branches of industry, by force of circumstances to a great extent, originated in the more densely populated parts of the continent, and it was only in such cases where natural resources and other factors beyond human control had counteracted prevailing influences that Canada was enabled to attain an equal level and perhaps forge slightly ahead in industrial enterprises of various kinds.

A Pioneer Firm

Ball-bearing manufacture, together with several allied industries, has experienced tremendous developments in recent years; an essential component of the automobile, the production of this engineering accessory, has been compelled to undergo continuous expansion to keep pace with the requirements of car builders, and it would seem, therefore, that this preoccupation had been the opportunity whereby the perseverance of a pioneer Canadian firm has been rewarded with the ability to carry the fight into the enemy's camp, so to speak. It is a significant fact, however, that the past fourteen years have seen the Chapman Double Ball Bearing Co., Ltd., develop, introduce, improve, and finally export to



GROUND PLAN SHOWING LOCATION OF PRESENT SHOPS AND RAILROAD CONNECTION.

the States a type of ball-bearing which originated across the line, and which, according to all ordinary business expectations should have attained, in the hands of the originators, a development far exceeding that possible in this country with its limited market, and inherent manufacturing handicaps.

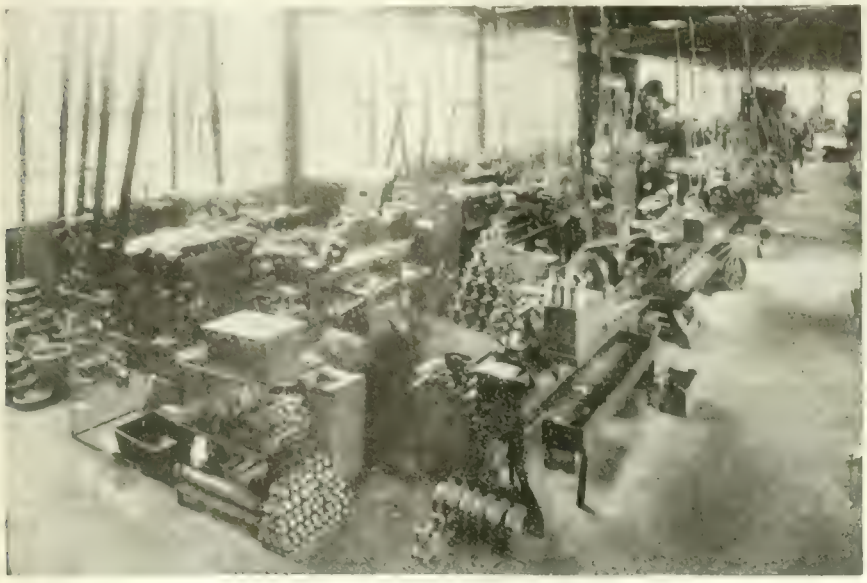


FIG. 3. PART OF LATHE DEPARTMENT SHOWING EXCELLENT LIGHTING, ARRANGEMENT OF MACHINES AND TYPE OF SAFETY GUARDS INSTALLED.

Despite all of these conditions, the enterprise of what might be termed the Canadian branch, has succeeded in creating a demand from U. S. manufacturers which has resulted in the former "branch" house establishing a branch of its own whereby the American markets can be more effectively supplied with the Canadianized product.

Opportunity Offered

Two years ago, when U. S. industries began to enter that period of activity, the end of which is not yet in sight, certain Canadian and American interests incorporated the Transmission Ball Bearing Co., and manufacturing operations were commenced in the City of Buffalo. That the occasion was opportune, has been proven by the rapid and continuous development forced upon the new concern. Producing an article adapted to a wide range of applications, perfected as the result of many years use under all sorts and conditions of service, and supported by an organization which had grown up with the business, the U. S. branch had everything in its favor to insure success from its inception. The necessity for securing enlarged manufacturing facilities quickly became evident, culminating in the erection of an entirely new plant in the Blackrock district, on the immediate outskirts of Buffalo City.

Location and Type of Plant

A site was secured on Military Road, the main thoroughfare between Buffalo and Niagara Falls, having a frontage of 360 ft., with a depth of 916 ft., the rear boundary abutting on the main line of the New York Central R.R. Both labor and material are thus easily obtainable, an excellent car service existing between the plant location and all residential districts. The future growth of the factory was kept well in mind, and a glance at the plan view reproduced in line drawing, Fig. 2, shows the ample provision for expansion. Destined to ultimately occupy a space of 240 ft. by 400 ft., the complete plan calls for two main bays, 90 ft. wide, separated for most of their length by a 60 ft. space, which insures ample light and ventilation.

The building, of which the accompanying views are illustrative, is exactly half of what will be later a main bay, being 200 ft. long by 90 ft. wide. It is of the monitor-daylight type, the roof being carried on rolled steel girders and columns, the side columns being surrounded by a light brick filling, which adds to the stability and appearance of the building without an appreciable diminution of lighting area. Hinged panels in the steel sash lights, both inside walls and monitor sides, insure an excellent degree of ventilation; while radiators extend continuously around the brick filling from the floor to the steel sash.

Department Arrangement

A general view of the interior is shown in title illustration, Fig. 1, from which the principal features of the shop layout can be gathered. The shafting is laid out in two main lines, one to each wing, located close to the main columns so as to give a suitable length of belt drive to the machine countershafts. The lathe department occupies the left foreground, the grinding department the right fore, with assembly benches and material extending across the centre aisle back to the tool crib, which is exactly in the centre of the shop within equal and convenient access from all departments.

The lathe department equipment is quite varied in view of the variety of work involved in producing the different parts, such as cast iron housings, steel sleeves, cone wedges, and numerous items of transmission equipment, such as pillow blocks, loose pulley sleeves, etc. Turret lathes, made by Pratt & Whitney, Acme Mach. Tool Co., Jones & Lamson, and Bardons & Oliver, are installed for this work, and a double spindle Jones & Lamson for certain details which lend themselves to production on this machine. The heavier work is done on a Libby turret lathe, while much miscellaneous and special work is handled to advantage on a Lodge & Shipley lathe with turret carriage, one Bullard and one Colburn boring mill, and a Kelly shaper. Much work of a suitable nature is found to keep a Foster screw machine fully employed, also a National speed lathe.

The amount of drilling required is comparatively slight, and is well taken care of by a couple of medium drill presses by W. F. & J. Barnes and Rockford Machine Tool Co.

Lathe Department

A view of the lathe department is given in Fig. 3, a feature of which is the extensive provision of wire guards. The State regulations in this matter are very rigid, and include such features as arrangement of the machines themselves

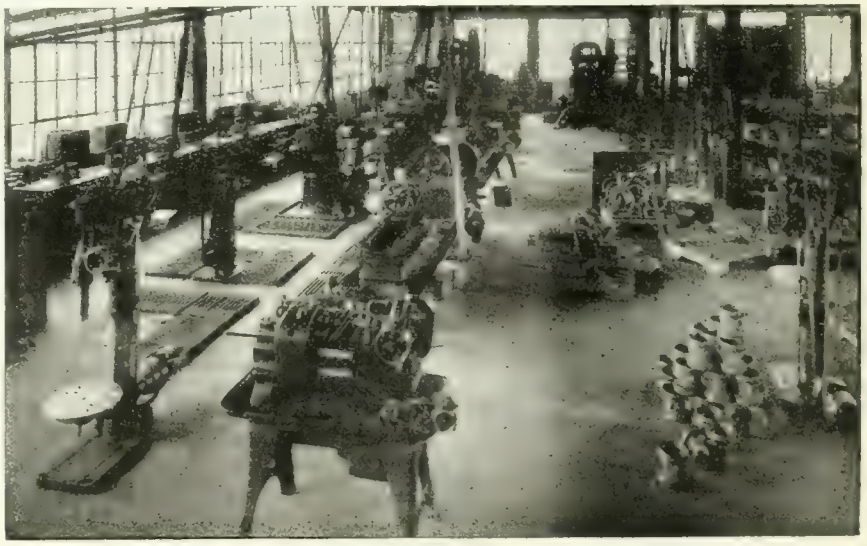


FIG. 4. TOOL ROOM SHOWING SPACIOUS LOCATION OF MACHINES.

independently of such handling systems or manufacturing methods which may be desired by the firm.

Beyond the lathe department is the tool room, which, like all parts of the building, is spacious, orderly and well equipped. The line shaft from the lathe department extends to the tool room with a clutch drive between the motor pulley and the lathe department. This allows the tool room to be run by itself on accasion, and, as it is a much smaller load than the lathe department, it does not add appreciably to the load when the latter department has to run extra time. The equipment illustrated in Fig. 4 is representative of good modern practice, being suited for the production of jigs and fixtures as well as a tooling outfit and upkeep—one 20 in., one 18 in., and one 14 in. American lathes; one No. 2 Kempsmith universal miller; one Cincinatti shaper; one Excelsior sensitive drill; one Universal, one Blount, and one La Salle grinder.

Power Press Department

At the extreme end of the left wing is the press department. This consists of five power presses driven from a shaft running transversely. These are used for stamping and forming the cup and cone ball races, drawing sleeves and housings for power table bearings, and stamping out ball cages or containers. Two large presses are made by the Toledo Mach. & Tool Co., and Niagara Mach. & Tool Works, with one medium and two small machines by the latter maker.

Three phase 25 cycle current at 440 volts is used throughout the factory, the lathes and tool room being operated by a 35 horse-power G. E. induction motor, and the cross shaft in press department by a ceiling type of Crocker-Wheeler motor.

Grinding Department

Returning to the right foreground of Fig. 1, the grinding and polishing of the ball races is here performed. Extreme accuracy is called for in this work which consists of parallel grinding on the outside of the outer race, taper grinding on the inside of the inner race, and radius grinding on the ball tracks of both races.

The first and last are done on three No. 3 modern universal grinders, while the radius work is done on No. 1 Landis radius grinders with automatic swivelling head carrying the work. Preliminary rough grinding or dressing is done on a Gardner double disc grinder, while a high speed polishing spindle is provided for finishing the ball tracks to that degree necessary for long and successful operation.

Suitable space is set aside in this department for an electric spot welding machine which unites the two halves or sides of the ball cages. These are of special design as developed for Chapman bearings, which allows them to be assembled and adjusted complete with balls in position before putting in the housing. The convenience of being thus able to complete the manufacture of the cage without riveting or other work after assembling is a feature peculiar to this type of bearing and greatly facilitates replacements and repairs when necessary.

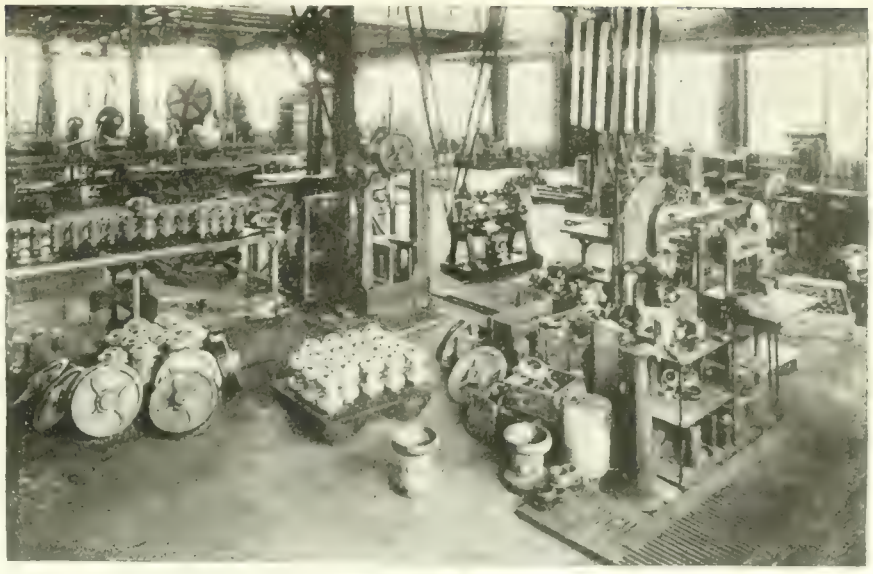


FIG. 5. FINAL TEST DEPARTMENT WHERE BEARINGS ARE ADJUSTED AND RUN UNDER SPECIFIED LOADS, ETC.

Final Testing

Assembling and testing is an important feature of the work, the satisfactory service of these bearings being due to accurate adjustment of parts followed by severe testing under abnormal running conditions. Hydraulic power is utilized in obtaining a uniform degree of pressure on each individual bearing as its components are put together, a Perrin four column press and a Lucas gear-hydraulic power press. The testing of balls and ball races is accomplished by means of three stands on which various sizes of shafts can be quickly arranged so that a definite controllable load can be put on a number of bearings simultaneously by adjusting a hydraulic jack. A specified length of run and amount of load proportioned to the various sizes of bearings enables their reliability under service to be accurately determined before going into use.

A view of this department is given in Fig. 5, showing the Lucas press and testing stands in the centre, with numbers of shafting bearings and ball-bearing car wheels in course of assembly.

In the right bay, immediately beside the tool crib is the stock room and shipping department. Here are stored the detail parts used in final assembly as well as raw material and supplies for manufacture and shop operation. A 50 horse-power motor which operates the line shaft to the grinding room is installed in a suitable location here, as is also the transformer equipment, and main switch board.

The manufacture of elevating transfer trucks, into which ball-bearings enter largely, has been an important branch of the firm's activity for some years. The patented design has certain exclusive features which have aided largely in securing a growing demand for it, a fact of special interest being that the apparatus was invented and developed to its present state entirely in Canada, and as such reacts favorably in regard to the friendly rivalry, in trade exportation which is referred to at the beginning of the article.

FIG. 6. ELEVATING TRUCKS ARE BUILT ON A CONSIDERABLE SCALE AS SHOWN HEREWITH.

MONTREAL EAST'S BIG OIL INDUSTRY

THE expedition which has marked the construction of the new industrial centre recently established in Montreal East by the Imperial Oil Company has attracted more than passing attention from those who have been watching the growth of the city as a manufacturing centre. The plant is so extensive and has become so important a factor, not only in the business life of the community, but in the war requirements of the nation, that its completion in a remarkably short time is the subject of many congratulations. The Montreal refinery completes a system of great distributing and refining plants, extending across the country, all controlled by the Imperial Oil Co. It is one of the largest and most important of the five refineries located respectively at Montreal, Vancouver, Regina, Sarnia and Halifax. It represents an investment of over $3,000,000, and in equipment is as modern as any refinery plant on the continent, with, in addition, unique deep water shipping facilities.

Refinery Site

The site of the refinery occupies some 90 acres in Montreal East, and is bounded on the south by the St. Lawrence River, and traversed by Notre Dame Street East, the tramway to Bout de l'Ile, and the Canadian Northern Railway System. Construction of the refinery and asphalt plants began a little over a year ago, and eleven hundred men have been engaged in building operations ever since. Of the block of land occupied, one-quarter is on the south side of Notre Dame, while three-quarters is on the north side of that thoroughfare.

When the Montreal Harbor Commissioners realized the importance of the enterprise which the Imperial Oil Co. had in hand, they began the construction of a wharf 900 feet long and 300 feet wide, with 28 feet depth of water. While the wharf is scarcely completed, tank steamers, carrying upwards of 50,000 barrels of crude oil from Tampico, Mexico, from which port the company's supply of crude oil is obtained, are making regular trips to the Montreal refinery. The round trip occupies thirty days, and the system of oil tanks extending for and aft of the SS. "Luz Blanca," the SS. "Imperoyal," and other tankers engaged in the trade, are of great interest. The pumping and pipe line system is so efficient that an entire cargo can be transferred from the ship's tanks to the reservoirs in thirty hours or less.

Refinery Capacity

It is understood that the annual amount of business of this Montreal refinery will reach a million barrels, and the storage capacity of the company will be large enough to carry over crude oil to last from the close of navigation to the following spring. It is evident that little has been spared to make this plant one of the finest on the continent, and when the last details of construction are completed, a sum well on to three million dollars will have been expended in the town of Montreal East by the company. Of the eleven hundred men employed since the breaking of the ground a year ago in May last, half of the number have been skilled and half unskilled labor, and A. W. Forman, superintendent of the works, states that when the manufacturing and refining process is well under way the permanent force employed will most likely reach from five to six hundred men.

The housing of all these men is a problem which had to be solved, and the company is encouraging the construction of not less than one hundred houses in the vicinity, which will rent at about twenty dollars per month.

The Asphalt Unit

The asphalt unit of the refinery plant is located between Notre Dame street and the river, and is one of the most interesting features of the undertaking. The several tanks and buildings for the manufacture of this modern commodity are constructed of brick and steel. The plant is practically finished, and the company now in the asphalt market.

The refinery and its subsidiary plants are located on the north side of Notre Dame street, the whole being connected with the different transportation systems by the Harbor Commissioners and Canadian Northern tracks, as well as the Montreal Tramway Co. So the company considers its transportation difficulties have been practically mastered. In a few weeks' time, the whole series of pipe lines, tanks, and all other appliances required for the operations of the refinery will be completed.

THE ELECTRIC TRUCK

IT IS stated that the total value of electric trucks in the United States is approximately $36,000,000. If the same ratio in proportion to the population were obtained, Canada should possess electric trucks to the value of about $3,000,000. Information at hand shows that the total investment in electric trucks in the Dominion of Canada very likely does not exceed $300,000. From the above we can conclude that the field in Canada for the sale of electric trucks is very fertile and offers great possibilities either to the manufacturer or central station that is willing to put forth the proper amount of effort, said the report of the Canadian Electrical Association.

The principal reasons for the rapid success of the electric truck are the low up-keep and reliability. Supplementary reasons are the improvements in charging apparatus, the development of charging stations equipped with proper facilities, together with the increased capacity of storage batteries. In this connection it is interesting to note that the storage battery, as manufactured at present, possesses an average life of double that of a few years ago. The modern electric truck in city and suburban service is capable of going from 40 to 50 miles on one battery charge, a total travel per day that well satisfies the requirements of most commercial transportation. By using a spare battery this mileage may be easily doubled.

Large manufacturers and others requiring extensive trucking or large departmental stores have proved the immense value of the electric truck. Departmental stores in larger cities have come to depend nearly exclusively upon their electric delivery system, utilizing electric cars from 1,000 to 2,000 lbs. capacity, for their house to house delivery.

OUR UNDEVELOPED WATER POWERS

WHEN the present survey of Canada's natural resources are completed under the auspices of the Canadian Pacific Railway, it will doubtless contain a great deal of new information relative to the undeveloped waterpower of Manitoba, Saskatchewan and Alberta. Investigations already made by a sub-department of the Ministry of the Interior, it is claimed, establish the fact that in the Saskatchewan River, with its tributaries furnishing the water arteries of a vast expanse of country, and in the Winnipeg River and other streams emptying into Lake Winnipeg, there is hydro-electric energy sufficient to harness 1,172,000 horse-power.

In the upper reaches of these provinces, the Athabasca, Peace and Churchill Rivers, with a number of other large streams, in their long course to the Arctic Ocean and Hudson Bay, afford new sources of energy equivalent to at least 5,500,000 horse-power. Out of this aggregate of over 1,000,000 horse-power, only a little over 100,000 has been employed. Manufacturers, it is expected, after the war, will take on new life at Calgary, within 100 miles of the Selkirk range of mountains. The Bow River, from which 31,000 horse-power has been drawn, has at least 75,000 undeveloped reserve power available for the industries of that city.

S.S. "WAR WASP" LAUNCHED

THE S.S "War Wasp," the first steel ocean-going steamer built in Nova Scotia was successfully launched at New Glasgow, N.S., 10 days ago by the Nova Scotia Steel and Coal Co. Work on this vessel was started in October of last year, and when launched, was practically ready for sea. The boat has a carrying capacity of about 2,000 tons, a displacement when loaded of 2,870 tons, and a speed of 11 knots. The "War Wasp" has been sold to the British Government and will be taken across by the British representative in a few days. A second vessel, about 25 per cent. larger, is now under construction, and a third vessel will immediately occupy the berth vacated by the "War Wasp." Townspeople of New Glasgow presented Col. Thomas Cantley with an address and silver plate, while the Town Councils of New Glasgow and Trenton also presented the former Scotia president with addresses, adding the hope that the East River of Pictou would become the Clyde of Canada.

Women are now employed in the chemical laboratory of the Algoma Steel Corporation. Two-thirds of the force of routine chemists are girls, who have shown aptitude, accuracy and notable orderliness after a short period of training.

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

INSIDE PROFILING ON SHELLS

AN OBJECTIONAL feature in connection with the inside profiling of the various sizes of shells, is that of the shells running out of true when thi operation is being performed. To many this detail seems to be one of minor importance and therefore sufficient attention is not given to prevent the possibilities of eccentricity at this particular juncture. Another cause of rejections for faulty machining at this point is that arising from making the diameter too great by allowing the tools to undercut. A tool that has materially assisted in the elimination of these errors is shown in the accompanying

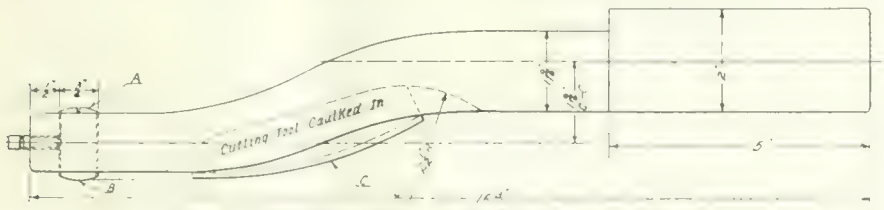


FIG. 1 INSIDE SHELL PROFILING ATTACHMENT.

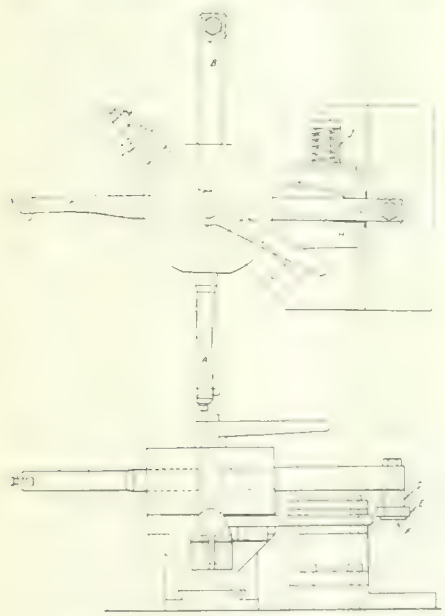


FIG. 2 INSIDE SHELL PROFILING ATTACHMENT

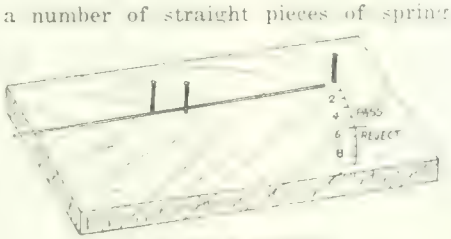
sketch; the design of this bar is such that not only is the danger of undercutting prevented, but extra weight has been given to the bar to provide increased cutting power not available in the lighter bar generally used. After the bar is bent to the desired shape, the slot for the cutter is milled-in, and the cutter inserted and afterwards caulked-in to prevent it from maving in either direction. The bar is made long enough to permit of a screw A being placed through the end; this screw is adjustable so that the point B rides on the parallel bore of the shell while the cutter is working, thus following the slight irregularities in eccentricity resulting from the hurried setting of the shell in the chuck. As the cutter is ground from time to time, the adjusting screw A can be set back to conform to the changed conditions.

Another interesting profiling arrangement is here illustrated, the inner profile being generated by means of a cam motion, that is transferred to the cutting tool by the use of bars held in the turret. After the shell has been placed in the chuck, the roughing of the inside contour is accomplished by the tool held in the bar A, its motion being guided by the roller in the bar B on the opposite side of the turret. The finishing is performed by the tool in the bar 6, the motion being controlled by the passage of the roller opposite, through the cam H; this cam being bolted to a fixed support secured to the bed of the lathe, back of the saddle. Opposite to the generating cam H is the pressure plate I, which is forced forward by the spring J. The object of this plate is to always retain the rollers against the generating cam H. The undercutting for the fuse thread is accomplished by the small tool in the short bar K, this bar being provided with an adjustable gauge for the desired position and depth of cut. When the shells are being placed in the chuck, the carriage is moved to the extreme forward position, with the short bar I in line with the lathe spindle, the shell position in the chuck being determined by the gauge stop L.

A WIRE TESTER

By D. A. Hampson.

A CERTAIN manufactured article uses a number of straight pieces of spring



A WIRE TESTER.

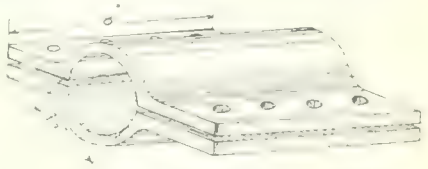
wire ⅛ in. in diameter. This wire is bought from various makers, test pieces are selected at random from each lot received, and samples are submitted in competitive solicitation of orders. Some means of comparing and testing has to be employed and, outside of a fatigue test, which consists of bending the wire back and forth in a machine several hours at a time, the most satisfactory test as well as the simplest to arrange is the test board shown in the drawing.

A polished maple board has two nails driven in it and the straightened wire is laid between them. With the wire extending 6 in. from the last nail, a zero point is made with a third nail. An arc is drawn, graduated, and the face shellaced. Now, any wire which can be pulled to the No. 5 in. mark and return to zero without acquiring a permanent bend, or "set," will go. If they bend before they reach the 5, the wire or the lot is rejected. Those that remain straight when pulled farthest beyond No. 5 are rated the highest and this grade selected.

REPAIRING BROKEN STREET CAR AXLES

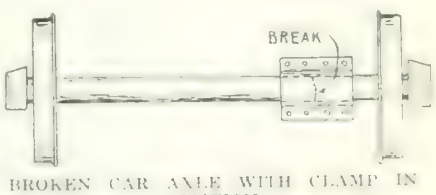
By H. Middleton.

BROKEN axles on street cars are not frequent, but when they do occur they produce a lot of trouble, expense and de-



CLAMP FOR BROKEN CAR AXLE.

lay, particularly if the accident happens where traffic is dense. The way in which one company combats the delay is to use the clamp shown, which is wide enough to reach on each side of the break, and stiffen the axle sufficiently to keep it together while the car is being towed to



BROKEN CAR AXLE WITH CLAMP IN POSITION.

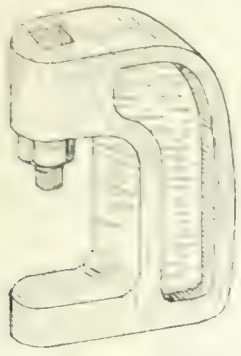
the barns. Half a dozen clamps for each size of axle are made up and a complete set left at as many stations throughout the city. This avoids the delay of sending to distant shops for repairs and materially cuts down the time of blocking the line of cars and vehicular traffic.

IMPROVED C-CLAMP

By H. A. D.

AN inventor has just been granted claims on an improved C-clamp. All who have used the ordinary kind, even the highest priced, have had trouble with

their slipping off sloping or rounded surfaces; this has caused the C-clamp to get a name for unreliability in machine shops and their use in some cases to be forbidden by safety inspectors. The trouble lies in the screw end which (in spite of various swivels) turns as the



C. CLAMP WITH NON-REVOLVING.

screw is turned and just naturally slides away from the work.

This new clamp has a screw which does not turn. The screw is moved longitudinally by turning the nut. The screw head is square and travels in a squared opening—this prevents turning. The screw used is an ordinary set screw and its point end engages the work. It takes hold—bites in—rounded and slanting surfaces with no chance of slipping because it is fed in without turning. It has an easy renewability—ordinary nuts and set screws are found in every shop. This construction puts the wear not on the clamp itself, but on loose pieces—renewable parts.

PLANING A LARGE COMPRESSOR BED

By D. S. Mann

IN machining the large compressor bed shown in the accompanying cuts several interesting problems were encountered, the shop not being equipped to handle such large work. One of these was the planing, there being considerable of this work on the casting, it having been designed especially to be handled on an open-side machine. The main bearings were to be planed out as well as faced off at the ends; the top also required machining for the oil cover. There were also three openings on the one side and two on the other. The bottom was left rough. The casting weighed practically 7,000 pounds and was over eight feet long.

The only planer with which the shop was equipped was a 30 in. x 30 in. unit, and considerable scheming was indulged in before it was finally decided to do the job at home. The photos show quite clearly how it was handled. A heavy ribbed casting was made to bolt to the planer table, being provided with tongues to fit the table slots so that the strain would be relieved from the clamping bolts. This casting extended about 39 ins. over the edge of the table and was machined to the same dimensions as the regular crossrail so that the saddle could be removed from the planer proper and used on the table. The regular feed screw was also used, the planed portion of the casting being the same length as the crossrail. This necessitated the making and machining of but the one casting. All feeling of the tools had to be done by hand, of course. To prevent the table rising from the reaction of the cut, it was loaded with a number of counterweights.

The bed was placed alongside the planer on the floor and levelled up; due to its weight, no clamping was necessary except when planing out the main bearings when it was placed at right angles to the machine. Several settings were, of course, required and it was necessary to line the bed up for each one. As the bed had previously been bored, this was not a difficult task. The outfit gave good satisfaction, and the bed was finished in record time. Of course, it was impossible to take the heaviest cuts at the outer end of the fixture, but this caused little delay. Needless to say, considerable time was saved over what would have been necessary had the casting been finished on the outside.

BRITISH MUNITIONS OUTPUT

DR. CHRISTOPHER ADDISON, Minister of Munitions, speaking in the House of Commons, London, England, recently, on the estimates for his department, gave a striking account of the work of the department since it started a little more than two years ago.

Dr. Addison said that some conception of the magnitude of the production of explosives might be formed from the fact that in March of 1917 the capacity for the production of high explosives was more than four times that of March of 1916, and 28 times that of March of 1915.

The Ministry had recently reached such a state of production with respect to gun munitions that it was able to divert certain national factories to assisting other sections of the munitions programme.

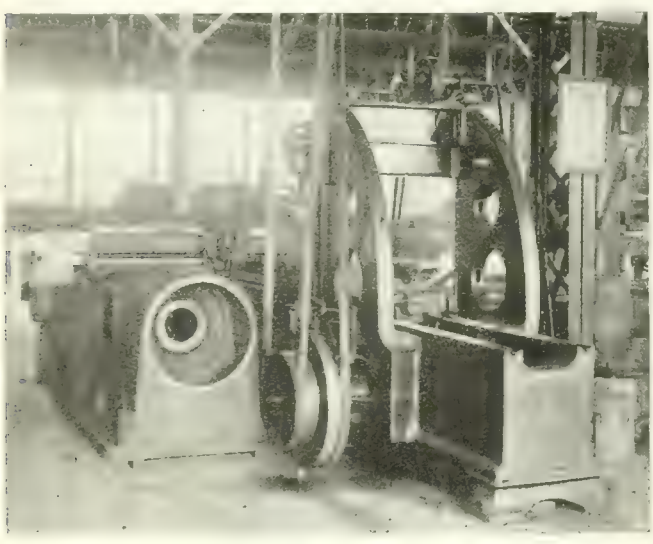
He mentioned the discovery of a component of a new type which possessed great advantages for certain purposes. A large supply of this had been produced in a short time, and was proving of the greatest value in facilitating the advance at the front and in saving life.

Enormous Stock of Shells

The requirements regarding the accumulation of a great reserve of field gun ammunition would be met in good time, and, despite the enormous expenditure in the first nine weeks of the offensive, the stock of shells had only fallen off seven per cent. Field Marshal Haig had enthusiastically reported on the accuracy and fine detonating quality of the ammunition, whether it was used for wire cutting, barrage, or other purposes.

The ouput of machine guns and rifles was full equal to the demands, while for railway purposes tracks pulled up in England, Australia and Canada, had been utilized. Canada had arranged to pull up 800 miles of track and ship it complete when wanted. More than 2,000 miles of track had already been supplied in complete condition, and nearly 1,000 locomotives, apart from hundreds supplied by the railways.

The supplies of new design tanks were coming forward excellently, and, continued the Minister, "the end of the story is not yet, for the enthusiasm of Colonel



PLANING A LARGE COMPRESSOR BED.

PLANING A LARGE COMPRESSOR BED.

Stern, the inventor of the tanks, and his colleagues knows no limits.

Steel Output Increasing

With respect to steel, the Minister said that the output of steel before the war had for some time been stationary at a little over seven million tons yearly. The output was ten million tons, and he would be disappointed if the country did not reach a twelve million ton output by the end of next year. Within fourteen months the capacity for the manufacture of basic steel had increased by thirty per cent.

The demands for steel were so many that the control had been very close, and despite all the help from Canada and the United States, he would not offer any immediate prospect of relief. Notwithstanding the cost of material and labor, the Government was obtaining steel plates at home, at less than half their cost in the United States, while shell steel cost 30 per cent. less.

Referring to salvage operations at the front, the Minister said it was now possible to reform hundreds of thousands of 18-pounder cartridge cases weekly at a cost of fourpence each, compared with seven shillings for new cases. Regarding trench warfare, he said:

"While we started behind in the race, we are prnbably now as superior to the Germans in this section of warfare as we are in that of artillery."

Enormous Demands

More than 1,500,000 steel helmets had been supplied in the last six months, and whereas in December the tonnage required for trench warfare material was 7,648 tons, in the last six months it was 17,963 tons. The work of the Ministry had almost doubled within the last twelve months. The aircraft supply alone at the beginning of the year required an additional 10,000 workers, and that which applied to the aircraft applied also to shipbuilding, gunmaking, tanks, agricultural implements and other necessities of war.

The widespread employment of woment had been attended, singularly, with little difficulty. From 60 to 80 per cent. of the machine work on shells, fuse and trench warfare supplies was done by women.

Comparing the cost of ammunition during the past year with what the same would have cost the previous year, said Dr. Addison, the saving was £43,000,000.

Dr. Addison said that before the war the production of spelter in Britain was only one-third of the natural requirements, but that he hoped the capacity would be doubled before the end of the year. Part of the plan involved the working of Australian zinc concentrate, which formerly was under German control. Some time ago steps were taken to obtain control of the wolfram ores of the Empire, with a view to regulating the stock of tungsten for production of steel, and if the prices at Sheffield were compared with those in New York it would be found that the country had profited enormously by the enterprise.

Sub Losses Are Small

Arrangements were in hand, the Minister continued, which increased the home production of aluminum by 45 per cent., while a committee of experts was considering development of copper and other mineral resources of the United Kingdom.

At the suggestion of the United States Government, negotiations are now in progress for further consolidation of interests in America and England. The results of these negotiations, if successful, would be of enormous value, not only in enabling the American Government to place its great resources more readily and effectively at the disposal of the Allies, but in promoting economy in purchase. Dr. Addison said these arrangements had been facilitated greatly by the work of the Balfour mission in the United States.

The Munitions Ministry, Dr. Addison continued, had an interest in nearly 1,500,000 tons of shipments monthly. The submarine campaign, bad as it was, did not provide much comfort for the enemy when he knew, for example, that of the shell components shipped from North America, the total since the commencement of unrestricted submarine warfare, had been only 5.9 per cent. of the amount shipped.

LEATHER BELTING NOTES

IN the choice of a belt, the first consideration is that it be made from a good hide. Some indicative opinion may be had by cutting a thin shaving from the samples offered, and tearing them between the fingers. This will enable even the unskilled to form an opinion as to how much of his purchase is leather, and how much simply weight-making material.

Leather belts lose a good deal of their strength and nature unless impermeated with a certain amount of oil. Good quality cod oil is largely used for this purpose. An ordinary belt thus lubricated, develops a stretching propensity, which is, of course, both troublesome and wasteful. The problem, therefore, is to secure the admittedly advantageous features of "lubrication without stretch." The solution is obvious—Stretch the belt fully before application.

The ultimate tensile strength of belting is not generally a factor in power transmission calculations. It may be reckoned at an average of, say, 3,500 pounds per square inch. Variation in ultimate strength is due not only to possible variation in the quality of the material, but to want of its homogeneity as well. The ultimate strength of a laced joint well put together should be taken at from 1,000 to 1,500 pounds per sq. inch, while that of a riveted joint may be taken as equal to one-half of the strength of the solid belt.

Adhesion of Belts

The motion transmitted by a belt is maintained solely by the frictional adhesion of the belt to the pulley rim. Belts do not communicate motion with precision on account of their liability to slip. The adhesive grip of a belt is greater on wooden than on cast iron rims.

A belt will slip just as readily on a pulley four feet in diameter as it will on a pulley two feet in diameter, provided the conditions of the faces of the pulleys, are area of contact, the tension and the number of feet the belt travels per minute, are the same in both cases. Causes of slippage are because belts are overloaded, dirty, clogged, dried up and neglected.

It stands to reason that while slip may be prevented by undue tightening, this is not the right method to make the belt do its full duty. A belt properly filled and of correct dimensions for its work, should break before slipping.

Engineers usually pay little attention to their belting except that which is giving immediate trouble. The ingredients of a leather, cotton, or camel's hair belt, Manila or hemp driving rope, slowly dry out and leave the contact surfaces hard. Unless something is added to replace these natural ingredients the belt or rope cannot be expected to grip the pulley close enough to transmit full load.

Creep of Belt

By creep of Belt is meant its stretching and contracting propensity as it passes over the pulleys, and is due to inherent elasticity and nature of load. The net result is a continuous creep or shifting of the belt around the pulleys in a direction opposite to that in which the belt runs. Belt creep in practice is usually kept within a one per cent. limit, and to make certain of its attainment, the working strain for best material belt body and substantial joint is taken at 40 pounds per inch width single belt, 70 and 100 ditto for double and treble belts respectively.

When a belt runs at a high velocity, centrifugal force produces tension in addition to that existing when the belt is at rest or moving at a low velocity. This diminishes the effective driving force. Double belts are less pliable than single belts and the centrifugal force is greater. Furthermore, the tension is seldom increased proportionately; for these reasons, double belts should not be expected to transmit more than 8-5ths the power of single belts.

Could Spare Father.—Little Denis, out for a walk with mother, noticed a poor, ragged little urchin.

"Yes, dear," said mother. "That poor little boy has no father to give him toys and things, like you have. Wouldn't you like to do something for him? Wouldn't you like to give him your rabbit?"

Denis thought a moment, and then suggested:

"I'd rather give him father!"

A Hedger.—A Cockney teacher was giving a lesson to a class of children and questioning them about the various joints of mutton. The neck, shoulder, leg, and loin had been mentioned. "Now," said the teacher, "there is another joint no one has mentioned. Come, Mary, I know your father is a groom. What does he often put on a horse?"

"A shilling each way, miss," was the unexpected answer.

Problems Entering Into Aeroplane Engine Design--II*

By Charles E. Lucke

The aeronautical engine is emerging from the stage of invention to the stage of design, and this paper suggests steps to be taken towards the satisfactory solution of the problem. It resolves the engine into a light, high-tensioned steel structure, consisting of seamless tubing and forged or welded steel parts, possibly formed in drop forge dies. To this steel stress structure are added certain members, such as the piston, exhaust valve and guide, designed primarily for heat-flow conditions and not for stresses; and certain closing members, such as the parts for the intake and exhaust, which can be very properly cast in aluminum; and the oil crank case closure, which can be made of any material desired and readily available.

CYLINDER METAL—CAST IRON

THE first cylinders built were made of cast iron, with head cylinder and jacket cast in one piece, and the valves being arranged in a side pocket—the ordinary T or L-head construction. It is clear that the weight of the valve pocket is detrimental. The first step in any cylinder-weight reduction, then, is to take that pocket away, retaining the cast cylinder (on the assumption that we do not know how to make any other kind) and putting the valve in the head. This results in the valve-in-head construction, which is now practically universal, but which, strange to say, it took six or seven years to realize.

A similar instance of slow realization of facts exists with reference to the cast-iron jacket wall, which has no other function than to hold water. Cast iron for that purpose, especially in an aeroplane engine is wasteful of material, so the next step is to get rid of the cast iron. When one stops to think how it is to be done, a structural difficulty becomes apparent, and therefore one must not too readily condemn the holding on to the cast iron jacket. The difficulty is of course the necessity of providing openings for the intake and outlet from each valve, an igniter plug hole and at least two pipe connections for the jacket, and in an aeronautical engine under heavy stress there is some driving gear which requires fastenings. This naturally tends toward the use of a casting.

Suppose such a casting is used, with inlet and one exhaust valve each with a port leading out, and such valve seating in the head which turns down to form the cylinder; then the casting may be led around the top, forming the enclosure of the head jacket and joining the several outlets and coming down outside the cylinder. The cylinder-head jacket casting ends in the form of a skirt at about the level of the valve deck, and to this end a tube jacket can be added by any one of several possible fastenings. That is the next step: cast iron for the cylinders, head and head jacket in a one-piece casting, but with sheet metal for the jacket over the cylindrical barrel. It is a logical step, but it took several years to reach it just the same.

Proceeding along the same line of weight reduction, the next step is to cut away this cast iron joining the ends of the ports and forming the wall of the head jacket, and substitute sheet metal welded to the ports by the oxygen welding system. Wherever there are connections to be made for attachment of gears there must be some additional supports welded or brazed on. The cast-iron cylinder is still there, and with cast-iron ports.

Cylinder Metal—Steel

There is a fundamental objection to a cast-iron cylinder for aeronautical work, and it is a perfectly valid one. Cast-iron cylinders do not have to be very thick to be amply strong, so far as the gas-pressure stresses are concerned, but the fact remains that so long as they are cast-iron, no one knows whether they are good cast iron inside or not, and the use of cast iron cut down to ⅛ inch in thickness incurs taking some chances. Hence attention is turned toward steel.

Drawn steel or forged steel is a reliable material and a logical selection, so designers have sought means of using it; but when one stops to think how to use a drawn-steel tube for a cylinder, and get the necessary attachments on it, one soon recognizes that the matter is not so easy as it looks. That is the reason the adoption of the steel cylinder was so long delayed.

There are now several schemes developed for steel cylinders. The first of these is a steel cylinder of a drawn tube formed without a head, screwed into a separate head carrying the ports and the head jacket cast in one piece. This is rather a satisfactory way of attaching a head, but it involves more than one difficulty. When such a screwed head is set up against the shoulder, it is not at all clear just where it is going to stop; and to secure the proper position one must either scrape the faces or shim them—neither of which is a nice job. A further objection is the considerable weight of the cast iron in a rather complicated casting, and also the inner wall of that cast iron is a stress wall, the stress of which must pass through the thread to the cylinder. There is no objection to using a casting if it is not stressed, but a casting under stress is not satisfactory and is to be retained only in the absence of something better.

Complete elimination of castings has been tried by using all-steel and sheet metal welded together, but this did not prove satisfactory for a very interesting reason. A flat sheet-metal head on which the valves are seated will not remain flat, and a round valve seat will not stay round. Such sheet metal tends to warp out of shape, and with it the valves will not stay tight. However, the material does not break, which is something worthy of thought.

To eliminate the weld between the steel cylinder and head, another construction was developed. In this, a seamless drawn-steel shell with head just like a cartridge is used, and two holes are arranged in the head to seat the valves. It is evident that this is a structure which is sound against all kinds of stresses. It still has some of the difficulties of warping the seats, causing leakage of the valves; and when a valve leaks the amount of heat developed is tremendous. Once a valve starts to leak, it is only a question of a short time before it will be completely destroyed.

Aluminum Combination Cylinders

The particular construction of cylinder just described is rather difficult to attach to its jacket ports. It is interesting to note one case at least in which a satisfactory attachment has been worked out, and that is the Hispano-Swissa engine, now used on the European war front, and now also being built in this country. In this particular engine the entire outside of the cylinder is threaded, and the cylinders are screwed into an aluminum casting which is double-walled just like the cast-iron block casting of an automobile engine. The thread performs the double purpose of holding the cylinder in place and bringing its head up against the aluminum cast head which carries the ports, and also acting as a thermal bridge between the metal of the cylinder and the metal of the aluminum casting which carries the jacket water. Without the latter there would be poor thermal contact and overheating of the cylinder. While this construction is not entirely satisfactory, it is nevertheless very interesting and suggestive. It immediately calls attention to the fact that a water jacket may be made of an aluminum casting and the ports formed just as easily as in iron, the steel interior carrying the stress due to the interior gas pressures.

It is, however, quite feasible to get rid of the double aluminum wall down along the cylinder barrel into which this steel cylinder is placed and which carries the ports above, by leaving out its interior wall and retaining the outside, or even by stopping the wall just below the head as a skirt to take a short thin tube which may itself be of aluminum, ending at the bottom in a cast stuffing-box ring to act as a joint against the steel cylinder. That, so far as I know, represents the last word in this direction, the steel cy-

*Abstract of A.S.M.E. Spring Meeting Paper.

linder head being bolted up to the aluminum head-port casting at the valve-seat bases, and not just pressed up against it by a remote thread.

One-piece Steel Forged Cylinder

Finally, there is to be noted the one-piece steel-forging construction for cylinder, cylinder-head, ports and ignition holes, surrounded by a sheet-metal welded jacket, a very satisfactory though expensive construction.

These heads are themselves a subject of considerable study. We have first a plain head in which the valve inside diameter is half the cylinder less the width of seat, and half the bridge between the valves. Both valves have stems pointing upward and parallel. The plain cylinder, then, which can be made of a plain, seamless-drawn steel cartridge, and which is so desirable structurally, limits valve diameter, and this is a factor against it. Valve diameter is a strong influence in volumetric efficiency and weight of charge, controlling, as it does, flow-resistance conditions. Naturally, designers must get the volumetric efficiency as high as possible by keeping flow resistance as low as possible. Therefore, the tendency is to go towards larger valves than is possible with the previous arrangement.

Block Arrangement vs. Separate Units

One variation in form for this purpose is the flat bulged head where the valve diameter is larger than before by the amount of the bulge. The flat bulged head is a very desirable thing for larger volumetric efficiency and higher mean effective pressure, but offers some difficulty in manufacture when one is making a one-piece seamless-drawn steel job, but not a serious difficulty.

Another suggestion for getting the same result is to bulge this head upward in the form of two flats and put the valves on the two inclines. It is perfectly clear that a very large increase in diameter can be secured in this way. The valve stems in this case are not parallel but diverge at any angle and the limit is reached when the angle is 180 degrees, in which case they are horizontal.

Block Arrangement vs. Separate Units

The question of block arrangement of cylinders and their jacket vs. separate units deserves some attention. In some cases each cylinder with its jacket and head is entirely separate. In other cases the jackets are cast or welded in a block form, around more than one cylinder — sometimes two and sometimes four, and in some cases six. It is clear that the more cylinders included in the jacket block the less will be the weight of the jacket, because the length of the tangent to two jacket circles is less than a half circumference. But there are objections to the block, and in some cases it may not pay to use it.

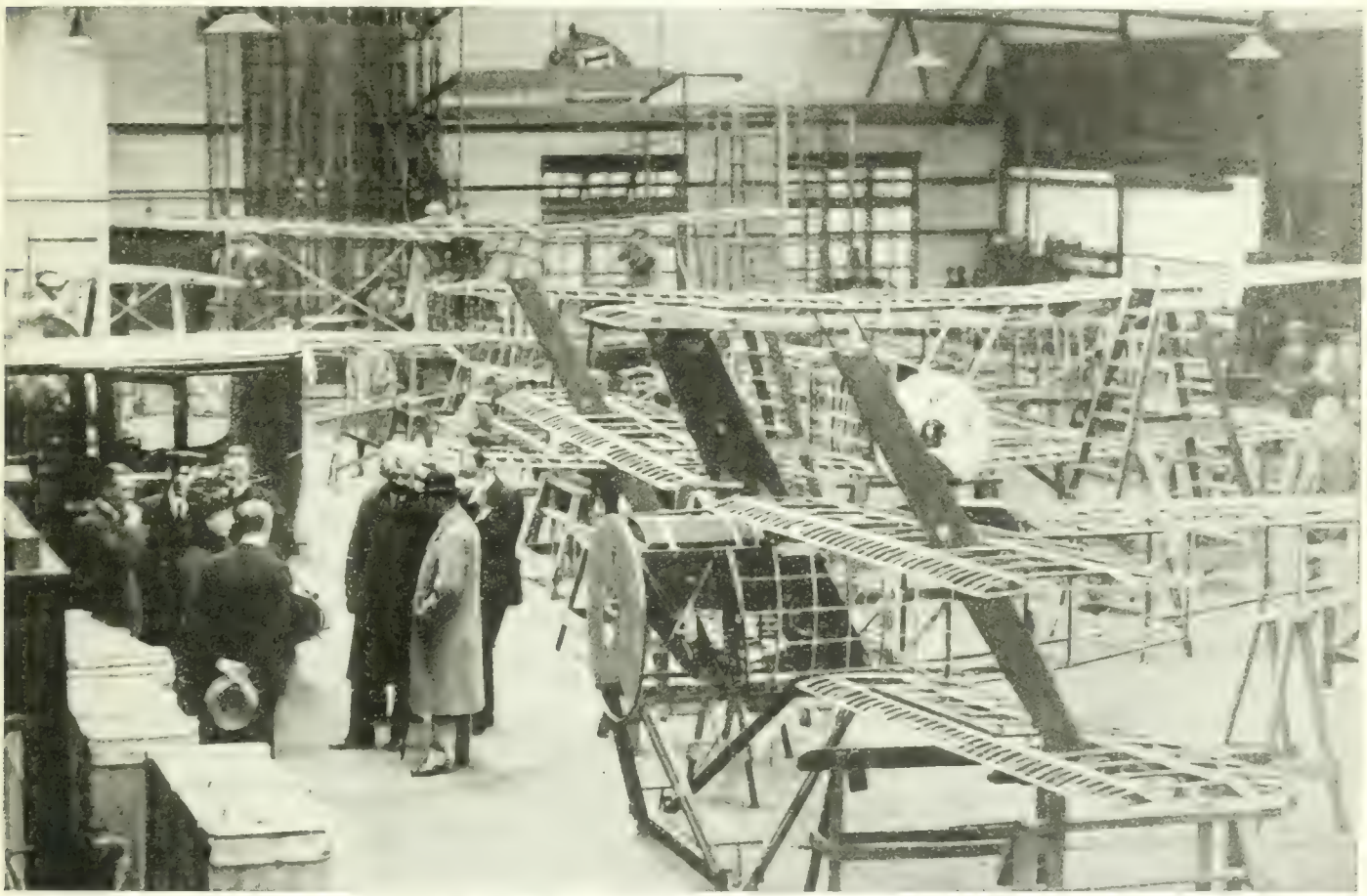
In a case in point, a cast-aluminum block jacket was set down over four steel cylinders which were bolted to the frame by their usual flanges and studs. These cylinders gave trouble on the outer flanges, the end studs breaking off or pulling out. The trouble was caused by the crank case running hot, expanding, and the aluminum block cylinder casting running cool, because it was water-jacketed, not expanding. The cylinders being bent inward tore the stud ends right out.

Another point: the steel cylinder is naturally flexible, and it belongs—in fact, the entire motor belongs—to that class of structures which should properly be termed flexible, exactly similar to bridge structures.

These flexible motors weave just as the engine of a steamship weaves. To attempt to hold one against springing is to attempt what is practically impossible. The cylinders of aeroplane engines should all be perfectly free to go as they will, and not be held on the top in any way. All the block arrangements of cylinders of the sort just described are therefore, objectionable. Steel cylinders have a natural spring and give to them, and if let alone they will serve well; but attempting to secure them may result in serious distortions, or in highly localized excess stresses.

Typical Valve Gears

It was my intention to elaborate on the different arrangements of valves and valve gears, but that would take up too much space, so I will first just draw attention to some typical gears. One of these has a rocker arm overhead, worked



OUR KING AND QUEEN, ACCOMPANIED BY THE MAHARAJAH OF BIKANER, IN THE ASSEMBLY DEPARTMENT OF ONE OF BRITAIN'S NUMEROUS AEROPLANE FACTORIES.

by a push rod from a camshaft in the crank case. In some cases this one push rod works two valves. When the valve stems are in line with the rocker fulcrum placed in the middle, each may be worked alternately. This push-and-pull may be secured by a single cam having a plus and a minus face, or by two opposed plus face cams having a plus face with a fork—the second form being far preferable. That particular form of driving the overhead valve by a rocker from a crankcase camshaft is now regarded as old-fashioned, but here is one case where there is something in favor of the old-fashioned. The new fashion is the overhead camshaft, where one camshaft, running along over a whole line of valve stems, will work them directly, or, being offset a little bit, may work through rockers, all stems being equidistant from the camshaft. When the two valves for one cylinder are on a line at right angles to the shaft, the camshaft may be placed between them, working with double rockers.

The objection to the overhead camshaft is two-fold. In the first place, a camshaft mounted on separate cylinder heads exerts a restrainst against their free movement. The variance of that camshaft will necessarily cause a stress, and the camshaft will be bent, and it is only a question of time when something will fail—either by wear or breakage. Again, the cam is very close to the valve stem, and the adjustment of timing is very delicate. It is difficult to adjust a valve directly driven by a cam so that it will be accurately timed, and stay timed, when a difference of 0.01 in. means several degrees.

The location of the camshaft down in the crankcase, with rods coming up to the rocker arms or levers, allows each cylinder to be entirely free, and does not interfere with its turning in any direction whatever. Also it permits the use of longer levers and a far more accurate adjustment of the timing clearances between the cam and the stem on the long reach rod; but such a reach rod should be either a tension rod or should not be used at all. A push rod in a place like that seems to be fundamentally wrong. Here is a case of a long column of thickness of about half one's little finger, which is, in many cases, opening a valve —an exhaust valve—against an internal pressure of 40 lb. per sq. in., and a diameter of 2 in. or more, and, in addition, overcoming all the inertia of the gear and valve at perhaps 2,500 r.p.m. That is not a proper function for a long column, but is a perfectly proper function for a tension rod, or steel wire, and why no one has put a steel wire between the valve stem and camshaft, which will allow the whole structure to go the way it wants to, instead of abandoning the crank case camshaft, is more than I can see. Of course, the block construction is more favorable to the overhead camshaft, but it has not all the advantages.

Valve Types

Coming now to the question of valves, everyone knows that it is of no consequence to lift a poppet valve more than one-quarter of its diameter. It is also true that the valve will work better, and the volumetric efficiency and mean effective pressure be better, the larger the diameter of the valve and the smaller the lift. That is, the valve should not approach the quarter-diameter lift. That condition conforms to good principles of gaseous flow.

It is also a fact that the timing of the valves on the high speeds in aeroplane engines, when one is desirous of getting the largest possible mean effective pressure, is a matter of basic importance. In no case should an inlet valve close sooner than 20 degrees late, and the amount more than 20 degrees late must still be determined experimentally for each machine, because the porting and manifold is different on each machine and no general formula has yet been found. Likewise the exhaust opening must be 45 degrees plus something ahead; the exhaust closing 5 degrees late plus something, etc. The inlet opening is the only period that does not seem to matter.

Suppose one had a valve lift of 0.4 in.—which would be reasonable for one of these motors—the valve is supposed to lift 0.4 in. and close again in the open period of the valve, which we may assume is 200 degrees in round numbers. If one examines that 0.4 in. lift and 200 degres of crank angle, one finds that a variation of 0.01 in. in the lift corresponds to 5 degrees of crank-angle timing effect. It is clear, therefore, that with valve lifts of the order we are dealing with, in facing the problem of accurate timing we are running into a question of very great accuracy of dimensions, where a difference of 0.01 in. in any part between the cam and the valve stem means a difference of 5 degrees in time, and that means a loss of 5 per cent. in power.

A valve is normally made of a quite thin disk with a small diameter stem joined by a fillet. It sits in a seat supposedly water-cooled. It is a stress member, and is normally designed for stress. Designers talk about Grashof's formulæ for flat plates as the basis for its design, but that has nothing to do with the case.

These valves, designed according to this formula, will burn out. If they are designed according to the flat-plate formula they are quite thin, and their stems also—when calculated for compression loads. Consider heat being added to the outside face of that whole disk, and at a rate that is not equalled in any other structure that we have anything to do with. In the case of the exhaust valve there is some heat added on the other side, too, and when the valve opens there is a tremendous increase on the back, as is also true when the valve leaks. But excluding that extra heat, and considering only the heat added on the flat of the disk, the valve can attain a steady state of temperature only when the heat is being disposed of at a rate equal to that at which it is received. Where is the heat going to go? How is it going to get out? It is perfectly evident that the problem of keeping the valve cool is entirely a problem of providing for getting the heat out, because there is no control over what comes in. The heat flow is radially inward, then axially upward to a stem bearing. After the heat gets up the stem, it turns off through the stem bearing to the water.

When it is remembered that the conductivity of a gas film is ever so much less than the conductivity of the metal through which the heat is flowing, and that the same is true of the water which must ultimately receive it, it is perfectly clear that the amount of area in the stem guide must be very large in proportion to the area of this stem circle carrying the heat up to it, and the ratio of one to the other should be based somewhat on the conductivities, with due regard to gas-oil and water-film thicknesses. Also, the heat received on the disk must pass through the cylinder of metal constituting the stem. Therefore, the stem thickness must bear a logical relation to the disk face, and the thickness of the face should regularly increase toward the centre. If one followed this out, one could easily develop a rational form for valve based not on stresses, but on heat flow.

The ratio of the conducting area to the heating surface becomes the prime variable, and it is perfectly evident that that ratio ought to be the same all through one piece of metal itself, and ought to be increased when the heat must cross a bridge, as at the stem guide where there is a film of oil or dead gas, by an amount representing the ratio of thermal resistances. If one does that, he is carrying through the principle of establishing a regular temperature gradient from the most distant point; and it only requires one or two experiments in that direction to decide what metal to use, and what shape, and how close it ought to fit, in order that any fixed temperature will not be exceeded at the hottest part. So long as it remains below a red heat a valve is all right, but as soon as it attains a red heat it will first oxidize and warp, and then will cause preignition.

This thermal study of a valve has not been undertaken by anyone in the shops. It is one of the things that the scientific men are contributing to this problem, but it is now about to be put to practical use. The same situation exists with respect to the piston, as the following shows:

Piston Types

The ordinary piston, as built for aeronautical motors, has been a failure; and even in the best motors to-day I venture to say that, next to the exhaust valve, the piston is the source of greatest trouble. I put it before the exhaust valve. I think more accidents and trouble can be traced directly to pistons than any other single part of the engine structure, and yet pistons have been entirely neglected from this thermal standpoint. In the first place, the aeronautical man, in starting out to build his aeroplane on the automobile model, had in mind only one thing—to take metal away from every possible place with the idea that the metal was there only for stress purposes and might be taken away as long as the stress did not go above a certain value. What happened? In the first place, the piston was cut off from one

and one-half diameters long to less than one diameter long, which reduced the contact between the piston barrel and the cylinder. Not being satisfied with that, the early designer bored holes in the piston and then cut the head down until it was ⅛ in. in maximum thickness, and frequently only 1-16 in. across the top. So far as stresses were concerned the piston thus reduced was all right, but it ran hot and soon gave trouble.

Consider the piston from the standpoint of heat dissipation, and something surprising follows the logic of the analysis. The piston is receiving heat all over the top at a very high rate. Where is the heat going? It must go out through the barrel walls and the oil film to the cylinder—that is the only place it can go.

It is perfectly clear that the heat received within a circle drawn concentrically on the head must pass radially outward through a cylindrical surface equal to the circumference of the circle multiplied by the head thickness at that point. The heat received within a larger circle drawn on the head, passing also radially outward, must have a larger head thickness at its circumference. If the temperature is not to get unduly high, then the head thickness must regularly increase from centre outward, so that the metal-conducting area bears a constant ratio to the area of the heat-receiving circle to control the temperature gradient from centre to edge. The principle is the same as is used in designing copper electrical conductors to control the voltage drop. It can be shown by a simple equation that the thickness ought to increase on a straight line.

When the heat gets to the edge, it is clear that it must flow down the piston barrel. Therefore, there ought to be as much metal behind the first ring as the thickness of the head at the inside edge of the barrel. Practically no heat can get through the ring, this being a floating member. Then the barrel thickness can be regularly decreased toward the open end, to control the temperature gradient from end to end. It is also clear that the more surface there is around the barrel, and the better the fit, the easier it is to establish a low-temperature gradient between piston barrel and cylinder wall, providing there is sufficient conducting metal in the piston walls, head and barrel. From considerations of that character, backed up by any number of broken and burnt pistons, it is about time we stopped cutting the metal out of the pistons and began putting in considerably more metal. The additional weight is not going to injure the motor at all, but will permanently have the effect of enabling it to run longer periods of time.

Motor Frames

A qualitative analysis of frames is also worth while. The frame of the aeronautical motor has been regarded as a thing that nobody has to be bothered about. It was a crankcase and, of course, we had lots of crankcases. Automobile crankcases had been made in great numbers and variety, and it seemed a simple thing to create an aeronautical-motor crankcase from that of an automobile motor.

Now, it is a fundamental fact that if one is going to reduce the metal weight of a structure such as this, to a minimum, every piece of metal should be required to carry a very heavy stress—as heavy a stress as possible, and do it all the time. The basic principle, then, of weight reduction, after the thermal considerations have been disposed of, and the conditions for high mean effective pressure and thermal efficiency properly met, is to make the metal carry real loads. That is not to be accomplished with the ordinary crankcase construction, because the crankcase is a reasonably heavily stressed member, and is subjected to complicated sets of stresses that cannot be opposed with any economy of metal weight by a common casting of box form—which is all that the ordinary crankcase is.

The old-style crankcase, of upper and lower halves, formed a box with holes on top to take the cylinders. The lower half of the box carried webs, which in turn carried the bearings with top caps. If one started off with the idea of designing a structure as little adapted to the stress conditions as possible, this is about what he would get. Consider the fact that the stress due to the gas pressures is always upward, producing tension in the cylinder and its fastening to the frame that is carried out along the flat top of the box as a beam load and down along the upper side walls as tension; then through the parting joint to the lower side walls, and then through the webs as beams from both sides to the main bearing and shaft, where it finally ends. Coming around like that is an excellent example of indirectness of stress transmission and consequent demand for the maximum of metal.

Consider also that the crankcase is stressed in another way, in that it has in the 4-cylinder motor a pair of cranks acting downward between a pair acting upward, so that there is a rotating radial centrifugal load due to both rotating mases and the inertia of the reciprocating parts. This sort of loading puts on the crankcase the duty of a beam, but in which the direction of loading rotates. It would appear that the box structure is rather better for the beam-load condition than it is for this tension condition.

Slowly these ideas have percolated, and the effects are to be seen. The first direct effect is noticed when this bottom web is eliminated, and the bottom crankcase member ceases to be a stressed member, and becomes merely what it ought to be—a cover. The web is introduced in the top half, and the bearing now has bottom bearing caps held by studs in the top web. Now the gas pressure stress can come straight down through the webs. This, however, is not as satisfactory as it might be, because each web is a plate subjected to the same kind of stresses as a truss is. The next suggestion, therefore, is to build it truss-like; and we find top-web castings taking truss forms, cutting out holes in the unstressed section of the web member. That is an example of appreciation of the nature of the problem. The next step, however, shows rather more intelligence, where there is substituted for the cast web member a high-tension steel long-bolt member running up through a hole in the web. That bolt takes a bearing cap on one end and takes the cylinder flange on the other end. This represents the last word to-day.

It is my belief that the next step should be to eliminate the cast-aluminum webbed box member entirely, and to build the whole thing of direct truss form, using nothing but steel. Furthermore, I do not hesitate to say that it is my belief, founded upon the study of practice and on some analyses, that no member of the aeronautical engine that is subjected to heavy stress should be anything but steel, except when that member is subjected to heat-carrying conditions and must be designed for heat-carrying, rather than stress resistance, in which case it will be found that there is more than enough metal for stress. This leaves only one other class of member, which is the enclosing member, and which can be made of whatever suggests itself.

Now, in the course of this designing, it is necessary to build, test, analyze results and repeat. One can argue, as I have done, at very great length from the standpoint of qualitative analysis; but that sort of analysis, however nicely it leads into certain directions, as shown, does not give the right answer. It requires in addition a quantitative analysis, which can only be obtained experimentally, and which is the final step which we, as engineers, are bound to demand.

CANADIAN BOUNTIES

ACCORDING to the latest report issued by the Department of Trade and Commerce at Ottawa, the following trade bounties were paid out in one year:—

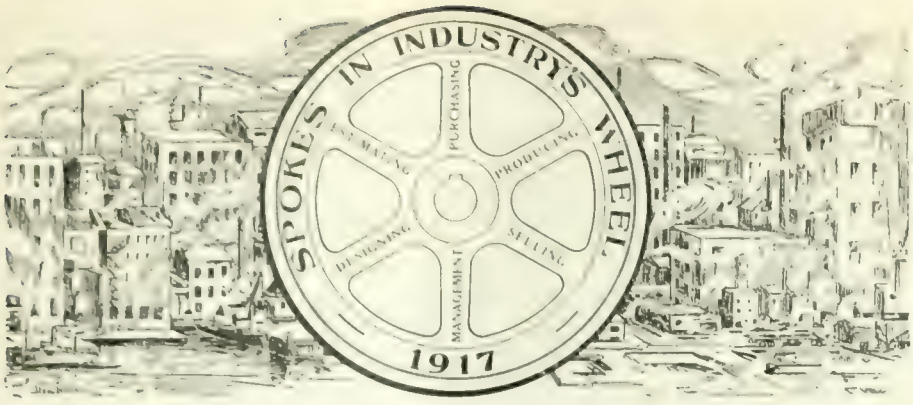
Total bounties paid $21,669,965

Metal	Amt., Tons	Bounty
Pig iron	5,431,547	$7,097,041
Puddled iron bars	42,812	113,671
Steel	4,448,780	6,706,990
Manufactures of steel	499,312	2,868,122
Lead (pounds).	1,187,083,350	1,979,164
Manila fibre (pounds) ...	108,048,641	367,962
Crude petroleum (gallons) ...	169,134,123	2,537,012

Their Pet Names.—A very tall, thin boy reported to a battalion in Flanders. His colonel was bald and elderly, but adored by his men. After a few days' experience of his new command the sub. approached the officer commanding and asked permission to ventilate a grievance.

"I wish you would use your influence, sir, to restrain my platoon from referring to me as 'Legs,'" he said.

"Sure! my lad, sure!" replied the colonel, solemnly; "if you'll use yours to stop my whole battalion callin' me 'Old Baldy.'"



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

WILLIAM A. SWEET

THE development and transmission of electrical power has advanced to such a point, and demands such qualifications in the individual that it may well be said that wires like guns need men behind them. Electrical engineering in its operative features, requires a degree of practical experience equalled only by mechanical engineering, and obtainable only by lapse of time and occurrence of trouble. Just as it is impossible to cross bridges before you come to them, so is it impossible to gauge one's ability to overcome trouble until unwelcome events have presented themselves for solution. While it is not implied that the subject of these remarks has a special leaning toward trouble, it is believed that, because of the closeness with which his personal career and activity are interwoven with the development of his present duties, his biographical details possess more than passing interest for readers of this journal.

The early days of electrical engineering were characterized by a rapidity of development experienced by few other industries and the fact that our "Spoke's" experience with electrical machinery dates from the early "Eighties" is sufficient evidence that he not only knows how to meet trouble when it comes but what is perhaps more important, is capable of maintaining a preventive attitude against the trials and sorrows of the station engineer.

Born in the county of Wentworth, township of Salt Fleet, May 3, 1862, William A. Sweet is a Canadian son of Canadian parents, although four generations back his forefathers were of Holland birth. After receiving the ordinary school education of that period, he commenced work at the age of sixteen, learning the milling trade in the town of Woodburn, Ont., where he was employed at the Woodburn Flour Mills. They were owned by John Edmonds and during the three and a half years he was there, Mr. Sweet had charge of a beam engine having a cylinder 20 in. dia. by 5 ft. stroke, running at 30 revs. per min. An interesting feature of this plant was the presence of a water tube boiler of which the following description is given: A main horizontal shell about 6 ft. dia., and proportionate length, had a central rectangular flue 48 in. wide by 30 in. high. About 500 tubes were disposed vertically in this flue, connecting the water

W. A. SWEET.

spaces above and below the square flue. This boiler was made by some firm in Hamilton, whose name history recordeth not.

After a short time with Morgan Bros., who owned a flour mill in Hamilton, Mr. Sweet decided to become a real out and out engineer, and with this end in view he commenced his apprenticeship in 1882 with the firm of Reid & Barr, who were engaged in the building of stationary and portable engines and also boilers. The four years spent there were full of opportunity, particularly as regards the operation of machinery, a fact which was to be of considerable influence in the later activities of our friend.

At this time, Mr. Sweet devoted considerable time to study, taking both the electrical and steam engineering courses of the Scranton School, so that he was amply qualified to take charge of the electrical plant at the Royal Distillery, Hamilton. This equipment included one bi-polar dynamo of 400 light capacity, 2 bi-polar motors and one electric lift. Three boilers of 125 horse-power were installed, and the engines were one 100 horse-power, and one 20 horse-power, the latter being an Armington & Simms, built by the Inglis Co., of Toronto. The electrical machinery was built by Tom Kay, of Hamilton.

Mr. Sweet's connection with the various plants now owned by the Dominion Power & Transmission Co., dates from June 1, 1894, when he took charge of the power plant of the Hamilton, Grimsby and Beamsville Electric Railway, this plant being under his care till the present time. His duties were extended in Sept., 1896, to include the power plant of the Hamilton Radial Electric Railway, this latter plant being in continuous operation as a generating plant until 1901, when it was converted to a transformer and motor-generator station. At this time Mr. Sweet was placed in charge of all stations owned by the Hamilton Cataract Power, Light and Traction Co., these consisting of the old electric light plant on King street, the Street Railway plant at the foot of John street, and the Grimsby Electric plant.

The formation of the Dominion Power and Transmission Co., solidified the various electric projects in the Hamilton district and incidentally increased Mr. Sweet's responsibilities so that in addition to the companies mentioned he has charge of plants belonging to Hamilton & Dundas Street Railway, Dundas Electric Co., Brantford & Hamilton Elec. Ry., Hamilton Terminal Co., and Western Counties Electric Co. The Victoria Ave. sub-station belonging to the old Cataract Co., is the only plant where steam generation is still in use.

Social and political activities of limited degree have characterized Mr. Sweet's past life. Radical in politics and Anglican in religion, he has never been attracted by municipal politics. A Mason and member of the I.O.O.F., he is also a member of the C.A.S.E., being one of the old members of No. 2 Lodge, past president of the C.A.S.E. executive, and a warm friend of that organization.

Hunting is his chief relaxation, and a fall trip has been an annual feature for the last 25 years.

On Jan. 26, 1889, he married Cozens Tryphena, of Hamilton, the union being

blessed with two sons and two daughters, one of each of whom is married; the family residence being 78 Colborne St., Hamilton, Ont.

Outside of his duties, Mr. Sweet has various interests, one of special interest at this time being the Hamilton Molybdenum Alloys Co., of which he is a director. His success in life he attributes to a lot of mighty hard work, not a little of it being study in the wee sma' hours of the morning; in fact, he admits that his wife has occasionally hidden books from him for days at a time. She cannot, however, deprive him of technical papers, which appear regularly, and Mr. Swet regards these as one of the necessities of life for the modern aspirant to success.

Cool collectedness is particularly necessary for successful electric station operation and both Mr. Sweet's personality and the various plants under his control bear out the truth of this assertion.

RUSSIA PRESENTS VALUABLE MARKETS

A SPECIAL REPORT on trade conditions in Russia has been forwarded to the Department of Trade and Commerce at Ottawa by C. F. Just, Canadian Trade Commissioner, Petrograd, Russia.

Contrary to expectations, on this side of the Atlantic the many plans for the extension of Russo-Canadian trade have not been interfered with to any appreciable extent by the revolution; in fact, acording to the latest advices, much new development work will be the outcome of the revolution as soon as order is brought out of chaos.

Mr. Just states that the important programs which have been authorized in connection with Russia railway construction, the development of the road system of the empire, the improvement of internal navigation, land reclamation, colonization and settlement should provide numerous opportunities for Canada's participation in supplying a wide range of machinery and of general supplies which will be called for and for which, at the outset at all events, the administration must depend upon outside sources of supply. These should include many of our Canadian specialties which have been evolved by these same conditions and the same necessities of development as those which confront Russia of to-day. It is pleasant to know that the authorities are prepared to recognize the help which Canada can render their country in this respect, and it would seem that they are willing to give us a preference in such matters within reasonable limits.

The question of finance and the difficulties of exchange as well as of transportation throughout the year have had considerable influence in delaying the placing of orders in Canada for any requirements of a character which were not absolutely necessary for war purposes.

Agricultural Machinery

Among the great and immediate necessitities of Russia must be classed a fuller supply of agricultural machinery. The seriousness of the present short supply, due to the reduction of local production and to the interruption of imports, is fully recognized by the Russian authorities, and there is every disposition on the part of the Government, acting in co-operation with the chief zemstvo unions and agricultural credit associations, to meet the situation as far as circumstnces will allow. There is room here for a fuller participation of Canadian works. It is true that the contracts for the 1917 campaign allotted to Canada were larger than in former years. They were confined, however, to a single Canadian firm. Contracts for 1918 will be arranged doubtless during the spring of the year. The requirements to be met are bound to be larger than ever, and it rests with our manufacturers to take advantage of the position.

The question of forest exploitation, particularly in northern Russia, was the subject of prolonged and careful investigation by the Russian Government during the year, and the decision was arrived at to encourage by generous commission the development of exports on a greatly increased scale.

The only possible market of Russia open to Canada now is the Russian Far East, with Vladivostok as the chief centre, and a good many inquiries have reached me in this regard. Complaints have come to hand, however, from the importing houses in Vladivostok of the difficulty in getting Canadian firms to agree to the terms of settlement—i.e., cash against documents in Vladivostok, which prove acceptable to shippers in other countries. It is much to be desired that some kind of agreement could be reached that would enable Canadians to obtain a firm foothold in that market.

Getting Business By Correspondence Futile

Judging by the inquiries I am receiving from Canada there is too great a tendency with Canadian firms to rely merely on correspondence for securing business. This course in a general way is quite a futile proceeding. As I have repeatedly pointed out, little progress can be made in this market without a personal understanding of the situation and without creating a selling organization founded on local knowledge. It is absolutely necessary for Canadian firms which are in earnest regarding the Russian market to send over responsible representatives.

I am fully aware that the question of winning the war must be our chief preoccupation in Canada, and that this will interfere for the present in many instances with such a course. The prolongation of the war makes the resumption by Germany of her old activities an ever remoter possibility, and the way will be rendered easier for entry of new firms and for the formation of new connections. The commercial and financial circles in Russia, however, are looking with some impatience for fuller proofs of interest on the part of the allied countries in this regard, and the matter is one which we shall do well to provide for.

Pooling Business Advised

Perhaps the best advice I can offer to Canadians is to urge again this practical consideration upon their attention. My firm belief is that the position is to be best met, so far as Canada is concerned, by the grouping of like or correlated industries interested in the Russian market, and of frankly pooling Russia business. Under the conditions that are likely to exist after the war such collective or co-operative effort will be more adapted to success than by the old part of individual effort. Again it is not unreasonable to ask that Canadian firms which are believed to have made unusual profits during the war should set apart a portion of those profits as a fund for investigating possibilities of new markets, including that of Russia, and for forming necessary connections in order to maintain their present enlarged output.

Prior to the war Canada was a terra incognita in Russian commercial and fincial circles, but time and circumstances are working a change, and the evidence of Canada's industrial strength and varied production is receiving generous recognition, which only requires to be supported by practical work on the spot in order to secure substantial results. Canada, with her new capacities and new spirit of self-reliance, will find in Russia a rich field for her newly-devoted energies, but manufacturing ability must receive its direction from well-informed commercial enterprise, and both the support of far-sighted and patriotic finance and carefully-matured transportation facilities.

RESTRICT USE OF PLATINUM

NOW that the price of platinum has risen to such a figure that its use by chemists and chemical manufacturers is now practically prohibited, large stores of the metal are in the hands of jewellers who are holding it for making up into rings and other similar articles to sell to people who will pay for it the present inflated price, which is five times that of gold. When sold in small quantities, such as is usually the case, an insignificant amount of platinum will go a long way, it being the third most ductile, as well as malleable, of the metals, but the total of all these small sales reveals the fact that the price of the metal has been forced up to such an extent that its purchase for chemical use, except in these microscopic quantities, is indeed at a minimum.

Platinum is one of the essentials in the manufacture of sulphuric acid by the contact process; in the methods of obtaining nitric acid by the oxidation of ammonia, in the production of explosives and as a catalyst in many other operations.

EDITORIAL CORRESPONDENCE

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

MACHINISTS' INSTRUCTION COURSE—XXIII.

By J. Davies

GRINDING is a term that is used for many different operations, many different kinds of material including all kinds of metal, glass, rubber, wood etc., being ground by emery

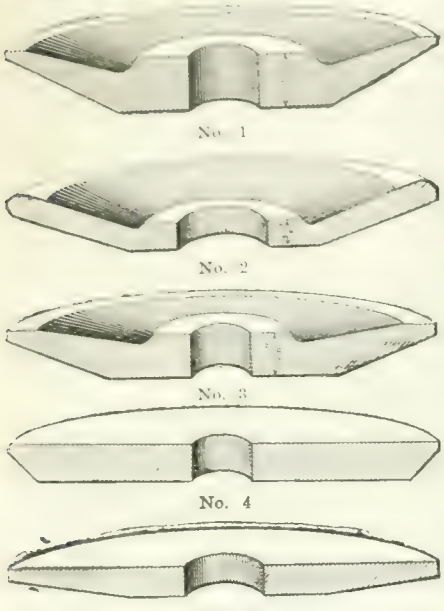


FIG. 85.—TYPES OF EMERY WHEELS IN GENERAL USE.

wheels. It is not our intention to discuss grinding in its many varied phases, but only as it applies to modern machine shop practice. Our old friend the grindstone is rapidly losing its popularity and is conspicuous by its absence in most machine shops. Carpenters and patternmakers, however, regard it with more favor than the machinist. They claim that for grinding tools that have sharp thin cutting edges the grindstone can't be beat, because it does not draw the temper of the steel, and leaves the tool in good cutting condition.

Care of Grindstones

Grindstones are usually run in a trough partly filled with water, as they cut more freely when wet; the water also keeps the work cool and washes away particles of dislodged stone and steel. Grindstones are softer when wet than dry, and for this reason the water should be drained out of the trough every night. If the stone is allowed to remain all night partly submerged in water, next day the wet side will wear away faster than the dry side and there will be great difficulty in keeping the stone true.

Grindstones under favorable conditions rapidly work out of truth and require truing up. This is most often accomplished by a steel bar, or an old file, but the most popular tool is a piece of old gas or water pipe, which is supported on a rest and rolled across the face of the stone. Be sure to have the rest close up to the face of the stone or the end of the pipe may slip in between the stone and the rest; also have the pipe long enough to give a good leverage. The modern machinist is a hog for speed so he has practically discarded the grindstone in favor of the emery wheel, and the word emery wheel in shop language includes all kinds of built up wheels of different grades and materials. Emery wheels are made in different grades of hardness, and makers have their own system of grading.

Selecting a Wheel

In selecting a wheel, more depends upon the material that is being ground, and upon the finish required than upon the grade or hardness of the wheel. It does not follow that a fine grain wheel will always produce a fine finish, and a coarse grain wheel rough finish, irrespective of the material being ground and the nature and conditions of the work. Generally speaking the harder the material to be ground the softer and coarser should the wheel be. When grinding steel or chilled iron the harder the steel the softer the wheel, and vice versa. Brass and copper require very soft wheels. When grinding brass, or copper, or any of the soft metals or alloys with a fine hard wheel, you will have trouble with the particles of metal sticking to the wheel.

Emery wheels are practically cutting tools that are bound together to form a circular cutting tool that presents thousands of cutting edges to the work. These thousands of minute particles break away from the wheel more or less readily according to the hardness of the material being ground, so that when grinding hardened steel it is necessary to have a soft wheel so that these numerous cutting edges will be worn or broken away rapidly and new cutting edges presented to the work.

Shape of Wheels

Figs. 85 and 86 show the most common form of wheels in general use. Nos. 1, 2 and 3 are difficult forms for endurance in cutting into sharp corners. No. 5 is a solid soft free cutting wheel, and is used on fluted reamers and milling cutters, it is made with both sharp and round corners. No. 6 is a cupped wheel used for face cutter sharpening or face grinding. No. 7 is a plain cylindrical wheel used for general work and surface grinding. No. 8 is a very narrow wheel for cutting-off hardened stock, slotting or similar work; these are made as narrow as 1/16 in. No. 9 is a cone which can be used for wood gouges that

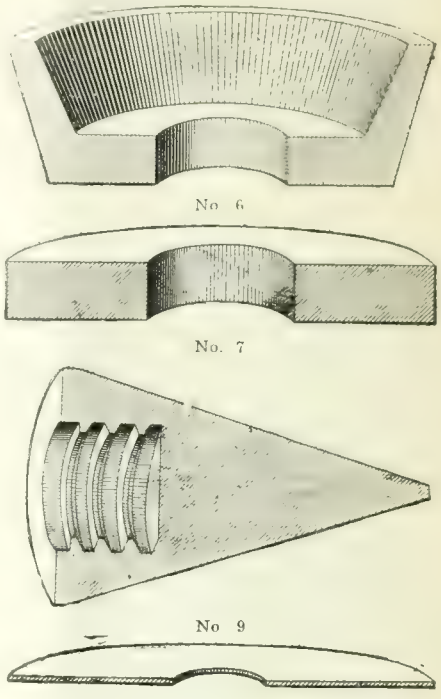


FIG. 86.—TYPES OF EMERY WHEELS IN GENERAL USE.

are ground on the inside of the curve of the blade. Many other shapes are manufactured but these are the principal ones used. These wheels can be altered to other forms as desired.

Truing Emery Wheels

It is essential that the grinding wheel should run quite true and bear evenly against the work over its entire cutting surface. A diamond is undoubtedly the best tool for truing small wheels but unfortunately diamonds are quite expensive and are not very much in evidence in general machine shops being the exception rather than the rule. When they can be obtained, they should be set in the end of a round bar, Fig. 87 which

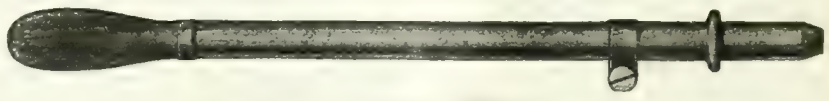


FIG. 87.—DIAMOND DRESSER.

enables them to be used in any position. Some machines have devices for holding the diamond point to the wheel, but the writer has observed that most grinder

operators prefer to hold the tool by hand, resting it upon some stationary object while the revolving wheel moves back and forth past the tool, or the tool moves past the wheel.

Truing with a diamond is not practicable for rough work, and where large and coarse wheels are used, some other method of dressing the wheel must be resorted to. A dressing tool made of steel or chilled iron disks that are free to revolve on a central spindle is shown in Fig. 88. This tool is pressed against the wheel and as the disks revolve, the teeth strike the wheel and dislodge particles of emery thus making an even surface. A very useful dressing tool is a lump broken out of an old wheel that is coarse and harder than the wheel to be dressed. It should be kept moving around, applying the different edges to the stone.

FIG. 88. DIAMOND DRESSER.

Chatter and Its Causes

It often happens that the wheel leaves a lot of peculiar wavy lines called chatter marks. These marks may be due to a number of different causes the name given to them suggests the cause, chatter. The grinding wheel spindle may be loose in its bearings and so chatter,—the work itself may be slender and not properly supported, or the wheel may be too hard. Chattering may often be overcome by usisg a softer or a narrower wheel,—of course the narrower wheel means a slower feed, and speed is sacrificed for a better job.

In grinding cylindrical work where there is a fair amount of metal to remove, it is necessary to flood the work with water to carry away the heat and prevent distortion of the work. Many experiments have been made which prove conclusively that if a round bar is ground in the middle only, and the heat is allowed to generate and spread itself unevenly through the bar it is impossible to grind the bar round. Here is how one operator greatly reduced the heat trouble, he was grinding very thin stock on the surface grinder, and found that the unequal distribution of the heat caused unequal expansion and when his work was finished and cooled off it was unequal in thickness. He therefore turned a groove in the face of his wheel which not only reduced the bearing surface, but also provided an air space which helped materially to keep the work cool.

POWDER MONKEYS

By H. H. Brown.

IN Canada there are four plants manufacturing smokeless powder for use as a propellant in cannon. Two of these plants manufacture "cordite," which originally is an English powder, having been first made about twenty-five years ago. The name cordite was derived from the shape of the finished powder, which resembles a cord in appearance. It ranges in length from ten to twenty-six inches, depending on the calibre of the gun in which it is used. Cordite is a mixture of gun-cotton, nitro-glycerine, acetone, and a small per cent. of vaseline. After being mixed into a thick paste, it is pressed through apertures of an hydraulic press and comes out like macaroni, is cut into proper length, dried, and packed ready to be shipped to the loading station, where it is placed in the cartridges. This kind of powder is made at —— and ——.

The other two plants making smokeless powder are located at —— and ——. Their product is known as N.C.T. (nitro-cellulose tubular) powder. The finished product is cylindrical in shape, having perforations running lengthwise, therefore the name tubular. Grains vary in size, according to calibre, but the average is about one-half inch in length and one eight-inch in diameter. Nitro-cellulose powder is nitrated cotton treated with ether and alcohol, pressed into cakes resembling a cheese both in appearance and consistency, then pressed through dies, similar to the cordite apertures, and cut into grains of the proper length by machinery. The capacity of these plants vary, the largest being equal to 50,000 lbs. per day.

At the latter of these two plants about twelve hundred men work day and night turning out finished powder from raw material. The three main constituents of smokeless powder are sulphuric acid, nitric acid and cotton. Sulphur from the State of Alabama is used to make the sulphuric acid, nitrate of soda from South America for the nitric acid, and American cotton for the cellulose. After the cotton has been nitrated with a mixture of nitric and sulphuric acid (forty pounds of mixed acid to one pound of cotton), it is beaten into a pulp and put through a process of purification, after which it is ready for the "powder line." In this state, nitro-cellulose is also known as "pyro."

Powder Line

The pyro is dehydrated with alcohol by means of hydraulic pressure to take out the moisture that remains in the cotton after it has passed through the hydro-extractors or centrifugal wringers. After treatment with alcohol it is then mixed with ether, which changes the pyro into a collodion state resembling a mealy dough. While being handled in this form, the ether rapidly volatilizes, filling the shop with heavy fumes and intoxicating the operators in a manner similar to an alcoholic drink. On account of the silly capers the men on the powder line perform while drunk on ether fumes, they have been given the name "powder monkeys." Some will sing, dance, and play, while others are made melancholy and are wont to sleep. Some perform silly stunts such as untieing a fellow workman's shoestring. Sleepiness and nausea often follow an ether drunk. The fumes are generally heavy in the "finishing press" house where the powder is pressed through performating dies and granulated by cutting machines while still in a plastic form and exuding fumes. Ether fumes are highly inflammable, almost explosive. Often a spark from a cutting machine will cause the entire room to burst into blue flame intensely hot.

After granulation, the powder is dried and ready to be loaded into cartridges. The process of drying takes about nine days.

Canary Birds

Picric acid, which is probably the heaviest explosive used in high explosive shells, gives off a yellow fume which stains the skin, hair and clothing of the workmen with a staying quality that is faster than the fastest dyes. The hair is dyed a greenish yellow which remains so until it grows out and is cut off. These men are called "canary birds" from their bright yellow appearance.

Acid Rats

"Acid Rats" is the name given to the operators in nitric and sulphuric acid. They are not dyed as deep yellow as their cousin, the canary bird, nor do they present as good an appearance on account of their acid-eaten clothes, which are often reduced to mere rags. Woollen cloth withstands acid much better than cotton, consequently nitrators wear thick, cheap woollen garments often made in rich colors and large checks. The Inferno is very applicable to the nitrating room, where the nitrators slowly shuffle to and fro with long iron forks, dressed in red checkered trousers, colored shirts, rubber boots and aprons, and capped off with white handkerchiefs to shied their mouths and noses from the hot pungent fumes that float up from the acid pots over which they stand and stir with long iron forks.

No greater field for the study of human nature could be chosen than a smokeless powder plant. In such a plant in the United States, twenty thousand men at work, are to be found representatives from practically every nation and race on earth. In this mass of humanity is found every type from the lowest to those who have scaled the heights of success and known the better things in life. There are representatives from the chosen professions, such as doctors, lawyers, etc., as well as a fine collection of ex-jail birds and jail birds working side by side for thirty cents an hour.

The Canadian plants may contain the same variety of racial representation as do the large plants in the States.

STEEL INDUSTRY DEVELOPMENTS

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

TURBO-BLOWERS FOR BLAST FURNACES—I.*

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

THE blowing of blast furnaces is a process which, at best, is attended with considerable variation, both in the operation of the furnace, and in the factors which are necessary to the proper working of the plant as a whole. In modern furnace practice every effort is being made to reduce the number of variables and increase the steadiness of operation, and a careful study of these variables and what is being done to decrease or eliminate them will be useful. The variable elements which enter into the operation of a blast furnace are as follows:—

1.—Variations in the composition of the ore, and variations in the size of the particles thereof.

2.—Variations in the composition and in the size of the particles of the limestone.

3.—Variations in the carbon content, strength and size of the coke.

4.—Variations in the quantity of oxygen blown into the furnace, due to variations in barometer, temperature, and humidity of the entering air.

5.—Variations in the pressure and volume of the blast, due to the character of the blowing agent.

Of variables which have no relation to the blast, these are dealt with as follows:—

1.—Variations in the composition of the ore are being dealt with by proper combinations of ore; and variations in the size of the ore are being dealt with by proper means of sizing the ore, including crushing, screening, sintering and roasting.

2.—Analyzing and mixing various compositions of limestone in order to secure a uniform quality.

3.—Careful choice of coke, and proper attention to the uniformity of manufacture.

4.—An attempt to decrease variables in blowing was made by the introduction of the dry blast. The expense of the plant for this method of removing the moisture from air and the operating cost thereof is so great that this method of treating the blast has not made any considerable progress recently.

5.—The introduction of the turbo-blower has provided a means of rendering the blast conditions more uniform. Not only is the blast pressure held steady but also the very steadiness of the blowing permits accurate measurement of the air volumes, and accurate adjustments thereof, and compensation for variations in barometer, thermometer and humidity; so as to insure a constant rate of flow of oxygen into the furnace, and the accurate adjustment of this rate to the needs of the furnace conditions.

Steadiness and Control of Blast

It is difficult to demonstrate, to those furnace operators who have not had experience with the steadiness and ready controllability of the blast from a centrifugal compressor, what the effect of this steadiness of conditions will have on the furnace; which is in direct contrast to the attitude of those who have had experience with the operation of such units. In no case has there been a failure on the part of the people who have acquired experience with this method of blowing, to appreciate the improvements which result from these conditions.

It is only recently, however, that an accurate means has been provided for correcting the rate of blowing to correspond with the variations in atmospheric conditions. Experience with the use of these corrections is very limited; only one case is known to the writers where some of these corrections have been applied by observation of the atmospheric conditions and an arbitrary correction of the weight beam in accordance with this observation, and in this case (speaking of the Northern Iron Co., Port Henry, N. Y.), the correction has only been made for barometer and temperature, and no attempt has been made to correct for humidity.

It is not to be wondered at that those whose experience is exclusively with ordinary methods of blowing should fail to appreciate the desirability of the steady blast and the accurate measurement of oxygen, for the reason that there are so many variables which necessarily have occupied the attention of our blast furnace operators that it has been almost impossible to differentiate and evaluate the various variables which have to be dealt with. By the recent improvements in the operation of furnaces, which permit the removing of some of the variables by sizing of the ore, and by proper attention to the coke and limestone charges, some of these variables are being removed and the final step would seem to be the removal of all possible variations from the blast itself.

Blast Pulsations Absent

It goes without saying that the blast from a centrifugal compressor will be a steady flow without pulsations. The very nature of the apparatus necessitates this. It also seems evident, and has been proved by actual observation of the blast delivered from a reciprocating machine discharging its air in puffs, each puff corresponding to one stroke of the engine, that the flow of the blast must be more variable and produce some variations of effect in the furnace. Whatever these variations are, it seems evident that it is desirable to remove them. Experience with centrifugal machines on blast furnaces demonstrates this, and shows that an improved output, a somewhat less quantity of dust, and a general steadying up of conditions has resulted. A part of this improvement is due to the steadiness of the blast, and a part is due to the more accurate control of the rate of blowing.

An interesting experience which shows the importance, and even absolute necessity, of accurate control of the rate of air flow has been had with a blast furnace centrifugal compressor within the last few years. In this case the measuring device which was relied upon to determine the rate at which the blast was being blown was so located that the indications of this measuring device were inaccurate; at some time indicating more blast than was actually flowing and at other times less. The result of this inaccurate measurement of air was an inaccurate adjustment of the machine, causing excessive quantities of dust to be produced and a decreased output from the furnace as compared with the reciprocating engines, which were installed to blow the same furnace in alteration.

After operation in this condition for a considerable period the measuring device was relocated where the connections were more accurate. I am informed that the result of this relocation and consequent more accurate operation of the blower, was to decrease the quantity of dust to normal and increase the output of the furnace. In order to determine the effect of improvement in these parts such instances are of extreme value. They show the importance of the proper regulation of the rate of flow of blast and indicate the possibilities which can be expected when inequalities and irregularities are entirely removed.

Governor Controlled Rate of Blowing

A governor has been devised that is capable of accurately controlling the rate of blowing. This governor is used on blast furnace blowers built by the General Electric Co. It consists of a disc riding on the ingoing air in the centre of a frustro-conical portion of the inlet pipe. Movements of the disc are transmitted direct to the valve gear, and ample power is secured by the use of very moderate dimensions. The angularity of the walls of the conical pipe is determined by the desired accuracy of regulation. No packing is necessary and the device is therefore practically frictionless and wear-proof. Differing rates of flow are secured by moving a weight along a scale beam, which is graduated in cubic feet of free air per minute, and calibrated at

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

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

the factory before shipment. A recent improvement of this governor consists of a means of adjusting the index on the sliding weight to compensate so that the weight can readily be reset to take account of variations in atmospheric conditions. The following is a description of this device, which is called a volume corrector.

Description of Volume Corrector

On the scale beams are marked with various numbers of cubic feet per minute. An index marked on the sliding weight is set opposite the number of cubic feet per minute which is desired should be held by the constant volume governor. This index is adjustable and its exact position is secured by the setting of three scales which are carried on the sliding weight. These scales are for barometer, atmospheric temperature, and atmospheric humidity. Proper settings on these three scales are made corresponding to atmospheric conditions, and this automatically sets the index on the sliding weight in such a position that the corresponding volume on the scale beam is corrected for the atmospheric conditions as set.

A phenomenon with which we had to deal in the eariy days of our experience with centrifugal compressors on blast furnaces was the so-called "surging" which appeared when the machines were operated at considerably less rates of blowing than those for which they were designed, or when excessive pressures were met with, as in case of tightening up of the furnace. The occasional phenomenon which is often called "surging" is only met with when, at normal pressures, the volume being blown through the centrifugal compressor is considerably less than that for which it was designed. In case of high pressures, for instance, with a tight furnace, this phenomenon may be met with, although the volume discharged is about that for which the machine was designed. It consists of an alternate forward and backflow of air through the compressor, and is the result of the improper functioning of the discharge vanes owing to the variation of blowing conditions from those for which the vanes were designed.

These alternate forward and back flows through the compressor result in a variation of pressure in the discharge mains of sometimes as great as two pounds, and cause some irregularity in the working of the furnace. This phenomenon is not peculiar to any one type of centrifugal compressor, but is met with in all types. For some time after the installation of our first machines this phenomenon was difficult to deal with, particularly as the first machines were designed for much larger quantities than have ever been blown through them. However, in the 10 years of experience which we have had with this apparatus effective means have been devised and applied which render it unnecessary that any such phenomenon should again give difficulty.

"Surge" Elimination

The steps which have been taken to eliminate this surging are: First, the reasonable proportioning of the machine to the requirements of the furnace; second, provision of a by-pass with an automatic valve which, under conditions which would ordinarily permit surging, leads back into the inlet a small quantity of air. This valve is self-compensating for variations in volume and pressure, and once adjusted needs no attention. The use of this apparatus increases the efficiency of operation in conditions where it is operative, since it maintains the proper air discharge pressure without diminution.

The centrifugal compressor, therefore, properly governed, affords a means of blowing the blast furnace with the steadiest possible conditions of blast and the most uniform rate of inflow of oxygen contents; a means of blowing which can be adjusted to meet any variations which may be necessary in the composition and mechanical conditions of the charge; and one which is automatic in operation when set for any existing condition and quickly reset for any change of condition of furnace or atmosphere, and one which requires comparatively little care and attention on the part of the operating staff.

Another feature, which tends to uniform operations, and permits of more accurate determination of the blowing conditions, is the fact that the turbo-blower is readily manufactured in such sizes that a single blower can be used for blowing a single furnace. In this way each blowing unit is adjustable to meet the exact furnace conditions with certainty, thereby increasing the uniformity of the product and the amount thereof; also decreasing the gas consumption, since the turbo-blower is more efficient in the larger sizes than in the smaller, and also because two units, whether of turbines or of engines, are less efficient than a single unit. This is on account of the fixed losses which exist in every turbine or engine unit and which do not increase in proportion to the size of the unit.

Turbine Efficiency

The efficiency of the turbine need hardly be argued here. It is the cause of its adoption as a prime mover in all our central power stations, and in practically all our industrial plants throughout the country in competition with all other forms of units. Very recent improvements in turbine construction have greatly improved the efficiency of such units, and these units of increased efficiency are now available in cases where steam consumption is an important requirement of blast furnace blowers. The discussion which will follow as to the cost of blowing furnaces will be based upon the use of one of these modern units. Another feature of this type of blowing apparatus is that, considering its efficiency, its first cost and cost of installation, its operating costs are also low.

Operation Costs

Reliable figures have been obtained from existing plants to the actual cost of operation, both for the gas plant and the steam plant. While these figures were not obtained from plants of the same magnitude, or located in exactly the same places, the conditions are so nearly uniform as to location, and figures for gas engines are obtained from plants which are so much larger than the turbine plants compared with them, that it is felt that the comparison is not unjust; in fact, any advantage which would obtain from the character of the plant appears to be in favor of the gas engine. It is well known that large plants operate with greater economy than smaller ones.

The gas engine figures are not those obtained from any one location, but are the result of comparison of figures of plants in several locations. In every case where choice of data could be made those results most favorable to the gas engine have been chosen. In selecting the gas engine installations best adapted for comparison with the steam turbine plant, the best possible examples of recent gas engine practice have been chosen; plants which are in the hands of most capable operators, installed for the purpose of securing the highest efficiency and containing all the various elements for proper operation for such plants. Furthermore, by reason of the care and supervision which is exercised over these plants it is believed that they are, without unnecessary expenditures, now in the best possible condition for service, and maintained at the highest practical efficiency.

Again, the physical location of these plants is also favorable, since they are placed at such points as give them readily proper supplies of ore, fuel, limestone, water and all the other materials necessary for economical operation, and they are equipped with handling devices for storing and transportation of these materials to the fullest practical extent. They are large plants, involving more than four blast furnaces, but in order to bring the plant unit down to one which would be most practical for consideration in new installations they have been reduced to the equivalent of a four furnace plant.

Plant Size Feature

In making this reduction no allowance has been made for a decrease of operating efficiency which would result in the reduction in size. On the other hand, the turbo-blower plant which has been selected for comparison is one which is used with only two furnaces. In enlarging it to the four-furnace plant no account has been taken of the increased economies which would result from the increase in size. Therefore it will be seen that the turbo-blower suffers in two directions; first, that the gas engine plants selected for comparison are larger than the plant which is taken as the standard unit, and second, the turbine plant, which is selected for comparison is, in turn, smaller. If these facts were taken into account we should expect that the figures would come out more favorable to the turbine than results actually given; but it is not desired, in making this comparison, to leave any doubt as to the conservatism of the result.

Installation First Cost

In considering the installation of a gas

engine equipment for a steel mill of the type under consideration, the first fact which strikes the investigator is the first cost of the installation. It has not been customary in the past to consider the addition to operating cost which results from the charges necessitated by this capital investment. It is, however, of vital importance in considering the desirability of installation of one type of prime mover or another, that all the elements involved be taken into account in the same way that they are taken into account in other cases involving differences of first cost.

It is obvious that the capital invested in such plants must give some return to the investor, and a proper allowance for this return is a just and legitimate charge against operating expense. Furthermore, these investments involve taxes, which also should go against operating expense; and insurance is an item of the same class. Again, and more important than any of these, is the question of obsolescence, by which is meant the amount to be laid by as a sinking fund to retire or amortize the plant at the time when its usefulness becomes extinguished by the improvements in the available apparatus, whether as to efficiency, as to increased reliability, or in other ways; also to provide for the general ageing of the apparatus which takes place no matter how carefully the repairs and renewal of parts are taken care of. That is to say, this obsolescence charge which I am now discussing also includes depreciation.

It is, perhaps, not necessary to go too deeply into the necessity of an obsolescence or depreciation charge, but a familiar instance which is often cited, to show the necessity of the charge, is the case of the horse, investment in which is automatically extinguished by the ageing of the horse no matter how carefully he is taken care of, kept free from sickness, and otherwise preserved so far as possible in good condition. While the depreciation of machinery is often not so rapid or so easily seen as in the case of the horse, the two instances are fairly analogous.

If these fixed charges on the investment are not taken care of by charges against operating expense, they must be handled in some other manner, by charges against the product of the mills, or otherwise; which charges are wrongly allocated and do not show, unless put into operating expenses, the true value of investment in the various types of apparatus.

In most steel plants it has been the custom to consider merely the running charges. The management has been given the plants to operate, and it has been judged by this cost of operation without including the fixed charges due to investment. This had led to an inaccurate view of the desirability of extreme efficiency in the prime mover and does not consider the cost of obtaining this high efficiency. This leads to a use of the most expensive plant, provided such plant gives a larger output from the gas available without regard to the first cost.

OPERATING COSTS ADVANCE 80 PER CENT.

IN the United States there is a very general demand on the part of traction concerns for higher fares, due to the increased operating costs since the outbreak of the war. To show how the high cost of fuel and materials have affected the traction companies, the following compilation of the costs of fuel and materials in 1914, as compared with 1917, and the percentage of increase, is given:

	1914 Price.	1917 Price.	P.C. of Increase
Cast iron car wheels, each	$ 7.06	8.15	15.15
Steel iron car wheels, each	15.00	22.50	50.0
Round steel axle blanks, each	30.15	23.51	11.65
Brill axles	17.12	18.81	9.96
Armature coils, G-57, each	125.00	151.56	21.2
Armature coils, W. H.-510, each	26.00	40.66	51.2
Copper wire, per lb.	30.00	62.50	107.0
Soft steel, per cwt.	.16	.35	118.9
Glass, for car windows, per box	1.65	4.50	172.5
Brake shoes, per ton	4.05	5.07	25.2
Street car controller, each	25.00	45.00	80.0
Trolley bases, each	17.00	24.00	41.1
Rail, per ton	32.40	60.00	85.1
Track bolts, per cwt.	2.25	3.58	59.1
Track spikes, per cwt.	1.85	2.39	29.18
Oak ties, each	.69	.88	27.6
Crushed stone, per cu. yd., delivered	1.25	1.70	41.60
Tongue switches and mates complete, each	290.00	355.00	22.40
Wire nails, per keg	1.88	3.45	78.20
Portland cement, per bbl.	1.30	2.19	68.50
Sand, per cu. yd. delivered	.50	1.25	150.00
Gravel, per cu. yd., dlvd.	.85	1.25	47.10
Structural beams, per cwt.	1.10	4.00	263.60
Coal, per ton, delivered	1.50	4.50-6.50	333.33

In addition to the foregoing, it is pointed out that wages have increased during this interim from 15 to 25 per cent. and that whereas two years ago a mile of trolley wire only meant an investment of $325, it now requires $725. Altogether the traction companies must now pay on an average of 80 per cent. more for fuel, materials, etc., than they did heretofore.

WORK OF CANADIAN RAILWAY TROOPS

THE Government at Ottawa has received from General Headquarters in France the following summary of the work of the Canadian railway troops for the month of April:

Broad gauge lines—	
Miles located	44.75
Miles graded	36.25
Miles grade repaired	43.55
Miles track laid	51.50
Miles ballasted	46.45
Miles surfaced	43.67
Average number of miles maintained	60.70
Average number O.R. (ordinary ranks) C.R.T., daily on construction	1,597
Average number O.R., C.R.T., daily on maintenance	686
Casualties from shell fire, officers	none
O. R.	7
Average number of British unskilled labor attached	2,660

In most cases these lines were laid over the remains of old metre-gauge lines, which tended to hinder rather than help the work. Owing to the destruction of the lines by the enemy, it was necessary to do a considerable amount of bridge work.

Narrow gauge lines—	
Miles located	57.58
Miles graded	64.98
Miles grade repaired	28.74
Miles track laid	72.89
Miles ballasted	77.84
Miles surfaced	49.63
Average number of miles maintained	100.06
Average number O.R., C.R.T., daily on construction	2,504
Average number O.R., C.R.T., daily on maintenance	1,258
Casualties from shellfire, officers.	3
O.R.	75
Average number of British labor attached	3,276

Weather conditions during the beginning of April were bad. In many cases, building of narrow gauge railways was carried out under shell and machine gun fire, the former necessitating constant patrolling and repairing.

TRADE ENQUIRIES

THE following enquiries relating to Canadian trade have been received by the Department of Trade and Commerce, Ottawa from which further particulars may be obtained.

1023. **Railway sleepers.**—A railway engineer in France wishes to arrange for supplies of railway sleepers in lots from 100,000 to 1,000,000. The sizes of sleepers generally used are:—

2 metres 60 centimetres long.
0 " 24 " wide.
0 " 14 " Thick.

1024. **Machines, tools and materials.**—A French concern which is erecting large works for the manufacture of locomotives and railway materials wishes to secure supplies of machines, tools and materials from Canada.

1025. **Locomotives and railway materials.**—A French railway engineer wishes to get in touch with Canadian manufacturers of locomotives and railway materials.

1028. **Galvanized sheets.**—A hardware firm in British Guiana desires to import from Canada galvanized iron sheets and barbed wire.

1062. **Motor-cars and accessories.**—A manufacturers' agent in Jamaica would like to secure an agency for motor-cars and accessories.

Military Inspecting Officer—"Now, sergeant, what precautions do you take against infected water?"

Sergeant—"Well, sir, first we boil it,"

Officer—"Good."

Sergeant—"Then we filter it."

Officer—"Excellent!"

Sergeant—"Then we drink beer!"

Assist in the work of preventing accidents for your own sake and for the good of our country at large.

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MERCHANT SHIPBUILDING PUBLICITY

AT the beginning of the present month, the United States authorities at Washington gave official intimation that the lid would be shut down tight on information to the public so far as the development and progress of the national shipbuilding programme was concerned. Apparently, the circumstances necessitating such a drastic measure left no alternative—the activities of German sympathizers being directed against new plant establishments at various centres and with, unfortunately, some considerable degree of success. War vessel construction and movements, and the latter even so far as merchant craft are concerned, are on common-sense as well as strategical grounds closely veiled from the public, but whether due to instinct or education, the lack of this data neither arouses curiosity nor causes irritation. In peace times, little of real naval construction achievement gets beyond a very charmed circle in any country, and even when a type ship and its equipment passes into the fleet reserve and, later, into the discard, the detail does not become publicly available. This, of course, is as it should be, for the possibilities are many that in some feature or features even a discard might provide the stepping stones of advantage to an unfriendly or unscrupulous competitor.

To merchant ship construction the public maintain an altogether different attitude, and while instinct may be wholly absent, it can truthfully be stated that education is largely responsible for the stand taken. In no previous war has merchant shipping figured so prominently, whether the latter be relative to what they have accomplished and continue to accomplish, or to the enormous tonnage losses sustained. Their vocation is rightfully looked upon as a peaceful one, in consequence their construction comes under the same category. On this account, instead of a spirit of curiosity being aroused when secrecy is enjoined and enforced, there is liable to supervene a considerable degree of irritation.

It would appear that Hun "submarines" are operative on land as well as at sea if we judge the situation rightly in the United States, and we might as well admit straightaway, that our views as to combatting them do not lie along the lines of secrecy. Meeting the submarine emergency, as the latter is popularly known, whether it be on sea or land, will be most promptly and effectively accomplished by dealing with the devils directly, instead of dodging them as appears to be the meantime tendency both ashore and afloat. We talk of sea power and as individual nations we claim to have land power, to the extent at least of the territory and the people embraced; but have we? Germany is endeavoring to show us that she owns both the land and sea power of the world meantime. Further, she is making a fairly effective display of her ownership. Isn't it just about time we told her and showed her otherwise? Publicity is the most potent known adversary of evildoing as it is of everything else that cannot measure up to the very moderate standards of human decency, then why not lengthen and strengthen its arm instead of paralyzing it?

Let us show Germany, that not only in the United States but here in Canada, we are openly planning and procuring accomplishment of the means whereby her devilishness is going to be absolutely squelched, and let us make the demonstration so comprehensive, and so public, that she will realize that her game of world-conquest is up, and that the oceans and their highways are free to all, irrespective of nationality, creed or color. In our haste to establish shipyards, munition factories, infantry and aviation camps, let us not forget internment camps for the Hun "submarines" at large in our cities and towns, if our jails are already or are likely to become too full. Both Canada and the United States have thousands of acres lying idle on which to erect domiciles for their enemies, besides the adjacent land might be none the worse for tilling.

Many things call for censorship in times like these, and while it may appear to be politic to have the ban operate as comprehensively as can be determined, a big advertising campaign concerning our merchant shipbuilding effort would undoubtedly shake German confidence to its foundations more quickly than will "sealing the lid" tight.

WATER POWER TO SAVE COAL

CANADA depends upon the United States for a large portion of her coal supply both for domestic and industrial purposes; she is therefore much interested in the coal conditions obtaining there. A recent communication from Secretary F. K. Lane, of the U.S. Dept. of the Interior shows how acute the situation has been made by the entrance of our neighbors into the war. One of the remedies urged, particularly applicable to Canada, is the immediate conservation of fuel by the efficient use of all available water power. Elimination of unnecessary consumption of coal is considered a problem of national interest and of immediate concern.

New power requirements should therefore be met, so far as practicable by utilization of hydro-electric energy; this would also apply to present steam generating energy consuming coal or oil in its production. Thus, all water available at water power plants should be utilized to produce energy up to the capacity of the works and the requirements of the population and industries within transmission distance of the site; every facility should also be given for the efficient development of new sites. In regions where water power can be made available, steam power plants should be operated only to carry loads in excess of those that can be carried by water power plants. The adoption of this course, in many cases, would mean cheaper operation, particularly in view of the rapidly increasing price of coal.

Every additional hydro-electric horse-power used in Canada means the yearly liberation of from 10 to 12 tons of coal for domestic heating or other purposes where hydro-electric energy cannot be so effectively substituted.

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 [illegible]
Lake Superior charcoal, Chicago	[illegible] 00
Standard low phos., Philadelphia	$7 00
Bessemer, Pittsburgh	[illegible]
Basic, Valley furnace	[illegible] 00
Montreal [illegible]	
Hamilton	[illegible]
Victoria	[illegible]

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.	12 10
Chequered floor plate, ¼ in.	12 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	$35 00	$36 00
Electro copper	35 00	36 00
Castings, copper	34 00	35 00
Tin	62 00	65 00
Spelter	11 00	11 50
Lead	13 75	14 00
Antimony	20 00	24 00
Aluminum	70 00	65 00

Prices per 100 lbs.

PLATES.

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

WROUGHT PIPE.

Effective July 5, 1917.

Size.	Black Standard Buttweld. Per 100 feet	Galvanized Standard Lapweld. Per 100 feet
⅛ in.	$ 5 00	$ 6 50
¼ and ⅜ in.	5 12	7 16
½ in.	6 46	8 03
¾ in.	8 17	10 29
1 in.	12 07	15 22
1¼ in.	16 33	20 59
1½ in.	19 53	24 61
2 in.	26 27	33 12
2½ in.	42 12	52 94
3 in.	55 08	69 23
3½ in.	69 92	86 94
4 in.	82 84	103 00
4½ in.	29 23	36 71
5 in.	43 88	54 11
6 in.	57 38	70 76
7 in.	71 76	89 70
8 in.	85 02	106 28
9 in.	96 52	121 29
10 in.	112 00	141 34
12 in.	145 90	183 36
7 in.	190 10	238 00
8 in.	200 00	250 00
8 in.	230 40	288 00
9 in.	276 00	345 00
10 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	$21 00	$22 00
Copper, crucible	25 00	27 00
Copper, heavy	25 00	26 50
Copper wire	25 00	26 50
No. 1 machine composition	21 50	22 00
New brass turnings	17 00	19 00
No. 1 brass turnings	15 00	16 00
Heavy melting steel	20 00	17 00
Steel turnings	9 00	8 00
Shell turnings	12 00	12 00
Boiler plate	15 00	10 50
Axles, wrought iron	25 00	24 00
Rails	19 00	18 00
No. 1 machine cast iron	26 00	25 00
Malleable scrap	20 00	20 00
Pipe, wrought	17 00	9 00
Scrap zinc	8 00	9 50
Heavy lead	11 50	10 75
Tea lead	7 50	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 10
Structural rivets, as above	7 00
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	55
Sq. & Hex. Head Cap Screws	50
Rd. & Fil Head Cap Screws	10
Flat 82° But. Hd. Cap Screws plus	10
Fin. & Semi-fin. nuts up to 1 in.	55
Fin. and semi-fin. nuts, over 1 in., up to 1½ in.	50
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	55
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	$100 00
Open-hearth billets	100 00
O.H sheet bars	105 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	6 50	
Spikes, ¼ and 5-16 in.	7 00	

MISCELLANEOUS.

Solder, strictly	0 38
Solder, guaranteed	0 41
Babbitt metals	16 to 65
Soldering coppers, lb.	0 53
Lead wool, per lb.	0 15
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 62½
Linseed oil, raw, single, bbls.	1 27
Linseed oil, boiled, single bbls.	1 30
Plaster of Paris, per bbl.	2 50
Plumbers' oakum, per cwt.	9 00
Packing, square braided	0 34
Packing, No. 1 Italian	0 [illegible]
Packing, No. 2 Italian	0 32
Pure Manila rope	0 37
British Manila Rope	31
New Zealand Hemp	31
Cotton Rope ¼-in. and up	47
Transmission rope, Manila	0 43
Drilling cables, Manila	0 39
Sandpaper, B. & A. ..list plus	20
Emery Cloth .....list plus	33 1-3
Borax, cyrstal	15

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 71½%; 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	11 70
Premier, 10¾ oz.	13 85	12 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN.

B	
¼ in.	$12 00
5-16 in.	11 50
⅜ in.	11 15
7-16 in.	10 90
½ in.	10 70
9-16 in.	10 70
⅝ in.	10 50
¾ in.	10 40
⅞ in.	10 25
1 inch	10 10
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$15 50
3-16 in.	11 70
¼ in.	8 40
5-16 in.	7 40
⅜ in.	6 35
7-16 in.	6 35
½ in.	6 35
⅝ in.	6 35
¾ in.	6 35

Prices per 100 lbs.

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
Globe	50
Vulcan	50
Disston	50

COAL AND COKE.

Solvay Foundry Coke	$10 90
Connelsville Foundry Coke	
Steam Lump Coal	8 50
Best Slack	8 05

Net ton f.o.b. Toronto

BOILER TUBES.

Size.	Seamless	Lap-welded
1 in.	$33 00	....
1¼ in.	36 00	....
1½ in.	38 00	32 00
1¾ in.	38 00	32 00
2 in.	45 00	33 00
2¼ in.	48 00	35 00
2½ in.	50 00	38 00
3 in.	58 00	45 00
3¼ in.	....	53 00
3½ in.	70 00	55 00
4 in.	82 00	67 00

Prices per 100 feet, Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	40
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	13
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	6 15
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	11

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1 50
Leather in sides	1 35

TAPES.

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 46
Reliable Jun. Steel Tape, 50 ft.	3 50

WASTE.

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

COLORED.

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

WOOL PACKING.

Arrow	25
Axle	20
Anvil	15
Anchor	11

WASHED WIPERS.

Select White	12
Mixed colored	10
Dark colored	09

This list subject to trade discount for quantity.

RUBBER BELTING.

Standard	40%
Best grades	20%

ANODES.

Nickel	.50 to .54
Cobalt	1.75 to 2 00
Copper	.44 to .46
Tin	.49 to .56
Zinc	.23 to .25

Prices Per Lb.

COPPER PRODUCTS.

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	53 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x28 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base	64 00	60 00
Braziers', in sheets, 6x4 base	55 00	52 00

BRASS.

Brass rods, base ½ in to 1 in rd.	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamless	0 58

PLATING SUPPLIES.

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

Prices Per Lb.

LEAD SHEETS.

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

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb extra.

PLATING CHEMICALS.

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

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

THERE has been as yet no marked changes in the coal situation, although an improvement is looked for within the next few months. There appears to be some possibility of a decline in the price of soft coal, but not in anthracite. Prices of steel products continue firm, but there have not been so many advances this week. The situation in the steel trade is somewhat uncertain and developments in the United States are being watched closely. A tentative agreement has been made at Washington between the Government and the steel interests, but no definite prices have yet been fixed. The main point of interest is the probable affect of the pending decision on prices of steel to private consumers. In the meantime buying is being restricted to more urgent requirements. The situation in the pig-iron market is very similar to that in the steel market, and consumers are generally waiting developments. Quotations on domestic foundry irons are still withdrawn. There is no improvement in the coke situation, prices are still very high and supplies are coming forward slowly. The scrap metal market continues dull and prices have a lower tendency with the exception of steel and cast iron scrap, which are firm. Prices of old materials are unchanged. Machine shop supplies are moving out in good volume at steadily advancing prices. Higher prices have been issued on some makes of stocks and dies, pipe cutters, die plates, dry batteries, hammer and file handles, screw jacks, etc. The non-ferrous metal markets are quiet and prices lower on tin, spelter, lead, antimony and aluminum. Machine tools continue to advance and deliveries are getting more backward.

Montreal, Que., July 16, 1917.—Still hovering between uncertainty and possibility, the entire industrial situation is in an unsettled condition, due largely to the delayed action of the American Government in their policy of price regulation on materials required for the war programme. Recent developments have opened the way for relief in the coal situation, both in the States and in Canada, and the early future may have a similar effect in other lines of industry. The uniform price policy contemplated by the United States Government does not entirely meet with the approval of the producers, as they intimate that this would disorganize business, and have a serious effect upon early future conditions. The Canadian situation is, comparatively speaking, unchanged, but interests here are patiently awaiting American developments as a guide to future conditions.

Pig Iron

Although disturbing conditions still prevail in the American situation owing to the uncertainty of the Government's attitude regarding the regulation of prices, current quotations continue to move to higher levels. The nearer approach to decisive action on the part of the authorities has resulted in a rather unsettled market, with activity on the wane. Canadian conditions are much the same, no quotations being available.

Steel

That the situation in steel is nearing a point where a better understanding will be marked between the producer and the consumer seems very apparent, as American developments seem to indicate that the marketing of steel will be placed on such a basis that much of the trafficking will in future be largely eliminated. The scramble for steel on the part of consumers has undoubtedly been one of the chief causes of the present high levels of steel prices, and if the sale and purchase of material is systematically controlled by the Government it may be the means of placing the market in such a position that much, if not all of the uncertainty, will be done away with. Prices are still in the ascendency, but there is the belief that with few excep-

tions the apex has been about reached.

Interest is still centred in the needs of the shipbuilding plants, and to fill the heavy demands for plates remains the unsolved question of the present abnormal situation. Forging billets have again been advanced, the current quotation at East Pittsburgh being $150 per ton, the price being $5 above that quoted last week. The week's advance on steel bars, New York, has been $20 per ton, the prevailing price this week being 5.669c per pound. Tank plates are again stronger, with quoted advances in some quarters; others are expected. The market in sheets, in common with that of other commodities, is strong, but unsettled, owing to pending developments. The United States requirements for steel supplies are being contracted for, with the price to be paid arranged at a later date; the prevailing tentative price to be readjusted following certain investigations into the cost of raw materials and production. The entire situation in respect to early future conditions would seem to hinge on the decision of the Government as to whether the cost to the domestic consumer shall be the same as that to the Government. Price lists on cold rolled shafting have been subjected to another readjustment, the discount being now only 5 per cent. off. Other commodities are practically unchanged, with prices very firm. Local conditions are much the same, with quotations steady; delivery has been relieved a little, but considerable difficulty is still experienced in obtaining material.

Metals

The influencing feature in the metal situation is the pending developments in the American Government policy in connection with the regulation of prices for the various war requirements; this condition is resulting in considerable uneasiness concerning the early future of these markets, and much anxiety is expressed by both producers and consumers as to the final attitude of the Government and its ultimate effect upon industrial conditions generally. The market has developed weakness followed by easier prices. Copper is quieter and lower. Tin remains inactive, and has declined slightly. Spelter has a weak undertone, but is at present quiet. Lead is wavering on possible developments. Antimony continues to weaken on poor demand. Aluminum is steady and firm.

Copper.—The statement that the American Government would pay 25c per pound for their copper requirements, pending a later price adjustment based on the actual cost of production, seemed for a time to clear the atmosphere regarding present conditions, but the report that this price may also apply to all consumers, Government and domestic alike, has created a condition that promises some very interesting developments unless further consideration is given to the matter. In the present state of the market, it is not anticipated that the Government will completely tie the hands of the producers in connection with the domestic demand. The effect of the uncertainty existent has been to develop a weakness that has been reflected in lower prices, the New York quotations having declined 1½c on lake, 2c on electro, and ½c on castings; the prevailing prices this week being 30c, 29½c and 28¾c respectively. On a quiet market local dealers have shaded prices 2c per pound, the current quotations being 35c for lake and electrolytic and 34c for castings.

Tin.—The regulations contemplated by the American Government to control the sale of war materials are not expected to have the same effect on the tin market owing to the fact that the source of supply is in foreign countries; to some extent, however, this metal will no doubt be influenced by the developments that are now pending. The New York market has experienced a fluctuating tendency during the past week, and is at present ½c lower than a week ago, the quotation being 62c per pound. The local market continues firm, but quotations show a decline of ½c on the week, the present price asked being 62½c per pound.

Spelter.—As an inducement for consumers to buy metal, concessions continue to feature the market. Should the regulations that are proposed by the American Government be delayed much longer it is anticipated that the market will become still weaker, as the uncertainty is so influencing the situation that early interest may be hard to revive. The absence of demand has again resulted in a slow market, and prices have consequently declined, the quotation of 8⅞c showing a decline of ¼c on the week Locally the price of spelter has declined 1c, the quotation being 11c per pound.

Lead.—Like other metals, lead has become quite stagnant on the United States market, as a result of the delayed action of the Government in connection with the regulation of prices. The possibility that a one price to all policy may be adopted by the authorities is causing considerable uneasiness, as this would undoubtedly mean a price much lower than that prevailing at the present time, the previous price paid for Government requirements being about 8c per pound. The outside quotation on the New York market is now on a par with the leading interests after the week's decline of ⅛c per pound, the general quotation being now 11c per pound. The local price is well maintained at 13¾c per pound.

Antimony.—This market, while quiet, is not as weak as price quotations would indicate, as these are largely an inducement to draw out buyers, the actual strength of the market being covered by the uncertainty of present conditions. The New York quotation of 16c shows a decline on the week of 1c per pound. The quieter market abroad has been reflected here by a falling off in price quoted, dealers asking 20c, a decline on the week of 4c per pound.

Machine Tools and Supplies

The increased activity in the States has stepped into the breech that was all too evident after the shell industry had attained its maximum in Canada, and at a time when the demand for equipment had fallen off considerably. The machine tool requirements in the States to-day reflect a similar condition to that prevailing in Canada during the first year of the war, with the possible exception that the producers are not so pressed for delivery owing to the large volume of machinery that is at present available, due to the decline in the manufacture of munitions for the British Government; America having completed her contracts in this connection. Owing to the condition of the general steel and iron market the prices on all kinds of machinery continues very firm or stronger, but early developments make the position very uncertain, as the projected regulation of prices may also affect machine tools. The demand for all classes of supplies is well maintained with quotations taking an upward trend.

Scrap

With few exceptions the market in old materials has become weaker and prices have shown a decline. This is largely due to the nervous state that prevails in the market over the pending American regulations covering transactions in sale and purchase of the various commodities. The eventual control of iron and steel must necessarily cover the scrap market, to avoid a very perpelxing situation in speculation enterprise. The American market generally has become weaker, coppers and brass being about ½c lower; with the exception of wrought iron, which is slightly stronger, the situation in scrap iron and steel is considerably easier, Pittsburgh quotations on hydraulic compressed and low phosphorus steel being about 4c lower on the week. The local market is unchanged, with iron scraps showing a weak undertone.

Toronto, Ont., July 17.— The announcement made recently that orders for blankets aggregating one million dollars had been placed among Canadian manufacturers by the American Government for army purposes is an interesting development in Canadian industrial circles, and may be the forerunner of further business.

Although there has been as yet no reduction in prices of soft coal in this district, it is possible that within the next week or so something will be done along this line. At the present time there does not appear to be much hope for lower prices on anthracite coal. The coal situation, although serious, may ultimately be less acute when relief measures have had time to become effective. There appears to be a shortage of coal at the mines, as well as insufficient transportation facilities.

Steel

The situation in the steel market is less tense following the agreement which has been reached between the American Government and the steel interests. It was announced that the entire output of the mills will be made available for the Government's war purposes at a price to be determined on the basis of a cost of production inquiry being conducted by the Federal Trade Commission. It is assumed that when prices are actually fixed that they will be considerably below the

market. It is also predicted that steel prices will decline for the private consumer as well as the Government. What will actually happen in regard to the private consumer is problematical, but in view of the urgent demand for steel and restriction in available supplies for the private consumer it is difficult to see how prices can decline to any great extent. The action of the Government will doubtless have the effect of curbing the upward movement in prices, and thus be a distinct benefit to the trade. While the Canadian steel companies are not directly affected by any action that the American Government may take, domestic consumers are in many cases vitally interested, and are naturally closely watching developments across the line. One thing is certain that there will be no relief in the shortage of steel, so in any event no real relief to the situation is anticipated. Prices of all steel products continue very firm, but there are no important price changes to note in the meantime except plates, which have advanced to $12.

Prices of sheets continue to advance, No. 28 gauge black being now quoted at $11 and No. 10, blue annealed, $11.50. The situation in sheets is getting tighter. There has been a large increase in direct Government orders, and also for making products for the Government. The distribution of sheets from the mills to domestic consumers is getting steadily less as the Government demands increase.

The situation in the steel trade in the United States has not as yet been affected by the Government agreement in regard to fixing prices, but the demand has declined pending further developments. Unfilled tonnages are decreasing principally because of the inability of the mills to accept orders that are offered.

Pig Iron

Prices of domestic foundry irons are still withdrawn, and there is no change in the situation. In the Buffalo market prices are very firm, with an advancing tendency. Developments, however, seem to indicate that prices of pig iron will eventually work to a lower level. Because of this prospect consumers are holding off. Very little tonnage of any grade is procurable from the furnaces in the Buffalo district for 1917 delivery.

Scrap

The market for old materials is dull, with prices generally showing a lower tendency. An exception, however, must be made in cast iron and steel scraps, which are holding firm.

Machine Tools

The chief feature in the machine tool market is the continued high cost of equipment of all kinds, due to the renewed activity in the United States. For the same reason deliveries are getting more backward. Business continues fairly good, the demand being chiefly for general engineering tools.

Supplies

Prices of machine shop supplies are still advancing, due to the high cost of raw materials. Some supplies, which have recently advanced, include Beaver stocks and dies, Gardner governors, Simplex jacks, file and hammer handles. Dry batteries have advanced approximately 10 per cent. All lines of Butterfield goods have advanced, including stocks and dies, die plates, pipe cutters, pipe taps, etc.

Metals

The dullness which has characterized the metal markets during the past few weeks is even more pronounced this week and prices of all metals have declined, with the exception of copper, which is unchanged. Copper, however, is weaker, and the tendency is for lower prices. Appearances seem to indicate that prices have reached the top, and that adjustments probably to lower levels are likely. Although the American Government has not issued any definite statement regarding prices, reports from Washington indicate that prices on Government purchases of metals will be considerably below the market, and also that prices to the private consumer will also be lower than obtain at present. On account of the uncertain situation the market is quiet and little activity is to be expected until the outlook clears.

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.

Copper.—Prices continue nominal and easy, while the market is dull and unsettled. The market has been depressed since the price of 25c was fixed on a purchase of copper by the American Government. It is now reported that a still lower price of probably 20c will be in future paid by the Government, and also that the price to private consumers will be at the same rate. This latest development has further upset the market. The strikes have caused a considerable reduction in output of copper, and unless they are settled now, a greater scarcity of metal than at present exists will result. Local quotations are unchanged, lake and electrolytic being quoted at 36c and castings at 35c per pound.

Tin.—The London tin market is weaker and prices lower, but New York has not followed the lead. The market, however, is uncertain, and very little business is passing at the present time. The position of tin continues to be a strong one, and no marked weakness is anticipated further than a decline of 1c locally. Tin is now quoted at 65c per pound.

Spelter.—The market is weaker and lower, the decline being due to lack of buying support. It is reported that at present prices some producers are losing money, and that some furnaces have been shut down, presumably for repairs. Spelter has declined ½c locally, and is now quoted at 11½c per pound.

Lead.—In keeping with the general position of all the metals, lead is quiet. Apart from requirements for munitions, there is little forward movement, and increasing production is not calculated to strengthen the situation. Lead has declined ½c, and is now quoted at 14c per pound.

Antimony.—Little interest is shown in antimony and lack of demand has resulted in lower prices. Local price is 26c per pound, representing a decline of 2c.

Aluminum.—The market is quiet and demand light. Aluminum has declined 3c, and is now quoted at 65c per pound.

New York, July 16.—Important developments have occurred in the steel industry during the last week, and all branches of manufacture dependent upon iron and steel have been affected. All collateral lines of trade reflect, or will reflect, the agreements, made at the Washington conferences, between Government officials and representatives of the Iron and Steel Institute. The latter were, and are, in a position to speak and to act in full measure for the entire industry. The administration gave assurance of reasonable prices, including a fair profit, to be paid to the steel manufacturers for all commodities by the Army and Navy Departments. The steel companies in turn placed the entire productive capacity of the country, at the disposal of the Government and confidently left the settlement of prices to the Administration, which is now endeavoring to ascertain productive cost of various commodities through the Federal Trade Commission.

Immediately following the happy outcome of the price controversy, came the interesting decision made by the United States Transportation Commission, to renew efforts to distribute orders for the construction of 80,000 steel cars and 2,000 locomotives among American manufacturers. The plan to build railroad equipment by the Government was recently held in abeyance because of a belief that steel would not be available in ample tonnage to build all steel cars; but it is now understood that the mills have given assurance that a full amount of steel will be provided to enable the Commission to carry out its original intention. It is estimated that 800,000 tons of steel will be required to build the cars and 400,000 tons of steel to construct the locomotives, included in the program. Deliveries of the steel probably will be made in monthly installments over a year.

Another and most important development was revealed by the startling announcement made by Major General Goethals, now in supreme command of the Government shipbuilding activities, that the United States Emergency Fleet Corporation will take bids to-day for the construction of two large shipbuilding plants, to be owned and operated by the Government, in which 400 fabricated steel ships of 2,500,000 tons displacement, will be constructed. It is estimated that the building of ship ways will require 12,000 tons of structural steel and that the plants will be ready for the erection of ships inside of four months. The 800,000 tons of steel shapes and plates required in building these cargo ships, will be fabricated by various commercial shops and delivery will be expedited because of this fact.

The latest development is the appropriation of $640,000,000 by the House of Representatives to build a gigantic air fleet and to train and equip an army of 75,000 aviators. The Government has also distributed numerous additional munition contracts and has given various orders for structural steel to be used in improvements at navy yards and arsenals, and to build storehouses, hangars and for a key bridge over the Potomac river.

All of these activities are reflected in the machine tool industry. Sixteen manufacturers with munition contracts have placed orders for machinery and negotiations continue actively on many more machine tools. Six more shipbuilding concerns also have placed orders for shop equipment and several large manufacturers of motors and engines for airplanes have closed contracts for machinery and buying continues apace.

Builders of machine tools having contracts to supply the United States Navy, either directly or indirectly, are required by the Compensation Board to give facts and figures to justify the high prices now prevailing for their products.

In the export trade for machine tools, the latest important feature is the resale of many tools originally sold to Russia. France and Great Britain have placed additional orders for lathes and drills and have put out new inquiries for portable electric tools.

Pittsburgh, Pa., July 14.—The pig iron and steel markets have become completely stagnant, the cause commonly assigned being the prospect that there will be regulation of prices, either voluntarily on the part of the producers or through direct action by the Government. A contributing cause, however, is undoubtedly the very high level to which prices have risen, a level that the average consumer cannot see his way clear to follow. In the case of pig iron, all descriptions except Southern iron at Birmingham are above $50 at furnace. If the furnaces have cleaned up their deliveries at $18, furnace, they have done so only lately. Certainly the average foundryman would have difficulty in adjusting the selling prices of his finished products so as to provide for a tripling in the cost of the pig iron. As to the steel works, they of course have high prices and can pay almost any price for pig iron if they need it.

In the case of the finished steel market, really forward buying many weeks ago dwindled to practically insignificant proportions. The forward market practically disappeared, the only market left being the prompt market, for delivery in say from two or six months. Prices in this market have been made by buyers who were exceptionally situated. Either they were making a product that would bring almost any price or they needed some little additional tonnage to average with much lower priced tonnage. Thus the quotable market, which is really a prompt market, has ascended until it averages about double the level at which the great bulk of the steel shipments are being made, under old contracts.

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.

Price Regulation

This subject takes a new aspect almost every day. To the "food bill" which is having such a tortuous course in the Senate, there was added an amendment giving the President power to regulate iron and steel prices as well as food prices. Within the past week a substitute bill has come to the front, with no price regulation except for food, and the prospect has been that this bill, rather than the other, would be the one that would eventually pass. Now a totally new turn has occurred. The general committee of the American Iron and Steel Institute, the chief body representing the steel makers in connection with sales of steel to the Government, was called to Washington for Wednesday, July 11. After they had been in session one day, the President issued a statement called an "appeal" that manufacturers forego unusual profits at this time, promising all manufacturers a fair profit, so as to maintain prosperity, and enunciating clearly the entirely new doctrine that prices to the Government and to the ordinary consumer be the same, intimating, perhaps, that the Government is as well able to pay as the private consumer, but laying stress upon the fact, which the iron and steel industry has been coming to realize of late, that it is impossible to draw a clear distinction, when we are endeavoring to prosecute the war with our full material resources, where Government purchases end and purely private purchases begin.

On the second day of the conference, after this proclamation had been issued, Secretary of War Baker made a public statement that an agreement had been reached as to Government purchases of steel, the Federal Trade Commission to determine costs, and prices to be fixed so that reasonable profit would be assured, asd attention given to the needs of the steel industry for expansion. As the President's "appeal" must have been intended quite largely to refer to iron and steel, the conclusion to be drawn is that prices to all buyers are to be scaled down very greatly from the present fictitious level. In view of the fact, however, that the aspect of affairs has been continually changing this conclusion may have to be modified or dropped entirely within a few days.

Unfilled Tonnage Decreases

The unfilled obligations of the United States Steel Corporation decreased 503,304 tons during June, to 11,383,287 tons, equal to about a nine months' run, provided the orders were equally distributed in the different departments, which is not the case. The decrease in June was equal to about 40 per cent. of the month's shipment, bookings of all descriptions being about 60 per cent. of shipments. These bookings were made up of Government orders and of special transactions with preferred customers, whose continued needs must be taken care of as old obligations are filled.

The Export Embargo

The export embargo proclaimed by the President to become effective July 15, includes in iron and steel commodities, coke, pig iron, billets, plates, and structural shapes. Licenses are to be granted by the Secretary of Commerce. To what extent such licenses will be granted remains to be seen. The object, of course, is primarily to prevent material reaching Germany but there is the further object of conserving supplies for the United States and its Allies. From one view point, Canada might be held to fall between, but there is no use speculating.

Pig Iron

There has been practically no change in pig iron prices for a fortnight, but the market has become stagnant. There is a little buying of odd lots for early deliveries and that is about all. Perhaps sellers would make price concessions if that were likely to result in sales but it is obvious that decline in the market would merely confirm the views of buyers that they had better stay out.

U. S. Steel Corporation Unfilled Tonnage.—The unfilled tonnage of the U. S. Steel Corporation on June 30, 1917, was 11,383,287 tons, a decrease of 503,304 tons, compared with the figures for May 31, according to the monthly report recently issued.

INDUSTRIAL AND CONSTRUCTION NEWS

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

ENGINEERING

Montreal, Que.—Mansions, Ltd., have obtained a permit to build a boiler room at Lincoln Avenue, to cost $4,000.

Oshawa, Ont.—The directors of the Canada Malleable & Steel Range Co. have decided to dispose of the plant.

Owen Sound, Ont.—Green & Woolrich have begun the construction of a new coal dock for the malleable iron plant. The new structure will be 80 ft. wide by 200 ft. long, and 200 piles will be driven.

Montreal, Que.—A permit has been taken out by the Frederick Thompson Co., electrical engineers, to erect a factory at 7-11 St. Genevieve Street. The building will be 60 x 104 feet, four storeys, and will cost $30,000.

Montreal, Que.—It is expected that the Montreal Tramways Co.'s new steam plant will be in operation within two weeks. This plant has a capacity of 12,000 k.w.h., or of about 17,000 h.p., developed from steam turbine, and a similar installation will be added next year, making a total of 34,000 h.p.

Hamilton, Ont.—The National Abrasive Co. will begin at once the erection of a factory and office building on Biggar Avenue, at an estimated cost of $16,700. The contract has been awarded to the Hamilton Bridge Works, and completion is expected before September. The company will manufacture artificial abrasive, principally polishing and grinding materials. The initial investment in the Hamilton plant will be about $75,000.

Amherst, N.S.—Fire in the International Engineering Works here on July 11, did damage estimated at between $75,000 and $100,000. The blaze developed in the pattern storage room and spread rapidly, completely destroying that building. Other buildings were threatened, but were saved. The origin of the outbreak is unknown. The destroyed building and its contents were partially insured.

GENERAL

Kitchener, Ont.—The W. E. Woelfle Shoe Co. are building an addition to their factory.

Montreal, Que.—The Dominion Oil Cloth Co. have got a permit to build a warehouse, 102 x 75, at 1,235 Notre Dame East, to cost $2,500.

Halifax, N.S.—J. E. Chipchase, the eastern manager for Hinde & Dauch Paper Co., of Canada, Ltd., manufacturers of corrugated and fibre containers, has been in the city for the past week interviewing the box users and gathering the box data, with the view to the further development of this industry in the Maritime Provinces.

Ingersoll, Ont.—The John Morrow Screw & Nut Co. is building an addition to its plant to cost $30,000.

Fergus, Ont.—John Watson will erect a sawmill to cost $10,000, to replace the one recently destroyed by fire. New machinery and equipment will be required.

Strathroy, Ont.—Fire, entailing an estimated loss of $175,000, totally destroyed the three-storey building and its contents of the Strathroy Canning Co. here on July 13. The company is a branch of the Dominion Canning Co., of Hamilton, Ont.

Nobleford, Sask.—A large number of grain elevators are to be erected this summer in the West, according to reports received. The McLaughlin Co. is projecting the erection of one at Nobleford, Sask. It will be the first one built by this concern in the West.

MUNICIPAL

Grandmere, Que.—The Town Council are considering extending the municipal pumping plant.

London, Ont.—Tenders will be called shortly for a motor-driven hose truck for the fire department.

London, Ont.—The Council have decided to purchase a booster pump, on the recommendation of Fire Chief Aitken.

Sarnia, Ont.—A by-law for $25,000 will shortly be submitted to the people for an incinerator plant. John A. Baird, City Engineer.

Verdun, Que.—The City Council have decided to proceed with the laying down of an underground conduit system, for which there is an authorized loan of $225,000.

Hamilton, Ont.—The City Council recently made an appropriation of $2,500 to aid the Engineering Department in the preparation of a report regarding the remodeling of the sewer and sewage disposal system.

Galt, Ont.—It is believed that there is considerable leakage in the water mains, and the Water Commission is considering the advisability of making a test to find the leaks. Dr. Radford, chairman of the commission, suggests buying a pitometer.

St. Catharines, Ont.—The Water and Light Committee have recommended the acceptance of the tender of the Jenckes Machine Co. for castings for the year 1917 at the following prices: Manhole tops, $20.75 each; gulley tops, $20.70 each; Tomlinson traps, $10.25 each.

Welland, Ont.—Tenders for street sprinklers have been received as follows:—Somerville & Son, Sawyer Massey sprinkler, flusher and oiler combined, $600; Studebaker sprinkler, $450; Austin sprinkler, $547; Tiffin sprinkler, $592. No award has yet been made.

Oshawa, Ont.—A by-law calling for construction of a $38,000 filtration plant, was carried here on Saturday by a vote of three to one. Work on construction of the plant will be started at once by the John ver Mehr Engineering Co., of Toronto.

Windsor, Ont.—This city will refuse to recognize an estimate of $40,300 as its share of the apportionment of the cost of the proposed sewer and water improvements submitted in a report by Maurice Knowles, engineer of the Essex Border Utilities Commission. At a recent meeting of the commission, Mayor Tuson declared the city will not sell its waterworks, but is ready to supply water at a reasonable rate.

Montreal, Que.—Only one tender—that of the Montreal, Light, Heat & Power Co., was received by the Board of Control for the civic power supply for lighting the streets and for operating the low level pumping station. The company offers to supply primary power for lighting purposes at $27.50 per h.p., and secondary power for lighting at $25.50 per h.p. per year. For the pumping station $26.50 is tendered for primary power and $24.50 is bid for secondary power.

Weston, Ont.—Plans and data for the reconstruction of the sedimentary basin and the laying of a new intake pipe, have been ordered by the Weston Water, Power & Light Commission, to be ready by July 24, so that tenders may be called for as soon as possible. This action was taken upon a special report submitted by Engineer E. A. James, of Toronto, in which he advised immediate adjustment of the water system, as the present equipment does not meet the growing demands of the town.

Swift Current, Sask.—At the City Council meeting held on July 3, on motion of Ald. West and Carter, the Mayor and Clerk were authorized to sign the contract with Theodore Kipp, of Oshawa, Ont., for the purchase of the Diesel oil engine that is to take the place of the present steam plant at one of the city's power stations. The engine is to cost $53,000, and the city will receive $45,000 for the old steam plant. It is expected that delivery will be made within a month of so, or as soon as the necessary money by-laws can be put through.

Swift Current, Sask.—Engineer Calder has recommended the immediate purchase of a 75 h.p., induction motor to be used as an auxiliary. This motor will be a necessary precaution in case of fire and will cost $1,175. He also recommended the purchase of repair parts for pumps, as well as calling for tenders for piping and specials and for the laying

Enlarged Canadian Trade Intelligence Service

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

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

CHILE — Valparaiso, British Consul General.

COLOMBIA — Bagota, British Consul General.

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

EGYPT — Alexandria, British Consul General.

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

INDIA—Calcutta, Director General of Commercial Intelligence.

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

MEXICO—Mexico, British Consul General.

NETHERLANDS—Amsterdam, British Consul.

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

PERU—Lima, British Vice-Consul.

PORTUGAL—Lisbon, British Consul.

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

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

SWEDEN—Stockholm, British Consul.

SWITZERLAND—Geneva, British Consul.

URUGUAY—Monte Video, British Vice-Consul.

VENEZUELA — Caracas, British Vice-Consul.

Canadian Commercial Intelligence Service

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

CANADIAN TRADE COMMISSIONERS.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CANADIAN COMMERCIAL AGENTS

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

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

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

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

CANADIAN HIGH COMMISSIONER'S OFFICE

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

of the concrete foundation for the new Diesel engine. These recommendations were all adopted.

Winnipeg, Man.—Rapid progress is being made with the construction of the big lock-joint aqueduct from Deacon to the Red River. The Lock Joint Pipe Co. acting as subcontractors for the Winnipeg Aqueduct Construction Co., have fully 20 per cent. of the pipe made and ready for laying. The only remaining contract to be let is that for the big syphon under the Red River and piping on to the McPhillips reservoir, but this, together with the projected reservoir on the site of the present Victoria Park, will, it is thought, not be commenced until the winter of 1918-1919.

ELECTRICAL

Beeton, Ont.—The Hydro Commission engineers estimate that it would cost $15,000 to install a transmission and lighting system in Beeton. A by-law will be submitted to the ratepayers.

Brantford, Ont.—Hydro-Electric service for the suburbs of Brantford Township has been approved, only 36 votes being cast in opposition, out of a total of 193. The by-law, authorizing the issue of debentures by the Township Council to finance the undertaking, received a majority of 158.

New Westminster, B.C.—Permission to run a power line from Third Avenue and Eleventh Street down Third Avenue and across to Poplar Island, to serve the shipbuilding plant of New Westminster Construction and Engineering Co., was granted to the Western Power Co. of Canada, by the City Council.

BUILDINGS

Toronto, Ont.—The Separate School Board have secured a permit to erect a two-storey brick school on the south side of Westminster avenue, at a cost of $21,500.

Toronto, Ont.—A building permit has been issued to the Dominion Bank for a new building to be erected at the corner of Yonge Street and St. Clair Avenue, to cost $35,000.

Montreal, Que.—A permit has been taken out by the Merchants' Bank of Canada to build a new bank building at the corner of Harvard and Sherbrooke streets, to cost $20,000.

Regina, Sask.—In response to the call for tenders for the children's home which is to be built at an approximate cost of $35,000, ten bids have been received by the architects, Storey & Van Egmond.

Toronto, Ont.—E. D. Norris, 97 Waverley road, has been granted a permit by the City Architect to erect a store and apartment building of concrete block construction at 2102 Queen street east, at an estimated cost of $25,000.

Toronto, Ont.—On the recommendation of the City Architect and Property Commissioner, it was decided to advise the Council to sanction the cancellation of the contract for the erection of a dormitory building at the Women's Industrial Farm, and that it be completed by the

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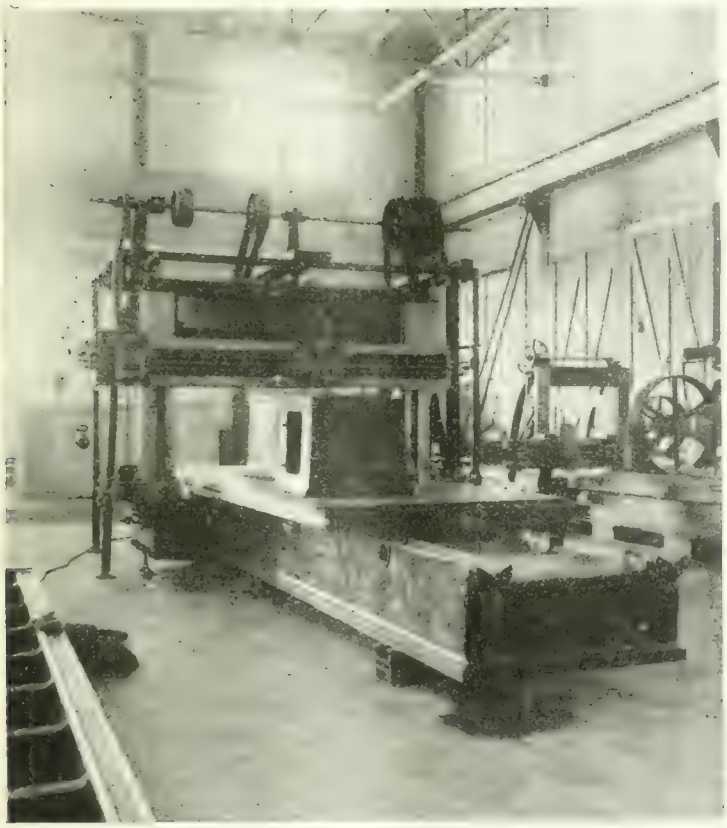


are guaranteed

If a remanufactured machine is not suited for your work, if it disappoints you in any way, send it back to us within 30 days from shipment, freight prepaid, and we will cheerfully refund your purchase price in full.

The Picture

at the left shows the bed of a large Horizontal Boring Machine being replaned. Every remanufactured machine is disassembled as completely as this machine has been, and the important surfaces and bearings tested with B. & S. precision instruments. If they are inaccurate for any reason, they are replaned, worn or broken parts are replaced where necessary, and the finished machines tested under belt for operation and accuracy.

Visit Our Re-Manufacturing Plant

This work is carried on daily by more than 50 experienced mechanics. The process is the result of 15 years' experience along these lines. We like to have you visit our plant whether immediately in the market for Machine Tools or not. At the same time you can see the following machines in stock for immediate or very prompt shipment.

HORIZONTAL BORING MACHINES.

1 Newark, 5" bar.
1 Betts, 2⅞" bar.
1 Bement, 2⅞" bar.
1 Beaman & Smith, 2¼" bar.
1 No. 4 Newton, 2-spindle
1 Beaman & Smith 2-Spindle Cylinder Borer.

MILLING MACHINES.

1 No. 3 Hendey.
1 No. 2 Cincinnati Universal.
1 No. 20 Oesterlein Universal.
1 No. 25 Becker
1 No. 5 Schuchardt & Schutte
1—No. 0-Y Brown & Sharpe.
1 60" x 54" x 8' Ingersoll
1 92" x 72" x 15' Beaman & Smith Slab.
1 No. 2 Beaman & Smith Horiz. and Vert.
1 Hilles & Jones Vertical

PLANERS.

1 32" x 32" x 10' Gray.
1 32" x 32" x 8' Gray
1 30" x 30" x 10 Powell.
1 26" x 26" x 6' American.
1 26" x 26" x 7' Gray.
1 24" x 24" x 6' Cincinnati.
1 24" x 24" x 6' Gray.
1—24" x 24" x 5' Gray.
1—24" x 24" x 4' Gray.
1 23" x 23" x 5' Flather.
1—22" x 22" x 6' American.

LARGE LATHES.

1—42" x 18' Draper.
1—30 x 16' Pittsburgh.
1—36" x 16' Springfield.
1 32" x 14' New Haven.
1—31" x 14' Pond.
1—31" x 12' Pond.
3 30" x 16' Lodge & Shipley.
4 28" x 14' Lodge & Shipley.
1 28" x 10' Pond.
28 26" x 12' Putnam.
1 26" x 12' Schumacher & Boye.
2 26" x 12' Wickes.
13 26" x 10' American.
1 26" x 10' Prentice.
1 24" x 14' Blaisdell.
1 24" x 12 Draper
1 24" x 10 New Haven.
16 24" x 10 Lodge & Shipley.
1 22" x 16' Flather
1 22" x 10' Schumacher & Boye.
1 22" x 10 Reed
20 22" x 10 Davis
8 22" x 8 Hamilton.
4 22" x 8 Davenport
1—22" x 8' Lodge & Shipley.

LARGE TURRET LATHES.

1 No. 3-A Warner & Swasey.
29 24" Gisholt.
52—21" Gisholt.

1—22" Libby.
1 No. 6 Bardons & Oliver.
3—2" Gridley.
1—2" x 26" Pratt & Whitney G. H.
1—3" x 36" Pratt & Whitney.
2 21¼" x 26" Greenlee.
2—2" x 24" J. & L., Gd. Hd.
2—2" x 24" J. & L., Cone Head.

RADIAL DRILLS.

3 5' Niles Semi-Universal.
1 4½' Niles Full Universal.
1 3½' Gang
1 3' Prentice.
1 3' Mueller.
1 2½' Dreses.
1—2½' Fosdick.
2 2½' Mueller

MISCELLANEOUS.

3 8" Nutter Barnes Cold Saws
2 72" Bickford Vertical Boring Mills
1 42" Betts Car Wheel Borer
1 84" Poole Vertical Boring Mill
3 No. 73½ Bliss Presses
1 No. 23½B Niagara Toggle Press.
1 36" Gleason Spur and Bevel Gear Former
1 1½" Morton Keyseater
1 10" Bement Slotter
2 No. 14 Brown & Sharpe Plain Grinder
1 Gleason Gear Planer, 84" bevel, 96" spur
1 48" Morton Draw-cut Shaper.

SEND FOR GREEN LIST AND PICTURE BOOK

HILL, CLARKE & CO. OF CHICAGO

625 WASHINGTON BLVD., CHICAGO, ILL.

city. The work should have been finished in December, but the contractors have been unable to obtain labor, and have been delayed by weather conditions.

TRADE GOSSIP

The Canadian Locomotive Works Co., of Kingston, Ont., has been given an order for six switch engines for the Toronto, Hamilton and Buffalo Railway. They are to be delivered some time next March and are to be used in the operation of the T. H. & B., at Bridgeburg.

No Embargo on Coal from U.S.—Fuel Controller Magrath has received a message from Washington stating that the United States authorities had issued instructions to all customs and other border officials to allow all coal shipments to pass freely. This means that there is to be no fuel embargo against Canada. Complete blanket license is granted.

Government Will Advertise in France.—In the Dominion Senate on July 10, a resolution offered by Senator Beaubien, urging the Government to advertise Canadian products in France by means of an exhibition train of sample goods for the purpose of obtaining for Canadian producers a larger share of the French market, especially at the cessation of hostilities, was adopted.

Montreal, Que.—A rich deposit of graphite has been discovered at St. Remi d'Amherst, about 50 miles from here. The results of the tests of the analysts and engineers to whom have been submitted samples of this graphite, have been remarkably favorable. One American milling firm declares that the sample they have analyzed shows a recovery of 47 per cent. graphite of a very high carbon content from the raw material.

New Fibre Containers.—Several canning companies that have used the new containers, which are a sort of fibre-ware which has been thoroughly treated with paraffin, are very pleased with the results. The containers are light in weight, and said to be absolutely sanitary, as they are germ and moisture proof. It is not proved yet whether they will stand long shipments and consequent knocks, but so far everyone seems satisfied.

U. S. Will Build 400 Steel Ships.—An agreement has been reached regarding the proposed shipbuilding programme. The plan as outlined in a communication by General Goethals to Chairman Denman, calls for the immediate construction of two Government shipbuilding plants to produce 400 fabricated steel ships of 2,500,000 tonnage; the commandeering of 1,500,000 tons of shipping now under construction for private account in American yards, and for another big appropriation for building ships.

The Power Plant Equipment Co., Toronto, has recently been reorganized and the scope of the concern's activities considerably extended. The manager, L. O. Smith, is well known to local engineers and has been in business for sometime under the above firm name. J. M. Prentiss who was for a number of years secretary of the Chartered Trust & Executor Co., has taken charge of the office and Thomas Henry, for many years chief engineer of the Interurban Electric Co., and later connected with the Toronto Electric Light Co., has charge of the electrical department.

Ontario Gold Output Increases.—It is estimated that the output of the Northern Ontario gold camps for the current year will reach $17,000,000. In 1916 the united output of the gold and silver mines of the province was $23,500,000, a sum which will be considerably surpassed this year. The gold for the year was valued at $10,000,000, and the silver at $13,500,000. In 1915, the figures were lower. In that twelve months the gold value was $8,501,391, and the silver value, $11,742,463, or a total of $20,243,854, the increase in 1916 over 1915 being thus about 16 per cent.

Canadian Railways Increasing Rates.—Canadian railways are increasing their class rates from points in Canada to points in the United States in line with the decision recently given at Washington by the Interstate Commerce Commission, on the application of the American companies for a 15 per cent. advance. There companies have been allowed something in the neighborhood of from 12 to 14 per cent., which will also apply to freight consigned to Canada, and in order to maintain the same relationship Canadian railways have advanced their international rates to the same extent. The new tariff will come into effect between July 16 and Aug. 1.

Increase in Loading Draft.—Increases in loading draft averaging from two to four inches are reported by the Lake Carriers' Association. The upbound draft for Lake St. Clair remains the same, while the downbound draft is increased two inches. There is an increase of four inches in downbound draft in the American and Canadian locks, and an increase in upbound draft at the American lock of one inch. The upbound draft recommended in the American lock is 20 feet 3 in. and in Lake St. Clair 20 feet 4 in. Downbound boats can load not to exceed 20 feet 6 in. for either the American or the Canadian lock.

Glycerine From Sugar.—Discovery in the U.S. Internal Revenue Division laboratory of a process for the manufacturing of glycerine from sugar was announced recently by the Treasury Department, Washington, D.C. Under the secret process evolved the cost of this substance, a heavy factor in the manufacturing of explosives, will be reduced to slightly more than one-fourth of its present cost. Glycerine is at present manufactured almost entirely from fats at a cost of ninety cents a pound, which is six times its cost of production before the war. Extraction of the product from sugar will ensure production, officials estimate, at 25 cents a pound or less.

Steel Co., of Canada Acquire Ore Lands.—The directors of the Steel Company of Canada, at a meeting held in Toronto recently, practically adopted a

new policy which is likely to have an important bearing on the future of the company. In co-operation with American interests, the directors propose to acquire certain ore and coal properties situated in an advantageous location in the eastern States, from which such of its supply as is necesary in the future will be drawn. Hitherto the company has not controlled its supply of raw material, although it has enjoyed the reputation in the steel trade of having the benefit of some exceptional contracts. It is understood that the plans of the company included the construction of a considerable plant for the production of coke. The Steel Company of Canada has been the only large domestic steel corporation without its own ore and coal reserves.

M. A. Hanna & Co., Cleveland, Ohio, have taken over the bulk of the Hill ore properties on the Minnesota ranges. Together with the recent leases to the Jones & Laughlin and Inland steel companies, this transaction practically removes the Hill interests from the ore market. They are said to retain only about 15 per cent. of their original holdings, this ore being largely low-grade. The Hanna company has been ore agent for the Hill interests for some time.

Trade When War Is Over.—A despatch from Ottawa states that Sir Frederic Nichols has secured the adoption by the Senate of a resolution declaring it expedient that the Senate "appoint a committee to enquire into and report upon the best method of conserving and increasing our domestic and overseas trade to the end that our present prosperity may not unduly suffer when the stimulus resulting from orders from munitions and other war supplies is removed."

Steel Co's. co-operate with U.S. Government.—Formal announcement was made at Washington by Secretary of War Baker, on July 12 that an agreement has been reached with representatives of the American Steel Industry in conference here, under which the entire product of the industry would be made available for the Government's war purposes at a price to be determined on the basis of a cost of production inquiry being conducted by the Federal Trade Commission. On their side the Government representatives assured the steel men that reasonable profits would be included in the price fixed and that provision also would be made to care for the expansion of the industry to meet new demands. The Government also assured the steel men that its war order would be distributed over the entire iron and steel producing capacity of the country leaving no single producer or group of producers to carry an unfair share of the war burden.

PERSONAL

C. W. Stokes has been appointed assistant general publicity agent for the C.P.R.

Clifford B. Langstroth, supervisor of the heat-treating drop-forge departments of the Ross Rifle Co., Quebec, has

been appointed metallurgist with the Link-Belt Co., Indianapolis.

J. White, of the ornamental iron department of Canadian Allis-Chalmers, Ltd., has been appointed general superintendent of the Canada Foundry Co.'s Davenport works, in place of J. J. Scollan, who recently resigned.

Frank H. Crockard, the new president and general manager of the Nova Scotia Steel & Coal Co., has arrived at New Glasgow, N.S. He recently attended a meeting of directors and was introduced to the heads of the various departments.

W. J. Amor, of Transcona, Man., has been appointed acting superintendent of the Canadian Government railway shops and yards at Transcona, filling the position made vacant by the death of J. L. Hodgson. Mr. Amor is a well known Transcona man and a former councillor.

H. E. Streeter, manager of the Montreal agency of the Swedish Gage Co., will in future also handle the following lines of percision tools and equipment:—universal angle plates, bench lathes, surface grinders, magneic chucks, adjustable reamers, scleroscopes, pyroscopes and Higley saws.

Cadet Claire A. Page, of the Royal Flying Corps, was accidentally killed on July 10, when his machine crashed down on a road near Ypres Junction, near Camp Borden, during an electric storm. Cadet Page belonged to Hamilton, where he was formerly sales manager of the Canadian Hart Wheels, Ltd.

H. P. McCue, general manager of transportation for the Pittsburg Coal Co., and vice-president of the Montour Railroad, has been appointed by the Canadian Government to fill the newly created position of assistant fuel director. In his new position Mr. McCue will be charged with responsibility of hurrying forward supplies of coal to Canada.

R. S. White, who a few months ago resigned his post as Collector of Customs of the Port of Montreal, after twenty-one years' services, was presented with $21,000 and an illuminated eddress by importers, manufacturers, merchants, and representatives of railway and steamship companies in Montreal, in appreciation and acknowledgment of his administration of the Customs service and courtesies during his tenure of office.

Geo. F. Sheppard, who has been manager of the Toronto office of the Canadian Hoskins, Ltd., Walkerville, Ont., has been transferred to the Montreal office, 31 Ottawa Bank Building. In addition to handling the business of the Canadian Hoskins, Ltd., he will have the Canadian agency for the Ideal Electric and Manufacturing Co., of Mansfield, Ohio; the Winfield Welding Machine Co., of Warren, Ohio; the Enterprise Electric Co. of Warren, Ohio, and the Claywood Electric Co., of Toronto, Ont.

E. F. Ashley Cooper, well known in Victoria, B.C., shipping circles, and for many years connected with the various steamers plying in the British Columbia coastal service, having served as purser aboard vessels of the C. P. R. and G. T. R. fleets, is now a lieutenant in the Royal Naval Volunteer Reserve. Mr. Cooper left Victoria last September to join the R.N.V.R. as a sub-lieutenant and the news of his promotion was received in the city recently. He is at present serving on H.M.S. Research.

Lieut. A. S. Bertram, who was reported wounded a few days ago, died of his wounds in a military hospital in London, according to information received on July 11, by his uncle, Brigadier-General Sir Alexander Bertram. Lieut. Bertram was the son of Henry Bertram, of the firm of John Bertram & Sons Co., of Dundas, Ont. He was a graduate of Queen's University, Kingston, in applied science, and after serving his apprenticeship with his father, entered the employ of the Dominion Bridge Co., in Montreal. Early in the war he joined the 58th Westmount Rifles, and later was given a commission in the 5th Pioneer Battalion. He, however, did not go to the front with that unit, being, instead, transferred to an infantry battalion on the firing line. Lieut. Bertram is the second member of the Bertram family to make the supreme sacrifice in the present war, a cousin of his, Capt. J. K. Bertram, who was for a time adjutant of the 20th Battalion, and later one of the officers of Major-General Garnet Hughes' staff, being killed in action. He was in his fourth year medicine at McGill University, prior to enlisting. Three other members of the Bertram family are still on the firing line.

TENDERS

Port Arthur, Ont.—The Canadian General Electric Company have secured the contract for the sub-station and electrical equipment for the plant of the Eastern Terminal Elevator, now being built at Current River, Port Arthur, for Jas. Richardson & Sons.

Lauzon, Que.—Tenders will be received until July 26 for the construction of a transmission pole line between the new and old dry docks at Lauzon, Que. 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 post office, Quebec, Que.

Winnipeg, Man.—Tenders addressed to the chairman, Board of Control, will be received up to July 27, 1917, for the supply and delivery f.o.b. Winnipeg, of 4,500 more or less, complete high voltage porcelain insulators. 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.—Tenders will be received addressed to the chairman, Board of Control, City Hall, up to July 31, for the complete construction and equipment of a single track extension to the Bloor Street Division of the Toronto Civic Railway. Specifications and forms of tender may be obtained upon application at Room No. 313, Department of Works, City Hall, on payment of ten dollars ($10), this sum to be refunded upon return of specifications, forms of tender, and plans.

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

CLASSIFIED ADVERTISING SECTION

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

FOR SALE

1 24" CONRADSON TURRET LATHE. APPLY McDougall-McIntyre Limited, Toronto, Ont. c3m

FOR SALE—THREE 24" x 12' C.M.C. DOUBLE back geared quick change gear engine lathes; never been used. McKinnon Dash Company, St. Catharines, Ont. c2m

FOR SALE 1 REED PRENTICE ROUGH Turning Lathes with cut-off attachments in first-class condition. These will make an excellent machine for 15 shells. The Hayes Wheel Co. of Canada, Ltd., Chatham, Ont. c5m

FOR SALE 10 PRACTICALLY NEW NO. 7-C Heavy Duty Racine Hack Saw Machines. Suitable for all cutting purposes. For further information and price address The Peck Rolling Mills, Limited, Montreal. c3m

ONE BRAND NEW 10 x 36 NORTON PLAIN grinding machine. This machine on our floor still crated, never been used. For price and further particulars address Windsor Machine & Tool Works, Windsor, Ontario. c5m

FOR SALE—2 36" HARRINGTON DRILLS, 3 No. 14 Colborn Standard Heavy Duty Drills, 1 Cincinnati 32" Drill, back-geared, sliding head, power and wheel feed. Anxious to dispose of these tools quickly. Wire or write if interested. Metal Drawing Co., Ltd., St. Catharines, Ont. c1m

1—ROBB HORIZONTAL STEAM ENGINE, 10 x 12, 35 h.p. Just overhauled by makers. Price $300.00. 1—Heavy Duty Rockford Drill. Suitable for shells or heavy work. Weight of drill 3,600 lbs. Good as new. Write for specification. 1—Jones & Lamson 2 x 24 Turret Lathe, 2¼" hole in spindle, 16" swing, cone drive, collet chucks for bars up to 2" diameter. Or lathe can be fitted with standard universal chuck. Flat turret 16" diameter. Good condition. Price $400.00. 1—Warner & Swasey Turret Lathe. Round turret, diameter 8", hand cross feed for turret. Swing 14". Fairly good condition. Price $200.00. 1—Bertram 2-spindle Thread Miller. Made by makers for threading 18-pdr. shells. Now used for threading sockets. Good condition. Steel Furnishing Co., Ltd., New Glasgow, Nova Scotia. c2m

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

BUSINESS CHANCES

SHELL PLANT FOR SALE COMPLETE plant installed since 1914, for the machining and assembling of 4.5 inch H.E. shells, situated at Dartmouth, Nova Scotia, on line of Intercolonial Railway, with siding running into the works. Will sell the equipment outright, with privilege of renting the building in event of the purchaser engaging in the same business. Starr Manufacturing Co., Limited, Dartmouth, Nova Scotia, Canada. c26m

FOR SALE—A MEDIUM-SIZED TWO-STOREY brick factory situated in the best small city in Ontario. Buildings in good condition, suitable for either metal or wood-working; shipping facilities unexcelled. Two trunk lines; direct connections east, west, north and south. Educational advantages the very best. Plant will be sold at a bargain and on easy terms of payment, if desired. Apply Box 294, Canadian Machinery. c2m

SPECIAL MACHINERY

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

WANTED TO BUY

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

FOR

IMMEDIATE DELIVERY

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

Pratt & Whitney Vertical Surface Grinder, 36" Table.

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

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

36 ft. Niles Plate Planer.

Lynd-Farquhar Co.

Boston, Massachusetts

SITUATIONS WANTED

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

MACHINE SHOP FOREMAN DESIRES change as shop foreman or master mechanic; acquainted with scientific management; 26 years' experience. Box 322, Canadian Machinery.

FOREMAN TOOL MAKER OPEN FOR ENgagement July 15th. Expert on gauges, jigs, dies and tool equipment, both for shells, fuses and interchangeable manufacturing; 15 years' experience. Apply to J. T. Jamieson, 2647 St. Urbain St., Montreal, Que. c2m

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

SITUATIONS VACANT

THOROUGHLY CAPABLE BRASS FOUNDRY Foreman to take charge of small foundry doing a general jobbing business and also munition work. Location Montreal. Address for information, "Brass Foreman," P.O. Box 1934, Montreal. c26m

WANTED—TWO EXPERIENCED BORING lathe hands to take charge on day and night shifts, of battery of boring lathes for 6" Mark III. shell. Only men who can get good bores and high production need apply. Give in the first instance, experience, wages required and full particulars, otherwise application will not be considered. Box 317, Canadian Machinery. c26m

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

TECHNICAL ADVERTISING MAN — LARGE manufacturing concern near Toronto, building a general line of heavy machinery, requires a young man to take care of its advertising; must be able to prepare machine descriptions from blue prints and to write clear, concise English; advertising experience desirable, but not necessary; please state age, nationality, experience and salary desired, and send samples of your work with first letter. Box 320, Canadian Machinery. c26m

FOR MILL MACHINE SHOP—A COMPETENT foreman with energy and resource, with some knowledge of French; also general machinists for small shop in a modern town with established manufacture. This is an opportunity for family man to locate to permanent benefit. William S. Nish, 53 Maple Avenue, Shawinigan Falls, Quebec. c3m

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

DOMINION MACHINERY CO. TORONTO

THE REAL GOODS

AT

RIGHT PRICES

MUST BE SOLD THIS WEEK

1—Warner & Swasey Turret Lathe, 2″ capacity through automatic chuck. Friction geared head, power feed, oil pan.

2—No. 2 Foster Turret Lathes. Automatic chuck, wire feed, 1 1/16 cap, oil pan.

In Splendid Condition.

DOMINION MACHINERY COMPANY

Office, 110 Church Street - Toronto, Ontario, Canada
Warehouse, 14 Darling Ave Phone Main 6519

Rebuilt Machines For Sale

PLANERS

1—Sellers 20x20x10′ with 2 heads.
5—Sellers 20x20x6′.
2—Sellers 30x30x8′.
1—Putnam 24x24x8′ 6″.
1 Putnam 30x30x10′.
1 Wheeler Heavy 30x30x8′ 6″.
1 Latrobe Morse 24x24x8′ 6″.
1 New Haven 24x24x8′.
1 Wood Light 30x30x8′.
1 Putnam 42x42x12′ 6″.

GRINDERS

1—LeBlond Universal Tool and Cutter, power feed, same as new.
1 Bridgeport Plain Grinder 8x30.
1—No. 1 Landis Universal Grinder.
1—No. 3 Landis Universal Grinder.
2—No. 6X Diamond Double Disc Grinders.
1 Ford Smith Plain Grinder.

AUTOMATICS

1—1″ National Acme Double Belt Type.
1 1¼″ National Acme Double Belt Type.
1—No. 35 National Acme.
1—1″ National Acme four spindle.
2—No. 5B National Acme four spindle.
1—¾″ Cleveland.
1—2¼″ Cleveland.
2—2¼″ Gridley Single Spindle Motors.
1—3¼″ Gridley Single Spindle Motor.

LATHES

1—32x12′ Draper Lathe, C.R., H.S.
1—36x22′ Fitchburg Lathe, C.R., P.C.F.
1—36x8′ Fitchburg, C.R., P.C.F.
1—18x8 Putnam, C.R., taper.
1—18x8 Porter, C.R., semi-quick taper.
1—18x8 Davis, C.R., pan, pump, taper.
1—18x8 Greaves-Klusman, C.R., pan, pump.
1—20x8 Perkins Plain Turning, pan, pump.
1—14x6 Porter, C.R.
1—20x8 LeBlonde, C.R.
1—18x8 Seneca Falls, C.R., pan.
1—20x8′ Perkins Lathes for last chuck, Fay & Scott Turrets.

MISCELLANEOUS

1—No. 3 Kempsmith Plain Miller same as new.
1—2″ Industrial Works Slotter.
1—24″ Avery Sliding Head Back Geared Drill.
3—Prentice 24″ Sliding Head Drills.
2—Industrial 40″ Drills.
1—Western Hydraulic Banding Machine.
1—Jenkes Band Turning Lathe, with 3″ Universal Chuck.
1—36″ Aurora Drill.
1—8″ Bement Travelling Head Shaper.
1—22″ Jones & Crank Shaper.
1—12″ Putnam Wheel Lathe, inside quartering.
1—Sellers Slab Miller 24x24x12′.
1—No. 2 Lee-Simplex Saw.
1—2x30 Cincinnati Gear Cutter.

This is only partial list—Send for full list

Simmons Machine Company, Inc.

NEW YORK, 1001 Singer Bldg., Telephone Cortlandt 6575
ALBANY, N. Y., 985 Broadway, Telephone 4876 Main

New York's Greatest Stock

(Partial List)

PUNCHES AND SHEARS

48″ SELLERS PUNCH, CAPACITY 6″ THROUGH 2″
General Engineering Co. Multiple Punch, gap type, punch any length plate, weight about 20,000 lbs.
Reade Multiple Punch, 15″ throat
Hetherington & Berner double geared Beam Punch, 17″ throat
Pels Beam Shear "T-40"
Alligator Shear, 15″ throat, capacity 1″ x 6″ flats
Kling Bros. Rotary Splitting Shear, capacity ⅝″ plate, any width, weight 13,000 lbs.
No. 17 Niagara Rotary Shear, circle cutting attachment
Perkins Model "M" Rotary Shear
Wm. Sellers double end Punch & Shear, 21″ throats, punch 1½″ through 1″, shear 1″ x 6″ flats
Bass double end Punch & Shear, 20″ throats, capacity 1¼″ through ¾″
No. 4 Industrial double end Punch and Shear, 20″ throats, punch 1″ through 1″
No. 4 Royersford Punch and Shear, 18″ throat, punch 1″ through ⅞″, shear 3″ x 8″ flats
McDougall double end Punch and Shear, 15″ throat, punch 1″ through ¾″
Hilles & Jones single end Punch and Shear, punch ¾″ through ⅝″, shear ⅜″ x 3½″ flats
Coping Machine, 3″ stroke, weight 10,000 lbs.

BENDING ROLLS

Ship Plate, 9′2″ between housings
Niles Plate, 8′6″ between housings, drop end housings
Niles double geared, drop end housing, 40½″ between housings

MILLING MACHINES

No. 4B Brown & Sharpe Plain, single pulley drive
No. 4 Brown & Sharpe Plain
No. 4 Cincinnati Plain, heavy duty, single pulley drive
No. 2 Hendey-Norton Universal
No. 2 Cincinnati Plain
No. 2 Cincinnati Universal
No. 1½ New American Improved Plain
No. 1 Kempsmith Plain
No. 1 Pratt & Whitney Plain
No. 3½ Garvin Plain, table 12″ x 36″
Beaman & Smith 2 spindle Vertical, table 24″ x 48″

BORING MILLS

Two 20″ Bullard Vertical Turret Lathes
Three 34″ Rogers Vertical, single turret head
Five 30″ Bullard Vertical, single turret head
Pratt & Whitney Horizontal, 2¼″ bar
48″ Niles Car Wheel
Underwood Automobile Cylinder, 3⅝″ bar

New York Machinery Exchange, Inc.

50 Church Street . . New York City

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

BORING MACHINES—VERTICAL.

1 30" Colburn, 1 turret head.
1 New 30" Gisholt, one turret head. Sept. delivery.
1 34"-42" New Colburn, one turret head. Aug. delivery.
1 34" Rogers, one turret head. Sept. delivery.
1 34" Gisholt, including motor.
2—36" N-B-P, one plain and one swivel head.
2 36" B & S., one turret head.
12 New 42" Putnam, 2 heads. Nov. delivery.
1—53" N-B-P, two swivel heads.
1 72" Niles, two swivel heads.
1 New Bickford. December delivery.

BORING MACHINES—HORIZONTAL.

1 Lucas, 2½" bar.
1—Hoefer Horizontal Driller and Borer with 1 11-16" spindle, vertical adjustment 40", horizontal adjustment 16", size of table 33" x 48".
No. 2—Rochester 3" bar power feed to table in all directions.
2-Spindle Beaman & Smith 3¼" bar, page 18-G of G-1907 Cat.

BULLDOZERS.

1 New No. 4 Garrison, same specification as No. 4 Williams & White.
1 No. 7 Ajax, 20" stroke.
1 No. 7 High-speed Ajax, 16" stroke.

COMPRESSORS—AIR.

1 8" x 8" Curtis belt-driven.
1 10" x 10" x 10" Single Cylinder Smith-Valle, steam driven.
1 10" x 12" Chicago Pneumatic belt driven.
1 10"-16½" x 13" Peerless, cross compound, steam driven.
1 22"-42" x 16" Ingersoll-Rand, motor driven.
1 Ingersoll-Sargent Duplex 8" x 14½" x 8".
1—Ingersoll-Sargent steam driven, 345 cu. ft.
1 Cincinnati cross compound, two-stage, 790 cu. ft.

CUTTING-OFF MACHINES.

2 No. 00 Brown & Sharpe.
1 2" capacity Warner & Swasey.
4 3¼" Hall.
10 4½" Williams.
3 4" Curtis & Curtis.

DRILLING MACHINES—RADIAL.

2 New No. 3 American plain core drive.
3 New 3' Americans, positive tapping attachment.
7 New 3' Prentice, July delivery.
1 New 3' Mueller, plain speed box drive.
1 New 3½' Mueller, cone drive, July delivery.
1 New 3½' Western Drill, 86" circle.
2 4' Mueller, plain, speed box drive.
1 3' Bickford gear drive.
1 5' Bickford, plain, speed box drive.
1 5' American, plain, motor drive.
5 5' spindle, arm does not raise and lower, hand feed.
1 5' Fosdick plain cone drive tapping attachment.
1 6' Baush plain cone driver.

DRILLING MACHINES—HEAVY DUTY.

3 No. 14 Colburn 24" swing, capacity 2" in solid steel.
2—D-3 Colburn plain table.
2—No. 26 Foote-Burt, 44" swing, 3½" capacity in solid steel.
1 No. 310 Barnes, single [illegible], late type.

DRILLING MACHINES—MULTIPLE SPINDLE.

1 No. 30C Barnes, 12-spindle, capacity 1½" holes, 30" circle.
No. 24 Barnes, 12 spindle.
1 Gardam, 12-spindle, capacity ¾" holes, 14" square.
1 14-spindle Baush, capacity ¾" holes, 9" circle.
No. 11, Pratt & Whitney, 3-spindle, cap. 10 spindles, ¾" cap.

GEAR CUTTING MACHINES.

1 New 6" Standard gear cutter, type.
1 12" G. & E. Gear Hobber.
1 12" Gleason Bevel Gear Planer.
1 16" Gleason Bevel Gear Planer.
1 16" Bugram Bevel Gear Generator.
1 20" Grant-Lees Gear Hobber.
1—No. 1 20" Schuchardt & Schutte Gear Hobber.
1 24" Fellows Gear Shaper.
1 22" x 8" G. & E. spur and bevel cutter.
1 24" x 8" G. & E. for spur and bevel.
1 26" x 10" Cincinnati, spur gears only.
1 New 30" Flather, spur gears only.
3 36" Fellows Gear Shapers.
1 50" x 11" G. & E., spur gears only.
1 No. 3 Brown & Sharpe Auto gear cutter, spur.

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

1 New Norton, No. 1.
1 New Wilmarth & Morman, style BX.
1 No. 1 Cincinnati.
1 New Walker No. 2, outfit K (capacity 9" x 26").
8 No. 190 Wells.

GRINDING MACHINES—CYLINDRICAL—PLAIN.

1—No. 11 (6 x 30") Brown & Sharpe.
1 6" x 48" Pratt & Whitney.
1 New No. 12 (8" x 26") Brown & Sharpe.
1 10" x 50" Norton.
1 New 10" x 72" Norton, plain.
1 No. 16 (10" x 72") Brown & Sharpe.
20 12" x 24" modern, self-contained.
6 12" x 36" Modern, self-contained, motor or belt driven.
6 12" x 48" Modern, self-contained, motor or belt driven.
1 16" x 66" Landis, with crank grinding 12 x 32 Landis, rebuilt.
1 18" x 96" Brown & Sharpe.
1 New 10" x 36" Landis, immediate.

GRINDING MACHINES—CYLINDRICAL—UNIVERSAL.

1—No. 1 Fraser, with surface grinding attachment.
1—No. 1½ (10" x 30") Landis.
1 No. 2½ (10" x 36") Bath.
1—New No. 3 Bath.
1 No. 2 New Walker, 9" x 26".
1 10" x 42" Modern.
1—No. 2 (12" x 30") Brown & Sharpe.
10 New No. 2 Morse, cap. 12 x 30", Universal. Dec. delivery.
1—No. 3 (12" x 40") Brown & Sharpe.
1 12" x 42" Landis.

GRINDING MACHINES—INTERNAL.

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

GRINDERS—CYLINDER.

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

GRINDERS—DISC.

1 No. 14 Besley.
1 New No. 17 Gardner (Pattern Makers).

GRINDING MACHINES—RING.

1—No. 200 Heald.
1—No. 210 Heald.

GRINDING MACHINES—EDGE.

1—No. 374 Safety Emery Wheel Co.

GRINDING MACHINES—SURFACE.

1—No. 1 Diamond, cap. 12" x 12" x 24", automatic.
4 New No. 2 Reid (same as B. & S.).
1—22" x 12" x 60" Springfield, planer type, automatic.
1 New No. 1 Wilmarth & Morman.

GRINDING MACHINES—DUPLEX.

1 No. 7 Bath, suitable for grinding cylinders, pistons, piston rings, etc., 16" feed, swivel table, water pump.

GRINDING MACHINES—FACE.

1—Diamond Face Grinder, 4' travel, 14" wheels.

HAMMERS—POWER—FORGING.

1 [illegible]-lb. Bradley Helve.
1—150-lb. Bradley Helve, upright.

HAMMERS—BOARD LIFT—DROP.

1 [illegible] Billmeyer & Spencer, 2,000-lb. Chambersburg.

HAMMERS—STEAM—FORGING.

1 New 600-lb. Bell.
1 New 2,000-lb. Bell, September delivery.

KEYSEATERS.

2 No. 0 Mitt & Merrill.
1 No. 2 Mitt & Merrill, motor driven.
1 [illegible] Cincinnati Keyseater Regular.

LATHES—ENGINE.

6 New 12" x 8' Shepard reverse head.
2 New 14" x 8' Shepard reverse head.
2 New 12" x 8' Shepard reverse head.
1 14" x 6' Bradford, taper attachment.
2 16" x 6' LeBlond, pat. lock nut change, taper attachment.
1 18" x 8' L. & S., geared head, taper.
1 20" x 9' Chard.
1 24" x 10' Kendy, quick change gear, 14" chuck.
1 New 19" x 8' LeBlond, heavy duty.
22 20" x 8' Lodge & Shipley, quick change gear.
7 New 20" x 8' American, heavy duty.
9 22" x 10' Putnam, oil pan, turret.
4—24" x 10' Reed.
2 24" x 12' S. & B.
1 24" x 14' Lodge & Shipley, patent head.
1 24" x 14' American, quick change.
6 New 26" x 12' Boye & Emmes.
1 26" x 24' New Haven.
1 New 28" x 12' Boye & Emmes.
1 28" x 18' S. & B.
6 New 30" x 14' Boye & Emmes.
3—New 32" x 12' Pittsburg pattern.
8 New 36" x 24' Putnam, triple geared.
1 48" x 19' Steptoe, single back gear.
1 36" x 15' Fifield, 36" x 16'.
1 24"-42" x 22' McCabe, double pinion.
1 48" x 27" 9' Betts, triple back gear.
1 60" x 27' Betts, triple back gear.
1—New 66" x 30' Putnam, Dec. delivery.
1 74" x 20' Fifield, triple geared.

LATHES — MANUFACTURING — NOT SCREW CUTTING.

13 No. 5X Reed-Prentice, semi-automatic.
14 Reed Prentice shell lathes for 4" or 18 lbs. American shells.
60 14" x 6' Reed stud and bolt.
3 16" x 8' Fairbanks-Morse, heavy duty.
70 New Simplex, 16" x 8'.
14 16" x 8" Simplex single pulley drive.
22 18" x 8' Battle Creek, heavy duty.
5 20" x 8' Merschon.
50—20" x 10' Hindman, high duty.
12 21" x 8' LeBlond, quick-change with attachment for grooving and facing both ends of shells with air cylinders and mandrels for 5" shells.

MILLING MACHINES—KNEE TYPE—UNIVERSAL.

2 New No. 1 Kempsmith.
1 No. 1½ Hendey-Norton.
1 No. 2 Kempsmith back geared.
1 No. 2 new Cincinnati.
3—No. 2½ LeBlond, Sept. delivery.
2 No. 3H LeBlond, Sept. delivery.
1 No. 3 Cincinnati, single pulley drive, high power, vertical attachment.
1—New No. 4 LeBlond Heavy Duty, immediate.

LATHES—TURRET.

5 2 x 24 Jones & Lamson.
5 3 x 36 Jones & Lamson.
18—6A Potter & Johnson.
2—21 Gisholt.

MILLING MACHINES—KNEE TYPE—PLAIN.

1 No. 0 Pratt & Whitney.
3 New No. 1 Rockford.
2 New No. 1 Kempsmith.
1 No. 1 American.
1 New No. 2 Rockford.
1 No. 3 LeBlond.
1 No. 3 Cincinnati.
1 No. 4 Garvin.

MILLING MACHINES—VERTICAL.

1 New No. 4B Becker.
No. 2 New Cincinnati.
2 No. 5 Becker.

MILLING MACHINES—PLANER TYPE.

1 No. 2 Beaman & Smith.
2 Universal rob miller, working surface of table 60" x 20".
1 No. 4 Beaman & Smith, vertical spindle, open side, working surface of table 120" x 24", recessed for boring or one side.

PLANERS.

1 24" x 24" x 6' Gray, one head on cross rail.
1 26" x 26" x 8' Gray, one head on cross rail.
1 30" x 30" x 8' Gale planer, one head.
1 30" x 30" x 8' Whitcomb, one head.
1 New 36" x 36" x 12' Power, high speed, one head.
1 36" x 36" x 12' New Haven, one head.
1 36" x 36" x 12' Sellers, four head.
1 36" x 36" x 12' Sellers, two head.
New 36" x 36" x 12' Woodward & Powell, two head, on cross rail, one side head. October delivery.
1 42" x 42" x 14' Sellers, four heads.
1 60" x 60" x 11' Niles, four heads.
1 42" x 16' Bliss & Philip, one head on cross rail, one side head.
1 42" x 42' Pond, two heads.
1 72" x 38" x 16' Sellers, one cut head, two side heads.

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

Oxy-Acetylene Welder at Wo k in Machine Shop

Oxy-Acetylene Welding Effects Important Savings

In practically every metal manufacturing industry, oxy-acetylene welding is providing better, neater appearing and more lasting joints than have been hitherto attainable by riveting, threading or other methods, and at the same time is lowering production costs. Operations on metal parts, large and small, are handled easily, quickly and economically by this process. Welded joints can be built up to give added strength if desired. The metal is left in satisfactory condition for subsequent machining. For repair work it more than pays its way—preventing costly delays and replacements—handling the jobs "right on the spot" with efficiency and dispatch.

If you are interested in making your plant more profitable — in reducing operating costs and effecting many economies in production—if you wish to make your product stronger, neater, better—investigate what Prest-O-Lite Welding will accomplish for you.

Prest-O-Lite Process

employs both gases (acetylene and oxygen) in portable cylinders. Prest-O-Lite Dissolved Acetylene (ready-made carbide gas) is backed by Prest-O-Lite Service, which insures prompt exchange of full cylinders for empty ones. Provides dry, purified gas, insuring better welds, quicker work and lower operating cost. Avoids the large initial outlay and heavy depreciation incurred in making crude acetylene in a carbide generator.

Apparatus consists of an equal pressure blow pipe, automatic regulators and gauges, and all necessary equipment.

Adaptable for oxy-acetylene cutting by the addition of special cutting blow pipe.

Thorough instructions are furnished free to every user of Prest-O-Lite Dissolved Acetylene. Any average workman who understands metals can learn the welding process quickly and easily.

Many savings and advantages are possible in **your** shop or factory. Where you now use rivets, bolts or threaded joints, investigation may show a real need for welding. Write for valuable illustrated literature and data on work others are doing by the Prest-O-Lite Welding Process. It may point out ways to solve **your** problems.

Address Dept. C-107.

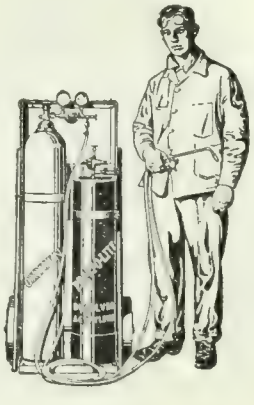
THE PREST-O-LITE COMPANY, Inc.

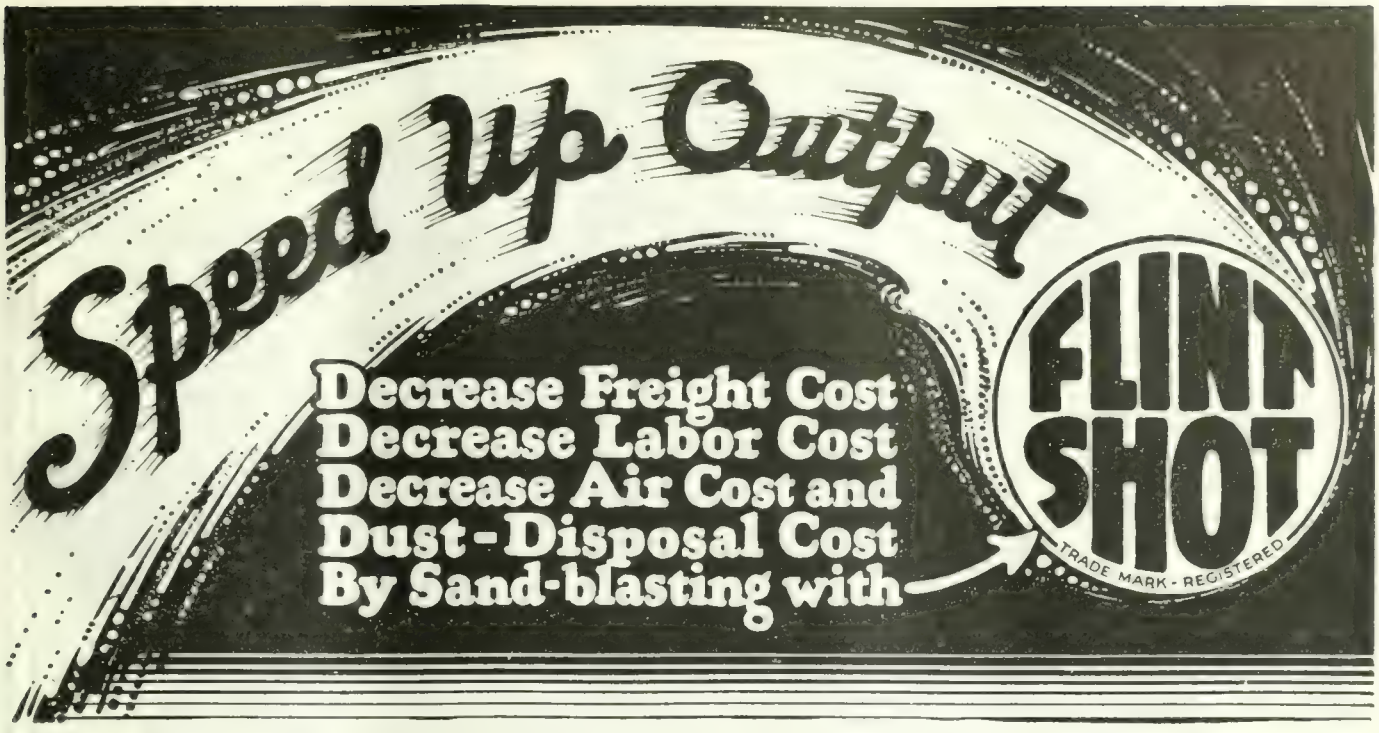
Canadian General Offices: 913-14 C.P.R. Building, Toronto

Direct Factory Branches:
Montreal, Toronto, Merriton, Winnipeg

Canadian Plants:

Toronto, Ontario
Merriton, Ontario
Winnipeg, Manitoba
Shawinigan Falls, P.Q.
(Under Construction)





Better Than Sand

Flint Shot is to a bank or ocean sand what a regiment is to a mob—it is an *organized* product of similar units, equal in size, texture, shape, hardness and in their resistence to splitting.

Sand is unorganized, unequal and therefore not uniform in the work done by the granule-impact.

As the foreman of the enameling department of the Chicago Hardware Foundry put it: "Flint Shot has more 'pep'—takes a better 'bite'—goes twice as far—makes a cleaner, evener surface."

Let us send you a bag or two for working test — free of charge, freight prepaid

Ask for our Flint Shot Book

U. S. SILICA COMPANY

430 Peoples Gas Building **Chicago, Illinois**

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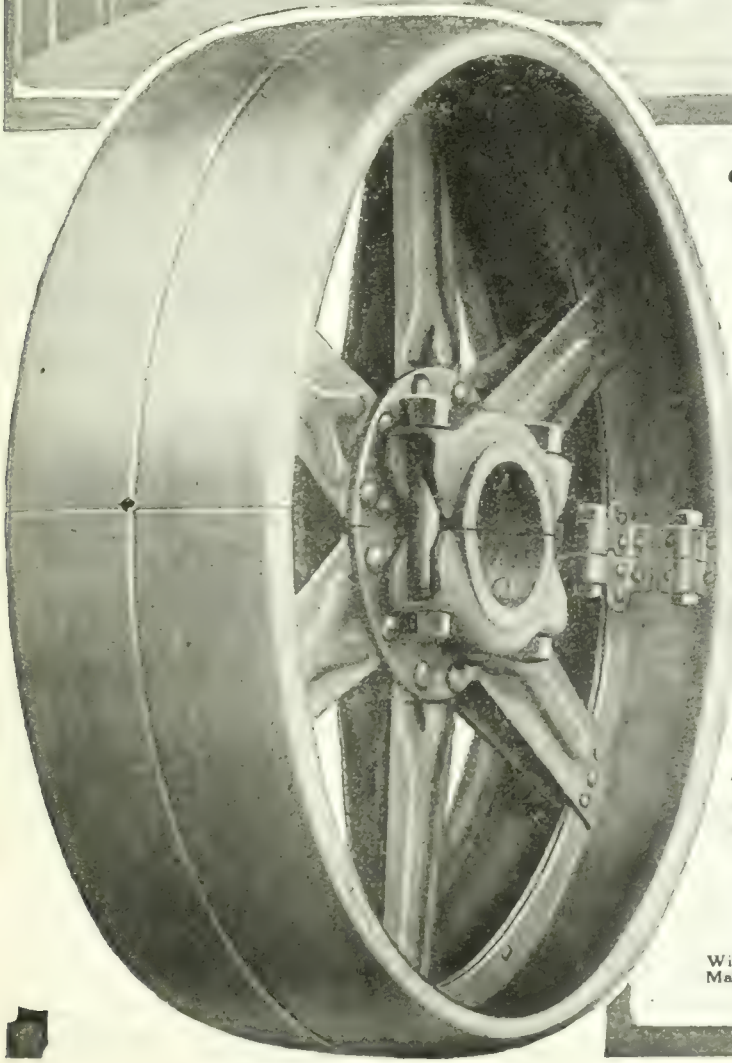

"We Must Stop These Pulley Losses"

Pulley breakdowns—men and machines idle—are all too frequent in some plants.

Belt slip and air resistance eat up power.

Not enough attention is paid to the selection of pulleys. Perhaps wood and iron pulleys are still being used. Their first cost may be low, but their last cost is far higher than

AMERICAN STEEL SPLIT PULLEYS

The flat V-braced arms of "American" Pulleys cut the air and save enormously on power.

Belt slip is reduced to a minimum.

"Americans" are guaranteed to perform double belt duty under all conditions not demanding a special pulley.

They are capable of enduring higher speeds than any other standard metal pulley.

FREE BOOK "Pulley Efficiency" sent on request. Full of money-saving pulley information.

THE AMERICAN PULLEY CO.
Philadelphia, Pa.

Canadian Distributors:

Williams & Wilson, Ltd., Montreal, Que. A. R. Williams Machinery Co., St. John, N.B.; Toronto, Ont.; Vancouver, B.C.; Winnipeg, Man. H. W. Petrie, Ltd., Toronto, Ont.

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HINTS TO BUYERS

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

Canadian Machinery BUYERS DIRECTORY

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

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

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

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

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

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

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

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

ALLOY, STEEL
Can. B. K. Morton, Toronto, Montreal.
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Hawkridge Bros. Co., Boston, Mass.
Michigan Steel Exchange, Inc., Detroit, Mich.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Standard Alloys Company, Pittsburgh, Ont.
Vanadium Alloys Steel Co., Pittsburg, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

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

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

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

AUTOMATIC WOOD SCREW MACHINES
Cook, Asa S., Hartford, Conn.

BABBITT METAL
Aikenhead Hardware Co., Toronto, Ont.
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Canadian Fairbanks-Morse Co., Montreal.
Canada Metal Co., Ltd., Toronto.
Can. B. K. Morton, Toronto, Montreal.
Foss & Hill Machy. Co., Montreal.
Hoyt Metal Co., Toronto.
Hungerford Brass & Copper Co., U. T., New York.
Jardine, Geo. A., Hamilton, Ont.
Magnolia Metal Co., Montreal.
H. W. Petrie, Toronto.
Tallman Brass & Metal Co., Hamilton.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal.
Can. S. K. F. Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto.
Lyman Tube & Supply Co., Montreal, Que.
R. E. T. Pringle, Ltd., Toronto, Ont.

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

BASE FACING MACHINES
Rollins Engine Works, Nashua, N.H.
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
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Monarch Brass Mfg. Co., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Webber Bros. Mach. Co., Toronto, Ont.

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

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

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

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

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

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

BELTING, LEATHER
Canadian Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Montreal, Que.
Dominion Machinery Co., Toronto.
Graton & Knight Mfg. Co., Worcester, Mass.
Goodyear Tire & Rubber Co., Toronto, Ont.
McLaren, J. C., Belting Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
H. W. Petrie, Ltd., Montreal.
Standard Machy. & Supplies, Ltd., Montreal, Que.

BELTING, STITCHED COTTON DUCK
Baxter Co., Ltd., J. R., Montreal, Que.
Bennett, W. P., 51 Montford St., Montreal, Que.
Dominion Belting Co., Hamilton, Ont.
H. W. Petrie, Ltd., Montreal.
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BENCH LEGS, STEEL
New Britain Mach. Co., New Britain, Conn.

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

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

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

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MacKinnon, Holmes Co., Sherbrooke.
Toronto Iron Works, Ltd., Toronto, Ont.

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

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

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Montreal, Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.

BLUE PRINTING MACHINERY
Mellmar Patent Tool Co., Syracuse, N.Y.

BOARTZ
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Geo. A. Jarvis Co., Ltd., New York, N.Y.

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MacKinnon, Holmes Co., Sherbrooke.
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Riverside Machinery Depot, Detroit, Mich.
Wickes Bros., Saginaw, Mich.

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

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

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Garlock-Walker Machinery Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
A. R. Williams Machinery Co., Toronto.

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Garlock Walker Machinery Co., Toronto, Ont.
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H. W. Petrie, Toronto.
Stow Mfg. Co., Binghampton, N.Y.

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

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

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

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

BRAKES
Brown Boggs & Co., Hamilton, Can.
Steel Bending Brake Wks., Ltd., Chatham, Ont.

BRASS AND COPPER BARS, RODS AND SHEETS
Brown's Copper & Brass Rolling Mills, New Toronto.
Hungerford Brass & Copper Co., U. T., New York.

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

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

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Brown's Copper & Brass Rolling Mills, New Toronto.
Hungerford Brass & Copper Co., U. T., New York.

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Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

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

BUCKETS, CLAM SHELL, CRAB, DUMP
Northern Crane Works Ltd., Walkerville, Ont
Whiting Foundry Equipment Co., Harvey, Ill
BUCKETS, ELEVATING AND HOISTING
[illegible] Brown J., Toronto
BULLDOZERS
John Bertram & Sons Co., Dundas
F. W. [illegible] Brockville, N.Y.
Canada Machinery Corp., Galt, Ont.
BURNERS, OIL AND NATURAL GAS
[illegible] Mich
Gen. M. & W. [illegible]
Northern Crane Works Ltd., Walkerville, Ont
Owen Equipment & Mfg. Co., New Haven, Conn.
BURRING REAMERS
Wells Bros. Co., of Canada, Galt, Ont.
BURRS, IRON AND COPPER
Hungerford Brass & Copper Co., New York, N.Y.
Parmenter & Heinrich Co., Granby, Que.
BUTTERISERS
Wells Bros. Co. of Canada, Galt, Ont.
CANNERS' MACHINERY
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
[illegible] Toronto, Ont.
CARS, INDUSTRIAL
Corbet Fdry & Mach. Co., Ltd., Owen Sound, Ont.
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
Dilion 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.
Hungerford Brass & Copper Co., New York, N.Y.
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, Quebec.
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 Machy. 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 Machinery Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
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.
Hyde Engineering Works, Montreal.
CHUCKS, AIR
Manufacturers Equipment Co., Chicago, Ill.
CHUCKS, COLLET
Hannifin Mfg. Co., Chicago, Ill.
CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
John Bertram & Sons Co., Dundas, Ont.
Can. Blower & Forge Co., Kitchener, Canada.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Hannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford.
Manufacturers Equipment Co., Chicago, Ill.
Millers Falls Co., Millers Falls, Mass.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Richmond Mfg. Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Skinner Chuck Co., New Britain, Conn.
Thomas Elevator Co., Chicago, Ill.
D. E. Whiton Machine Co., New London, Conn.
CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont.
Corbet Fdry & Mach. Co., Ltd., Owen Sound, 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, Que.
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.
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
Hannifin Mfg. Co., Chicago, Ill.
Hardinge Bros., Inc., Chicago, Ill.
Hyde Engineering Works, Montreal.
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 Cos., Rochester, N.Y.
CONDENSER TUBES AND FERRULES, BRASS
Hungerford Brass & Copper Co., New York, 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 Cos., 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.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
COUNTERSHAFTS
Raird 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, Walkerville.
CRANES, GANTRY
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
CRANES, GOLIATH AND PNEUMATIC
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.
CUPOLAS
Can. Blower & Forge Co., Kitchener, Ont.
Northern Crane Works, Walkerville.
H. W. Petrie, Toronto.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
CUPOLA BLAST GAUGES & BLOWERS
Sheldons, Ltd., Galt, Ont.
CUTTER GRINDERS AND ATTACHMENTS
Cincinnati Milling Machine Co., Cincinnati.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Monarch Brass Mfg. Co., Toronto, Ont.
Norton Grinding Co., Worcester, Mass.
H. W. Petrie, Ltd., Montreal.
CUTTERS, FLUE
Cleveland Pneumatic Tool Co. of Canada, Toronto.
CUTTERS, PIPE (SEE PIPE CUTTERS)
CUTTERS, MILLING
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
Can. Economic Lubricant Co., Montreal.
Cataract Refining & Mfg. 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.
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 Machy. & Supplies, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.
CYLINDERS, AIR
Manufacturers Equip. 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 Truing 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, Que.
Wells Brothers of Canada, Galt, Ont.
DIES FOR BIT BRACE USE
Wells Brothers of Canada, Galt, Ont.
DIES, NOSING
Marsh & Henthorn, Ltd., Belleville, Ont.
DIES, PIPE-THREADING
Ideal Tool & Mfg. Co., Beaver Falls, Pa.
DIE SINKERS
Cook, Asa S., Co., Hartford, Conn.
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 E. Pond Eng. Works, Chicago.

DIES, SELF-OPENING
Eastern Machine Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven.
Ideal Tool & Mfg. Co., Beaver Falls, Pa.
[illegible] Co., Waynesboro, Pa.
[illegible] Co., Erie, Pa.
[illegible] & 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. [illegible] Co., Brooklyn, N.Y.
[illegible] Canada.
Wood, [illegible] Co., Toronto, Ont.

DISCS, LEATHER
[illegible] & Knox Mfg. Co., Worcester, Mass.

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

DRAFT, MECHANICAL
W. H. Lambe & Sons, Toronto.
Lamontagne & Co., Ross Island, Que.
Can. Blower & Forge Co., Kitchener, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.

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

DRESSERS, GRINDING AND EMERY WHEEL
Can. Diamond Stephan Mfg. Co., Hamilton, Ont.
[illegible] Machine Co., Hamilton, Ont.

DRILL HEADS, ADJUSTABLE, TWO SPINDLE
[illegible] Mfg. Co., Detroit, Mich.

DRILL PRESSES
Adams, O. R. and St. Paul St., Rochester, N.Y.
Arcana 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, Que.
United States Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, BENCH
Baker 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.
Snow 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.
D. Maxwell 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
Arcana 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 Electrical Tool Co., Cincinnati, Ohio.
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.
Clark Equipment Co., Buchanan, Mich.
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 Machy. 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
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.

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.
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.
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, 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
Pure Sanitary Drinking 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, Canada.
Sheldons, Ltd., 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.
H. W. Petrie, Toronto.
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.
Petrie of Montreal, Ltd., H. W., Montreal, Que
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
Hungerford Brass & Copper Co., U. T., New York.
Parmenter & Bulloch Co., Gananoque, Ont.

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

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

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Canada
R. E. T. Pringle, Ltd., Toronto, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton

FAUCETS
Pure Sanitary Drinking 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
[illegible]
FIRST AID CABINETS
[illegible]
FISH PLATES
Can. Steel Foundries Ltd., Montreal, Que
FIXTURES
Geometrical Tool Co., Chicago, Ill.
Monarch Brass Mfg. Co., Toronto Ont.
[illegible]
FLEXIBLE SHAFTS
R. E. T. Pringle, Ltd., Toronto, Ont.
Stow Mfg. Co., Binghamton, N.Y.
FLINT SHOT
U.S. Sales Co., Chicago, Ill.
FORGES, HAND, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Canada
Stephens, Ltd., Galt, Ont.
FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE
Bliss, E. W., Co., Brooklyn, N.Y.
Can. Billings & Spencer, Ltd., Welland, Ont.
Cumming & Son, J. W., New Glasgow, Canada
Dom. Forge & Stpg. Co., Walkerville, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont
J. H. Williams & Co., Brooklyn, N.Y.
FORGING HAMMERS, BELT-DRIVEN
Bliss, E. W., Co., Brooklyn, N.Y.
J. H. Williams & Co., Brooklyn, N.Y.
FORGING HAMMERS, STEAM OR AIR
Erie Foundry Co., Erie, Pa.
FORGING MACHINERY
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Erie Foundry Co., Erie, Pa.
Garlock Walker Machinery Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Petrie of Montreal, Ltd., H. W., Montreal, Que.
H. W. Petrie, Toronto.
FUEL OIL SYSTEMS
Gilbert & Barker Mfg. Co. Springfield, Mass.
FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.
FURNACES, ANNEALING, ETC.
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Montreal Engineering Co., Montreal.
Rockwell Co., W. S., New York, N.Y.
Thos. Jones & Co., Leesdale, 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
Can. Hoskins, Ltd., Walkerville, Ont.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Thos. Jones & Co., Leesdale, 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.
GASKETS, COPPER
Hungerford Brass & Copper Co., New York, N.Y.
GAS BLOWERS AND EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Stephens, Limited, Galt
GAUGES, MERCURY COLUMN, DRAFT
Charles F. Elmes Eng. Works, Chicago.
GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.
GAUGES, STANDARD
Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Goodell-Pratt Co., Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Pratt & Whitney Co., Hartford, Conn.
Sheldon, Avram & Sheldon, Inc., New York
Swedish Gage Co., Montreal, Que.
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.
Lyman Tube & Supply Co., 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. Wilson 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.
Hall 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.
Stuttevant Co., B. F., Galt, Ont.
A. R. Williams Machy. Co., Toronto.
GLASSES, SAFETY
Strang, 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.
Strong, Kennard & Nutt Co., Cleveland, Ohio.
GLOVES, STEEL GRIP
Hickory Steel Grip Glove Co., Chicago, Ill.
GLOVES, 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.
Sloeum, Avram & Sloeum, Inc., New York
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, 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, PRECISION
Sloeum, Avram & Sloeum, Inc., New York.
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.
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, 523 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. Hart Wheels, Ltd., Hamilton Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Carborundum Co., Niagara Falls.
Dominion Abrasive Wheel Co., New Toronto, Ont.
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.
Goodell-Pratt, Greenfield, Mass.
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.
Goodell-Pratt, Greenfield, Mass.
Millers Falls Co., Millers Falls, Mass.
HAMMERS, AIR
Erie Foundry Co., Erie, Pa.
HAMMERS, COPPER
Hungerford Brass & Copper Co., New York, N.Y.
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.

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

HAMMERS, MOTOR-DRIVEN
[illegible] Ont.

HAMMERS, NAIL MACHINES
[illegible]

HAMMERS, STEAM
[illegible]

HAND LEATHERS OR PADS
[illegible]

HANGERS, SHAFT
[illegible]

HARDENING AND TEMPERING
[illegible]

HARDNESS TESTING INSTRUMENTS
[illegible]

HEATERS AND PURIFIERS
[illegible]

HEATING AND VENTILATING ENGINEERS
[illegible]

HEAT GAUGES, HARDENING AND ANNEALING
[illegible]

HIGH SPEED TOOL METAL
[illegible]

HINGE MACHINERY
[illegible]

HINGES
[illegible]

HOBS
[illegible]

HOISTING AND CONVEYING MACHINERY
Can. Matthews Gravity Carrier Co., Toronto, Ont.
[illegible]
Northern Crane Works, Walkerville, Ont.
[illegible]
Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS, CHAIN, ELECTRIC 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.

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.
Wright Mfg. Co., Lisbon, Ohio.

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

HOPPERS
The 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.
Goodell Pratt Greenfield, Mass.
L. S. Starrett Co., Athol, Mass.

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

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

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

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

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

JACKS, PNEUMATIC
Northern Crane Works Walkerville.

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

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

JIGS, TOOLS, ETC.
Goddard Tool Co., Chicago, Ill.
Horner & Wilson, Hamilton, Ont.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Toronto Tool Co., Toronto, Ont.
[illegible]

KEY SEATERS
Garlock Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich.
National Mach. Tool Co., Cincinnati, Ohio
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 POINTED
National Machy. Co., Tiffin, Ohio.

LATHES, BENCH
H. E. Strecker, 335 New Birks Bldg., Montreal Que.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio
Hyde Engineering Works, Montreal.

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., Brighton, 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.
Adams, O. R., 159 St. Paul St. Rochester, N.Y.
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 Machy Co., Toronto, Ont
Garvin Machine Co., New York.
Hamilton Mach. Tool Co., Hamilton, Ohio.
Hendey Machine Co. Torrington, Conn.
Himoff Machine Co. New York.
Houston, Stanwood & Gamble Co., Cincinnati, O.
Hyde Engineering Works, Montreal.
McCabe J. J. New York, N.Y.
R. McDougall Co. Galt.
Niles Bement Pond Co., New York
Oliver Machinery Co., Grand Rapids, Mich
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.
Wickes Bros., Saginaw, Mich.
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.
Jenckes Mach. Co., 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, Que.
Garlock Walker Machinery Co., Toronto, Ont.
Gray Mfg. & Mach. Co., Toronto, Ont.
Hepburn, John T., Ltd., Toronto.
Himoff Machine Co., Inc., New York N.Y.
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
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Dominion Machinery Co., Toronto.
Foss & Hill Machy. Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto Ont
Hardinge Bros., Inc., Chicago, Ill.
Hepburn, John T., Ltd., Toronto, Ont.
McCabe J. J., New York, N.Y
Niles-Bement-Pond Co. New York.
H. W. Petrie Toronto.
Rivett Lathe & Grinder Co., Boston Mass.
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Cumming & Son, J. W., New Glasgow, Canada.
Niles-Bement-Pond Co., New York.

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

RAILING, BRASS
Hungerford Brass & Copper Co., New York, N.Y.

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, 523 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.
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. B. 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.
Cook, Asa S., Co., Hartford, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
National Machinery Co., Tiffin, O.
H. W. Petrie, Ltd., Montreal.

RIVETS, TUBULAR, BIFURCATED
Hungerford Brass & Copper Co., U. T., New York.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

RIVETS, IRON, COPPER AND BRASS
Aikenhead Hardware Co., Toronto, Ont.
Hungerford Brass & Copper Co., U. T., New York.
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.
Hungerford Brass & Copper Co., U. T., New York.
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.

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

SANDING MACHINES
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

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, 523 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
Adams, O. R., 159 St. Paul St. Rochester, N.Y.
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
Cook, Asa S., Co., Hartford, Conn.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.

SECOND-HAND MACHINERY
Bath & Co., Cyril J., Cleveland, Ohio.
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.
Stucki Rundy-Wachs, Chicago, Ill.

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

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

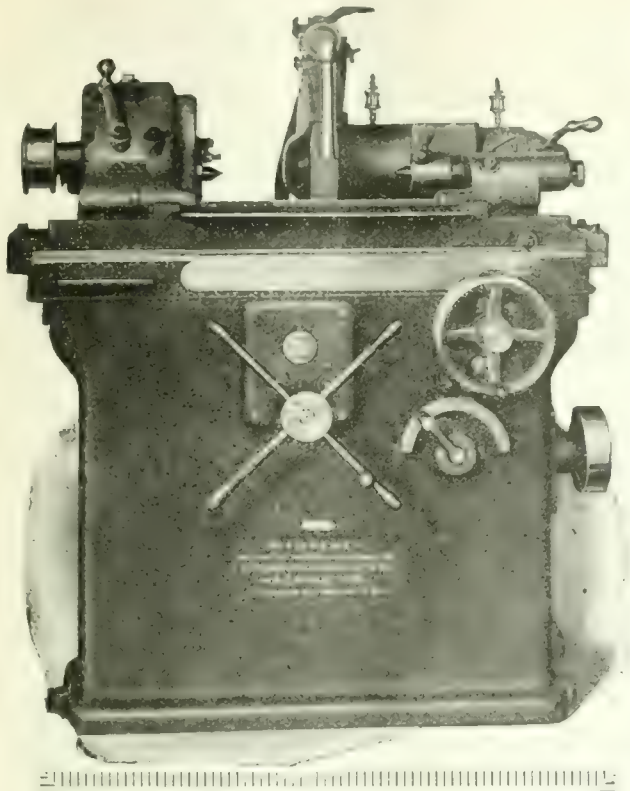
SHAPERS
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton, Ohio.
Petrie of Montreal, Ltd., H. W., Montreal,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

SHAFTING
Can. Bond Hanger & 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.



Fitchburg Grinders

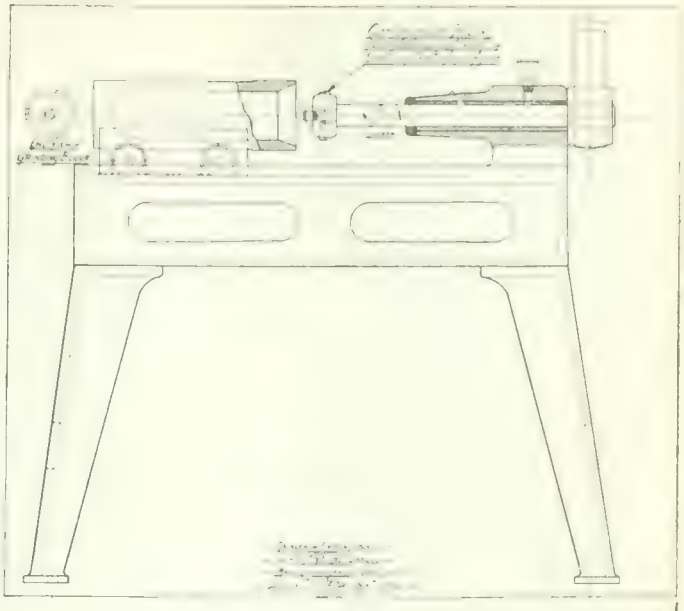
Model "A" illustrated here is a machine whose chief feature is its capacity for size, variety and quality of work. Its speed will give you greater production; its size, convenience, increased production, strength and saving in floor space will effect such a saving as to make it preferable over all other machines of similar character.

It is specially adapted for grinding straight or taper shafts.

An inquiry would speedily get you valuable information and data.

Fitchburg Grinding Machine COMPANY

Fitchburg, Mass. U.S.A.



Smooth Bores

We have designed for our own use a simple and inexpensive grinder to give the final touch to the bore of our shells.

It does the work, and we will have some of these machines on the market shortly.

Write us for our proposition.

Marsh & Henthorn Limited

BELLEVILLE, ONTARIO

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
Toronto Machine & Tool Co., Toledo.

SPEAKS, TOWER
Joseph Bertram & Sons Co., Dundas.
Ross E. W. Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
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.

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 Lawless Mach. Co., Ltd., Sherbrooke, Que.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, 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.

SHELL WASHER
Can. Equipment Lubricant Co., Montreal, Que.

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
Stone, Kennard & Nott Co., Cleveland, Ohio.

SILVER SOLDER
Hungerford Brass & Copper Co., U. T., New York.
Geo. H. Lees & Co., Hamilton, Ont.

SKATE SHARPENERS
Can. Bear. Hanger & Cutg. Co., Alexandria, Ont.

SLEDGES
Architectural 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.
Rivett Mfg. Co., Hartford, Conn.

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

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
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.

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

SOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Hungerford Brass & Copper Co., U. T., New York
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.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
Garvin Machine Co., New York.
Gisholt Machine Co., New York, N.Y.
Gosney & Edlund, Inc., Courtland, N.Y.
Grant Mfg. & Machy. Co., Bridgeport, Conn.
John H. Hall & Sons, Brantford.
Gray Mfg. & Mach. Co., Toronto, Ont.
Hendey Machine Co., New York, N.Y.
Hyde Engineering Works, Montreal, Que.
Jardine, A. B. & Co., Hespeler.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacLean & Son, F. W., Niagara Falls, Ont.
National-Acme Co., Cleveland, Ohio.
D. McKenzie Machinery Co., Guelph, Ont.
Mollmer & Enlund Tool Co., Syracuse, N.Y.
Peter O Lite Co., Inc., Toronto, Ont.
Rivett Mfg. Co., Hartford, Conn.
Riverside Machinery Depot, Detroit, Mich.
Smart-Turner Machine Co., Hamilton, Ont.
T. C. M. Mfg. Co., Harrison, N.J.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

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

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

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

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

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

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

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

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

STAMPINGS
Dillon Mfg. Co., Oshawa, Ont.
Dom. Forge & Stpg. Co., Walkerville, Ont.
Hemer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Brown Boggs & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.
Noble & Westbrook Mfg. Co., Hartford, Conn.

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

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

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

STEEL ALLOY (SEE ALLOY STEEL)

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

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

STEEL, CARBON, FERRO-TUNGSTEN
Can. B. K. Morton, Toronto, Montreal.
Colonial Steel Co., Pittsburgh, Pa.
Comstedt, Josef F. A., 120 Broadway, N.Y.
Latrobe Electric Steel Co., Latrobe, Pa.
Michigan Steel Exchange, Inc., Detroit, Mich.
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.
Zenith Coal & Steel Products, Montreal, Que.

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

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

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

STEEL, HIGH SPEED
Armstrong Whitworth of Canada, Ltd., Montreal.
Can. Fairbanks Morse Co., Montreal
Can. B. K. Morton, Toronto, Montreal.
Colonial Steel Co., Pittsburgh, Pa.
Comstedt, Josef F. A., 120 Broadway, N.Y.
H. A. Drury Co., Ltd., Montreal.
Fairley Davidson Steel Co., New York, N.Y.
Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall Geo. A., 70 Lombard, Toronto
Michigan Steel Exchange, Inc., Detroit, Mich
Osborn (Canada), Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Toronto.
Standard Alloys Company, Pittsburgh, Pa.
Vanadium Alloys Steel Co., Pittsburg, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.; represented in Canada by Norton, Callard & Co., Montreal, Que.
Zenith Coal & Steel Products, Montreal, Que.

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

STEEL VANADIUM
Comstedt, Josef F. A., 120 Broadway, N.Y.
Drury, H. A., Co., Montreal, Que.
Michigan Steel Exchange, Inc., Detroit, Mich.
Standard Alloys Co., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa.

STELLITE, HIGH-SPEED TOOL METAL
Can. B. K. Morton Co., Montreal, Que.
Deloro Smelting & Refining Co., Toronto, Ont.

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

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

STOCKS, PIPE
Butterfield & Co., Rock Island, Que.

STOOLS, STEEL, SHOP
Dennis Wire & Iron Works, London, Canada.
New Britain Mach. Co., New Britain, Conn.

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

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

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

TANKS, GASOLINE AND OIL
Dominion Forge & Stpg. Co., Walkerville, Ont.
The Jenckes Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes & Co., Sherbrooke, Que.

TANKS, STEEL, WATER PRESSURE
Can. Welding Works, Montreal, Que.
Jenckes Mach. Co., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke
Toronto Iron Works, Ltd., Toronto.

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

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

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto
Greenfield Tap & Die Corp., Greenfield, Mass.

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

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

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

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

TESTING INSTRUMENTS

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

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

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

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

THREADING TOOLS
Rivett Lathe & Grinder Co., Brighton, Mass.

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

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont
Peck, Stow & Wilcox, Cleveland, Ohio.

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

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

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

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

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

TOOL STEEL
Atkins & Co., Wm., Sheffield, Eng.
Armstrong, Whitworth, Ltd. of Canada, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Can. B. K. Morton, Toronto, Montreal.
Colonial Steel Co., Pittsburgh, Pa.
Deloro Smelting & Refining Co., Toronto, Ont.
H. A. Drury Co., Montreal.
Hawkridge Bros. Co., Boston, Mass.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Geo. A., 70 Lombard, Toronto.
Michigan Steel Exchange, Inc., Detroit, Mich.
Osborn (Canada, Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Ltd., Toronto, Ont.
Swedish Steel & Importing Co., Montreal, Que.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Ahquippa, Pa.

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

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

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.

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

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

TORCHES, STEEL
Armstrong, Whitworth of Canada, Ltd., Montreal
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TRACK SYSTEMS
Dillon Mfg. Co., Oshawa, Ont.
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Morse Chain Co., Ithaca, N.Y.
H. W. Petrie, Ltd., Toronto, Ont.
The Smart-Turner Machine Co., Hamilton.

TRANSMISSION TOWERS
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Tallman Brass & Metal Co., Hamilton.

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

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

TUBING, SEAMLESS, BRASS & COPPER
Hungerford Brass & Copper Co., New York, N.Y.
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OXY-ACETYLENE

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