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CANADIAN MACHINERY AND MANUFACTURING NEWS

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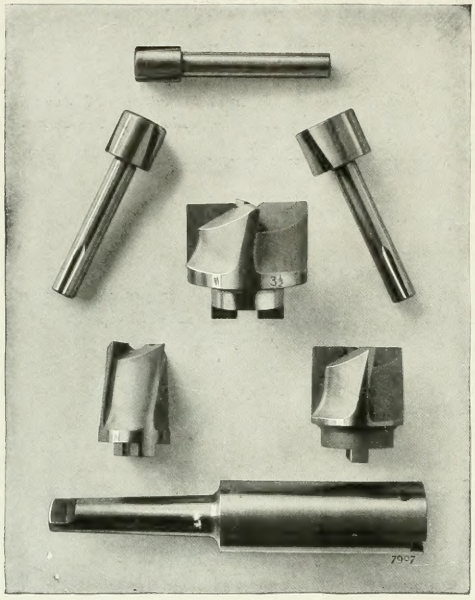
Make Your Own Combination



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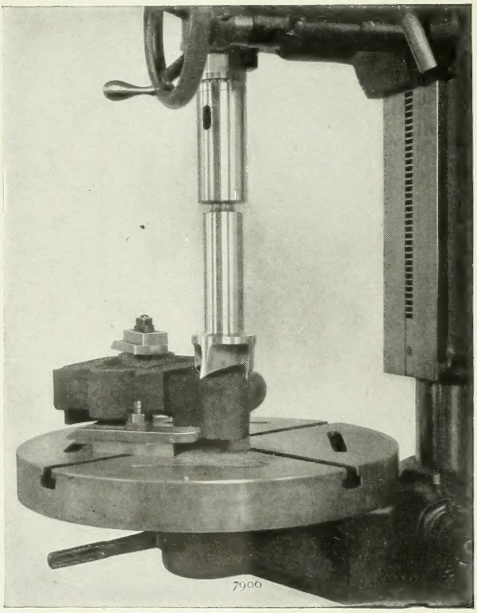

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The Publisher's Page

By B.G.N.

The Technical Journal As A Technical School

Toronto's famous $2,000,000 Technical School opened a few weeks ago, and is reported as being already overcrowded.

This is fine, and promises well for the future. With an era of great industrial expansion looming up in front of us, it is reassuring to know that so many of our boys and young men are equipping themselves for the task ahead.

And what is equally important, is the problem of keeping strictly up-to-date those who graduated from the school of apprenticeship long ago.

Fortunately the problem is easy to solve. The answer is **the Technical Journal.**

The Technical Journal and the Technical School have much in common, and are curiously alike. Each instructs; each introduces the best in modern practice; each has its experts for consultation and advice! Each shows the latest and best in machinery and equipment. The one for the beginner—the other for the graduate—the man who is already responsible for shop management.

The Technical Journal will be more and more valuable as time goes on. More and more will men turn to its editorial pages for guidance, information and instruction, and its advertising pages will grow more and more like a work-shop and show-room, full of the latest and best in machinery.

CANADIAN MACHINERY
143-153 UNIVERSITY AVE. TORONTO, CANADA

Intensified Production in a Shrapnel Shell Factory

Staff Article

Prior to the advent of shell making the products of modern machine tool builders seemed to have reached finality, not only in refinement of design and accuracy of work, but also in quantity of production. The conditions pertaining to shell work have afforded progressive manufacturers welcome opportunity for exercising individual initiative in machine design. The examples described are as interesting as the results are commendable.

SIX months ago the plant referred to in this article was completing shells at a rate of 800 per day. This was considered good, as it was the result of several months' work on shells.

To-day this plant completes 2,700 shells per day with practically the same number of men and machines. Considered in the light of other manufacturers' progress, the previous methods and equipment were well advanced, and any shell maker would not have offered himself for criticism had he decided at that time to leave well alone, and insure the continuous operation of the plant under the then existent conditions.

While the arrangement of the plant, generally speaking, is more or less the same as six months ago, certain changes in methods, machines, and equipment have more than trebled the output.

The changes in methods resulted in the saving of time by combining certain operations with others, either before or after. Other instances arose where it was found better to move the work instead of the tool, as in waving, for example.

Changes in machines refer to at least two specific instances where castings used in the regular business of the company were utilized in a manner very different from what they were originally intended to be. Other cases refer more to improvement in fixtures and operating devices. The principal change in equipment refers to the substitution of a chute system in place of transfer trucks.

Methods

A careful study of the requirements showed that the contour of the base could be done as part of the rough turning on boring mills instead of as a separate subsequent operation. As performed on a "Bullard" vertical turret lathe, the rough turning is an excellent example of speed and accuracy on the part of man and machine. The square tool box on the side carriage has two turning tools, one roughing A and one sizing B. The cross slide carriage has a radius tool C, which is also used for facing across the base. The turning tool on side carriage is started at the base of the shell, which is driven on to a grooved arbor. While it is travelling downwards, the cross slide carriage is run down by rapid power and set for cleaning up the base, which has been previously roughed in a miller (see Fig. 4). By the time the base is cleaned up and the radius formed (see Fig. 1), the turning tool A has reached the point on the shell where the taper starts. The operator now feeds it out gradually by hand, producing a taper of sufficient accuracy to meet the requirements for nosing later.

Rapid travel now takes the tool A up to the base of the shell, when a quarter-turn of the tool box brings tool B into position, when a finish cut is taken across the groove. The operation of rough turning is now completed, the groove being machined afterward.

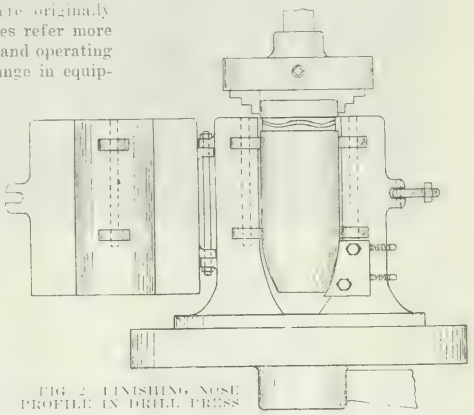


FIG. 2. FINISHING NOSE PROFILE IN DRILL PRESS

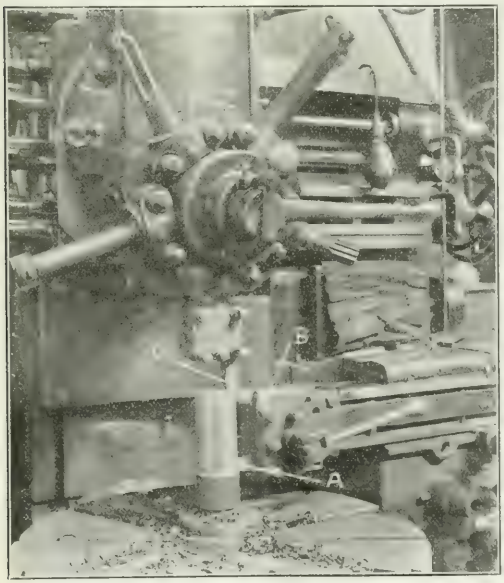


FIG. 1. ROUGH TURNING SHELL FORGING ON "BULLARD" VERTICAL TURRET LATHE

The method adopted for waving is quite a departure from recognized practice, although the variety of methods already in use by shell makers are quite numerous. A helical spring and ball thrust bearing on the tail end of the spindle maintain the spindle in its normal position. The shell is gripped base end in the chuck, a pipe centre truing up nose from the inside. A rapid movement of the tailstock spindle is obtained by hand lever. The pipe centre slides inside of spindle and is backed by a helical spring. The undercutting tool in front of the work is of the solid type which is fed straight in to the proper depth and then moved sideways. This tool is operated first, the sidewise movement of the carriage being controlled by stops. A wedge like plate is interposed between the left hand stop and the end of the carriage. This plate may be swung round on its hinge and allows of accurate adjustment being made when setting the tool.

Reversed Waving

As soon as the undercut is machined, the tool is withdrawn, the carriage held

towards one side against the stop, and with the spindle reversed, a hand lever is pressed which forces a roller between the end of the front spindle bearing and a cam plate on the back of the chuck. The springs A and B are now in action, and the shell is moved sideways in front of the waving tool which is back of the shell, and which is fed in by hand in the usual manner.

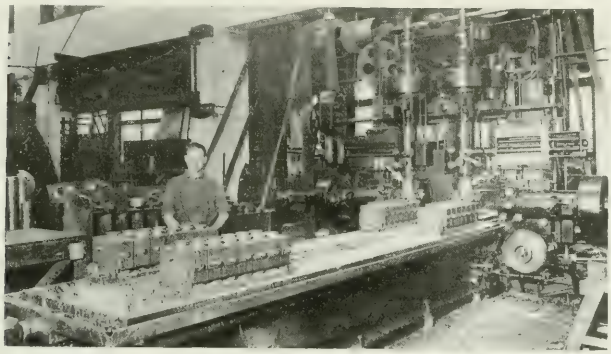


FIG. 3. ROUGH MACHINING BASES IN HORIZONTAL MILLING MACHINE.

This method of waving provides a very smooth running machine which turns out smooth waves with no chattering, and runs at a high speed. The use of springs instead of weights is preferable because of the absence of inertia and momentum which cause greater wear on the cam.

The idea of holding the tool steady with the carriage in a stationary position against a stop eliminates all chatter such as sometimes occurs on reversal with reciprocating carriages on tool holders.

Machines

It has been the experience of many shell makers that the limiting factor of grinding success is the necessity of truing up the curved portion of the wheel A skilled operator using a piece of carborundum crystal has been known to get almost sixty shells ground without bringing the truing up device into play and using the diamond. Average operators run about half, but the occasional loss of diamonds is an objectionable feature. This firm, like others, has accordingly discarded the grinder for the nose profile, retaining it for the cylindrical portion only. After nosing, the shell is rough turned to profile with a flat forming tool, and then ground on the parallel portion, after which it is chucked by the base in a drilling machine, nose down, and forced down into a fixture which has three pairs of guiding rollers, and is provided with a flat forming tool for finish scraping the nose to shape. One pair of the rollers is hinged on a gate which opens to allow the shell to enter and leave the fixture. The action of the fixture is identically that of a huge pencil sharpener (see Fig. 2).

A large 4-spindle "Ingersoll" milling machine has been employed for rough machining the bases, and until recently it operated with the two vertical heads only; the side heads remaining idle as shown in photograph, Fig. 3. As will be noticed here, the shells are held in fixtures each holding 12 shells, and arranged in pairs at each end of the table so that in machining a lot of 24 shells, the table had to travel sufficiently far to pass six shells across the cutter.

A Striking Comparison

Reference to Fig. 4 will show clearly how the machine was utilized to its full capacity. The fixtures at either end of the table were redesigned so as to each hold four groups of seven shells each. These are arranged so that the cutter heads come into action on their own group of shells simultaneously, the vertical heads projecting in advance of the side heads.

The difference in the methods of clamping the work in Figs. 3 and 4 call for special mention. In Fig. 3 the original fixtures had 24 nuts which had to be loosened and tightened each travel of the table. The present fixtures require 12 set screws only to be adjusted.

With a table travel of six shell diameters plus clearance, this machine formerly completed 24 pieces. With a table travel of four shell diameters without clearance this machine now completes 28 shells. Neglecting clearance spaces in fixtures this represents an increase in rate of output of approximately 75 per cent.

Machine Tools Extraordinary

If any self-respecting machine tool builder were to be told that a gas engine frame with a few fixtures added made a first class boring machine, he would have serious doubts regarding the sanity of his informant. Fig. 5 is a sketch of such a machine in actual use. It was constructed after trials with a converted bolt cutter proved successful. The cylinder A forms a substantial support for the cutter spindle B, a suitable bearing being mounted at each end. In the crankshaft supports is mounted a yoke C, the upper and lower portions of which support two fixed slide rods D. One end of these slide rods is fastened to the cylinder head, and the other end extends to the end of the bedplate where a yoke E is mounted, in the centre of which is mounted the feed gear.

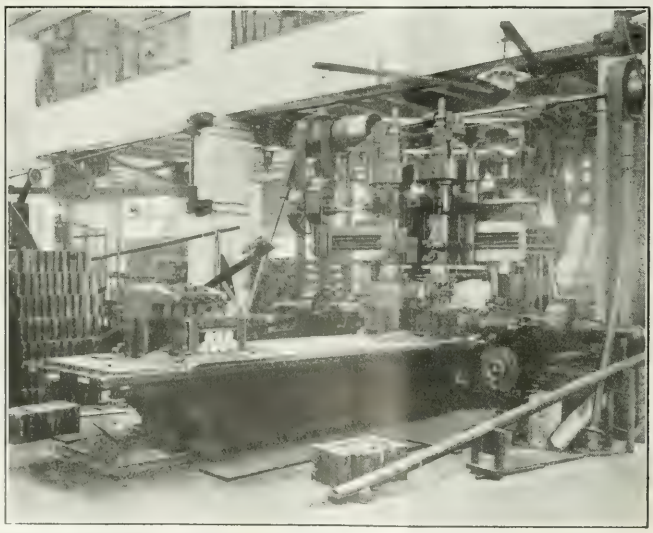


FIG. 4. FIXTURES WHICH INCREASED OUTPUT OF MACHINE 75 PER CENT

Between the cylinder head and the yoke C a sliding chuck G, is mounted on the slide rods. Rapid traverse of this chuck along the slide rods is obtained by means of a link and handwheel H.

The chuck G, is made a close fit for the shell which is tightened by one blow veniently operated by hammer E, which has a head at either end, one for tightening, and one for slackening.

A cross slide is fitted with a tool box F, which carries the tool proper, and is operated by elevating the hand lever G. Shells are received via the chute H, the

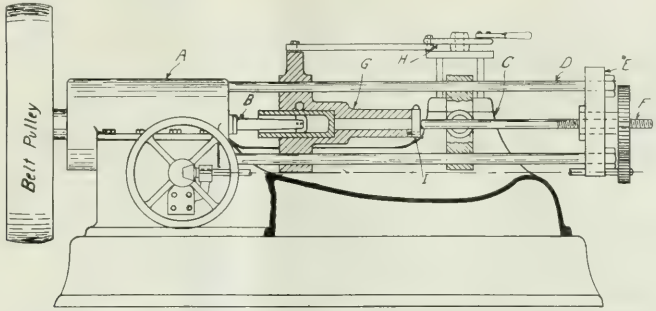


FIG. 5. SHELL BORING MACHINE BUILT FROM GASOLINE ENGINE PARTS.

of a hammer on a taper pin. When the chuck G, is moved away from the cutter bar B to let the shell into position, the plate I is swung clear, allowing the body of the chuck to telescope over feed spindle F.

The shell is now slipped over the cutter bar B, the chuck G, moved over the shell and taper pin tightened. Plate I is swung back into line with spindle F, and boring commenced, on completion of which the operations are reversed, the shell remaining on the cutter bar while the chuck is drawn away.

Experiments with cutters have shown the feasibility of doing this operation with one cutter only, the extra output more than off-setting upkeep of cutters. Owing to the lack of a large enough pulley, this machine takes 56 seconds per shell for boring to gauge, but when properly equipped and operated, it is expected to surpass even that satisfactory performance.

Another example of all precedent being thrown aside is illustrated in Fig. 6, which shows a cutting off machine built from a gasoline engine bed and cylinder on somewhat the same lines as the boring machine just described. The hollow spindle extends through the cylinder casting A, being suitably mounted on bearings at each end. The rear end carries the large belt pulley B, while chuck C is mounted on the front end of the spindle. Chuck C is solid, and is bored an easy fit for the rough forgings, which are instantly fastened in position by a blow on the large end of the massive taper pin D. In practice the pin D is stopped in a horizontal position, so as to be con-

lowest shell being contained in loader I, which is hinged so as to swing into line in front of the chuck. During this movement the shells in the chute are held back by retainer J. Rod K is used to eject the shell from the loader I into the chuck, the collar on the rod locating the shell. A smart blow or two with the hammer E securely wedges the shell afte which cutting off is merely a matter of belt power and tool strength, both

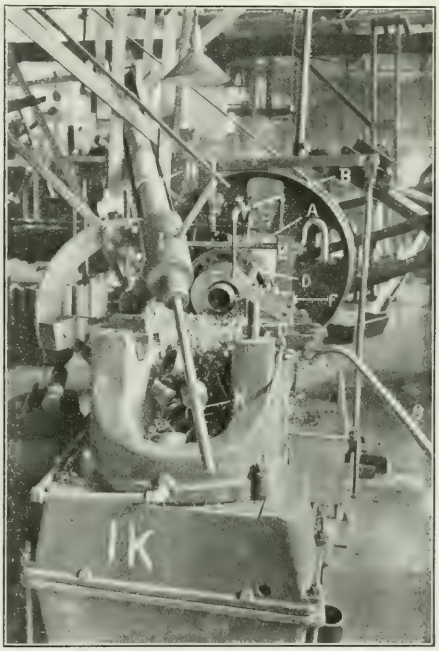


FIG. 6. TRANSFORMED GAS ENGINE DOING DUTY AS CUTTING-OFF MACHINE

of which are ample, accomplishing the complete operation in an incredibly short space of time.

Each additional shell pushes the preceding one ahead of it until they drop out of the back end of the spindle where a chute with a registering device conveys them to their destination.

Trucks Eliminated

The mention of chutes brings forward what is perhaps the most interesting of the many interesting features in this plant. The duties of the chute system which has been installed here, are passive rather than active, yet its influence on the output in proportion to its cost, is perhaps, greater than any other portion of the plant.

Persons familiar with machine shops, know that a considerable amount of each man's time is spent lifting a job off a truck and putting it back when finished. In the case of shells, this time is apt to be unduly prolonged either through fatigue, or lack of interest, etc. If it is possible to avoid this slackness, and arrange a system whereby the shell is slipped right under the man's hand, where he can reach it without exertion, and which only requires the shell to be lifted to the height of the man's shoulder to start it on the next stage of its journey, then an amount of unproductive energy is conserved, and the time required, which formerly was an actual loss to employer and employee, is now spent in doing productive work, which under the bonus system in force at this factory, means just so much more money for the workman at the end of the pay.

The adoption of the system rendered necessary the establishment of inspection benches at certain points, where the work is received from a preceding group of machines, and is distributed through individual chutes to several machines in another group, which perform the necessary work, and if immediate inspection is required, return it by another series of chutes to the inspection bench. Where corrections have to be made, a "returns" chute is provided to each machine, making three chutes on occasion between inspection bench and each machine of a group.

Should inspection not be required, the operator does not return the shell to the inspection bench, but instead, sends it on by a chute to the machine which is to do the succeeding operation. In this manner the shells travel individually as each stage is completed.

Full advantage has been taken of the many time saving possi-

bilities of such a system, the adoption of which made it possible to immediately locate the cause of any slowing down in production. The whole plant now became one vast unit with each machine, or group of machines, as the case might be, having its output strictly limited to the number of shells sent on to it from the previous group. A choking or overflowing of the chutes indicates where a hold-up is taking place, and enables additional facilities to be provided as the minimum output is shifted around from one operation to another.

A considerable amount of time and labor was also saved by providing each chute with a counter which had suitable symbols marked on it, indicating nature of operation, etc. These counters were simply and cheaply made by using Veeder cyclometers with a large disc mounted on the spindle. The counter is mounted on the chute so that as the shell passes underneath, it revolves the disc a certain amount so that each shell keeps tally for itself. In the case of shells which are returned to a machine for correction, the shell is put in the chute ahead of the counter so as not to register twice.

Fig. 7 shows an inspection bench with chutes serving three boring machines, the small machine in the right foreground being a converted bolt cutter, which has rendered excellent service in shell boring. The counters can be seen on the upper end of each chute at the machines. Fig. 8 gives a good idea of the labor saved in carrying shells from the banding press to the band turning machines. These machines are small turret lathes fitted with automatic collet chuck coupled up by link motion to the turret slide. The movement of the turret tightens the chuck and takes a rough cut off the band at one operation.

Finishing and sizing tools are mounted on small cross slide. With copper of average softness, one of these machines can finish a band complete in 27 seconds.

A great amount of labor in handling, counting and trucking shells is thus dispensed with, and records are kept up to the hour or minute if desired.

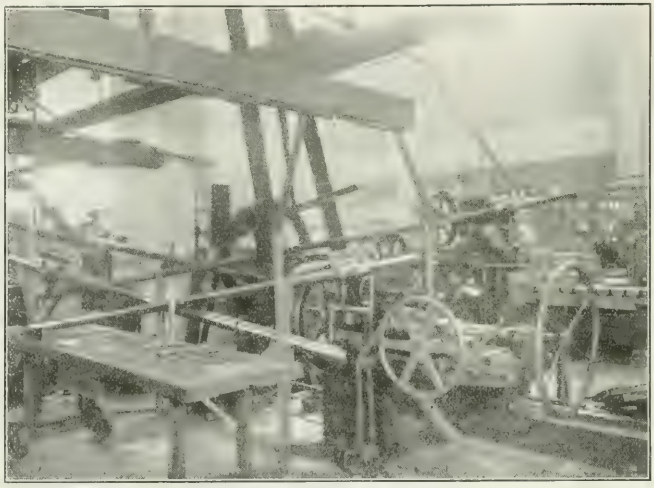


FIG. 7. CHUTE SYSTEM BETWEEN INSPECTION BENCH AND MACHINES

Premium and Bonus Systems

The greatly increased output in this plant is largely due to the efforts and ability of the company's executives in providing labor saving devices, improving machining methods, rebuilding machines, developing chute systems, and otherwise keeping up every detail of the work to the last notch of efficiency. Such efforts by the company would have yielded much less gratifying returns had it neglected that all important factor of modern commercial success, i.e., the human element.

Some concerns have attained considerable prominence, and achieved large financial success while maintaining an attitude of decided indifference towards employees' earnings. The possession of valuable patent rights and large profits accruing therefrom have in a few individual instances enabled the employers

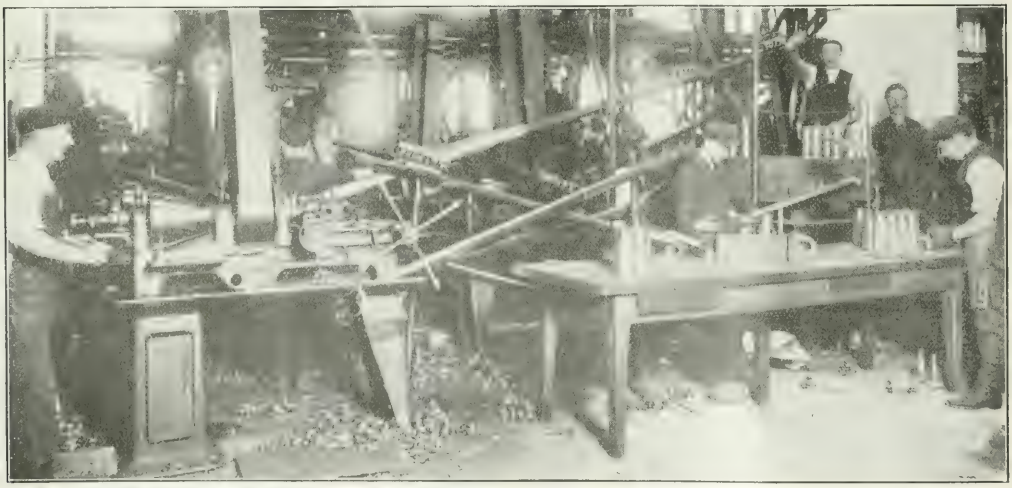


FIG. 8. CHUTE SYSTEM FROM BANDING PRESS TO MACHINES AND THENCE TO INSPECTION BENCH.

to ignore altogether the just claims of the actual producers.

The capable manner in which this concern approached the problem of securing the men's whole-hearted co-operation has met with all the success to which it is entitled. It is safe to say that the attitude and enthusiasm of the men toward the work being done, is only equalled by the sincerity of their regard for the frank, open-handed manner in which the company has dealt with them.

This desirable condition is due to the adoption and faithful carrying out of a combined premium and bonus system. All of the men who are engaged on machining, hardening, loading, etc., or producing in any form, are paid on the premium system. After careful study, a time limit was established for a certain operation, and except when a new method, process, tool, or other improvement is introduced, this limit is never changed. When the fortnightly earnings are made up on the basis of the number of hours worked, each man receives a premium payment equal to the value of half of the time saved over the limits set for the different operations. In this way every producer automatically becomes a partner in the business, the firm supplying machinery, work, material, power, etc., and sharing equally with each employee the profits which are directly due to his own individual effort.

A Factor of Success

The "human element" is always present in such affairs, and however great the success of the present instance, other cases might result in failure if this factor were not properly regarded. The chief point of this regard is a liberal basis for time limits. If a certain time limit yields a satisfactory cost for a certain operation, then the employer should constantly remember the all important fact that every dollar extra which a man earns as premium, also represents a dollar less cost to the company.

In addition to this premium system, a bonus system has been put into effect which applies to all non-productive labor. This covers tool-makers, stock-keepers, laborers, etc., and also the entire office force. This bonus is distributed on a percentage basis, and is based on the average daily output over a fortnightly pay roll period.

A bulletin board in a prominent position is kept posted with the latest output figures and the corresponding bonus, thus maintaining a state of active expectation which reflects itself in a steadily increasing output at less cost to the firm, and accompanied by proportionately higher wages for the men.

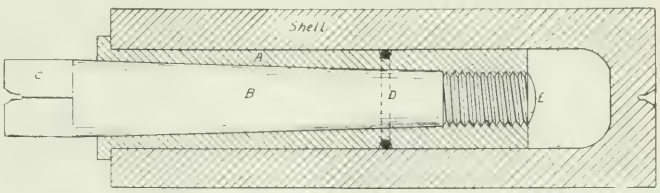
EXPANDING MANDREL FOR TURNING SHELLS

By J. A. Moffat

THE accompanying sketch illustrates an expanding mandrel used in turning shells where the bore is parallel. The sleeve A is turned about .010 smaller than the bore of the shell and is split in the centre to allow it to expand when the taper plug B is screwed in.

A round steel spring D holds the two pieces of the sleeve together. The end C of the plug fits into a square driver fastened to the face-plate of the lathe The screw E is made standard pitch, which prevents the plug from pulling out when the sleeve expands.

In practice two mandrels are used. While one shell is being turned, its predecessor is being removed from the mandrel and another put in its place and made ready.



EXPANDING MANDREL FOR TURNING SHELLS

MOLYBDENITE SAMPLES FROM NORTHERN QUE.

G. R. E. KENNEDY, of Sherbrooke, has returned from a trip into Northern Quebec, with some 50 lbs. of molybdenite specimens which have been sent to the Assay office for analysis. They were obtained by him and J. D. Kennedy, who investigated and successfully relocated claims formerly taken up and prospected by Capt. K. E. Kennedy, who had to abandon them on going to the front.

Remarkable rich samples were secured with nothing but a prospector's pick, in a granite and pegmatite formation, of which there is a large area, and covered by their claims.

There are only a few places in Canada where this somewhat rare mineral, molybdenite (sulphite of molybdenum) is found, and the world's production is very limited.

It is used in the manufacture of high speed steels armor plates, rifle and big gun barrels, etc., to which around 10 per cent. imparts the quality of taking a great heat without loss of temper. It is now in great demand by Great Britain and France. Before the war, it was worth around $400 per ton, for 90 per cent. concentrates. Late quotations are $3,300 up. It is substituted for and superior to tungsten.

The Kennedy Claims are splendidly situated for shipping and can be worked to great advantage by tunnel, which, with the fine showing of ore, give the property all the earmarks of a very valuable mine, despite the usual pockety nature of the few known deposits of molybdenum.

STEEL MAKING IN ELECTRIC FURNACES

THE making of steel in electric furnaces was the subject of several interesting addresses given before the Montreal Metallurgical Association at a meeting held on October 13 under the chairmanship of Dr. Alfred Stansfield. Attention was drawn to the fact that the making of steel by this process is about to be practised in Montreal. The meeting was opened by Dr. Stansfield, who spoke of the commercial possibilities of the electric furnace in steel foundries.

The chairman was followed by Mr. Davey, of the Canadian Brake-Shoe Co., who gave a detailed account of the furnaces in use at the Sherbrooke steel foundries of that company. These furnaces are four in number, each of 5,000 pounds metal capacity.

G. C. McKenzie, of Ottawa, representing the Mines Branch of the Department of Mines, told of the electric furnaces for making steel at Welland and Toronto. He referred also to the Moffatt-Irving process for the production of steel directly from Canadian ore, and explained that this process was about to be tested by the Government.

Mr. Evans, of Belleville, described the Evans-Stansfield process for making cold steel electrically from titaniferous magnetite ore.

A short account of steel making at the Longueuil plant of the Armstrong-Whitworth Co., which will shortly introduce the Heroult furnace for that purpose, was given by C. Bristol, and Mr. Green, of the same company, had with him some materials which he melted in the electric furnace in the McGill metallurgical laboratory. At the end of the meeting he poured the molten steel into two ingots .

Sheet Metal Elbows: Their Development and Laying Off

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

THE fabrication of elbows forms a considerable part of sheet iron workers' practice. The various forms, cylindrical, oval and rectangular, will be herewith described, and the patterns developed for both heavy and light plate.

For the purpose of students' home practice, the measurements will be given

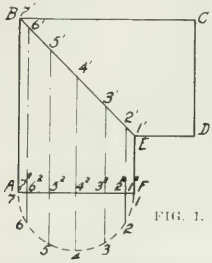


FIG. 1.

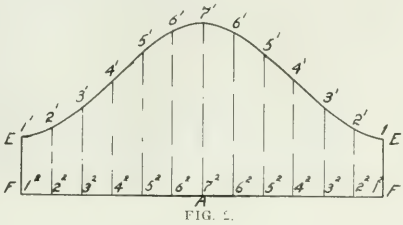


FIG. 2.

in inches, so that the developments may be made on stiff paper. The patterns may be perforated at the located "rivet holes," by a punch similar to a tram conductor's transfer punch, which may be purchased at any 15-cent store, this punches a round hole. The patterns can then be connected together by common paper fasteners. This is good practice for the student in laying out the rivet holes, which will give him the necessary confidence when laying out on the plate.

Cylindrical Elbows

Fig. 1 shows an ordinary two-piece 90-degree elbow which will be developed by the parallel line method.

Measure off AF, Fig. 1, equal to 11/2 inches, at right angles to AF, draw AB and FE, making AB equal to 2¼ inches, and FE ¾ inch. BC is drawn parallel to AF, and equal in length to AB. CD is parallel to BA, and equal in length to AF. DE is drawn at right angles to CD and EF, and of the same length as EF. Connect the mitre line BE, which is at 45 degrees, to the lines BA and BC. Bisect AF, and with 4^2 as centre and 4^2 A as radius, describe the semi-circle A 4F, showing the half section view of the elbow. Divide this view into a suitable number of equal parts, in this case 6 parts are chosen. Each point is numbered in consecutive order. From these points draw lines parallel to the lines AB and EF, up to their insections with the mitre line BE, which are numberged in relation to the points on the half plan view.

As the elbow is made in two courses and of equal diameters, it will readily be seen that the mitre line as stated forms an angle of 45° degrees, therefore it will only be necessary to lay out one course, from which afterwards the other may be marked.

The neutral circumference of the elbow, or the stretchout as it is more generally termed, equals the neutral diameter multiplied by either 3 1/7 or 3.14, which equals $1.5 \times 3.14 = 4.71$ inches, or slightly under 4¾ inches. Measure off FAF, Fig. 2, equal to 4¾ inches. Bisect at 7^2 and erect the perpendicular $7^2 7^1$. Divide 1^2 to 7^2 into the same number of equal spaces, as in Fig. 1 on the plan view; also divide $7^2 1^2$ similarly, thus making 12 spaces in all. Erect perpendiculars on these points, which are, of course, at right angles to the line FAF, and parallel to the centre line AB. Set the dividers to the distance $7^2 7^1$, Fig. 1; transfer this over to the corresponding number in Fig. 2. It will be noted the seam is located on the line $1^2 1^1$, Fig. 1.

Reset the dividers in each case to the distances $6^6 6^1$, $5^5 5^1$, $4^4 4^1$, $3^3 3^1$, $2^2 2^1$, $1^2 1^1$, Fig. 1, and transfer over each distance to its allocated line in Fig. 2.

A smooth even curve drawn through these located points will define the mitre line, which is also the rivet line. Laps are to be added to the rivet mitre line, and also the rivet lines $1^2 1^1$, Fig. 2, for the vertical seam.

As both courses are the same size, the connection at the mitre line, after the plate is rolled up, will necessitate one of the courses to be slightly opened out with a machine suitable for that purpose, or, in default, with a hammer, so that one course will fit over the other.

In tinsmith work suitable seaming allowances are made according to the style of seaming. Fig. 2 shows the pattern without any allowance for laps.

60-Degree Elbow

Fig. 3 shows the elevation and half-sectional views of a two-course cylindrical 60-degree elbow. Draw the line GLO, make OL equal to 1 1/16 inches, and the neutral diameter of the elbow GL equal to 1½ inches. With centre O and radius G, describe the arc GI. With the same radius and G as centre describe another arc to intersect arc GI at I. Connect I to O by a straight line.

The angle formed by GO and IO is 60 degrees. Bisect the arc GI at M, and through this point draw a straight line from O, extending to H. At right angles to GL draw the lines GH and LK to intersect the mitre line HK. Connect H to I and K to J. If carefully constructed the course GHIKL will be equal to

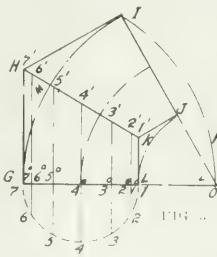


FIG. 3.

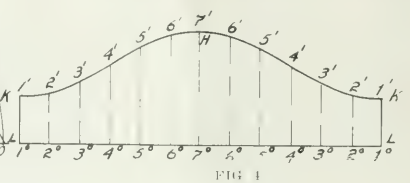


FIG. 4

HIJK. Bisect GL at 4" and draw in the half-sectional view G4L. Divide this semi-circle into any number of equal parts, according to the exigencies of the work. Project these located points to the mitre line, as explained in Fig. 1.

The stretchout LGL, Fig. 4, equals 1½ times 3.14, which equals 4.71 inches, or slightly less than 4¾ inches. Bisect this line LGL at 7^6 and erect the perpendicular $7^6 7^1$, thus locating the centre line

of the templet, and also defining the seam lines $1^0 1^1$ and $1^0 1^1$. Divide $1^0 7^0$ and $7^0 7^0$ each into the same number of equal spaces, as in Fig. 3. Erect perpendiculars parallel to the centre line $7^0 7^1$ through the points thus located, also numbering each perpendicular in relation to the construction lines, as $1^0 1^1$, $2^0 2^1$, etc., in Fig. 3. Transfer all the distances $7^0 7^1$, $6^0 6^1$, $5^0 5^1$, etc., in Fig. 3, over to their corresponding ordinates in Fig. 4. An even drawn curve through these points locates the rivet line or seaming line. Laps to be added accordingly.

Elbow With Gore

Fig. 5 illustrates a two-course 90-degree elbow, with the section BKC cut away to clear an obstruction, the gore

FIG. 9

FIG. 8

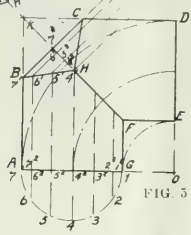


FIG. 5

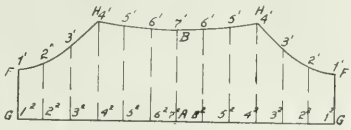


FIG. 6

BCH being fitted to the resultant opening. Fig. 9 shows the templet for the gore, and Fig. 6 for each of the courses.

Measure off on the line AGO, Fig. 5, AG equal to 1½ inches and GO to ¾-inch. With O as centre and OA as radius, strike the quadrant AD. With OG as radius and O as centre, strike the quadrant GE. Connect D to E, which is in line with O and at right angles to AG. Bisect the quadrant AD, and through this point draw a straight line from O to K, thus locating the mitre line. Draw KA at right angles to AG, and KD parallel to AG. Locate the points B, C by measuring ⅞-inch from the point K. Connect B to C, thus defining the portion cut away.

With 4^2 as centre, draw in the half-sectional view 7, 4, 1. Erect the perpendicular $4^2 4^1$ on the line AG. The point H where the line intersects the mitre line KF will also locate the termination of the gore. Connect B to H and H to C, which makes BH and CH the mitre lines between the gore and the courses. Divide the half-sectional view into a number of suitable equal spaces, as shown. Project the points 6 and 5 to their intersection with BH, also the points 3 and 2 to the mitre line HF.

The stretchout GAG, Fig. 6, equals 3.14 times the neutral diameter 7 1, which equals $3.14 \times 11_2$ slightly less than 4¾ inches.

Measure off GAG, Fig. 6, equal to 4¾ inches. Divide this into 12 equal spaces, erect perpendiculars and number in relation to their corresponding lines in Fig. 5. Set the dividers to the various distances, $7^0 7^1$, $6^0 6^1$, $5^0 5^1$, $4^2 4^1$, $3^3 3^1$, $2^2 2^1$, $1^2 1^1$, in Fig. 5, and transfer these over to their allocated lines on Fig. 6. An evenly-drawn curve through these points locates the mitre or rivet line. Fig. 6 illustrates the templet, to which must be added laps according to requirements, whether for seaming or riveting.

The gore BCH will now be dealt with. It is here necessary to have a cross sectional view through the plane $H7^3$, Fig. 5, to obtain the true length or stretchout of the gore, which is foreshortened in the elevation view shown in Fig. 5.

The cross sectional view is shown in Fig. 8.

The construction of such is as follows: From the points 7^1, 6^1, 5^1, 4^1 draw parallel lines to BC, and project to the points 7^1, 6^1, 5^1, 4^4, Fig. 8. Draw in the line H^1F^1 parallel to KH, and right angles to the projection lines, $7^1 7^4$, $6^1 6^4$, etc. Now with distance equal $4^2 4$ in plan view, Fig. 5, measure off the distances 4.4^4 in Fig. 8. Similarly with distances $5^2 5$ and $6^2 6$, Fig. 5, transfer to $5,5^4$ and $6,6^4$, Fig. 8. Draw an even curve through these points. This shows the true length of the gore through $7^3 H$, Fig. 5. The mitre line FK is extended to $H^0 H^0$. On this is laid off the true length of the gore which has just been computed.

The exact length of the distances 7^4 to 6^4, 6^4 to 5^4, and 5^4 to 4^4, measured along the curve, is transferred to Fig. 9, as 7^5 to 6^5, 6^5 to 5^5, and 5^5 to 4^5. Lines are drawn through these points at right angles to the line $H^0 H^0$. The distances on the gore BCH, $7^0 7^1$, $6^0 6^1$, and $5^0 5^1$, Fig. 5, are transferred and measured in Fig. 9, as $7^0 7^0$, $6^0 6^0$, $5^0 5^0$. A curve drawn through these points completes the pattern, with the exception of the laps. This curve locates the rivet lines, and all the points of intersection on the templets, Figs. 6 and 9, may be used for the pitch of the rivet centres through which the holes may be punched—by the punch already referred to, so as to facilitate the fitting up of the paper models—and in the case of plates for riveting together by.

TEMPERING REAMERS AND TAPS

A GOOD way to harden a long reamer without warping is to suspend the reamer and tongs by a twisted string. When the reamer is heated properly, hold it over the tub perpendicularly by the string in one hand, and keep it from turning with the other. When ready let go and allow it to revolve rapidly and dip at the same instant. Reamers or taps hardened in this way will remain straight. This idea is worth testing, not with a bit of twisted string, but with a proper mechanical rotor, the speed of which could be varied in the experiments. There are many small cutting tools which cannot be hardened and kept to their required form. A good many twist drills are not very straight after tempering.—Ex.

PREVENTING CORROSION IN BOILERS

IT IS extremely doubtful whether the suspension of zinc slabs in a boiler will prevent scale, says the Electrical World. Scale is due to the presence in the feed water of substances like the sulphates and carbonates of lime and magnesia. When the water is heated, these substances are precipitated and are baked on the plates and tubes. The action of zinc in a boiler is galvanic and is intended primarily to prevent corrosion of the metal parts of the boiler. To prevent scale formation, it would have to change the nature of the sulphates and carbonates or else keep them from coming in contact with the boiler, neither of which it is able to do.

It is true that in the course of the galvanic action set up by the use of zinc, hydrogen is set free at the water surface of the plates and tubes, and the liberation of hydrogen in this way, if rapid enough, might prevent scale from adhering; but it is scarcely to be believed that the feeble galvanic action set up by the use of zinc slabs could produce hydrogen at a sufficient rate to keep all sediment and precipitates from collecting on the surfaces on the metal.

Steel Piston Rod Tests.—An American steel concern has announced the results of a series of tests on piston rods made of the steel it manufactures. The steel showed a tensile strength of 123,775 lbs. per square inch, an elastic limit of 82,600 lbs., with an elongation of 24 per cent. in 2 in., and a reduction of area of 53 per cent. In a revolution testing machine, 984,933 revolutions were required to break the test pieces at a stress of 30,000 lb. per square inch. This steel, which contains manganese, is produced in an electric furnace.

Papers Read at the Recent Foundrymen's Convention

Selected from the more important subjects presented for discussion before the Annual Convention of the American Foundrymen's Association and the American Institute of Metals at Atlantic City, N.J., during September, 1915. The papers cover a wide field of foundry and allied activity, the nature of the results and the completeness of the reports making them of particular interest to all who desire to keep in touch with metallurgical progress.

THE CONVERTER IN STEEL CASTINGS MANUFACTURE

By C. S. Koch*

A WRITER of a paper on the manufacture of steel castings, some four or five years ago, started with the following words: "This subject has already been discussed so thoroughly before this association, that not many points remain uncovered." Since then there have been numerous additional papers. Consequently, it has been difficult for the writer to dig up something not yet touched upon, which would still be of general interest. There have been refinements in many ways, but they are generally too detailed to go into. If one looks over the Transactions of the Association, he will find a large amount of good matter on the converter. He will find papers on its construction, its lining, its manipulation, and its chemistry, and all the details pertaining thereto, all of which is of interest to those who are in close touch with the subject. However, little is found in regard to the various factors which have tended to make the converter a successful means for making steel in many cases and equally as disastrous in as many more; little material is available giving reasons why the converter is still being run in some foundries after 10 or 15 years, and why it was run six months or less in others. The writer proposes to discuss this subject.

Is the Converter Practical?

If, say 10 or 12 years ago, the following question were asked, "Is the converter a practical means for making steel for castings?", the total number of replies in the affirmative would have been less than 10. That is, replies from men whose experience would justify their endeavoring to answer the question. The number of negative replies would have been almost too great to record. The proportion would have been about nine negatives out of 10 answers. If the same question were asked to-day from the same class of individuals, the trend of replies would be just about the reverse. The converter process has about as large a proportion of adherents to-day as it had adverse critics 10 years ago.

Up until about 1905, the failures greatly exceeded the successes. For the next five years, the number each way was nearly equally divided and of late years, the successes have been, probably, in excess of the failures. But we must not lose sight of the fact that news of a success is published, while that of a failure is squelched. In the early days, the failures were not due, as we might suppose, to the crudity of the process, but rather, as a rule, to the fact that in a great number of cases the converter was being employed for purposes for which it was not adapted and was being wrongly applied. Better results have been obtained in recent years because the users have exhibited better judgment in the selection of the particular lines into which they have entered.

This can be demonstrated by an analysis of the history of the converter foundries of the United States. In making this analysis, trade conditions must be taken into consideration as they vary from one locality to another.

The conclusions from this examination seem to show that the following statements are approximately true:

1.—The application of the converter to the manufacture of a general line of railroad car castings has not, to date, been a success.

2.—The use of the converter in conjunction with an open-hearth furnace has not generally met with success. That is, the open-hearth foundries, which have endeavored to add the converter to their equipment, have nearly always given up this process after a short trial.

3.—Iron foundries which have endeavored to add the converter to their equipment, except in favored conditions, have been unsuccessful.

4.—Various manufacturing companies, having a fair consumption of steel castings, have not by any means been satisfied with the results of making a small tonnage for their own use.

Why Success Was Achieved

On the other hand, the resume of the history will show the companies that have been successful, and in almost every case it will be found that these companies have employed the following methods:

1.—They have made steel by no other process.

2.—They have adhered, as a rule, to a maximum metal line, or perhaps, we might say, weight of casting. This weight has varied somewhat in different localities, as competition and a few other conditions have varied.

Now all these causes for failure and success can be argued pro and con and exceptions can be cited. Nevertheless, if anyone is considering the application of the converter to the steel foundry business, he would do well to give due weight to the foregoing, because the statements given are not the result of theoretical considerations, but of a detailed analysis of the history of the converter business for the past 15 years.

It will be noted that in the writer's opinion, the reason for successful operation has been careful consideration of the maximum weight and the question naturally arises, what is this? It will vary in different localities, but is more or less dependent on the proximity, activity and attitude of open-hearth steel foundries.

Generally speaking, converter steel costs more than open-hearth steel. Consequently other things being equal, such plants can underbid the converter plant on all such castings as they can properly run. Therefore, if a converter foundry is in a locality where open-hearth competition is keen, the maximum weight of the castings which it ordinarily can take at a profit will be less than in the case where such competition is remote or less active. In considering this competition, there is another element that should not be overlooked. The manufacturer of large, heavy castings naturally has a lower average overhead per ton, and unfortunately in many cases, this small overhead expense is spread equally over the large and small work. In bidding, this naturally puts the converter plant at a disadvantage, with the logical tendency of restricting the converter plant to castings which the open-hearth cannot run; that is, restricting it to smaller and smaller castings.

Effect of Increased Skill in Molding

Again, the tendency in some localities is for the manufacturers of large castings to encroach more and more on the field of the converter shop owing to increased skill in molding. It is believed by the writer that owing to various conditions, greater skill in molding difficult, medium-size castings was formerly possessed by the converter plant. During every dull period, in their desire for work, the manufacturers of large castings have gone after more difficult jobs. This has developed their skill and given them confidence.

We have already stated that in the past, success was more or less dependent on restrictions to small work, and these latter considerations show that in the

*East Pitt. Steel Casting Co., McKeesport, Pa.

future the converter plant will be compelled to carry this restriction further. There are, however, modifying features that should be given weight. There are converter plants strewn all over the country, located in districts where ordinary competition from the cheaper metal does not exist. These reap profits not possible to others. For example, the plant may be at such a distance from outside competition that the buyer is willing to pay a price sufficiently high to enable the converter plant to take the work with a reasonable profit. Proximity to user is always a valuable feature.

Most all converter plants, even the successful ones, handle some large work. This is obtained on the basis outlined previously, but it would not be safe to bank too much on this as being a particularly lucrative part of your business. From all of the foregoing it must not be concluded that the amount of work to be done by a converter plant is to grow less. On the contrary, new uses for steel are being found, which will give the industry more work than formerly. It is an adjustment of classes that will follow.

Shop Practice

To return more particularly to the application of the converter, there are a few fundamental principles of operation that it may be well to mention. These, again, are not theoretical considerations, but are brought to mind by a study of what has been accomplished and **not accomplished** by the converter plants of this country:

The points I wish to make are as follows:

GENERAL VIEW IN ANNEX, FOUNDRY AND MACHINE CO. EXHIBITION, ATLANTIC CITY, N.J.

MACHINERY HALL EXTENSION, FROM LOWER END, FOUNDRY AND MACHINE CO. EXHIBITION, ATLANTIC CITY, N.J.

1.—Unusually good cupola practice is essential.

2.—The speed of the cupola should be regulated to the speed of the converter, that is, neither too slow nor too fast.

3.—Proper crane facilities are necessary.

The writer has endeavored to learn the causes, (a) of complete failures, (b) of the cases in which there was perhaps no real failure, but in which there was a discontinuance in the use of the converter, and (c) of mediocre success. As far as the steel-making end was concerned, these could be attributed to a bad combination of the three operations listed.

Holding the cupola back in any way whatever, to wait for the crane or the converter is not good practice, especially when the economical operation of the converter requires the use of a burden of perhaps 40 per cent. steel scrap. It should not be necessary to say much on this subject to foundrymen, but strange to say many converter foundries can be adversely criticized on this point. Quality and temperature of iron should be considered and if a large number of heats are to be taken off, the time element is essential. As is well known, a 2-ton converter will produce steel at the rate of two tons every 20 to 25 minutes. If 12 heats are produced daily, an unnecessary delay of only five minutes per heat will aggregate one hour. It is well not to be obliged to start pouring any earlier in the day than is necessary on account of fumes and heat, but at the end of the day overtime is not only costly, but has many other disadvantages. Consequently, quick operation, at a uniform rate, is helpful, and this can be obtained only by a well-run cupola that is not too slow for the converter, and by proper crane facilities, arranged to remove the steel from the converter as soon as it is blown and to immediately refill the converter with iron. The crane should not be busy pouring off, when it is wanted at the converter. A wait means holding back the cupola, which means not only loss in time, but bad iron later in the day. That the ideal relationship of cupola, converter and crane is not present in many foundries is not the fault of the foreman or superintendent, but is due to original faulty design.

Temperature of the Steel

Furthermore, the temperature of steel should be uniform from heat to heat and should be adapted to the class of work turned out and arrangement of the shop. The need of some shops is for steel much hotter than others. This is logical and correct and one might say that each shop has its own particular ideal temperature. This should not be higher than necessary, as heat is costly. Most shops do not seem to aim at any particular temperature. The result is changed temperature conditions daily. This puts the foreman at a disadvantage in guiding his molding practice.

If the ideal shop temperature is eventually attained, there still remains a difficulty. The steel will be too hot for some castings and too cold for others, and will burn in badly on some and not run others. To avoid this and many other foundry difficulties, the policy of the company should be toward a narrow range of sizes. It will be argued that this cannot be done in a jobbing shop, which must take whatever comes. The only answer to this is that such a statement is like many others emanating from foundrymen. We are in a rut and not until we get out, and break away from antiquated, preconceived principles, will we attain the highest degree of success. Establish your class and range of sizes and adhere to it. You will loose some work to the other fellow and at the same time take some from him. In time your plant will be operating on work for which it is best adapted, and your competitor will be doing likewise. You will have made the first step in specialization. In conclusion, let me say that the first step to take in the practical application of the converter to the steel foundry is to specialize, being sure that it is on that class of work to which the converter is best adapted.

GRAY IRON CASTINGS DEFECTS—THEIR CAUSES AND REMEDIES

By Herbert M. Ramp*

A COMPREHENSIVE discussion of the causes of defects common to gray iron castings and remedies for overcoming them would encompass the consideration of practically every foundry operation, but unfortunately the time at our disposal will permit only of a brief review of this interesting and complex problem. A discussion of the losses incurred by defective castings is one of the first things a man hears when he enters a foundry and it usually is the last thing that comes to his notice when he leaves it. Unfortunately, more attention is given to the losses incurred by defective castings than to making improvements that will eliminate practices that cause them. More consideration is given the pounds of bad castings a molder produces than to his output of good work. Also, more importance is attached to the bad castings reported than to the cost of productive labor per ton. The reason for this is not hard to find. The one is a tangible, direct loss that stares the foundryman in the face every day, while the others are intangible factors that can be corrected by the exercise of gray matter and the installation of proper equipment.

It is estimated that defects common to gray iron castings are the direct cause of the rejection, or loss, of at least 5 per cent. of the iron castings produced. Some patterns may have a better record, although many, also, will show a higher percentage of loss. This estimate on the average, however, is low. If this loss were eliminated many foundries struggling for existence today could not make a profit on their operations. The reduction of the defective output is a problem of great importance and should command the earnest attention of every foundryman.

Ninety per cent. of all defects can be attributed to two causes, namely, incompetency and carelessness. However, since it is exceedingly difficult to obtain competent and careful labor, the operations involved in making castings to-day must be so safeguarded and simplified that a lesser degree of experience, intelligence and care is necessary to the successful operation of the casting plant than heretofore. Classifying casting losses in the order of their causes, it will be found that 50 per cent. can be attributed to the sand and its treatment, 20 per cent. to the cores, 10 per cent. to the patterns, five per cent. to equipment and five per cent. to the iron.

What constitutes defects in gray iron castings is another question of great importance. The standard of excellence for the different classes of castings varies and consumers using castings of a similar nature for the same purpose, frequently will have widely varying requirements. In other words, castings that will be accepted by one company will be rejected by another, and the line differentiating sound from defective castings is drawn at different points. In this respect every consumer is a law unto himself, and there really is no standard for casting quality. Each consumer fixes what he considers a standard for his own requirements which he believes is adequate to his needs.

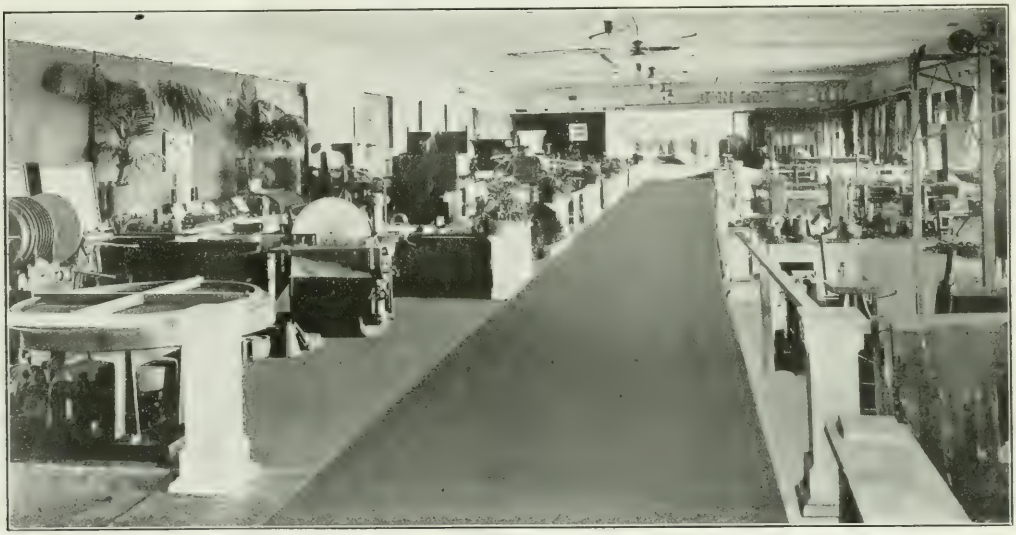
Sand as a Cause for Defectives

No effort will be made to enumerate the many causes leading to the production of defective castings as the list will be entirely too long and, furthermore, in many instances the causes are so obvious that further comment is unnecessary. However, some practices are common to many shops which cause needless expense, and these are repeated day after day in one form or another without an intelligent effort being made to correct them. The sand, and its treatment, is probably one of the most prolific causes of defects, and to it can be attributed more losses than to all other causes combined. In three cases out of four, the sand is the cause of dirty castings; it causes the mold to cut and the castings to scab and blow. If a casting blows, it is generally attributed to the cores, the

*Elmwood Casting Co., Cincinnati, Ohio.

sand or its treatment, and its repetition is guarded against. However, the cause of the cut, scab or buckle is not investigated carefully, notwithstanding the fact that the losses thereby incurred are deadly to profits. It is the small defect that causes the foundryman to stop and wonder if the casting will pass the machine shop, but finally after it has been cleaned and shipped, it is returned with a caustic letter of complaint. It might be pointed out in this connection that the little foxes spoil the grapes. A casting that is defective beyond question usually points out its own remedy, but the casting which is questionably defective is the most elusive. The remedy is not sought as earnestly or intelligently as that causing the larger defect, neither discovers a scabbed casting, he usually tells the molder to be more careful, or advises him that the mold was too hard or too wet, or whatever his judgment dictates, but how often does he examine the facing and the sand? How often does he employ every possible resource to secure better sand or to make mixtures of sand for his work that are more satisfactory? How often does the foundryman show the molder how to ram the mold, to vent or finish it? How many foremen to-day believe that they discharge their duty by merely telling the men in their employ what is patent to any one who has walked through a foundry a few times in place of personally instructing them how to avoid their troubles and to do their work right?

tion of the supervising force. The molder next must be instructed in its use and if defects develop in his work, he must be taught, regardless of the fact that he may have pounded sand for 40 years. It is futile to attempt to formulate fixed rules covering supervision and instruction, since every foundryman has individual ideas on this subject. However, not many realize that the cause of defective castings might be eliminated if they would start at the sand bin and see to it that the best possible sand is obtained and that the proper instructions are given regarding its use. Too frequently, also, this instruction partakes of the form of criticism, when the molder is called to the scrap pile where his defective castings



MACHINERY HALL, LOWER END, FOUNDRY AND MACHINE CO. EXHIBITION, ATLANTIC CITY, N.J.

are the molders instructed as carefully to prevent the causes of small defects as of those which are more apparent.

The foundryman usually becomes provoked and exceedingly angry when a molder has a run-out or breaks a casting hot. He views this in the light of exceedingly poor workmanship, but he considers in an entirely different spirit a casting that is slightly scabbed or dirty. The casting that is almost good enough offers the most difficult problem and the cause of its defect, as a rule, cannot be determined readily.

Scabs, Cuts and Buckles

Scabs, cuts and buckles come and go. They vary with the temperament of the man who wields the rammer and the vent wire and blossom forth with the use of too much water, too much finishing, too little venting and the use of improper sand. When the foundryman

Poor or misused sand is the cause of more defective castings than any other factor. It has a decided influence on the cost of the product and may be the means of establishing a reputation for high grade or poor castings. It is the foundation upon which the entire foundry structure is built. Suitable sand means better and cheaper castings, lower losses and an easier shop to operate successfully. It is one of the great fundamentals of a happy business.

Preparation and Use of the Sand

Next in importance are the instructions regarding the preparations and use of the sand after its careful selection, consistent with its cost. However, cheap sand frequently is the most expensive raw material that a foundry can buy. The sand must be mixed and tempered for the particular work for which it is required and this must have the atten-

are pointed out to him in no uncertain terms. In other words, in most instances, what should be well-intended instruction, is mere denunciation. Anyone can find fault, but a man must study his business if he wants to place himself in a position where he may be able to correct bad practice. The average molder does not lose a casting on purpose. He feels regretful over its failure, but the average molder does not always know the underlying cause of defects, nor how they may be overcome. He needs help, not hell, which he usually receives. He must be taught the rudiments of the business over and over again, since the conditions of the trade are changing constantly. This is the remedy that must be applied by the supervising force before the defective losses can be reduced. If the same energy is expended in instruction as in

condemnation, far more satisfactory results will be achieved.

Dirt Another Cause of Defects

Dirt ranks as the second of the prolific causes of defective castings. From a molding standpoint, the casting may be perfect, yet it is dirty in the rough, or it may display dirt spots in the finishing operations. The number of excuses attributed as the causes for dirty castings is legion, yet only two can be assigned for this defect. Either the iron does not lie quiet in the mold, or against the cores, or dirt has been permitted to enter the mold with the iron, or it was in the mold at the time when the metal was poured. Occasionally the blacking may wash; again the gates will cut, but more often the dirt can be attributed to the same cause as that of the scab or buckle, namely, improper sand, or its improper treatment. A casting will not be clean when the iron does not lie quietly in the mold. The metal may not boil or agitate sufficiently to cause a scab, yet its effect is apparent on the finished casting. If the slag which accumulates on top of the iron is permitted to enter the mold, the casting, of course, will be dirty and this is true also if the gates cut or scab, or if the gates or runners are improperly constructed, or are defective in any way. It is possible to make a perfect mold, yet if the gates are improperly made, the casting will be dirty and will prove defective. Here again the remedy is care and supervision.

Sources of Dirt

An excuse generally offered for defectives is dirty iron. This is the bulwark behind which the molder hides and is the shield which he employs to cover his shortcomings. First of all, it might be well to direct attention to the fact that iron and dirt are enemies and have nothing in common. The dirt referred to is the foreign substance that occurs or forms on the upper side of finished castings. Iron and dirt have no affinity and are of widely different specific gravities. Ninety per cent. of the so-called dirt in castings is composed of silica, alumina and magnesia and none of these is mixed with iron mechanically. They will not remain in solution by any known process, but they may unite to some extent chemically, in this event changing the chemical composition of the iron. This, of course, could be readily determined. However, the natures of these elements are not similar, resembling each other, which is indicated when such substance rises to the surface of the metal in the ladle. Some of the different oxides contain iron, being formed while the iron is in a liquid state and subjected to the action of the oxygen in the air. These oxides also are classed as dirt. However, this dirt, the same as any other refuse that rises to the surface of the metal in the ladle, must be skimmed-off before pouring and does not form a part of the iron. Oxides cannot, form, however, after the casting is poured.

Dirty Iron.

Iron is unlike most of the non-ferrous metals, in that it will form only a comparatively few combinations with the exception of those produced in the blast furnace. It repels all but a few elements that are taken up in almost constant proportions and these only at extreme temperatures. Regardless of the composition or the character of the iron, if it is melted and poured fairly hot, it will be clean. The sulphur may be 0.05 or 0.20 per cent. the manganese may be 0.20 or 2 per cent., the phosphorus may be 0.10 or 1.25 per cent., but none of these varying contents of these elements will make iron dirty in the castings. The iron may be too hard, too soft, too open; it may shrink, crack, draw or warp, but dirt is not its inheritance, nor its progeny.

During the past 25 years, the author has had direct charge of the mixing and melting of more than 500,000 tons of iron, but he has yet to find dirty iron in the sense assigned for it by the molder. Why does a molder make nine castings good and one bad? Why does a molder make a clean record for 30 days and then lose everything he makes? If a molder can produce 20 good castings why is he unable to make 21 or 200? These are the questions put up to the foundryman every day and he has yet to give a convincing answer. First of all, there are no standards or set regulations governing foundry work. The sand may be wet down more one day than another and this makes different the ramming, venting and finishing problem if the castings are to be good. The iron may be colder and duller one day than another, and this would necessitate the use of gates of different size, or different pouring arrangements and the cores may be swelled out of shape, which would require different methods of securing. The flasks may be worn out and finally give way and a hundred other conditions may arise which never are the same on subsequent days.

Inexplicable Foundry Problems

Little has been done in most shops to remove the many causes of defective castings, except in foundries specializing in a particular class of work. No effort has been made to catalog the ills of the foundry and no one has attempted to place the foundry business on a level with the machine shop. If this were done, many and marvelous changes would be made. The patterns, cores, core boxes, flasks, would be inspected daily, the sand would be prepared by machinery and the different grades and ingredients would be carefully measured; different rules would be laid down covering the pouring temperature of the metal, as well as the methods of gating. The foundryman would have a voice in the design of the patterns and he also would have the patterns made, not the cheapest way, but the most satisfactory way for foundry use. Every possible pattern would be mounted on a molding machine instead of placing so much dependence upon the skill of the individual operator. Either by lectures, by a school course, or through technical papers, would be imparted to the molders the knowledge gleaned by the employers as the result of the development of the business. Premiums would be paid for high grade service and efficiency.

The foregoing and many more factors would contribute as remedies for defective casting losses. Unfortunately, these needs cost money and the trail has to be blazed; some must be pioneers in elevating foundry practice to a class where definite standards exist and where definite practice will produce definite results.

The Personal Equation

In a large measure the personal equation will have to be limited and particular jobs will have to be so safeguarded that if Tom Jones lays off a day, his substitute won't make 50 per cent. scrap; that if Mike Murphy has been out the night before, he won't spoil his day's work; or, if a molder has sickness at home, he won't forget some minor detail and ruin his casting. More of the responsibility, judgment and skill must be taken away from the individual and the work must be placed upon a higher mechanical basis than it is to-day. Then, only, will the beginning be made for the elimination of defects in castings. An honest comparison of the defective work of the ordinary jobbing foundry with that of the shop equipped for a special line of work, proves conclusively that defectives can be reduced by placing operations on a higher mechanical plane.

Tellurium belongs to the same chemical group as sulphur and selenium, but unlike these two elements, tellurium is a metal, and resembles antimony in a general way. Tellurium fuses at 500 deg. Cent. and when heated above this point it burns with a fine blue flame to tellurium dioxide, at the same time evolving a very peculiar odor. Its combination with hydrogen forms the very poisonous and colorless gas hydrogen telluride.

PROGRESS IN NEW EQUIPMENT

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

SELF-CONTAINED GRINDING MACHINE

THE grinding machine illustrated herewith is driven by a direct connected motor located towards the rear on the left side. The motor is within the working space of the machine, and as all speed changes are controlled within the unit, it thus possesses the unique feature of being self-contained, no external belting or other driving devices being necessary.

In accordance with the maker's established practice, the grinding wheel travels, while the work revolves in a stationary position. It is claimed that this arrangement reduces the power necessary to operate the machine, much of which would otherwise be absorbed in moving considerable weight instead of doing useful work.

The swivel table has two scales, graduated in degrees, and also in inches per foot. The speed changes for the work are made by shifting a belt on cone pulleys, the mechanism for which is operated by a single lever.

The grinding wheel head is massive and rigid and is mounted to slide on a large V and a flat guide. The spindle, which is of special steel, runs in adjustable bronze bearings, while the driving belt is maintained at a uniform tension by an automatic tightener.

Grinding wheel feed is automatic or hand, the automatic feed varying from .00025 in. to .007 in. at each reversal of the wheel carriage.

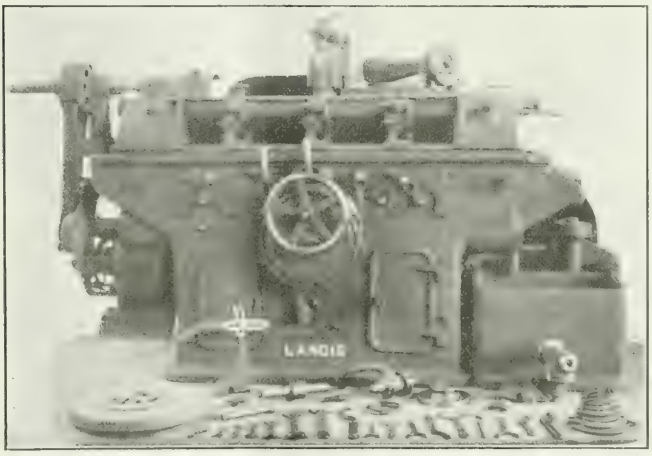
The traverse of grinding wheel is automatic, the movement of a single lever controlling all the speeds by means of a belt on cone pulleys. A period of dwell or tarry which can be varied to suit the work is arranged to take place at the reversing points. Two-point rests with independent adjustment and stops for each support, are provided.

FIG. 1. FLEXIBLE STEEL AIR COMPRESSOR VALVES

The machine is liberally proportioned having a 5-inch driving belt, and 20-inch diameter grinding wheels of 1½ in. and 2½ in. face. Power required is 12 horse power; floor space 8 ft. x 5 ft. net weight 7,800 lbs., boxed for export 9,500 lbs.

When driven from line shaft, an auxiliary shaft with tight and loose pulley, 12 in. diameter, running at 450 r.p.m., is furnished.

The Landis Tool Co., Waynesboro, Pa., who are the makers of this machine, supply a complete outfit of accessories as part of the regular machine equipment.



SELF-CONTAINED GRINDING MACHINE

HIGH SPEED VERTICAL AIR COMPRESSOR

A LINE of air compressors of the high-speed, vertical type exclusively, is being marketed by the Gardner Governor Co., Quincy, Ill. The Gardner-Rix compressors are specially designed to give satisfaction where skilled attention is not always available, and toward this end the mechanism has been simplified to the greatest possible extent.

Light sheet steel valves (see fig.1) are employed. These are flat rings of flexible sheet steel, noiseless in operation, and subject to practically no wear after long periods of service. The valve areas are large insuring economical working.

Enclosed crank cases with splash lubrication are a feature of all the types of these compressors, while the absence of stuffing boxes and crossheads, and the reduced weight of working parts enables higher speeds to be adopted whereby the capacity of machines having cylinders of certain size can be increased. This allows the use of high speed motors on combination units, without having to use gear reductions of excessive ratio.

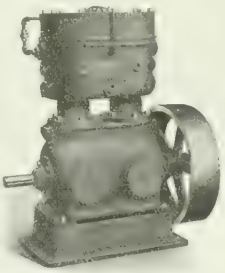


FIG. 2. CLASS "HF" COMPRESSOR

Duplex cylinder compressor with subbase is shown in Fig. 2. Gasoline driven sets, portable outfits with tanks etc., for all classes of work are furnished by the makers, having capacities from 8 cu. ft. to 140 cub. ft. per min. at pressures from 75 to 250 lbs. per sq. in. Cylinder dimensions are from 3 in. bore x 3½ in. stroke to 8 in. bore x 6 in. stroke; weights vary from 165 to 1800 lbs.

PNEUMATIC VIBRATOR

AMONG recent products of the Malleable Iron Fittings Company of Branford, Conn., the "Branford" vibrator is prominent. This device is made in all sizes from ⅜ inch to 2 inch. It is an

instant starter and possesses the unusual feature of having all parts hardened and ground, which justify claims

"BRANFORD" VIBRATOR

to long life, economy in air consumption, and ample power capacity.

The makers guarantee this apparatus against defective workmanship or material.

FUEL OIL HEATER AND STARTER.

THE use of liquid fuel for steam generating purposes, etc., is becoming more common every day, especially near the large oil fields. In burning crude petroleum, the fuel must be heated to above 200 deg. F. before it can be easily vaporized in the furnace, preparatory to combustion. This heating is practically always accomplished by steam heaters, the oil being passed through coils around which steam is circulated.

When starting up a dead boiler, steam must be borrowed from a live one to heat the oil and to pump it to the furnaces. If, however, no steam is available, a wood or coal fire, with its attendant dirt, must be resorted to. If a furnace is to burn liquid fuel it should be constructed with that object in view. The best results cannot be obtained if the furnace has to be adaptable to burn coal or wood to raise steam and to switch over to oil when sufficient steam is raised to supply the furnaces with fuel heated to the proper temperature.

The "Reichenbach" fuel oil heater and starter has been designed to eliminate the coal or wood fire trouble when raising steam. It consists in the main of a pump, a heater coil and a kerosene torch. Fig. 1 is a partial longitudinal section of the heater and starter, and shows the internal construction. The oil inlet is connected to the main supply line, the pump drawing oil which has passed the suction strainers and delivering it, through the heater, to the furnaces. The kerosene gas burner, standing upright in the centre of the fire pot, heats the oil as it passes through the coil of pipe. The tank on the right carries the supply of kerosene, which is kept under a slight air pressure, by means of the small hand pump.

The base of the apparatus is in the form of a tray, and is made oil-tight, thus preventing the spreading of oil should any accidentally be spilt. The suction flange of the pump is tapped for the nipple and a shellac joint is placed between the flange and the tray. Where the kerosene supply pipes pass through the bottom, the holes are tapped and the pipe threaded through and secured with a lock nut.

The fire pot is provided with an air re-

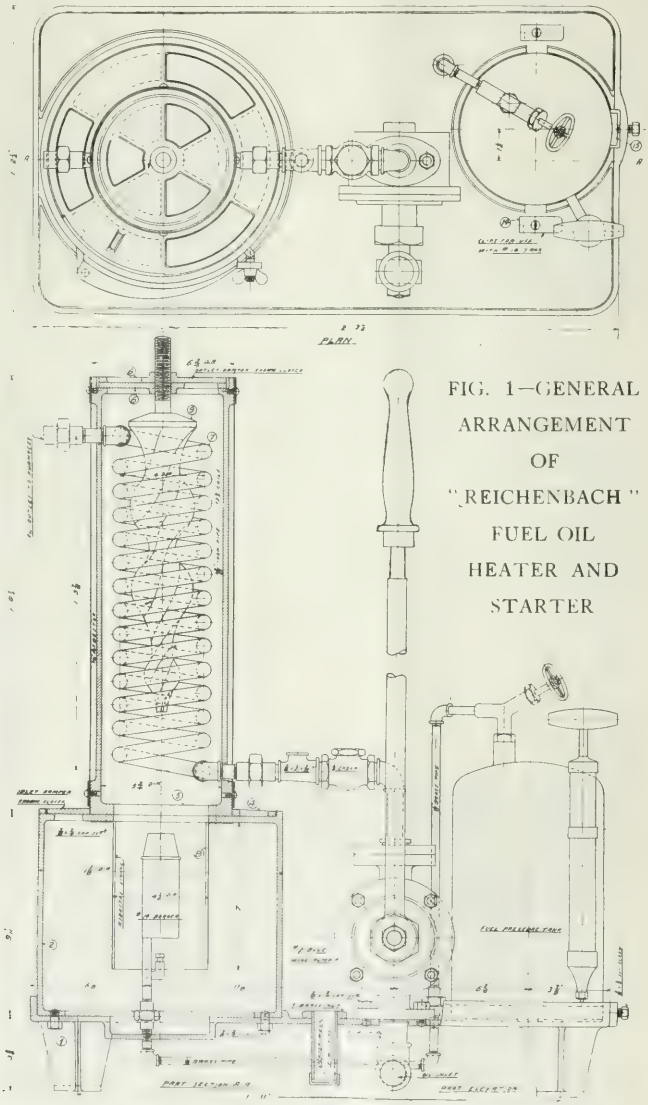


FIG. 1—GENERAL ARRANGEMENT OF "REICHENBACH" FUEL OIL HEATER AND STARTER

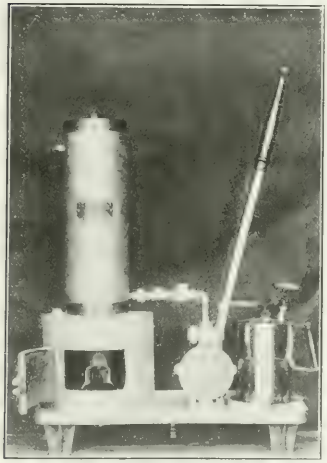


FIG. 2. THE "REICHENBACH" HEATER AND FUEL OIL STARTER.

gulator at the top for supplying air to the burner, which obviates the necessity of keeping the door of the pot open when the machine is in use. Closing this regulator completely shuts off the air supply to the burner, and will extinguish it instantly. Another regulator is provided on the top of the heater barrel. To direct the air to the bottom of the pot, an asbestos-lined petticoat is provided; this can be seen through the open door in Fig. 2. The petticoat is constructed of three segments, the two segments facing the front being arranged to swing outwards to facilitate the removal of the burner.

The heater proper consists of a coil of ⅜-in. wrought iron pipe, through which the fuel oil is forced. The coil is carried in a cast iron cylinder, lagged with planished iron, and bound top and bottom with polished brass bands, the space between the cylinder and the lagging being filled with asbestos. A peculiar-shaped cast iron damper is provided to spread the flame from the burner and to direct it on the heater coils. The damper is hung on a threaded spindle, and its position can be regulated, up and down, to get the best heating effect.

The burner is lighted by placing an asbestos ball, which has been soaked in kerosene and lighted underneath, until the burner is hot enough to vaporize the kerosene, which vapor is then ignited. Heat from the burner thereafter automatically keeps it supplied with kerosene vapor. An extinguishing receptacle is provided between the fire pot and the pump, in which is kept the asbestos ball.

The pump is of the four-valve wing type, and can be arranged for motor or hand drive. Fig. 2 shows a hand-operated outfit. When installed, a return connection is made from the heater coil outlet to the pump suction, for the purpose of circulating the fuel oil when starting the heater.

We are indebted to A. F. Menzies, consulting engineer, New Westminster, B.C., for the foregoing data and illustrations.

NEW MODEL COUNTING MACHINE

THE saving of time and labor, the unerring accuracy, and the simplicity of operation of modern calculating machines, are but a few of the features which have combined to render them indispensable to progressive factory managers.

While formerly the applications of counting machines were principally in connection with clerical work, the benefits to be derived from their judicious use have caused them to come more closely in contact with actual manufacturing conditions.

Some marked improvements in design are shown in the new models of counting machines made by the Durant Manufacturing Company of Milwaukee, Wis. Model "D" counter, illustrated herewith, is a recent production by this firm, and amongst other advantages, it is fitted with a knob at the left of the case, by means of which the operator can instantly re-set the machine or clear it to zero.

MODEL "D" COUNTER.

These machines are being used to a very liberal extent on stamping presses, punches, screw machines, conveyors, etc., for automatically counting product as it comes from the machine.

In factory offices they are of great assistance in maintaining exact records of labor, material, sizes, weights, etc.; in fact, all of the elements of modern cost keeping can be handled to advantage with these machines. The manufacturers will gladly send, to interested parties, a copy of their catalogue, which illustrates the many advantages of these machines, and contains valuable suggestions regarding their adaptation to existing conditions.

PORTABLE CHANNEL IRON PUNCH

AN addition to their existing line of portable hand metal punches, has just been made by the W. A. Whitney Mfg. Co., Rockford, Ill., in the shape of a punch for handling channel iron.

The tool as can be observed from the illustration is designed principally for use on channel or other similar flanged work, the gap on the end of frame lever being so shaped that the tool can be slipped over the end of the section and moved along to the desired part.

The portable channel iron punch has a capacity of a $^1_4$ inch hole through $^1_4$ inch iron, and can punch to the centre of 4 inch channel iron having 1½ inch flange. It uses the same punches and dies as the makers' No. 2 punch, all the small parts of each being interchangeable. The sizes of punches and dies are from ⅛ inch to ½ inch, advancing by 1-32 rds. Sheet metal workers in particular will appreciate the convenience of such a tool.

"WHITNEY" PORTABLE CHANNEL IRON PUNCH.

COMBINED PUNCH AND SHEAR

THIS compact combined punch and shear is capable of a variety of work on structural sections. The unit illustrated, and known as the No. 2 power machine, requires 3 horse-power to operate at its full capacity. It will punch a 1½ inch hole in ½ inch iron, and a 1 inch hole in ¾ inch iron. Angles up to 4 inches can be cut with it, also tees up to ⅜ in. x 2½ in. When used for shearing flats, it will handle up to 5 in. x 1 in., and 7 in. x ¾ in.

The main frame is built of two heavy castings which are bolted together in a vertical plane, allowing the machine to possess all the advantage due to compact assembly and accessibility while retaining the strength and rigidity of a solid casting.

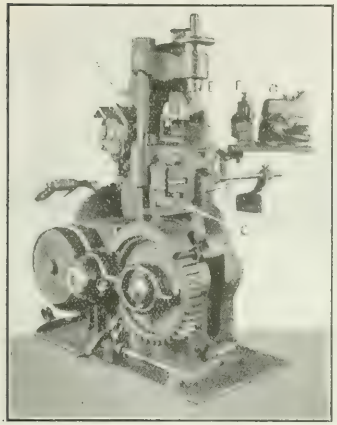
While the three principal operating features — angle cutting, punching and shearing—are individually provided in the design, the use of interchangeable attachments in the punch seat enables tees to be cut and the ends of angles trimmed.

The angle cutter A is located at the back of the machine. The shear is directly in front at B, where a flat is in position showing the adjustable guard C to prevent the work tilting up when being sheared.

The punch seat D which is part of the main frame is designed to accommodate fixtures E.F. and G. which are angle trimmer, punch, and tee cutter

respectively. A swinging shelf allows the change to be made quickly and easily. To the right of the machine is located the length gauge for shear.

All of the cutting parts operate vertically by means of two heavy steel rods actuated from the main shaft and guid-



COMBINATION PUNCH AND SHEAR

ed in long lossess formed on the main frame.

By means of a suitable arrangement the punch can be brought down to the work and into centre punch mark before starting, thus insuring accurate work. In addition, the machine can be set to stop at each revolution or run continuously.

The total weight is 4,000 pounds; floor space, 4 ft. 6 in. x 3 ft.; pulleys 16 in. diameter for a 3-in. belt. Speed 450 rev. per min.

The builders of these machines are the Clark Foundry Co., Rumford, Maine.

SAND MACHINE

FOR castings that must be smooth, perfect, and regular, the preparation of the sand is of great importance. In addition to thoroughly mixing and tempering, the machine shown in Fig. 1 passes the material through a pair of rolls 12 to 18 times, thus pulverizing all small lumps and produces a sand which is smooth, velvety and tough, and possesses an even and regular vent. With the process as used here, one pair of rolls does the work of 12 to 18 pairs as usually set.

The Standard Sand & Machine Company, Cleveland, O., builds these machines in four sizes, equipping them regularly with floor hopper, revolving screen, elevator boot, bucket and chain elevator, and tempering gear. When desired, a three department proportioning hopper is supplied for controlling the amount of old sand, new sand, and dry binder; also a pump for liquid compounds. With the single hopper type, the materials are assembled in proper proportions before delivering to the hopper. With the three or more department hopper, the correct proportions are fed into the elevator boot from each hopper, and it is only necessary to keep the hoppers well supplied. The proportioned materials are delivered to the mixer by means of the bucket and chain elevator, and there the tempering liquids are introduced. The mixture is carried forward by the worm mixture to the feed end of the revolving drum which is provided with buckets inside to deliver the sand to the rolls within the drum. The pitch of the drum carries the mixture forward regularly so that all the sand is treated alike, and is discharged after being thoroughly rolled and blended.

One roll is stationary while the other is set against heavy compression springs which are adjustable. Sand rolled in this way is not ground into dust, and retains its grain thereby helping toward a perfect vent which is so essential. The machine is modern in every respect, steel gears, bronze bushed bearings, and steel roller bearing chains being used.

The three larger sizes are particularly suited for steel foundries. Fig. 2 shows the arrangement of these, the compression springs back of the adjustable rolls being clearly seen. One pair of rolls

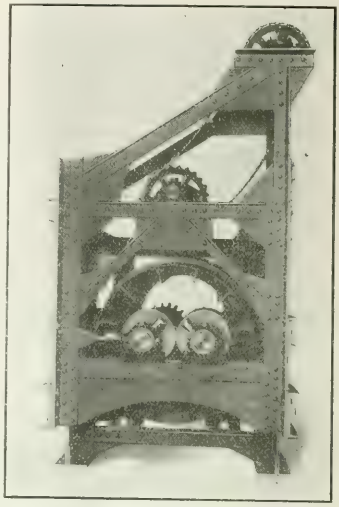


FIG. 2. SPECIAL SAND MACHINE FOR STEEL FOUNDRIES.

arranged in this manner will do the work of tandem or multiple rolls as the material can be passed through the same pair 9 to 36 times. These machines are designed to take the place of wet pan mills for core or facing sands.

The No. 1 machine has a capacity of 160 cu. ft. per hour, with 10 horse-power; rolls 8 in. dia. x 4 ft. long; the No. 4 machine has a capacity of 360 cu. ft. per hour, with 20 horsepower; rolls 16 in. dia. x 6 ft. long. Floor space required is 10 ft. x 14 ft. and 15 ft. x 17 ft. respectively.

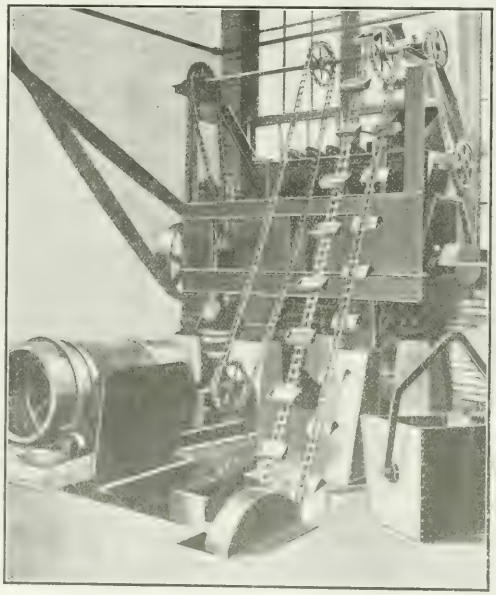


FIG. 1. MIXING, ROLLING AND BONDING MACHINE

SMALL PLANTS TO HELP

D. A. THOMAS, representative of Lloyd George, British Minister of Munitions, had a lengthy conference with Sir Robert Borden recently, regarding the question of the manufacture of ammunition and big guns in Canada. Others present were Sir Sam Hughes, Sir Frederick Donaldson and Lionel Hitchens, the two latter being the British representatives who will be added to the reorganized shell commission. A scale of prices which the commission is willing to pay for munitions will be drawn up, and the practice of tendering done away with.

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Vol. XIV. OCTOBER 21, 1915 No. 17

PRINCIPAL CONTENTS.

THE VALUE OF MANUFACTURING RECIPROCITY

JUST how much and just how little of a man's business should be known by his competitors is and always will be a moot question, and though at first sight anyone might be prepared to give a conclusive reply one way or the other, there are many qualifying features which prevent the average manufacturer from giving a definite reply offhand.

Apart from its desirability, which is questionable, or its efficiency which is still more questionable, the regime of quasi-secrecy inaugurated in connection with munitions manufacture may have a more or less permanent influence on many of our industrial organizations which must ultimately react to their disadvantage.

The advent of Government work has been characterized in the majority of cases by an absence of that spectacular display of industrial accomplishment which in ante-bellum days had been developed to a high degree. One result of this suppressed publicity has been to generate a feeling of mysterious importance in many enterprises whose pretensions were previously of a modest nature.

Without in any way detracting from the beneficial influence on the campaign which is to be obtained by keeping the enemy in complete ignorance of the extent of our munitions supply, it might be asked whether our own efficiency as munitions producers is not reduced as a result of excessive reticence regarding methods of production.

There are some persons who, in war time as in peace, look upon all journalists as necessary evils, to be borne with when necessary, and avoided when possible. Such individuals fail to realize that in standing in other people's light they also stand in their own.

No man is a hero to his valet, and few firms indeed are so highly regarded by all of their employees that they can afford to set themselves up as sphinx-like oracles. That liberty of employment which the North American workman cherishes as his inalienable birthright is one of the greatest factors in nullifying any attempts to form an Industrial Secrets Trust.

Ever since the munitions industry began to assume national proportions, we have consistently advocated, and devoted our efforts to the judicious dissemination of such technical and manufacturing information as could be of greatest immediate value to the numerous entrants into the ranks of producers. The knowledge that these efforts have not been valueless to many firms is our reward, and the manner in which nearly every concern has placed their experience at the disposal of others is proof of the soundness of our policy.

In another part of this issue we are privileged to place on record a few examples of extreme resourcefulness and development in specialized manufacturing, these being probably only some of many instances of improvised equipment throughout the country. Although the intrinsic value of such efforts may be confined to the originators, the ultimate suggestive value to manufacturers as a body may be very great, and wonderful possibilities may await designers and mechanics as the result of being thus jolted out of the rut of conventional design.

Reference might here be made to an instance in shell manufacture which emphasizes the service rendered by technical journals. In machining 3.3 inch shrapnel forgings, it was found necessary to make the wall of increasing thickness for a short distance near the mouth so as to provide ample metal for the internal thread after nosing in. When the making of 4.5 inch shells was being started, many makers spent a great deal of valuable time in ascertaining the proper taper to allow for the same operation. Meantime a new producer who was not bound by precedent, went ahead and dispensed with the taper, getting satisfactory results with one operation less. The fact that others were experiencing trouble by a too strict adherence to existing methods, did not increase the value of his own method to himself personally, while the lack of just such information delayed their progress perceptibly, besides giving rise to a feeling of disappointment, due to the absence of prompt and successful results.

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	$14 70
Lake Superior, charcoal, Chicago	15 75
Ferro Nickel pig iron (Soo)	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron.	26 00	.....
Victoria, No. 1	23 00	20 50
Victoria, No. 2X	22 00	20 50
Victoria, No. 2 plain..	22 00	20 50
Hamilton, No. -	22 00	20 50
Hamilton, No. 2	22 00	20 50

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.25
Steel bars, f.o.b., Toronto	2.25
Common bar iron, f.o.b., Montreal	2.25
Steel bars, f.o.b., Montreal	2.25
Twisted reinforcing bars	2.25
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.35
Tank plates, Pittsburgh	1.35
Beams and angles, Pittsburgh	1.35
Steel hoops, Pittsburgh	1.50
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 25	$12 00
Copper, crucible	14 25	13 50
Copper, unch-bled, heavy	14 25	13 50
Copper, wire, unch-bled	14 25	13 75
No. 1 machine compos'n	11 50	11 50
No. 1 compos'n turnings	10 00	9 50
No. 1 wrought iron	10 00	9 50
Heavy melting steel	8 00	8 00
No. 1 machin'y cast iron	13 50	11 00
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 50
Tea lead	$ 3 50	$ 3 50
Scrap zinc	10 50	9 50

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld		Lapweld	
	Black	Gal.	Black	Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws, 60 & 10%	
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	20 00	19 25
Castings, copper	19 75	19 00
Tin	37 00	37 00
Spelter	18 00	17 00
Lead	6 15	6 25
Antimony	35 00	35 00
Aluminum	60 00	60 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$24 50
Openhearth bilets, Pittsburgh	25 00
Forging billets, Pittsburgh	34 00
Wire rods, Pitsburgh	31 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	70-10
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65-10
Machine bolts, 7-16 and over	57½
Blank bolts	60
Bolt ends	57½
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4c per lb. off
Nuts, hexagon, all sizes	4½c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.75
Structural rivets, as above	3.75
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	5.00
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	30 & 5%

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

MISCELLANEOUS.

Solder, half-and-half	0.22½
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.65
Linseed oil, raw, single bbls.	0.74
Linseed oil, boiled, single bbls.	0.77
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, A, 25 per cent.; B and C, 35 per cent.; cast iron, 60; standard bushings, 60 per cent.; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 85
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 75	4 50
Apollo brand, 10¾ oz. galvanized	5 75	5 30
Queen's Head, 28 B.W.G.	6 00	5 95
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 00	6 00
Viking metal, No. 28	5 25	5 25
Colborne Crown, No. 28	5 70	5 80
Premier No. 28	5 10	5 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$13 00	.....
1¼ in.	13 00	.....
1½ in.	13 00	.....
1¾ in.	13 00	.....
2 in.	13 00	9 25
2¼ in.	14 25	10 50
2½ in.	15 00	11 50
3 in.	19 25	12 25
3½ in.	22 00	14 50
4 in.	27 00	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

	Cents per lb.
WHITE.	
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cobalt Sulphate	.50
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.15
Potassium carbonate	.40
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.22 to .25
Tin	.45 to .50
Silver	.55 to .60
Zinc	.22 to .25

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 18, 1915.—The manufacture of munitions still retains first place in our metal-working plants. The demand for steel bars and billets continues unabated, and little change otherwise is evident. The various mills are operating right up to capacity, and many of them will be unable to take on further business for delivery this year. Consumers are even having difficulty in placing orders for 1916, as the mills decline to commit themselves for any extended period. As a matter of fact, it is hinted that advanced prices may prevail when they are in a position to take on more business.

Machine Tools and Supplies

The situation in the machine tool trade shows little change over that of the previous week. In some instances the delivery of necessary tools for shell production is being longer delayed, and several plants are meantime handicapped in their operations as a consequence. The demand for supplies continues brisk. However, some concerns who require duplicate machine parts to replace those broken or worn, and which must be procured from the United States, find great difficulty in securing these promptly.

Metals

Prices on the different metals are holding firm. Spelter shows some inclination to drop in price, while aluminum has advanced considerably over the quotations of the last week, being now around 60c.

Old Material

Scrap metals have shown no material change during the week, quotations remaining the same, with the exception of tea lead, which registers a slight increase.

Toronto, Ont., Oct. 19.—Indications point to a return of better trade conditions and a distinctly optimistic tone exists in business circles. The record harvest means prosperity in the West; war orders are keeping many factories fully employed, the adverse trade balance has been eliminated and railroad earnings now show an increase. The steel trade is generally considered to be the barometer of industrial conditions, and in its present state of great activity gives reasonable grounds for hoping that the improvement in business now taking place is something more than temporary. The influx of large sums of money resulting from war orders cannot help but stimulate manufacturing, and with the improvement in Canadian fiscal conditions will lead to a marked industrial development in the country.

Developments in the shell industry are pending and arrangements are being made for the manufacture of shells up to 12 in. calibre. The duties and responsibilities of the Shell Committee have increased to such an extent that a reconstitution of its personnel is being made to meet the demands of the situation. It is understood that the British Government have reserved large orders for shells for Canada, providing quick delivery can be made and at a fair price. A central ordnance factory for making big guns is under consideration; this branch of the industry will also come under the control of the Shell Committee.

Steel Market

The steel trade is in a very buoyant condition and the mills are operating at capacity. The market is very strong and prices on a number of steel products are advancing. Canadian mills are quoting iron and steel bars at 2.25c Toronto. Prices on wire are withdrawn pending a revision, which will be in an upward direction. Pittsburgh bars, plates and small shapes for Canadian business are quoted at 1.35c f.o.b. the mill, but are likely to be advanced again very shortly to 1.40c. The difficulty in obtaining quick delivery on steel products is illustrated by a Canadian buyer recently paying several dollars a ton premium for prompt delivery of structural material.

The placing of orders for larger shells which is anticipated, and the repeat orders for 18-pdr. shells in considerable quantity indicates that the steel companies will be very busy for some time to come. It is understood that the Dominion Steel Corporation have decided to embark on the manufacture of shells and that a large order will be placed with them for those of large calibre. This concern has for some time been actively engaged in producing steel for shells but not turning out the complete product.

The galvanized sheet trade is somewhat unsettled. Although the price of spelter has declined, manufacturers of sheets are hesitating before making any further change since the revision announced recently. The semi-finished steel situation is steadily becoming a factor in the present sheet market. The unusual conditions in sheets have upset the price relationship as between gauges. Galvanizers are asking more for the light gauges of sheets than for the heavy gauges because of the greater amount of spelter required per ton in the former.

All the mills in the States are running to capacity on account of the tremendous buying of all kinds of steel products. Steel for near-by deliveries is almost impossible to get at any price. The heaviest demand is for round bars and blooms for shells. Prices are advancing, no business being placed for bars at less than 1.40c Pittsburgh. Forging billets have advanved $1 per ton and are now being quoted at $34 base, f.o.b. Pittsburgh. Prevailing prices on wire are strong, and it is not improbable that quotations will be put up $1 or $2 per ton in the near future.

Pig Iron

The chief interest in the market is in steel making grades, with low-phosphorous iron still the feature. Canadian buyers have taken considerable tonnage from the States. Among these is the Canadian Steel Foundries, who have bought 7,000 tons recently and have inquired for 5,000 tons additional, the price being $25 at the furnaces. Foundry grades are quiet at unchanged prices.

Machine Tools

Machine tool dealers are anticipating a period of considerable activity in the near future when it is expected that the orders for the larger calibre shells will be ready to be placed. A few tentative inquiries have already been received for large size lathes, but up to the present few orders have been given out. The great problem at present as regards new equipment is the question of delivery. Builders are in a sold-up condition and the supply of suitable second-hand tools is rapidly decreasing.

Supplies

The demand for machine shop and mill supplies continues good and prices are holding very firm. Prices of high-speed twist drills are withdrawn on account of the continued advance in high-speed steel. In regard to the latter, the situation shows no improvement and prices are away up; supplies in sufficiently large quantities are also still difficult to obtain. Prices of waste are very firm but unchanged. Turpentine has advanced 1c and is now quoted at 65c per gallon.

Metal Market

The metal market is dull and there is little of interest to note. Tin and spelter are lower, but aluminum has advanced. The copper market is steady as a result of good demand for war munitions which shows no signs of abatement. The lead market is unchanged, but the position of this metal is a good one. There is still some scarcity in supplies of antimony, but the demand has not improved and quotations are stationary. Prices of solders are unchanged, but have a weak

tendency due to tin having declined. There is no change locally in the general situation. The general trend of business continues the same, metal for munitions constituting the principal demand.

Tin.—The market is quiet and lower, and comparatively little interest is being shown by consumers. The one influence dominating the tin market in New York is the expectation that the British Government will impose a 10 per cent. tax on its importation; there is as yet no official confirmation of any such intention. No large business is looked for until that question is settled, as consumers are content to wait. Tin has declined 1c locally and is quoted at 37c per pound.

Copper.—The market is very dull, but prices are holding firm. Buyers have fair stocks on hand, but are reaching a point where they will have to take on additional supplies. Producers are well stocked up, but are not inclined to offer any price concessions. Quotations are steady and unchanged at 19½c per pound.

Spelter.—The market for spot is weaker owing to the absence of interest on the part of consumers. Another influence lending weakness was a decline in the London market. Spelter has declined 1c locally, and is quoted at 17c per pound.

Lead.—The market is quiet and unchanged. It is reported that Canadian consumers have closed contracts for some good amounts of lead in addition to those recently placed. Quotations are firm at 6¼c per pound.

Antimony.—There is no change in the situation and the demand does not show much improvement. Quotations are unchanged at 35c per pound.

Aluminum.—Supplies are diminishing and the demand is increasing heavily, due to war orders. Quotations have reached a record level and are nominal at 60c per pound.

LOOKING FOR NICKEL

VICKERS, LTD., the well-known armament manufacturers, are financing an exploration expedition to the Fond du Lac region lying northeast of Lake Athabasca, in northern Alberta, in search of nickel deposits which are believed to occur extensively in that country.

Some months ago H. V. Dardier, a prospector, returned from Fond du Lac with rich specimens of nickel ore and went to England in order to interest British capitalists. He has been placed in charge of the expedition, which is on a large scale, comprising 25 engineers, assayers and mineralogists in addition to a large force of laborers.

They take with them machinery valued at $50,000 and supplies costing $10,000, being prepared for a long stay in order to thoroughly prospect the region. The total cost of the enterprise will amount to fully $100,000.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Comissioners 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.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

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, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

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

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. 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.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbegad No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

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

Engineering

Kingston, Ont.—Davis & Son contemplate installing equipment in their power house.

Owen Sound, Ont.—The Owen Sound Ironworks are equipping their plant for making shells.

Welland, Ont.—It is reported that preparations are being made to reopen the plant of the Canadian Steel Foundries.

Owen Sound, Ont.—The Canadian Malleable Iron Co., will install equipment for making high explosive shells.

Port Moody, B.C.—The Port Moody Steel Works is contemplating the erection of a plant to cost upwards of $100,000.

Calgary, Alta.—The Alberta Hydro-Electric Power Co. will build a power plant here. Ald. Fawkes is consulting engineer.

Jacksonboro, Ont.—The Mattagami Pulp & Paper Co. will commence at once the erection of pulp and paper mills at Smooth Rock Falls, on the Mattagami River, near here, to cost $2,000,000.

Bay of Islands, Nfld.—Joseph Salters & Sons, of North Sidney, C.B., have applied for permission to develop water powers near here.

Walkerville, Ont.—The Canadian Duplex Steam Trap Co., which was recently incorporated with a capital of $40,000, will establish a plant here.

Pembroke, Ont.—Thomas Pink Co. are installing new machinery for making shells. The new plant will be a duplicate of the original one and will double the company's output.

Kingston, Ont.—A. Davis & Son are in the market for one 125 to 150 h.p. Wheelock engine; one 100-kw., 550-volts, 60-cycle, 3-phase alternating current generator, and one 100-kw. direct-connected, 550-volts, 60-cycle, 3-phase alternating current generator set.

Merritt, B.C.—The British Columbia Copper Co. proposes to spend in the neighborhood of $500,000 in the erection of a concentrating plant at their Copper Mountain properties. This is to be operated by an electric power plant to be erected either at Princeton or Tulameen, according to reports, it being estimated that it will take at least $300,000 to erect and equip same.

Ottawa, Ont.—An important new factory for the manufacture of munitions of war is to be established at Renfrew, Ont., entitled, "O'Brien's Munitions, Ltd." The company was incorporated last week with a capital stock of two million dollars. It is understood that M. J. O'Brien, the well-known contractor, is the leading spirit in the enterprise, and that his investment will be half a million dollars.

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.

ALLIES PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendence Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Atache, Russian Embassy, Washington, D.C.

Municipal

Winnipeg, Man.—By a vote of 104 to 64 the ratepayers of Assiniboia defeated the $27,000 incinerator by-law on Oct. 9.

Port Coquitlam, B.C.—A by-law has been passed by the ratepayers to raise $35,000 for the purpose of installing a civic water system.

St. Andrews, N.B.—The Town Council propose making extensions to the waterworks system at a cost estimated between $20,000 and $30,000.

St. Agathe des Monts, Que.—A sewage system will be installed here which will include a pumping station. Ouimet & Lesage of Montreal are the engineers.

Watrous, Sask.—A by-law will be voted on by the ratepayers on Oct. 26 to authorize the expenditure of $49,423 for the construction of a waterworks system.

Niagara Falls, Ont.—It is proposed to spend $14,000 on the purchase of the machinery and equipment of the city electric power station. A by-law will be submitted on November 3.

Whitby, Ont.—A macadamized road 26 miles in length, to cost $310,000, was recommended by Provincial Highways Engineer W. A. Maclean at a meeting of the Kingston Road Improvement Committee here, on Oct. 14. Representatives were present from all the towns and townships interested, also Controller Foster and Commissioner Harris from Toronto, which is backing the project.

Mimico, Ont.—Contracts for the new sanitary system of Mimico and New Toronto were awarded on Oct. 8 at a special meeting of the commission recently appointed. Harvey, Stewart & Co., of Nova Scotia, were the successful bidders for the construction of the sewage system, at the figure of $64,493. F. F. Frue, of Toronto, will build the disposal plant, the estimate being $15,253, and the Dominion Sewer Pipe Co. was awarded the contract for the vitrified pipes and segment blocks used in the system.

General Industrial

Guelph, Ont.—Fire on Oct. 14 did $15,000 damage to the Colonial Knitting Co. plant here.

Lindsay, Ont.—Horn Bros. have not completed arrangements for the rebuilding of their factory.

Vernon, B.C.—R. J. Graham & Co., of Belleville, Ont., will build a factory here for evaporating vegetables.

Halifax, N.S.—The Nova Scotia Underwear Co. mills at Eureka, were totally destroyed by fire on Oct. 13. The loss is covered by $150,000 insurance.

Montreal, Que.—J. R. Walker & Co. paper manufacturing plant at Sault Au Recollet was destroyed by fire on Oct. 14, the loss being estimated at $25,000.

Tenders

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, Nov. 9, 1915, for the supply of a radial drill for machine shop, Danforth avenue car barns. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to Wednesday, Oct. 27, 1915, for the following supplies for the Fire Department: 3,000 feet 2½-inch cotton, rubber-lined fire hose; 12 non-interfering fire alarm boxes. Specifications and forms of tender may be obtained at the office of the Chief of the Fire Department, Central Fire Station.

New Westminster, B.C.—Tenders will be received up till October 29, for an electric freight elevator for Public Building. Plans and specifications may be seen on application to the caretaker of the Public Building, New Westminster, B.C.; at the office of Wm. Henderson, Resident Architects, Victoria, B.C.; at the Post Office, Vancouver, B.C., and at the Department of Public Works, Ottawa.

Windsor, Ont.—Tenders, addressed to J. F. Smythe, chairman Water Commissioners, Windsor, Ont., will be received up to Saturday, October 23, for the building and installing at the Windsor water works pumping station of one 200 h.p. steel Scotch boiler—to carry 160 lbs. pressure according to specifications and blue prints on file at the office of the Water Commissioners, City Hall, Windsor, Ont.

Port Arthur, Ont.—Tenders for fittings, customs examining warehouse, etc., Port Arthur, Ont., will be received until Friday, October 29, 1915. Plans, specifications and form of contract can be seen and forms of tender obtained on application to the Department of Public Works, Ottawa, at the offices of Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Wm. Hood, Architect, Port Arthur, Ont.

Berlin, Ont.—Tenders will be received by the Chairman of the Sewerage Committee until Tuesday, October 26, 1915, for furnishing and installing sewage pumping machinery, comprising: (a) Two turbine pumps and all piping, capacity 500 gallons per minute, 33 feet head. (b) Two a.c. motors, switchboard and electrical instruments, installed complete. Specifications may be seen at the Engineer's Office, City Hall, Berlin, or at the office of Chipman & Power, consulting engineers, 204 Mail Building, Toronto.

Ottawa, Ont.—Tenders will be received up to Tuesday, November the 23rd, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease, castile soap, hard soap, turpentine, chemicals, cleansing powder, bunting. Forms of tender and all information may be obtained by application to the Naval Store Officer at H.M.C. Dockyards at Halifax, N.S., or Esquimalt, B.C., or to G. J. Desbarats, Deputy Minister of the Naval Service, Ottawa.

Contracts Awarded

London, Ont.—The Canadian Moloney Co., have been awarded a contract for transformers by the city council.

Trenton, Ont.—The contract for furnishing steel work and substructure of bridge over Trent river was awarded by Dominion Government to the Ontario Bridge Co., Toronto, at about $132,000.

Winnipeg, Man.—The Minister of Public Works has let the contract for the furnishing of the steel library and vault fittings for the new law courts to the Winnipeg Ceiling and Roofing Co., their price being $4,600.

New Incorporations

The Great West Direct Power Engine Co., Vancouver, B.C., has been incorporated with a capital stock of $25,000 to manufacture engines, machinery, etc.

The Paste & Gum Co. has been incorporated at Toronto with a capital of $40,000 to take over the business of the Paste & Gum Co. at Toronto, Ont. Incorporators: Robert Ellis and Goldwin Larratt Smith, all of Toronto.

The Ontario Cartridge Co. has been incorporated at Toronto with a capital of $40,000 to manufacture ammunition of all kinds at Ford, Ont. Incorporators: John Henry French, Walter Frank Tant and Forrest M. Keeton, all of Detroit, Mich.

The Belmont Oil & Gas Co. has been incorporated at Toronto with a capital of $40,000 to engage in the business of refining and treating artificial and natural gas, petroleum at Belmont, Ont. Incorporators: Frank Blair Tomb and John Stephenson Cousins, of London, Ont.

Personal

Lionel Hichens, chairman of Cammell, Laird & Co., has arrived in Ottawa to assume his duties as a member of the Shell Committee.

F. A. Skelton, director and secretary-treasurer of the Canadian Car & Foundry Co., Montreal, has left for New York on a business trip.

John Pugsley, at one time a member of the firm of Pugsley, Dingman & Co., soap manufacturers, Toronto, Ont., died in that city on Oct. 14, aged 63.

Hon. David MacKeen, of Halifax, N.S., at one time manager of the Dominion Iron & Steel Co., has been appointed Lieut.-Governor of Nova Scotia.

Charles Stewart, vice-president of Burrow, Stewart & Milne Co., iron founders, died at Hamilton, Ont., on Oct. 8. The deceased was born at Paterson, N.J., on Oct. 14, 1837.

W. W. Butler, vice-president of the Canadian Car & Foundry Co., Montreal, has left on an inspection trip, during which he will visit all the plants in the United States occupied on Canadian Car Co. orders.

Sir Hay Frederick Donaldson, K.C.B., recently appointed as technical adviser to the Shell Committee, has arrived in Ottawa. Sir Frederick Donaldson was until recently chief superintendent of Royal Ordnance Factories at Woolwich Arsenal.

George Cahoon, jr., has just been advanced from the vice-presidency of the Laurentide Co. to the presidency, to fill the vacancy caused by the death of Sir William Van Horne, and C. R. Hosmer assumes the vice-presidency. J. K. L. Ross was appointed to the vacancy on the board.

Charles Brewer Hunt, head of the milling firm of Hunt Bros., of the coal business bearing the same name, ex-president of the London Board of Trade, and one of the foremost business men of this city, died suddenly in London, Ont., on Oct. 11. The deceased was born at St. Thomas, 65 years ago. He was at one time actively associated with the London Electric Co., and was one of the pioneers of the milling industry in Western Ontario.

Walter Collis, manager of the Collis Leather Co., Aurora, Ont., died suddenly at the Western Hospital, Toronto, on Oct. 16. The late Mr. Collis was very well known in business circles. He was an expert in the manufacture of chrome leather, and for several years was engaged with the Davis Leather Co. of Newmarket. About three years ago, however, he severed his connection with the Newmarket concern and established the company of his name here. Deceased was 60 years of age.

Alexander Tropenas, inventor of the Tropenas converter, who died at Lyons, France, July 14, aged 55 years, served early in his career as a foreman in the plant of the French Brugès firm where he operated the Robert converter. Later he went to England to superintend the operation of the same converter for Edgar Allan & Co. at Sheffield. While there he invented his own converter, which he patented both in Great Britain and the United States. About 1901 he went to the United States to introduce his process for making small steel castings.

Trade Gossip

The Dominion Stamping Co., Walkerville, Ont., have recently installed a 5-ton electric traveling Northern crane manufactured by the Northern Crane Works, of Walkerville, Ont.

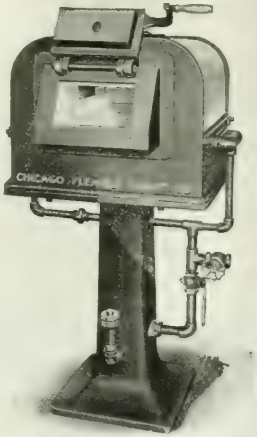
Ottawa, Ont.—The opening of a new transcontinental railway service was signalized by the departure on Oct. 12 of a Canadian Northern train of Pullman cars, bearing a party of senators and M. P.'s on an excursion trip to Vancouver, B.C.

Carriage Factories Ltd., who have plants at Montreal, Brockville and Orillia, have recently obtained large war orders for such articles as artillery harness, saddles, blankets, halters, ambulances, transportation carriages and water wagons.

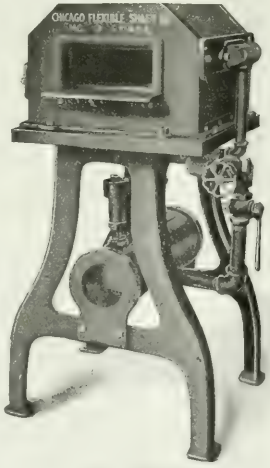
Inverness Railway & Coal Co.—A receiver and manager of the Inverness Railway & Coal Co. has on the application of the National Trust Co., Toronto, trustees for the bondholders of the Inverness Railway & Coal Co., been appointed by the Court of Nova Scotia.

Rise in Custom Receipts.—An increase of over $2,000,000 in customs receipts is shown by the figures for September. Receipts totalled $8,029,665, as compared with $5,919,273 in September of last year, or an increase of $2,110,391. For the six months of the present fiscal year receipts have been $44,760,830, as compared with $43,044,913, an increase of $1,715,917.

Contracts Affected by Exchange.—The rate of exchange is reacting to the detriment of Canadian war contracts on this side. It is said that one contract for $50,000 felt through a few days ago solely on this account. It is felt that the Dominion Government should take steps to obviate the difficulty.



STEWART NO. 1 OVEN
Size of heating space, 5"x9"x13½".
Price with blower, $100.00.
Price without blower, $75.00.



No. 3 FORGE
Front opening, 3½"x8".
Rear opening, 3¾" diam.
(Rear opening same as front, if specified.)
Depth of heating space, 10".
Price with blower, $65.00.
Price without blower, $40.00.

Perfect Control Makes Tool Hardening Sure

A Stewart Forge or Furnace is always under the absolute control of the operator. He can get any heat quickly and hold it accurately without any wavering above or below. There is no guessing, no trusting to luck, no uncertainty about the result. He can heat every piece or lot exactly according to the grade of steel and to the purpose for which it is intended. As a result steel heating becomes an *exact* science when you use Stewart Furnaces; and spoilt work is reduced to a minimum.

Stewart Oven Furnaces, except those built for assaying and enameling, are made without muffles; have no need of them.

The Stewart line includes over 100 stock styles and sizes and the patterns of many special designs for various purposes. In this wide range there is one style and size which will exactly meet your needs. Let our service department help you find it. We will ship it on 30 days' approval. Write for catalogue 56.

Chicago Flexible Shaft Co.

210 to 230 Ontario St., Chicago, Ill.

The W. T. Rawleigh Co., who have a large factory at Freeport, Ill., and plants also at Memphis, Tenn., and Winnipeg, Man., will build a factory at Hamilton, Ont., on Rosslyn avenue. The company manufacture proprietary medicines, extracts, spices, toilet articles, stock remedies, disinfectants, etc. The first building will be 120 feet long by 60 feet deep, and five storeys high. Work will be started shortly, and Hamilton will be Canadian headquarters.

Halifax, N.S.—A petition for the winding-up of the Nova Scotia Car Works, was presented to the Supreme Court, on Oct. 15. It was ordered that the petition come up on Oct. 29 before the judge presiding at Chambers. Notice is given on behalf of the company that on Oct. 29 an application will be made for an order appointing the Eastern Trust Co., liquidator, that company having to-day been appointed liquidators. The plant is now engaged on an order for the 200 cars for the I. C. R.

Canadian Flour Mills Busy—Canadian milling companies have entered on another year under favorable auspices. Practically all mills are working to capacity now, and they have orders on their books from British and Foreign Governments that will keep them fully employed for at least two months to come. Two mills share in one Government order for 140,000 bags of flour. Certain mills are operating day and night. It is interesting to note, too, that Minneapolis mills in order to fill export orders have purchased considerable quantities of Canadian flour.

Dominion Development Commission—It is understood that Senator J. A. Lougheed, will be chairman of the Commision to be appointed by the Government to study a scheme of Canadian national development, with special reference to present conditions. It is further learned that William Smith, the member for South Ontario, and a well known stock breeder; J. C. Watters, the prominent labor man, of Ottawa; J. W. Flavelle, of Toronto; Dr. J. G. Rutherford, former Veterinary Director-General of Canada, and E. N. Hopkins, of Moose Jaw, a well known member of the Grain Growers' Association, have all been named as members of the commission, while other appointments are expected to be announced shortly.

Tenders Received on Big Pulp Limit.—The Ontario Government has received several tenders in response to its decision to offer for sale the Lac Seul or English River pulp limits north of Kenora. The limits were advertised some time ago, and offers were to be based upon strict conditions as to capital investment and paper output, similar to those imposed on the company that is now operating the immense plant at Iroquois Falls and turning out two hundred tons of print paper a day. Hon. G. Howard Ferguson, Minister of Lands, Forests and Mines, is now considering the tenders.

Lake Superior Corporation.—At the annual meeting of Lake Superior Corporation held last week the following were elected directors: Walter K. Whigham, Frederick McOwen, John T. Terry, Herbert Coppell, J. S. Dale, H. I. Underhill, W. E. Stavert, W. C. Franz, Alex. Taylor, James Hawson, A. H. Chitty and Thomas Gibson. At the meeting of the board, following the shareholders' meeting, officers were elected as follows: Chairman of board, W. K. Whigham; president, W. E. Stavert; vice-president, Herbert Coppell, W. C. Franz and James Hawson; secretary, Alex. Taylor; treasurer, James Hawson.

Mussens Ltd. Affairs.—Exchange of about $35,000 worth of stock for cash or bills receivable, without reduction of estimated surplus to creditors, is an encouraging note in a statement issued by the liquidator of Mussens Ltd. The six months extension granted by the court has just expired, and application will be made for further extension, as the showing made during the past six months would seem to warrant it. Of $131,000 bills receivable, $81,000 has been collected, and a considerable portion of the remainder is considered good. Stock amounting to $209,000 remains on hand, but can likely be sold for full value if time is given to do so. The liability to the bank is materially reduced, and a 10 per cent. dividend has been declared for the benefit of ordinary creditors. The liquidator, J. J. Robson, estimates that there is a surplus of $183,000, as assets exceed liabilities by that amount. Among the assets is an item of $66,750 equity in property in Montreal and other cities.

Catalogues

Plastic Boiler and Furnace Linings.—The C. B. Turner Co., Toronto, Ont., have issued a booklet dealing with plastic linings for boilers and furnaces. Directions for applying this lining are given and a list of users is included.

The Precision Instrument Co., Detroit Mich., have issued a set of bulletins describing an interesting line of measuring and recording apparatus for flue gases, etc. The bulletins deal successively with the Parker Co. machine, the "Simmance & Abady" combustion recorder, the "Simmance & Abady" "Precision" pressure and vacuum recorders

and indicators, "Precision" gauges, "Precision" efficiency kit, "Wright's" boiler tester and "Orsat" apparatus, the "Roland Wild" calorimeter, "Precision" water meter, "Simmance & Abady" encased thermometers. The principal features and method of operation of each apparatus are described fully especially as regards the CO_2 combustion recorder which is dealt with at considerable length. The bulletins contain price lists and code words and are fully illustrated. They are gotten up in an attractive manner and are bound together in a loose leaf folder.

Refractory Efficiency Engineering is the title of a 42-page booklet presented to the firebrick trade by the Elk Firebrick Co. of Canada, Hamilton, Ont., with the idea of bringing to the attention of the consumer a few facts concerning firebrick that it is hoped will prove beneficial to all concerned. The booklet is arranged in two parts. The first contains a brief description of the manufacture of firebrick from the mining of the fire-clay to the selling and loading of the products, including a description of the various processes. The second part deals more particularly with the company's products and includes references to the clays and equipment used, brands of firebrick and methods of sorting. Mention is also made in this section of the company's engineering department and policy. A number of ordinary special shapes are illustrated with their dimensions, while the concluding pages contain a number of useful mechanical tables for the trade.

Book Reviews

Northern Pacific Ports is the title of a book compiled and published by the Terminal Publishing Co., Inc., San Francisco, Cal. This is the second edition and the contents consist of useful marine, exporting and importing information for Alaska and the western coasts of Canada and the United States. The book contains a great deal of useful information for shipping concerns, traders, port authorities, etc. Brief mention of some of the subjects dealt with will give an idea of the scope of this publication. These are as follows:—Navigation laws of the United States, particulars of the various ports along the seaboard of the North Pacific including their harbor rules and regulations, list of transportation companies and their fleets, matters pertaining to Canadian and United States customs, currency tables, Rule of the Road at Sea, etc. The book contains 44 pages of reading matter printed in clear type with index and is bound in substantial cloth covers.

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Abrasive Materials.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Norton Co., Worcester, Mass.
Stevens, F. B., Detroit, Mich.

Acetylene.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Acetylene Generators.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Accumulators, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Wks., Chicago.
Mesta Machine Co., Pittsburg, Pa.
William R. Perrin, Ltd., Toronto.
Wm. Tod Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Air Compressors.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Smart-Turner Machine Co., Hamilton, Ont.

Air Hoists.
Whiting Foundry Equipment Co., Harvey, Ill.

Air Hose.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Can. Ingersoll-Rand Co., Montreal.

Air Receivers.
Can. Ingersoll-Rand Co., Montreal.

Air Washers.
Buffalo Forge Co., Buffalo, N.Y.
Can. Sirocco Co., Ltd., Windsor, Ont.

Ammeters.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Aluminum.
Tallman Brass & Metal Co., Hamilton.

Alloys, Steel.
H. A. Drury Co., Ltd., Montreal.
Hawkridge Bros. Co., Boston, Mass.
Vanadium Alloys Steel Co., Pittsburg, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Annunciator Systems.
Lintz-Porter Co., Toronto.

Arbors.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Plessisville Foundry, Plessisville, Que.
Pratt & Whitney Co., Dundas, Ont.

Assembling Stands.
Skinner Chuck Co., New Britain, Conn.

Automatic Chucks.
Garvin Machine Co., New York.

Asbestos Packing.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Autogenous Welding and Cutting Plants.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Automatic Index Milling Machines.
Garvin Machine Co., New York.
National Machinery and Supply Co., Hamilton.

Automatic Machinery.
Baird Machine Co., Bridgeport, Conn.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt. & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
Pratt & Whitney Co., Dundas, Ont.
Owen Sound Iron Works Co., Owen Sound.
Windsor Machine Co., Windsor, Vt.

Automatic Multiple Spindle.
Windsor Machine Co., Windsor, Vt.

Automatic Wood Screw Machines.
Asa F. Cook Co.

Axle Cutters.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler, Ont.

Babbitt Metal.
Can. Fairbanks-Morse Co., Montreal.
Hoyt Metal Co., Toronto.
Magnolia Metal Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

Baking Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.
Owen Sound Iron Works Co., Owen Sound.

Ball Bearings.
Can. Fairbanks-Morse Co., Montreal.
Chapman Double Ball Bearing Company, Toronto.

Ball Burnishing Machines.
Baird Machine Co., Bridgeport, Conn.

Banding Machines, Hydraulic.
West Tire Setter Co., Rochester, N.Y.

Barrels, Steel Shop.
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

Bars, Boring.
Charles F. Elmes Eng. Works, Chicago
Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.

Bar Benders and Straight Edges.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Bar Benders, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Bar Twisting Machines.
Mesta Machine Co., Pittsburg, Pa.

Batteries and Accessories.
Lintz-Porter Co., Toronto.

Bell Systems.
Lintz-Porter Co., Toronto.

Belt Benches.
Tabor Mfg. Co., Philadelphia, Pa.

Belt Dressing and Cement.
Graton & Knight Mfg. Co., Montreal.

Belt Lacing, Leather.
Graton & Knight Mfg. Co., Montreal.

Belting, Chain.
Can. Fairbanks-Morse Co., Montreal.
Graton & Knight Mfg. Co., Montreal.
Jones & Glassco, Montreal.
Morse Chain Co., Ithaca, N.Y.

Belting, Cotton.
Dominion Belting Co., Hamilton.

Belting, Leather.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Graton & Knight Mfg. Co., Montreal.
Main Belting Co., Montreal
Morse Chain Co., Ithaca, N.Y.

Belting, Stitched Cotton Duck.
Dominion Belting Co., Hamilton, Ont.
Main Belting Co., Montreal.

Belting, Rubber.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Benders, Angle and Tee Iron.
Can. Buffalo Forge Co., Montreal.
Watson-Stillman Co., Aldene, N.J.

Bending Machinery.
John Bertram & Sons Co., Dundas.
Bertrams, Limited, Edinburgh, Scotland.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Buffalo Forge Co., Montreal.
Can. Machinery Corporation, Galt, Ont.
Charles F. Elmes Eng. Works, Chicago
Jardine, A. B., & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.
Toledo Machine & Tool Co., Toledo, O.
Steel Bending Brake Works, Chatham, Ont.
Watson-Stillman Co., Aldene, N.J.

Bins, Steel.
Dennis Wire & Iron Works Co., Ltd., London, Canada.
Toronto Iron Works, Ltd., Toronto.

Bit Brace Tools.
Wells Bros. Co., Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Blast Gauges, Cupola.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Blocks, Lifting.
Northern Crane Works, Walkerville.

Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Girard Machine & Tool Co., Philadelphia, Pa.
Sheldons, Ltd., Galt, Ont.
Southwark Foundry & Machine Co., Philadelphia.

Blow Pipes and Regulators.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Bluing Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Boilers.
Can. Locomotive Co., Kingston, Ont.
National Machinery & Supply Co., Hamilton.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.

Boiler Compounds.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Boiler Graphite.
Dixon Crucible Co., Jersey City, N.J.

Boiler Makers' Supplies.
Jno. F. Allen Co., New York.

Bolt Cutters and Nut Tapers.
Wells Brothers Co., Greenfield, Mass.

Bolts.
Galt Machine Screw Co., Galt, Ont.
London Bolt & Hinge Works, London, Ont.

Bolt and Nut Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas, Ont.
Owen Sound Iron Works Co., Owen Sound.
Gardner, Robt., & Son, Montreal.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
National Machinery & Supply Co., Hamilton.
Wiley & Russell Co., Greenfield, Mass.

Books.
MacLean Publishing Co., Toronto.

Boring Machines, Upright and Horizontal.
John Bertram & Sons Co., Dundas.
Colburn Machine Tool Co., Franklin, Pa.
Garlock-Machinery, Toronto.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghamton, N.Y.

Boring Machines, Pneumatic, Cylinder.
Baker Brothers, Toledo, O.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N.Y.

Boring and Turning Mills.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Boxes, Annealing, Charging.
Mesta Machine Co., Pittsburg, Pa.

Box Puller.
Jardine, A. B., & Co., Hespeler, Ont.

Boxes, Steel Shop.
Cleveland Wire Spring Co., Cleveland.

Boxes, Tote.
Cleveland Wire Spring Co., Cleveland.

Brakes.
Brown, Boggs & Co., Hamilton, Can.
Whiting Foundry Equipment Co., Harvey, Ill.

Brakes, Heavy Plate Bending and Cornice.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Brass Working Machinery.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Warner & Swasey Co., Cleveland.
Niles-Bement-Pond Co., New York.

Brick Cars.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Brick Dryers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Brick Machinery.
Eastern Machinery Co., New Haven.
Sheldons, Ltd., Galt, Ont.

Bridges, Railway and Highway.
Can. Bridge Co., Walkerville, Ont.

Buckets, Clam Shell, Crab and Dump.
Whiting Foundry Equipment Co., Harvey, Ill.

Buffing and Polishing Machinery.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Girard Machine & Tool Co., Philadelphia, Pa.
Gray Mfg. & Machine Co., Toronto.
New Britain Machine Co. New Britain, Conn.

Bulldozers.
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Mach. Corporation, Galt, Ont.
National Machinery & Supply Co., Hamilton, Ont.
Watson-Stillman Co., Aldene, N.J.

Burners, Enclosed Flame Gas.
Oven Equipment & Mfg. Co., New Haven, Conn.

Burners, Fuel, Oil and Natural Gas.
Whiting Foundry Equipment Co., Harvey, Ill.

Burring Reamers.
Wells Brothers Company, Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Butterises.
Wells Brothers Company, Greenfield, Mass.

Burrs, Iron and Copper.
Parmenter & Bulloch Co., Gananoque

Canners' Machinery.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
National Machinery & Supply Co., Hamilton, Ont.

Calssons.
Toronto Iron Works, Ltd., Toronto.

Cars, Charging Box Ingot.
Mesta Machine Co., Pittsburg, Pa.

Cars, Industrial.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Castings, Aluminum.
Cunningham & Son, St. Catharines, Ont.
Owen Sound Iron Works Co., Ltd., Owen Sound, Ont.
St. Lawrence Foundry, Galt, Ont.
Tallman Brass & Metal Co., Hamilton

Castings, Air Furnaces.
Wm. Tod Company, Youngstown, O.

Castings, Brass.
Cunningham & Son, St. Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.
T. C. Lawrence Foundry, Galt, Ont.
Mesta Machine Co., Pittsburg, Pa.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Bronze.
Cunningham & Son, St. Catharines, Ont.
Mesta Machine Co., Pittsburg, Pa.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Copper.
Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Gray Iron.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Erie Foundry Co., Erie, Pa.
Alexander Fleck, Ltd., Ottawa.
Gardner, Robt., & Son, Montreal.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Mesta Machine Co., Pittsburg, Pa.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.

Castings, Steel Chrome and Manganese Steel.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Mesta Machine Co., Pittsburg, Pa.
Wm. Tod Company, Youngstown, O.

Castings, Malleable.
Galt Malleable Iron Co., Galt.

Castings, Nickel Steel.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Mesta Machine Co., Pittsburg, Pa.

Cement, Disc Wheel.
Gardner Machine Co., Beloit, Wis.

Cement, Iron.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Shelton Metallic Filler Co., Derby, O.

Cement Machinery.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
National Machinery & Supply Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound.

Centre Reamers.
Wells Brothers Co., Greenfield, Mass.

Centering Machines.
John Bertram & Sons Co., Dundas.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Hurlbut, Rogers Machinery Co., South Sudbury, Mass.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Centrifugal Pumps.
Can. Buffalo Forge Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.

Chain Blocks.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton.

Chains, Silent and Transmission.
Jones & Glasco, Montreal.
Morse Chain Co., Ithaca, N.Y.
Plessisville Foundry, Plessisville, Que.

Chemists.
Can. Inspection & Testing Laboratories, Ltd. Montreal.
Toronto Testing Laboratory, Ltd., Toronto.

Chucks, Aero, Automatic.
Garvin Machine Co., New York.

Chucks, Drill, Lathe and Universal.
John Bertram & Sons Co., Dundas, Ont.
Buffalo Forge Co., Buffalo, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Cushman Chuck Co., Hartford, Conn.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Wells Brothers Co., Greenfield, Mass.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Machinery & Supply Co., Hamilton.
Skinner Chuck Co., New Britain, Conn.
D. E. Whiton Machine Co., New London, Conn.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Chucks, Drill, Automatic and Keyless.
Buffalo Forge Co., Buffalo, N.Y.

Chucks, Ring Wheel.
Gardner Machine Co., Beloit, Wis.

Chucking Machines.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Turner Machine Co., Danbury, Conn.
Warner & Swasey Co., Cleveland, O.

Clocks, Time and Watchman's.
Lintz-Porter Co., Toronto.

Cloth and Wool Dryers.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Sheldons, Limited, Galt.

Clutches.
Eastern Machinery Co., New Haven, Conn.
Jones & Glasco, Montreal.
Owen Sound Iron Works Co., Owen Sound.
Positive Clutch & Pulley Works, Ltd., Toronto.

Coal Handling Machinery.
Whiting Foundry Equipment Co., Harvey, Ill.

Coke and Coal.
Hanna & Co., M. A., Cleveland, O.

Collectors. Pneumatic.
Can. Buffalo Forge Co., Montreal.
Sheldons, Limited, Galt.

Compressors, Air.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.
Mesta Machine Co., Pittsburg, Pa.
National Machinery & Supply Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia, Pa.
The Smart-Turner Machine Co., Hamilton.

Concentrating Plant.
Gardner, Robt., & Son, Montreal.

Concrete Mixers.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton.

Concrete Reinforcement.
Canada Wire Goods Mfg. Co., Hamilton.

Condensers.
Can. Buffalo Forge Co., Montreal.
Mesta Machine Co., Pittsburg, Pa.
The Smart-Turner Machine Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia.
Wm. Tod Company, Youngstown, O.

Contracting Engineers, Electrical
Lintz-Porter Co., Toronto.

Controllers and Starters, Electric Motor.
A. R. Williams Machy. Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Conveyor Machinery.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton, Ont.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.

Coping Machines.
Can. Buffalo Forge Co., Montreal.
John Bertram & Sons Co., Dundas.
National Machinery & Supply Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Cornice Brakes.
Brown Boggs Co., Ltd., Hamilton, Canada.
Steel Bending Brake Wks., Chatham.

Counting Machines.
W. N. Durant Co., Milwaukee, Wis.
National Scale Co., Chicopee Falls, Mass.
C. J. Root Co., Bristol, Conn.

Counterbores and Countersinks.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Countershafts.
Baird Machine Co., Bridgeport, Conn.
Wells Bros. Co., Greenfield, Mass.

Country House Lighting and Cooking.
Can. Blaugas Co., Montreal.

Couplings.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Eastern Machinery Co., New Haven, Conn.
Gardner, Robt., & Son, Montreal.
Owen Sound Iron Works Co., Owen Sound, Ont.

Couplings, Air Hose.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Crabs, Travelling.
Owen Sound Iron Works Co., Owen Sound.

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.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Cranes, Pneumatic.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Post Jib.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Portable.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Swing Jib.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

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

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

Cranes, Travelling Electric and Hand Power.
Dominion Bridge Co., Montreal.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Crane, Chain.
Northern Crane Works, Walkerville.

Cranes, All Kinds.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound, Ont.
Southwork Foundry & Machine Co., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Crank Pin Turning Machine.
Niles-Bement-Pond Co., New York.

Crimps, Leather.
Graton & Knight Mfg. Co., Montreal.

Cupolas.
Can. Buffalo Forge Co., Montreal.
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola and Blast Gate Blowers.
Can. Sirocco Co., Ltd., Windsor, Ont.

Cupola Blast Gauges & Blowers.
Sheldons, Ltd., Galt, Ont.

Cutters, Angle, Tee Iron and Bar.
Can. Buffalo Forge Co., Montreal.

Cutters, Flue.
Independent Pneumatic Tool Co., Chicago.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Cutters, Pipe.
Can. Fairbanks-Morse Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Trimont Mfg. Co., Roxbury, Mass.

Cutting Compound & Cutting Oil.
Can. Economic Lubricant Co., Montreal.
Can. Oil Companies, Toronto.
Cataract Refining Co., Buffalo, N.Y.
Crescent Oil Co., New York.
Racine Tool & Machine Co., Racine, Wis.

Cutter Grinders and Attachments
Cincinnati Milling Machine Co., Cincinnati.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.

Cutters, Milling.
A. R. Williams Machy. Co., Toronto
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Morse Twist Drill and Machine Co., New Bedford.
Tabor Mfg. Co., Philadelphia, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Cutting-off Machines.
Armstrong Bros. Tool Co., Chicago.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Espen-Lucas Machine Wks., Philadelphia, Pa.
Foss & Hill Machy. Co., Montreal.
Garlock Machinery, Toronto.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Geo. Gorton Machine Co., Racine, Wis.
Hurlbut, Rogers Machinery Co., South Sudbury, Mass.
John H. Hall & Sons, Brantford, Ont.
Nutter & Barnes Co., Hinsdale, N.H.
Pratt & Whitney Co., Dundas, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
L. S. Starrett Co., Athol, Mass.

Damper Regulators.
Can. Fairbanks-Morse Co., Montreal.

Derricks.
Dominion Bridge Co., Montreal.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Designers, Special Machinery.
Baird Machine Co., Bridgeport, Conn.

Dies and Die Stocks.
Armstrong Mfg. Co., Bridgeport, Conn.
Banfield, W. H. & Son, Toronto.
Butterfield & Co., Rock Island, Que.
Brown, Boggs & Co., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Duncan Electrical Co., Montreal.
Gardner, Robt., & Son, Montreal.
Greenfield Tap & Die Corporation, Greenfield, Mass.
A. B. Jardine & Co., Hespeler, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wiley & Russell, Greenfield, Mass.

Dies for Bit Brace Use.
Wells Brothers Co., Greenfield, Mass.

Die Sinkers.
Garvin Machine Co., New York.

Dies for Machines.
Wells Brothers Co., Greenfield, Mass.

Die Sinking Presses, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Dies, Self-opening.
Duncan Electrical Co., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Duncan Electrical Co., Montreal.
Greenfield Tap & Die Corporation, Greenfield, Mass.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.

Dies for Screw Plates.
Wells Brothers Co., Greenfield, Mass.

Dies, Sheet Metal Working.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

Dies, Screws and Thread.
Armstrong Mfg. Co., Bridgeport, Conn.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.

Discs, Leather.
Graton & Knight Mfg. Co., Montreal.

Draughtsman's Tools.
Emmert Mfg. Co., Waynesboro, Pa.

Draft, Mechanical.
W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Windsor, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Limited, Galt, Ont.

Drift Bolt Cutters.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drill Presses.
Baker Bros., Toledo, O.
W. F. & John Barnes Co., Rockford.
Can. Buffalo Forge Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
A. R. Williams Machinery Co., Toronto.

Drilling Machines, Locomotive and Multiple Spindle
Amalgamated Machy. Corporation, Chicago, Ill.
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Garlock Machinery, Toronto.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial and Turret.
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Turner Machine Co., Danbury, Conn.

Drilling Machines, Sensitive.
Baker Bros., Toledo, O.
W. F. & John Barnes Co., Rockford.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Rockford Machine Tool Co., Rockford.

Drilling Machines, Upright and Horizontal.
Amalgamated Machy. Corporation, Chicago, Ill.
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Colburn Mach. Tool Co., Franklin, Pa.
A. R. Williams Machy. Co., Toronto.
W. F. & John Barnes Co., Rockford.
John Bertram & Sons Co., Dundas.
Garlock Machinery, Toronto.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Rockford Machine Tool Co., Rockford.
R. McDougall Co., Galt.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

Drilling Posts.
Keystone Mfg. Co., Buffalo, N.Y.

Drills, Bench.
W. F. & John Barnes Co., Rockford.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
United States Electrical Tool Co., Cincinnati.

Drills, Blacksmith and Bit Stock.
Can. Buffalo Forge Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills, Centre.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills Corner (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drills, Electric and Portable.
A. R. Williams Machy. Co., Toronto.
Can. Buffalo Forge Co., Montreal.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

Drills, High Speed.
Baker Bros., Toledo, O.
Cleveland Twist Drill Co., Cleveland.
Can. Fairbanks-Morse Co., Montreal.
Morse Twist Drill and Machine Co., New Bedford.
W. F. & John Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills, Multiple Spindle.
Pratt & Whitney Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.

Drills, Oil Tube.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.

Drills, Pneumatic.
John F. Allen Co., New York.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.

Drills, Ratchet and Hand.
Armstrong Bros. Tool Co., Chicago.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Rock.
A. R. Williams Machy. Co., Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drills, Track.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Twist.
Armstrong, Whitworth of Canada, Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
John Morrow Screw Co., Ingersoll, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drill Holders.
Wells Brothers Co., Greenfield, Mass.

Drill Sockets.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drying Appliances.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Drying Out Barrels.
Baird Machine Co., Bridgeport, Conn.

Drying Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Dump Cars.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.

Dust Separators.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Dust Arresters (for Tumbling Mills).
Whiting Foundry Equipment Co., Harvey, Ill.

Dynamos and Electrical Supplies.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo and Motor Co., Ltd., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Electrical Supplies.
Duncan Electrical Co., Montreal.
Lintz-Porter Co., Toronto.

Elevator Enclosures.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Elevating and Conveying Machinery.
Can. Mathews Gravity Co., Toronto.
Plessisville Foundry, Plessisville, Que.

Emery Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Stow Mfg. Co., Binghamton, N.Y.

Emery and Emery Wheels.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Hamilton, Ont.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.

Emery Wheels, Dressers and Stands.
Canadian Hart Wheels, Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
National Machinery & Supply Co. Hamilton, Ont.
Norton Co., Worcester, Mass.

Emery Wheel Safety Flanges.
Canadian Hart Wheels, Hamilton, Ont.

Enameling Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Engines, Corliss, Compound, Pumping.
Mesta Machine Co., Pittsburg, Pa.
Wm. Tod Company, Youngstown, O.

Engines, Gas and Gasoline.
Can. Fairbanks-Morse Co., Montreal.
Jones & Glassco, Montreal.
Mesta Machine Co., Pittsburg, Pa.
National Machinery & Supply Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Engines, Horizontal and Vertical.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Mesta Machine Co., Pittsburg, Pa.
A. R. Williams Machy. Co., Toronto.
Sheldons, Ltd., Galt, Ont.
Wm. Tod Co., Youngstown, O.

Engines, High-Speed, Automatic.
Can. Buffalo Forge Co., Montreal.

Engines, Steam.
Can. Buffalo Forge Co., Montreal.
Mesta Machine Co., Pittsburg, Pa.
Plessisville Foundry, Plessisville, Que.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Wm. Tod Company, Youngstown, O.

Engines, Stationary and Marine.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Engineering Books.
The MacLean Publishing Co., Ltd., Toronto.

Engraving Machines.
Geo. Gorton Machine Co., Racine, Wis.

Elevators and Buckets.
Eastern Machinery Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Equipment Shop.
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.
Wm. Tod Co., Youngstown, O.

Escutcheon Pins.
Parmenter & Bulloch Co., Gananoque.

Evaporators' Machinery.
Brown, Boggs & Co., Hamilton, Can.

Exhaust Heads and Hoods.
Can. Buffalo Forge Co., Montreal.
Can. Steel Products Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Exhausters.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.

Experimental Machinery.
Owen Sound Iron Works Co., Owen Sound.

Extractors, Ingot.
Mesta Machine Co., Pittsburg, Pa.

Fans.
Can. Buffalo Forge Co., Berlin, Ont.
Baird Machine Co., Bridgeport, Conn.
Can. Sirocco Co., Ltd., Windsor, Ont.
Lintz-Porter Co., Toronto.
Plessisville Foundry, Plessisville, Que.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Feed Water Heaters.
Can. Fairbanks-Morse Co., Montreal.
The Smart-Turner Machine Co., Hamilton.

Fence, Iron Factory.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.
Standard Tube & Fence Co., Woodstock, Ont.

Files.
Delta File Works, Philadelphia, Pa.
Nicholson File Co., Port Hope, Ont.

Fire Alarm Apparatus.
Lintz-Porter Co., Toronto.

Fire Extinguishers.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Fire Escapes.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Flash Lamps.
Lintz-Porter Co., Toronto.

Flexible Shafts.
Chicago Flexible Shaft Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N.Y.

Flumes.
Toronto Iron Works, Ltd., Toronto.

Foot Valves.
Smart-Turner Mach. Co., Hamilton.

Forges, Hand, etc.
Can. Buffalo Forge Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
National Machinery & Supply Co., Hamilton.
Sheldons, Limited, Galt, Ont.

Forgings, Drop, Automobile and Locomotive.
Bliss, E. W., Co., Brooklyn, N.Y.
Canadian Billings & Spencer, Ltd., Welland.
Mesta Machine Co., Pittsburg, Pa.
J. H. Williams Co., Brooklyn, N.Y.

Forging Hammers, Belt-Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Plessisville Foundry, Plessisville, Que.

Forging Hammers, Steam.
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.
National Machinery Co., Tiffin, Ohio.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Foundry Equipment.
Northern Crane Works, Walkerville.
W. W. Sly Mfg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

Friction Leathers.
Graton & Knight Mfg. Co., Montreal.

Friction Clutch Pulleys, etc.
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Eastern Machinery Co., New Haven, Conn.
Owen Sound Iron Works Co., Owen Sound.
Positive Clutch & Pulley Works, Toronto.

Furnace Engineers and Contractors.
Mechanical Engineering Co., Montreal.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Blast.
Toronto Iron Works, Ltd., Toronto.

Furnaces, Oil, Coal, Gas and Electric.
Canadian Hoskins, Limited, Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Steel Heating and Brass Melting.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Heat Treating, Hardening and Tempering.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Forging.
Mechanical Engineering Co., Montreal.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Annealing, etc.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces for Baking, Bluing, Drying, Enameling, Japanning and Lacquering.
Mechanical Engineering Co., Montreal.
Oven Equipment & Mfg. Co., New Haven, Conn.

Furnace Lining.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Mechanical Engineering Co., Montreal.

Fuse Cap Machinery.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Gang Planer Tools.
Armstrong Bros. Tool Co., Chicago.

Gaskets, Leather, etc.
Graton & Knight Mfg. Co., Montreal.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Gas Blowers and Exhausters.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Limited, Galt.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Gas Burners.
Oven Equipment & Mfg. Co., New Haven, Conn.

Gas Machines.
Brown, Boggs & Co., Hamilton, Can.

Gas Producer Plants.
Can. Fairbanks-Morse Co., Montreal.

Gauges, Hydraulic Pressure.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Gauges, Standard.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Holden-Morgan Co., Toronto.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Garvin Machine Co., New York.
National Machinery & Supply Co., Hamilton.

Gear-Cutting Machinery.
Girard Machine & Tool Co., Philadelphia, Pa.
Hamilton Gear & Machine Co., Toronto.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
Sheldons, Limited, Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Wm. Tod Co., Youngstown, O.
D. E. Whitton Machine Co., New London, Conn.

Gears, Cut, Mortise, Angle, Worm.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Jones & Glasco, Montreal, P.Q.
Mesta Machine Co., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.
Wm. Tod Co., Youngstown, O.

Gears, Rawhide.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glasco, Montreal, P.Q.
Philadelphia Gear Works, Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.

Generators, Electric.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo and Motor Co., Ltd., Toronto.
Toronto and Hamilton Electric Co., Hamilton.

Grain for Polishing.
Norton Co., Worcester, Mass.

Graphite.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
Stevens, F. B., Detroit, Mich.

Grinders, Automatic Knife.
W. H. Banfield & Son, Toronto.

Grinders, Centre, Pedestal and Bench.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Ford-Smith Machine Co., Hamilton.
Foss & Hill Machy. Co., Montreal.
Gray Mfg. & Machine Co., Toronto.
Niles-Bement-Pond Co., New York.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
New Britain Machine Co., New Britain, Conn.
Norton Grinding Co., Worcester, Mass.
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.
Pratt & Whitney Co., Dundas, Ont.

Grinders, Die Chaser.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Disk.
Armstrong Bros. Tool Co., Chicago, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Grinding Co., Worcester, Mass.

Grinders, Drill.
Garvin Machine Co., New York.
United States Electric Tool Co., Cincinnati, O.

Grinders, Cylinder, Internal.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Norton Grinding Co., Worcester, Mass.
Rivett Lathe & Grinder Co., Boston, Mass.

Grinders, Electric.
Lintz-Porter Co., Toronto.

Grinders, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Grinders, Portable, Electric, Hand, Tool, Post, Floor and Bench.
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Hisey-Wolf Machine Co., Cincinnati, O.
Landis Tool Co., Waynesboro, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Norton Co., Worcester, Mass.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machy. Co., Toronto.

Grinders, Swing, Portable, Electric.
Hisey-Wolf Machine Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.

Grinders, Tool and Holders.
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
Tabor Mfg. Co., Philadelphia, Pa.

Grinders, Universal, Plain.
Girard Machine & Tool Co., Philadelphia, Pa.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Vertical Surface.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Pratt & Whitney Co., Dundas, Ont.

Grinding and Polishing Machines, Portable, Pneumatic and Spring Frame.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Gray Mfg. & Machine Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Norton Co., Worcester, Mass.
Stow Mfg. Co., Binghamton, N.Y.

Grinding Wheels.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Carborundum Co., Niagara Falls.
Ford-Smith Machine Co., Hamilton, Canada.
Gray Mfg. & Machine Co., Toronto.
Norton Co., Worcester, Mass.

Guards, Window and Machine.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Hack Saw Blades.
E. C. Atkins & Co., Hamilton, Ont.
Victor Saw Works, Ltd., Hamilton, Canada.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Racine Tool & Machine Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.

Hack Saw Frames.
Ford-Smith Machine Co., Hamilton, Canada.
Garvin Machine Co., New York City.
Mussens, Limited, Montreal.

Hammer High Speed.
High Speed Hammer Co., Rochester, N.Y.

Hammers, Drop and Belt Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canadian Billings & Spencer, Ltd., Welland.
A. B. Jardine & Co., Hespeler, Ont.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Plessisville Foundry, Plessisville, Que.
Toledo Machine & Tool Co., Toledo.

Hammers, Helve Power.
West Tire Setter Co., Rochester, N.Y.

Hammers, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.

Hammers, Steam.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Hand Hoists & Trolleys.
Whiting Foundry Equipment Co., Harvey, Ill.

Hand Leathers or Pads.
Graton & Knight Mfg. Co., Montreal.

Hangers.
Baird Machine Co., Bridgeport, Conn.
Gardner, Robt., & Son, Montreal.
The Smart-Turner Machine Co., Hamilton.

Hardness Testing Instruments.
Shore Instrument & Mfg. Co., New York.

Heating and Ventilating Engineers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Heat Gauges, Hardening and Annealing.
Shore Instrument & Mfg. Co., New York.

Hide.
L. S. Tarshis & Sons, Montreal.

Hinge Machinery.
Baird Machine Co., Bridgeport, Conn.

Hinges.
London Bolt & Hinge Works, London, Ont.

Hoists, Hydraulic.
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Hoisting and Conveying Machinery.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound.
Southwark Foundry & Machine Co., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Chain, Electric and Pneumatic.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Electric.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoppers.
Toronto Iron Works, Ltd., Toronto.

Hose Clamp Tool.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Hose, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.

Hose, Steam, Suction and Water.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Holders for Dies and Drills.
Wells Brothers, Company, Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Horsehair.
L. S. Tarshis & Sons, Montreal.

Hydraulic Accumulators.
Can. Boomer & Boschert Press Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Mesta Machine Co., Pittsburgh.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
The Smart-Turner Machine Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Hydraulic Machinery.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago.
Mesta Machine Co., Pittsburgh.
Niles-Bement-Pond Co., New York.
National Machinery & Supply Co., Hamilton.
William R. Perrin, Ltd., Toronto.
Southwark Foundry & Machine Co., Philadelphia.
Wm. Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Indicators, Speed.
Brown & Sharpe Mfg. Co., Providence, R.I.
L. S. Starrett Co., Athol, Mass.

Index Centres.
Fred. C. Dickow, Chicago, Ill.
Garvin Machine Co., New York.

Ingot Metals.
A. C. Leslie & Co., Ltd., Montreal.

Intensifiers.
Mesta Machine Co., Pittsburg, Pa.

Iron Filler.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

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

Jacks, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Jacks.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Plessisville Foundry, Plessisville, Que.

Jacks, Pneumatic.
Northern Crane Works, Walkerville.

Jacks, Pit and Track.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Watson-Stillman Co., Aldene, N.J.

Japanning Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Jaws, Face Plate.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

Jigs, Tools, etc.
Hamilton Gear & Machine Co., Toronto.

Key Seaters.
Baker Bros., Toledo, O.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights Mich.
A. R. Williams Machy. Co., Toronto.

Kilns.
Can. Buffalo Forge Co., Montreal.
Sheldons, Limited, Galt, Ont.

Laboratories, Inspection and Testing.
Can. Inspection & Testing Laboratories, Ltd., Montreal.

Lacquering Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

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

Lag Screw Gimlet Pointers.
National Machy. Co., Tiffin, Ohio.

Lamps, Arc and Incandescent.
Can. Fairbanks-Morse Co., Montreal.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Ker & Goodwin, Brantford.

Lamps, Tungsten.
Lintz-Porter Co., Toronto.

Lathe Chucks.
Ker & Goodwin, Brantford.

Lathe Attachment for Shells.
Lymburner, Ltd., Montreal.

Lathes, Automatic.
Windsor Machine Co., Windsor, Vt.

Lathe Dogs and Attachments.
Armstrong Bros. Tool Co., Chicago.
Fay & Scott, Dexter, Maine.
Hendey Machine Co., Torrington, Conn.
National Forge & Tool Co., Erie, Pa.
J. H. Williams Co., Brooklyn, N.Y.

Lathes, Bench.
W. F. & John Barnes Co., Rockford.
Blount, J. G., & Co., Everett, Mass.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.

Lathes, Band Turning.
Jenckes Machine Co., Sherbrooke, Que.

Lathes, Engine.
Amalgamated Machy. Corporation, Chicago, Ill.
A. R. Williams Machy. Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Iron & Steel Co., Cincinnati, O.
Fay & Scott, Dexter, Maine.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Machinery, Toronto.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
R. McDougall Co., Galt.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Lathe Pans.
New Britain Machine Co., New Britain, Conn.

Lathes, Patternmakers'.
J. G. Blount Co., Everett, Mass.
Fay & Scott, Dexter, Maine.
Foss & Hill Machy. Co., Montreal.
Garlock-Machinery, Toronto.
Mussens, Limited, Montreal.

Lathes, Roll Turning
Mesta Machine Co., Pittsburgh.

Lathes, Screw Cutting.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Cincinnati Iron & Steel Co., Cincinnati, O.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

Lathes, Spinning.
Bliss, E. W., Co., Brooklyn, N.Y.
Toledo Mach. & Tool Co., Toledo, O.

Lathe, Turret and Speed.
John Bertram & Sons Co., Dundas.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Cincinnati Iron & Steel Co., Cincinnati, O.
Colburn Machine Tool Co., Franklin Pa.
Fay & Scott, Dexter, Maine.
Foss & Hill Machy. Co., Montreal.
Garlock-Machinery, Toronto.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
Windsor Machine Co., Windsor, Vt.
A. R. Williams Machy. Co., Toronto.

Leather Strapping.
Graton & Knight Mfg. Co., Montreal.

Lifts, Pneumatic.
Whiting Foundry Equipment Co., Harvey, Ill.

Lighting Fixtures.
Lintz-Porter Co., Toronto.

Link Belting.
Can. Fairbanks-Morse Co., Montreal.
Graton & Knight Mfg. Co., Montreal.
Jones & Glassco, Montreal.

Linoleum Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.

Liquid Air.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Lockers, Steel Wardrobe and Steel Material.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Lockers.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Locomotive Equipment.
Can. Locomotive Co., Kingston, Ont.

Locomotives, Railroading, Contracting.
Can. Locomotive Co., Kingston, Ont.
National Machinery & Supply Co., Hamilton.

Lubricants.
S. F. Bowser & Co., Fort Wayne, Ind.
Can. Economic Lubricant Co., Montreal.
Can. Oil Company, Toronto.
Cataract Refining Co., Toronto.
Crescent Oil Co., Inc., New York.

Machine Tools.
Amalgamated Machy. Corporation, Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Can. Machinery Corp., Galt, Ont.
Garlock-Machinery, Toronto.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Machinery Dealers.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Machinery, Toronto.
Hill, Clarke & Co., of Chicago.
Marshall & Huschart Machinery Co., Chicago.
National Machinery & Supply Co., Hamilton.
Frank Toomey, Inc., New York.
A. R. Williams Machy. Co., Toronto
New York Machinery Exchange, New York.

Machinery Guards.
Jones & Glassco, Montreal, P.Q.
Canada Wire & Iron Goods Co., Hamilton, Ont.
A. R. Williams Machy. Co., Toronto.

Machinery Repairs.
Cunningham & Sons, St. Catharines, Ont.
Plessiville Foundry, Plessiville, Que.

Machinists' Scales, Small Tools and Supplies.
Can. Fairbanks-Morse Co., Montreal.
Frank H. Scott, Montreal.
J. H. Williams & Co., Brooklyn, N.Y.

Magnetos.
Lintz-Porter Co., Toronto.

Mandrels.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. R. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Marine Engines.
Cunningham & Sons, St. Catharines, Ont.

Marking Machinery.
Brown, Boggs Co., Hamilton, Ont.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Marquises.
Dennis Wire & Iron Works, London, Ont.

Measuring Tapes and Rules.
James Chesterman & Co., Ltd., Sheffield, Eng.

Metallurgists.
Can. Inspection & Testing Laboratories, Ltd., Montreal
Toronto Testing Laboratory, Ltd., Toronto.

Metals.
L. S. Tashis & Sons, Montreal.

Metal Cutting Machines.
Hurlbut, Rogers Machinery Co., South Sudbury, Mass.
Racine Tool & Machine Co., Racine, Wis.

Metal Stamping.
Duncan Electrical Co., Montreal.

Meters, Electrical.
Can. H. W. Johns Manville Co., Ltd., Toronto.
Lintz--Porter Co., Toronto.

Mill Machinery.
Cunningham & Sons, St Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.

Milling Attachments.
John Bertram & Sons Co., Dundas.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Cincinnati.
Hendey Mach. Co., Torrington, Conn.
Kempsmith Mfg. Co. Milwaukee, W.
Mesta Machine Co., Pittsburg, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Horizontal and Vertical.
A. R. Williams Machy. Co., Toronto.
Brown & Sharpe Mfg. Co., Providence.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
John Bertram & Sons Co., Dundas.
Foss & Hill Machy. Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Goslyn & Edlund, Cortland, N.Y.
Kempsmith Mfg. Co., Milwaukee, W.
Motch & Merrywether Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Plain, Bench and Universal.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Machine Co., Cincinnati.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Goeley & Edlund, Cortland, N.Y.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Hendey Machine Co., Torrington.
Kempsmith Mfg. Co., Milwaukee, Wis.
Mesta Machine Co., Pittsburg, Pa.
Motch & Merrywether Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
A. R. Williams Machy. Co., Toronto.

Milling Machines, Profile.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia Pa.
Mesta Machine Co., Pittsburg, Pa.
Motch & Merrywether Machy. Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

Milling Tools.
Brown & Sharpe Mfg. Co., Providence.
Electric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, W.

Mine Cars and Hitchings.
Pratt & Whitney Co., Dundas, Ont.
Modern Tool Co., Erie, Pa.
Can. Fairbanks-Morse Co., Montreal.

Mining Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Mixers, Hot Metal.
Mesta Machine Co., Pittsburg, Pa.

Mortising Machines.
Jones & Glassco Montreal.

Motors, Electric
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lintz-Porter Co., Toronto.
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John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

Nitrogen.
L'Air Liquide Society, Montreal, Toronto.
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Nozzles, Spray.
Can. Buffalo Forge Co., Montreal.

Nuts, Semi-Finish and Finished.
Galt Machine Screw Co., Galt, Ont.

Nut Burring Machines.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Machines (Hot).
National Machy. Co., Tiffin, O.

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National Mach. & Sup. Co., Hamilton

Nut Tappers.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Hall, J. H., & Son, Brantford, Ont.
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Landis Machine Co., Waynesboro, Pa.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

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Wells Brothers Co., Greenfield, Mass.

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

Oil Stones.
Carborundum Co., Niagara Falls, N.Y.
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Oven Trucks, Steel.
Oven Equipment & Mfg. Co., New Haven, Conn.

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Oven Equipment & Mfg. Co., New Haven, Conn.

Oscillating Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

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L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Oxygen.
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Cleveland Wire Spring Co., Cleveland

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Guelph Pattern Works, Guelph, Ont.

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Shell Painting Machine.
Can. Buffalo Forge Co., Montreal.
Can. Locomotive Co., Kingston, Ont.

Shell Screws, Headless.
Blake & Johnson, Waterbury, Conn.

Shell Riveters.
Grant Mfg. & Machine Co., Bridgeport, Conn.

Shelving, Steel Partitions.
Canadian Steel Products Company, Montreal.

Shrapnel Shell Marker.
Brown-Boggs Co., Hamilton, Ont.
Holden-Morgan Co., Toronto.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Shrapnel Sand Blasts.
W. W. Sly Mfg. Co., Cleveland, O.

Side Tools.
Armstong Bros. Tool Co., Chicago.

Sirens, Electric.
Lintz-Porter Co., Toronto.

Silver Solder.
Geo. H. Lees & Co., Ltd., Hamilton, Ont.

Slotters.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.

Smokestacks.
Plessisville Foundry, Plessisville, Que.

Sockets.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Soldering Irons.
Brown, Boggs & Co., Hamilton, Can.

Solders.
Tallman Brass & Metal Co., Hamilton.

Specialties, Electric.
Lintz-Porter Co., Toronto.

Special Machinery.
Armstrong Bros., Toronto.
W. H. Banfield & Sons, Toronto.
John Bertram & Sons Co., Dundas.
Baird Machine Co., Bridgeport, Conn
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Can. Fairbanks-Morse Co., Montreal.
Canada Machy. Agency, Montreal.
Cunningham & Sons, St. Catharines, Ont.
Charles F. Elmes Eng. Works, Chicago
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Courtland, N.Y.
Grant Mfg. & Machy. Co., Bridgeport, Conn.
John H. Hall & Sons, Brantford.
Jardine A. B. & Co., Hespeler.
National Electric Welder Co., Warren, Ohio.
National Forge & Tool Co., Erie, Pa.
National Mach. & Sup. Co., Hamilton.
Plessisville Foundry, Plessisville, Que.
Smart-Turner Machine Co., Hamilton, Ont.
William R. Perrin, Ltd., Toronto.
Wm. Tod Company, Youngstown, O

Spike Machines.
The Smart-Turner Machine Co., Hamilton.

Spring Coilers.
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

Springs, Machinery.
Cleveland Wire Spring Co., Cleveland.
Jas. Steele, Ltd., Guelph, Ont.
Wallace, Barnes Co., Bristol, Conn.

Spring Making Machinery (Automatic).
Baird Machine Co., Bridgeport, Conn.

Sprockets, Chain.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.

Stairs, Iron.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Stamping.
Duncan Electrical Co., Montreal.

Stamping Machinery.
Brown, Boggs & Co., Hamilton, Can.

Stationary Ladders.
New Britain Machine Co., New Britain, Conn.

Steam Specialties.
Sheldons, Ltd., Galt, Ont.

Steam Separators and Traps.
Can. Fairbanks-Morse Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Steel Alloy.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Chains for Pulp Mill and Saw Mill.
Plessisville Foundry, Plessisville, Que.

Steel Bench Legs.
New Britain Machine Co., New Britain, Conn.

Steel Bending Brakes.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Steel, Cold Rolled.
Can. Drawn Steel Co., Hamilton, Ont.
A. C. Leslie & Co., Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.
Wallace, Barnes Co., Bristol, Conn.

Steel Pressure Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Steel, all kinds.
Lackawanna Steel Co., Lackawanna, N.Y.

Steel, High Speed.
Armstrong Whitworth of Canada, Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
H. A. Drury Co., Ltd., Montreal.
Thos. Firth & Sons, Montreal.
Hawkridge Bros. Co., Boston, Mass.
National Mach. & Sup. Co., Hamilton.
Vanadium Alloys Steel Co., Pittsburg, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Die Engraving.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Steel Machinery.
Hawkridge Bros. Co., Boston, Mass.

Steel Vanadium.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Stock Racks for Bars, Piping, Etc.
New Britain Machine Co., New Britain, Conn.

Stocks for Dies.
Wells Bros. Co., Greenfield, Mass.

Stocks, Pipe.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corporation, Greenfield, Mass.

Stools, Steel, Shop.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Storage Systems.
S. F. Bowser & Co., Fort Wayne, Ind.

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Lintz-Porter Co., Toronto.

Straight Edges.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Straightening Machinery.
Baird Machine Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland
National Mach. & Sup. Co., Hamilton.

Structural Steel.
Hamilton Bridge Works Co., Hamilton, Ont.
Lackawanna Steel Co., Lackawanna, N.Y.
Owen Sound Iron Works Co., Owen Sound, Ont.

Stud Driver.
Keystone Mfg. Co., Buffalo, N.Y.

Switchboards and Telephones.
Lintz-Porter Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

Switches, Railway.
National Mach. & Sup. Co., Hamilton.

Tanks, Oil, Etc.
S. F. Bowser & Co., Fort Wayne, Ind.

Tanks, Steel.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que.
Toronto Iron Works, Ltd., Toronto.

Tanks, Pressure.
Toronto Iron Works, Ltd., Toronto.

Tank Wagons.
Toronto Iron Works, Ltd., Toronto.

Tapes, Measuring.
James Chesterman & Co., Ltd., Sheffield, Eng.

Tapes, Friction.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Tapping Machines (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Tapping Machines and Attachments.
Baker Brothers, Toledo, O.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Tap & Die Corporation, Greenfield, Mass.
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.
Rickart Shaper Co., Erie, Pa.
L. S. Starrett Co., Athol, Mass.

Tap Chucks.
Wells Bros., Greenfield, Mass.

Taps, Adjustable.
Geometric Tool Co., New Haven.
Manufacturers Equipment Co., Chicago, Ill.
Murchey Machine & Tool Co., Detroit.

Taps, Dies and Wrenches.
Butterfield & Co., Rock Island, Que.
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Can. Tap & Die Co., Galt, Ont.
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Geometric Tool Co., New Haven, Conn.
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Technical Books.
The MacLean Publishing Co., Ltd., Toronto.

Telephone Systems.
Lintz-Porter Co., Toronto.

Testing Instruments, Metallurgical.
Shore Instrument & Mfg. Co., New York City.

Testing Laboratories.
Can. Inspection & Testing Laboratories, Ltd., Montreal.
Toronto Testing Laboratory, Toronto.

Thread Cutting Machines.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Geometric Tool Co., New Haven, Conn.
Girard Machine & Tool Co., Philadelphia, Pa.
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Landis Machine Co., Waynesboro, Pa.
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National Machy. Co., Tiffin, Ohio.

Time Clocks.
International Time Recording Co Toronto.
Lintz-Porter Co., Toronto.

Tinsmiths' Tools.
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Tire Setting Machines, Hydraulic.
William R. Perrin, Ltd., Toronto.
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Tire, Wheels.
Wells Bros. Co., Greenfield, Mass.

Toolmakers' Files.
American Swiss File & Tool Co., New York.

Tool Boxes, Steel.
Can. Steel Products Co., Montreal.

Tool Holders.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Tool Room Partitions.
Can. Wire & Iron Goods Co., Hamilton.

Tool Posts, Lathe.
Armstrong Bros. Tool Co., Chicago.

Tool Steel.
Armstrong, Whitworth, Ltd., of Canada, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Thos. Firth & Sons, Montreal.
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National Mach. & Sup. Co., Hamilton.
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Tools, Blacksmiths', Etc.
A. R. Williams Machy. Co., Toronto.

Tools, Electrical.
A. R. Williams Machy. Co., Toronto.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
United States Elec. Tool Co., Cincinnati, O.

Tools, Lathe, Planer and Slotter.
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Torches, Steel.
Stevens, F. B., Detroit, Mich.
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Whiting Foundry Equipment Co., Harvey, Ill.

Track Tools.
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Can. Fairbanks-Morse Co., Montreal.

Transformers and Converters.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Transmission Machinery.
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Hamilton Gear & Mach. Co., Toronto.
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Main Belting Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plessisville Foundry, Plessisville, Que.
F. Reddaway & Co., Montreal.
The Smart-Turner Machine Co., Hamilton.

Transmission Towers.
Can. Bridge Co., Walkerville, Ont.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
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Tallman Brass & Metal Co., Hamilton.

Traveling Cranes.
Northern Crane Works, Walkerville.
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Whiting Foundry Equipment Co., Harvey, Ill.

Trolley Hoists, Electric.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Trucks, Lumber and Kiln.
Sheldons, Ltd., Galt, Ont.
Northern Crane Works, Walkerville.

Trucks, Factory, Freight, Etc.
Chambers, Ltd., Toronto.
Chapman Double Ball Bearing Co., Toronto.
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Southwark Foundry & Machine Co., Philadelphia, Pa.

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National Machy. Co., Tiffin, O.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Vacuum Pumps.
Buffalo Forge Co., Buffalo, N.Y.
Mesta Machine Co., Pittsburgh.
Smart-Turner Machine Co., Hamilton, Ont.

Valves, Foot.
Smart-Turner Mach. Co., Hamilton.

Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Valves, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Mesta Machine Co., Pittsburg, Pa.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood & Co., Philadelphia, Pa.

Valve Leathers.
Graton & Knight Mfg. Co., Montreal.

Valves, Back Pressure, Steam.
Mesta Machine Co., Pittsburg, Pa.
Sneldons, Limited, Galt.

Vanadium Steel.
H. A. Drury Co., Ltd., Montreal.
Hawkridge Bros. Co., Boston, Mass.

Ventilating Apparatus.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Limited, Galt.
A. R. Williams Machy. Co., Toronto.

Vises, Bench.
Emmert Mfg. Co., Waynesboro, Pa.
Hollands Mfg. Co., Erie, Pa.
National Mach. & Sup. Co., Hamilton.
New Britain Machine Co., New Britain, Conn.

Vises, Pipe.
Armstrong Mfg. Company, Bridgeport, Conn.
Bignall & Keeler Mach. Works, Edwardsville, Ill.
Butterfield & Co., Rock Island, Que.
Emmert Mfg. Co., Waynesboro, Pa.
National Mach. & Sup. Co., Hamilton.
J. H. Williams Co., Brooklyn, N.Y.

Vises, Planer and Shaper.
Girard Machine & Tool Co., Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
Skinner Chuck Co., New Britain, C.

Vises, Milling Machine.
National Mach. & Sup. Co., Hamilton.

Vises, Woodworking.
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Washers.
Graton & Knight Mfg. Co., Worcester, Mass.
London Bolt & Hinge Works, London, Ont.
Wallace, Barnes Co., Bristol, Conn.

Washer Machines.
National Machy. Co., Tiffin, Ohio.

Waterproof Coating, Cement, Fabric.
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Lintz-Porter Co., Toronto.
A. R. Williams Machy. Co., Toronto.

Water Towers.
Toronto Iron Works, Ltd., Toronto.

Welding and Cutting Clamps.
Can. Blaugas Co., Ltd., Montreal.
Detroit Electric Welder Co., Detroit, Mich.
L'Air Liquide Society, Toronto.
Lever Bros., Toronto.
National Electric Welder Co., Cincinnati, O.

Welding and Cutting Work.
Can. Blaugas Co., Ltd., Montreal.
Detroit Electric Welder Co., Detroit, Mich.
L'Air Liquide Society, Toronto.
Lever Bros., Toronto.
Metals Welding Co., Cleveland, O
National Electric Welder Co., Cincinnati, O.

Welding, Autogenous.
Can. Blaugas Co., Ltd., Montreal.
Detroit Electric Welder Co., Detroit, Mich.
L'Air Liquide Society, Toronto.
Lever Bros., Toronto.
National Electric Welder Co., Cincinnati, O.

Welding, Acetylene and Oxygen.
Can. Blaugas Co., Ltd., Montreal.
Detroit Electric Welder Co., Detroit, Mich.
L'Air Liquide Society, Toronto.
Lever Bros., Toronto.
Metals Welding Co., Cleveland, O
National Electric Welder Co., Cincinnati, O.

Welding Machines, Electric, etc
Can. Blaugas Co., Ltd., Montreal.
Detroit Electric Welder Co., Detroit, Mich.
Lever Bros., Toronto.
National Electric Welder Co., Cincinnati, O.
Tabor Mfg. Co., Philadelphia, Pa.

Wheels, Emery, Carborundum.
Can. Hart Wheels, Ltd., Hamilton, Ont.

Wheels, Belt, Fly, Gear and Rope.
Mesta Machine Co., Pittsburg, Pa.

Winches.
John H. Hall & Sons, Brantford.
Northern Crane Works, Walkerville.

Window Wire Guards.
Canada Wire & Iron Goods Co., Hamilton.

Wire Cloth and Perforated Metals.
Canada Wire & Iron Goods Co., Hamilton.
Dennis Wire & Iron Works Co., Ltd., London.

Wire Forms.
Wallace, Barnes Co., Bristol, Conn.

Wire Forming and Stamping Machinery.
Brown, Boggs Co., Ltd., Hamilton Canada.
F. B. Shuster Co., New Haven, Conn.
Baird Machine Co., Bridgeport, Conn.

Wire Guards and Railings.
Canada Wire & Iron Goods Co., Hamilton, Ont.

Wire Nails.
Parmenter & Bulloch Co., Gananoque.

Wire Nail Machinery.
National Machy. Co., Tiffin, Ohio.
A. R. Williams Machy. Co., Toronto.

Wire, Spring.
Wallace, Barnes Co., Bristol, Conn.

Wire Straighteners and Cutters.
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Canada.
F. B. Shuster Co., New Haven, Conn.

Wire Coiling and Pointing Machines.
Baird Machine Co., Bridgeport, Conn.
F. B. Shuster Co., New Haven, Conn.

Wood Boring Machines.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Machinery, Toronto.
Girard Machine & Tool Co., Philadelphia, Pa.

Woodworking Machinery.
Buffalo Forge Co., Buffalo, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Machinery, Toronto.
Girard Machine & Tool Co., Philadelphia, Pa.
New Britain Machine Co., New Britain, Conn.
Plessisville Foundry, Plessisville, Que.
A. R. Williams Machy. Co., Toronto.

Wool.
L. S. Tarshis & Sons, Montreal.

Wrenches, Compression.
Lutz-Webster Engineering Co., Inc., Philadelphia, Pa.

Wrenches.
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Rock Island, Que.
Canadian Billings & Spencer, Ltd., Welland.
Keystone Mfg. Co., Buffalo, N.Y.
Lutz-Webster Engineering Co., Inc., Philadelphia, Pa.
Wells Bros. Co., Greenfield, Mass.
J. H. Williams Co., Brooklyn, N.Y.

Wrenches, Automobile Narrow Jaw and Monkey.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Pipe, Monkey.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Ratchet and Basin.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Keystone Mfg. Co., Buffalo, N.Y.
Trimont Mfg. Co., Roxbury, Mass.

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