FEATURE ARTICLES | STEEL MAKING FOR SHELLS IN CANADA
THE MANUFACTURE OF LARGE SHELLS

CANADIAN MACHINERY AND MANUFACTURING NEWS

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The Publisher's Page

By B.G.N.

Profit Follows in the Path of Service

MANY are the conjectures as to the future of the metal-working industries of Canada when peace conditions again overtake them. It is significant that there are few pessimists and few misgivings.

¶ The experiences of the past year have stiffened our manufacturers for any emergency. They are more confident, more self-reliant, more keenly alert, more resourceful than they ever thought they could be. The marvellously quick and efficient solution of the problems connected with munition making on a colossal scale, have given Canadian manufacturers an easy confidence that will enable them to successfully tackle any problems of the future.

¶ Moreover, they will be ambitious, broad of vision, reaching out for greater things. The vast machinery that is now being employed in converting ploughshares into swords will not be scrapped. More likely will the swords be scrapped and turned again into ploughshares, and marketed in the uttermost parts of the earth.

¶ Let Canadian manufacturers maintain the same high courage and resourcefulness that has marked their work during the past nine months. Let big ideas be conceived and carried out. Let the same standard of perfection that has had to be maintained in shell making guide their work and guard their good names in making the implements of peace.

¶ We are on the threshold of a new era. A new industrial nation is being born. Let SERVICE, honesty, integrity and high quality distinguish it always. Profit follows in the path of service. Let quality prevail. Let service support quality and let good advertising back up both.

¶ Advertising has raised a giant army for the purpose of destruction. It will be used for the purposes of construction in the raising up of a giant among industrial nations—Canada.

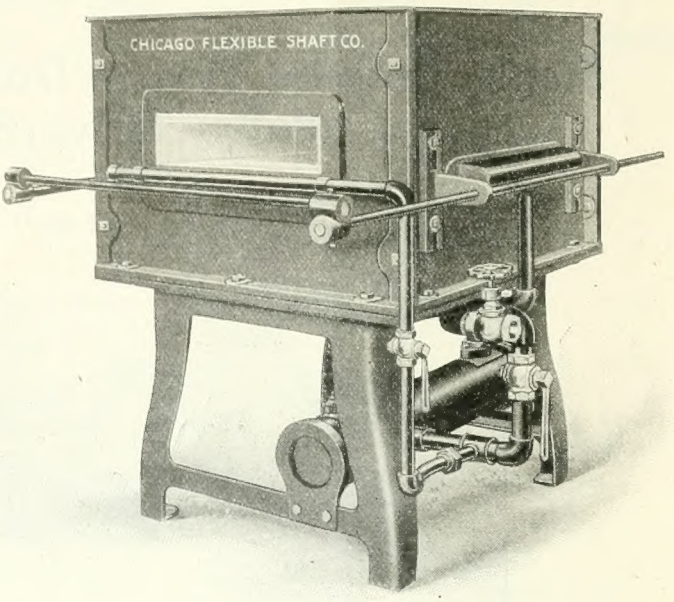
CANADIAN MACHINERY

143-153 University Avenue TORONTO

STEWART FURNACES

Stewart Drop Hammer Forges

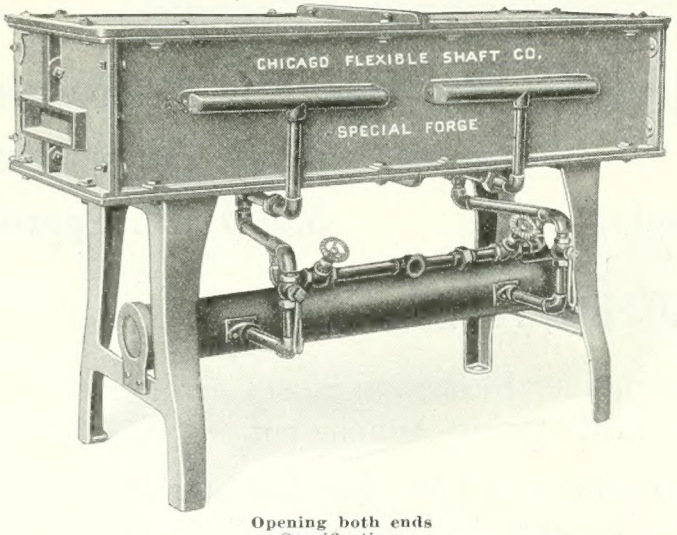
For natural or manufactured gas or oil. Will heat rods up to 5 inches in diameter. Especially adapted for drop hammer work. Equipped with brackets for adjustable rack, so that long pieces may be handled without the inconvenience of dragging rests or stands to the furnace.



Specifications

No.	SIZE OF OPENING			With Blower	Without Blower
	Height	Width	Depth		
30	1 in. to 5 in.	15 in.	15 in.	$130 00	$ 90.00
31	1 in. to 5 in.	15 in.	18 in.	140.00	100.00
32	1 in. to 5 in.	15 in.	21 in.	150.00	110.00
33	1 in. to 5 in.	15 in.	24 in.	185.00	120.00
34	1 in. to 5 in.	18 in.	15 in.	145.00	105.00
35	1 in. to 5 in.	18 in.	18 in.	155.00	115.00
36	1 in. to 5 in.	18 in.	21 in.	190.00	125.00
37	1 in. to 5 in.	18 in.	24 in.	200.00	135.00

Special Forges



Opening both ends
Specifications

	Height	Width	Depth	Price, with Blower	Price, without Blower
Opening,	2 in.	12 in.	20 in.	$130.00	$ 90.00
Opening,	2 in.	12 in.	46 in.	200.00	135.00
Opening,	2 in.	12 in.	56 in.	215.00	150.00
Opening,	6 in.	20 in.	66 in.	290.00	225.00
Opening,	6 in.	18 in.	72 in.	365.00	300.00
Opening,	6 in.	22 in.	78 in.	390.00	325.00

Burners arranged in two sections so heat is delivered for half lengths, if desired. Heats for bending, forming, etc.

Any good steel properly heat treated will do the work for which it is intended, as it is carefully compounded from formulas that are exact.

To "Properly Heat-Treat" means to follow instructions from the Steel Makers to the letter.

There is a certain temperature to which the steel must be brought, and the heat must be so uniform that the entire piece receives the same amount.

It is economy to get 100 per cent. efficiency from a properly hardened tool. Why pay the high grade price for raw material and get cheap grade results?

Don't blame the steel that is treated by an antiquated method.

With Stewart Furnaces the unknown quantity is eliminated.

Tell us what you want to do and get our recommendation on a "Satisfaction guarantee," covering a thirty-day trial in your own plant.

A reputation for prompt and efficient service has long been established. Spare parts for all Stewart Furnaces carried in stock for "Same Day" shipment.

Tell us your requirements when you ask for catalog and save time.

CHICAGO FLEXIBLE SHAFT COMPANY

210-230 Ontario St., Chicago, Ill.

GENERAL SUPPLY CO. OF CANADA, Canadian Distributors

OTTAWA MONTREAL TORONTO WINNIPEG

Nova Scotia Steel & Coal Company, Ltd.

Head Office,
NEW GLASGOW,
N.S.

Western Sales Office,
Room 14 Windsor Hotel,
MONTREAL

Manufacturers of

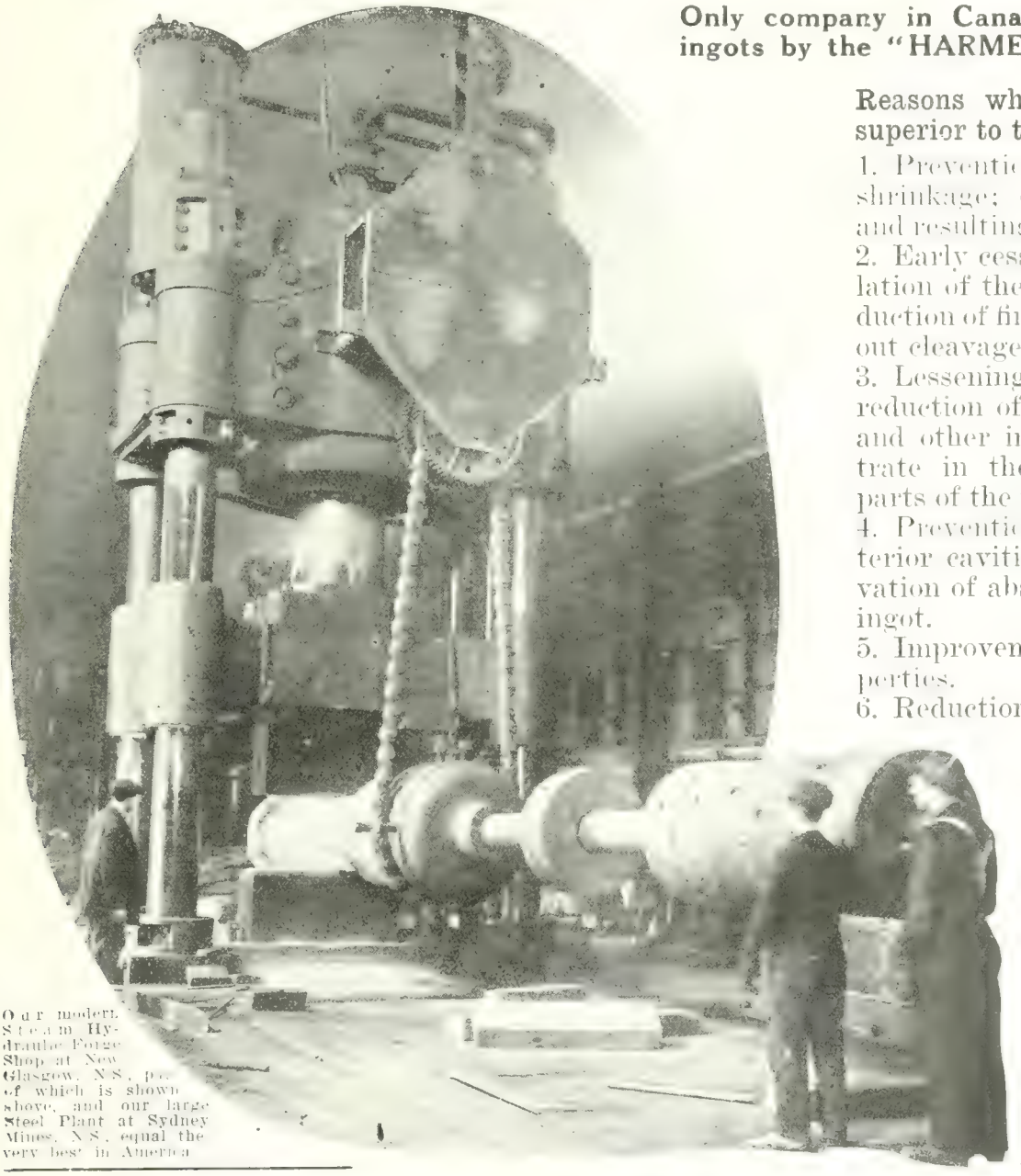
STEEL

FOR SHRAPNEL SHELLS,
AND SHELL BLANKS.

Only company in Canada producing steel ingots by the "HARMET" Liquid Process.

Reasons why these ingots are superior to the ordinary kind:

1. Prevention of cracks, due to shrinkage; of internal stresses and resulting cracks and fissures.
2. Early cessation in the crystallation of the metal, and the production of fine crystallation without cleavage planes.
3. Lessening of segregation, i.e., reduction of tendency to carbon and other impurities to concentrate in the central and upper parts of the ingot.
4. Prevention of "Pipes" or interior cavities, and thus preservation of absolute solidity in the ingot.
5. Improvement in physical properties.
6. Reduction in waste of ingot.



Our modern Steam Hydraulic Forge Shop at New Glasgow, N.S., part of which is shown above, and our large Steel Plant at Sydney Mines, N.S., equal the very best in America

WE CAN SUPPLY FORGINGS OF ALL SHAPES AND SIZES, MADE OF ORDINARY OR "HARMET" FLUID COMPRESSED OPEN-HEARTH STEEL ON THE SHORTEST NOTICE.

Hunter "Duplex" SPEED

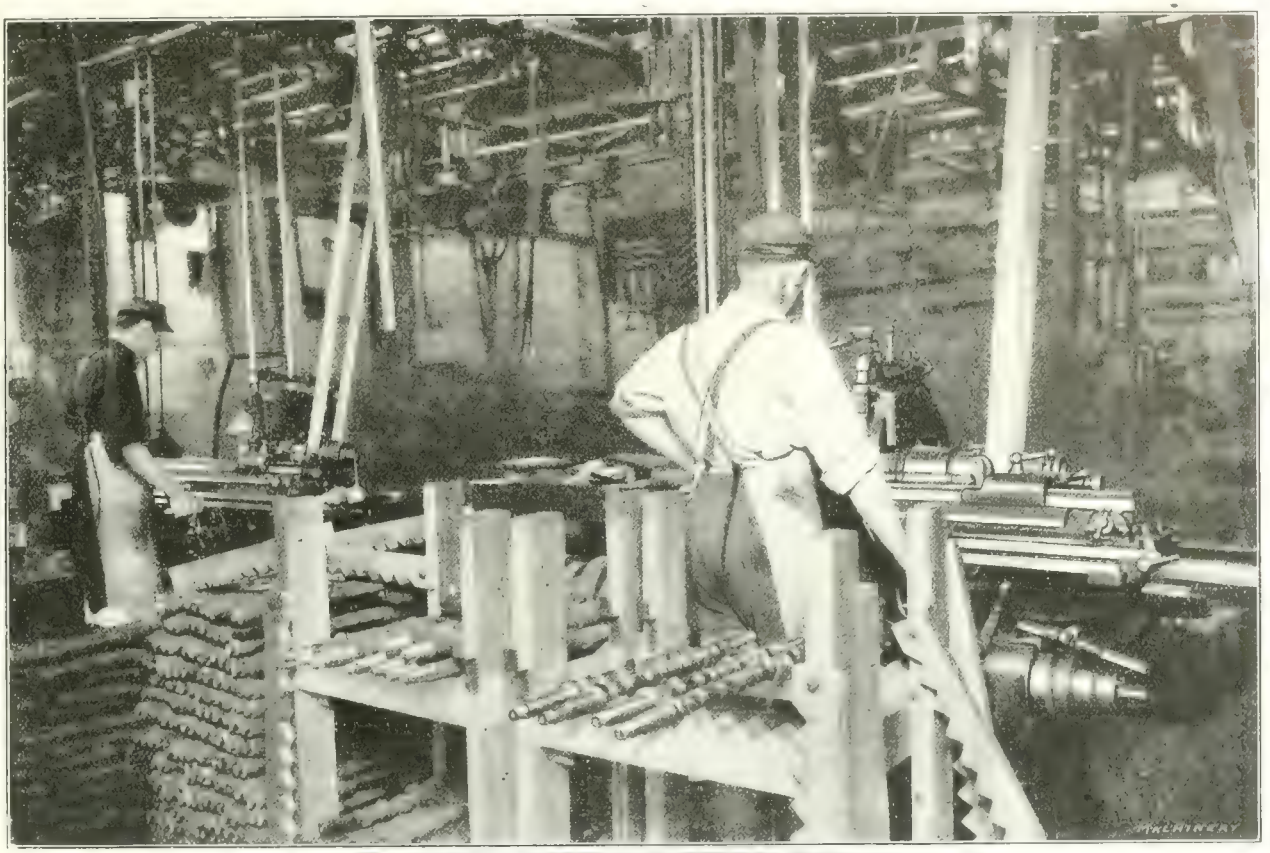
can be employed very profitably on shrapnel or any other stock

The secret of *Hunter "Duplex" Saw Speed* is the method of holding the high speed teeth. The illustration shows a Hunter "Duplex" speeding through $3\frac{1}{2}$" round 60 carbon, 70 manganese Shrapnel stock—it's a tough cut made easy and fast.

Let us demonstrate what a saving can be made by installing a Hunter "Duplex" inserted tooth blade.

Mail us a line for full particulars.

HUNTER SAW & MACHINE CO.
Pittsburg, Pa.



GRIND 50 CAMSHAFTS PER DAY

A very good idea can be gotten of how automobile engine camshafts are being machined in Norton Grinding Machines, by considering what is being done on the job illustrated above. The two

NORTON

Grinding Machines shown are each handling 25 camshafts per day. They rough and finish three bearings, and grind two timing-gear seats.

Twenty-five thousandths is taken off, while a half thousandth is the limit of error allowed.

Pretty good day's work this. Nothing very unusual though. Norton Grinding Machines everywhere are doing such work—making good—satisfying their owners—cleaning up more profit.

Let us have a chance to show you where Norton Grinding can help you out.

The Canadian Fairbanks-Morse Co., Limited

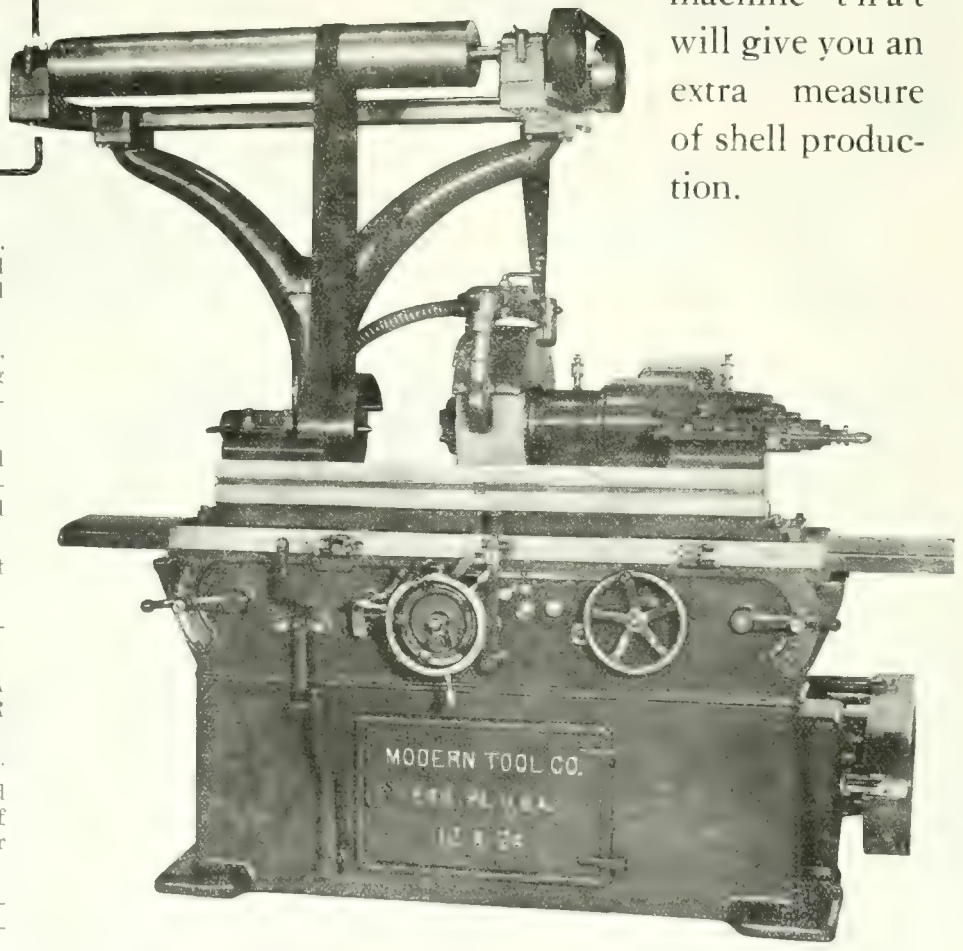
St. John, N.B. Montreal Ottawa Toronto Winnipeg Saskatoon
Edmonton Calgary Vancouver Victoria

Canadian Agents for
NORTON GRINDING COMPANY, Worcester, Mass., U.S.A.

especially adopted for Grinding SHELLS

"Modern" 12" x 24" Self-Contained Grinding Machine

This is a powerful, rigid and effective machine that will give you an extra measure of shell production.



Large diameter, wide face wheel with powerful drive.

Automatic feed, without traversing the table, where required.

Absolute central control of all levers and hand wheels.

Single constant speed drive.

Write for full details.

USED BY A LARGE NUMBER OF SHELL MAKERS IN CANADA.

It comes equipped for all classes of straight and taper cylindrical work.

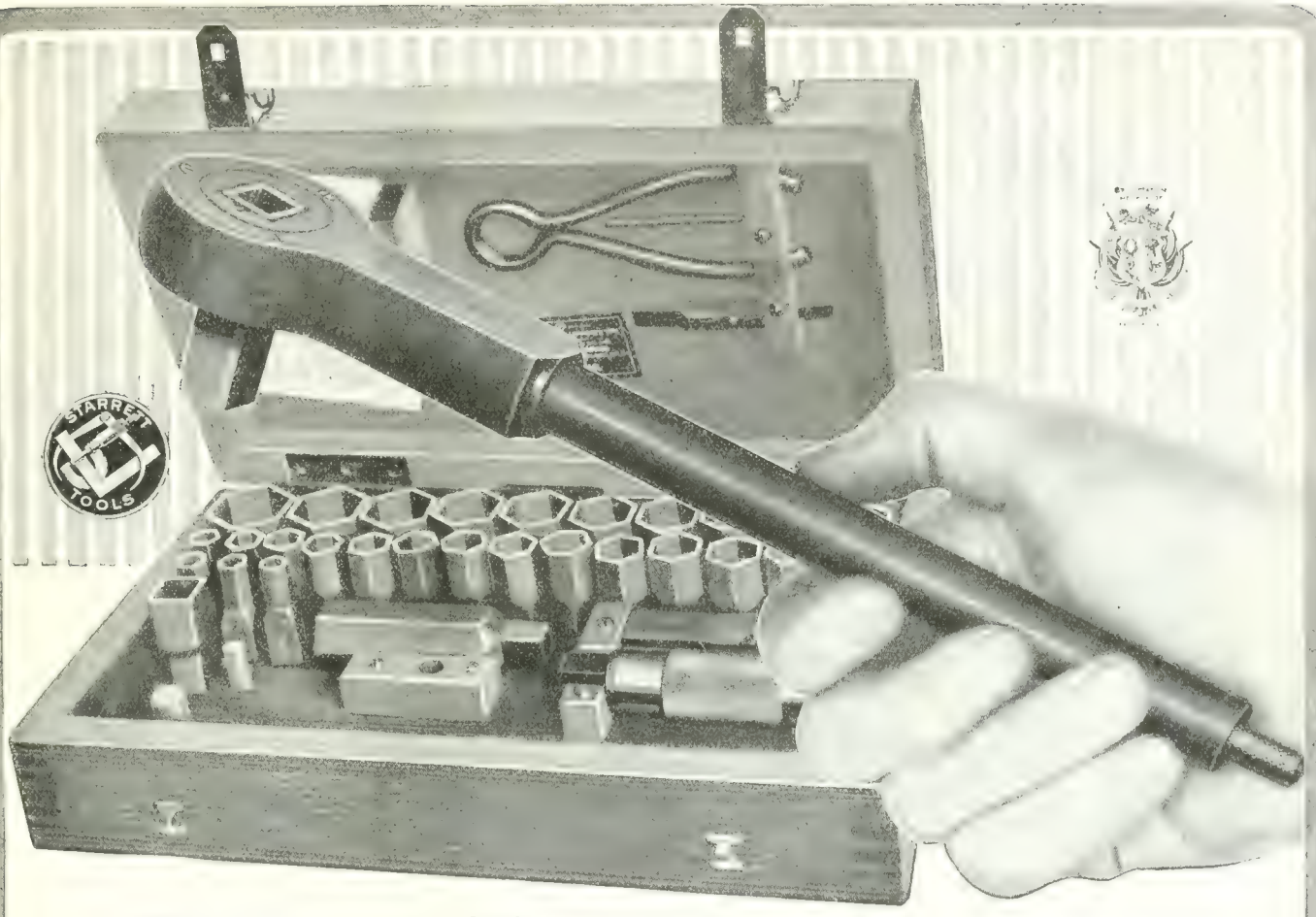
Send for blueprints and estimates.

Modern Tool Company

Main Office and Works: State and Peach Streets, Erie, Penn'a

Canadian Agents: Rudel-Belnap Machinery Co., Toronto and Montreal

The advertiser would like to know where you saw his advertisement—tell him.

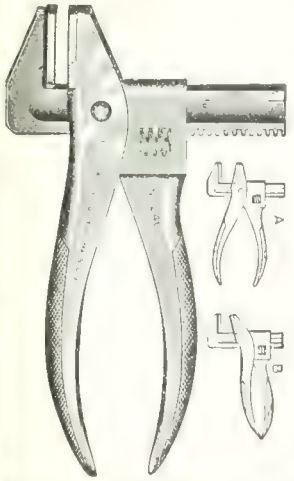


Starrett Tools for Motorists

Starrett Tools are known throughout the world as tools for fine mechanical work. Among these tools are several especially adapted for use on automobiles.

The Starrett Ratchet Wrench $15

includes 28 sockets for all standard hex nuts—handle with ratchet and reversible pawl, universal joint, drilling attachment, spark plug socket, screwdriver.



Expansion Pliers $2

Jaws are adjustable, will take any shape up to 1¼ inch. Handles are always just right to squeeze. Great leverage gives powerful grip. Quicker than a wrench for small adjustments.

Hack Saws and Frames

Flexible back blades for hand work prevent breakage. Adjustable hack saw frames take 8, 10 and 12 inch blades and permit turning the blades to saw in any position.

Starret Tools and Instruments include 2100 styles and sizes of fine tools and hack saws.

We deal direct with retail dealers. Send for free catalog No. 20-MA. prices, etc.

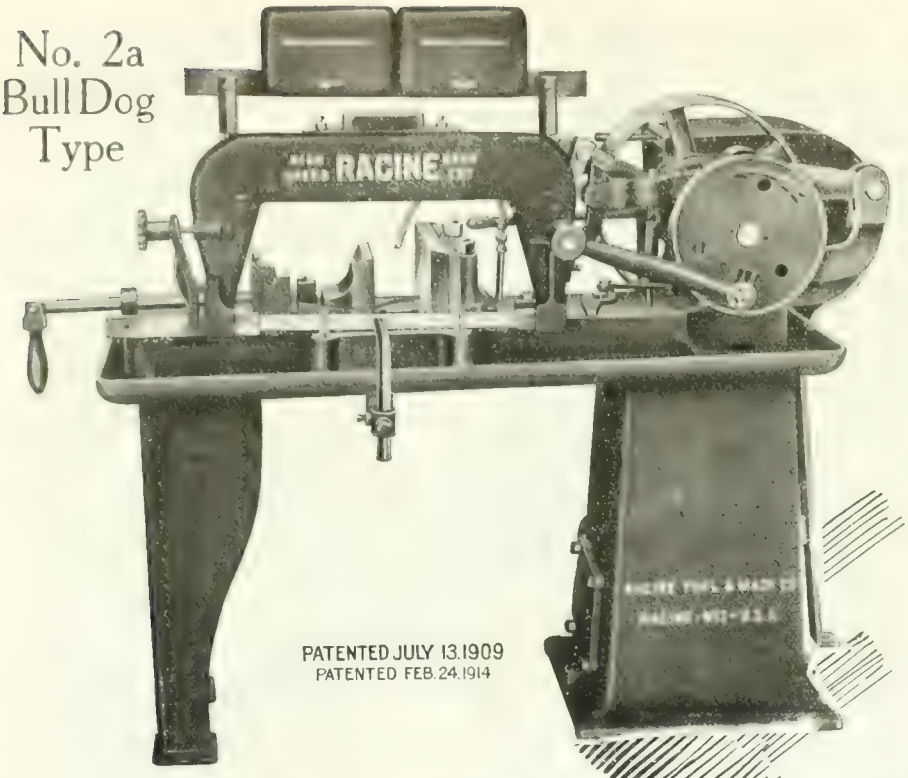
THE L. S. STARRETT COMPANY

"The World's Greatest Tool Makers"

ATHOL - - MASSACHUSETTS

NEW YORK LONDON CHICAGO

No. 2a
Bull Dog
Type



The Racine Metal Cutter

Less Blades and Utmost

One Canadian Steel Company uses 120 Racine Metal Cutters

Racines are popular everywhere because they work fast and are easy on the blades — because springing is absolutely prevented by the mechanically correct design and construction.

The heavy, rigid saw frame guide of the Racine is made of the best grade of semi-steel and will hold the saw absolutely rigid and square with the work at all times, ensuring a straight cut with the least possible waste of material.

The Blade Tightener is operated without the use of a wrench and is a great time saver.

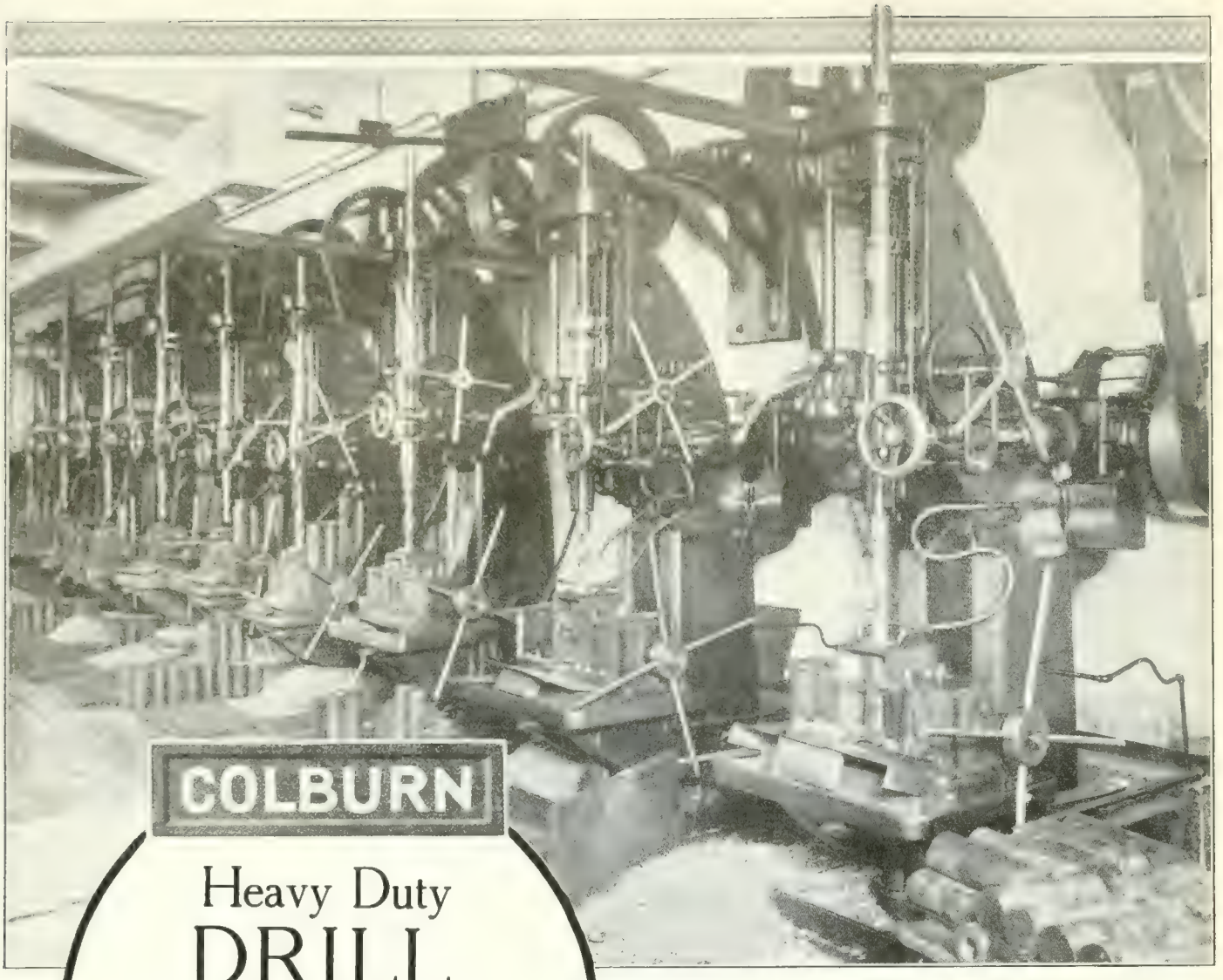
The **Three-Speed Transmission** gives unlimited range to machine illustrated herewith, adapting it to cutting all kinds of metal at proper speeds.

USED EXTENSIVELY IN CANADA

Write for full details and list of Canadian Customers.

Racine Tool & Machine Company

15 MELBOURNE AVE., RACINE, WIS., U.S.A.



COLBURN

Heavy Duty
DRILL
PRESSES

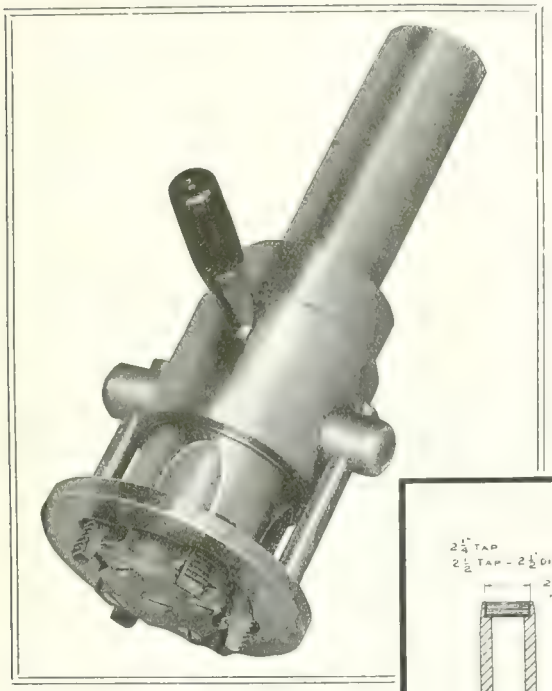
Machines That Make Tough Jobs Look Small

Important Factors in Fast, Accurate and Profitable Shell Production.

Colburn Drill Presses stand up to and deliver the goods in the hard, tough work of drilling shrapnel and high explosive shells, because they are built to take the toughest jobs and drive the best of high-speed twist drills to their full capacity.

Their power, stiffness and rigidity has won place for them in hundreds of munition manufacturing plants here and abroad. There is absolutely no spring, drill breakage is small and drills wear long between grinds.

COLBURN MACHINE TOOL CO., Franklin, Pa., U.S.A.

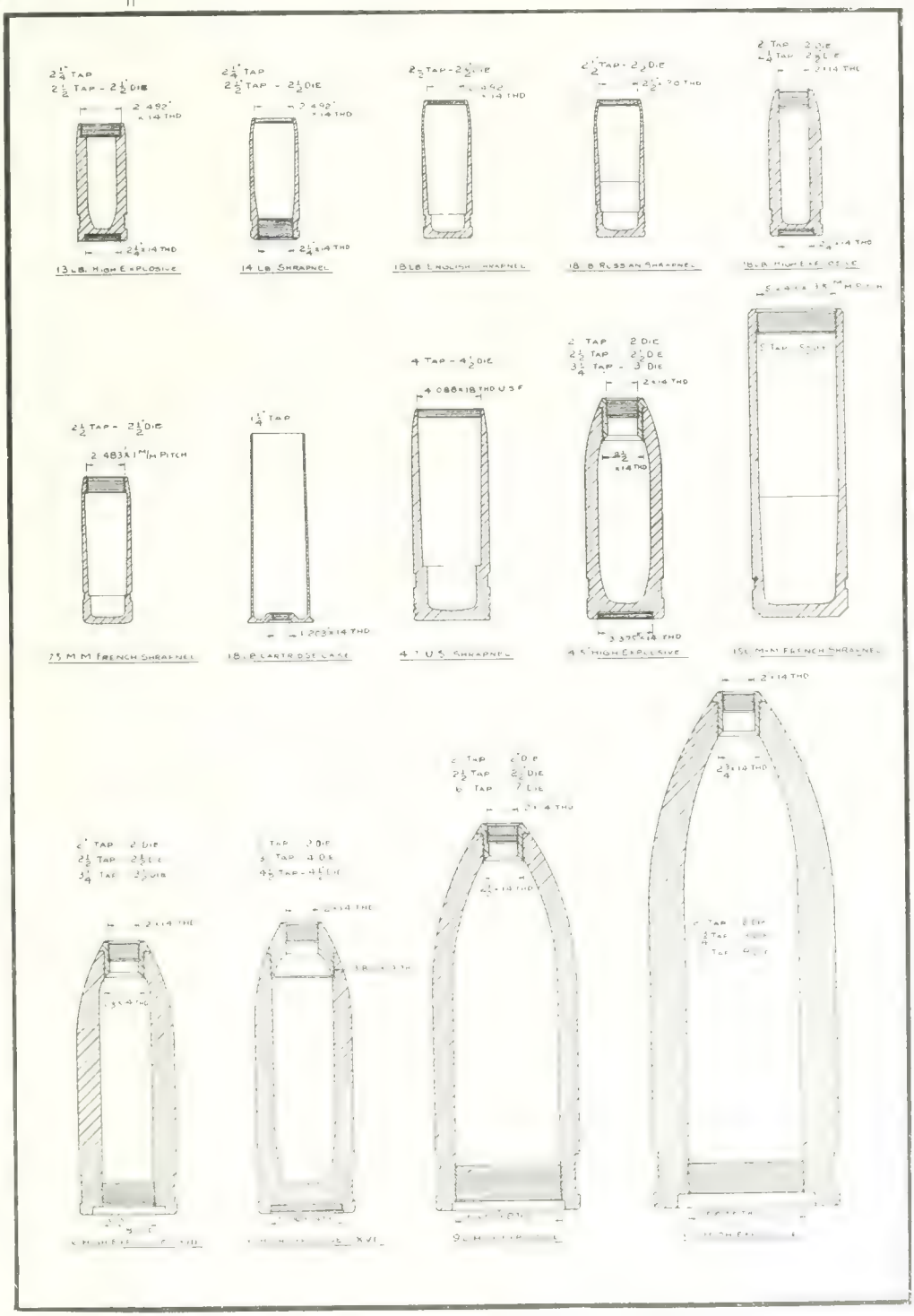


"Murchey" Tools

are threading successfully
all types and sizes of

High Explosive Shells

English, French, Italian,
United States and Russian.



LARGE SHELLS

of 9.2" and 12" diameter

are calling for improved and larger types of Tools to produce them.

Murchey Service

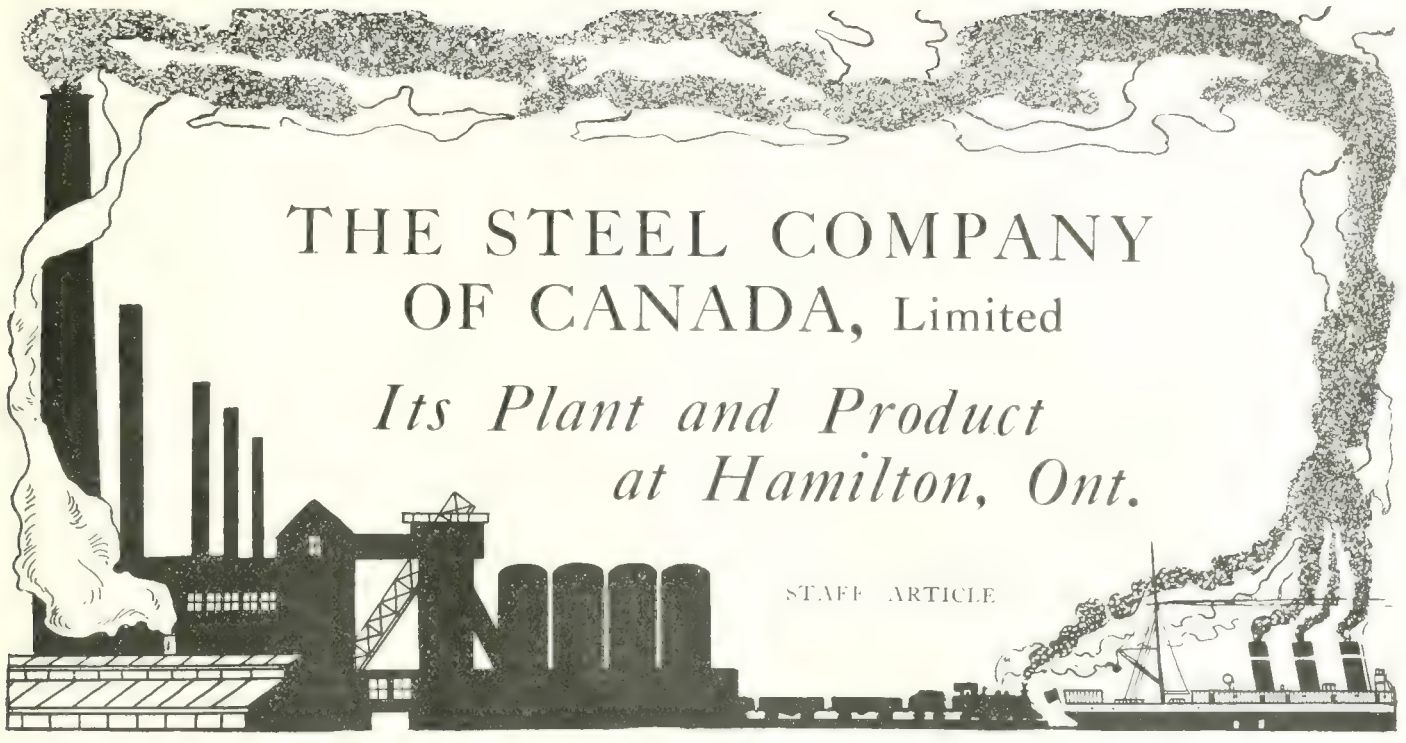
which means Murchey Collapsing Taps and Self-opening Dies — is doing this work NOW in a number of the largest munition plants with entirely satisfactory results.

Send us B P of your requirements and let us quote you on the necessary tools.

Murchey Machine & Tool Company

75 Porter Street

DETROIT, - MICH.



THE STEEL COMPANY OF CANADA, Limited

Its Plant and Product at Hamilton, Ont.

STAFF ARTICLE

From the ore mines of Mesabi to the fight ng front in France is a long way to go, but not long enough to prevent a steady flow of shells and other munitions of war. The help which Canada is giving to the Empire, grows in volume and variety as it progresses Eastward and the valued assistance being rendered by establishments such as the one described in this article is convincing evidence of Canada's present power and future potentiality.

THE entrance of Canada into the ranks of munitions producing nations was one of the unexpected events of a war, in which the unexpected has been more than once prominent. A year ago, when hostilities had been in progress for several months, there were few, if any, indeed, who foresaw the extent to which this country's resources would be relied upon for providing not only ammunition, but army stores of all descriptions in enormous quantities. Possessing an area of 3,-817,000 square miles, equal to more than one-quarter of the land possessions of the Empire, with natural resources more varied and extensive than any other colony, and geographical location and political environment of the most favorable nature, Canada would have failed in her duty as a loyal colony had she exerted herself one whit less strenuously than she has done during the past year. Circumstances point to intensification and continuation of such efforts till the British Empire once more asserts itself as the chief factor in the world's peace, and in the attainment of such a state of affairs Canada will be looked to for increased help and support until the much desired consummation of events is attained.

The building of ordnance in the near future along with impending developments in munitions manufacture will tend more and more towards the consolidation of the Dominion as a self-contained and fully developed unit, and increase to a desirable extent the effective help so necessary in the terrible struggle for liberty and justice.

The Genesis of a Shell

While the successful production of guns will form the completion of Canada's military development, the demand for munitions has been most urgent, and so far the efforts of all parties have been so concentrated on actual production that few of us have realized that every step, every operation, every substance that enters into a finished shell, and last, but not least, the men and the guns to use them; in fact, each and every phase in the life of a shell from the ore mine to the battlefield is now in existence in this country.

The successful production of a modern artillery projectile is dependent on a degree of scientific knowledge, mechanical ability, and complexity of operations, of which the casual observer has only the faintest idea, and in devoting its efforts to the manufacture of munitions The Steel Company of Canada affords a splendid instance of that promptness, thoroughness and wholeheartedness which has been so characteristic of our manufacturers.

Immediately it became apparent that the company's services would be needed, preparations for new, and alterations to operating plant and equipment were begun and carried out with such promptness and alacrity that in a very short time, shells were being produced at a highly creditable rate, and during the months which the plant has been engaged on this work the company has earned a lasting reputation as a producer of material for this purpose of the very highest order. In considering this performance one must remember that the metal is made from the ore, the forging is made from the metal, and the finished shell produced from the forging all under the one management. The life story of a shell as observed at the company's various plants is fascinating, instructive and highly stimulative of that industrial patriotism which is so characteristic of Canada's present efforts.

Mining the Iron Ore

Situated in the Mesabi range of hills in the northern part of the State of Minnesota, close to the Canadian border, and 800 miles from Hamilton, Ont., as the crow flies, are vast deposits of iron ore. From this locality, known as the Lake Superior district, about 40,000,000 tons of hematite iron ore are shipped annually to blast fur-

ranges which yield more than three-quarters of the pig iron production of the North American continent. This red or "Mesaba" hematite is one of the richest forms of iron ore, containing in some cases as much as 68 per cent. of iron, and in appearance resembles soft brownish earth. The deposits of the Mesaba range of hills lie near the surface, and are mined by means of immense steam shovels or excavators, such as are used for digging foundations, canals, railway cuttings, etc. These deposits are particularly adapted for handling by machinery, and the mining, transportation, and unloading of this material have resulted in the perfection of mechanical appliances of wonderful capacity and efficiency.

Photo LOADING ORE BOATS AT MESABA ORE DOCK, DULUTH Gallagher, Duluth

Lake Transportation

Ore boats carrying 10,000 or 12,000 tons of ore in one cargo, convey the ore to its destination. These boats are loaded from immense bins, into which the cars from the mines are emptied, the bins being elevated above the level of the boats, so that by means of ore chutes leading into each hatchway, the ore is rapidly conveyed by gravity into the hold of the vessel. In a few hours the ship has received its cargo and is ready to start on its long journey down the chain of inland lakes to its destination, where unloading of the boats is accomplished almost as rapidly as the loading.

The Production of Pig Iron

The plant of The Steel Company of Canada is complete in every detail, and is considered by many authorities to be of most modern design and construction. Here, in an extent of several acres, and in the course of a few hours may be seen steel in every stage of production from iron ore, barely distinguishable from common earth to the shrapnel and high-explosive shell, wanting only the addition of the explosive charge and propellant to make it ready for actual use in battle.

A short explanation of the reasons for and nature of the various processes through which the metal passes, may render clearer a description of the plant.

The first step in the manufacture of steel from iron ore is to separate the iron from the various substances associated with it in that form. This is accomplished by smelting the ore in a blast furnace with fuel and flux, whereby much of the impurities is removed, and a cast iron, commonly known as pig iron, is obtained. The pig iron thus produced is still an impure grade of

Photo MALLET COMPOUND LOCOMOTIVE HAULING TRAIN OF

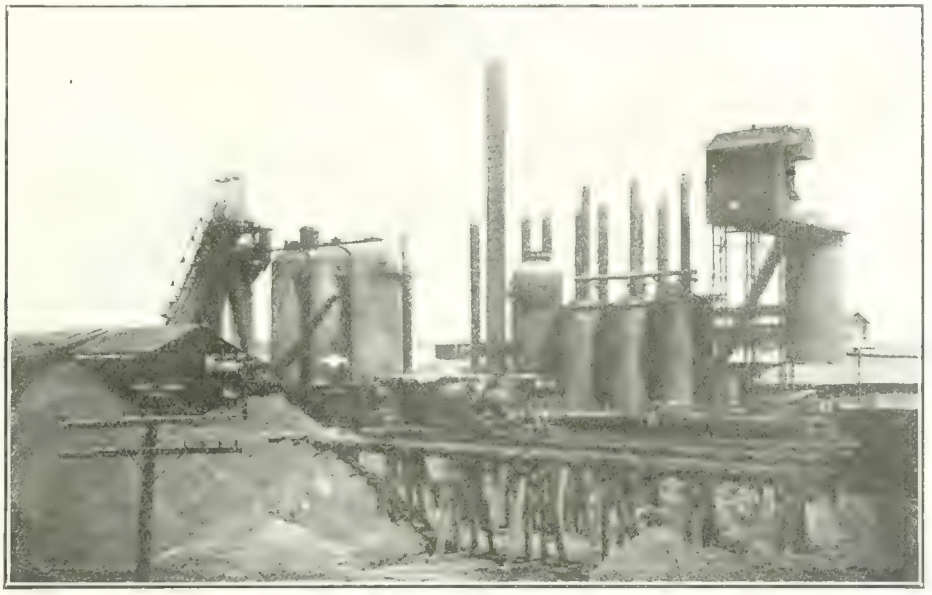
iron, containing roughly 1.00 per cent silicon, 0.1 per cent. sulphur, 1.50 per cent. phosphorus, 1.50 per cent. manganese, 3.50 per cent. carbon. A steel suitable for projectile manufacture would have a composition approximately thus: .15 silicon, 0.03 per cent. sulphur, 0.05 per cent. phosphorus, 0.70 per cent. manganese, 0.50 per cent. carbon. In order to obtain metal of this composition it is necessary to remove nearly all of the various impurities from the pig iron, and then add the necessary proportions of such ingredients as are desired.

This constitutes steel-making proper, and may be accomplished by various processes, all of which are similar in general principles, though differing widely in certain features which have important bearing on the finished produce.

After the desired chemical composition has been obtained, the steel is subjected to various mechanical treatments terminating with its appearance in the shape of the now familiar shell forging.

The Blast Furnace

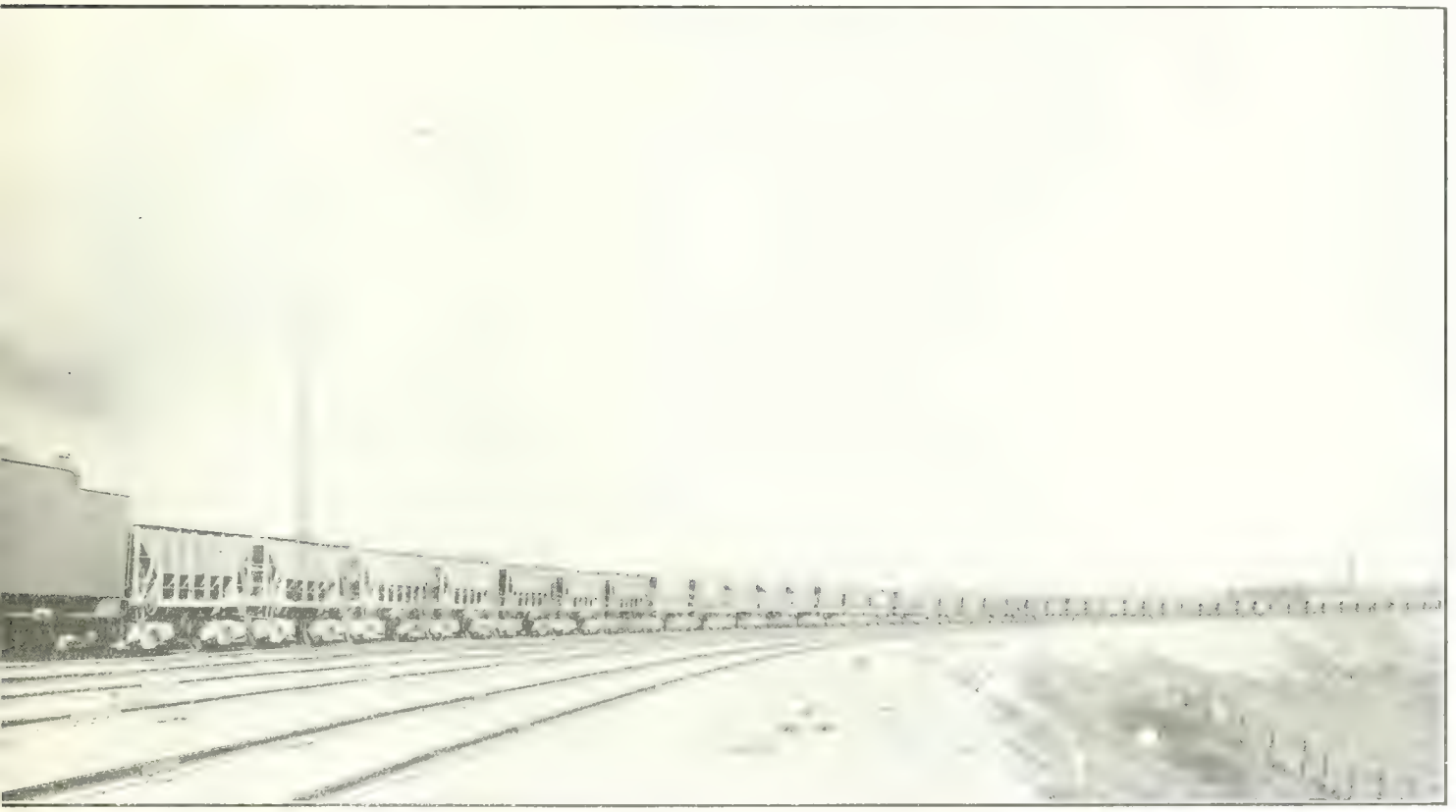
Returning now to the blast furnace, the iron ore arrives in hopper bottom cars, which are run out on elevated tracks and dumped in large storage piles in close proximity to the blast furnace. Limestone and coke, which are necessary materials in steel-making, are similarly stored.



BLAST FURNACE PLANT OF THE STEEL COMPANY OF CANADA, LTD., HAMILTON ONT.

A sectional view of the blast furnace with skip hoist and charging bins is shown on page 465.

The charging bins are situated well above ground level, the discharge spouts being so arranged that the necessary amounts of ore, coke and limestone may be fed into a travelling dump car provided with scales, and running on a track below the bins. The car empties its load of material into the skip, two of which are used, one [illegible] ascending to be filled when the other ascends with the charge for the furnace. When the loaded skip nears the top of the hoist tracks, projections on the ends of the rear axle engage with suitable curved guide rails, and tip the skip over so that its contents are discharged into the hopper on top of the furnace. This hopper is of double construction, being fitted with two bells or cones A and B. Bell B is held against the bottom of the upper hopper by a counterweight, and is opened by hydraulic gear, thus allowing the charge to fall into the main hopper I, which in turn is closed by bell A. When hopper I has been charged with the proper quantities of ore, limestone and coke, bell A is opened, while bell B is kept tightly



LOADED CARS FROM ORE MINES TO LAKE SUPERIOR

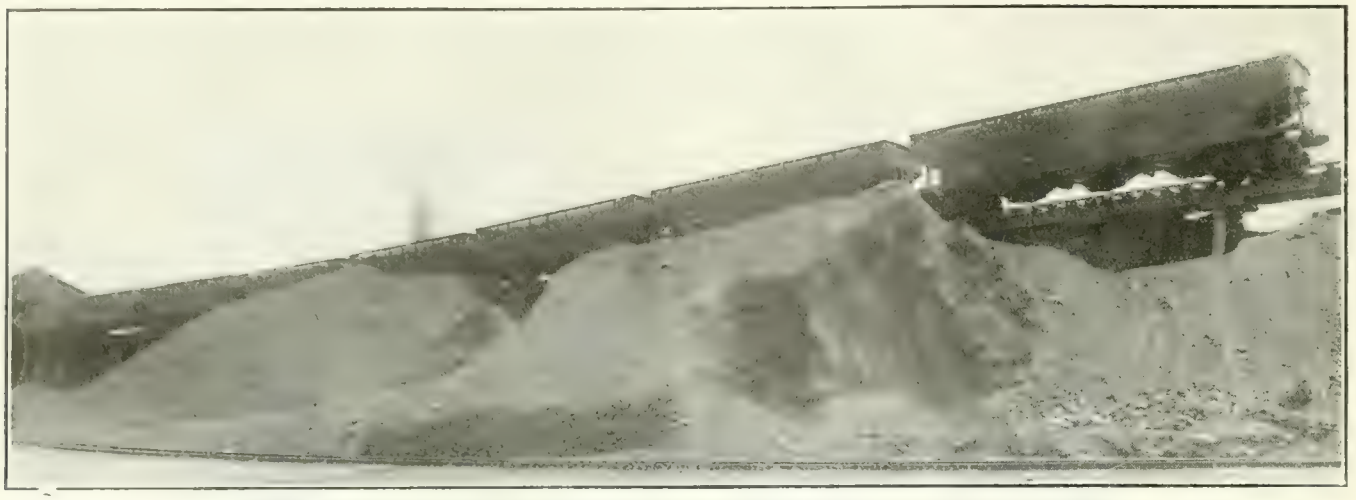
closed. The contents are now precipitated into the furnace, while the gas is prevented from escaping by bell B and going to waste as formerly, thus giving rise to the long flame which some years ago was such a prominent feature of blast furnace plants.

protected by a water-cooled casting, and is closed by means of an iron plug. The purpose of this hole is to draw off the cinder and prevent it reaching the level of the tuyeres. On a level with the bottom of the crucible, on the front side of the furnace, is the iron tap-hole through

seen lying at the base of the furnace in photograph on page 466.

Blowing Engines

The air which is necessary to operate the furnace is supplied at a pressure of from 15 to 30 lb. per sq. in., according



STORAGE PILES OF IRON ORE AWAITING TREATMENT IN BLAST FURNACE.

Design

As will be observed from the drawing, a blast furnace consists of a vertical brick-lined shaft, the internal shape being of a special outline, which has assumed its present form and proportions as the result of experience and scientific investigation. The lining of the furnace consists of acid (silicious) fire-brick, into the outer surface of which are built numerous water pipes for cooling purposes. These are easily seen in the photograph on page 466.

Encircling the lower part of the furnace is the blast pipe L, which supplies air to the furnace through the tuyeres N. The tuyeres, 12 in number, extend through the lining, the openings or "notches" as well as the tuyeres being cooled by water circulating through special pipes and hollow shields.

The hearth is the lower portion of the furnace, about 8 ft. in height, with vertical sides. Above that for a distance of 12 ft. is a portion of gradually increasing diameter, known as the bosh. From the top of the bosh, which is the largest diameter of the furnace, the walls close in gradually, forming the stack, which extends upwards to the throat where the charging hopper is located.

About three feet below the level of the tuyeres a hole is provided, known as the "cinder notch" or "monkey." This is

which the liquid metal is drawn off from the furnace. This is simply a large hole in the brick work, which is stopped with clay balls. In tapping the furnace, these balls are broken up with a bar, and in order to stop the hole again a mud gun is employed, which shoots the balls of clay into the hole. This gun is

ELECTRICALLY DRIVEN CHARGING CAR WHICH WEIGHS THE ORE, COKE, ETC., AS DELIVERED BY OVERHEAD CHUTES FROM CHARGING BINS

to furnace conditions. The blowing engines for supplying this air are of a type which is more or less peculiar to blast furnace plants, and one of these is shown in a photograph on page 465. They are what are known as disconnected compound, long cross-head blowing engines. The steam cylinders are 44 in. and 84 in. diameter by 60 in. stroke, and are placed above the blowing cylinders, which are located between the fly-wheels.

Before entering the furnaces the air is heated to a temperature of 900 to 1,250 deg. Fahr. by passing through the hot blast stoves. These stoves, of which there are three, are distinctive features in the appearance of blast furnace plants. They are upwards of 100 ft. high and 20 ft. in diameter.

The hot gas from the top of the blast furnace is conveyed through large pipes to the base of the stoves, where it is mixed with air and burned. The products of combustion pass upwards through the central passage and then downward through the surrounding space, which is constructed of suitably arranged fire-brick chambers, after which the gases escape through the chimney. After running for a certain period, the stove has absorbed a maximum amount of heat from the gases, and the process is then reversed. The air from the blowing engines is now re-

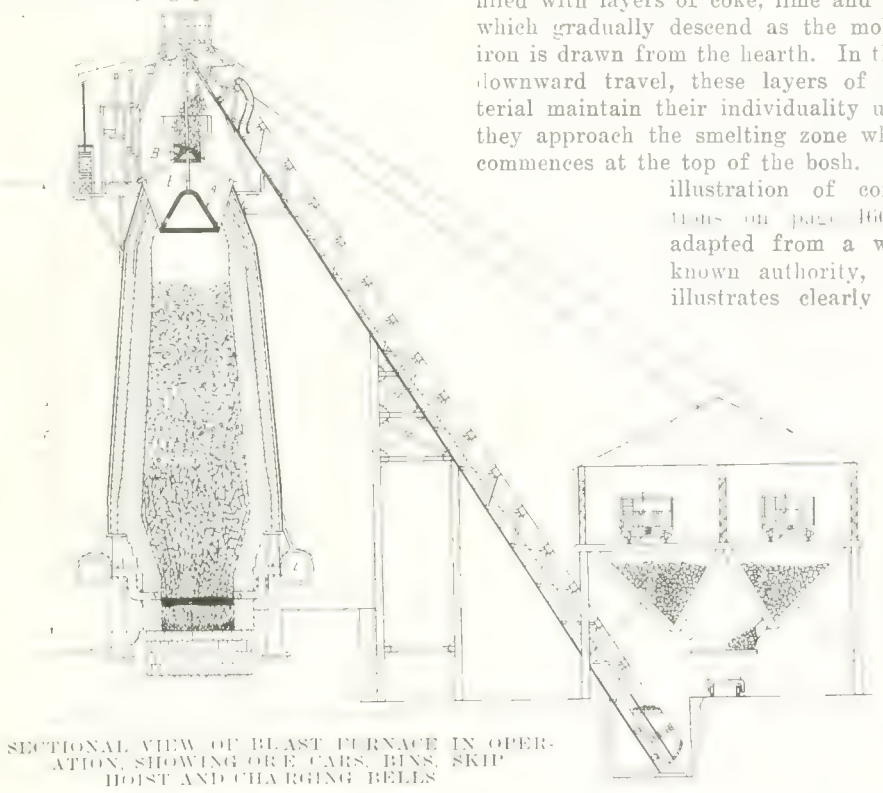
ceived through a valve at the base of the chimney, and, passing upwards through the hot fire-brick, is raised to a high temperature before passing out at the bottom of the central passage and thence to the tuyeres. When this reversal takes place, the hot gases from the furnace are switched into that stove, which was previously heating the air. While one stove is heating the air, the remaining stoves are being warmed up by the hot gases. In order to maintain a fairly regular temperature in the blast furnace, the stoves are changed over about once an hour.

Utilizing the Waste Gases

Only one-third of the waste gases from the blast furnace is necessary to keep the stoves hot, and the remaining two-thirds are available for use in various ways. In the case of this plant, the gas is burned under a battery of boilers, producing the steam required to operate the blowing engines and refrigerating plant which is required for drying the air before entering the stoves.

Undried air, if blown directly into the furnace, would carry with it water vapor equivalent to from 1 1/3 to 8 gallons per minute, according to the humidity of the air, materially cooling the smelting zone of the furnace. The process of drying the air by refrigeration was originated by James Gayley, a prominent American steel maker, and the saving in fuel and increased regularity of working due to the absence of moisture have resulted in its adoption by the leading plants in various countries.

The air-drying plant consists of three 150-ton compound steam-driven ammonia compressors, which supply the necessary refrigeration for cooling the brine which is circulated by three steam-driven flywheel type brine pumps.



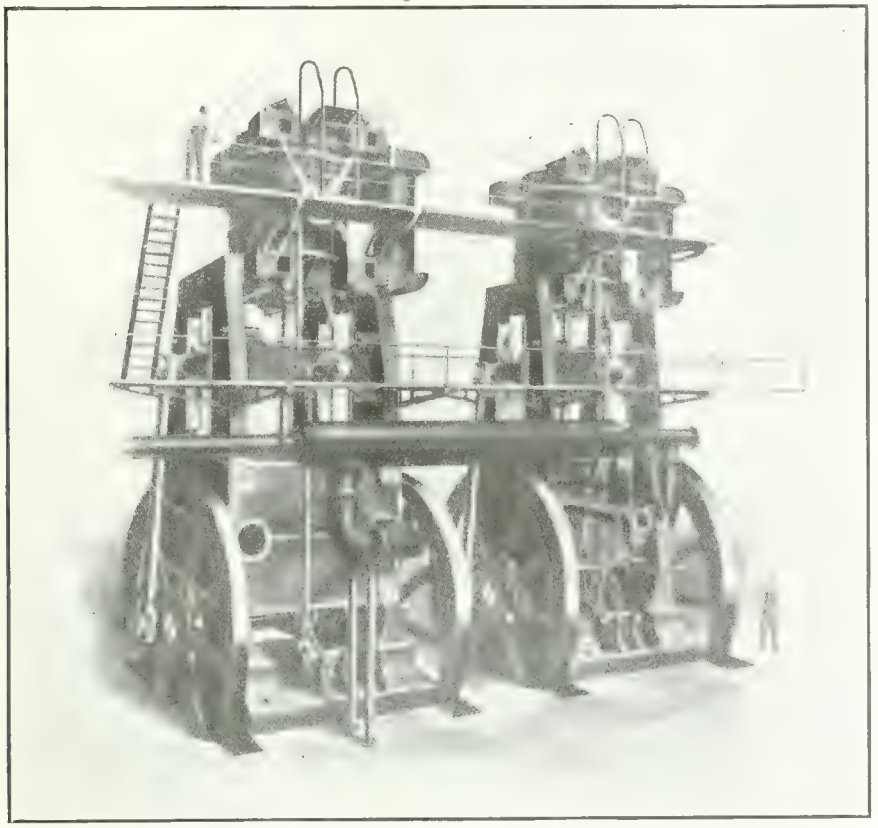
SECTIONAL VIEW OF BLAST FURNACE IN OPERATION, SHOWING ORE CARS, BINS, SKIP HOIST AND CHARGING BELLS

Operation of the Blast Furnace

When in operation, the furnace is filled with layers of coke, lime and ore, which gradually descend as the molten iron is drawn from the hearth. In their downward travel, these layers of material maintain their individuality until they approach the smelting zone which commences at the top of the bosh. The illustration of conditions on page 466 is adapted from a well-known authority, and illustrates clearly the action of the various materials. The exact location of the smelting zone is dependent upon the volume and pressure of blast, size of furnace, character of slag made, etc., but will extend from the level of the tuyeres to a few feet above them, or about to the top of the bosh. It will require perhaps fifteen hours for the material to descend from the top of the furnace to the smelting zone. During this descent, it is upheld partly by the resistance of the uprushing column of hot gases, partly by its friction on the walls of the furnace, and partly by the loose column of coke which extends through the smelting zone and to the bottom of the furnace, and which alone resists melting in the intense heat of this zone. The oxygen of the air blast attacks all the coke in the smelting zone and as much of it below the level of the tuyeres as is not covered by accumulations of iron and slag in the hearth, producing a large volume of carbon monoxide gas (CO), and a temperature which may exceed 3,000 deg. Fahr. This CO along with the nitrogen of the blast passes up between the particles of solid material, which takes up the greater part of their heat. The CO also performs certain chemical reactions, and thus in both ways the rising column of gases prepares the charge for its final reduction in the smelting zone.

Smelting the Iron

When the charge has travelled about half-way down the furnace, the in-



DISCONNECTED COMPOUND LONG CROSSHEAD BLOWING ENGINE

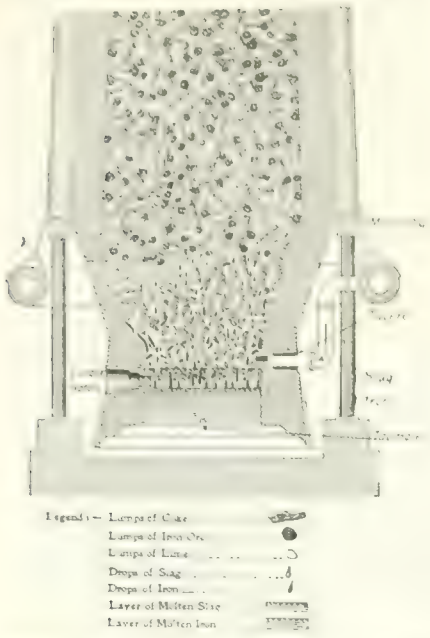


DIAGRAM SHOWING VARIOUS STAGES IN PROCESS OF SMELTING IRON ORE
From Howe, "Iron, Steel and other Alloys."

duced to metallic iron. This spongy iron is impregnated with deposited carbon, which is absorbed in a similar manner to the process known as carbonizing. This reduces the melting point of the iron, and causes it to become liquid at a higher point above the tuyeres than it otherwise would.

On reaching the smelting zone, the iron melts and trickles quickly down over the columns of coke, from which it completes its saturation with carbon. At a corresponding point the lime unites with the coke ash and impurities in the iron ore, forming a fusible slag, which also trickles down and collects on the hearth. It is during this transit that the different impurities are reduced by the carbon, and the extent of this reduction determines the characteristics of the pig iron, for in this operation as in all smelting, reduced elements are dissolved by the metal, while those in the oxidized form are dissolved by the slag.

The slag is drawn off through the cinder notch four or five times, be-

the furnace, which takes place about every six hours. This is run through channels in the sand floor to ladle cars at the side of the cast house, whence it is taken to the water front and dumped into the bay, making an ideal foundation for the reclaimed land which is being gradually brought into existence on the company's lake front.

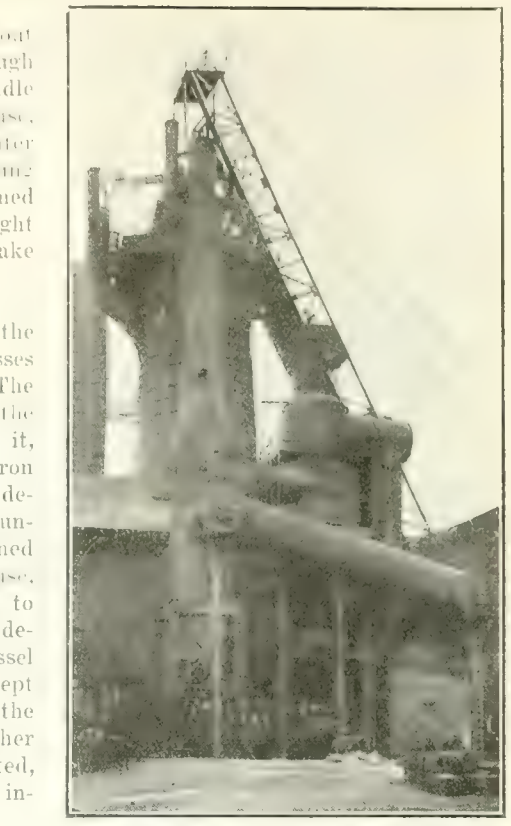
Tapping the Furnace

The scene in the cast house when the furnace is tapped is one which impresses even the most passive observers. The tap hole is opened by breaking up the clay balls which were forced into it, forming a solid plug. The molten iron flows underneath a skimmer, which deflects the floating slag into its own runner, while the iron flows into brick-lined ladles at the end of the cast house, which are immediately transferred to the open-hearth department and deposited in a large cylindrical vessel known as the mixer, where it is kept hot until it is time to charge it into the open-hearth furnace, where further changes in its composition are affected, which finally transform it into that indispensable metal steel.

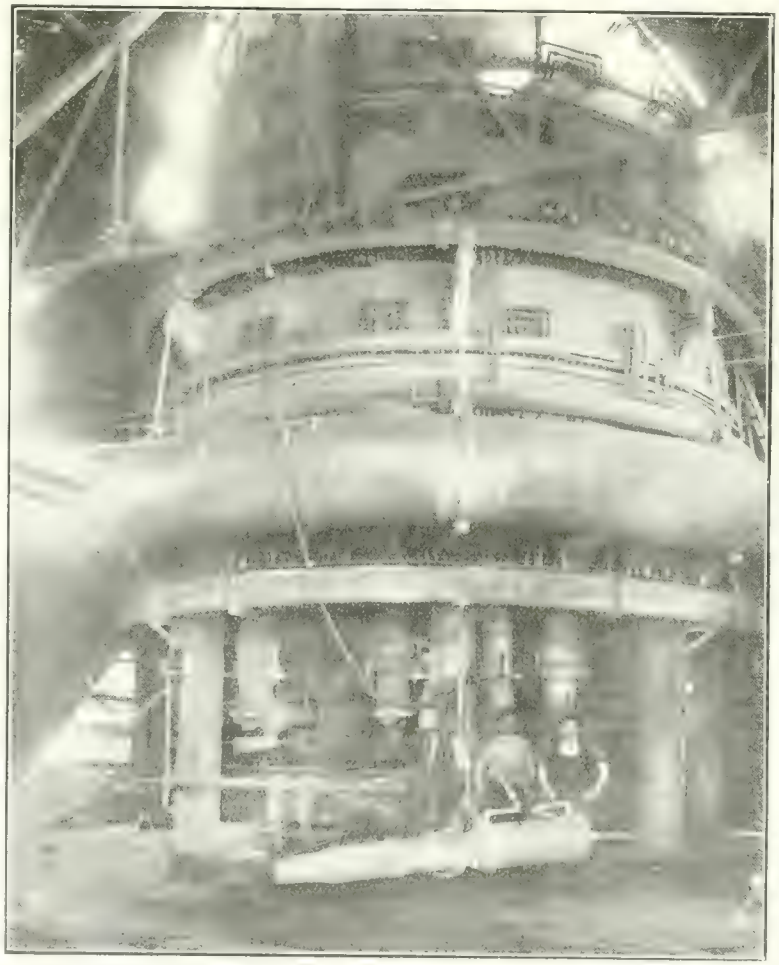
Manufacture of Steel

The physical properties possessed by iron as produced in the blast furnace are such as to render it unsuited for shells. The large proportion of carbon and other impurities present impart a brittleness and absence of ductility which are entirely absent when these substances are wholly or partially eliminated. This elimination or purification is performed by various processes, but the chemical action of oxidation is common to all.

The particular process of purification adopted by the Steel Company of Canada is that known as the basic open-hearth process, and differs sufficiently from other processes to demand a brief description. In all cases of purification, i.e., steel-making, the impurities are removed from the pig iron by means of oxidation—that is to say, the molten metal is subjected to the action of oxygen either in the form of air or iron oxide or both. The name of Bessemer naturally occurs to many people in connection with steel-making, and in the pro-



EXTERIOR VIEW OF BLAST FURNACE SHOWING PIPES FOR CONVEYING WASTE GASES TO STOVES. DUST SEPARATOR IN FOREGROUND.

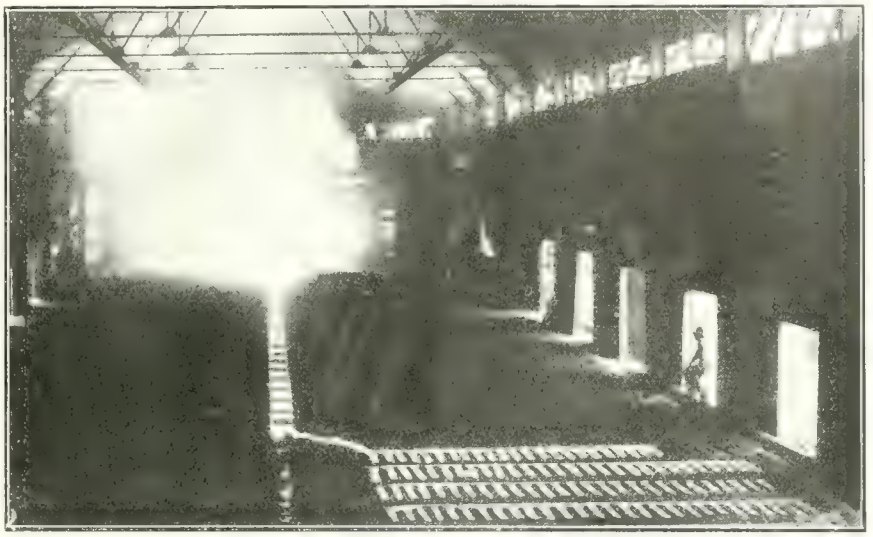


BASE OF STACK SHOWING LARGE BLAST PIPE SUPPLYING AIR TO THE TUYERES. STEAM OPERATED MUD GUN IN FOREGROUND USED FOR PLUGGING TAP HOLE BEHIND THE MUZZLE

cess invented by the late Sir Henry Bessemer, air alone is used to remove the impurities from the molten iron.

Bessemer Process

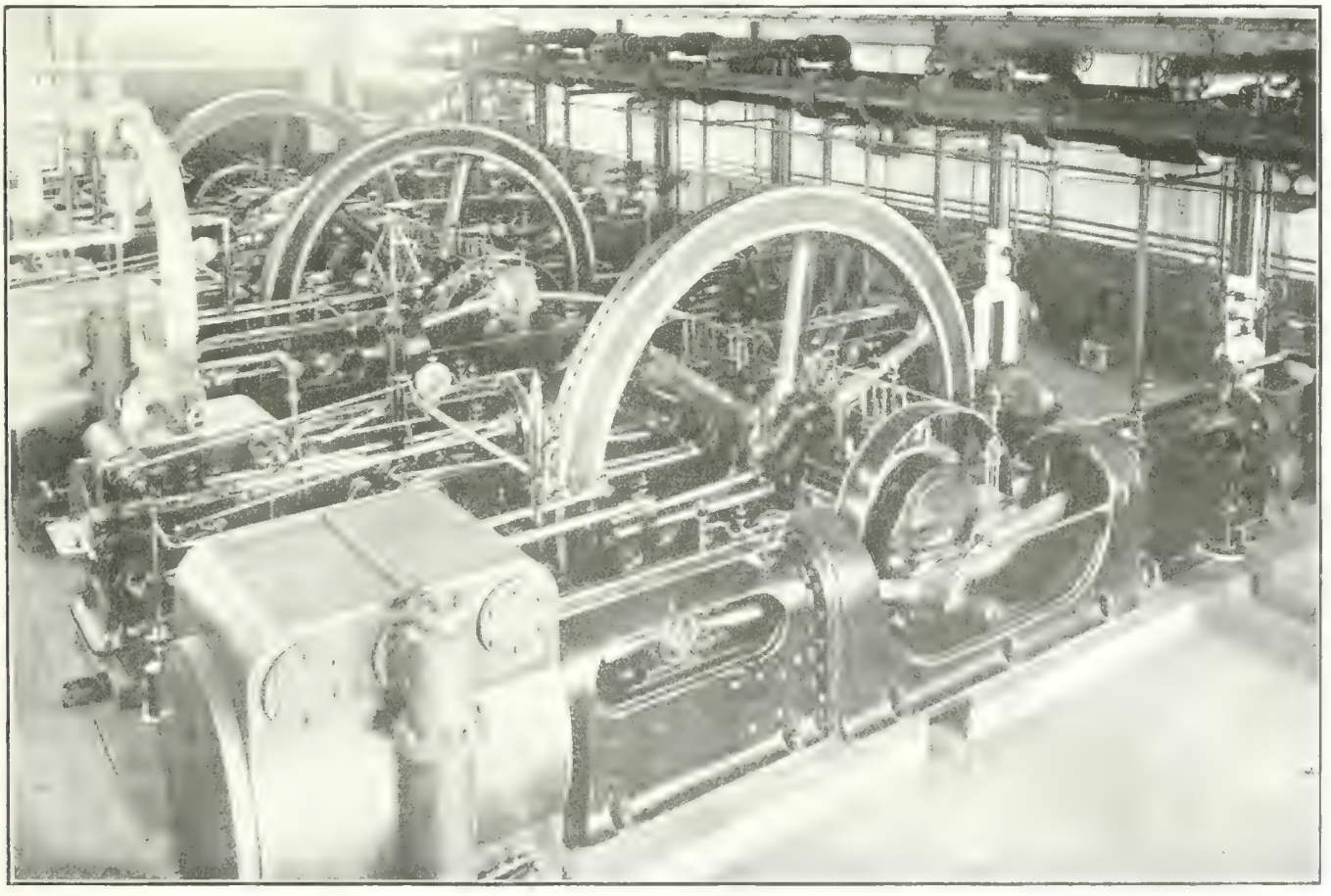
A large pear-shaped vessel known as a converter is lined with suitable protective material and provided with means whereby air can be forced upwards from the bottom with sufficient force to bubble through the molten metal. A converter, as the receptacle is termed, with a capacity of 15 tons, would require 30,000 cu. ft. of cold air per minute. The effect of such treatment on the iron impresses the lay mind chiefly by reason of its peculiar physical aspect, but no matter how wonderful its behaviour and appearance during this treatment, the resulting changes in the physical properties of the metal are little short of marvellous. A concise description of a "blow" or "heat" is given by Bradley Stoughton. "In about four minutes the silicon and manganese are all oxidized by the oxygen of the air and have formed a slag. The carbon then begins to oxidize to carbon monoxide, CO, and this boils up through the metal and pours out of the mouth of the vessel in a long brilliant flame. After another six minutes the flame shortens or 'drops' the operator knows that the carbon has been eliminated to the lowest practicable limit (say 0.04 per cent.), and the operation is stopped. So great has been the heat evolved by the oxidation of the impurities that the temperature is now higher than it was at the start, and we have a waste of liquid mass of relatively pure metal. To this is added a carefully calculated amount of carbon to produce the desired degree of strength or hardness, or both; also about 1.0 per cent. of manganese and 0.15 per cent. of silicon. The manganese is added to remove from the bath the oxygen with which it has become charged during the operation, and which would render the steel unfit for use. The silicon is added to get rid of the gases which are contained in the bath. After adding these materials, or 'recarburning' as it is called, the metal is poured into ingots, which are allowed to solidify, and are then rolled, while hot, into the desired size and form."



CAST HOUSE, SHOWING THE MOLTEN IRON BEING RUN INTO MOULDS OR PIGS

Basic Open-Hearth Process

The open-hearth process in operation at this plant differs considerably from



THREE COMPOUND, 150-TON AMMONIA COMPRESSORS IN AIR DRYING PLANT

the Bessemer process, and its use in preference to the other is due to a complexity of circumstances, such as nature of ores available, quality of product desired, demands of customers, etc. The basic open-hearth differs from the acid open-hearth in the nature of the lining and the composition of the slag produced, the effect of which is to aid greatly in the removal of phosphorus and sulphur, thus permitting the use of high phosphorus ores as distinguished from low phosphorus ores, which are necessary for both Bessemer and acid open-hearth practice.

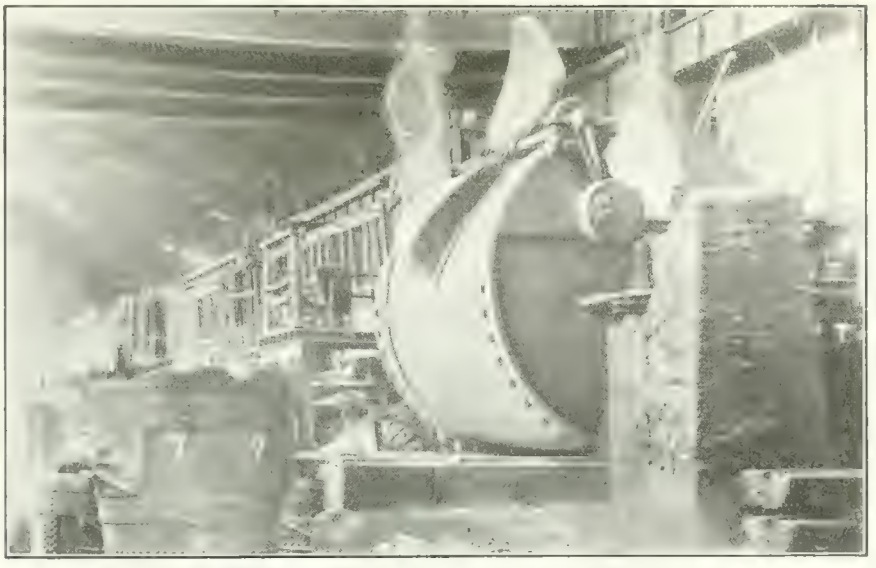
A sectional view of the furnace plant is given on page 469, while the accompanying views of the melting platform, charging machine, casting pit and ingot teeming give a good idea of the actual conditions under which the work of steel making is carried on.

Furnace Arrangement

The furnaces, which are in continuous operation, are of the stationary type, in which the metal is drawn off through a tap hole in the sides (see photo of casting pit). The melting platform or charging floor is on the other side of the furnaces and on the same level as the hearth. Two charging machines travel along this floor on rails, while directly in front of the furnaces is a standard gauge track on which trucks convey the scrap metal and limestone which are deposited in the furnaces through the various doors shown. Spanning the casting pit, which is situated on actual ground level, are two traveling cranes for handling the ladles in charging, teeming, etc. The mixer, which is at one end of the casting pit, is also served by these cranes.

Situated on the opposite side of the charging floor and at a lower level are the gas producers, which supply the necessary fuel for the furnaces. Regenerators or preheating chambers are built beneath the charging floor, and perform a similar function to that of the hot blast stoves in connection with the blast furnace.

RUNNING SLAG FROM THE BLAST FURNACE INTO LADLE-CARS.



THE MIXER WHICH RECEIVES THE MOLTEN IRON TO PREPARE IT FOR TREATMENT IN OPEN-HEARTH FURNACE.

Construction of Furnaces

A longitudinal section of one of the furnaces is given on page 469, from which the principle of construction can be understood. The hearth in which the metal lies is formed of a shallow dish-like depression, which in the case of a 50-ton furnace is about 24 inches deep. The bottom is composed of a magnesite brick shell on which is built up a special lining of calcined magnesite with a small proportion of anhydrous tar, which acts as a binder. This magnesite and tar is deposited on the surface, where the tar is immediately incinerated, forming a strong frame work, which holds the magnesite securely in place. By means of successive layers this protective coating is built up to a thickness of 18 inches.

The fuel and air enter the furnace through separate ports at the same end of the furnace. Ports are provided at

STORAGE YARD OF SCRAP STEEL. THIS MATERIAL FORMS A CONSIDERABLE PROPORTION OF THE FURNACE CHARGE.

both ends, however, so that each pair of ports alternately acts as exit for the products of combination, which are conveyed through the regenerators to the chimney flue. After a suitable lapse of time the ports are reversed, so that the incoming gas and air is heated by the regenerators which were previously being heated by the waste gases, the ports which formerly supplied the fuel and air now acting as exits and allowing the regenerators in their flues to be heated again.

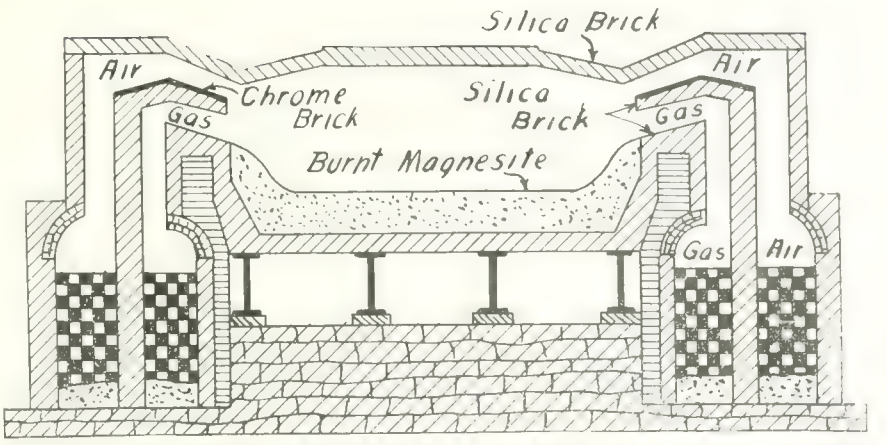
Charging the Furnace

In charging the furnace, the charging machine is placed opposite the furnace door. Between the machine and the door is a truck with a number of long buckets containing limestone. One end of each bucket is specially formed so that the arm of the machine is able to pick it up and carry it forward into the furnace and then revolve it, so that the contents are distributed equally over the bottom. Steel scrap and other cold metal is then added, and lastly, the molten iron from the blast furnace, which has been held over in the mixer till the furnace is ready to receive it. This molten iron is charged through a special door on the casting pit side of the furnace. The object in charging this last is to avoid damage to the furnace lining, which would result from dropping solid lumps of stone and metal into the liquid iron.

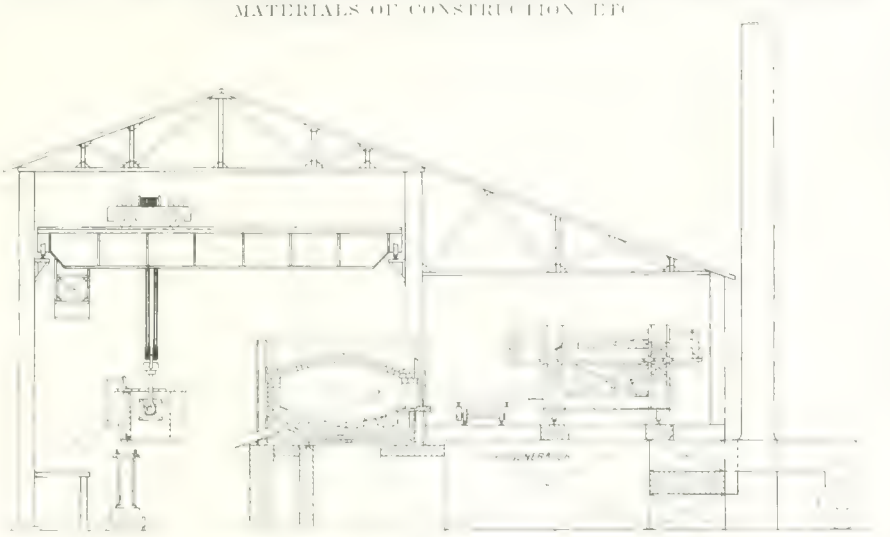
The charge melts down in about five hours or so. When this is complete, the melter takes a sample and continues to do so at stated intervals, until the laboratory tests show the desired composition. The charge is now run off through the tap hole, which was securely closed by forcing material into it from the inside of the furnace. As will be observed in the illustration of the casting pit, a gallery extends round the furnace close to the tap hole, and the hole is pierced by a man from this position. The metal pours out in a state of great fluidity, its appearance being like white hot water. After 35 or 40 tons are in the huge ladle, the surface ripples and waves, due to the pouring, continue to travel back and forth across the surface, and indicate in a most impressive manner the wonderful nature of the operations incidental to the production of steel.

The results of the various reactions in the open-hearth furnace are these.

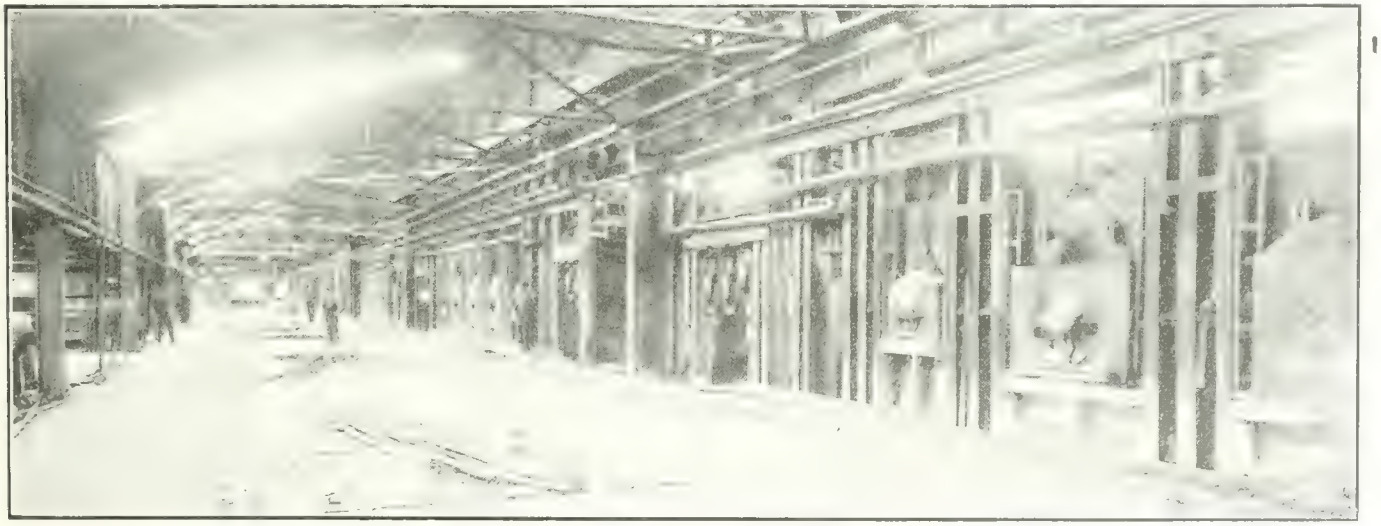
The molten lime absorbs the silicon, manganese and phosphorus with a proportion of sulphur, after which it floats on the surface of the metal and protects it from being oxidized by the furnace gases. The carbon content is brought down by introducing iron ore at a suitable time, the



SECTIONAL VIEW OF OPEN HEARTH FURNACE SHOWING GAS AND AIR PASSAGES MATERIALS OF CONSTRUCTION ETC



SECTION OF OPEN HEARTH FURNACE BUILDING

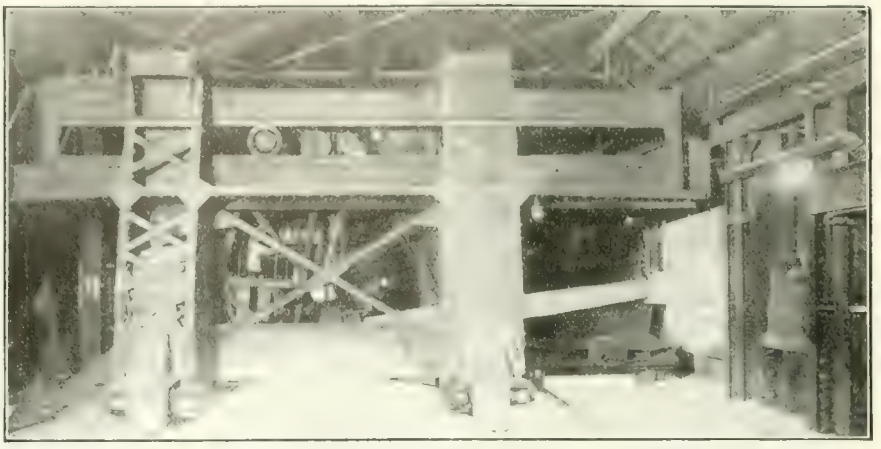


CHARGING FLOOR IN OPEN-HEARTH BUILDING. FURNACES ON RIGHT

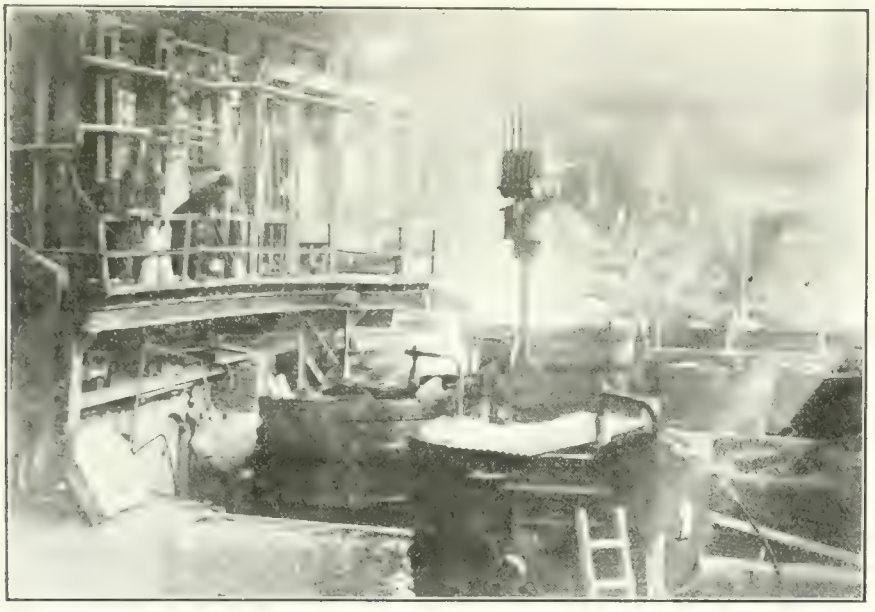
oxygen of which combines with the carbon, boiling off and escaping as gas.

While the metal is running off into the teeming ladle it is recarburized by adding to it the necessary quantity of ferro manganese and charcoal or coke. These materials are prepared in suitable size, and at a given time during the filling of the ladle, two large paper bags containing the mixture are thrown in from the gallery. About half of the carbon content of the materials is absorbed by the steel, and if all calculations and operations have been correctly made and carried out, the steel has now a composition roughly as follows: Silicon, 0.15 per cent.; sulphur, 0.03 per cent.; phosphorus, 0.05 per cent.; manganese, 0.70 per cent.; carbon, 0.50 per cent.

deposits it in a section of the soaking pit, where it is maintained in an upright position at a steady temperature for about one hour. This treatment is necessary to allow the ingot to attain an even temperature throughout, and also to confine the pipe or segregation core to the centre.



CHARGING MACHINE DEPOSITING MATERIAL IN FURNACE.

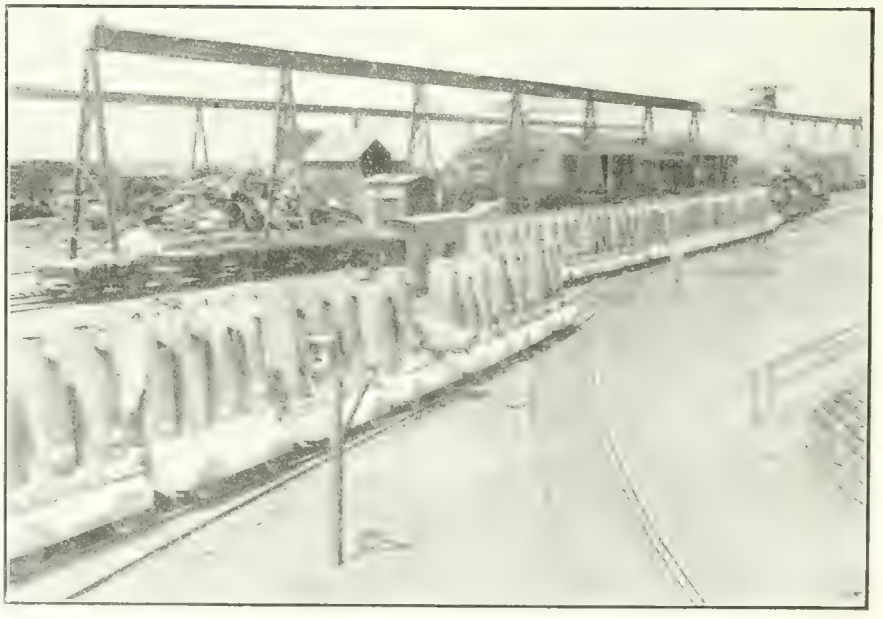


CASTING PIT. RUNNING CHARGE FROM FURNACE INTO TEEMING LADLE

Each soaking pit furnace supplies heat to four holes, 5 ft. x 8 ft. 6 in., capable of holding eight ingots each, and served by a 10-ton soaking pit crane installed by the Morgan Engineering Co. These furnaces are fired by producer gas generated by four Morgan gas producers. They are provided with regenerating chambers similar to the open-hearth furnaces, suitable chambers and passages being provided for reversing the flow of the gases in order to utilize all of the heat. A photograph on page 471 gives a view of the top, showing the hydraulic cylinders which operate the doors. These doors are made of fire-brick tiles, supported in a suitable frame and run on wheels giving easy access to the various pits. The actual manufacture of the steel is now completed, as all subsequent operations are of a more

Teeming

The pouring of the molten steel into moulds is known as teeming. The teeming ladle is made of heavy sheet steel lined with fire-brick and provided with a stopper or plug which fits into a hole in the bottom. The stopper is controlled by a handle which allows the operator to control the flow of metal into the ingot moulds, the ladle being moved over each mould by the overhead crane from which it is suspended. These moulds are of very massive cast iron construction and rest on stools carried by the cars. After the ingot moulds are filled, the train of cars is taken to the rolling mill, by which time the metal is sufficiently solidified to allow the mould to be drawn off or stripped, as shown in photograph. This is done by a 75-ton Alliance crane, which has a pair of links which grip the mould under the lugs and pull it up clear of the ingot. Another crane immediately grips the ingot and



TRAIN OF INGOT MOULDS EN ROUTE TO ROLLING MILL

or less mechanical nature, and exercise no decisive influence on the chemical composition or quality of the steel.

The Mechanical Treatment of Steel

Steel which is cast, i.e., poured into moulds after being drawn from the furnace, is subject to certain defects, the prevention and removal of which can be accomplished by suitable means. Ingotism, piping and segregation are three of the defects liable to occur in steel. The former consists of the formation of excessively large crystals which form when molten steel is cooled too slowly, and also when it is not poured at the correct temperature. This crystalline structure when allowed to take place may persist throughout the entire ingot, whereas piping and segregation are more of a localized nature.

Piping, the term applied to the central porous core at the upper end of the ingot, is due to the shrinkage of the outer layers which induces an outward flow of the still liquid metal in the centre. This reduction in internal pressure also facilitates the evolution of contained gases which fill up the spaces left by the solidifying metal, resulting finally in the peculiar structure known as a "pipe."

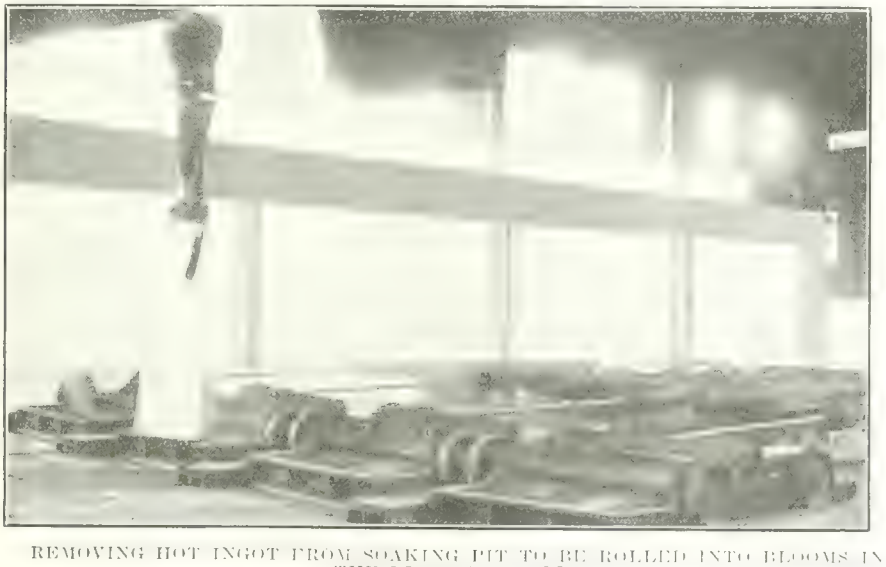
"TEEMING" THE MOLTEN STEEL INTO INGOT MOULDS.

Segregation, a partial separation of the various ingredients from the iron during solidification, due to the difference in solubility of the various impurities and the iron itself. As the presence of some of the impurities lowers the melting point of the iron without increasing their own solubility, the result is that when the lower layers of steel solidify, a small portion of the impurities is rejected and passes upward into the still molten metal. This action proceeds upward through the ingot until when the topmost metal reaches the point of solidification, the percentage of impurities present is considerably greater than in the bulk of the ingot.

Segregation, like piping cannot be entirely eliminated, but by suitable treatment and the use of deoxidizers, such as aluminum, etc., the trouble can be not only greatly reduced, but localized, so that the cropping of a comparatively small portion of the upper end of the ingot removes completely all possibility of harm from these causes. The progress made in this direction will be realized from the fact that although specifications for shell steel called for the discard of 40 per cent. of the ingot when operations were commenced, the thoroughness of manufacture and the resulting high quality of material have enabled this loss to be reduced below 15 per cent. with a large margin of safety.

Rolling the Steel

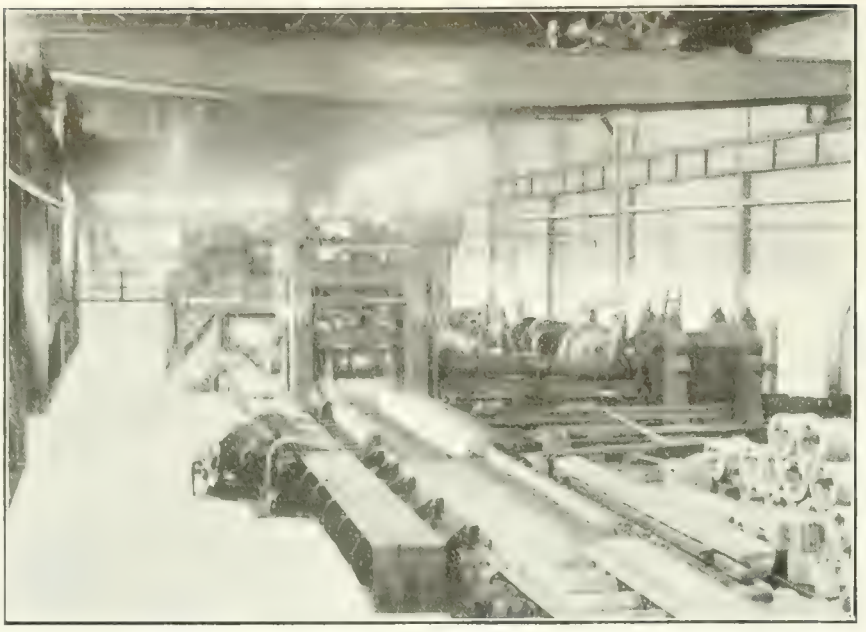
Having now been in the soaking pit



REMOVING HOT INGOT FROM SOAKING PIT TO BE ROLLED INTO BLOOMS IN THE BLOOMING MILL

STRIPPING THE MOULD FROM THE HOT INGOT

long enough to attain the necessary condition as regards solidification and temperature, the ingot is withdrawn from the pit by the crane and deposited on the approach table of the blooming mill. The ingot, which is 15 in. x 17 in. x 7 ft. long, is passed back and forth between massive steel rollers, which while reducing its cross-sectional area, increases its length until, when reduced to about 6 inches square, the bloom, as it is now termed, is 50 ft. in length.



ELECTRICALLY DRIVEN REVERSING BLOOMING MILL.

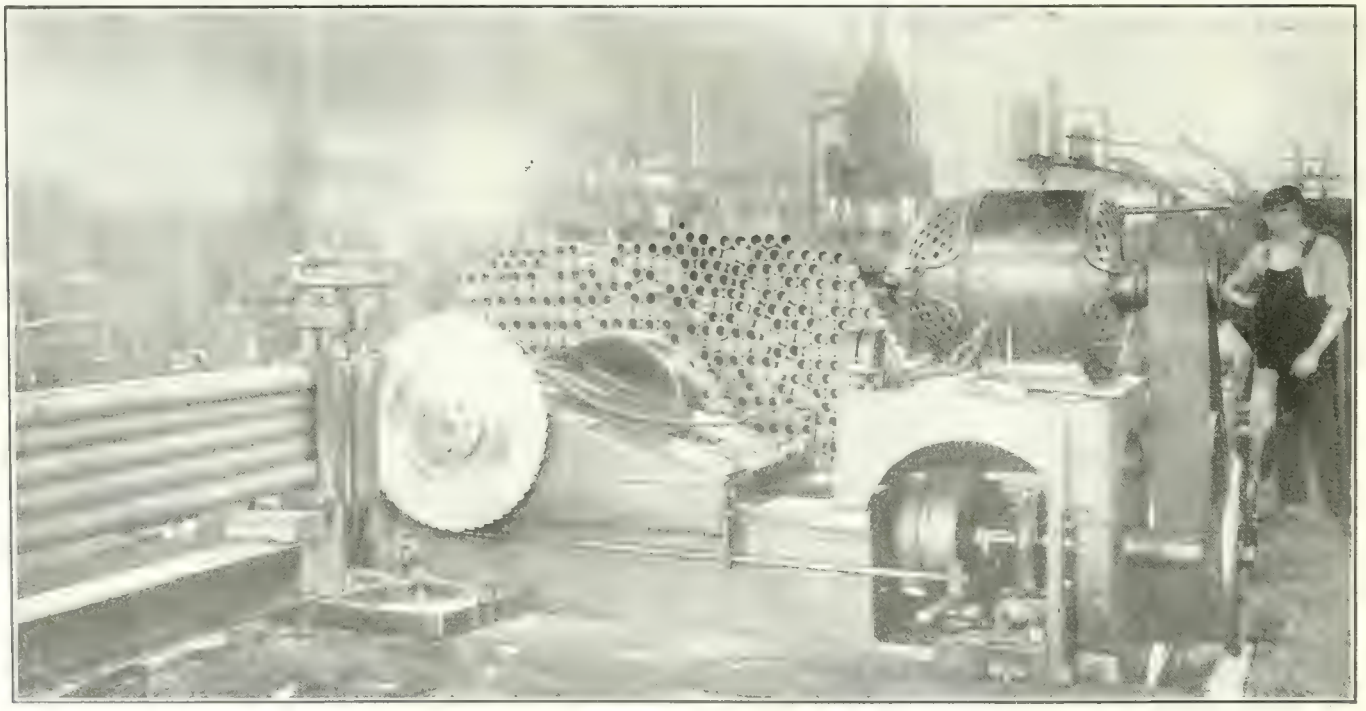
A photograph on this page shows a semi-finished bloom entering between the rollers of this mill, which is very complete in design and construction and along with its power plant is one of the best examples of modern steel working machinery on this continent.

The installation consists of a two-high 34-inch reversing motor-driven blooming mill designed by the Morgan Construction Company and built at the Lloyd-Booth plant of the United Engineering and Foundry Co., Pittsburgh, and is served by a Shaw 20-ton crane. The approach table in the immediate foreground is operated by a 30 horse-power direct-current motor, while the tables on either side of the mill are driven by 100-horse-power motors. The side guards for handling the bloom from one part of the rolls to another, are operated by hydraulic gear to the right of the tables. Here are also located the pinion housings. The lower pinion is directly coupled to the motor shaft, which passes through the wall into the power house; the other end of the pinion shaft is coupled to the lower roll of the mill.

The spindle or shaft which connects the upper pinion with the upper roll is provided at either end with a flexible coupling or wobbler, so that the spindle may assume an inclined position as the upper roller is raised or lowered to suit the thickness of metal passing between the rolls. The traveling crane is provided with special tackle to facilitate changing rolls and replacing pinions, etc., in case of accident. The entire operation of the mill is controlled from a platform or pulpit located above the table, affording a clear view of the rolls and the work.

After being reduced to the desired size, which is accomplished in 15 to 18 passes, the bloom is cut to suitable lengths in a 10 x 10-inch vertical bloom shear, which then go to the finishing mill, which reduces them still further to a round section of suitable diameter according to the size of shell to be made.

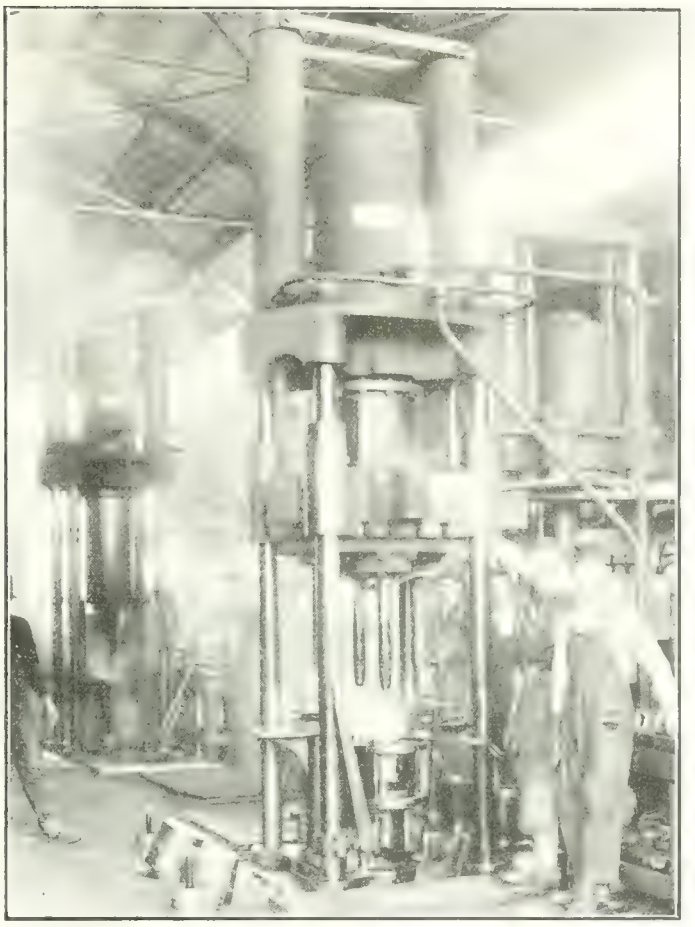
The blooming mill is driven by a 3,000 horse-power normal rating twin armature reversing motor, constructed by the Canadian Westinghouse Co., Hamilton, Ont., operated by electric power purchased from the Dominion Power & Transmission Co., which operates a 42,000 h.p. hydro-electric plant near St. Catharines, Ont., about 40 miles distant. The current, which is received at 44,000 volts, 66 2/3 cycles, is stepped down to 2,200 volts three-phase for the large motors and to 220 volts, two-phase, for several smaller motors and for lighting



ELECTRICALLY DRIVEN SAW CUTTING FIVE BARS OF SHELL STEEL AT ONCE

and all other purposes throughout the plant.

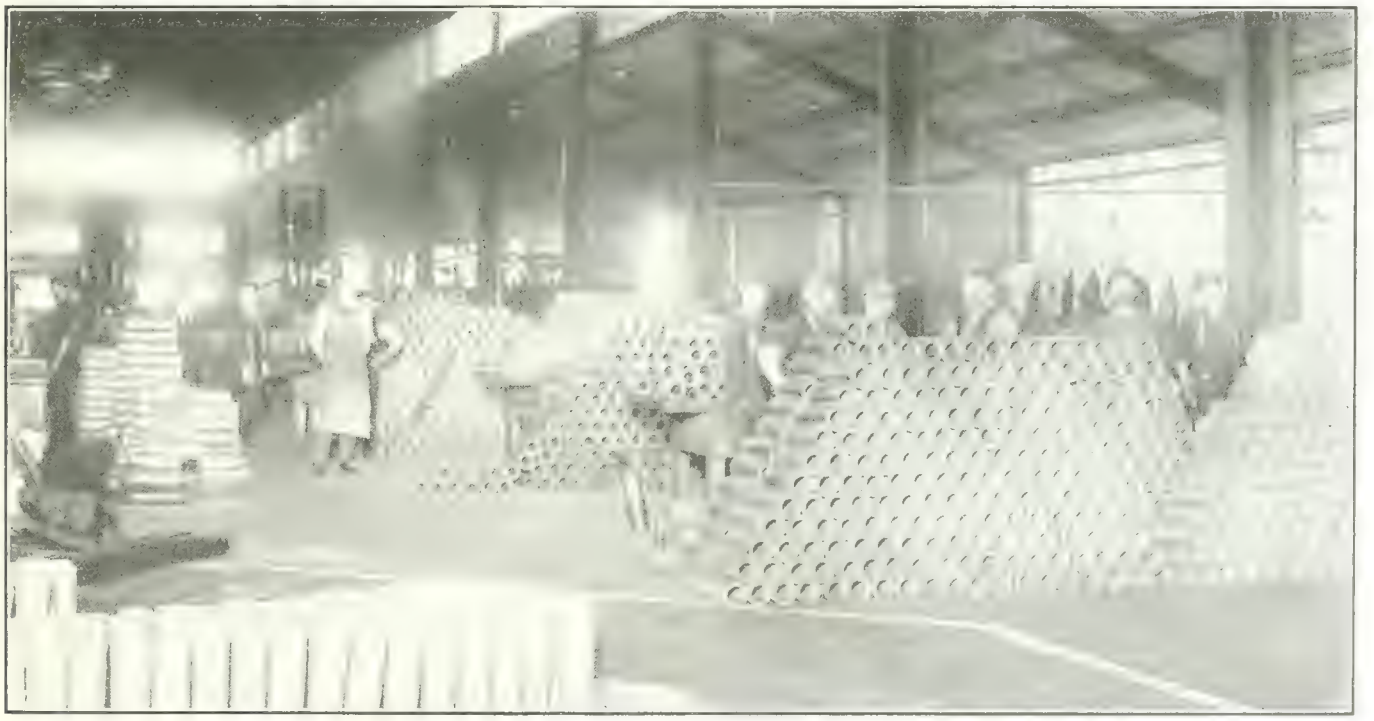
When breaking down ingots into blooms for the billet mill, the steel is given 18 passes through the rolls, but when breaking down for 6 x 6-inch blooms, the number of passes is reduced to 15. It is apparent, therefore, that the loads on the motor-generator set which supplies power to the reversing motor will vary rapidly over a wide range, the rate of change at times aggregating 4,000 to 5,000 horse-power per second during acceleration and approximately the same when braking. A load of this kind from the standpoint of power supply would be exceedingly undesirable and the cost of the current necessarily would be excessive. The twin armature reversing motor, while rated at 3,000 horse-power is, therefore, designed to carry a momentary peak load of 8,000 horse-power, receiving the necessary electrical energy through the medium of a motor-generator flywheel set consisting of one 1,800 horse-power alternating current, 2,200-volt, three-phase motor mounted on a common shaft with a 50-ton flywheel and two 1,200 kilowatt generators. This set is located in a power house on the other side of the wall from the blooming mill. Under light loads the fly-wheel has a speed of 500 r.p.m., while under the heaviest loads its speed does not fall below 400 revolutions per minute. The flywheel stores up energy during the period of light load and attains its maximum speed. When the heavy momentary loads comes on, the speed of the flywheel is allowed to drop, thus enabling it to deliver some of its stored-up energy in order to help the generators supply sufficient power to the reversing motor without making excessive demands on the external supply of electrical power.



VIEW OF SHRAPNEL FORGING PRESS SHOWING PUNCHES FOR PIERCING THE SHELL BLANKS

To enable the flywheel to assist the 1,800 horse-power motor to drive the two 1,200 kilowatt generators, during maximum demand periods, an automatic slip regulator has been installed, which introduces resistance in the rotor circuit as the output to the set increases, the speed thereby being reduced and a portion of the flywheel energy utilized for driving the two generators. Reducing the load on the generators automatically cuts out the resistance, and as the speed increases, energy is again stored in the flywheel.

The speed and direction of the rotation of the 3,000 horse-power motor are controlled by changing the polarity of the generators and varying their field strength, thereby varying the voltage applied to the armatures of the mill motor. This eliminates rheostatic losses except in the field circuit and permits any desired speed to be obtained independent of the load. As a result of this arrangement, no peak loads are taken off the line and the current input to the motor-generator set is maintained practically constant. The blooming



INSPECTION DEPARTMENT FOR SHELL FORGINGS

and flywheel complete weighs 429,000 pounds, and the rotating part, which rotates at a maximum speed of [illegible] revolutions per minute, weighs 164,000 pounds. This motor is provided with a thrust bearing on its shaft and a braking coupling is installed between the coupling and the pinion housing. The flywheel set weighs 367,130 pounds, and the rotating part weighs 240,000 pounds.

Ventilation is provided by a Sirocco fan installed by the American Blower Co., Detroit, which has a capacity of 24,000 cubic feet of free air per minute.

FORGING SHOP ERECTED FOR PRODUCING

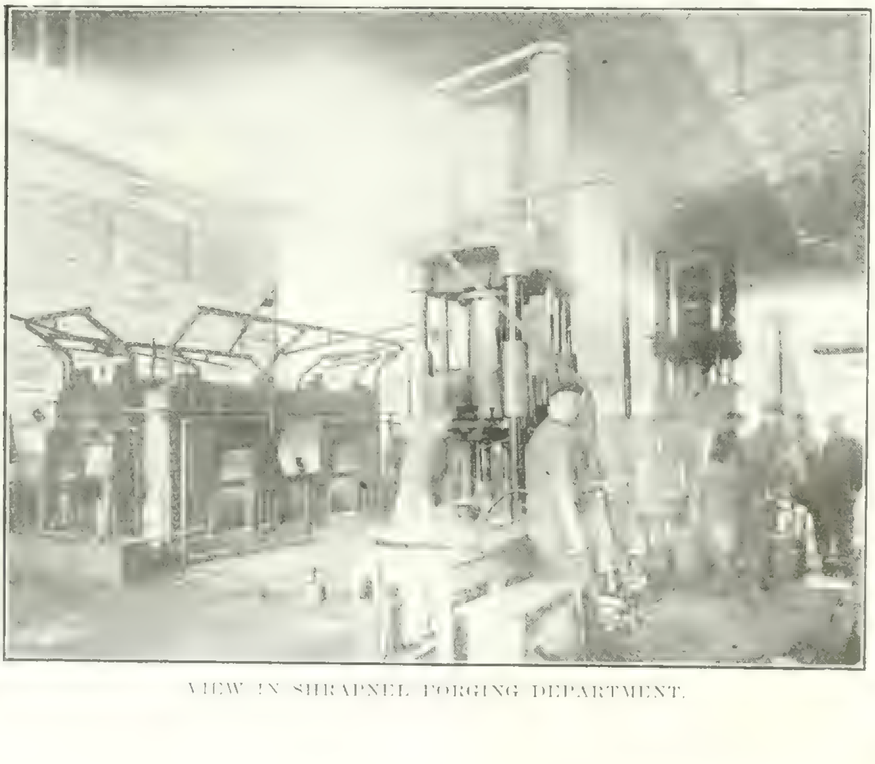
Forging the Shell

The round bars, from which the shell forgings are made, are of considerable length and must be cut to an exact size so that excess material or waste is reduced to a minimum. The bars or "rounds" as they are termed by the trade are cut off by electrically driven cold saws as illustrated on page 472. This photograph shows one of several machines which are engaged continuously on this work. The long bars are clamped in a frame or rest which holds them in a curved position corresponding to the curve of the circular saw so that all five bars are cut through simultaneously, and no time is lost waiting for the last bar to be finished by itself as happens in some cases.

All forgings for shrapnel and 4.5-inch shells are produced by hydraulic presses, the two-operation method being adopted as the most satisfactory. In order to handle the immense volume of work involved, an entirely new forging shop with complete equipment was installed and has already produced innumerable forgings for both shrapnel and 4.5-inch high explosive shells.

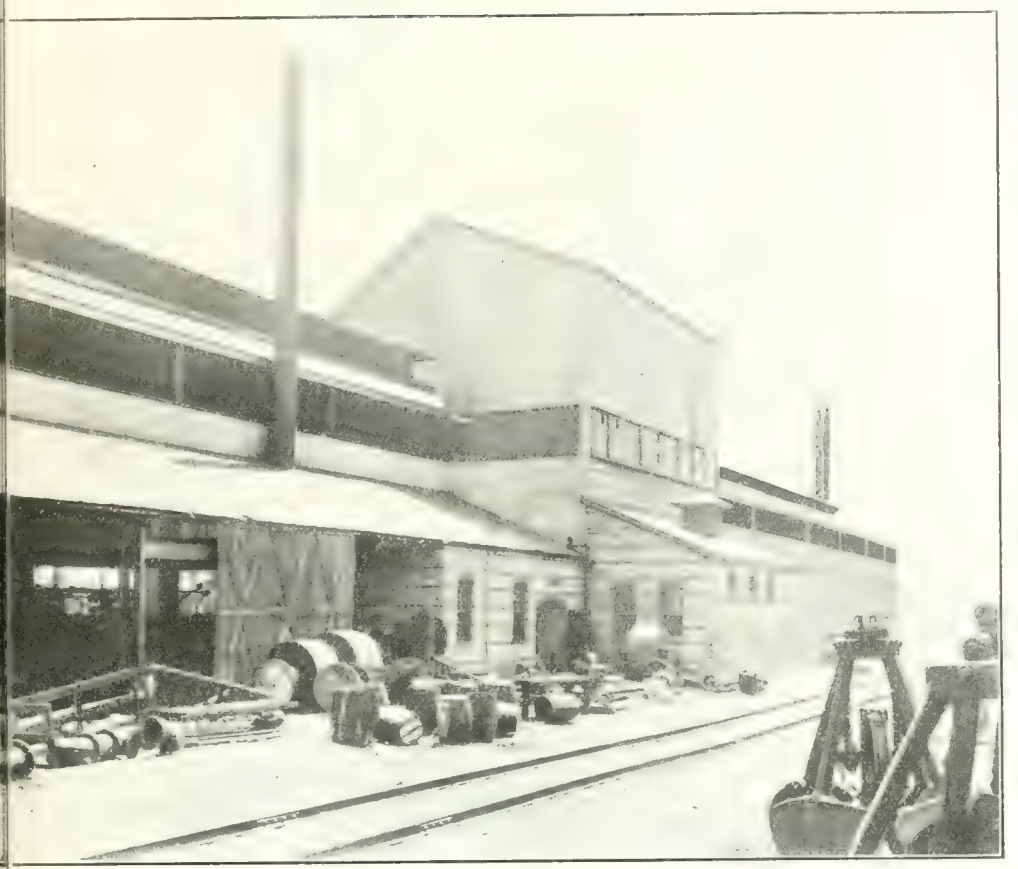
From the cold-sawing machines, the billets, as the pieces are called, now proceed to the heating furnaces where they are carefully brought up to the necessary temperature. The shrapnel billet is 6½ inches in length by 3 5/16 inches diameter and is forged at a temperature between 1,900 to 2,100 degs. F.

The process of forging as performed here consists of two operations, viz., piercing the solid billet, and then drawing the pierced billet out to length, this second operation including cupping or forming the pocket for powder cup. The north portion of the building is devoted to shrapnel forgings exclusively while the south end houses the 4.5 department. Each installation is complete with numerous hydraulic presses, heating furnaces, etc., the hydraulic power being supplied from a central station on one side of the building at the centre. Views of these departments are shown on this page, also the stock of finished forgings undergoing inspection by government officials. When piercing, the hot billet is placed in a cup-shaped die, and a round nose punch is forced into it causing it to fill out and extrude upwards around the punch. Suitable stripping gear removes the pierced billet from the die, and it is immediately transferred to an adjoining press for cupping and drawing.



VIEW IN SHRAPNEL FORGING DEPARTMENT.

In order to form the interior to the desired shape, the point of the drawing punch is made to the proper outline and the press is moved downward forcing the punch into the bottom of the billet which rests in a cupping die placed in position temporarily. Solid stops are arranged to arrest the travel of the punch at the required point after which the punch with the forging on it is raised slightly to allow the cupping die



GINGS FOR 3.3 IN. AND 4.5 IN. SHELLS.

to be removed. The punch is now forced down through the drawing dies which draw the hot metal up around the punch giving the proper outside diameter to the forging which now has the form of a tube with one end closed.

The finished forgings are now deposited on end in large groups on a cinder floor which retards the cooling sufficiently to avoid any trouble due to air hardening, etc. As each forging leaves the drawing press, it is stamped with a number indicating the heat or melt of metal from which it is made, and is gauged for depth of bore and thickness of wall. After cooling it is finally in-

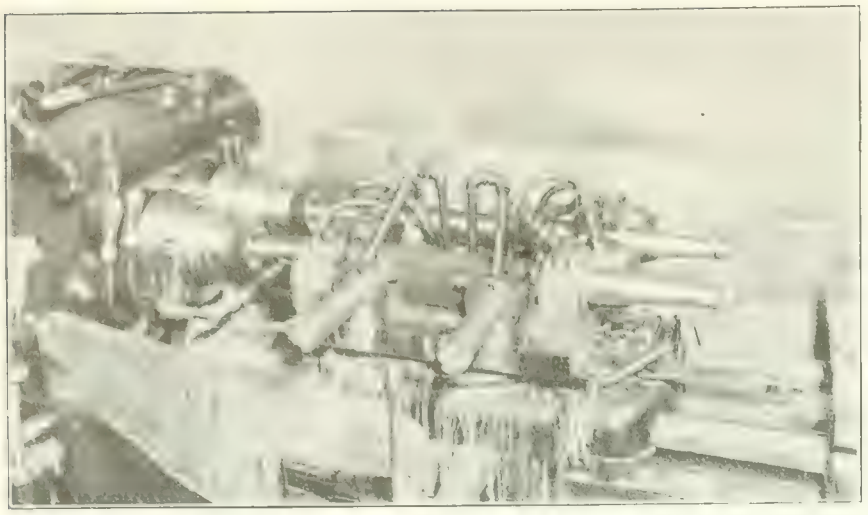
spected and marked after which it is transferred to the machine shop for completion, or forms one of the vast number of forgings supplied by the company to numerous machine shops throughout the Dominion, engaged in machining and assembling shells and components.

Finishing and Loading the Shell

The machining of the shell forging is done in fully-equipped machine shops, where the various operations, with which so many of our workers are familiar, are performed with all possible haste. Cutting off the rough forging to length, turning, boring, waving form the preparatory work followed by heat treating and nosing, after which threading, fitting base plugs, finishing to exact shapes and weights are all necessary before the shell is delivered from the machine to the assembly bench. Here may be seen the bullets being packed and the resin poured in to form a solid mass, which will behave in the desired manner while traveling through air from the muzzle of the gun. Varnishing the interior of high explosive shells is an operation that has to be thoroughly carried out in view of the deleterious action of the explosive on bare metal.

The assembling of the copper bands by hydraulic presses is one of the most interesting of the many operations which conclude with the painting and boxing of the projectiles, which then await shipment to the fixing plant to receive the charge of propellant contained in the brass cases which ultimately strew

4.5 IN. SHELL FORGING DEPARTMENT.



BORING EQUIPMENT ON DOUBLE SPINDLE U AND L FLAT TURRET LATHE

the battlefield in the region of artillery engagements.

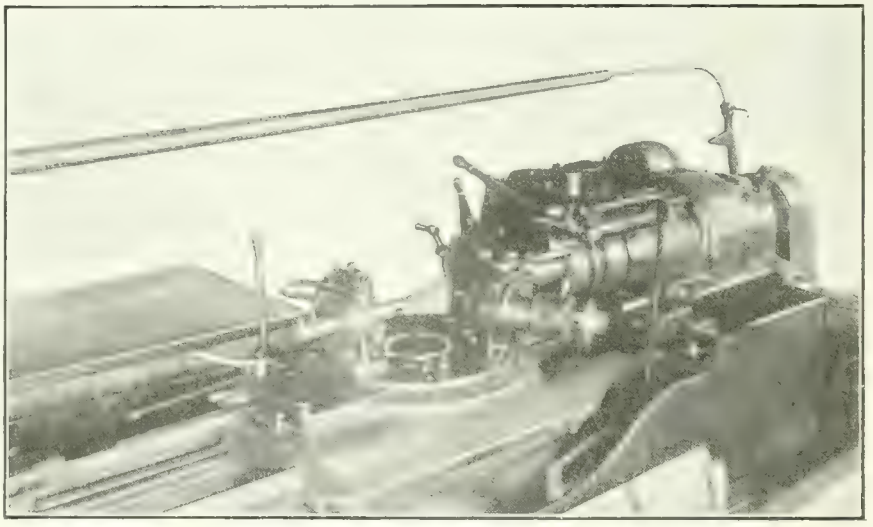
The Spirit of the Plant

The vagaries of fate are well illustrated by the fact that while "doing their bit" in producing the much-needed material required by the Empire, the company, adhering to the most modern business policy, is an admirable exponent of the humane principles of "safety first." The mutual consideration for each other's interests which exists between the company and its army of employees is well evidenced by the environment of harmony which permeates the atmosphere of the entire organization.

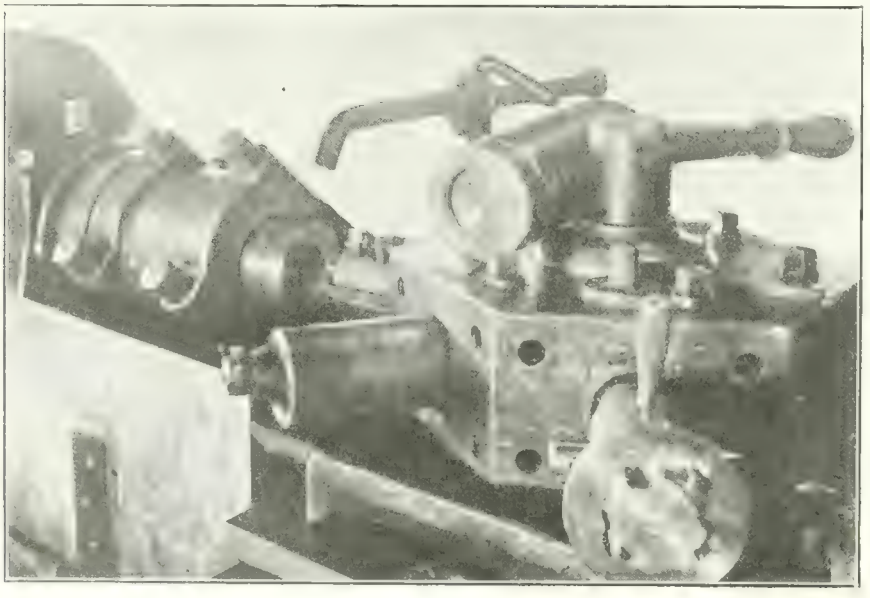
In the midst of industry and activity, heat, smoke, grime, and other inseparable features of steel manufacture, the company has not failed to realize its moral duty to those whose toil and effort, both of brain and muscle, have helped to establish and maintain the position of the company in the foremost ranks of Canadian industry.

Firm believers in that old adage, "a sound mind in a sound body," the company's sentiments received concrete expression in the form of an athletic field, which is the home ground of a ball club of no small ability. Situated in front of the main offices, club room and library buildings, this expanse of green contrasts pleasantly with, and forms a welcome oasis in the midst of furnaces, mills, forges, machine shops, and railroad tracks.

The creature needs and comforts of all members of the staff are most carefully attended to in the staff building. A club restaurant, library, rest room, accident ward and hospital for sick and injured, are a few of many evidences of the reciprocal spirit of the plant, and in maintaining the surroundings in a high state of artistic excellence — well-kept grounds, vine-clad buildings, expert landscape gardening, etc.—the company betrays that attention and consideration for every detail, which has been an all-important factor in placing it in the enviable position which it now occupies as one of Canada's leading industrial establishments.



MACHINING AND THREADING NOSE OF 18-PDR. SHRAPNEL SHELL.



FORMING BASE RECESS IN SHRAPNEL SHELLS

SPECIAL WELDING METAL FOR IRON AND MILD STEELS

THE necessity for using welding metals specially made for the oxy-acetylene welding process should be recognized by all users of the process, says the Acetylene and Welding Journal.

Until recently no special welding metal for work on iron and mild steels existed, and it is well known that until the advent of such a metal, wires or rods of Swedish iron should be used in preference to all other welding metals. The French Welding Union have been carrying out a series of experiments with the object of obtaining a welding metal for iron and steel which would deoxidize the welds, increase their strength and more important still, increase their ductility.

Such an investigation is naturally a slow process because each rod made to a new or corrected formula must be followed by a series of practical and mechanical tests. These important researches were nearing completion and were to have been published in due course when the war intervened and the labors of the Union were turned in other directions.

It is well to emphasize that, apart from the welding rod, there are other conditions which must be rigidly followed if good welds on iron and steels are desired. It is safe to say that in the majority of workshops using the process these conditions are unfulfilled and advice on, say, the preparation of the edges, the power of the blowpipe and its position, the regulation of the flame and the execution of the weld itself could be given. Thus defective welds would, in many cases, be obtained with a perfect welding metal.

The use of ordinary iron or mild steel wire or rods is not to be recommended where sound strong welds are required. The use of Swedish iron gives a distinct improvement, but the welds obtained are still imperfect. The presence of impurities in these metals exerts a bad influence on the welds. The chief impurities being sulphur and phosphorus. A special welding metal for the welding of iron and mild steels has recently been placed on the British market under the name of Ferrox, and this product is manufactured entirely in England by a British firm's patented process. The metal is obtained by subjecting ordinary iron, steel, or cast iron to a process whereby the metal becomes impregnated with extremely finely divided nickel, and also holds in a state of occlusion or chemical combination a considerable quantity of hydrogen gas. It is claimed, after considerable research, that the welding rods obtained by this process effectively eliminate and counteract the disadvantages of the welding process. An example of the method of carrying out the invention is as follows:—

Hydrogen gas is passed over powdered nickel, or nickel oxide so that nickel chemically combines with the gas. The gas, thus charged with nickel is passed into a closed vessel in which the material to be treated is contained. The temperature and time of treatment play an important part. The gas is continuously passed over the metal or rods under a pressure slightly above atmospheric pressure. The time of treatment and the temperature employed will necessarily vary with the degree of impregnation required, with the thickness of the iron treated and its quality. When the treatment has been effected the product is cooled down in an atmosphere of hydrogen, or other inert gas.

Among the principal results obtained by applying this patented process are:—

(a)—The elimination of all oxides from the original material from which the welding wire is manufactured.

(b)—The expulsion from the original material of occluded gases.

The increased cost of this scientifically manufactured product over ordinary welding wire is small, and it is claimed that in spite of its increased cost, its use is attended with real economy. Apart from the relative merits it is cheaper than Swedish iron. In fact, the welding rod forms a very small percentage of the total cost of a weld.

EXPANDING MANDREL

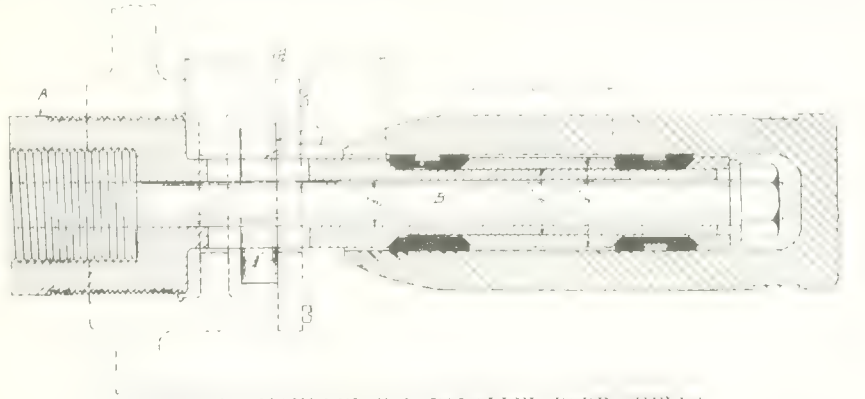
By E. T. Spidy

AS many of your readers are aware, the manufacture of munitions has called for much originality in designing tools and fixtures, partly because of the necessity of converting regular lines of machines which were adapted for work of a different nature, and partly because of the hurry in which they have had to be put into service.

One of the most called for pieces of mechanism at the present time is the expanding mandrel and every shop has its own variety to meet its particular requirements. It is a well-known fact that long holes are often not perfectly straight, particularly after the drill becomes worn. This may be accounted for in that a drill may strike a hard spot in the material and thereby glance a few thousandths of an inch to one side.

The mandrel illustrated was designed to average up the hole so that a "mean" along the total length would be obtained. It consists of a body A, which is threaded to suit the machine spindle. The body is bored out parallel and a spindle B, is fitted closely to its bore. At the lathe spindle end a cotter C is fitted through this spindle and corresponding slots D are milled in the body to allow for the travel of the cotter to tighten or slacken off the mandrel. On the outside of the body on the end inserted in the job, two steel sleeves are fitted and then split into three pieces. These three sections are held together by a retaining spring placed in groove shown for that purpose. Between these split sleeves a solid sleeve is placed which acts as a spacing block and also transmits the power applied by the centre spindle, through the nut and end bushing. It can be seen that when the spindle is moved towards the lathe spindle all the taper faces act in unison but do not tighten up until both split sleeves are engaged in the hole. Thus a hole tapered in either direction, or a hole out of line in any direction is held rigidly and at an average trueness. Any user of mandrels will appreciate this advantage because the style of mandrel in common use presses out the dogs in such a way that only a parallel hole is held along its total length solidly in such a manner that will produce accurate work.

The manner of tightening the mandrel into the job must be adopted according to the work requirements and the machine. For centreing purposes it is sufficient to attach a hand lever to directly engage the cotter, while for heavy turning in a lathe with a hollow spindle it is necessary to extend the spindle through the headstock and to attach a handwheel and a screw on the end of the lathe headstock and to attach a handwheel and a screw on the end of the lathe headstock.



EXPANDING MANDREL FOR PARALLEL BORE SHELLS

When the lathe has no hollow spindle and heavy duty is required, the body of the mandrel may be threaded on the outside over the part screwed on to the lathe spindle and a handwheel threaded to fit this thread. The boss on the other side of the handwheel is extended to reach the cotter and a plate fitted over same so that the cotter is free to travel up the mandrel with the motion of the wheel in the recess so formed. This latter method is the most simple to apply and is entirely successful in operation.

Expansion joints should be located in all approximately straight pipe lines at such intervals that the extreme change in the length of pipe will not exceed the safe travel or range of the expansion element and that the force or strain exerted in moving the length of pipe may not be excessive and start leakage.

Large Shells: Production Problems and Possibilities--I.

By C. T. D.

In preparing to undertake the production of large shells up to 9.2 in. dia., manufacturers will encounter problems of a nature altogether different from those connected with 18 pdr. shells. Automatic machinery will not be so applicable to the larger sizes, and productive ability will centre largely on such points as sequence of operations, tooling methods, etc.

IN undertaking the production of large shells up to 9.2 in. diameter, Canadian manufacturers will find considerable opportunity for utilizing all the experience obtained in making the smaller sizes, while at the same time many important differences, both in design and size, will be found which will require just as careful planning and carrying out as any of the initial problems encountered in shrapnel manufacture.

In producing shrapnel, difficulties were met which were peculiar to that type of shell, due to certain features of design and physical requirements. Buckling of the nose and walls, variations in heat treatment for different brands of steel, excessive wear on taps and tools due to irregularities in physical properties of the metal and so forth are some of the more familiar troubles which have been experienced by almost all producers of shrapnel.

The advent of high explosive 18 pdr. and 4.5 shells removed most of those previous troubles, to be succeeded by those incident to the insertion of the base plug, though the choice between a plain plug with a pinned joint, and a threaded plug offers an alternative which has certain desirable features.

A study of the drawings of forgings and finished shells, which we reproduce, shows certain variations which will determine to a considerable degree the procedure adopted by different makers.

The various sizes of shells may be divided into two main groups, viz., solid base, and open base. The 60 pdr. and the 6 in. shell belong to the first group, while 8 in. and larger form the second.

Considering the solid base designs, the inserted disc in the base is common to both the 60-pounder and the 6-inch. The use of threaded discs or plugs although more costly than the plain system, is preferred by many manufacturers because of the smaller possibility of rejections. In order to ensure contact over the entire surface of the disc, it is made slightly convex so that when tightened up, the contact commences in the centre and spreads over the surface as the thread tightens.

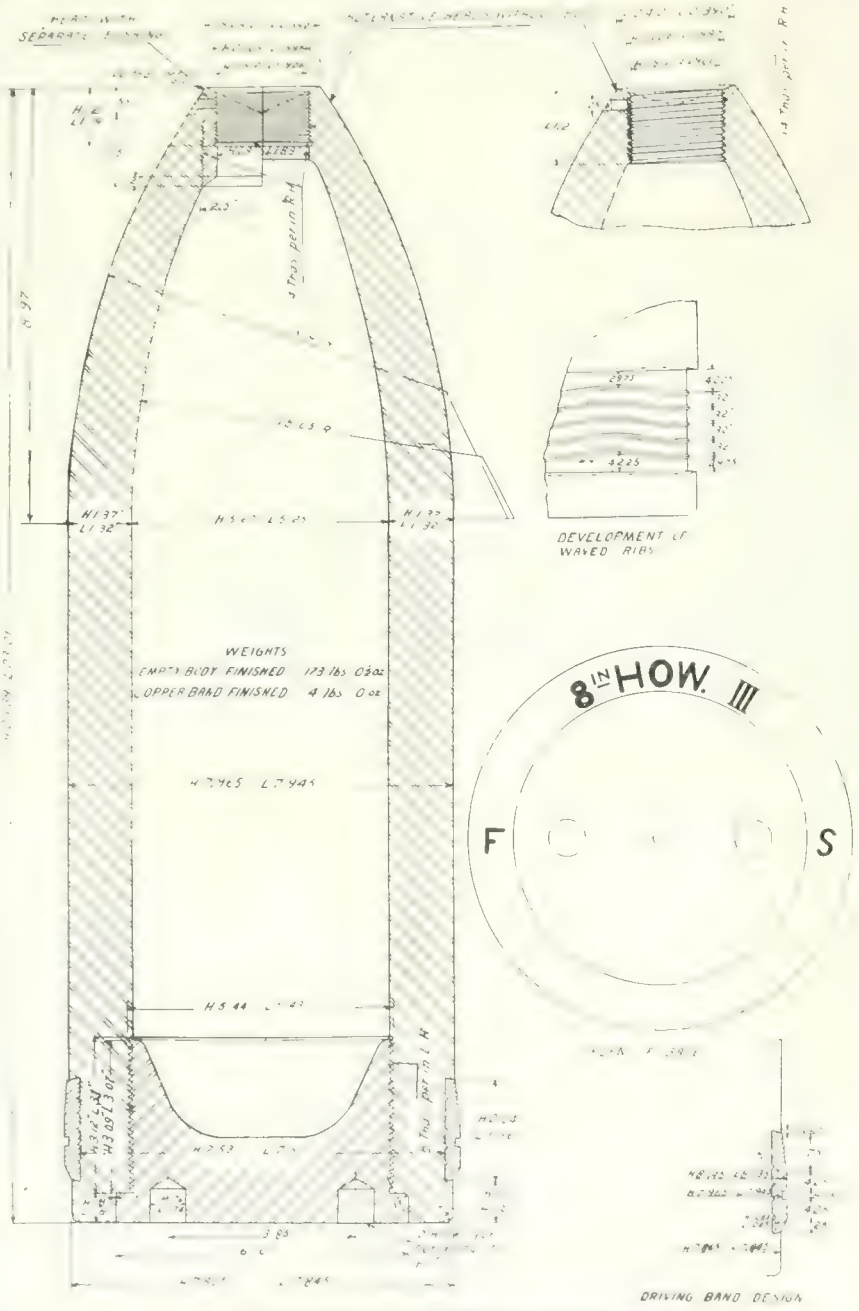
The special machines now available insure the production of perfect threads and a satisfactory job with ordinary care.

In the case of plain discs, these are made a fairly close fit, allowing for escape of imprisoned air. The outer edge is bevelled slightly and a ridge or bead left on the mouth of the hole is riveted over. The riveting gradually draws the plate down flat after which a finishing cut removes all traces of the operation.

The bore of the 60-pounder shell closes in at the mouth, necessitating nosing in, while the 6-inch shell is made with a parallel bore, the lower face of the socket being well hollowed out to form an approximately hemispherical upper end of the interior. In the event of a shortage of steel bushings, makers might be called upon to supply 60 pdr. shells with solid bushings, as has been done in some cases with 4.5 shells. The reduced size of boring bar and increased overhang of cutting tool are serious handicaps when finishing internal profile in this case.

The principal remaining difference is in the design of driving band. In addition to being more complicated in profile, the 6 in. band is featured with an undercut which calls for increased care in production and also in handling.

The principle of construction adopted in these shells is radically different from



SINGLE HIGH EXPLOSIVE SHELL

that of the 6 in. size and under.

8-in. and 9.2-in. Shells

In place of being made with a solid base and open-mouth necessitating a nosing operation, etc., these shells are forged with the nose closed or solid, and the base open. A solid forged steel plug with ample length of thread renders it possible to make a perfectly sound gas-tight joint, capable of withstanding the intense heat and pressure of the exploded gases.

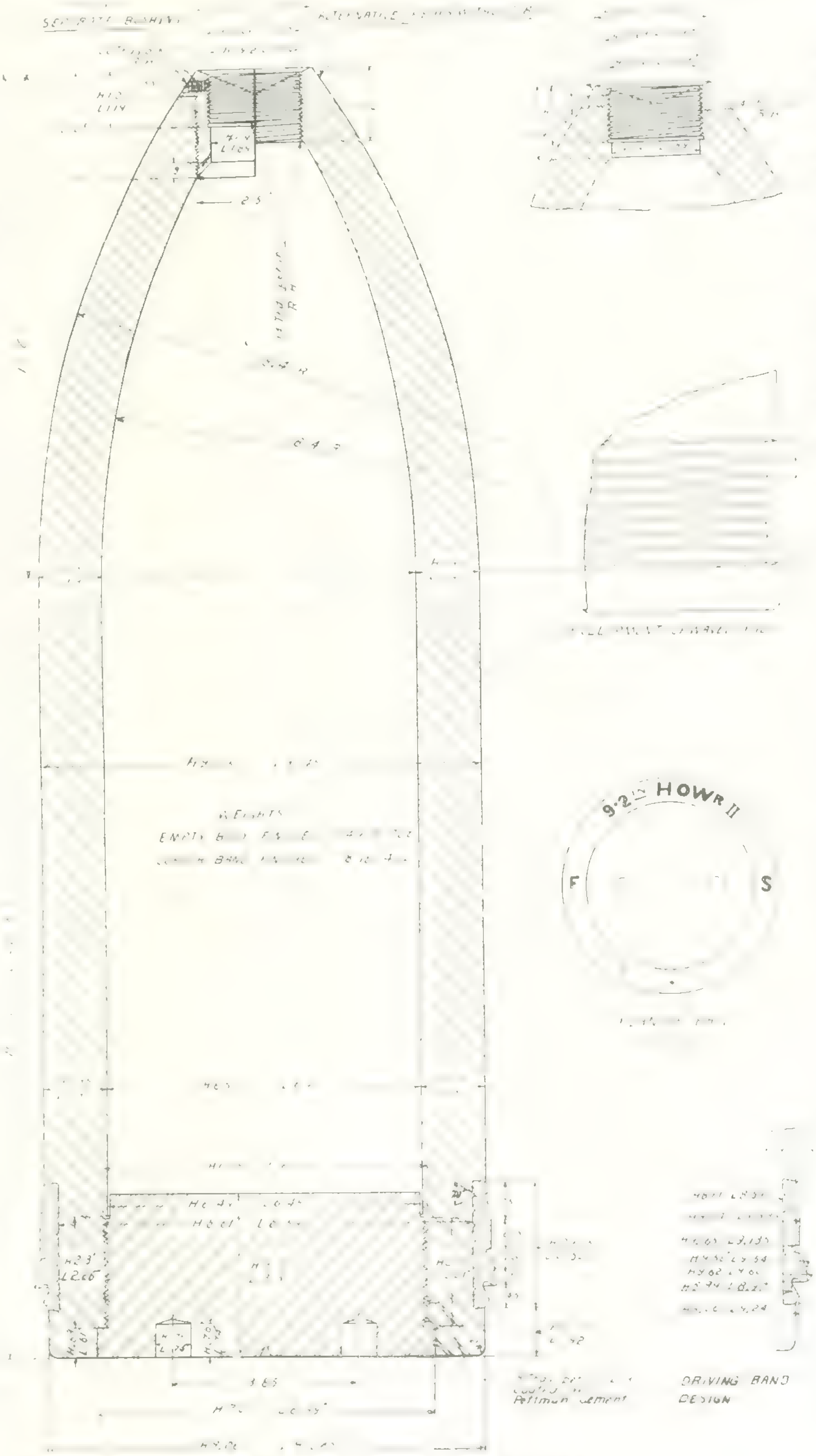
The first question which presents itself to the practical mind is that of machining the bore of the shell. Machines for performing this operation have been in use in the regular arsenals and munition factories right along, but the private firms undertaking this work for the first time will in most cases develop their own ideas, as in the case of the smaller shells. Methods of machining open base shells will develop round the manner of boring. In one case the shell will revolve and boring bars and cutters will be fed into it in the conventional manner. In the other case, the shell will be held rigidly in a cradle and fed on to a revolving cutter bar.

In either case the best way to start is to work from the inside of the shell outward. It may not appear so to all, and it may not be compatible with certain methods and systems of machining, but those makers who are not yet committed to a definite method should bear in mind the fact that just as these shells are bigger than 18 pounders, so will their variations in the rough state be greater. A much quicker approach to the required degree of accuracy can be obtained by locating all operations from the inner surface of the shell as inequalities in the thickness of metal can be anticipated and removed more conveniently and effectively with a turning tool on the outside, than with a more or less yielding boring bar working out of sight.

The question of whether to make a separate or solid base shell is a matter for individual judgment on the part of the maker. If sufficient stock is retained [illegible] tap expense and time of machining is possible, coupled with the reserve possibility of enlarging the hole and using a bush should the first hole be spoiled [illegible] threading. A further consideration would be the uncertainty of delay through the non-delivery of plugs from firms engaged in [illegible].

It is perhaps desirable that the base plugs be made in the same shop as the shells. The making of these in separate establishments is quite in accordance with modern machine practice, provided gauges of close enough limits are used and care is taken to avoid damage to threads and surfaces in shipment and handling. The allowable limits on the thread diameters are generous and while supplied plugs might be just within limits in one direction, the shell might be just as close to the limits in the other direction, consequently trouble would arise in one case getting the plug into the shell, and in the other, getting the shell past the inspector.

By producing the plugs in the same shop as the shell, more satisfactory work can be accomplished, as once having determined on a no-limit size for the plug, all available limits can be taken advantage of in tapping the end of the shell.



9.2 INCH HIGH EXPLOSIVE SHELL

Driving Bands

A considerable difference in profile between 8 in. and 9.2 in. bands exists, and in the absence of any obvious reason or official explanation, the requirements have simply to be fulfilled. As in the 6 in. shell, the 9.2 in. band is shown having an undercut which does not simplify matters. The numerous vee grooves call for particular care not only in machining but in securing properly annealed copper so as to produce perfect outlines. Banding presses of greatly increased power are necessary in view of the increased dimensions of the band.

The assembling of the plugs offers op-

possibilities for the development of plug driving machines for tightening plugs by power assuring efficient and uniform results.

Not the least important of equipment developments lies in the necessity for power handling apparatus.

Prospective makers of these large shells will be well advised to approach the driving band feature with all possible deliberation and care. The great increase in size, as well as the intricacy of outline, makes it an entirely different proposition from 18-pounders. The band profile of the smaller shells is comparatively simple, and the circumference about one-third that of the big bands, both of which facts conduce to a large output in numbers from a single set of forming tools.

Whether the present methods of band turning will be entirely satisfactory on these large bands is a point that can best be decided from actual experience. The possibility of developing a special profile miller seems not altogether remote, and from a theoretical standpoint offers certain advantages. Revolving a heavy forging at a high rate of speed in order to remove a small quantity of metal from a minor component is bad practice, not only from a power saving point of view, but from quality of production as well. Constant attention would be necessary to prevent heating up the steady rest, and any seizing of the shell with consequent scoring might easily cause enough damage to result in rejection. This fact alone would justify consideration being given to the use of a milling machine in which the heavy shell body would be revolved slowly while a formed milling cutter produces the profile on the band.

Several developments of design suggest themselves such as a multiple spindle milling device in which a roughing cutter fed into the work in front would remove the surplus stock and a sizing cutter behind would be elevated on a vertical slide till it was level with the centre of shell. If cutting compound had to be used to prevent the finer portions of profile from tearing, a copious stream would prevent heating of the band from spreading much beyond the parts being operated on.

The provision of a suitable tool with angular feed to undercut the band would seem necessary although it is more than probable that the fresh angle of attack, from which many of our manufacturers will approach these problems, will result in not a few ingenious and original methods and devices being produced.

Threading the plug also offers opportunities for milling applications, possibly the tapping of the shell itself may be treated in this way.

Handling Apparatus

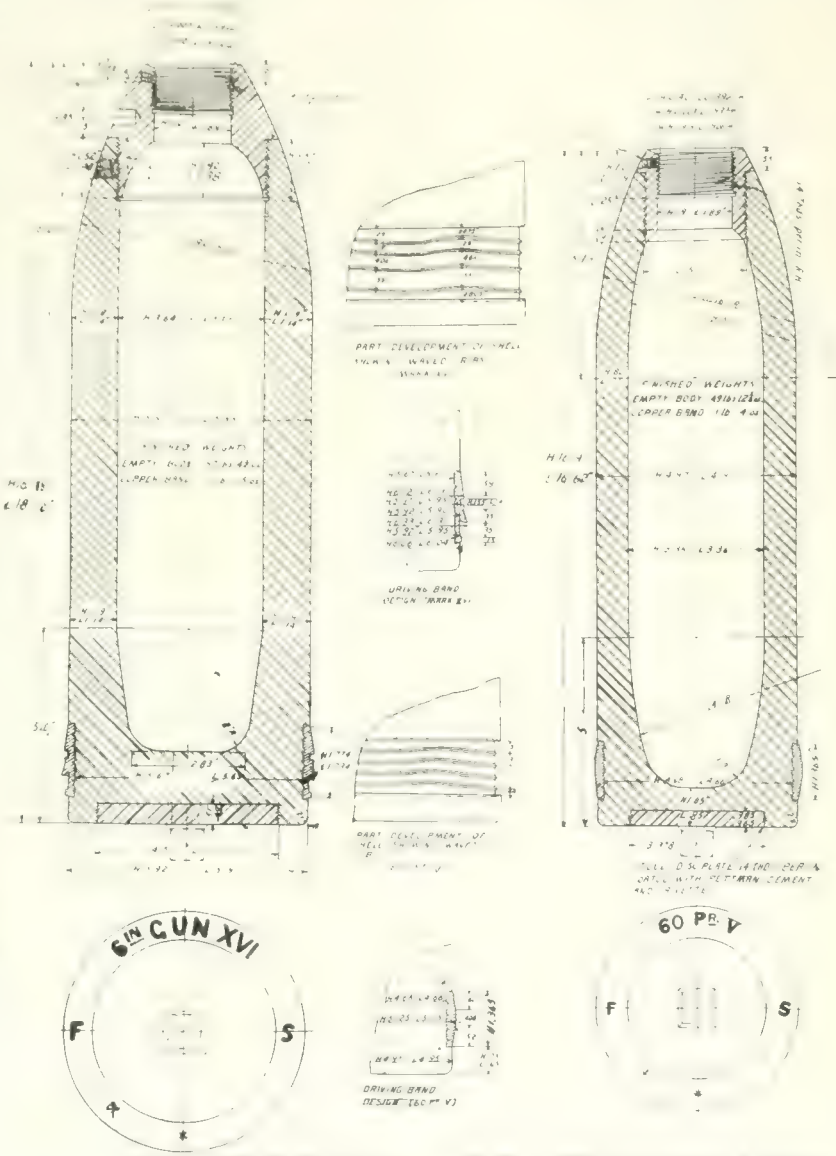
The increased weight of these large shells, both rough forged and machined, necessitates changes of a very radical nature in the ways and means of handling them not only in and out machines, but in course of transportation from one part of a factory to another.

From the time a forging commences to undergo the first operation until it is completed, or until a break in its progress is advisable, say at the banding press or enamelling oven, all its steps should be strictly in rotation so as to avoid any doubling on its tracks.

Where it is possible to do so, an overhead track, with travelling chain blocks or hoists, either air, electrical, or otherwise, will prove the most popular and efficient method.

Circumstances peculiar to certain shops may render preferable the adoption of small revolving jib cranes on each machine which would require the use of suitable transfer trucks for moving between operations. A well thought out arrangement of this nature might be much less costly and when properly used, just about as quick as an overhead track. Any doubling back that might be necessary on occasion would certainly cause little if any confusion with this system as compared with a track which would not allow movement in either direction when a job was being set up in a machine.

The production of forgings up to the 8-in. size is now an accomplished fact in this country, although some few weeks must elapse before 9.2-in. forgings are also in course of production. Reproductions of forging drawings which give a good idea of the probable amount of work which will be required and the detailing of different methods, with illustrations and descriptions of the machines and tools for use therewith will form the subject of future articles in these columns.



6 INCH HIGH EXPLOSIVE SHELL. 60-PDR. HIGH EXPLOSIVE SHELL.

—⚙—

Bombs Made in Canada.—Bombs have been added to the munitions products which Canada is now producing for the British War Office. An order for 5,000 of these projectiles has been received by the commission, and is being placed for speedy delivery. The bombs are to be used in trench warfare, and are to be fired from what are known as mine or trench guns.

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Vol. XIV. NOVEMBER 18, 1915 No. 21

PRINCIPAL CONTENTS.

ANTICIPATING RESUMPTION OF PEACE-TIME BUSINESS

APPARENTLY of equal moment and importance to the manufacture of war munitions—perhaps even transcending the latter, is the manufacture of industrial stock values. From week to week these continue to advance, not seldom by leaps and bounds, and the question is naturally being asked: what is going to happen them when the end of the war becomes imminent?

Undoubtedly our steel and metal-working industries are finding munitions production worth while, but we hesitate to believe that the margin between contract prices and production costs is anything like so great as to justify the high level attained by the stocks. The impression has got abroad that our manufacturers are making huge profits on war orders, and that the war is being made the medium whereby a multiplicity of individual and corporate enrichment may be brought about. In any case, "It's an ill wind that blows nobody any good." Therefore, in spite of the devastating influences of and distress caused by this war of wars, a considerable number of people, here and elsewhere, will no doubt realize a bountiful harvest of hard cash by devious means and channels. Combat their doing so how we may, such a consummation will be inevitable.

It is generally conceded, and at first sight reasonably so, that, after the necessarily long period of neglect, much constructional leeway will have to be made up. The expectation then is that a burst of prosperity such as we have probably never known, will so efface the transition from war to peace that neither stock prices nor productive activities will be affected.

A boom is predicted in merchant shipbuilding to make good the losses by sinking, and to compensate for the almost total extinction of vessel construction in Britain. A similar boom is predicted in the sphere of railroad betterment, to compensate again for the long period during which maintenance has been neglected and earnings conserved. Development work of every description, private, municipal and Governmental, is, we are told, to be no exception; thus, on paper, the end of the war seems to be desirable for a variety of reasons.

In all calculations or prophesies of the nature of the foregoing, no cognizance, however, is taken of the price we are having and will have to pay for the war. We forget that in addition to war stocks reaching giddy heights, material and labor, and all else have pyramided. Stock market prices have a knack of crashing down en masse when the opportune moment arrives; not so these others.

Steel, wages, food and clothing are largely interdependent and have a comprehensive application. They are usually super-sensitive to the upward turn, and during the past year have proved so on many occasions. Individually or collectively they are less sensitive to the downward tendency, be the latter of simple desire or judiciously applied force or pressure. The downward movement is not only hard to start, but is so slow and gradual as to be almost imperceptible of measurement.

With the end of the war in sight, attention will, as already indicated, be turned to the peace-time pursuits of shipbuilding, railroading, etc. It will be found, however, that shipowners, railroad executives, etc., continue to sit tight so far as the distribution of orders is concerned, the cost of raw and finished material for the purposes of their requirements being totally prohibitive from the standpoint of the then or immediately prospective earnings. War-time prices for equipment and supplies will match ill with peace-time revenue. A period of readjustment must needs be ushered in, during which business of every description will incline to languish, war stocks will disappear and plain industrials will take their place. Prices of raw and finished material will have to be marked down, however slowly and reluctantly those involved contribute to the process.

Only by producers and their help getting together now, without waiting for the end of the war to become more imminent, and planning the necessary and inevitable procedure when the time is ripe, will the transition period be shortened and perchance eliminated, and a prolonged and wholly unnecessary business depression be avoided. Capital and labor are equally interested in the matter and both will be called upon to make big concessions sooner or later. The general welfare of our people demands that they take time by the forelock and arrange the details now.

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	$15 [illegible]
Lake Superior, charcoal, Chicago	16 75
Ferro nickel pig iron	
Steel	25 00

	Montreal.	Toronto
Middlesboro, No. 3	$24 00	.....
Carron, special	25 00	....
Carron, soft	25 00	....
Cleveland, No. 3	24 00	.....
Clarence, No. 3	24 50	....
Glengarnock	28 00	.....
Summerlee, No. 1	30 00	.....
Summerlee, No. 3	29 00	.....
Michigan charcoal iron	28 00	.....
Victoria, No. 1	24 00	21 00
Victoria, No. 2X	23 00	21 00
Victoria, No. 2 plain	23 00	21 00
Hamilton, No. 1	23 00	21 00
Hamilton, No. 2	23 00	21 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2 50
Steel bars, f.o.b., Toronto	2.50
Common bar iron, f.o.b., Montreal	2.50
Steel bars, f.o.b., Montreal	2.50
Twisted reinforcing bars	2.55
Bessemer rails, heavy, at mill	**1.25**
Steel bars, Pittsburgh	1.60
Tank plates, Pittsburgh	1.60
Beams and angles, Pittsburgh	1.60
Steel hoops, Pittsburgh	1.75

F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.50
Small shapes	2.75

Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	2.20
Structural shapes	2.20
Plates	2.20

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 35
Heads, per 100 lb.	2 60	2 60
Tank plates, 3-16 in.	2 70	2 70

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, red	$12 75	$12 75
Copper, crucible	15 25	15 00
Copper, unch-bled, heavy	14 75	14 50
Copper, wire, unch-bled	14 75	14 50
No. 1 machine compos'n	11 75	11 75
No. 1 compos'n turnings	10 25	10 00
No. 1 wrought iron	10 00	8 50
Heavy melting steel	9 00	9 00
No. 1 machin'y cast iron	13 50	12 50
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
[illegible]	[illegible]	[illegible]
Tea lead	$ 4 00	$ 4 00
Scrap zinc	12 50	11 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Nov. 5, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	62	38½	...	...
½ in.	67	47½	...	...
¾ to 1¼ in.	72	52½	...	...
2 in.	72	52½	68	48½
2½ to 4 in.	72	52½	71	51½
4½, 5, 6 in.	....	....	69	49½
7, 8, 10 in.	....	....	66	44½
X Strong P. E.				
¼, ⅜ in.	55	38½	....	....
½ in.	62	45½	....	....
¾ to 1¼ in.	66	49½	....	....
2, 2½, 3 in.	67	50½	....	....
2 in.	....	....	62	45½
2½ to 4 in.	....	....	65	48½
4½, 5, 6 in.	....	....	65	48½
7, 8 in.	....	....	58	39½
XX Strong P. E.				
½ to 2 in.	43	26½	....	....
2½ to 6 in.	....	....	42	25½
7 to 8 in.	....	....	39	20½
Genuine Wrot Iron.				
⅜ in.	56	32½	....	....
½ in.	61	41½	....	....
¾ to 1¼ in.	66	46½	....	....
2 in.	66	46½	62	42½
2½, 3 in.	66	46½	65	45½
3½, 4 in.	....	....	65	45½
4½, 5, 6 in.	....	....	62	42½
7, 8 in.	....	....	59	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72%
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	65 & 5%
Sq. Head Set Screws	70 & 5%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in.	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	$20 50
Electrolytic copper	20 00	20 25
Castings, copper	19 25	20 00
Tin	45 00	48 00
Spelter	19 00	[illegible]
Lead	6 50	7 00
Antimony	40 00	40 00
Aluminum	62 00	65 00

Prices per 100 lbs

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$26 00
Open-hearth billets, Pittsburgh	28 00
Forging billets, Pittsburgh	45 00
Wire rods, Pittsburgh	35 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 60	$2 55
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
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	65
Machine bolts, 7-16 and over	50-7½
Blank bolts	50-7½
Bolt ends	50-7½
Machine screws, iron, brass	35
Nuts, square, all sizes	3¾c per lb off
Nuts, hexagon, all sizes	4¼c per lb. off
Iron rivets	72½
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	1¼in	.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	...	...
9 in	2.88	9 in	4.90	.	....
10 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	$6.25
Connellsville Foundry Coke	5.65
Yough Steam Lump Coal	3.63
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto

COLD DRAWN STEEL SHAFTING

At mill	30%
At warehouse	20%

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

MISCELLANEOUS

Solder, half-and-half	0.25
Putty, 100-lb. drums	2.70
Red dry lead, 100 lb. kegs, per cwt.	9.65
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.23½
Benzine, single bbls., per gal.	0.23
Pure turpentine, single bbls.	0.85
Linseed oil, raw, single bbls.	0.85
Linseed oil, boiled, single bbls.	0.88
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.50
Lead Wool, per lb.	0.11
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

POLISHING DRILL ROD

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN.

¼ in.	$9.00
5-16 in.	5.90
⅜ in.	4.95
7-16 in.	4.65
½ in.	4.40
9-16 in.	4.05
⅝ in.	4.30
¾ in.	4.15
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs

TWIST DRILLS

	%
Carbon up to 1½ in.	55
Carbon over 1½ in.	25
High Speed	
Blacksmith	55
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 30	$3 00
Canada plates, dull, 52 sheets	3 15	3 15
Canada Plates, all bright	4 60	4 75
Apollo brand, 10¾ oz. galvanized	5 50	4 80
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 40	5 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$14 25	.....
1¼ in.	15 00	.....
1½ in	15 00	.....
1¾ in.	15 00	.....
2 in.	15 00	.....
2¼ in.	16 50	9 25
2½ in.	17 50	10 50
3 in.	25 00	12 25
3½ in.	28 00	14 50
4 in.	33 00	18 50

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11½
X Grand	0 11
XLCR	0 10¼
X Empire	0 09¼
X Press	0 08¾
COLORED.	
Lion	0 07¾
Standard	0 07
Popular	0 06¼
Keen	0 05½
WOOL PACKING	
Arrow	0 17
Axle	0 12
Anvil	0 09
Anchor	0 07
WASHED WIPERS	
Select White	0 08½
Mixed Colored	0 06¾
Dark Colored	0 05½

This list subject to trade discount for quantity.

BELTING RUBBER

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	40 & 10%
Standard	50%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$12.75
3-16 in.	9.00
¼ in.	6.00
5-16 in.	4.75
⅜ in.	3.75
7-16 in.	3.75
½ in.	3.75
⅝ in.	3.60
¾ in.	3.60

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 bisulphate	.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	.07

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	.04½ 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., Nov. 15, 1915.—Favorable industrial conditions continue throughout the Dominion. In the iron and steel trades, the activity is quite unparalleled, and the possibilities are that the immediate future may see even greater developments.

The manufacture of steel promises to crowd the capacity of every mill both in Canada and the United States. In this connection it is interesting to note that one hundred years ago the United States were producing about 50,000 tons of pig iron a year, while the average daily output for October last was over 100,000 tons, or an increase of 600 to 1.

The pressure being felt by the steel mills is largely due to the demand for war supplies, not only in shell bars and billets, but in many other lines, such as steel rails, structural steel for cars, locomotives, automobiles and the countless necessities used, directly, or indirectly, for the maintenance of large armies in the field.

Previous to the breaking out of hostilities, Canada as well as other countries countries, was purchasing large quantities of chemicals from Germany. Brought face to face with the problem of supplying their own needs, or paying prohibitive prices for what little could be obtained, the Canadian chemists have not only succeeded in accomplishing remarkable results in the production of these much-needed chemicals for their own use, but are able to export to Britain.

Enlarged opportunities have been opened for Canadian manufacturers, not only for supplies relative to war munitions, but in all classes of trade, formerly monopolized by European nations.

Steel.

The steel trade continues at quite high pressure, every available mill working to the limit, in the endeavor to supply the abnormal demand for bars and billets, as well as to keep up with the gradually increasing commercial requirements. The stress placed upon the steel-producing plants on this continent is shown by the past week's reports, in which it is stated that the United States Steel Corporation have withdrawn all prices on steel products except tubes and pipes. They are practically out of the market on all other lines of steel. Delivery under nine months is almost impossible, and many plants are closing down on future orders, until they can state definitely their exact position.

The requirements of the finishing mills are beyond the output of crude steel, and one of the necessities of the moment is to bring the production of the basic material up to the output of the rolling mills.

Canadian furnaces are only producing about one-half of the steel being used by our manufacturers, and any restriction placed upon importation would have a serious effect meantime.

Construction of large additions to the plant of the Nova Scotia Steel Co. are now being undertaken, and within three months new furnaces are expected to be in operation, producing 200 tons a day in addition to their present output. New equipment for the production of the larger shells is also to be delivered at New Glasgow in about six weeks. The mines in connection with this company will continue operations at high pressure throughout the winter months.

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.

Machine Tools and Supplies.

Activity in machine tools has received a new impetus because of the expectation that many firms will receive orders for the heavy type of explosive shell, as well as additional orders for the present shells of 3.3. and 4.5-inch type. Many inquiries have come in for machines suitable for the production of 6-in., 8-in. and 9.2-in. shells, and in a short time definite information may be received as to the successful firms receiving contracts for additional munitions.

The demand for supplies is as heavy as ever. The munition factories are working night and day, and small tools and other supplies are a constant requirement.

Metals.

The present situation in the metal market is little changed from that of the preceding week. However, the reported closing of the Suez Canal has created some excitement among buyers of spot tin with the result that the persistent buying to cover requirements has advanced the price from 38c to 45c a lb.

Copper is showing some signs of improvement, but last week's quotations prevail. Spelter is a shade stronger, and is quoted at 19c, and antimony shows an advance of five dollars per 100 lbs. A slight increase is noted in aluminum, a price of 62c being now quoted.

Copper.—The optimistic outlook for future copper is keeping the market firm. Although foreign quotations show advances, prices locally remain steady.

Tin.—Conditions in the Far East have apparently clouded the tin situation for the present, with the result that heavy advances have been made on prices for spot tin. Any losses of spot tin now in process of transportation might easily cause a further advance. This week's quotation shows an increase of $7 per 100 lbs. over that of last week.

Spelter.—Foreign advances in the price of spelter have not affected the local market very much. However, an advance of one cent per lb. is shown in this week's prices. . .

Lead.—This continues firm at 6½c per lb.

Antimony.—The apparent scarcity developing in antimony and the demand has made the price stronger, the present quotation being $40 per 100 lbs.

Old Materials.

Business in scrap metals of all kinds has been fairly brisk during the past week, and a general advance is noted in many lines. Copper has advanced about $10 a ton, considerable quantities being handled.

Business in heavy melting steel has increased the price ½c per pound.

Heavy melting lead has risen to $5 per 100 lbs., and tea lead shows an increase of ¼c per pound. Scrap zinc is selling at 12½ cents.

Toronto, Ont., Nov. 16.—The recent action of the United States Steel Corporation with regard to the Canadian market shows conclusively the far-reaching effect which the war is having on the steel trade here and elsewhere. The situation has been caused entirely by the enormous demand for munitions which will increase now that the orders for the large calibre shells are being placed. No official list of successful tenderers will be given out, nor the size of the orders named, notwithstanding reports to the contrary. This is the wish of the British War Office, which has notified the shell Committee to that effect. It is understood that some orders for 6-in. shells have already been placed and that the contracts for the larger shells, although not actually signed up, are practically assured to certain firms.

The general industrial situation is gradually improving and a more confident spirit prevails as a result. A large

number of factories are engaged in the production of war equipment and the engineering trade is active on shell orders. Prices of all lines have a higher tendency, particularly iron and steel products, which continue to advance. The metal market is very active and a general advance in prices has to be noted.

Steel Market

The recent announcement issued by the United States Steel Corporation is of considerable importance to Canadian steel plants. The Corporation in addition to withdrawing prices to the Canadian trade, have decided not to solicit business in this market until conditions have become normal. This order will affect principally bars and billets, etc., for which there is such a heavy demand; structural shapes will also be affected. This action of the Corporation does not mean that they will refuse business, providing delivery is no object, or that orders already booked will not be filled. It is simply a question of delivery. The demand is so far ahead of production that the output of the mills is booked up for several months in advance. Under these conditions and with unfilled tonnage increasing each month, prices cannot be fixed so far ahead and no promise can be made to consumers when they are likely to get delivery. The situation thus revealed is unprecedented and while not particularly serious at present may become so as the demand for steel for munitions continues to in increase and present contracts run out. The market is naturally upset and the outlook is uncertain.

Canadian steel companies, although operating on capacity, are falling behind in meeting the demand, and higher prices for steel products are inevitable. The prosperity of the steel industry is assured for some time to come and plants will have to be extended to take care of the demand. It is announced that the Nova Scotia Steel Co. will build an open-hearth furnace having a capacity of 200 tons per day. The same concern will install new presses for forging 8-in., 9.2-in. and 12-in. shells, also the necessary machining equipment.

Prices continue in an upward direction. Canadian mills are now quoting bars at 2.50c base, and reinforcing bars 2.35c base Toronto, plus extra for twisting. Steel bars are 2.50c and small shapes 2.75c f.o.b. Toronto warehouse. Pittsburgh bars, plates and shapes for Canadian consumption are quoted at 1.60c, but this figure is practically nominal, as no orders are being booked. Seamless boiler tubes have advanced again, but lapwelded are unchanged for the present. Higher prices on tubes are expected. Boiler plates are very firm and an advance in price may be made early next month. Some lines of bolts and nuts have advanced, the new discounts being as follows: Coach and lag screws, 70 p.c.; machine bolts, ⅜ in. and less, 65 p.c.; machine bolts, 7-16 in. and over, 50 p.c.; blank bolts and bolt ends, 50 and 7½ p.c.; square nuts, 3¾c per lb. off, and hex. nuts 4½c per lb. off. Another advance in wrought iron pipe has been made and is now in effect. The new schedule affects black pipe only, galvanized remaining unchanged.

Prices of high-speed tool steel continue to advance and the situation shows no improvement. The scarcity of tungsten has assumed serious proportions and the supplies, although increasing, are not sufficient to meet the demand. As this alloy to a large extent determines the price, quality and quantity of high-speed steel, it is apparent that while tungsten keeps at the present high level, high-speed tool steel will also be correspondingly high. The situation is further aggravated by the exceptionally heavy demand, which is at least five times that of normal.

Prices of all descriptions of steel sheets are very firm, and higher prices are expected. In galvanized sheets, the differentials between the gauges continue upset by the abnormal spelter situation, and while the consumer may secure heavy gauges at comparatively low prices, he must pay higher price for light gauges. Acid is becoming scarce and is high in price, and this, together with spelter and black sheets becoming more costly, will not doubt cause galvanized sheets to advance. Bessemer black sheets are quoted at 2.15c to 2.25c and open hearth 2.25c to 2.30c Pittsburgh.

In the States prices continue to advance, but this has had no effect in curtailing the demand, which is even greater than at any stage in this present movement. The unfilled tonnage of the United States Steel Corporation for October shows an increase of 847,000 tons over September. This record shows the development which is taking place in the market. The heavy demand for billets continues and prices are very firm. Wire rods are higher at $35 f.o.b. Pittsburgh.

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.

Pig Iron

The heavy demand for steel making pig iron continues but foundry grades are quieter. Prices are firm but unchanged.

Old Material

The market is considerably firmer and quotations higher for some metals. Copper is very strong and prices have advanced throughout the list. No. 1 machine composition and No. 1 composition turnings have advanced about 25c per 100 lbs., while No. 1 wrought iron and heavy melting steel are also higher. Prices of scrap lead are higher and scrap zinc is also advanced. Complete prices are given in the selected market quotations. Business is improving, but the higher prices are due more to the general buoyancy in the market and improved tone.

Machine Tools

The placing of the orders for the large-calibre shells is resulting in increased activity in the machine tool market. Quite a number of orders for tools, principally lathes, have already been placed and others are pending. Deliveries are better on the larger size lathes than on the smaller tools. Second-hand tools suitable for shell work are getting scarce and are not so easy to get hold of. Prices on all tools have advanced considerably. A feature of the present situation has been the development of the single-purpose lathe for which there is a big demand. Special tools for making shells have also been put on the market with exceptionally satisfactory results.

Supplies

A number of price changes have to be noted again this week. Solder, half-and-half, is higher at 25c, due to strength in the tin market. Prices of gasoline and benzine have been readjusted to bring gasoline 1c higher than benzine. Gasoline is now being quoted at 23½c and benzine at 23c per gallon, in barrels. A sharp advance has been made in turpentine, which is now quoted at 85c per gallon. Linseed oil is higher and is quoted at 85c for raw and 88c for boiled oil. Business continues brisk.

Metals

The market has revived and is more active. Prices of practically all metals have advanced, tin showing the greatest strength. The sharp advance of tin is

owing to a belief that the Suez Canal is closed and also on account of submarine activity in the Mediterranean. It is feared shipments of tin will be interfered with on this account. Copper has advanced, and there is a better feeling in the market. Spelter, lead and antimony are all firmer and the market is strong, while aluminum is higher and quotations nominal.

Tin.—The London and New York markets are excited, buyers being anxious to cover their requirements, due to the report that the Suez Canal has been closed. If such is the case there will be a delay in getting supplies, while there is also a chance of shipments being lost in the Mediterranean on account of submarines. This scare, together with a spot scarcity, has unsettled the market. Tin has advanced 3c locally and is now quoted at 48c per pound.

Copper.—There is a better feeling growing in the market and the London market is stronger. There is no special improvement noted in the demand from consumers, but producers are confident that the latter must become heavy buyers soon. Copper has advanced 1c and is quoted at 20½c per pound.

Spelter.—The market is firm and higher. A corner in spot spelter has developed in London and quotations have advanced. Spelter has advanced 1c locally, and is quoted at 19c per pound.

Lead.—There is a shortage of supplies of spot and early delivery in London, and the market has advanced. The market is strong in New York and the "Trust" price is slightly higher at 5.15c which may be advanced. Locally, lead has advanced 1c and is quoted at 7c per pound.

Antimony.—The market is firm and there are indications of a scarcity in spot antimony developing if the demand for prompt metal continues as good as it has been during the week. Antimony has advanced 5c and is quoted at 40c per pound.

Aluminum.—The situation does not improve, and supplies are very difficult to obtain. Quotations have advanced 5c and are nominal at 65c per pound.

Moose Mountain Iron Mines at Sellwood, Ont., have closed down indefinitely after a series of disappointing experiments of the past several years to commercialize the immense bodies of ore which they control. The most recent experiments were with the Grondal system of concentrating and briquetting the ore for shipment to the blast furnaces, raising it from a 35 per cent. ore in the rock to a 60 per cent. in the concentrates, which was not a commercial success. It is estimated that over a million dollars has been expended by the Gates interests of New York and the Mackenzie and Mann interests of Toronto in this endeavor.

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, Grubbeged 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

Toronto, Ont.—The Canadian Hansen & Van Winkle Co. are building a brass foundry at a cost of $5,000.

Galt, Ont.—The Perfect Machinery Co. will build a machine shop to cost $4,000. S. L. Clark is general manager.

Chatham, Ont.—Park Brothers of this city have closed a contract with the Dominion Sugar Co. for $14,300 worth of machinery for the new plant.

Berlin, Ont.—Louis F. Dietrich has purchased a property which will be converted into a garage. An elevator and other equipment will be required.

Hamilton, Ont.—The Canadian Chadwick Metal Co. are having the old Gompf brewery building altered and machinery installed for making munitions.

Waneta, B.C.—The Waneta Development Co. will immediately start construction of a hydro-electric power plant to be erected at the confluence of the Columbia and Pend O'Reille rivers, which will have a capacity of 80,000 h.p.

Toronto, Ont.—It is officially announced that the Ontario Hydro-electric Commission has completed the survey for a Government powerhouse to be erected between Queenston Heights and Niagara Falls, Ont. Plans are being prepared. It is planned to use the surplus waters of the Welland Canal to develop 300,000 h.p.

Electrical

Hespeler, Ont.—The Hydro Commission will install a new transformer and also a number of 100 c.p. nitrogen filled lamps.

Port Lambton, Ont.—A petition has been drawn up asking for the hydro-electric system to be extended to this town.

Agincourt, Ont.—This village is planning to secure connection with the Hydro-electric at Duncan, on the C. N. R., and it is understood the preliminary arrangements are all completed.

London, Ont.—By a vote of 65 to 8, the ratepayers of the village of Granton, fifteen miles north of here, on Nov. 9 carried a by-law authorizing the village council to enter into a contract with the Hydro-electric Power Commission for a supply of power.

Stratford, Ont.—The council and representatives of adjoining municipalities met Engineer Gaby and officers of the Provincial hydro-radial union and approved of the general plans of the main Toronto to London hydro-radial line as it affects Stratford and district. A motion was adopted that steps be taken to have necessary by-laws submitted to the electors in January.

Municipal

Hespeler, Ont.—The town council will call for tenders for a pumping station.

Guelph, Ont.—The installation of fire alarm system is being considered by the City Council.

Hamilton, Ont.—Fire Chief Ten Eyck has asked for a new fire alarm system to be installed.

Chatham, Ont.—Hydro power will probably be installed in the pumping station this year.

London, Ont.—The City Council contemplate further extensions to the waterworks distribution system.

Tecumseh, Ont.—A new water distribution system is contemplated for this town. The cost is estimated at $25,000.

Owen Sound, Ont.—The town council have decided to submit a by-law to the ratepayers to authorize a loan of $12,000 to W. A. Wilson, of London, who will start a shoe factory here.

Regina, Sask.—The City Commissioners have decided to install a new pumping unit driven by electrical power at Boggy Creek. The new pump will have a capacity of about two and a half million gallons. The cost is estimated at $12,000.

Toronto, Ont.—The Board of Control have received a dozen tenders for the construction of the new Don incinerator building exclusive of the gas engines. The prices ranged from $84,500 to $95,000, several being $86,000. The Controllers awarded the tender to George Welof, whose price was lowest at $84,500, subject to the approval of that Street Commissioner. The chimney will cost about $9,000.

General Industrial

Hespeler, Ont.—The Porcelain Kitchen Furniture Co. will establish a factory here shortly.

Petrolia, Ont.—Fred Howlett has purchased a site and intends to erect a brick and tile manufacturing plant.

Preston, Ont.—The Solid Leather Shoe Co. contemplate the erection of an addition to their factory. Manager, J. Parker.

Thorold, Ont.—The Ontario Paper Mill here was damaged to the extent of $2,000 by fire on November 9. The fire originated in the large bin which supplies the coal for the boilers. The loss is covered by insurance.

Tenders

Grand'Mere, Que.—Tenders are being received for the supply of one 500 h.p. turbine and dynamo. Engineer, L. S. Pariseau, Montreal.

Toronto, Ont.—Tenders will be received up to Tuesday, November 23rd, 1915, for the construction and erection of smoke breeching at main pumping station. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredges for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred. H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, up to Tuesday, November 23rd, 1915, for the following: Asphalt, refined; brass and bronze castings; brass work for house services, bleaching powder, cast iron pipe; castings, special; castings, manholes, etc.; general supplies; house numbers; hydrants; iron and steel; lead pipe, mineral dust; oils; rubber valves, etc.; stop valves. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Personal

Frank Chappell, town engineer of Oshawa, Ont., has resigned his appointment to accept a position with the McLaughlin Motor Co., Oshawa.

Wm. Weir, of Montreal, president of the Canada Foundries and Forgings, paid a visit recently to the Welland plants, Canada Forge and Billings & Spencer.

William Bissett Smith, general manager of the Dominion Transport Co., died in Montreal on November 8, in his 87th year. He was born in Huntley, Aberdeenshire, and came to Canada in 1855.

Frank W. Hinsdale, who, after spending a year and a half in helping to organize the work of the Ontario Workmen's Compensation Board, has completed his duties, and has left Toronto for New York.

W. P. Hinton, assistant passenger traffic manager of the G. T. R. and G. T. P., has been appointed traffic manager in charge of passenger and freight of the G. T. P. R., with headquarters at Winnipeg, also Western traffic manager of the Canadian Government Railways.

C .H. Cahan, Jun., of the Canadian Car and Foundry Co., was in Pittsburgh recently with three members of the Imperial Russian Commission. They visited a number of important industrial plants with a view, it was stated, of ascertaining just how soon certain orders they desire to place could be filled.

Refrigeration

Chatham, Ont.—A proposal to establish a municipal dairy is under consideration by the council.

Ottawa, Ont.—The Ottawa Dairy Co. has let the contract for the erection of an ice-making plant to cost $15,000.

Toronto, Ont.—The Board of Control has sanctioned an expenditure of $9,500 for additional cold storage rooms at the Municipal Abattoir.

Rigaud, Que.—Curtis & Harvey have had their storage rooms equipped with two 15-ton refrigerating machines, furnished by the Frick Co., Waynesboro, Pa.

Wood-Working

Berlin, Ont.—George Guentzler will build an addition to his woodworking plant.

London, Ont.—The George H. Beton Lumber Co. is planning to add electrical equipment to operate woodworking machinery.

Nelson, N.B.—Fraser, Ltd., Fredericton, N.B., intend to erect a large sawmill at this place. Approximate cost, $100,000.

Rimouski, Que.—Work is about to start on the erection of a shingle mill for Price Brothers & Co., Quebec. Estimated cost, $15,000.

St. John, N.B.—A site has been purchased at Washademoak, N.B., by Daley & Carvell, of this city, on which they will build an axe handle and woodworking plant.

Marine

A. A. Larocque has been appointed vice-president of the Sincennes-McNaughton Line, Ltd., Montreal, in succession to the late Major A. V. Roy, who met his death recently while fighting with the Canadian forces in France. Mr. Y. Dupre was elected to fill the vacancy on the directorate.

St. Johns, Nfld.—The steamships "Adventure" and "Bellaventure" have been sold to the Russian government and will be used to keep Russian ports clear of ice in the winter. The "Bellaventure" has recently returned from Hudson Bay. Before leaving for Europe a trial trip will be run with Russian officials on board.

Windsor, Ont.—President Pressano of the Great Lakes Engineering Works, announces that he has booked contracts for the construction of four additional steel freighters, three for coast service and one for the Great Lakes trade. The steamer for lakes service will be a ship of about 9,000 tons, of 450 feet keel length, and about 56 feet beam. The three coast freighters will be of Welland Canal size.

Building Notes

Toronto, Ont.—B. C. Whitney and O. B. Sheppard have decided to rebuild the Princess Theatre.

Toronto, Ont.—The New Method Laundry will make an extension to their building to cost about $4,200

Toronto, Ont.—The Toronto Hydro-Electric Commission propose erecting a large office building to cost $450,000.

Montreal, Que.—The city of Westmount will erect a municipal building to cost about $150,000. Kenneth G. Rea is the architect.

St. John, N.B.—The Rhodes Curry Co., contractors, engaged on two new warehouses on the dock, have been instructed to build a third. The latter warehouse will be 80 ft. x 350 ft.

Contracts Awarded

Galt, Ont.—The R. McDougall Co. have been awarded a contract by the city for five hydrants at $32.50 each.

Wingham, Ont.—The Canada Furniture Co. has received a large order for shell boxes, and are now making preparations to start work in the Union Factory.

Toronto, Ont.—The Board of Control have let the contract for the supply of stop valves and other apparatus for the main pumping station to Drummond McCall & Company, Toronto, at $8,530.

The Roxton Falls Manufacturing Co. has been incorporated at Ottawa with a capital of $100,000 to manufacture articles in lead, copper, iron, malleable iron and wood at Roxton Falls, Que. Incorporators: Joseph Oscar Fauteux and Joseph Adolphe Desnmarteau, of Montreal.

Chatham, Ont.—The Water Commissioners have awarded contracts for equipment for the pumping station. The contract for the pumps was let to the Canadian Allis-Chalmers Co., and the contract for the motors was given to the Canadian General Electric Co., Toronto. The pumps will have capacities of two million gallons and three million gallons respectively.

Moncton, N.B.—The contract for the steel superstructure of the new bridge over the Petitcodiac River, at this place, has been awarded by the Provincial Government to the Dominion Bridge Company of Montreal. Announcement to that effect has been made by the Provincial Board of Works, and it was said that the contract price would reach about $125,000. The sub-structure will cost approximately $200,000, making the total cost of the bridge about $325,000.

Railways—Bridges

Victoria, B.C.—The C. N. P. R. is to resume construction work on the Vancouver Island sections of the system, not only in respect to the line to Patricia Bay and that to the West Coast, but also in the matter of the de-

[illegible] the former Songhees Indian Reserve. It is hoped before the close of the year to have a section of the West Coast line completed as far as the first point reached at tidewater.

St. Marys, Ont.—An important hydro-radial [illegible] was held here on November 11. Mr. Lyon, chairman of the Ontario Hydro-Radial Union, presided. Secretary T. I. Hannigan was also present along with Engineer Gaby, chief engineer of the Ontario Hydro-Electric Commission, and about 35 representatives of the following municipalities: London, Lucan, Exeter, Biddulph, Blanshard and St. Marys. Resolutions were passed approving of the map plans as presented.

Toronto, Ont.—Plans for the second link in the Hydro-Electric Radial System that is to link up Toronto with Sarnia and take in all the municipalities along the line from Toronto, by way of Guelph and London, received emphatic approval on October 28 when the representatives of the eighteen municipalities interested in the section from Guelph to London met to consider the proposals of Sir Adam Beck and his colleagues of the Hydro-Electric Commission. By-laws will be prepared in the various municipalities and submitted to the ratepayers at the next municipal elections.

Trade Gossip

New Liskeard, Ont.—The Wabi Iron Works have recently installed an electric furnace.

The Linde Canadian Refrigeration Co. will install an ammonia rectifier and oil trap at the Municipal Abattoir, Toronto.

The National Steel Car Co., Hamilton, Ont., will manufacture motor-driven fire apparatus in addition to their present lines.

Gananoque, Ont.—The Ontario Steel Products Co. have received a large order for automobile springs and trench digging shovels.

Expansion of Hydro System.—Sir Adam Beck, Chairman of the Hydro-Electric Power Commission, had a meeting with the Ontario Cabinet recently and submitted further data with reference to increased power development at Niagara Falls.

The Standard Steel Co. has been organized at Montreal to manufacture steel products and shells. A building has been rented and will be equipped with the necessary machinery. The head office is in the Transportation Building, and the president is E. G. Jackson.

Petrolia, Ont.—The Western Sugar Refining Co., which proposes building a sugar beet refinery here, have appointed the following provisional directors: Ralph D. Mitchell and D. J. Kelly of Cleveland, O.; David A. Gordon of Wallaceburg, Ont.; K. C. Kerr and R. G. R. MacKenzie, of Petrolia.

Agricultural Machinery for France.—Two big trains made up of sixty carloads of agricultural machinery have been shipped by Massey-Harris Co., from Brantford, Ont., for use in France. War for some time cut off the export trade of the local branch of the firm, but lately it has picked up again.

The Nova Scotia Steel and Coal Co. has disposed of $1,500,000 of common stock and $1,000,000 of 6 per cent. debenture stock. The capital which has been obtained in this way will greatly strengthen the financial position of the company and enable it to comfortably take care of any additional business that is offering over and above the large amount which is now on hand.

The Canadian Briscoe Co. has been formed by Carriage Factories, Ltd., of Canada, as a subsidiary. The Canadian Briscoe Co. will assemble the parts in Canada from the Briscoe Motor Co., of Jackson, Mich., and the cars will be sold through Carriage Factories, Ltd., which has acquired the carriage manufacturing end of the McLaughlin Motor Co., Oshawa, Ont.

New Trade Commission.—The Minister of Trade and Commerce has appointed a new Trade Commission to the Far East. L. D. Wilgress, who for some time has been training in the department here, is going to Omsk, while C. W. Just will go to Petrograd. Mr. Just has conducted an extensive investigation into possibilities of trade with Russia and reports many promising openings.

Railway Earnings New High Record.—The gross earnings of the three Canadian railroads, the C. P. R., the G. T. R. and the C. N. R., for the month of October reached notable dimensions. For the fourth week they were $7,147,358, or an increase of $2,413,017, which is at the rate of 50.9 per cent. over the corresponding period a year ago. These are new high records for years. The combined gross earnings of the three roads for all October were $21,656,192, an increase of $4,942,000 over September, of $7,464,000 over August, of $8,500,000 over July, and of $8,790,000 over June. Compared with a year ago, the increase was $5,519,000, or 34.2 per cent., this being the first monthly increase since the war began, and comparing with a decrease of 3.7 per cent. in September.

The Canadian Steamship Lines, it is stated, have 107 boats in active service, 65 freight, of which 16 are on the ocean and 42 passenger. The ocean freighters, the same authority states, earn on the average $10,000 net per month, which for the winter months figures out at nearly $800,000. In addition to this, six vessels of the Quebec Steamship Company, a subsidiary, operate all year. The passenger revenue this year has not been as large as in 1914, but the above figures indicate that ocean traffic alone will wipe out last year's deficit. Freights from the head of the lake average about 4 cents this year against 1¾ in 1914. Operating costs have been cut down by means of various economies to the extent of about $400,000. These are the reasons why September and October earnings alone stood almost half a million dollars ahead of the corresponding months in 1914. It is well known that freight boats had very small storage cargoes at the head of the lakes last winter, but this year the capacity of the fleet of the company will be filled, to the extent of about 2,500,000 bushels, which, it is estimated, will net the company in the neighborhood of $200,000.

New Incorporations

The Ontario Aeroplane Co. has been incorporated at Toronto with a capital of $200,000 to manufacture aeroplanes, hydroplanes and water boats at Toronto. Incorporators: Jacob William Broudy and Thomas Hubert Wilson, of Toronto.

Gray-Dort Motors, Ltd, has been incorporated at Toronto, with a capital of $500,000 to make motor cars at Chatham, Ont. Incorporators: J. Dallas Dort of Flint, Mich., Robert Gray and William Murray Gray of Chatham, Ont.

The Algoma Nickel Mining Co. has been incorporated at Toronto with a capital of $10,000 to acquire and develop mines and mineral lands. Head office at Toronto. Incorporators: George Hugh Baird and Henry Nicol Baird, of Toronto.

The Maple Leaf Motors, Ltd., has been incorporated at Ottawa, with a capital of $750,000, to manufacture automobiles and motor cycles, etc., at Brantford, Ont. Incorporators—James Harley and Edmund Sweet, of Brantford, Ont.

The Reginal Construction Co. has been incorporated at Ottawa, with a capital of $100,000, to carry on business as contractors. Head office at Mont

real, Que. Incorporators: Charles Gaspard Hebert and Arthur Laberge, of Montreal.

The Utilities Eqipment Co. has been incorporated at Toronto with a capital of $40,000 to manufacture electrical and mechanical apparatus and appliances at Toronto. Incorporators: William Davidson and John Calvin McFarlane, of Toronto, Ont.

The Dominion Magnesite Co. has been incorporated at Ottawa, with a capital of $100,000, to develop and operate mines, minerals, mining lands at Calumet, Que. Incorporators: Walter Robert Lorimer Shanks, Francis George Bush, of Montreal.

The Transcona Shell Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture shells, bombs and munitions of all kinds. Head office is at Montreal. Incorporators—F. G. Bush, G. H. Drennan and H. W. Jackson, all of Montreal.

Cleveland, Ltd., has been incorporated at Ottawa, with a capital of $40,000, to purchase a certain secret process known as the "Cleveland Process." Head office at St. John, N.B. Incorporators: Isaac MacDonald and Laurence Alexander Barry, of Halifax, N.S.

The E. W. Jeffres, Ltd., has been incorporated at Ottawa with a capital of $500,000 to carry on the business of manufacturing chemists at Walkerville, Ont. Incorporators: Edward Worsham Jeffres, of Detroit, Mich., and Albert J. Gordon, of Walkerville, Ont.

The Central Engineering Co. has been incorporated at Ottawa with a capital of $25,000 to carry on business as general dealers in and manufacturers of machinery at Montreal, Que. Incorporators: Thomas Arnold, Joseph Atter and Herbert M. Ewan, all of Montreal.

The Dominion Copper Products Co. has been incorporated at Ottawa, with a capital of $400,000, to manufacture articles made of copper, brass and all other metals, at Montreal. Incorporators: Walter Lorimer Shanks and Francis George Bush, of Montreal.

The Canadian Dove Smith Co. has been incorporated at Toronto with a capital of $40,000, to manufacture machinery and munitions of war at Toronto. Incorporators—Roderick George Kemble, Joseph Henry Harker, and Newton Howard Manning, all of Toronto, Ont.

Greenleafs, Ltd., has been incorporated at Toronto with a capital of $40,000, to purchase the business of Greenleaf & Son, machinists, electricians, automobile repairers, at Belleville, Ont.

ADVERTISING.

Advertising in a trade paper is simply stating openly who you are and what your business is. It is pointing out to the readers that you have something of service for them, a commodity to use them to profit both you and them. The only men who do not advertise are those who have nothing to offer. They are dead, even if they do not know it.

Incorporators: Henry Wilbur Greenleaf and Charles Orlando Greenleaf, of Belleville, Ont.

Yukon Copper Co. has been incorporated at Ottawa, with a capital of $200,000, to carry on the business of mining and smelting copper. Head office at Ottawa. Incorporators: W. D. Greenslade, of Whitehorse, Y.T.; Alfred Thompson, of Dawson, Y.T., and J. F. Smellie, of Ottawa.

The Gunn Electric Co. has been incorporated at Ottawa, with a capital of $20,000, to manufacture electrical, hydraulic, mechanical and other machinery at Montreal, Que. Incorporators: Edward James Gunn, William James Shaughnessy and Chilion Graves Heward, all of Montreal.

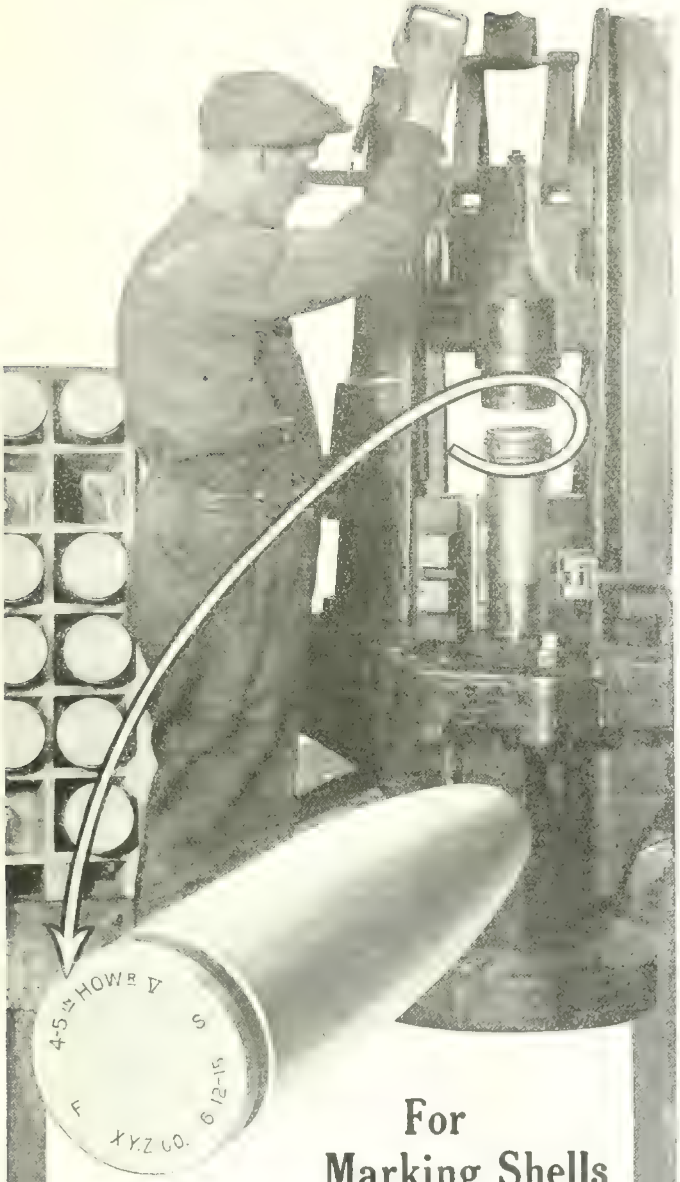
The Wizard Tire Inflator and Fire Extinguisher Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture tire inflators and fire extinguishers, fluid air, gas or other receptacles, at Toronto. Incorporators—John Edward Carroll, of Philadelphia, Pa., and James Douglas McWilliams, of Toronto, Ont.

TENDERS FOR SOUTH AFRICAN REFRIGERATING PLANT

THERE have been forwarded to the Department of Trade and Commerce, Ottawa, by W. J. Egan, Trade Commissioner, Cape Town, specifications and plans for the supply and erection of an ice-making and refrigerating plant and for the fitting up of refrigerating chambers at the municipal abattoirs, Newton, Johannesburg. The contract calls for the supply and erection at the above abattoirs of an ice-making and refrigerating plant with necessary foundations, etc., complete; all insulated walls, partitions, floors, ceilings, doors, etc., necessary to construct the various compartments in basement with all work required to leave same in complete working order; two lifts, with all operating gear, gates, etc., complete; all running rails for conveying, and hanging rails for hanging carcases, complete with all switches, hangers, runners, etc., in basement and lifts. Tenders for the above are to be in the tender box, municipal offices, Johannesburg, by or before noon on Thursday, December 30, 1915. Specifications and drawings may be inspected at the Department of Trade and Commerce, Ottawa. (Refer File No. A-1842.)

MONTREAL DRY DOCK & SHIP REPAIRING CO.

WHEN the steamer Rock Ferry went into dock at the end of Wellington Basin on Mill Street, Montreal, on November

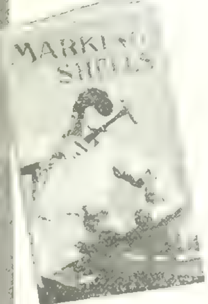


For Marking Shells

[illegible] shell contractors in the United States and Canada are using Matthews steel lettering dies and stamps because Matthews have made a special study of the requirements for this work, give them dies that stand up and make the promptest deliveries. They

Use Matthews Dies

with various stamping machines, such as is shown above. Matthews [illegible] holders and [illegible] type Matthews steel hand stamps.



This Book Shows How

well-known concerns are marking shells and illustrates, by actual photographs of shell marking, the devices Matthews have made for this work. The only book covering this important feature, containing valuable information and practical suggestion on marking shells.

Gladly sent on request to [illegible] concerns. Kindly use the company's letterhead. If you use [illegible] stamps you will be interested in Matthews complete catalog of **Steel Lettering Dies and Stamps.**

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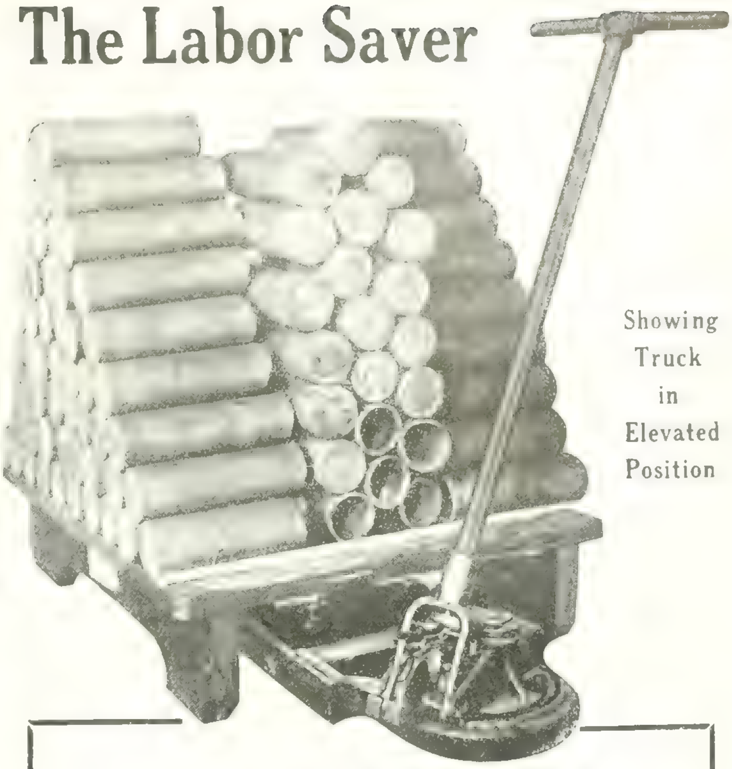
MAKERS OF STEEL LETTERS [illegible]

The Labor Saver



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This
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SHELLS
or any factory product where numerous operations are required.

All material is stacked on the platforms. To move material the truck is backed under the platform; the handle of the truck is then pushed down, keeping the button depressed, which raises the truck bed, and with it the loaded platform, at the same time automatically locking it in its raised position.

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Raising and lowering of the truck can be operated with one hand [illegible] can be raised or lowered at any angle.

[illegible] ball bearings throughout.

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You will profit by [illegible]

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Transmission Ball Bearing Co. Inc., 1407 West Ave., Buffalo, N.Y.

6, to have her rudder repaired, [illegible] arranged a new contract for work to be done by the Montreal Dry Dock & Ship Repairing Co.

For nearly [illegible] years [illegible] has been done [illegible] at the dock, which before that time was known as the Tate Dry Dock. All this summer work has been proceeding at deepening the dry dock so that its scope could be greatly extended. On Friday, November 5, a group of prominent business and shipping men were shown over the plant to see for themselves that now the dock can take any lake steamer which comes through the Lachine Canal.

The dock has been deepened four feet for 250 feet in length, and a new concrete bottom laid. The Rock Ferry is 260 feet long, and draws 11 feet when light, an indication of the capacity of the new dock. There is a good plant for iron work, completely supplied with air and electric tools. The dock is 50 feet wide and the blocks three feet six inches high. The entire length of the dock is 430 feet.

Among those present were Thomas Hall, of the Hall Engineering Works, who is managing director of the Montreal Dry Dock & Ship Repairing Co.; F. H. Fox, secretary-treasurer; Captain Johnson, marine superintendent of the Canada Steamship Lines; E. Marceau, chief engineer Quebec Canals; D. O'Brien, superintendent Lachine Canal; Captain Archibald Reid, port warden; Captain J. N. Bales, assistant port warden; L. L. Henderson, manager and director Montreal Transportation Co.; F. W. Cowie, chief engineer Harbor Commission; A. Kastella, chief engineer Department of Public Works; George Hadrill, secretary, Montreal Board of Trade; Captain J. O. Grey, Frank Wright, and Ralph Hall, the last three from the Hall Engineering Works.

MUNITIONS EXPORTS FROM THE UNITED STATES

EXPORTS of war materials from the United States now average more than $1,000,000 a day, according to a statement issued yesterday by the Foreign Trade Department of the National City Bank. From the port of New York alone the exports in September included $6,500,000 worth of gunpowder, $3,500,000 worth of shells and explosive projectiles, $1,250,000 of cartridges, nearly $1,000,000 of dynamite, cordite and trinitrotoluol, $500,000 worth of primers and fuses, $1,000,000 worth of empty projectiles, and nearly $1,000,000 worth of firearms.

In addition there were shipped in September $1,000,000 of military goods, nearly $1,000,000 of aeroplanes and more than $6,000,000 worth of auto trucks. There also were enormous shipments of copper, lead, spelter, hospital goods, harness and saddlery. Most of these shipments were to Great Britain, France and Russia.

Catalogues

Don't Waste Your Fuel is the title of a folder issued by the James Morrison Brass Mfg. Co., Toronto. The folder describes and illustrates two patterns of

recording gauges for steam pressure, vacuum and temperature gauges.

Temperature Booster.—The W. E. Clark Co., Toronto, have issued a folder describing the Clark temperature booster. This is a device for increasing the circulation of the water in hot water heating systems. A full description covering the construction and method of operation is given, accompanied by sectional views.

Shop Furnaces made by the American Shop Equipment Co., Chicago, Ill., are the subject of a supplementary bulletin recently issued. The lines briefly described include portable and stationary rivet forges, welding and forge furnaces, annealing, tempering and hardening furnaces, etc. The bulletin contains complete export shipping data for each product listed.

Heat Generator.—A booklet describing the "Knickerbocker" heat generator made by the James Morrison Brass Mfg. Co., Toronto. This appliance, which is designed for hot water heating systems, is illustrated and described, the illustrations including a number of diagrams of heating systems showing location of the generator. The method of installing the generator is described and also the benefits to be derived from its use.

Piston Rings—"To Save and to Hold Power" is the title of a bulletin issued by W. H. Banfield & Sons, Toronto, Ont., and describing the "Leak-Proof" piston ring. The bulletin first of all deals with piston rings in a general way and then proceeds to describe in detail the principal features of "Leak Proof" ring. The method of making these rings is described, followed by instructions for installing and the variety of uses.

The Lighting of Textile Mills with Edison Mazda lamps is the title of bulletin No. 4906 distributed by the Canadian General Electric Co., Toronto. The bulletin contains a number of excellent half-tones showing interior views of textile mills where "Mazda" lamps are installed. The reading matter deals with "Mazda" lamps as applied to the illumination of textile mills, while a variety of types of lamp are illustrated. Tables are included giving data covering these lamps.

Book Review

Forging of Iron and Steel, by William Allyn Richards, B.S., M.E., 219 pages 8 in. x 5 in., 337 illustrations. Published by the D. Van Nostrand Co., New York. Price $1.50 net. This is a new text book for the use of students in colleges, sec-

ordinary schools and the shop. The author as stated in the preface, has endeavored to treat the forging of iron and steel, and the hardening and tempering of tool steel simply enough for the high school boy, and at the same time thoroughly and systematically enough for the veteran smith. An endeavor has been made to bring out principles, and all methods used toward this end have been thoroughly tried out during ten years of experience of teaching and supervising manual training. The book contains sixteen chapters, including one devoted to a series of calculations, and the introduction. Chapter one is an historical sketch, while chapter two deals with the characteristics of iron and steel and methods of production treated simply. Equipment used in the forge is described in chapter three and chapter four deals with fuel and fires. The next four chapters describe the different smith shop operations and tools. Chapters nine, ten and eleven describe various methods of welding and brazing. The two succeeding chapters contain some interesting matter on carbon and high-speed tool steel, describing methods of annealing, hardening and tempering steel for various purposes. Chapter fourteen treats on art ironwork, and chapter fifteen describes the operation of steam and power hammers. The chapter on calculations contains the information necessary to know in order to obtain the exact size of stock to be used to make a forging. The appendix contains a course of exercises consisting of 42 examples which help to demonstrate the principles of forge work and the application of the methods described in the preceding pages. At the end of each chapter is a series of questions for review, a useful feature in helping to draw the attention of the student to the main contents in the chapter. This book is written in a comprehensive style and will be a great help to the student or smith, used in conjunction with the work in the forge. The book is printed in clear type, is fully illustrated and bound in substantial cloth covers.

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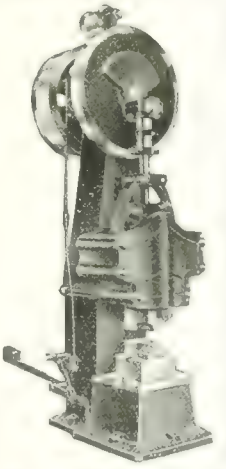

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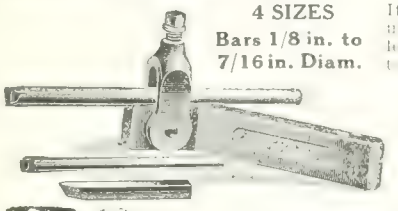

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H. W. Petrie, Toronto.
Skinner Chuck Co., New Britain, Conn.
D. E. Whiton Machine Co., New London, Conn.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.

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.
H. W. Petrie, Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Conveyor Machinery.
Heath W. D. & Son, Toronto.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton, Ont.
H. W. Petrie, Toronto.
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.
Southwark Foundry & Machine Co., Philadelphia.
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.
Alliance Machine Co., Alliance, O.
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.
Harvey, Ill.
Whiting Foundry Equipment Co.

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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
Matthews, J. H., & Co., Pittsburg, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
H. W. Petrie, Toronto.
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.
Matthews, J. H., & Co., Pittsburg, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

Dies, Opening
W. H. Banfield & Sons, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Duncan Electrical Co., Montreal.
Greenfield Tap & Die Corporation, Greenfield, Mass.
A. R. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
[illegible]
Modern Tool Co., Erie, Pa.
Moseley Machine & Tool Co., [illegible]
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.
Moseley Machine & Tool Co., [illegible]

Dies, 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. R. 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, Ill.
Can. Buffalo Forge Co., Montreal.
[illegible]
Foss & Hill Machy. Co., Montreal.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Garvin Machine Co., New York.
Gisholt Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
H. W. Peters, Toronto.
A. R. Williams Machinery Co., Toronto.

Drilling Machines, Locomotive and Multiple Spindle
American Machy. Corporation, [illegible] 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.
[illegible]
H. W. Peters, Toronto.
Garvin Machine Co., New York.
Gisholt Machine & Tool Co., Philadelphia, Pa.
A. R. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. W. Peters, Toronto.

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

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

Drilling Machines, Upright and Horizontal.
American Machy. Corporation, [illegible] 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, Ill.
John Bertram & Sons Co., Dundas.
[illegible]
Gisholt Machine & Tool Co., Philadelphia, Pa.
A. R. Jardine & Co., Hespeler, Ont.
Rockford Machine Tool Co., Rockford, Ill.
R. McDougall Co., Galt.
Moteh & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
H. W. Peters, Toronto.

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

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

Drills, Blacksmith and Bit Stock.
Can. Buffalo Forge Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. R. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
H. W. Peters, Toronto.
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.
H. W. Peters, Toronto.
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.
H. W. Peters, Toronto.
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. R. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
H. W. Peters, Toronto.
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.
H. W. Peters, Toronto.
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.
H. W. Peters, 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.
Gisholt Machine & Tool Co., Philadelphia, Pa.
H. W. Peters, Toronto.
Stevens, F. B., Detroit, Mich.

Emery Wheels, Dressers and Stands.
Canadian Hart Wheels, Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
[illegible]
National Machinery & Supply Co., Hamilton, Ont.
Norton Co., Worcester, Mass.
H. W. Peters, Toronto.

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.
H. W. Peters, Toronto.
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.
H. W. Peters, Toronto.
Sheldons, Ltd., Galt, Ont.
A. R. Williams Machy. Co., Toronto.
Wm. Tod Co., Youngstown, O.

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

Engines, Steam.
Can. Buffalo Forge Co., Montreal.
Gisholt Machine Co. of Canada Ltd., Ottawa.
Mesta Machine Co., Pittsburg, Pa.
H. W. Peters, Toronto.
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.
H. W. Peters, Toronto.

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 Brick.
Elk Fire Brick Co., Hamilton, Ont.

Fire Extinguishers.
Can. H. W. Johns-Manville Co., Limited, Toronto.
General Supply Co. of Canada, Ltd., Ottawa.

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.
Steel Co. of Canada, Hamilton, Ont.
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.
H. W. Peters, Toronto.
Plessisville Foundry, Plessisville, Que.
Steel Co. of Canada, Hamilton, Ont.
Wm. Tod Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.
Williams, White & Co., Moline, Ill.

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.
H. W. Peters, Toronto.
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.
H. W. Peters, Toronto.
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.
Southwark Foundry & Machine Co., Philadelphia.

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.
H. W. Petrie, Toronto.
Sheldons, Limited, Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Wm. Tod Co., Youngstown, O.
D. E. Whiton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.

Gears, Cut, Mortise, Angle, Worm.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Jones & Glassco, 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 & Glassco, 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.
H. W. Petrie, 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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.

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.
Alliance Machine Co., Alliance, O.
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.
General Supply Co. of Canada, Ltd., Ottawa.
H. W. Petrie, Toronto.
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.

Hides.
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.
Beath, W. D., & Son, Toronto.
General Supply Co. of Canada, Ltd., Ottawa.
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.
Alliance Machine Co., Alliance, O.
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.
H. W. Petrie, Toronto.
Southwark Foundry & Machine Co., Philadelphia.
Wm. Tod Co., Youngstown, O.
Watson Stillman Co., Aldene N.J.
Wood, R. D., & Co., Philadelphia

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.
Southwark Foundry & Machine Co., Philadelphia.

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.
H. W. Petrie, Toronto.
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 [illegible] 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.
Ottawa Machinery Co., Grand Rapids Mich.
H. W. Petrie, Toronto.
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.
H. W. Petrie, Toronto.

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.
H. W. Petrie, Toronto.

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
Gardner Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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.
General Supply Co. of Canada, Ltd., Ottawa.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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.
New York Machinery Exchange, New York.
H. W. Petrie, Toronto.
A. R. Williams Machy. Co., Toronto

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.
Plessisville Foundry, Plessisville 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
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Will Twist Drill Co. of Canada, Ltd. Walkerville, Ont.

Marine Engines
Cunningham & Sons, St. Catharines Ont.

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

Marvelene
Dennis Wire & Iron Works, London, Ont.

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

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

Metals.
L. S. Enstis & 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.
Gooley & Edlund, Cortland, N.Y.
Kempsmith Mfg. Co., Milwaukee, W.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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.
Gooley & 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 & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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 & Merryweather Machy. Co. Cleveland, O.
H. W. Petrie, Toronto
Pratt & Whitney Co., Dundas, Ont.

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

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

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

Motors, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Multiple Index Centres.
Garvin Machine Co., New York.

Nipple Threading Machines.
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

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

Nozzles, Spray.
Can. Buffalo Forge Co., Montreal.

Nuts, Semi-Finish and Finished.
Galt Machine Screw Co., Galt, Ont.
Steel Co. of Canada, Hamilton, Ont.

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

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

Nut Facing and Bolt Shaving Machines.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, O.
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.
A. R. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Wrenches.
Wells Brothers Co., Greenfield, Mass

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

Oil Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

Ovens for Baking, Bluing, Drying, Enamelling, Japanning, and Lacquering.
Geo. Gorton Machine Co., Racine, Wis.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co. Harvey, Ill.

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

Ovens for Drying, Temper and Under Trucks.
Oven Equipment & Mfg. Co., New Haven, Conn.

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

Oxy-Acetylene Welding and Cutting Plants.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

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

Packings, Leather, Hydraulics, Etc.
General Supply Co. of Canada, Ltd., Ottawa.
Graton & Knight Mfg. Co., Montreal.
William R. Perrin, Ltd., Toronto.
H. W. Petrie, Toronto.
Southwark Foundry & Machine Co., Philadelphia.

Packing, Rubber, etc.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Pans, Lathe.
Cleveland Wire Spring Co., Cleveland

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

Paper Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.
Can. Sirocco Co., Ltd., Windsor, Ont.

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

Patent Solicitors.
H. J. S. Dennison, Toronto.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.
Ross Thomson & Co., Ottawa, Ont.
Harold Shipman & Co., Ottawa.

Patterns
Galt Malleable Iron Co., Galt.
Guelph Pattern Works, Guelph.
Hamilton Pattern & Foundry Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound, Ont.
Plessisville Foundry, Plessisville, Que.
Toronto Pattern Works, Toronto.
Wells Pattern & Machine Works, Toronto.

Patterns, Metal and Wood.
Guelph Pattern Works, Guelph, Ont.

Perforated Metals and Ornamental Iron Goods.
Canada Wire & Iron Goods Co., Hamilton.

Phosphor Bronze Castings.
Tallman Brass & Metal Co., Hamilton.

Pickling Machines
Mesta Machine Co., Pittsburgh.

Pig Iron.
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Hamilton, Ont.
Stevens, F. B., Detroit, Mich.

Pinions, Mill Cut.
Mesta Machine Co., Pittsburg, Pa
Wm. Tod Co., Youngstown, O.

Pipe Cutting and Threading Machines.
A. R Williams Machy. Co., Toronto.
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Butterfield & Co., Rock Island ,Que.
Can. Fairbanks Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
R. McDougall Co., Galt.
H W Petrie, Toronto.
Trimont Mfg. Co., Roxbury, Mass.
Williams Tool Co., Erie, Pa.

Pipe Cutters, Rolling.
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
John H. Hall & Sons, Ltd., Brantford, Ont.

Pipe Fittings.
Southwark Foundry & Machine Co. Philadelphia.

Pipe, Riveted Steel.
Toronto Iron Works, Ltd., Toronto.

Pipe Straightening Machines.
Watson-Stillman Co., Aldene, N.J.

Planer Drives, Electrical.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Niles-Bement-Pond Co., New York.

Planer Jacks.
Armstrong Bros. Tool Co., Chicago.

Planers, Standard and Rotary.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
H W Petrie, Toronto.

Planing and Shaping Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co. Montreal.
Fay & Scott, Dexter, Maine.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
H W Petrie, Toronto.

Planing Mill Exhausters.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Pliers.
Canadian Billings & Spencer, Ltd. Welland.

Pneumatic Tools
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Independent Pneumatic Tool Co., Chicago, New York.

Polishing Machines, Electric and Band.
Can. H. W. Johns-Manville Co., Toronto.

Portable Vise Stands.
New Britain Machine Co., New Britain, Conn.

Portable Steel Tool Racks.
New Britain Machine Co., New Britain, Conn.

Portable Steel Work Stands.
New Britain Machine Co., New Britain, Conn.

Power Plant Equipments.
Can. Fairbanks-Morse Co., Montreal.

Power Transmission.
Mesta Machine Co., Pittsburg, Pa.
The Smart-Turner Mach. Co., Hamilton.

Press Screw (Adjustable).
W. F. & John Barnes Co. Rockford.
Wm. R. Perrin, Ltd., Toronto.

Presses, Bench Straightening.
Toledo Machine & Tool Co., Toledo.

Presses for Shells.
Can. Boomer & Boschert Press Co., Montreal.
Can Locomotive Co., Kingston, Ont.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
Charles F. Elmes Eng. Works, Chicago
Foss & Hill Machy. Co., Montreal.
Goldie & McCulloch Co., Galt, Ont.
Mesta Machine Co., Pittsburgh.
William R. Perrin, Ltd., Toronto
H W Petrie, Toronto.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Wm. Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.
West Tire Setter Co., Rochester, N.Y.
Wood, R. D., & Co., Philadelphia.

Presses, Cam, Toggle, Eyelet
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo O.

Presses, Broaching.
E. W. Bliss Co., Brooklyn, N.Y.
Toledo Machine & Tool Co. Toledo.
Watson-Stillman & Co., Aldene, N.J.

Presses, Drop.
C. H. Banfield & Son Toronto.
E. W. Bliss Co. Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton. Canada.
Can. Boomer & Boschert Press Co., Montreal.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.

Presses, Filter.
Lymburner, Ltd., Montreal.
Wm. R. Perrin, Ltd., Toronto.

Presses, Forging.
Can. Boomer & Boschert Press Co., Montreal.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
Charles F. Elmes Eng. Works, Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Mesta Machine Co., Pittsburg, Pa.
Niles-Bement-Pond Co., New York.
Wm. R. Perrin, Ltd., Toronto.
H W Petrie, Toronto.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Wm. Tod Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.

Presses, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Charles F. Elmes Eng. Works, Chicago, Ill.
Mesta Machine Co., Pittsburg, Pa.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Wm. Tod Company, Youngstown, O
H W Petrie, Toronto.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
Wood, R. D., & Co., Philadelphia.

Presses, Pneumatic.
Toledo Machine & Tool Co., Toledo.

Presses, Power.
Baird Machine Co., Bridgeport, Conn.
Can. Boomer & Boschert Press Co., Montreal.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Can. Fairbanks-Morse Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Geo. Gorton Machine Co., Racine.
Girard Machine & Tool Co., Philadelphia, Pa.
William R. Perrin, Ltd., Toronto.
H W Petrie, Toronto.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
A. R. Williams Machy. Co., Toronto.

Presses, Scrap Baling.
Can. Boomer & Boschert Press Co., Montreal.
William R. Perrin, Ltd., Toronto.
Watson-Stillman Co., Aldene, N.J.

Presses, Spring Foot.
Baird Machine Co., Bridgeport, Conn
Toledo Machine & Tool Co., Toledo.
Brown, Boggs & Co., Hamilton, Can.

Presses, Screw.
Can. Boomer & Boschert Press Co Montreal
Wm. R. Perrin, Ltd., Toronto.

Pressure Regulators.
Can. Fairbanks Morse Co., Montreal.

Protective Paint.
Jos. Dixon Crucible Co., Jersey City.

Pulleys.
American Pulley Co., Philadelphia, Pa.
Baird Machine Co. Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
General Supply Co. of Canada, Ltd., Ottawa
D. K. McLaren Ltd., Montreal.
H W Petrie, Toronto.
Positive Clutch & Pulley Works, Ltd. Toronto.
The Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.

Pulley Machinery, Drilling and Tapping.
Can. Fairbanks-Morse Co Montreal.
Niles-Bement-Pond Co., New York.

Pumps, Air
Mesta Machine Co., Pittsburg, Pa.
Smart-Turner Mach. Co., Hamilton

Pumps, High Pressure.
Charles F. Elmes Eng. Works, Chicago
William R. Perrin, Ltd., Toronto
Smart-Turner Mach. Co., Hamilton
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Pumping Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Darling Brothers, Montreal.
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
Wm. R. Perrin Co., Toronto.
H W Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia.
Wm. Tod Company, Youngstown, O.

Pumps, all Kinds.
Can. Buffalo Forge Co., Montreal.
Charles F. Elmes Eng. Works, Chicago
Darling Brothers, Montreal.
General Supply Co. of Canada, Ltd., Ottawa.
Owen Sound Iron Works Co., Owen Sound.
William R. Perrin, Ltd., Toronto.
H W Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
Watson-Stillman Co., Aldene, N.J.

Pumps, Electrically Driven.
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
The Smart-Turner Mach. Co., Hamilton.

Pumps, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Darling Brothers, Montreal.
Smart-Turner Mach. Co., Hamilton
Southwark Foundry & Machine Co., Philadelphia.
Wm. R. Perrin, Ltd., Toronto.
Wm Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Pumps for Oiling Systems.
S. F. Bowser & Co., Fort Wayne, Ind.

Pumps, Steam.
Darling Brothers, Montreal.
Smart-Turner Mach. Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Pump Leathers.
Graton & Knight Mfg. Co., Montreal.
Southwark Foundry & Machine Co., Philadelphia.

Punches and Dies.
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton. Canada.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Scott Bros., Halifax, Eng.
Gardner, Robt., & Son, Montreal.
Globe Machine & Stamping Co.
A. B. Jardine & Co. Hespeler, Ont.
H W Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont
Toledo Machine & Tool Co., Toledo O.

Punches, Power.
John Bertram & Sons Co., Dundas.
Bliss E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton Canada.
Girard Machine & Tool Co., Philadelphia, Pa
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Punches, Pneumatic.
Jno. F. Allen Co., New York.

Punching Machines, Horizontal.
Bertrams Ltd., Edinburgh, Scotland.
John Bertram & Sons Co., Dundas.
Bliss E. W., Co., Brooklyn N.Y.
Brown, Boggs Co., Ltd., Hamilton Canada.
Long & Alstatter Co., Hamilton Ohio.
Niles-Bement-Pond Co., New York
Williams, White & Co., Moline, Ill.

Pyrometers.
Canadian Hoskins, Limited, Walkerville, Ont.
Shore Instrument & Mfg. Co., New York City
Thwing Instrument Co., Philadelphia, Pa.

Quartering Machines.
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

Ratchet Wrenches.
Wells Brothers Co., Greenfield, Mass.

Railing, Iron and Brass.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada

Rail Benders.
Niles-Bement-Pond Co., New York.

Railroad Tools.
Can. Fairbanks Morse Co., Montreal
Niles-Bement-Pond Co., New York

Railroad Tools, Hydraulic.
Watson-Stillman Co., Aldene, N.J

Rapping Plates.
Stevens, F. B., Detroit, Mich.

Ratchets.
Keystone Mfg. Co., Buffalo, N.Y.

Raw Hide Pinions.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Smart-Turner Machine Co., Hamilton, Ont.

Reamers, Adjustable.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wells Brothers Co., Greenfield, Mass.

Reamers, Bridge, Expanding and High Speed.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
H W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.

Reamer Fluting Machines.
Garvin Machine Co., New York.

Reamers, Pipe, Cylinder and Locomotive.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reaming Machines, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Reamers, Steel Taper and Self-Feeding.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford.
H W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Rebuilt Machine Tools.
New York Machy. Co., New York.

Reels.
Baird Machine Co. Bridgeport, Conn.

Rheostats.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Rivet Machines.
Buffalo Forge Co., Buffalo, N.Y.
National Machinery Co., Tiffin, O.

Rivets, Tubular, Bifurcated.
Parmenter & Bulloch Co., Gananoque.

Rivets, Iron, Copper and Brass.
Parmenter & Bulloch Co., Gananoque.

Riveters, Pneumatic, Hydraulic.

Hammer, Compression.
Alliance Machine Co., Alliance, O.
Jno. F. Allen Co., New York.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co. of Chicago, Ill.
Mesta Machine Co., Pittsburg, Pa.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
H W Petrie, Toronto.
Southwark Foundry & Machine Co., Philadelphia.
Watson Stillman Co., Aldene, N.J.

Riveting Machines, Elastic Rotary Blow.
Girard Machine & Tool Co., Philadelphia, Pa
Grant Mfg. & Machine Co., Bridgeport, Conn.
High Speed Hammer Co., Rochester, N.Y.
F. B. Shuster Co., New Haven, Conn.
Southwark Foundry & Machine Co., Philadelphia.

Rolls, Bending.
John Bertram & Sons Co., Dundas, Ont
Brown, Boggs Co., Ltd., Hamilton, Canada.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.

Rolling Mill Machinery.
Alliance Machine Co., Alliance, O.
Mesta Machine Co., Pittsburg, Pa.
Wm. Tod Co., Youngstown O.

Roofing.
Can H W. Johns-Manville Co., Ltd., Toronto.

Rotary Converters.
A. R. Williams Machy. Co., Toronto
Toronto and Hamilton Electric Co., Hamilton.

Rubbers.
L. S. Tarshis & Sons, Montreal

Rubber Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland
Can H. W. Johns-Manville Co., Ltd., Toronto.

Rules.
Brown & Sharpe Mfg. Co., Providence, R.I.
James Chesterman & Co., Ltd., Sheffield, Eng
L. S. Starrett Co., Athol, Mass.

Safety Set Screws.
Allen Mfg. Co., Inc., Hartford, Conn.

Sand Blasts.
Curtis Pneumatic Machinery Co., St. Louis, Mo

Sand Blast Systems.
Whiting Foundry Equipment Co., Harvey, Ill.

Saw Blades.
Diamond Saw & Stamping Works, Buffalo, N.Y.

Saw Tables.
Hub Machine Welding & Contracting Co., Philadelphia, Pa.

Saw Sharpening Machines.
Nutter & Barnes Co., Hinsdale, N.H.

Saw Mill Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Espen Lucas Mach. Works, Philadelphia, Pa.
Gardner, Robt. & Son, Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
National Mach. & Sup. Co., Hamilton.
H. W. Petrie, Toronto.
Plessisville Foundry, Plessisville, Que.

Saws, High-Speed, Friction.
Espen Lucas Mach. Works, Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa.
Mesta Machine Co., Pittsburg, Pa.
Nutter & Barnes Co., Hinsdale, N.H.

Saws, Inserted Tooth.
Espen Lucas Mach. Works, Philadelphia, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hack.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
H. W. Petrie, Toronto.
L. S. Starrett Co., Athol, Mass.

Saws, Circular Metal.
Espen Lucas Mach. Works, Philadelphia, Pa.
Hub Machine Welding & Contracting Co., Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hot and Cold.
Hunter Saw & Machine Co., Pittsburg, Pa.
Mesta Machine Co., Pittsburgh.
Nutter & Barnes Co., Hinsdale, N.H.

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

Scrap Iron.
L. S. Tarshis & Sons, Montreal.

Screw Machine Products.
Wallace, Barnes Co., Bristol, Conn.

Screw Machines, Hand, Automatic.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
A. B. Jardine & Co., Hespeler.
Motch & Merryweather Machy. Co., Cleveland, O.
National Mach. & Sup. Co., Hamilton.
New Britain Machine Co., New Britain, Conn.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
Windsor Machine Co., Windsor, Vt.

Screw Machines, Multiple Spindle.
New Britain Machine Co., New Britain, Conn.
Windsor Machine Co., Windsor, Vt.

Screw Plates.
Butterfield & Co., Rock Island, Que.
Can. Tap & Die Co., Galt, Ont.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Wells Brothers Co., Greenfield, Mass.
Wiley & Russell Co., Greenfield, Mass.

Screw Slotters.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Set Screws, Safety.
Allen Mfg. Co., Hartford, Conn.

Second-Hand Machinery.
New York Machinery Co., New York.
Gardner, Robt. & Son, Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Gardner, Robt. & Son, Montreal.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.
Union Drawn Steel Co., Hamilton.

Shanks, Straight and Taper.
Jacobs Mfg. Co., Hartford, Conn.

Shapers.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canada Machy. Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Hendey Machine Co., Torrington, Ct.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
H. W. Petrie, Toronto.

Shafting.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Mesta Machine Co., Pittsburg, Pa.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.

Sharpening Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

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

Shearing Machines, Angle Iron, Bar and Gate.
John Bertram & Sons Co., Dundas.
Bertrams, Ltd., Edinburgh, Scotland.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler.
Long & Alstatter, Hamilton, Ohio.
Mesta Machine Co., Pittsburg, Pa.
Niles-Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
Toledo Machine & Tool Co., Toledo.
Williams, White & Co., Moline, Ill.

Shears, Power.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown Boggs Co., Ltd., Hamilton, Canada.
Buffalo Forge Co., Buffalo, N.Y.
Girard Machine & Tool Co., Philadelphia, Pa.
Mesta Machine Co., Pittsburg, Pa.
National Machy. Co., Tiffin, Ohio.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
H. W. Petrie, Toronto.
Toledo Machine & Tool Co., Toledo.

Shears, Lever, Hydraulic.
Mesta Machine Co., Pittsburg, Pa.
Watson Stillman Co., Aldene, N.J.

Shears, Pneumatic.
John F. Allen Co., New York.
Toledo Machine & Tool Co., Toledo, Ohio.

Shears, Squaring.
Brown, Boggs, & Co., Hamilton, Can.

Sheet Metal Working Tools.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Sheet Metal Stampings.
Duncan Electrical Co., Montreal.

Shell Banding Machines, Hydraulic.
Wm. Cramp & Sons Ship & Engine Bldg. Co., Philadelphia, Pa.
Can. Locomotive Co., Kingston, Ont.
Goldie & McCulloch Co., Galt, Ont.
Lymburner, Ltd., Montreal.
Motch & Merryweather Machy. Co., Cleveland, O.
Watson-Stillman Co., Aldene, N.J.
West Tire Setter Co., Rochester, N.Y.

Shell Horsling Machinery
Beath W. D. & Son, Toronto.

Shell Lathes.
Barrett Machine Tool Co., Meadville, Pa.
Garlock-Machinery, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Kellogg & Co., Toronto.
H. W. Petrie, Toronto.

Shell Manufacturing Tools.
Amalgamated Machinery Corporation, Chicago, Ill.
Frank Toomey, Inc., Philadelphia, Pa.
Garlock Machinery, Toronto.
New York Machinery Exchange, New York.
Hill, Clarke & Co. of Chicago.
H. W. Petrie, Toronto.

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.

Sherardizing.
Chambers, Ltd., Toronto.

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.
Armstrong Bros. Tool Co., Chicago.

Sirens, Electric.
Lintz-Porter Co., Toronto.
Sheldons, Ltd., Galt, Ont.

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

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

Smokestacks.
MacKinnon, Holmes Co., Sherbrooke, Que.
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.
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Vulcan Crucible Steel Co., Aliquippa, Pa.

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

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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.

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