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CANADIAN MACHINERY AND MANUFACTURING NEWS

A Weekly Newspaper Devoted to the Mechanical, Power, Foundry and Allied Fields.

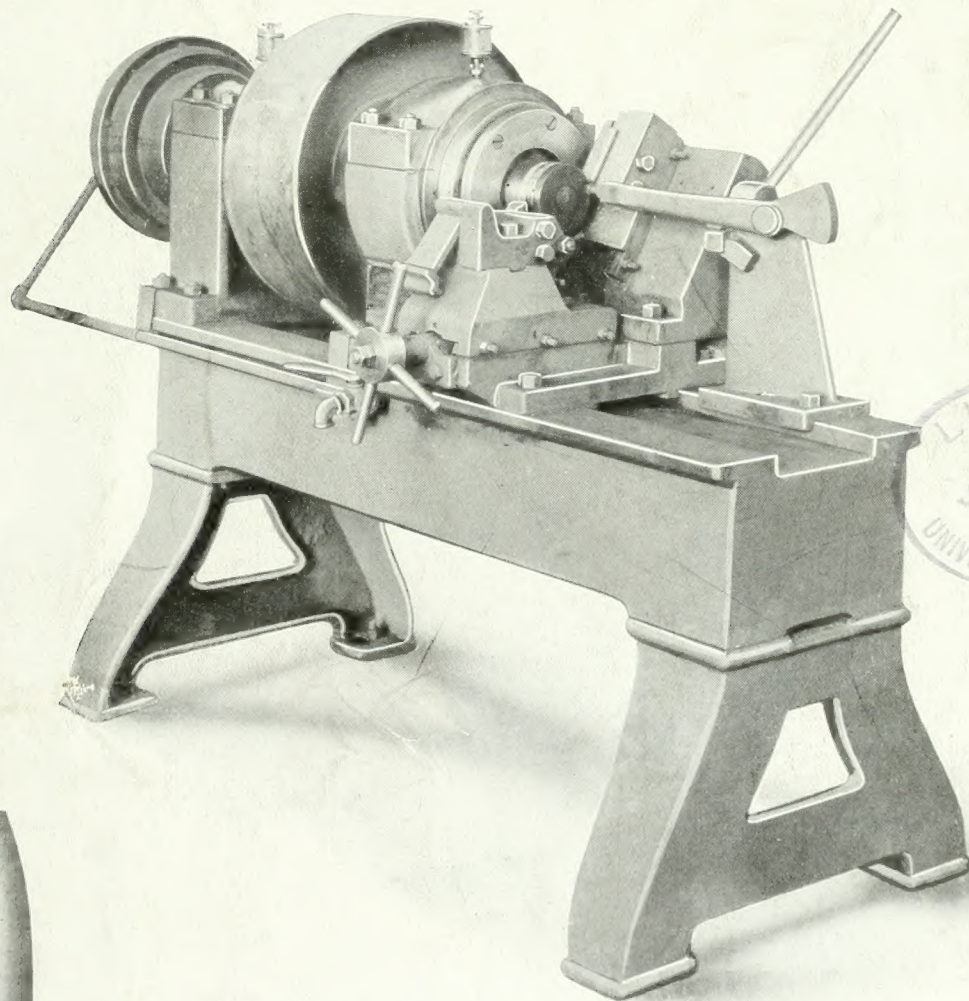
Vol. XIV.

PUBLICATION OFFICE, TORONTO, SEPT. 2, 1915

No. 10

COPPER BAND TURNING LATHES

The success of our Single Purpose Lathe for finishing the Copper Bands on the 18-pr. Shrapnel and High Explosive Shells has led us to develop a Lathe along similar lines for turning the bands on the larger High Explosive Shells which we illustrate below. As will be noted, this Lathe Combines Rigidity and Compactness.



4.5" H.E. Shell,
Rough Band.



4.5" H.E. Shell,
Finished Band.



The Machine shown is equipped with Chuck and Friction Drive actuated by Compressed Air.

For Description and Delivery Information, Address

THE JENCKES MACHINE CO., LIMITED

Works: SHERBROOKE, QUE.; ST. CATHARINES, ONT.

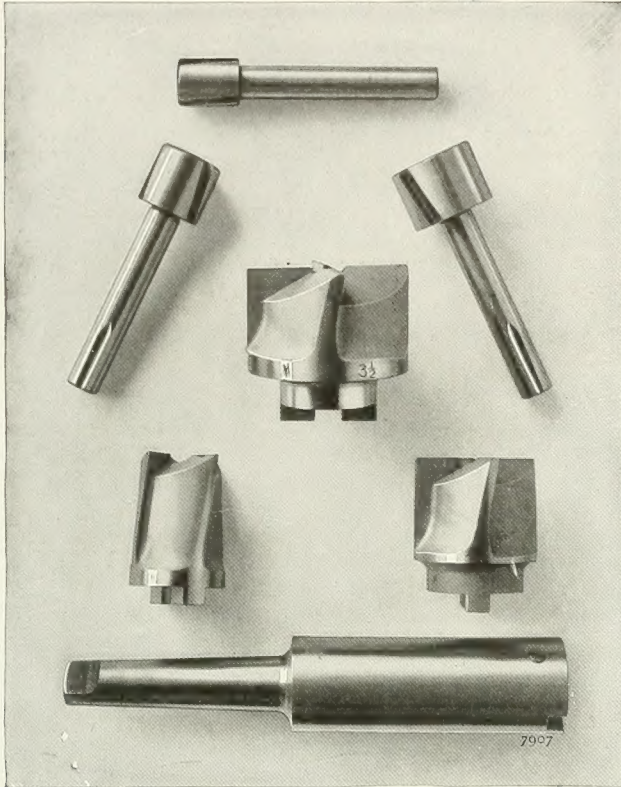
SALES OFFICES: 727 Traders Bank Bldg., Toronto; 908 E. T. Bank Bldg., Montreal; West Chester Ave., St. Catharines; Cobalt, Ont.; Exchange Bldg., Vancouver; Nelson, B.C.

The MacLean Publishing Company, Limited

MONTREAL, WINNIPEG, NEW YORK, TORONTO, CHICAGO, BOSTON, LONDON, ENG.

P
Technol
e

Make Your Own Combination



HOLDERS

End of holder is milled to receive the driving lug of the cutter and there is also a hole and set screw to accommodate the shank of the guides.

GUIDES

Are of hardened tool steel. They are held in place by means of a set screw in the holder engaging a V-slot in the shank of the guide.

CUTTERS

Can be furnished of either carbon or high speed steel.

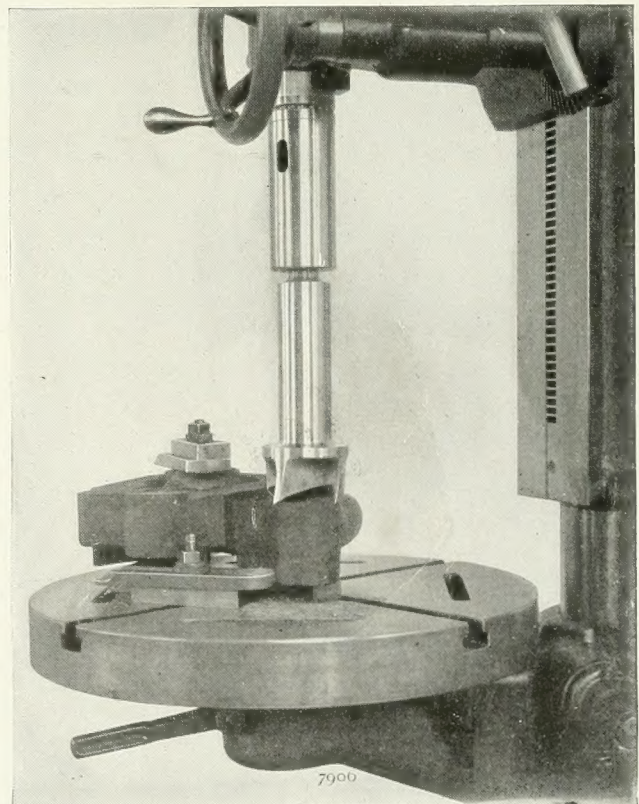
The shank of the guide passes through the hole in the cutter and the shoulder between the guide and its shank keeps the cutter in place. Cutters can be sharpened on the face and the guide is simply pushed further in the hole after grinding.

Write for catalog "Small Tools" showing our complete line.

For every counterboring job you can make immediately the right combination of holder, cutter and guide if your tool room is equipped with

P. & W. Interchangeable Cutter Counterbores

Holders, Cutters and Guides furnished in wide range of sizes.



Spot Facing
with a P. & W. Interchangeable Cutter Counterbore

Place a trial order with our nearest store.

Pratt & Whitney Company of Canada, Limited

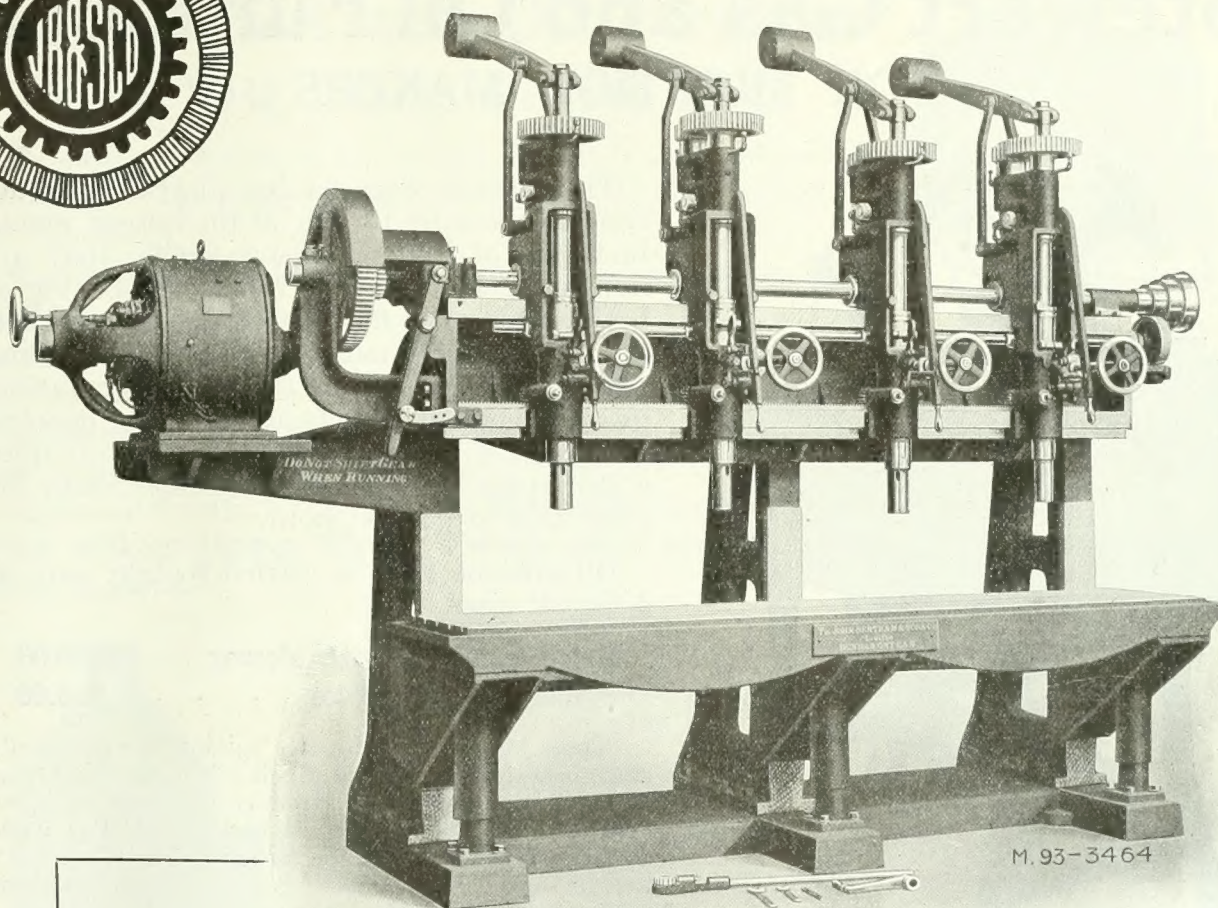
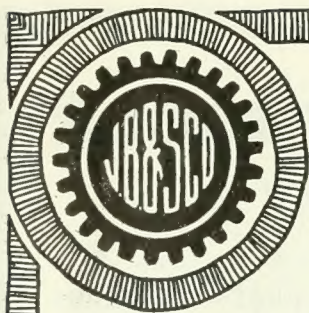
DUNDAS
Ontario

MONTREAL
723 Drummond Bldg.

WINNIPEG
Bank of Hamilton Bldg.

VANCOUVER
B.C. Equipment Co.

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



Multiple Drills

OF EVERY DESCRIPTION

Bertram Four-Spindle Multiple Drilling Machine for Locomotive and other work.

SIMULTANEOUS OR INDEPENDENT FEEDS WITH INDEPENDENT KNOCK-OFF FOR EACH HEAD AND CLUTCH DRIVE FOR EACH SPINDLE. CAPACITY, FOUR 2-INCH HOLES IN STEEL.

Drop us a line for photographs and full particulars.

The John Bertram & Sons Co.

Limited

DUNDAS

ONTARIO

CANADA

MONTREAL
723 Drummond Bldg.

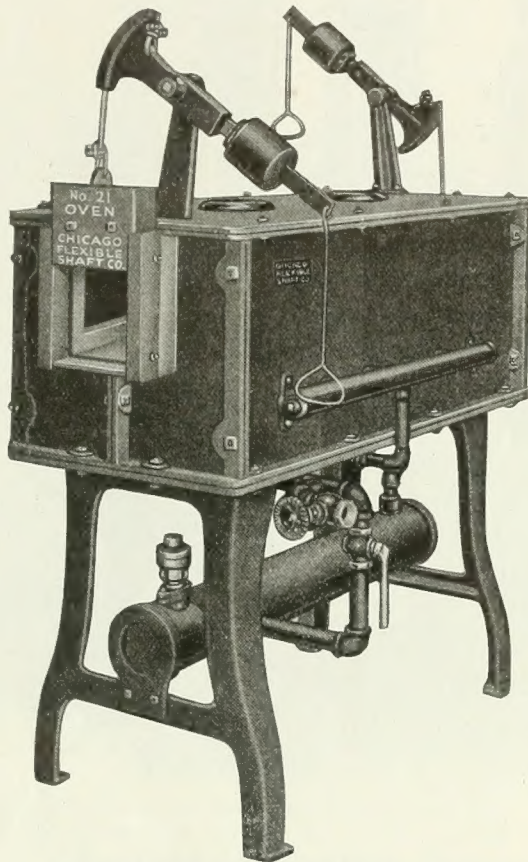
VANCOUVER
609 Bank of Ottawa Bldg.

WINNIPEG
1205 McArthur Bldg.

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

Stewart Gas and Oil Furnaces

FOR MUNITION MAKERS



STEWART SPECIAL No. 21 OVEN
For Heat Treating Brass Shells, etc.

One of our Canadian customers has a contract for 12,000,000 Charger Clips.

For economical fuel consumption and for convenience in handling he has installed three furnaces similar in appearance to the No. 25 Stewart Oven, but with opening 6" high, 18" wide and 24" deep—complete with separate blowers and pyrometers. Gas was not available at this plant, so the equipment was fitted with oil burners. The price on the furnace just named is \$160.00 and \$40.00 for the blower.

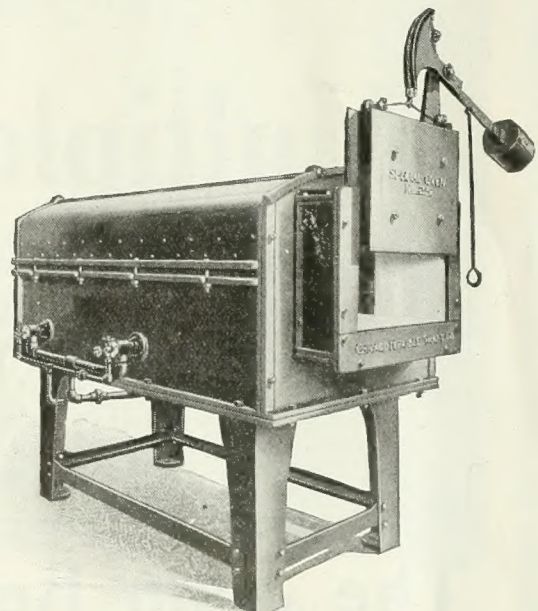
The No. 25 Oven (illustrated) has an opening 14" x 22" x 60" and the price is \$495.00 with blower, and \$360.00 without blower.

This Special Stewart No. 21 Oven was designed especially for one of the largest manufacturers of high explosive shells; they are now using 14 of them. It has an opening at both ends and is fitted with a U-shaped bottom slab (to prevent the flame from striking the work and to prevent the parts from falling into the combustion chamber). The opening is 6" high, 8" wide and 42" deep, and occupies a floor space 31" x 60", and consumes about 250 cubic feet of gas per hour.

Dimensions may be varied to take care of different sizes.

Price complete with blower - \$330.00
Price without blower - - - 265.00

There is a Stewart Furnace suitable for practically every heat-treating job and which will show a big saving in the cost of the finished product. The saving is not always shown on the cost of fuel, but if you could double your output with the same number of men at a fuel increase cost of one-half, you would still be ahead—to say nothing of the lower per cent. of spoilage.



STEWART No. 25 OVEN

Chicago Flexible Shaft Co.

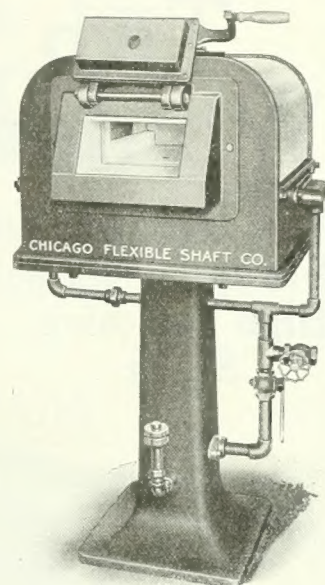
210 to 230 Ontario St., CHICAGO

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

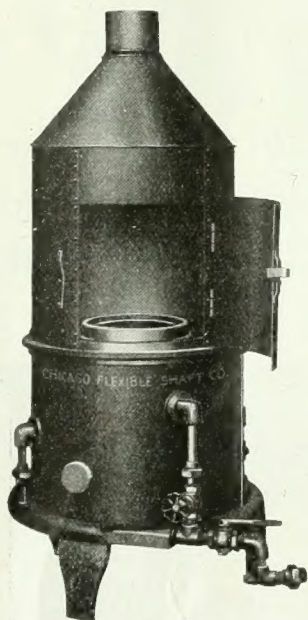
Stewart Gas and Oil Furnaces FOR THE TOOL ROOM, ETC.

To keep a plant up to its highest efficiency provision must be made for the proper hardening of its tools (high speed or carbon steel).

The Stewart No. 1 Oven has proven by most severe tests that it is equal to every occasion. The walls are 4" thick and made of a special mixture of fire clay and silica to withstand the high heats. By a Simple Central, heats may be varied from those for carbon steel to high-speed steel. The opening is 5" high by 9" wide by 13½" deep. The average gas consumption 100 cubic feet per hour. **Price with blower \$100.00. Price without blower \$75.00. Twenty-seven other sizes of ovens in stock.**



STEWART NO. 1 OVEN



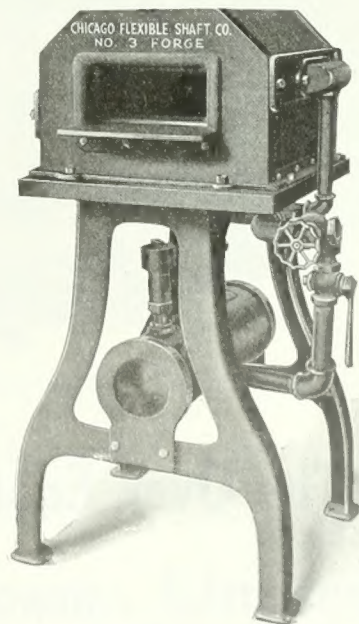
Stewart No. 10 Cyanide Furnace

The Stewart No. 10 Cyanide Furnace may be used for any sort of a bath requiring a heat under 1800° Fahr. It is fitted with a hood to carry the poisonous or offensive fumes to a flue. The pot is of pressed steel and is 8" in diameter and 10" deep, ¼" thick, allowing a quick heat. By having a number of extra pots (\$4.00 each), as many different baths as desired may be used. Lead or cyanide hardening—salts bath—oil tempering, etc.

Price with blower \$115.00
Price without blower 75.00

We have 24 other stock sizes in this type.

This Stewart No. 3 Forge is most convenient in the tool room for tool dressing, forming, shaping or bending. The front opening is 3½" x 8" and gives a heat 10" long. Rear opening 3¼" diameter (same size as front if specified.)



NO. 3 FORGE

High heats (direct) may be obtained much more quickly than in an oven and may be held indefinitely. Occupies little floor space (23" x 26") and consumes about 90 cubic feet of gas per hour. This, like all other furnaces, must operate on a positive air pressure of 1½ lbs. to the square inch, which is best supplied by a positive pressure blower.

Price with blower \$65.00
Price without blower 40.00

Send for our catalogue No. 56. Tell us your requirements and we will make recommendations.

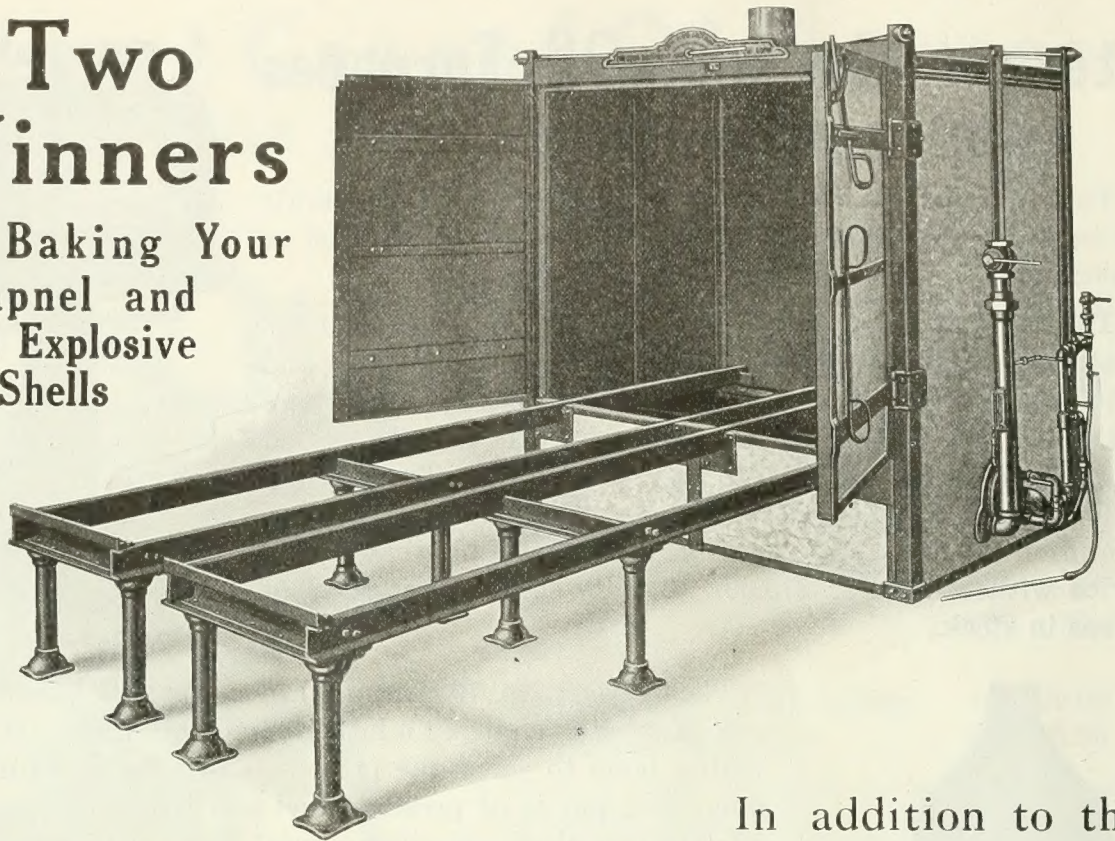
Chicago Flexible Shaft Co.

210 to 230 Ontario St., CHICAGO

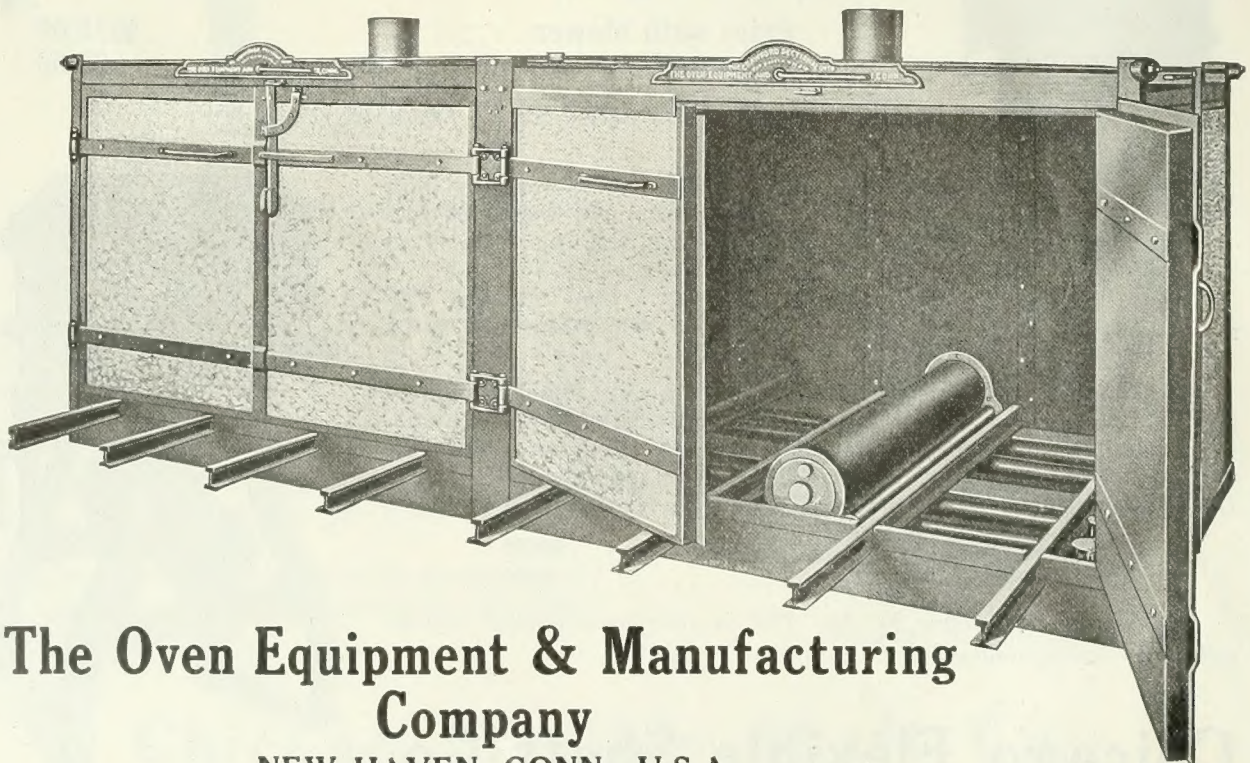
If what you want is not advertised in this issue consult the Buyers' Directory at the back.

Two Winners

for Baking Your
Shrapnel and
High Explosive
Shells



In addition to the
constructing of Special Oven Equipment we design and
build trucks suitable for handling any size of shell.



The Oven Equipment & Manufacturing Company

NEW HAVEN, CONN., U.S.A.

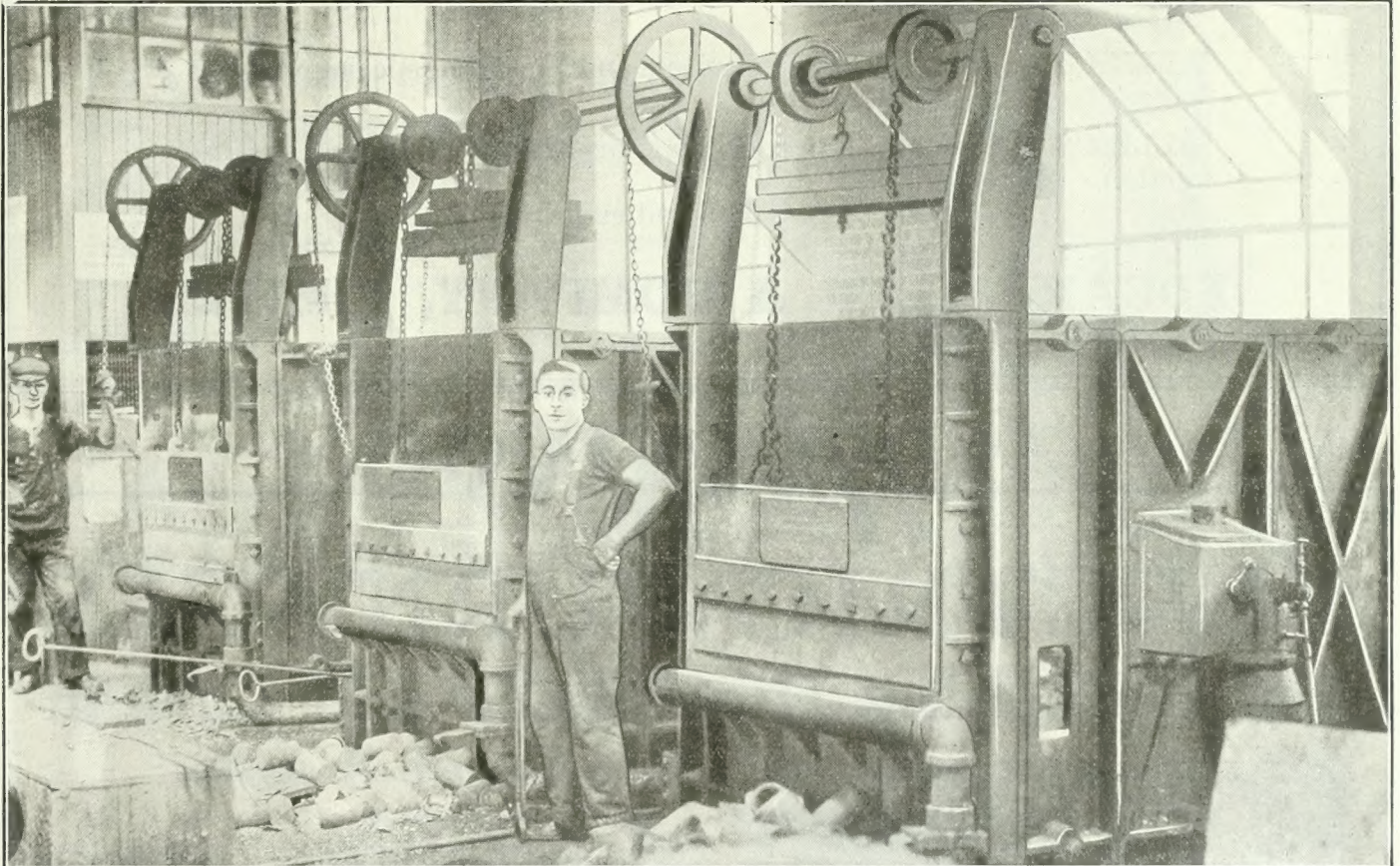
Canadian Representatives: THE A. R. WILLIAMS MACHINERY CO., LIMITED, TORONTO, CANADA

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

Heat-Treating Furnaces for **SHELL WORK**

“MECOL” FURNACES especially designed for this work
are giving entire satisfaction with **OIL,**
GAS, and other fuel

DESIGNED AND BUILT IN CANADA



Battery of our Furnaces in Operation in the Shell Shop of Canadian Vickers, Limited

- ‡ Shell, Howitzers and Cartridge Cases must be accurately HEAT TREATED for successful manufacture.
- ‡ See our Special Continuous Furnace for annealing Brass Cartridge Cases before buying your equipment.
- ‡ Largest manufacturers have them in use. Full particulars on request.

All Furnaces designed and built under personal supervision of F. DITCHFIELD, "THE FURNACE MAN."

Mechanical Engineering Company, Limited

55 COTE STREET, MONTREAL, QUE.

PHONE—MAIN 3585

The advertiser would like to know is issue consult the Buyers' Directory at the back.

ALLEN'S HIGH SPEED STEELS

IMPERIAL EXTRA SPECIAL
IMPERIAL SPECIAL
AIR HARDENING

ALLEN'S High Speed Steels are unequalled when High Cutting Speeds and Heavy Feeds are essential for obtaining maximum output at minimum cost, and are especially adapted for turning and boring **SHELLS**.

ALLEN'S Special Chrome, Vanadium and Nickel for special purposes cannot be beaten.

ALLEN'S Carbon Steels for general purposes give the greatest satisfaction.

Send your orders and enquiries to:

EDGAR ALLEN & COMPANY, LIMITED

330 St. James Street

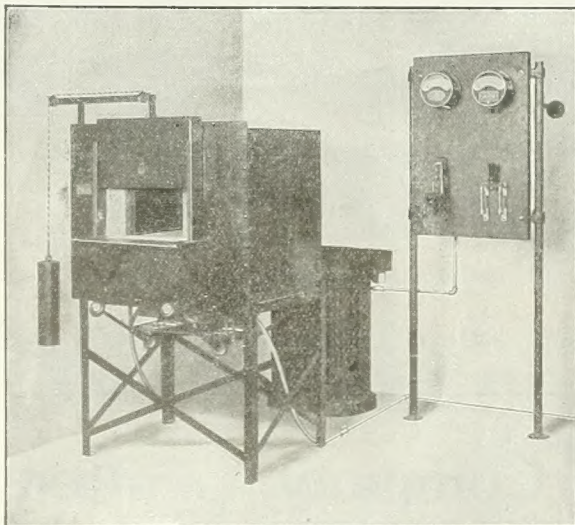
MONTREAL

HOSKINS

TRADE MARK REGISTERED

ELECTRIC FURNACES

For Hardening High-Speed and Carbon
Steel Tools



TYPE F. C. ELECTRIC FURNACE FOR
HARDENING HIGH-SPEED STEEL TOOLS.

Perfect heat control; absence of injurious gases and even temperature throughout the full furnace chamber, make it possible to increase the life of tools from 20% to 50% over those hardened in other types of furnaces.

Send for bulletin No. 10.

Canadian Hoskins Limited

Electric, Gas and Oil Furnaces and
Pyrometers.

Walkerville, Ont.

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

SAND BLASTS

Our 30"x36" machine is the ideal for cleaning shrapnel, 4.5's, cartridge clips, etc.

An economical machine operating on from 15 to 25 lbs. air pressure.

To purchasers of these machines we can also supply **DUST ARRESTERS.**

Satisfaction is the best evidence of merit—we would like to put you in touch with some of our qualified clients.



OIL BURNERS

The Gray Oil Burner is unequalled for efficiency and economy. "Made in Canada." Give them a trial.

In use by such firms as Canadian Fairbanks-Morse Co.; Jefferson Glass Co., Toronto; Canadian Allis Chalmers, Ltd., Stratford, Ont.; Russell Motor Car Co., Ltd., Toronto.

SHELL TOOLS

We are in a position to supply
Waving Attachments, Copper Banding Tools, Boring
Bar Tools, Shop Gauges, Special Chucks, Etc.

The Gray Manufacturing & Machine Co.

686-692 St. Clarens Ave., Toronto

Limited

SaBen Extra

HIGH SPEED STEEL



*The most economical and
efficient steel for
machining shells*

Manufactured by Sanderson
Bros. and Newbold, Limited,
Sheffield, England

H. A. Drury Company
LIMITED
Montreal and Toronto

Steel for Shells!

PROMPT SHIPMENT

Billets and rounds
of suitable physical
and chemical speci-
fication for forging
and turning into
shrapnel cases and
lyddite shells of any
size.

LACKAWANNA STEEL COMPANY

Standard structural shapes,
Standard heavy and light rails,
Sheared and universal mill plates,
Sheet bars, and Lackawanna
Sheet Steel Piling.

General Sales Offices: LACKAWANNA, ERIE CO., N. Y.

Canadian Correspondents:

H. A. DRURY & CO., LTD., 309 Craig St. W., MONTREAL

HIGH SPEED STEEL MAGNET STEEL

*Immediate
Delivery*

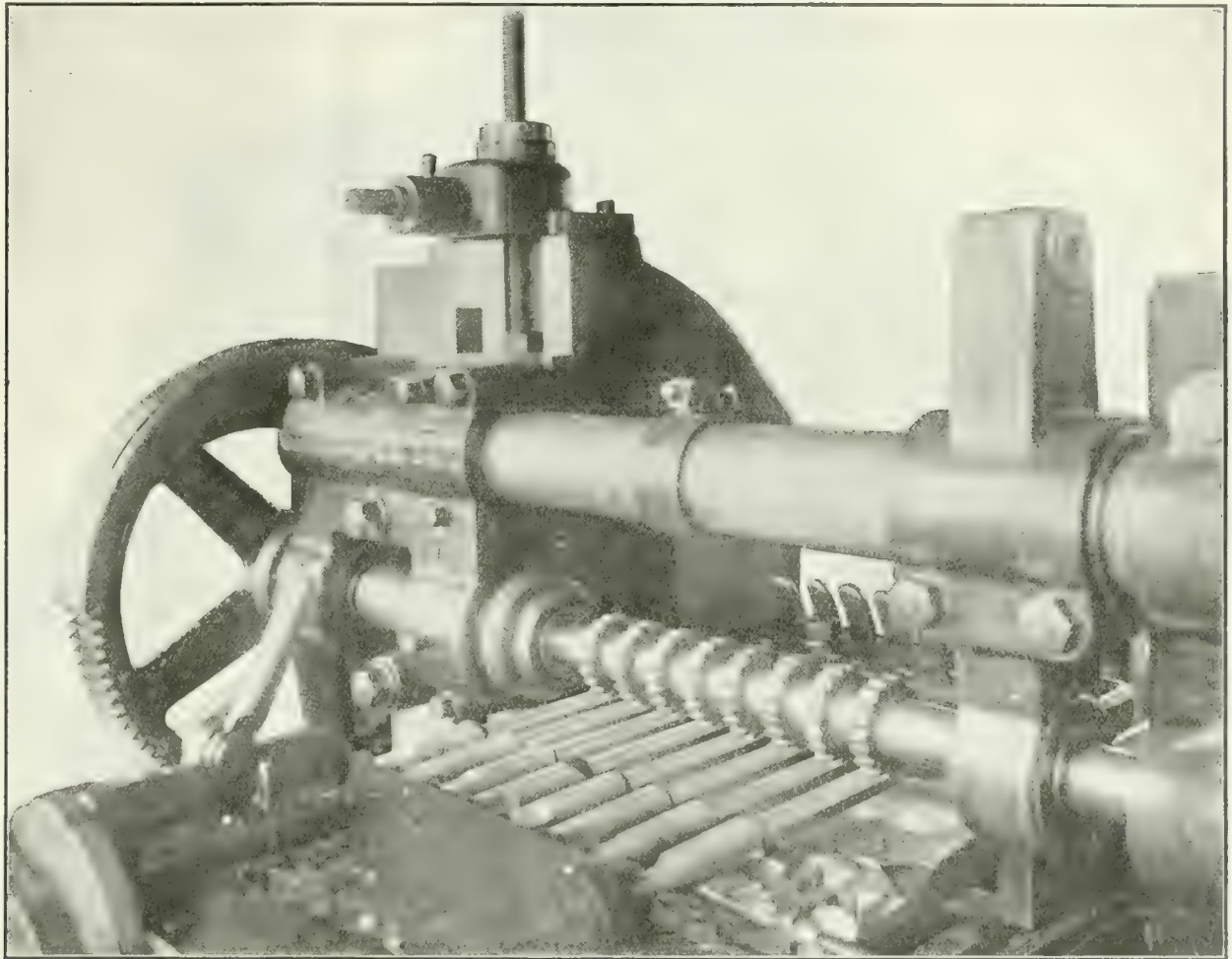
**HOT PRESS
die steel for
SHRAPNEL
forgings.**

ALL grades of ALLOY steels IN STOCK in
bars and billets.

The FAIRLEY DAVIDSON STEEL COMPANY
124 Maiden Lane, NEW YORK CITY

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

The Jewel of High-Speed Steels



Where Diamond Cuts Diamond

There are very few operations harder on tools than making high speed steel bridge reamers. The picture shows eight cutters made from "**Red Cut Cobalt**." These cutters are working at maximum speed—day after day, and have milled hundreds of Reamers without showing any appreciable signs of wear.

Many firms who were under the impression that they were getting the greatest possible efficiency with other brands, have been most agreeably surprised at the results obtained with

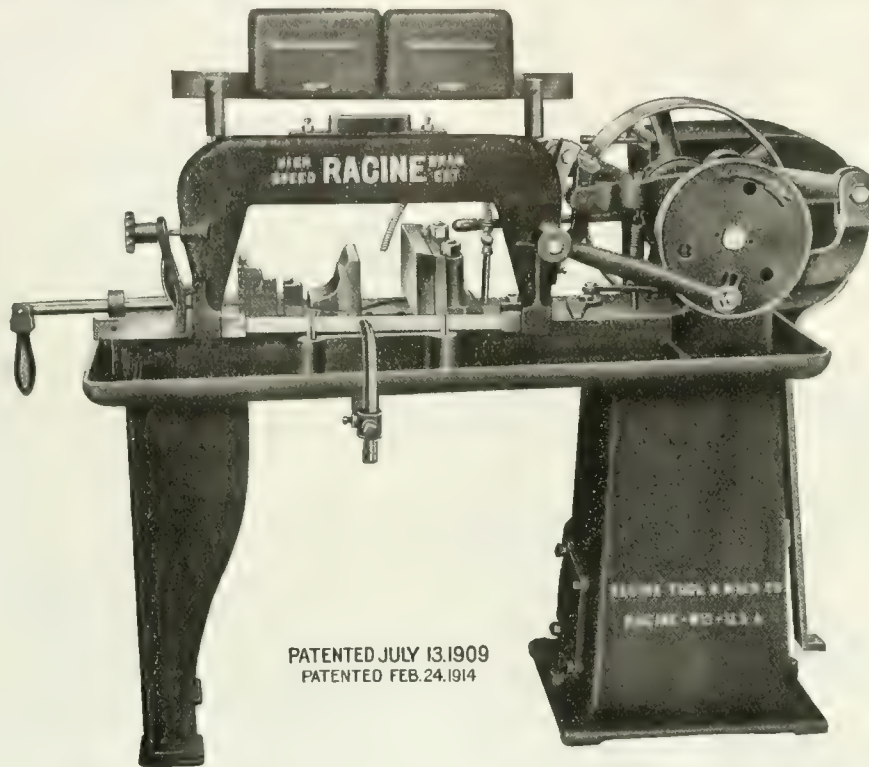
"Red Cut Cobalt"

HIGH SPEED STEEL

We invite you to investigate.

Vanadium-Alloys Steel Co., - Pittsburgh, Pa.

THE NEWLY IMPROVED RACINE HIGH SPEED METAL CUTTING MACHINE



PATENTED JULY 13, 1909
PATENTED FEB. 24, 1914

No. 2a Bull Dog Type—Eats Steel

The ORIGINAL, AUTOMATIC, POSITIVE LIFT, DRAW CUT, METAL CUTTING MACHINE.

Automatic Lifting Device.

This is accomplished by using a Patented, Return-Stroke, Automatic Lifting Device, which lifts the blade clear of the work, NO DRAGGING BACK on the non-cutting stroke, thereby increasing both the output and endurance of the blade 500 per cent.

Simplicity.

This machine has few moving parts and is very COMPACT and RIGID.

Swivel Vise.

This machine is equipped with a practical QUICK-ACTING VISE which swivels on the table bed and grips the stock close up to the saw blade, enabling the operator to cut short pieces at any desired angle.

Efficiency and Economy.

This machine is equipped with our Special 3-speed Transmission, which gives the proper speeds for cutting any kind of material (practically giving you THREE MACHINES in ONE) and cuts Faster, Truer and More Economically than any machine of

this kind on the market. We especially recommend this type for heavy, VICIOUS work.

Blade Holders.

The Blade Holders are made from a $1 \times \frac{3}{8}$ inch flat bar fitted into a milled slot which holds the blade square with the work. Therefore it must cut straight, while the BLADE TIGHTENER enables the operator to give the blade sufficient tension without the use of a wrench.

The Saw Frame Guide.

The Saw Frame Guide is made of the best grade of gray iron, which prevents SPRINGING, removing the objectionable feature of a steel guide. This guide also holds itself automatically at any height, which is very convenient when placing stock into the machine.

Cooling System.

A geared circulating pump applies a cutting compound on the blade.

Over 20 of these machines in operation in one of the largest shell factories in Toronto.
Write us for prices, or better still, come and see them doing their work.

SPECIFICATIONS

Capacity—0 to 6 in.
Bore—10 to 11 in.

Pulley— $2\frac{1}{2} \times 12$ in.
Floor Space— 21×51 in.

Height over all—38 in.
Height to top of table—22 in.

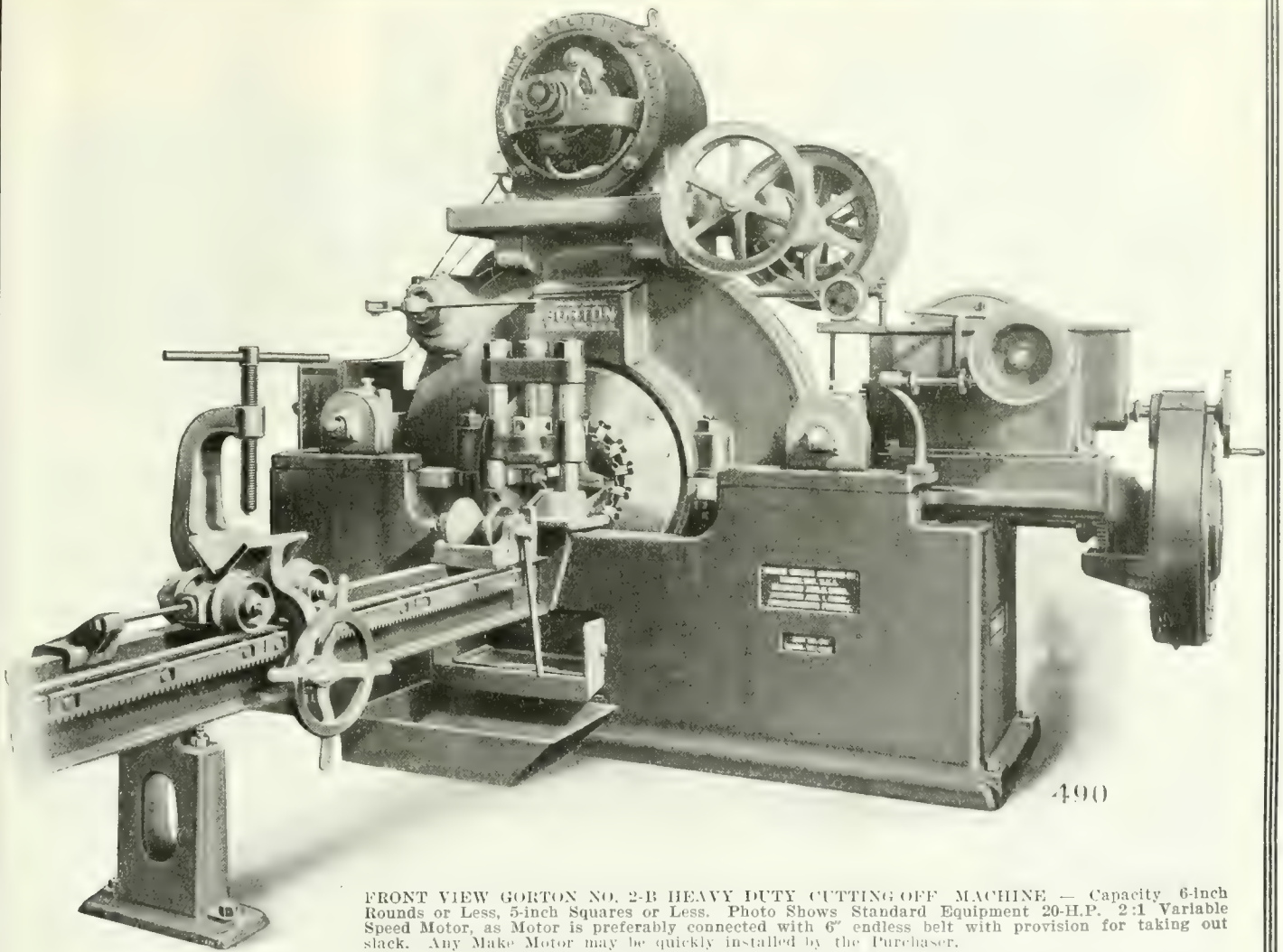
Weight (crated)—580 lbs.
Net Weight—520 lbs.

MANUFACTURED BY

RACINE TOOL & MACHINE COMPANY

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

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



FRONT VIEW GORTON NO. 2-B HEAVY DUTY CUTTING OFF MACHINE — Capacity 6-inch Rounds or Less, 5-inch Squares or Less. Photo Shows Standard Equipment 20-H.P. 2:1 Variable Speed Motor, as Motor is preferably connected with 6" endless belt with provision for taking out slack. Any Make Motor may be quickly installed by the Purchaser.

Net Weight Complete as Shown, but without Motor, 18,000 Pounds.

Code Word, Complete as Shown But Without Motor Kroudslager. (Special Catalog on request.)

Can make prompt delivery of 6" machine, as above. This is a type of machine which originated with this company, and has been very carefully developed for ten years past, and is used by all of the large steel works and by other manufacturers in the United States.

This is the only machine for shrapnel work. We are furnishing twelve to one large firm and several to each of a number of other firms.

3½" Round Shrapnel stock, when cutting bars singly, may be severed at the rate of 600 cuts per 12 hours. Arranged with special jaws to cut two bars at a time 800 to 1100 cuts can be made per 12 hours.

3¼" Square Shrapnel stock may be necked down to 1" diameter by using our rotary attachment, at the rate of 600 cuts per ten hours.

6" ordinary round steel may be cut at the rate of over 300 cuts per ten hours.

We have a 13" machine, net weight without motor, 53,000 lbs. Code word KRAAGMAN. It severs 12½" Round, Nickel Steel Armor Piercing stock at the rate of 60 cuts per ten hours, being about five times faster than any other machine obtainable. Catalog on request.

GEORGE GORTON MACHINE COMPANY

Manufacturers of Engraving Machines and Heavy Duty Cutting-off Machines

RACINE, WIS., U.S.A.

CABLE ADDRESS, "GORTON, RACINE."

Use A. B. C. Code (4th edition) or Western Union Code (Universal Edition)

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

SAWS

For Cutting Metal

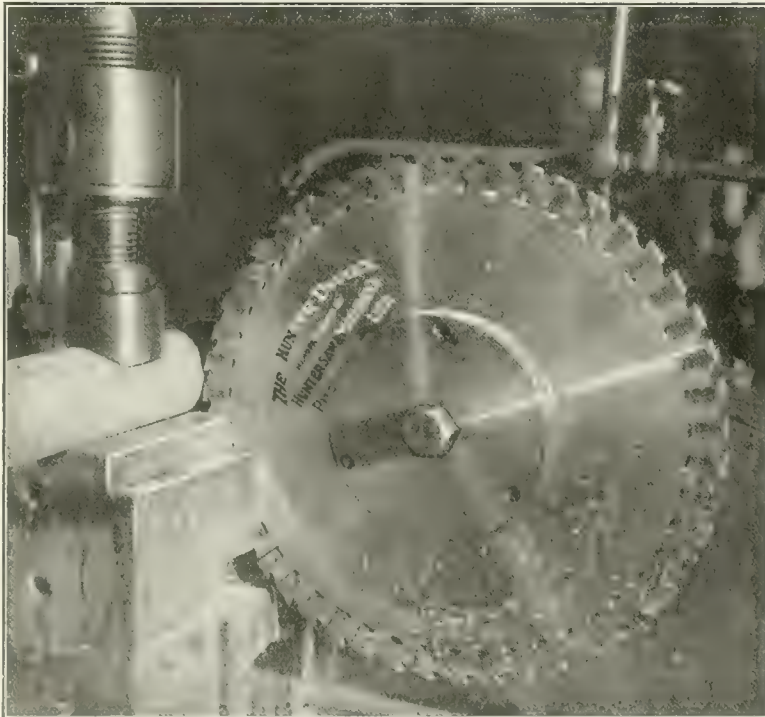
We manufacture high-speed steel, semi-high-speed steel, and carbon steel **COLD METAL CUTTING SAWS** of any desired diameter or thickness. We make a complete line of high-grade **FILES** and also manufacture the famous Non-breaking **HARD EDGE HACK SAW BLADES**. Shrapnel and war ammunition manufacturers should use the above most efficient metal cutters.

Write for prices.

SIMONDS CANADA SAW COMPANY Limited

St. Remi Street and Acorn Avenue, MONTREAL, QUE.

A Hunter "Duplex" on Shrapnel Stock



FAST GOING
on Newton Machine

Through 3½" round 60 Carbon, 70 Manganese Shrapnel Stock every

2 MINUTES

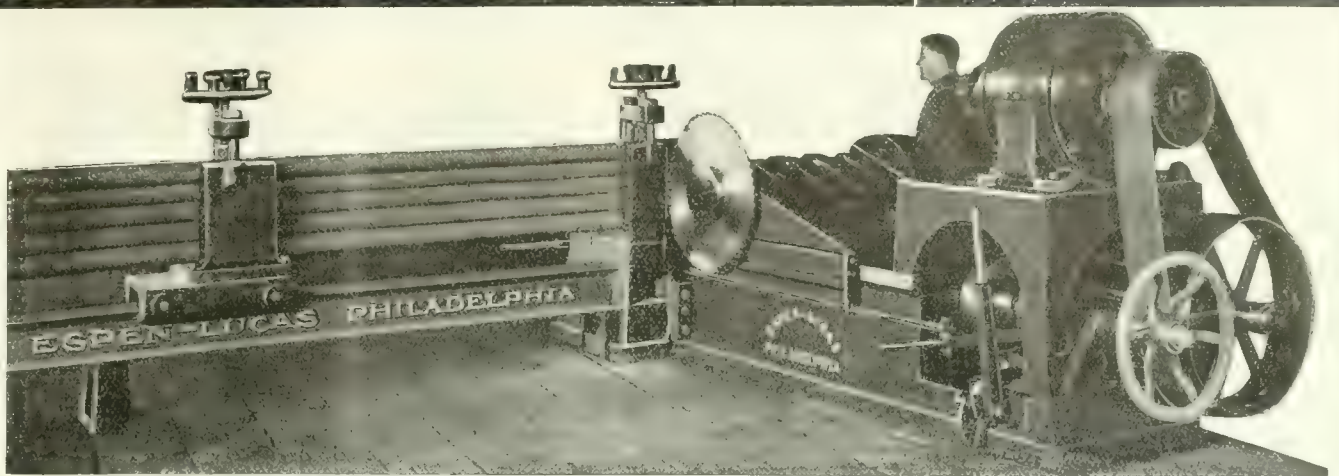
The secret of Hunter "Duplex" Saw speed is the method of holding the high speed teeth.

You can use this speed profitably—on shrapnel or any other stock.

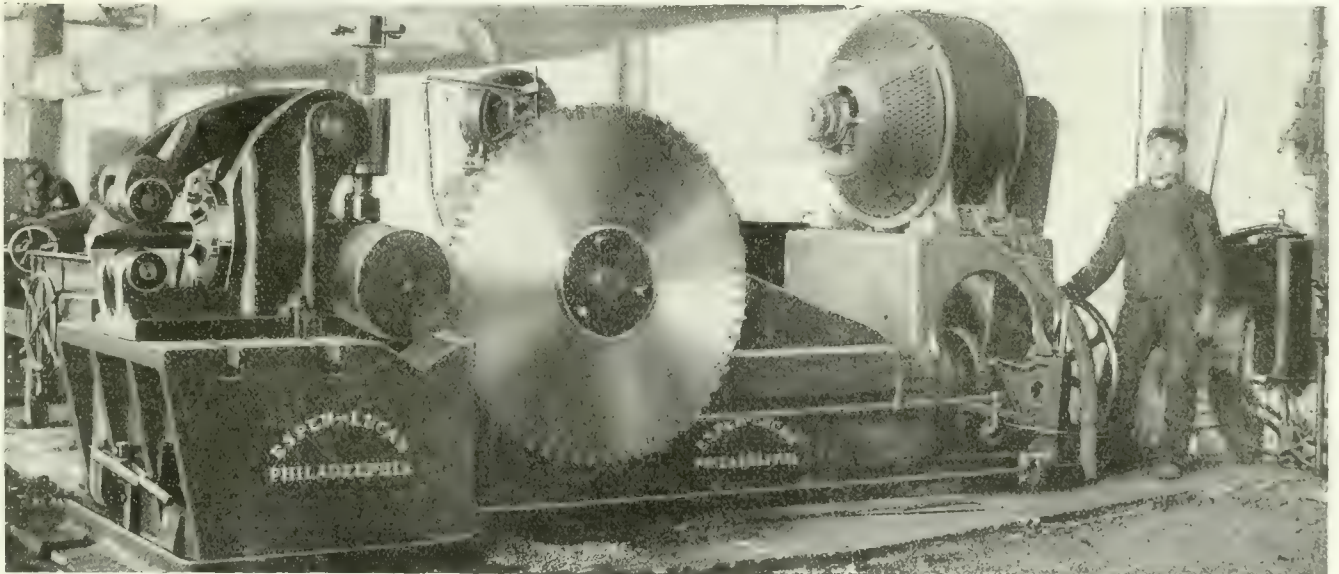
Let us send full Particulars.

HUNTER SAW & MACHINE COMPANY, Pittsburg, Pa.

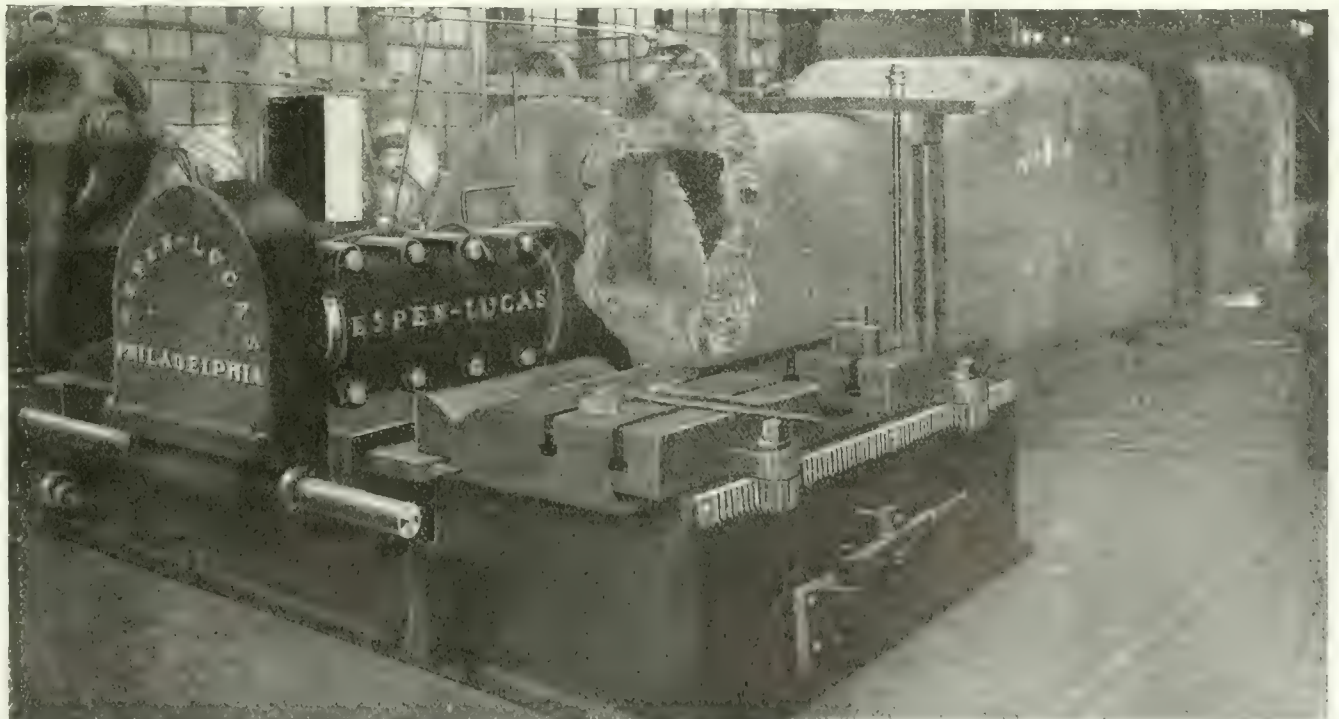
The advertiser would like to know where you saw his advertisement—tell him.



Used by all Large Shrapnel Manufacturers.



Nova Scotia Steel and Coal Co.

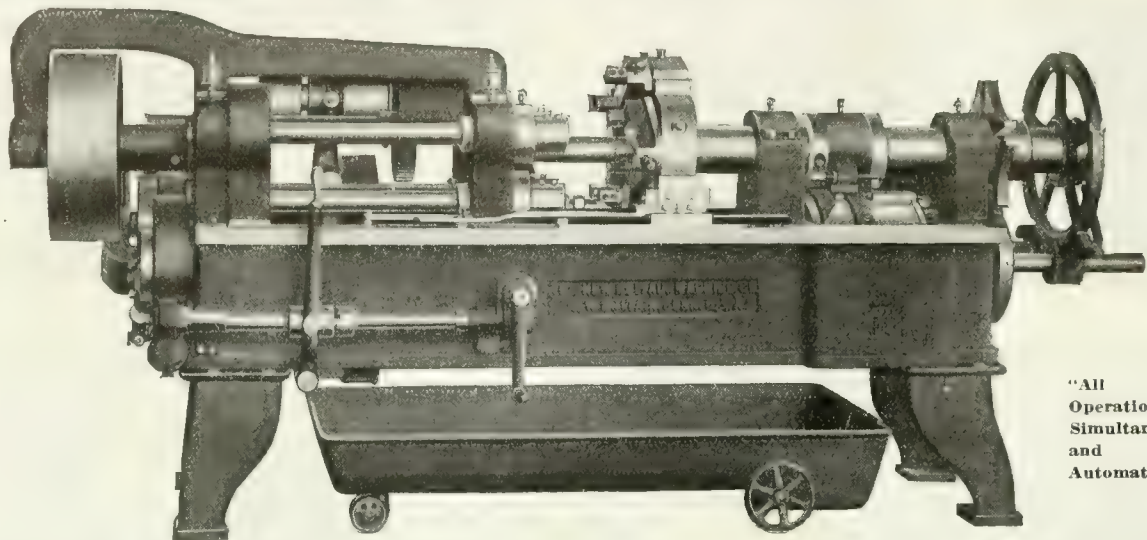


Penna. Steel Co.

THE ESPEN-LUCAS MACHINE WORKS, FRONT & GIRARD AVENUE, PHILADELPHIA, PENNA., U.S.A.

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

HIGH EXPLOSIVE SHELL WORK



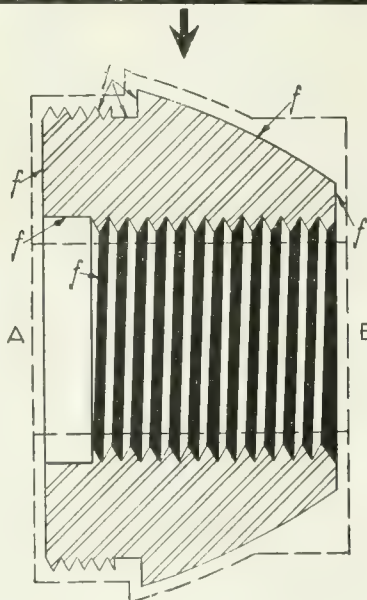
"All Operations Simultaneous and Automatic!"

28 HIGH EXPLOSIVE SHELL HEADS PER HOUR!

Labor Cost:
1 CENT A PIECE

This High Explosive Shell Head is machined complete at *two settings* in Size 24 Automatic Four-Spindle Single-Head Chucking Machine.

Outline of rough forging is indicated by dotted line on drawing.



Material:
STEEL FORGING

Operations

End A—Turned, Undercut, Faced, Counterbored, and Threaded at the rate of 65 pieces per hour.

End B — Rough Formed, Faced, Bored, Countersunk and Tapped while held on threaded arbors, at the rate of 50 pieces per hour.

Perfect concentricity of work produced on "New Britain" Automatic Chucking Machines is assured by reason of the fact that all operations about a common center on one end are performed at *one setting*. This is a feature of prime importance in the production of interchangeable parts, and accounts for the general use of "New Britain" Automatics by manufacturers in all lines.

Single-Head Machines in Four Sizes

These machines are adapted for all chuck work—whether castings, forgings or second operations on bar jobs—and will increase production three to ten times over that obtainable by other methods. Guaranteed production estimates submitted upon receipt of samples or blue-prints.

Double-Head Machines in Three Sizes

Catalog on request.

The New Britain Machine Company

Automatic Screw and Chucking Machines
NEW BRITAIN, CONN., U.S.A.

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

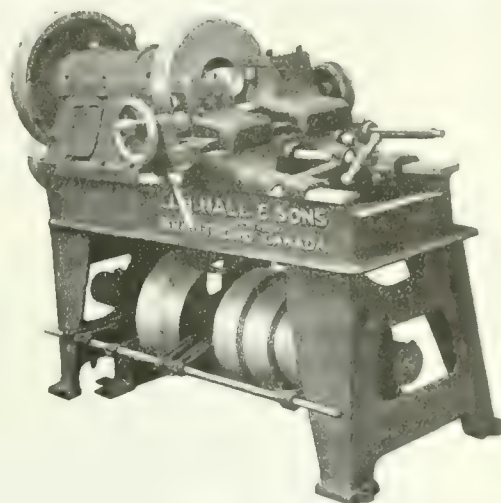
HALL

Shell Cutting-off and Facing Machines

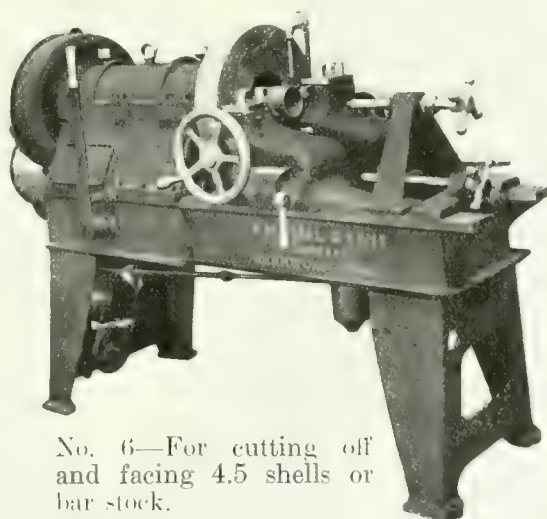
FOR SHELLS, BAR STOCK, INGOTS

HIGH SPEED, HEAVY DUTY

The new conditions imposed in the manufacture of Shells necessitated a new type of machine. This was successfully developed and we are now fulfilling all the important requirements of manufacturers in *cutting Shrapnel Stock, Bar Stock, Ingots, finishing the base of Shells and facing-off the plugs*. Satisfaction is the proof of good usage. This is the evidence we have from manufacturers all over the Dominion.



No. 4—For cutting off and facing shrapnel or for bar stock.



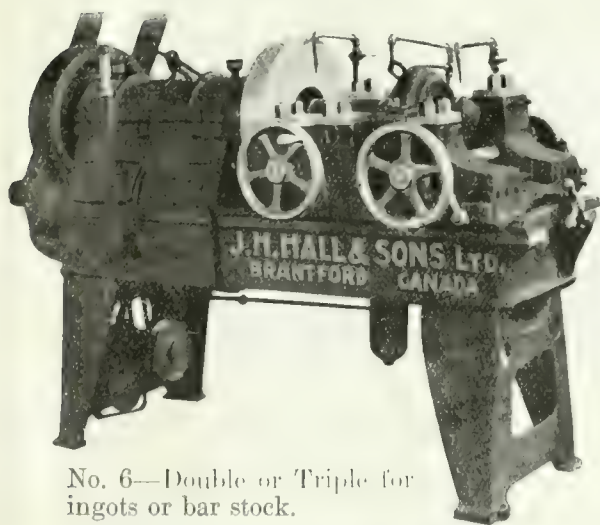
No. 6—For cutting off and facing 4.5 shells or bar stock.

After the shells are forged you need a "Hall" machine to get the required lengths.

After the Shells are bored and tested for wall thickness, etc., you need a "Hall" for finishing the base.

The projecting ends of the plugs must be faced off and "Hall" Machines are wonderfully adapted for this work also.

If you will write us for prices and further particulars we can go more closely into details and tell you the nearest point at which you can see one of these machines in operation.



No. 6—Double or Triple for ingots or bar stock.

John H. Hall & Son, Limited

Brantford, Canada

PIERCING, DRAWING, FORGING, CUPPING PRESSES

HYDRAULIC and STEAM-HYDRAULIC TYPES



OUR LONG EXPERIENCE
in designing and building
this class of machinery,
and our

**UNEQUALLED
FACILITIES**

enable us to make

QUICK DELIVERIES

on all types and sizes
of Presses, Accumulators,
Hydraulic Valves,
Etc.



MESTA MACHINE COMPANY

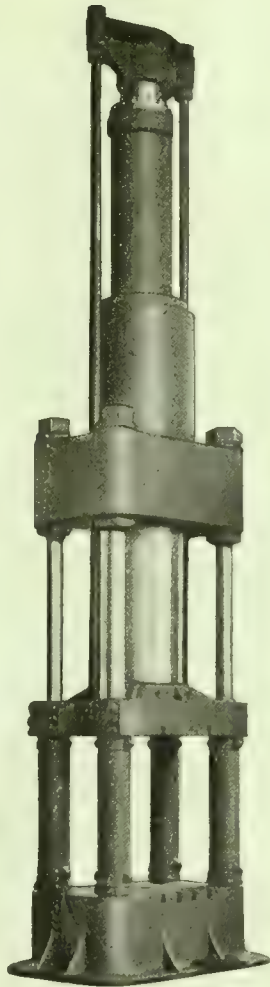
PITTSBURGH, PA., U. S. A.

DESIGNERS AND BUILDERS OF

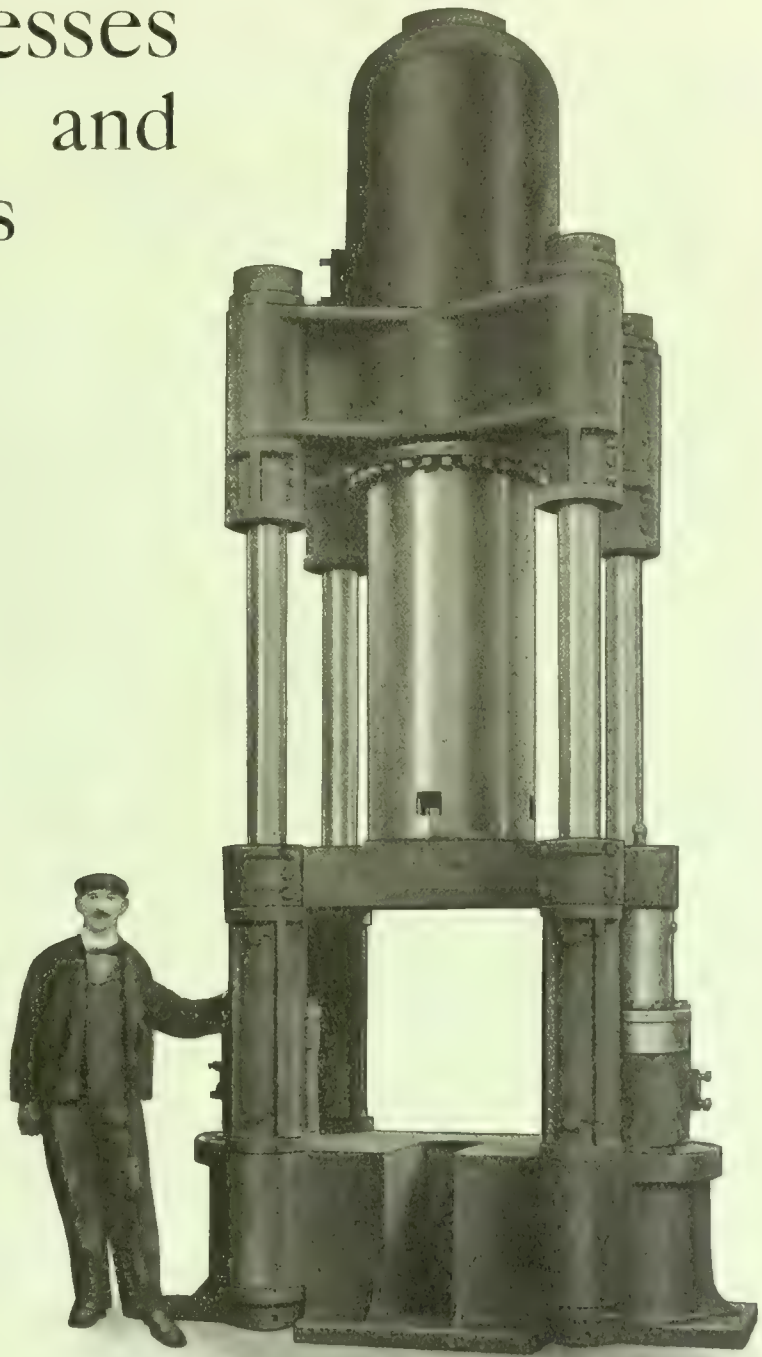
GAS AND STEAM ENGINES, ROLLING MILL MACHINERY, PRESSES, ACCUMULATORS, SHEARS, SAWS,
GEARS, PINIONS, ETC.

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

Forging Presses for Shrapnel and 4.5 Shells



150 and 200 Ton
Hydraulic Press for
Shrapnel



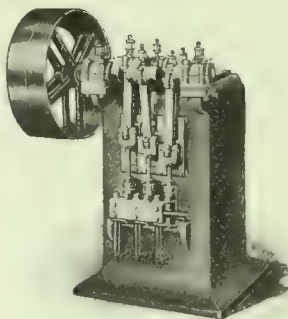
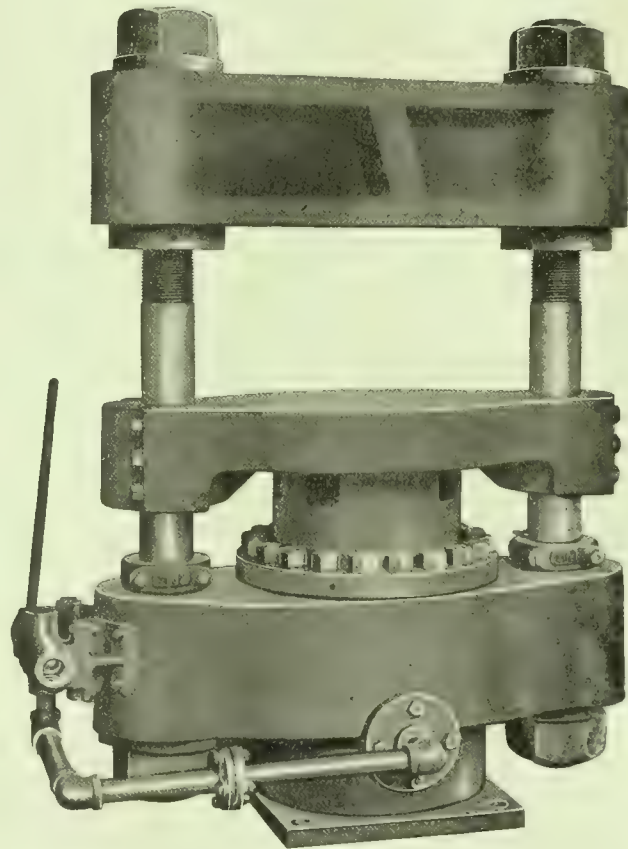
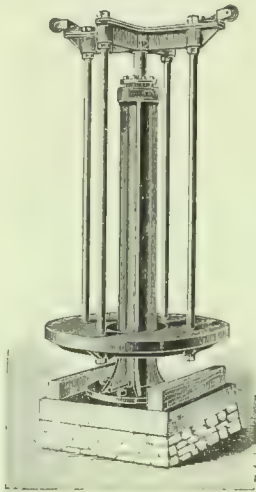
350 Ton Hydraulic Press
for 4.5 Shells

Full Specifications and Prices
sent upon request.

Canadian Boomer & Boschert Press Company, Limited
18 TANSLEY ST. *Cable Address: "PRESSCO"* MONTREAL

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

Complete Equipment for Nosing 4.5 and 60 pound Shells

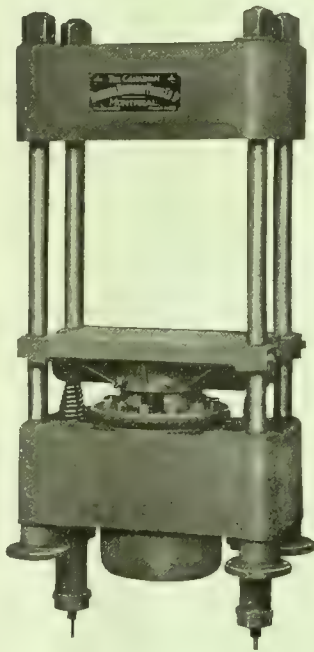


Full specifications and quotations sent
upon request.

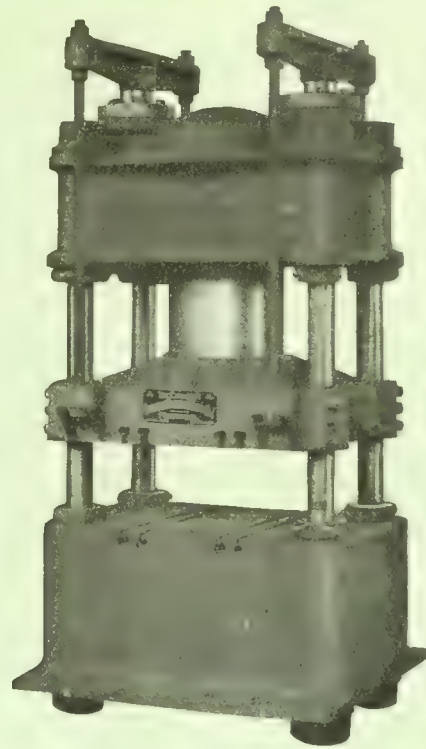
Canadian Boomer & Boschert Press Company, Limited
18 TANSLEY ST. *Cable Address: "PRESSCO"* MONTREAL

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

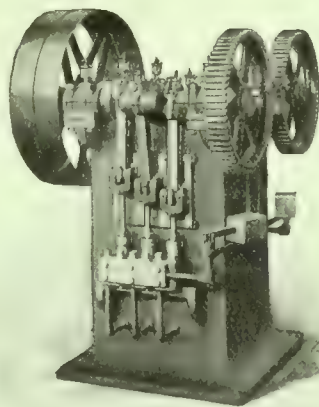
A Complete Line of Canadian-Made Machinery for Forging Shells of all Sizes, and Accessories



Shrapnel Nosing Press



150-Ton Disc Press



Double Triplex Power Pump

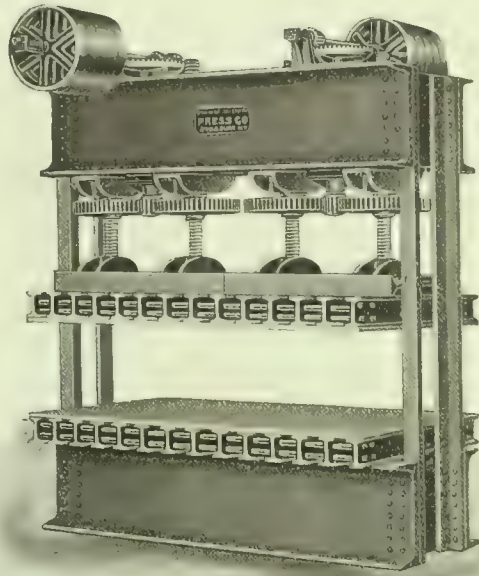
Hydraulic
Pumps and Accumulators
All Styles and Sizes

Press
Operating Valves,
Fittings, Etc.

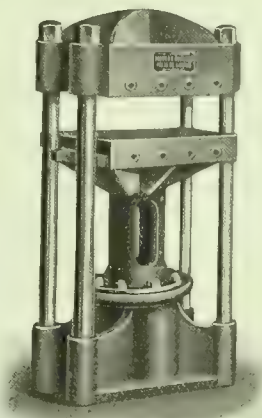
Canadian Boomer & Boschert Press Company, Limited
18 TANSLEY ST. *Cable Address: "PRESSCO"* MONTREAL

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

We Manufacture a Full Line of Presses for all Purposes where Pressure is Required



Veneer Press



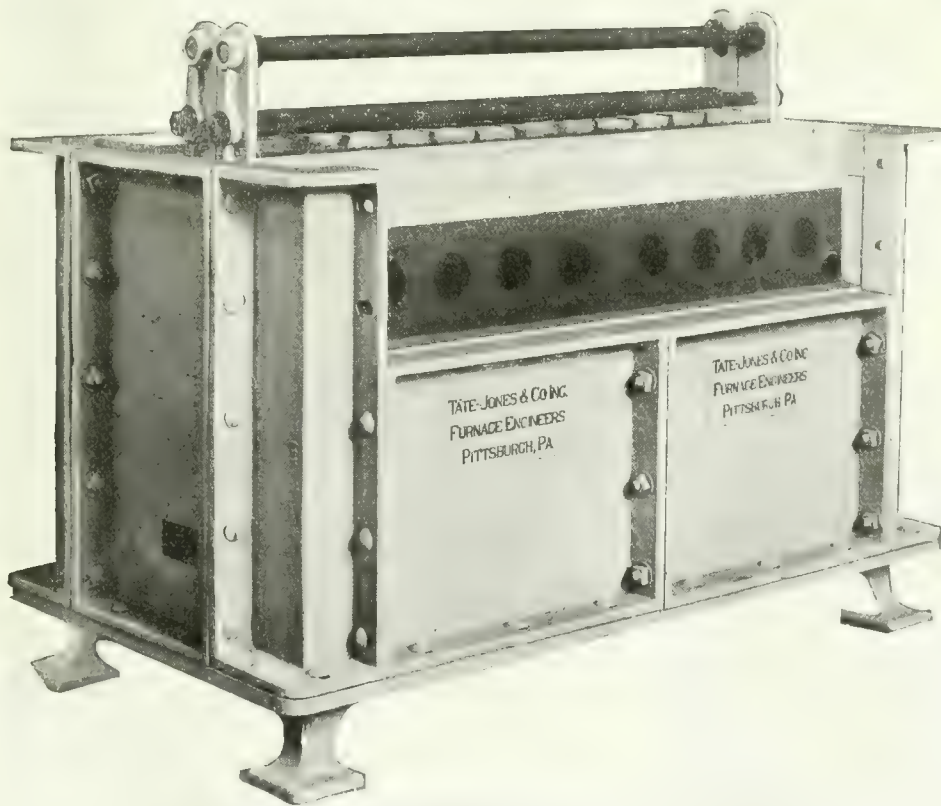
Steam Plate Press

Veneer Presses
 Vulcanizing Presses
 Packing House Presses
 Tannery Presses
 Belting Presses
 Baling Presses
 Forging Presses
 Pulp Presses

Hydraulic Pumps,
 Accumulators, Valves,
 Fittings, Etc., Etc.

Canadian Boomer & Boschert Press Company, Limited
 18 TANSLEY ST. Cable Address: "PRESSCO" MONTREAL

FOR NOSING
LYDDITE SHELLS
USE
TATE-JONES FURNACES



TATE-JONES FURNACE FOR 4.5 SHELLS

Are the furnaces you are using giving you maximum OUTPUT for the amount of fuel burned and the floor space occupied?

Correctly designed furnaces will maintain your output and reduce your fuel consumption.

Tate-Jones furnaces for all forging and heat-treating operations on Shells, and Tate-Jones continuous furnaces for the annealing of cartridge cases will give you maximum output and reduce your fuel consumption.

TATE-JONES & COMPANY, Inc., PITTSBURGH, PA.
FURNACE ENGINEERS

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

Nova Scotia Steel and Coal Company, Ltd.

BEG TO ANNOUNCE

That their new Steam-hydraulic Forge Shop is now in operation, as also is their recently installed "Harmet" Fluid Compression Plant.

These improvements bring "Scotia's" Equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes, made of Best Ordinary or Fluid Compressed Open-hearth Steel, and satisfying the most severe specifications.

For prices and particulars apply to

**Western Sales Office, Room 14, Windsor Hotel, Montreal, Que., or
Head Office, New Glasgow, Nova Scotia**

STEEL CASTINGS

WE MANUFACTURE
Adamantine, Chrome, Manganese and Nickel Steel Castings
ANNEALED AND UNANNEALED
NONE TOO LARGE FOR US TO HANDLE.

MACHINE MOULDED GEARS

Any size up to 18 feet in diameter,
without the use of patterns.

Hull Iron & Steel Foundries
LIMITED

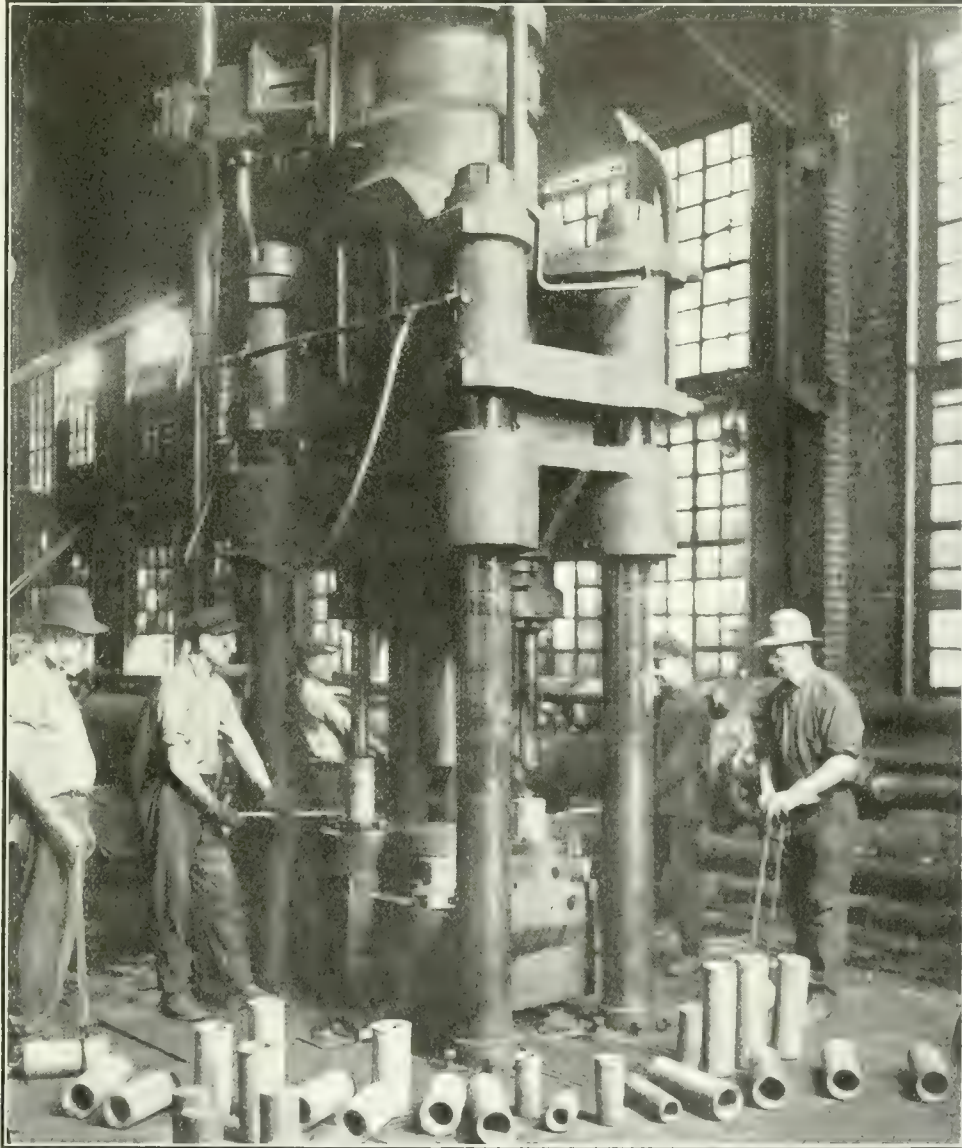
Head Office and Works at HULL, P. Que.
Branch Office at Montreal, P. Que.

TRADE MARK



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

PURELY HYDRAULIC "Extra Rapid" Forging Presses



Purely Hydraulic Tod Presses for Piercing and Drawing of Shells and Projectiles
WE CAN SUPPLY FORGED SHELL BLANKS UP TO 8 in. DIAMETER

The William Tod Company

YOUNGSTOWN, OHIO

ENGINES—Mill, Reversing, Blowing, Gas, Pumping
ROLLING MILLS—CONDENSERS—HYDRAULIC FORG-
ING PRESSES, IRON AND BRASS CASTINGS

SOUTHWARK

HYDRAULIC MACHINERY

For All Purposes

Presses, Pumps, Riveters,
Accumulators, Cranes,
Hoists, Intensifiers, Jacks,
Leather Packings, Pipe
Fittings, Gauges, Valves,
Etc., Etc.

Other Southwark Products

Centrifugal Pumps.

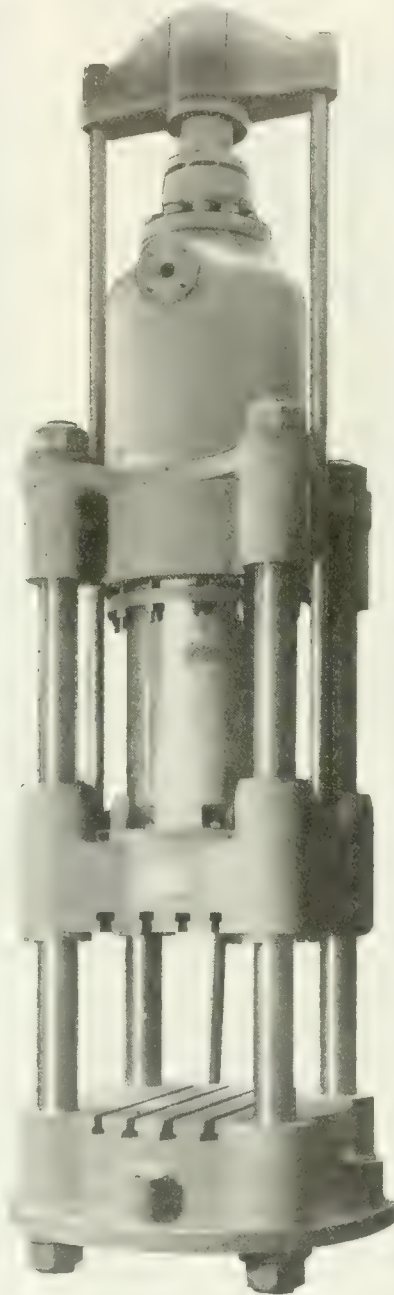
Turbo Generators for
Direct and Alternating
Current.

Turbo Blowers.

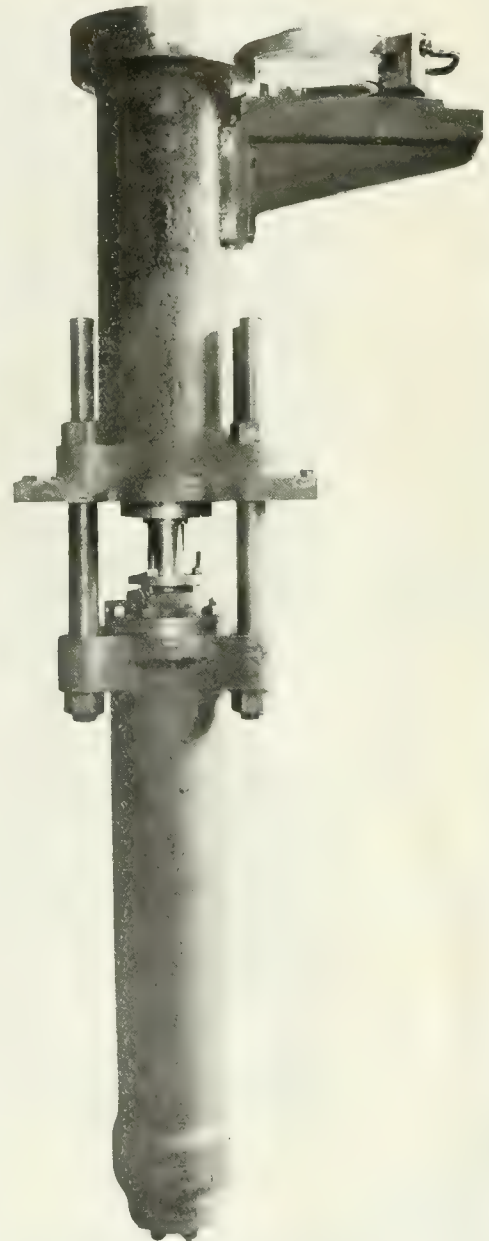
Turbo Pumps.

Surface and Jet Condensers
with their Auxiliaries.

Southwark-Harris Valveless
Oil Engine. For
Marine and Stationary
use—Built in sizes up to
1500 B. H. P.



350-Ton
Shell Piercing and Forging Press



8-inch Powder Press

Southwark Foundry & Machine Company

PHILADELPHIA

Founded 1836

Old Colony Building, Chicago

Brown-Marx Building, Birmingham

"First Builders of Large Centrifugal Pumps in America."

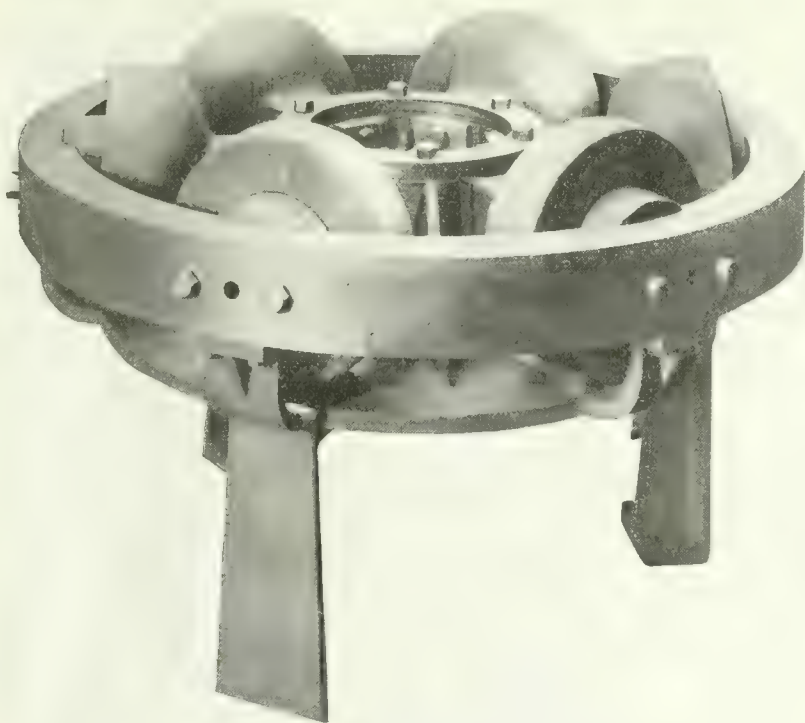
The advertiser would like to know where you saw his advertisement—tell him.

SOUTHWARK

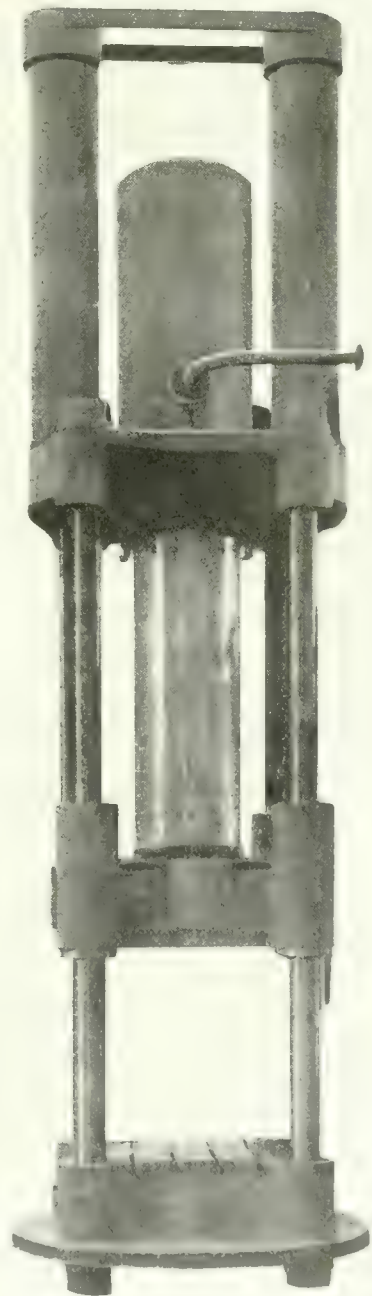
HYDRAULIC MACHINERY

For All Purposes

- | | | |
|--------------|----------|---------------|
| Presses | Leather | Accumulators |
| Riveters | Packings | Hoists |
| Cranes | Gauges | Jacks |
| Intensifiers | Pumps | Pipe Fittings |
| | | Valves, Etc. |



6-Cylinder Banding Press.



210-ton Shell Drawing Press

OTHER SOUTHWARK PRODUCTS

- | | |
|---|---|
| Centrifugal Pumps | Surface and Jet Condensers with their Auxiliaries |
| Turbo Generators for Direct and Alternating Current | Southwark-Harris Valveless Oil Engine for marine and stationary use. Built in sizes up to 1500 B. H. P. |
| Turbo Blowers | |
| Turbo Pumps | |

Southwark Foundry & Machine Company

PHILADELPHIA

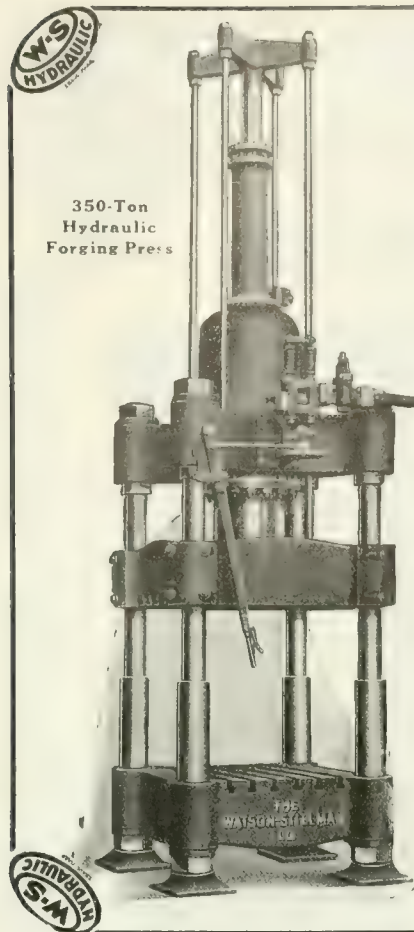
Founded 1836

Old Colony Building, Chicago

Brown-Marx Building, Birmingham

"First Builders of Large Centrifugal Pumps in America."

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



350-Ton
Hydraulic
Forging Press

Hydraulic Machinery

We show here some examples of our line of hydraulic machinery built especially for billet piercing, forging, forming, cupping, short drawing, etc. These machines are built with the idea of obtaining the **greatest strength, simplicity of operation and production possible.**

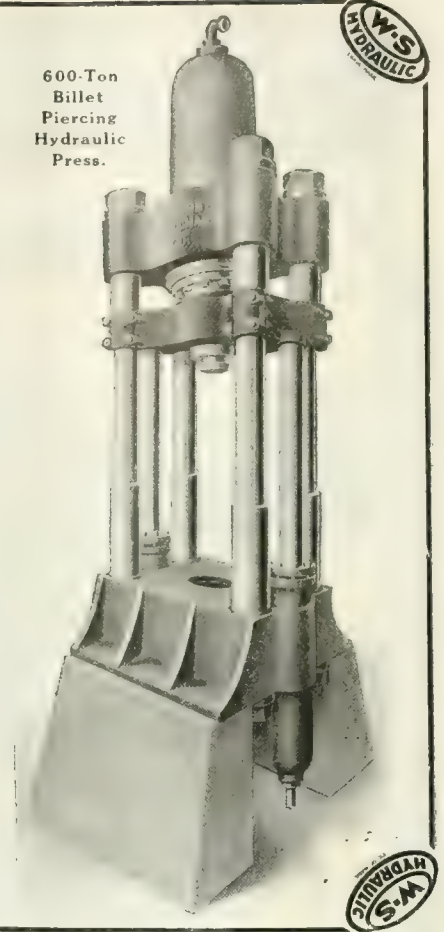
If in need of **HYDRAULIC EQUIPMENT OF ANY KIND**, write us. Our experience covers a period of over 60 years, in which time we have evolved and produced over 4,000 complete hydraulic machines. That experience is at your disposal.

Write for catalogs.

The Watson-Stillman Co

ENGINEERS AND BUILDERS
OF HYDRAULIC MACHINERY.

36 Dey Street, New York City.
Chicago, McCormick Bldg. 293



600-Ton
Billet
Piercing
Hydraulic
Press.

Nutter & Barnes Cutting-off Machines

For Cutting-off Metal Accurately and Fast

Built on the most modern lines, Nutter & Barnes Machines handle a wide range of work with accuracy and economy. Size of saw considered, they have a larger capacity than any similar machine. The 8-inch machine cuts 8½-inch stock with a 22-inch saw; the 6-inch machine carries a 16-inch blade and cuts 6¾-inch stock. A notable saving in the cost of saw blades—especially high-speed steel—is a further advantage.

The new Saw Hood and Lubricator Container, exclusive with Nutter & Barnes, guards against accident, forces lubrication, permits faster feeds, and is one of many features which increase production and reduce costs.

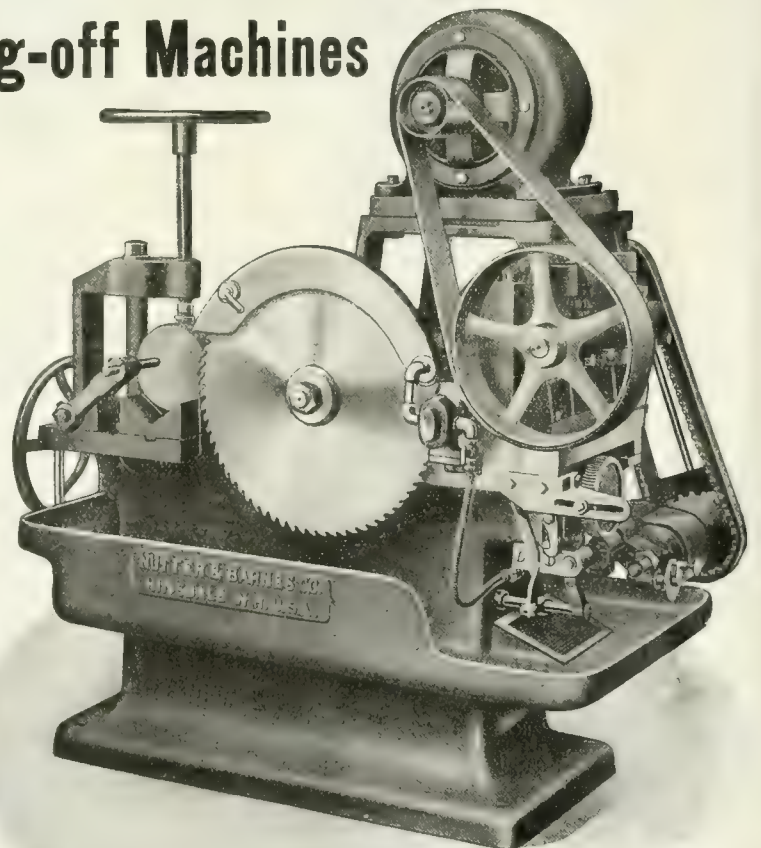
*Send for the catalogue—A Treatise on
Metal Cutting—to-day.*

Nutter & Barnes Company

Hinsdale, N.H., U.S.A.

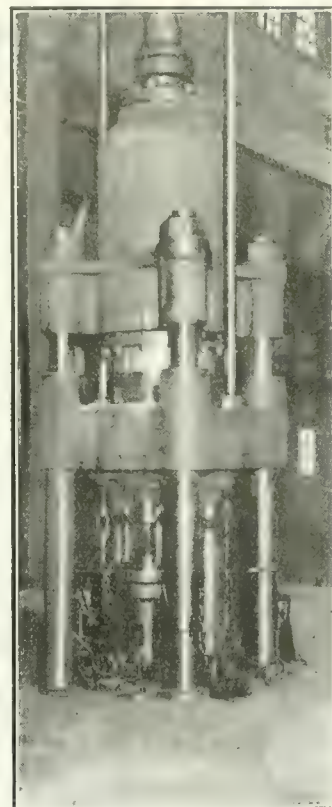
13 So. Clinton St., - - - Chicago

Rudel-Belnap Machy. Co., Montreal-Toronto
Agents for Canada

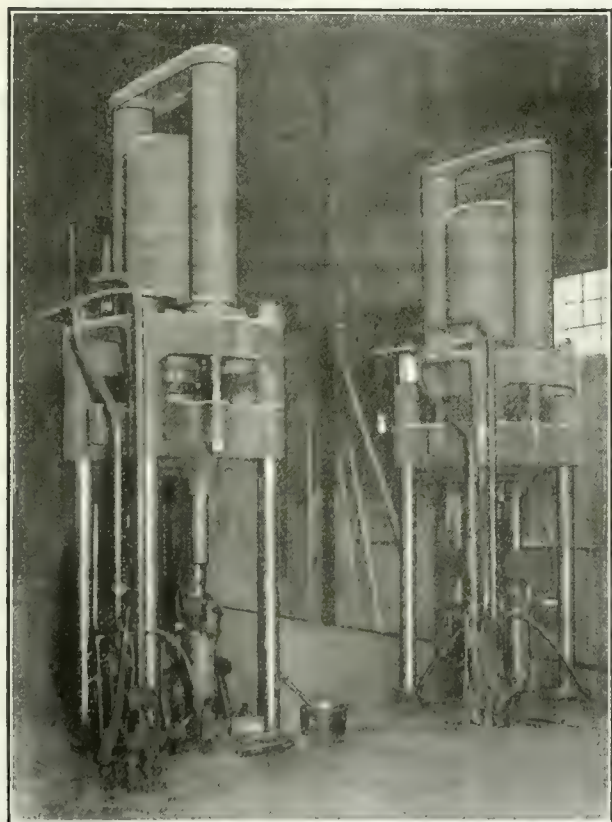


The advertiser would like to know where you saw his advertisement—tell him.

HYDRAULIC PRESSES FOR SHELL MANUFACTURING



PIERCING PRESS



DRAWING PRESSES

We are making

HYDRAULIC PRESSES

For Piercing and Drawing

SHELLS and PROJECTILES

and are in a position to give

PROMPT DELIVERY

**The William Cramp & Sons Ship and Engine
Building Company**

PHILADELPHIA, PA.

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

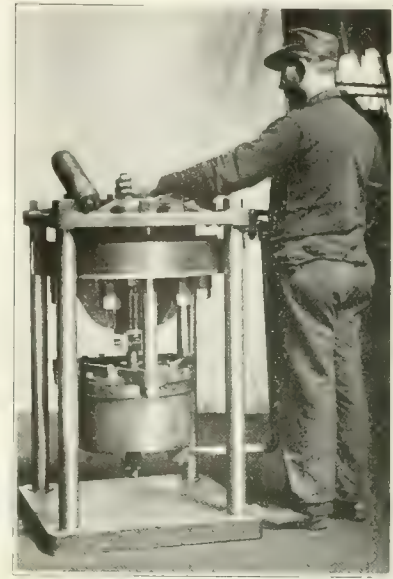
Shell Banding

The action of this pneumatically operated Banding Press is such that the dies strike a sharp blow and exert a heavy pressure, firmly forcing the band into the shell groove.

It is all ready to connect to your shop line. Production is only limited to your operator's ability to handle the shells. One operator and helper could easily produce three to four shells per minute.

The capacity of the machine is up to 5½" shells.

For full details and price write



THE NOTCH & MERRYWEATHER MACHINERY CO.

CLEVELAND

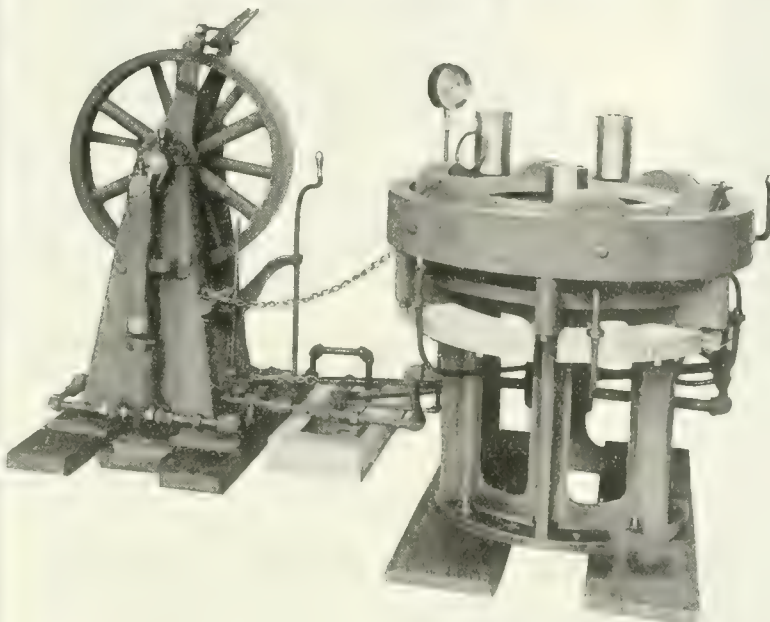
DETROIT

CINCINNATI

PITTSBURGH

In our Cleveland warehouse we have some 500 second-hand machines of all kinds, ready for immediate delivery.

Hydraulic Shell Banding Press



This machine sets the bands tight and spreads them to fill groove.

No trouble to meet inspection requirements when our machines are used.

Our equipment holds band in exact position so it enters groove without shearing and does not have to be set in with a hammer before compressing.

We have been making Tire-Setting and Hub-Banding machines since 1870, and think we know how to build machines of this character—so do our customers.

This shell machine is built in various sizes for shells 15" diameter down to 3" or smaller. *Machines for Canadian trade are built in Hamilton, Ont., to save duty charges.*

Please address all correspondence to our Rochester office and advise us diameter of shells and width and thickness of bands for which equipment is desired.

The WEST TIRE SETTER COMPANY

ROCHESTER

New York

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

Riveted Steel Tanks for Every Purpose



A SAMPLE OF OUR WORK.

Oil Storage Tanks
 Bins and Hoppers
 Smoke Stacks
 Boiler Breechings
 Penstocks

HEAVY
 and
LIGHT
STEEL PLATE
CONSTRUCTION

Pressure Tanks
 Riveted Steel Pipe
 Tank Wagons
 Concrete Forms
 Caissons

The Toronto Iron Works, Limited

TORONTO, ONTARIO

ARMSTRONG WHITWORTH OF CANADA LIMITED

MANUFACTURERS OF CELEBRATED BRANDS OF
HIGH SPEED STEEL & DRILLS

"AW" FOR CUTTING ALL METALS
 AT HIGH SPEEDS

FOR HARD METALS — **"TYR"**
 RAILWAY & TRAM TYRES

OFFICE 22 VICTORIA SQ. MONTREAL

WORKS LONGUEUIL QUE.

You Can't Buy Shell Lathes

From anyone who will give you as

Quick Delivery

as

The Cincinnati Iron & Steel Company

CINCINNATI, U.S.A.

Simplex Lathes for Shells under 6 inches
Simplex Lathes for Shells 12 inches and under

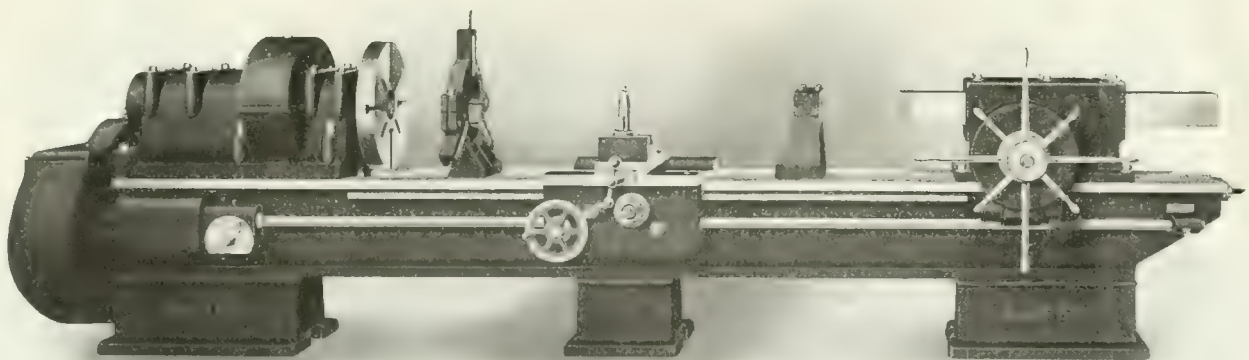
Made in Canada and the United States.

Delivery Large Quantities Quickly.

Furnished with all attachments

A Shell Working Wonder

Barrett 25" Heavy Duty Projectile Boring Lathe



A thorough tried-out proposition for boring and facing projectiles and shells
up to 12 inches.

LET US SEND YOU SPECIFICATIONS AND FULL PARTICULARS.

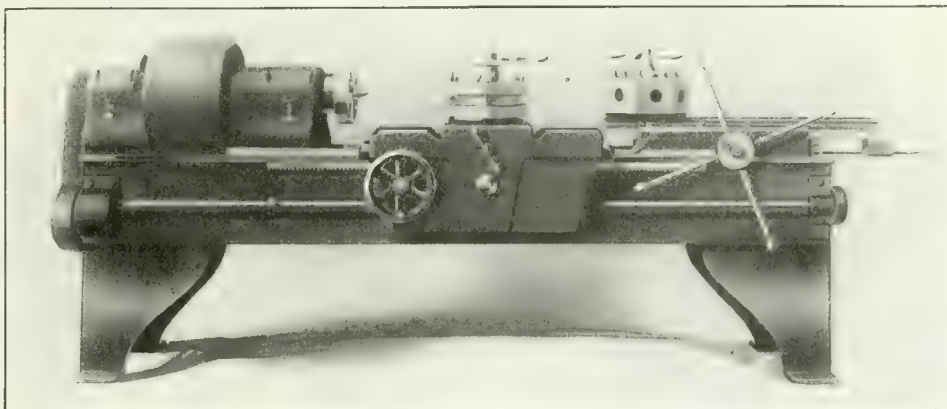
Barrett Machine Tool Co., Meadville, Pa., U.S.A.

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

SIMPLEX

"MADE IN CANADA"

Single Purpose Heavy Duty Shell Lathe



Swing Over Vs, 16 Inches. Bed Length, 8 Feet
 Crated Weight Plain Back Geared Lathe, 3,950 lbs.
 Crated Weight, with all Attachments, 5,000 lbs.

ATTACHMENTS:

Power Feed Turret on Bed, Special Forming Attachment
 Heavy Turret on Carriage, Standard Taper Attachment
 Four Tool Turret Tool Post, Special Waving Attachment

This lathe is suitable for machining operations on shells up to and including 4.5 inch.

Our heavier type lathe is suitable for similar operations on shells up to and including 12 inch.

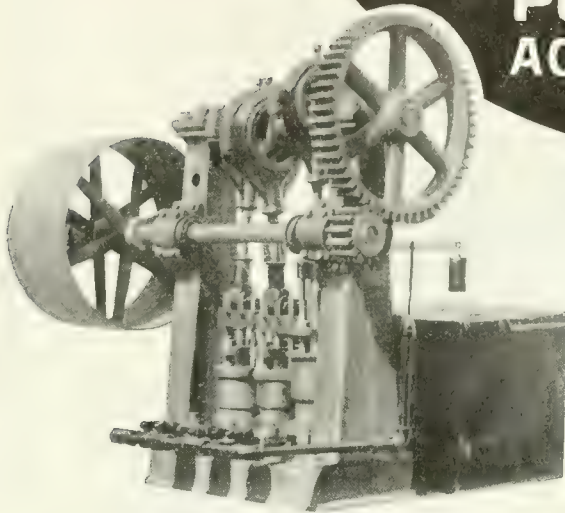
Exclusive Canadian Distributing Agents:

KELLOGG & COMPANY

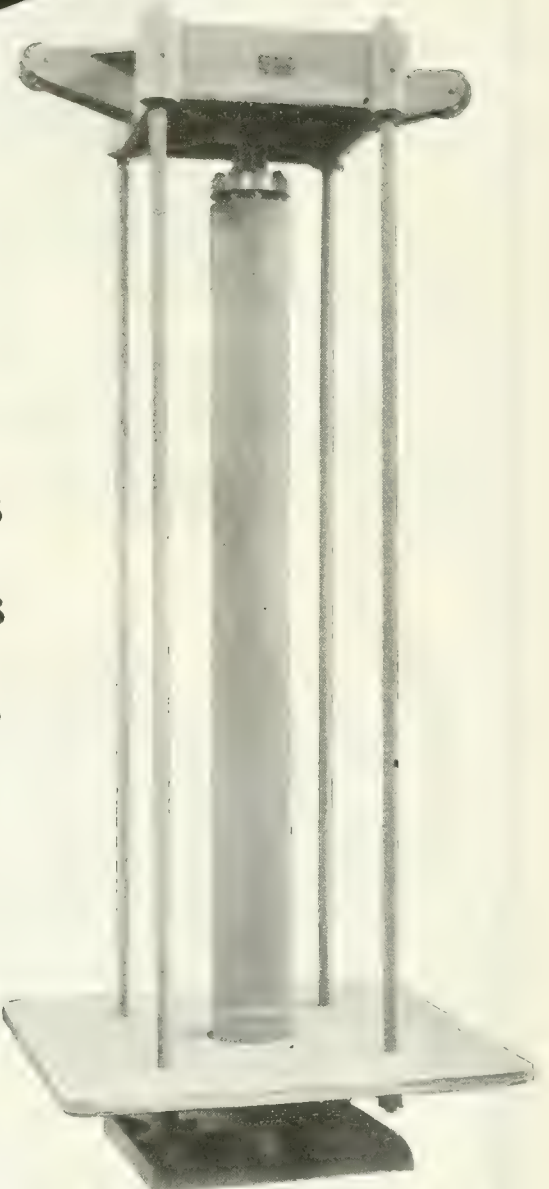
No. 1204 Traders Bank Building

Toronto, Canada

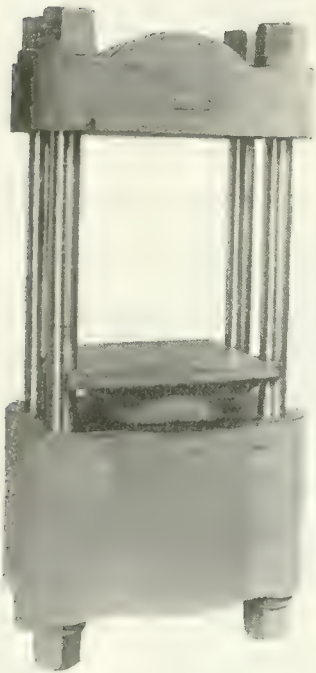
HYDRAULIC PRESSES, PUMPS AND ACCUMULATORS



TRIPLE-GEARED PUMP



ACCUMULATOR



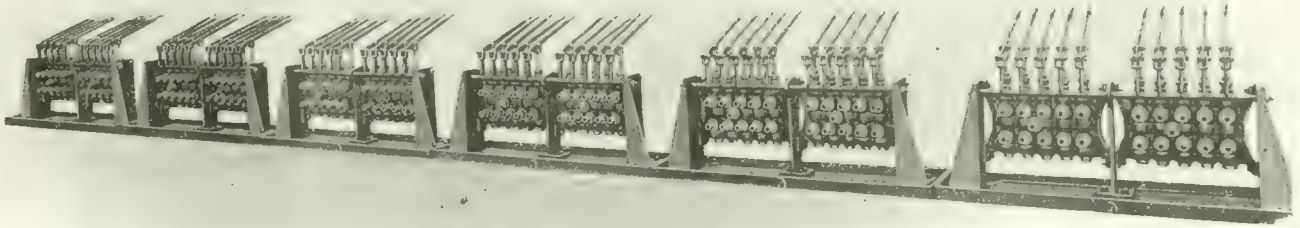
NOSING PRESS

Banding Presses
Forging Presses
Nosing Presses

MADE IN CANADA

William R. Perrin, Limited, Toronto, Ont.

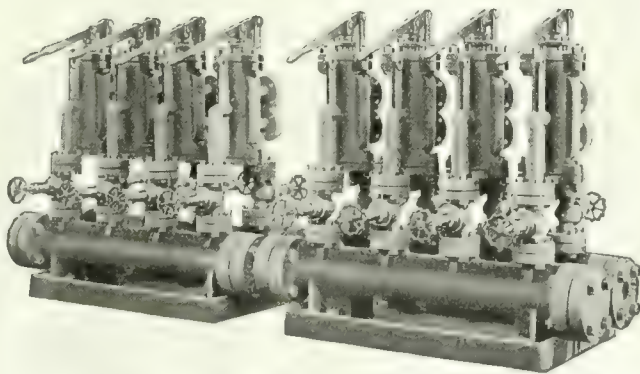
THIS IS NOT A BATTERY OF MACHINE GUNS



It is a Display of HYDRAULIC OPERATING VALVES

The cut reproduced above is one showing six groups of 1"-4 way, 5-chamber CRITCHLOW VALVE nests. Two nests to a group. This valve is the simplest form of hydraulic three or four-way piston valve and has no superior for working pressures up to 500 pounds.

For EXTREME HYDRAULIC PRESSURES We Offer the TANNER OPERATING VALVE.



This valve is more satisfactory than the Critchlow Valve on high pressures. It is of the cup packed piston type, so designed that the fluid forces the packing away from the ports instead of into them, prolonging the life of the packing and making operation easy. The arrangement of the supply and waste ports facilitates attaching to manifolds.

This cut shows two groups of hydraulic manifolds of 4- $\frac{3}{4}$ " TANNER OPERATING VALVES each. Larger sizes can be furnished with actuating cylinder, permitting remote control by means of pilot valve.

WE CAN SUPPLY YOU AN OPERATING VALVE TO MEET YOUR SPECIAL REQUIREMENTS.

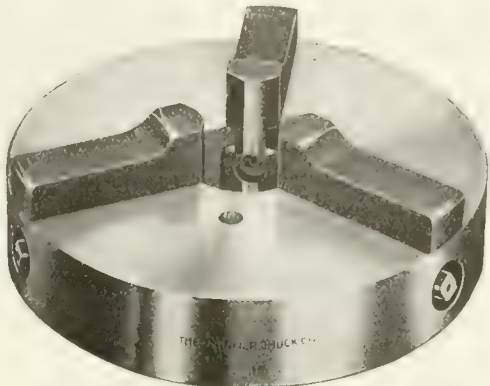
We also carry a line of Valves and Fittings for pressures up to 2,000 pounds, suitable for HYDRAULIC PRESS work. We are prepared to furnish specially designed valves and fittings for any pressure or for any special service. Your inquiry is solicited and details submitted on receipt of specifications.

PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION COMPANY
Pittsburgh, Pa.

Canadian Sales Representative—W. M. CAMPBELL, 32 Albany Ave., Toronto, Ont.

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

For Holding Shells



For gripping Shells on outside while inside is being machined, use Skinner Heavy Pattern Universal Geared Screw Chuck. It has extra large center hole, long bite on Jaws extending both above and below face of Chuck and tremendous gripping power. Hundreds are in daily use, giving entire satisfaction.

We furnish a special Scroll Chuck for facing off the outside of Shell, the Jaws of which grip from the inside, and have an auxiliary grip from the outside which holds the shell rigid, and permits a heavy and uneven cut to be taken.

Blue Prints and prices will be supplied on request.
Let us show you what others are using.

The Skinner Chuck Company
Main Office and Factory, New Britain, Conn.

SHELL MAKERS!

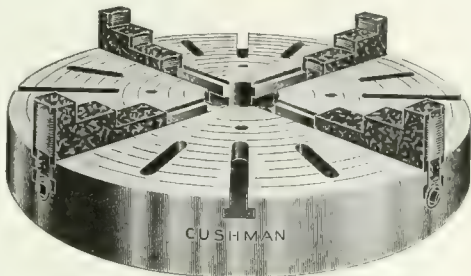
Are you **CUTTING** your shell stock and blanks by the **Oxygen Process?**

By means of a simple jet of Oxygen played on the metal, you get quicker cuts for less cost. You can increase your output and have a more dependable cutting apparatus.

ASK US!

LEVER BROTHERS, LTD.
Oxygen Department - - TORONTO

Cushman Chucks



When you buy a "Cushman" Chuck you are absolutely sure of getting one having strength, accuracy and durability. Being specialists in these goods we are able to furnish Chucks of quality at a very moderate price.

Our line of styles and sizes is very complete—

Lathe Chucks, Drill Chucks, Centering Chucks, Portable Face Plate Jaws

Our regular chucks are known as the heavy pattern, but we now have a new line called "Blue Line" Chucks, made entirely of steel.

Let us send you our catalog.

The Cushman Chuck Co.
Hartford, Conn., U.S.A.

Headless Screws

ALL KINDS
FOR
**SHRAPNEL SHELLS
AND FUSES**

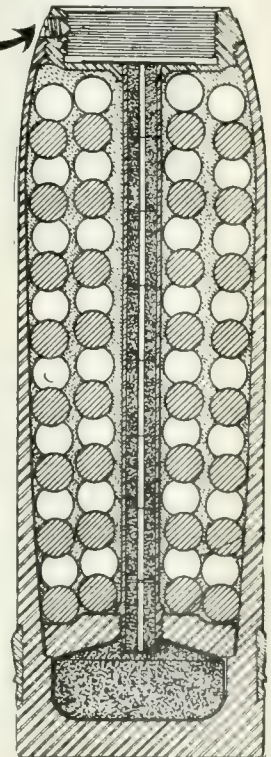
sometimes called "Grub Screws," are a part of Shell manufacturing.

Small in the unit—3-16 in. diameter and ¼ in. long—yet when you consider the multitude used, the aggregate business is very large.

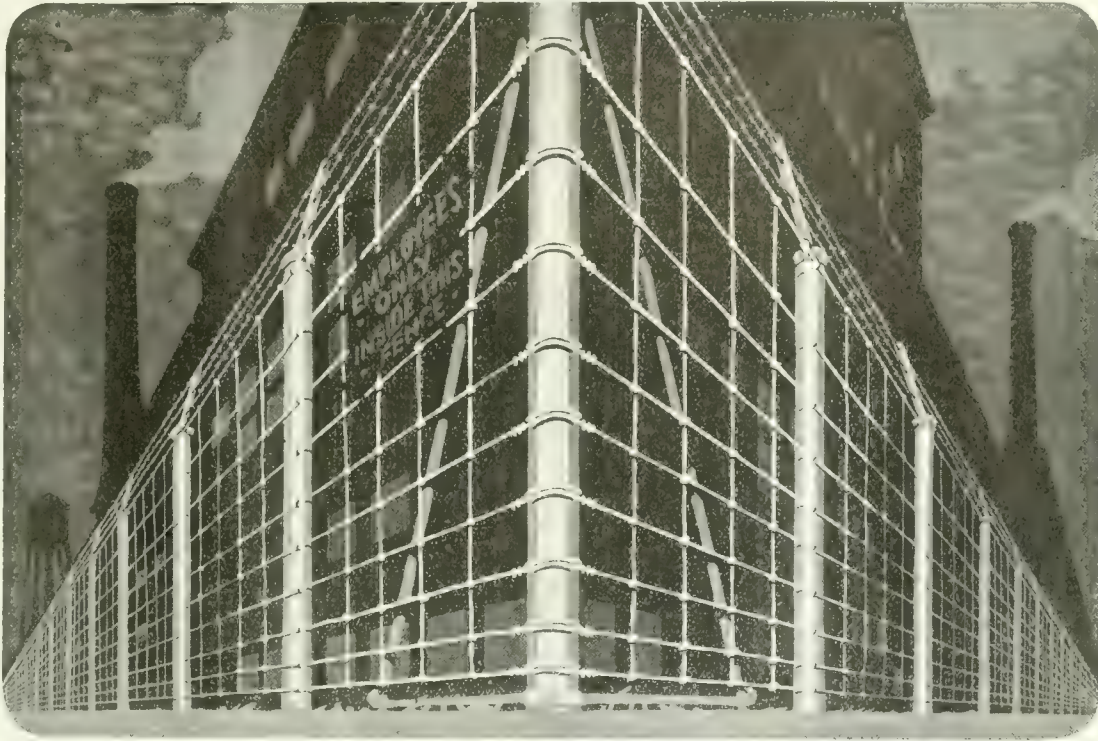
These Headless Screws are used for both

Shrapnel and Lyddite
Shells, sizes to suit requirements.

We have screws for other uses—Let us acquaint you with our product.



BLAKE & JOHNSON CO.
WATERBURY, CONN.



SURROUND YOUR FACTORY
 WITH THIS **KEEP OUT**
 PROTECTION

(Article 1 Manufacturers Alien Enemy Act.)

Every factory in Canada making munitions needs protection against trespassers. Lack of this protection explains some of the "unexplained accidents" that have had brief mention in the newspapers. Will you be awakened some night to receive a telephone message that "something has happened at the plant"?

Or will you to-day—right now—decide to give your factory protection against "accident"?

This equipment is ideal for the purpose. On request we will give the responsible officers of Shell factories names of other concerns who have installed Standard Protection. Ask

them about it. They will tell you it costs less money and time to erect — is neater in appearance —

more effective and in every way the superior of any other factory protection. Largely reduces the number of guards required. Can be charged with high voltage electricity if required.

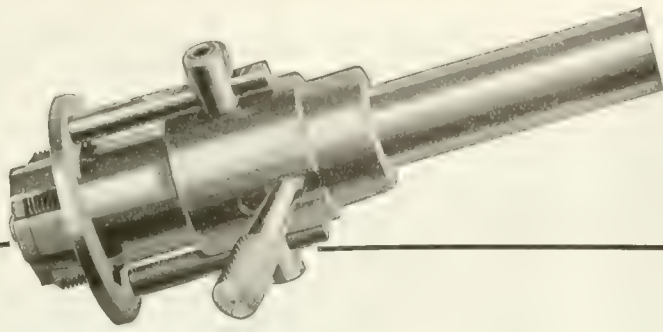
STANDARD STEEL TUBE FENCE POSTS

With Standard Wire Fencing and Barbed Wire Parapet—(with Steel Tube Gates)

Write to-day for particulars, price and names of users.

Standard Tube and Fence Co., Limited
 WOODSTOCK, ONT.

Montreal Office, 210 Coronation Building.



Tapping SHELLS with a "Murchey"

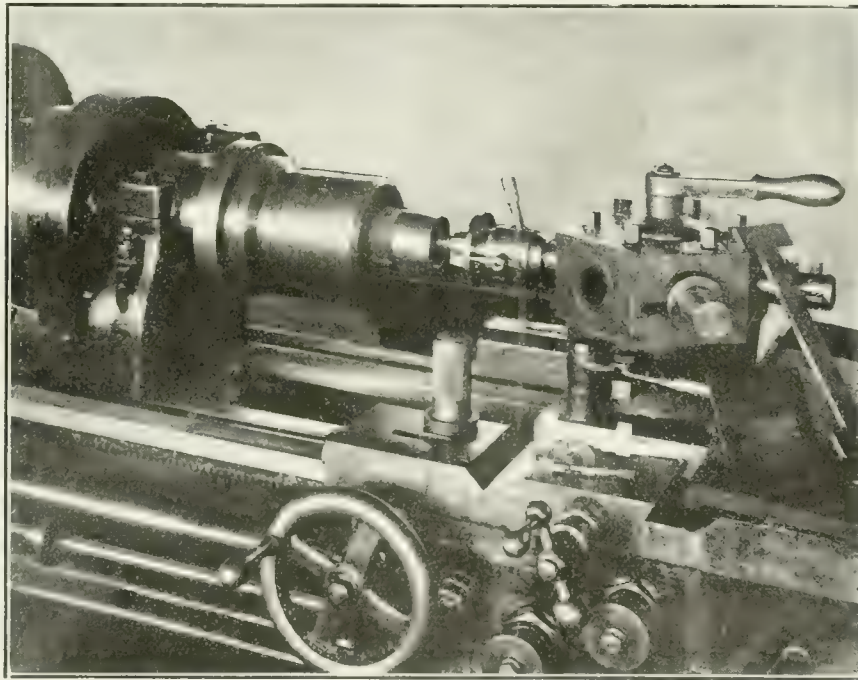
Shell tapping is hard, steady work on which Murchey Collapsing Taps are profitable tools. They cut perfect threads and trip positively. They are strong, durable and very fast in operation.

It is one of the details which, unlike some others that belong to the Shell business, affords great opportunities for economy.

One manufacturer ordered

260 Murchey Collapsible Taps

and this is self-evidence of a convincing nature.



Finishing and Threading Nose Inside, Forming Nose Profile Outside

We can offer positive proof that the majority of Canadian and American Shell Makers are using MURCHEY COLLAPSING TAPS on 4.5 and 18-lb. High Explosive Shell and Automatic Opening Dies for Plugs. These tools are the least expensive equipment for this work. We guarantee results will be satisfactory. You take no chances. Then why buy equipment costing five or ten times more?

ALSO—Collapsing Taps will handle tapping operations faster than any other method.

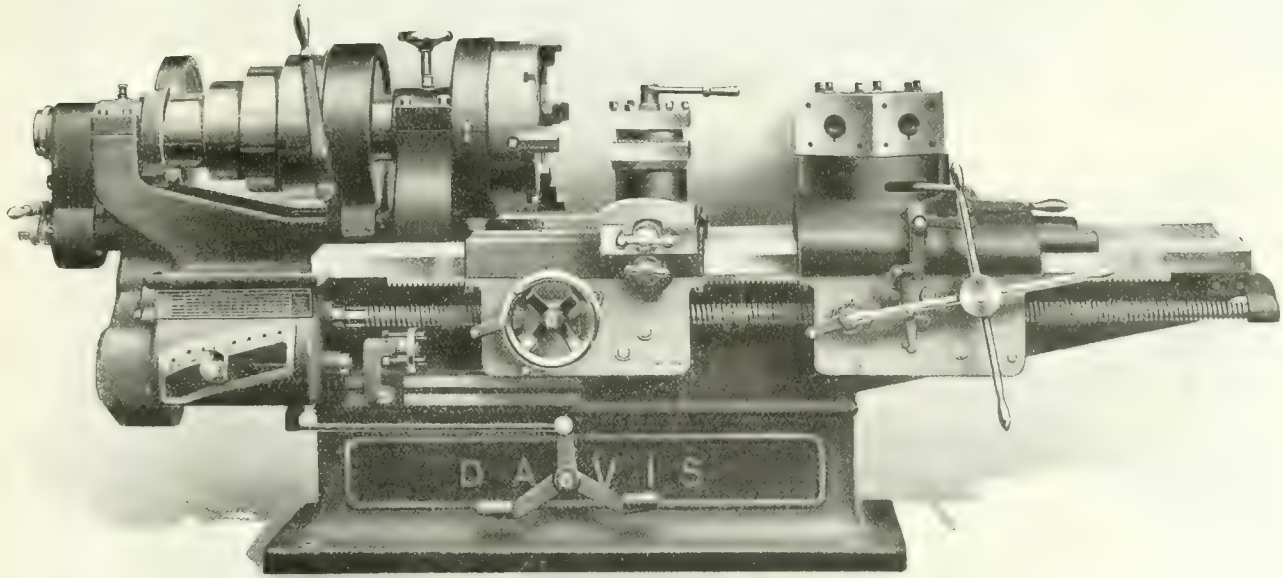
Use the BEST, CHEAPEST and FASTEST equipment and save money, time and worry.

MURCHEY MACHINE & TOOL COMPANY

34 Porter Street, Detroit, Michigan

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

Did You Say Shells ?
Now Being Built in Canada



Heavy Duty 26-in. Turret Lathe

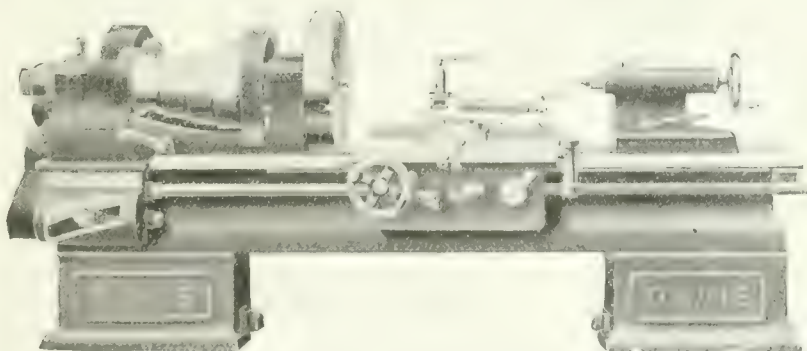
GARLOCK — MACHINERY

197 Wellesley Street

TORONTO

TELEPHONE NORTH 6849

WRITE FOR PRICES AND DELIVERIES



26-in. and 32-in. Engine Lathes, Double Back Gears,
Quick Change Feed

Also
 Cutting-off Machines
 and
 Double Spindle
 Horizontal
 Drills
 For Prompt Shipment

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



“Modern” Self-Opening and Adjustable Die Heads

Mean Greater Output of Precision Work and Elimination of Spoiled Pieces

Supported to insure the cutting of a perfectly straight thread, of full size and accurate lead, and the heads will not clog with chips, necessitating frequent cleaning.

All “Modern” Heads now have our cleaning improvement, which permits cleaning without disassembling the head. The chaser blocks in which the chasers are rigidly held, are firmly supported by a tool steel cam ring.

The “Modern” Die Head is made in a single style that will cut all threads, coarse or fine, of standard or special pitch and pipe threads, of any diameter or length within the capacity of the Die.

No other make of Self-Opening Dies has been able to attain these advantages, hence, if you desire a larger output of precision work, and a wider range, with a minimum investment, you will be compelled to purchase a “Modern” Die Head. So if you are having trouble with your present threading tools, you can eliminate this trouble by installing “Modern” Heads.

Drop us a line for descriptive circular.

Modern Tool Company

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

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



Shell Tapping IS THE IDEAL TEST FOR TAPS

They have got to be made right and tempered right to stand up to the job on shell metal.

Butterfield Taps

are just in their element on shell work or any other job where fast cutting on tough materials is required.

They produce more work in a given time and last longer. We know it because we have put them to many working tests against other makes.

Positively Guaranteed.

Butterfield & Co., Inc.

Rock Island,
Quebec

Derby Line,
Vermont

**MADE
IN
CANADA**



ECONOMIC WATER OIL

Shell Manufacturers use Economic Water Oil for Metal Cutting of every description. It will not gum nor rust, and it Saves Time and Labor.

**We Can Save You 50% in the
Cost of Your Cutting Mixture!**

BECAUSE:

One Gallon of Economic Water Oil will readily mix with **30 to 50** gallons of Water, making a thick, creamy emulsion, giving you a cutting mixture which will not only be **satisfactory**, but will produce very **economic results**.

One TRIAL ORDER Will Prove Our STATEMENT.

MADE IN CANADA

Canadian Economic Lubricant Co., Limited

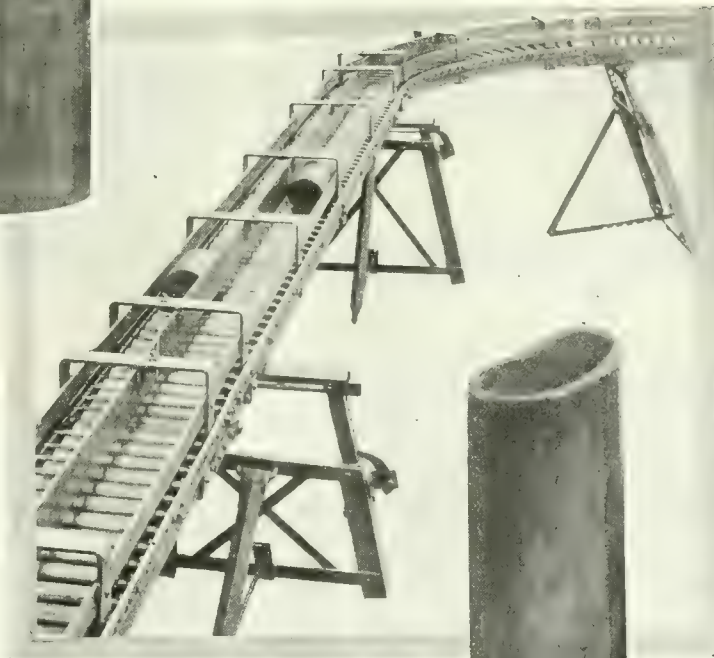
1040-1042 DUROCHER STREET, MONTREAL

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

Five Shell Manufacturing Problems

Solved by the use of

Mathews Gravity Steel Roller Conveyers—



Special types of gravity, Ball-Bearing Roller Conveyers. Designed to meet special conditions and requirements. Short runs or complete systems furnished.

- 1—Conveying Raw Material into Plant.
- 2—Distribution of Material for Process Work.
- 3—Moving Material through the Plant.
- 4—Conveying Shells to Packing and Shipping Rooms.
- 5—Conveying Shipping Cases into Cars.

Speed is the main object Safety in transit is also important

Both may be had at less initial cost than an adequate system of trucks.

We can handle raw material and finished product quicker, cheaper and better than by any other method.

We can install Gravity Conveying Equipment that will conserve valuable plant space, increase daily capacity, reduce pay roll, and eliminate wear and tear on floors. If your problem involves the conveyance of

Billets, Forgings, Completed Shells or any other commodity that will travel by gravity on ball-bearing rollers our system is necessary to secure highest efficiency.

An inquiry will bring our literature or representative—or both.

Explain your problem fully in first letter to save time. Give surface dimensions and weights of articles to be handled, and rough sketch showing distances and elevations.

Canadian Mathews Gravity Carrier Co.

484 Richmond St. West, TORONTO, ONT.

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

Used By Shell Makers Everywhere

National Cutting Lubricant

and

National Quenching Oil

Write us to-day

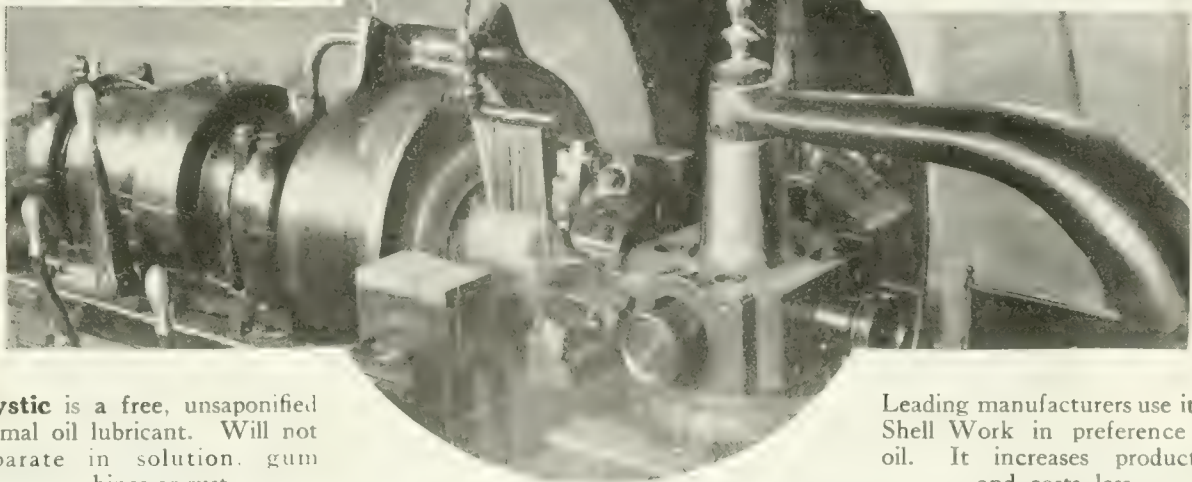
CANADIAN OIL COMPANIES, Limited

Toronto Montreal St. John Halifax Winnipeg

Mystic Cutting Compound

For Machining
SHRAPNEL SHELLS
It Has No Equal.

Keeps the Tools
Cool and Clean-cutting



Mystic is a free, unsaponified animal oil lubricant. Will not separate in solution. gum machines or rust.

Leading manufacturers use it on Shell Work in preference to oil. It increases production and costs less.

Cataract Refining Company, Limited, Toronto, Ont.

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

The BARRETT MULTI-TRUCK

*will effect a
big saving in your
cost of handling shells
or any factory product
on which numerous operations
are required.*



One of these trucks operated by one man can do the work of twenty ordinary trucks, because all loading and unloading is done away with.

This means a big saving in capital outlay for trucks and a big saving of labor.

The "Barrett" Multi-Trucks are saving large sums for hundreds of manufacturers—sums that were formerly lost in useless handling and trucking expense.

Write us to put a "Barrett" in your plant on a 30 days' free trial.

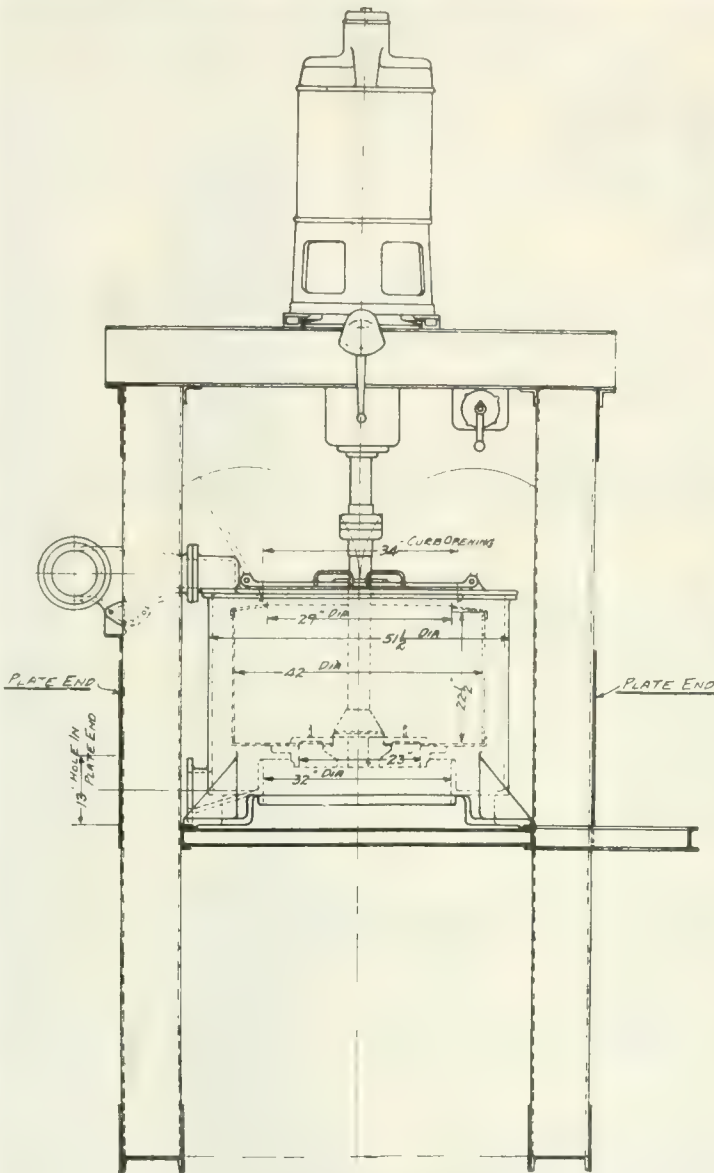
We positively guarantee it to save you money.

Prices from \$65.00 up.

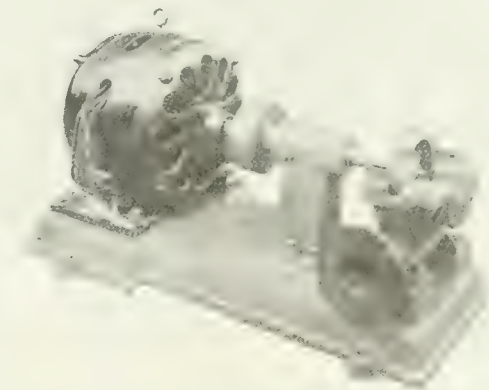


CHAMBERS LIMITED,

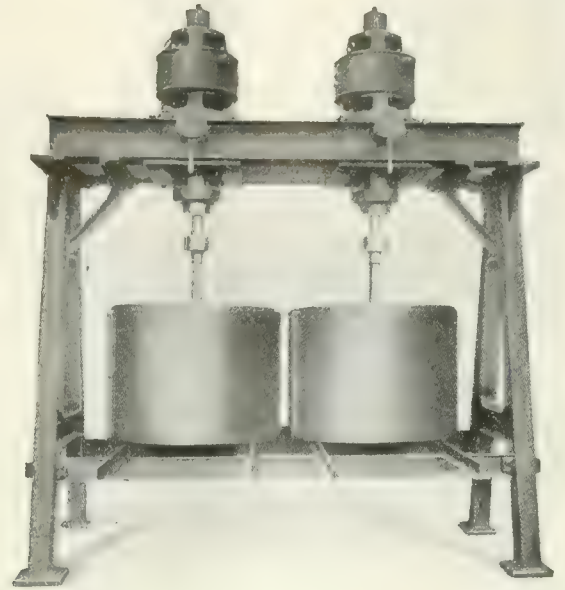
80 Don Esplanade
TORONTO, ONTARIO



NITRATING CENTRIFUGAL
D'Olier-Weston type
42" Direct Electric driven.
Unit steel framing construction



4" D'Olier pump for pumping nitrated cotton: efficiency and accessibility are features of this design.



All of the features recognized as essential to this ideal Centrifugal resulting in greatest output at lowest maintenance will be found incorporated in

D'Olier "Weston" Centrifugals

For sugar, chemicals, sewage, oil and waste reclaiming, clarifying and filtering and textile work.

Nitrating Centrifugals

D'Olier, patent, single spindle, ball bearing type. Strictly high-grade machines, of rugged construction and high efficiency.

Write for particulars of this improved type centrifugal, now being furnished for use in United States Government smokeless powder factories.

Bulletins on request.

D'Olier Volute and Turbine Pumps

for all pumping purposes in Sugar Refineries, Paper Mills, Mine Service, Metallurgical and Chemical Industries, General Water Supply, Fire Service. Write for Bulletin.

D'OLIER
CENTRIFUGAL PUMP and MACHINE CO.
Philadelphia, Pa., U.S.A.

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



Save Time and Material In Varnishing Shells



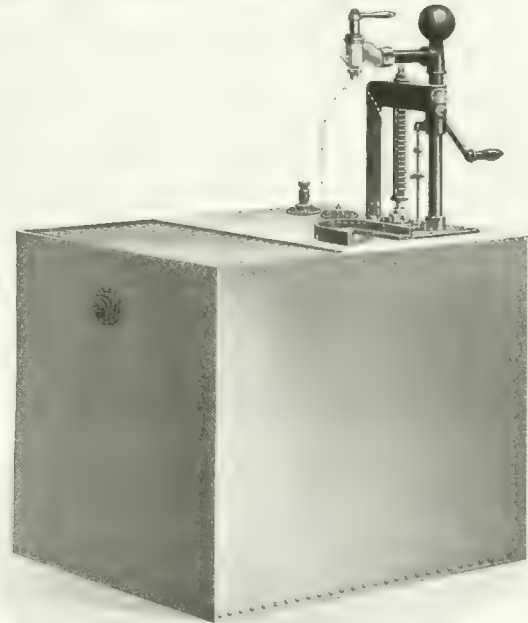
The only absolutely sure method of varnishing shells is to completely fill them with varnish thereby insuring that the entire interior is covered.

BOWSER

ESTABLISHED 1885
(STANDARD THE WORLD OVER)

Shell Varnishing Equipment

will enable you to varnish Lyddite Shells much faster than is possible with any other method.

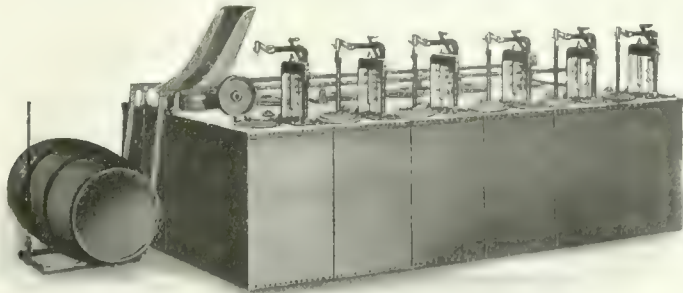


Cut No. 401—Shell Varnishing Outfit

Bowser Equipment is so designed that the pump can be set to exactly fill the different sizes of shells being manufactured. The shells can be filled as fast as the pump can be operated. They can then be drained and the varnish returned to storage in a clean and pure condition. Government specifications for varnishing can be fulfilled.

Think what this means to you as a manufacturer. There is no danger from spilling varnish on the outside of the shell and the shell is filled exactly full.

Should the Bowser Equipment at any time not be needed in manufacture of shells it is equally adapted to storage of varnish, paint and other oils wherever they are used.



A Battery Equipment for Lubricating and Paint Oils

We manufacture over 500 different oil handling devices, for storing and handling oils of all kinds under varying conditions. It will pay you to investigate what Bowser Equipment will mean to your works.

Write for further information on outfits suitable to your needs.

A letter or postal will bring you complete details and illustrated literature without obligating you in the least.

AWARDED HIGHEST HONORS—GRAND PRIZE AND GOLD MEDAL—AT PANAMA-PACIFIC INTERNATIONAL EXPOSITION, SAN FRANCISCO, CAL., U. S. A. A. D., 1915.

*Made in Canadian Works
by Canadian Workmen and
Sold by Canadian Salesmen.*

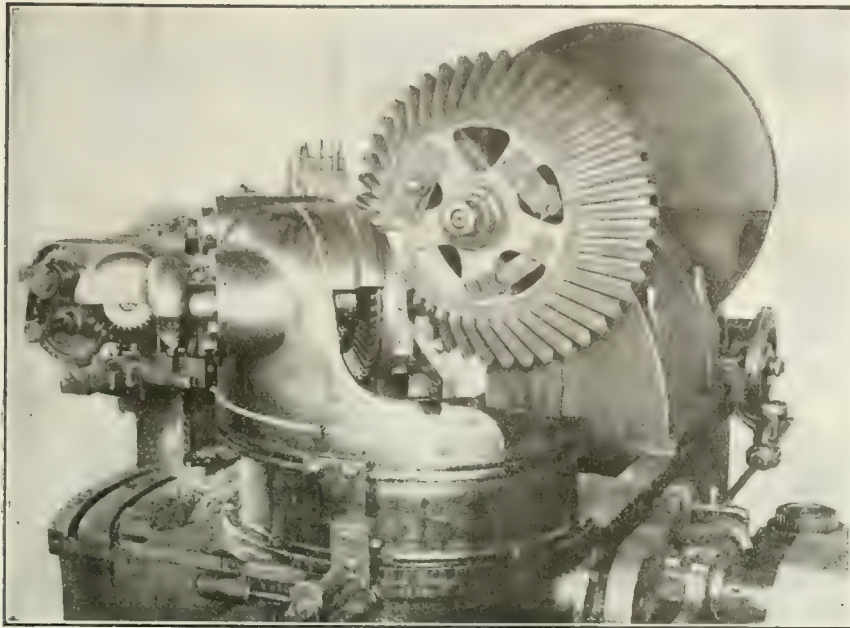


S.F. Bowser & Co., Inc.

66-68 Frazer Avenue
Toronto, Ontario, Canada

Sales Offices in all Centers and Representatives Everywhere

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



Planing large Bevel Gear on 60-inch Machine



Specialists in Gears

The best equipment and
an experienced shop force
is here for your service.

The Hamilton Gear & Machine Co.

(Chester B. Hamilton, Jr., B.A.Sc., Mechanical Engineer)
Cor. Concord and Van Horne—TORONTO

FOR 50 YEARS



"Camel" Belting Has Been Sold For Making Shells

During that time it has been transmitting more power than any other belting.

Try it on YOUR GRINDER, Presses, Heavy Lathes, etc.

Sole Makers:

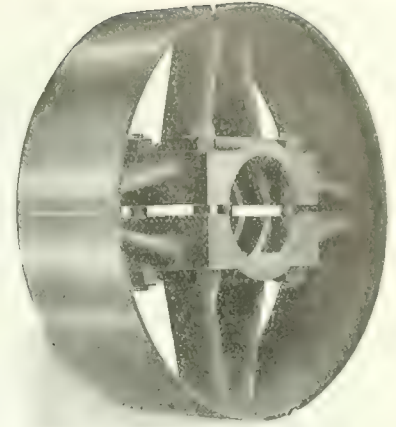
Beware of Imitations.

F. REDDAWAY & Co., 653 St. Paul St. W., Montreal

Stock, 1½ inch to 12 inch in Single
Stock, 2 inch to 24 inch in Double

PROMPT DELIVERY

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



Cast Iron Split Pressed Steel Pulleys
6 to 11-in. diameter, 8 to 12-in. face
inclusive.

Genuine Oak Leather Belting

None Better

We are supplying the largest users in
Canada

Balata Belting

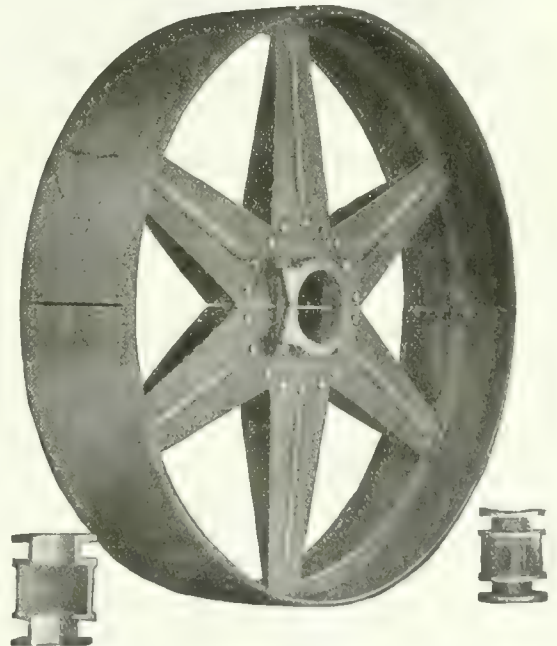
the genuine British made

D. K.

Wood Split Pulleys

We carry the largest stock
of these lines in Canada

PROMPT SHIPMENT



Steel Split Pulley from 12 to 48-inch Diameter,
3 to 12 in. face.

We carry a full stock of all sizes.

D. K. McLaren, Limited

Head Office and Factory:

351 St. James Street, Montreal, P.Q.

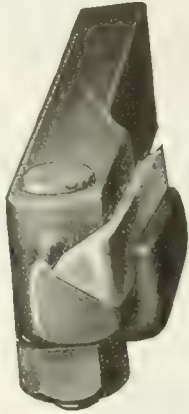
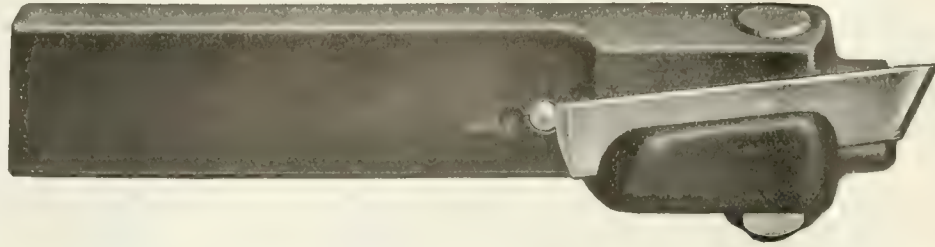
TORONTO, ONT.
200 King St. West

ST. JOHN, N.B.
64 Prince William St.

VANCOUVER, B.C.
847 Beatty St.

ENGINEERS SUPPLY COMPANY, 123 Bannatyne Ave. East, Winnipeg, Man.

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



Manufacturing Tool Holders for Heavy Service Have a Capacity Greater Than Any Other

The Triangular Cutter has twice the area and twice the depth of square cutters. Proper top and side angles, with no waste in grinding. Cutter supported at point directly opposite direction of thrust. Increase your production. Decrease your tool steel bill.

Equip your shop with "T" Bolt Heads and Studs, and always have a Holding-down Bolt when you want it.



"T" BOLT HEAD

NATIONAL FORGE & TOOL CO.

Hollow Bored Forging Specialists.

ERIE, PENNA.

Pneumatic Bench and Pedestal Riveters for Peining the End of High Explosive Shells

Will do your work cheaper and better than any other machine.

Valveless type—Simple—Durable—Economical.

They make 3,000 strokes per minute.

The admission valve is controlled by the foot, leaving both hands of the operator free for handling the work.

Air consumption twelve cubic feet at 80 pounds pressure.

Bench type can be bolted to a bench or truck.

Pedestal type can be attached to the floor or truck.

When mounted on trucks can be easily and quickly moved about in the factory.

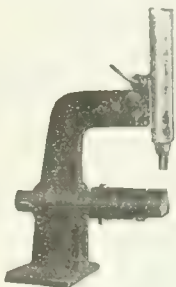
We also manufacture a complete line of pneumatic tools.

The Pittsburg Pneumatic Company CANTON, OHIO

CANADIAN OFFICES:

216 Bishop St., Montreal Tyrrell Bldg., 95 King St. E., Toronto
120 Lombard St., Winnipeg

BILL & BERRY, 39 Great Charles St., Birmingham, England



BENCH Riveter



PEDESTAL Riveter

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

Starrett Micrometers

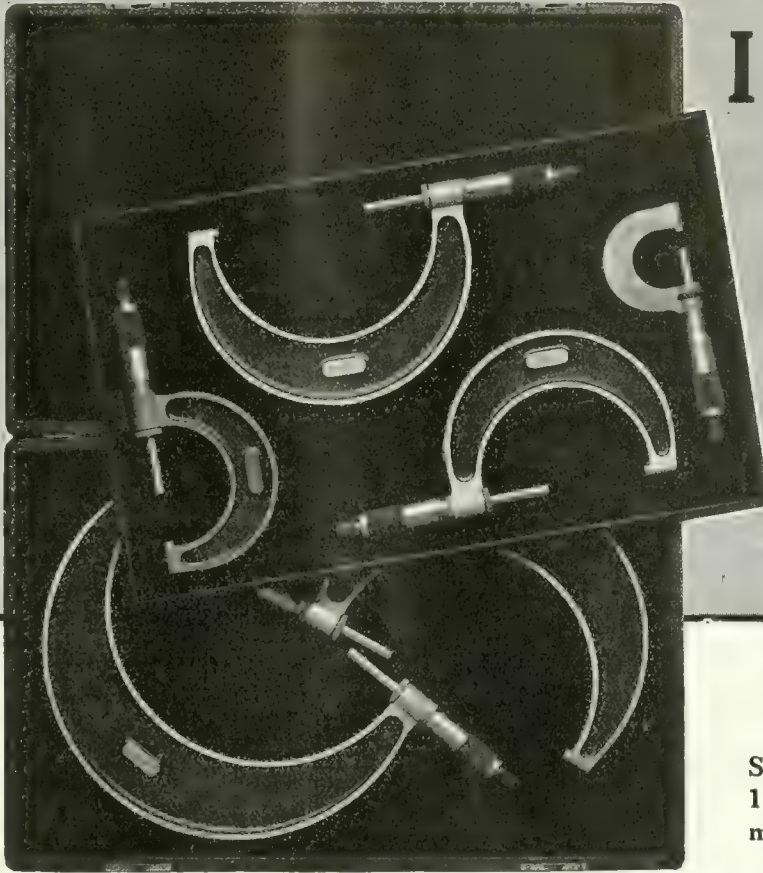
IN SETS

Sizes 1"–6"

or

25 mm. to 150 mm.

Furnished with or
without velvet lined
leather cases.



SIZES

1", 2", 3", 4", 5", 6".

Separately or in sets containing
1", 2" and 3" sizes or all six
micrometers.

EVERY large machine shop or manufacturing plant should have in the tool-room a set of accurate, convenient measuring instruments.

To suit the requirements of high-grade tool-rooms we have produced this remarkable set of high-grade micrometers which may be had separately or in sets. Each micrometer is graduated to read to .001 of an inch and is furnished with our patent lock nut and may be had with or without the ratchet stop, as desired. Frames

are drop forged from bar steel and are well finished. The one-inch micrometer has decimal equivalents stamped on the frame; the other sizes are marked to show their capacity. Standards by which to adjust these micrometers will be furnished when desired, at reasonable prices. These micrometers are sold separately in wooden boxes or in sets with velvet lined morocco leather case.

For measurements greater than 6" we make a set of micrometers up to 12".

*Send for free catalog No. 203 describing
2100 styles and sizes of fine tools and hack saws.*

The L. S. STARRETT CO.

World's Greatest Toolmakers

ATHOL,

MASS.



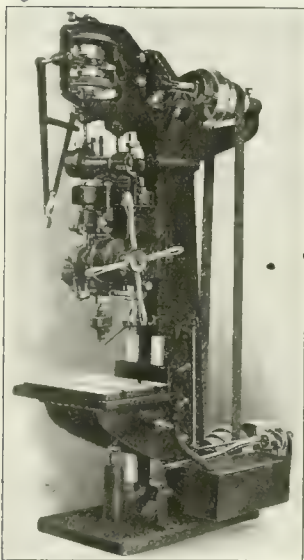
If what you want is not advertised in this issue consult the Buyers' Directory at the back.

In the Manufacture of Shrapnel and Lyddite Shells the

TURNER TURRET

has produced top-notch results.

It gives satisfaction for accuracy and rapidity in drilling, threading, reaming, undercutting, counterboring, etc., on Fuse Timing and Detonator Parts of Shells.



With the Turret 4, 5, 6, operations are possible without resetting. The Tools revolve, and Turret automatically indexes successive tools to exactly the same working centre. Only the working spindle rotates.

There is no fatigue from indexing Turret and no lost time through stopping for chucking or shifting of work.

The Trunnion Chuck makes working on several sides possible with one chucking.

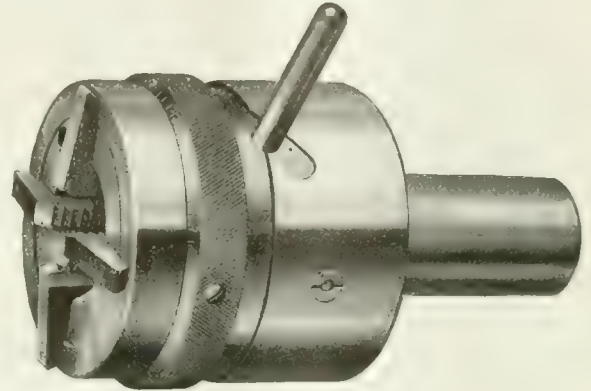
The Turner Turret minimizes idle movements, there being but a fraction of a second between successive tools.

Turret is suspended within rigid, accurate case. Detent located in case and fits adjustable sockets in turret. Very wide range of work. Hand and power feed.

Mail us your blue prints and let us give you estimates on the Turner Turret. Ask for catalog.

Turner Machine Company
Danbury, Conn., U.S.A.

Good Threads Cost Less Than Poor Ones



Wells Self-Opening Die—Model B.

The advent of the W.S.O.D. in his shop, has opened the eyes of many a manufacturer producing screw threads to the fact that he can

Increase Production Decrease Costs and Cut Perfect Threads

all at one and the same time.

Do you want us to prove it? We are ready.

We want to send you the booklet describing the different models. Are you willing to try the W.S.O.D. in your shop under your own conditions?

Wells Brothers Company
of Canada, Limited

GALT - ONTARIO

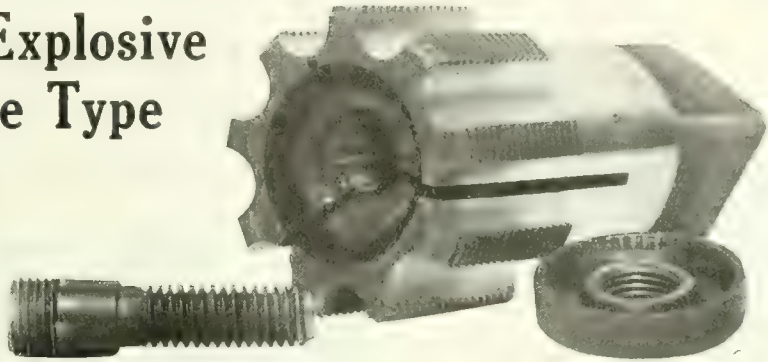
Sales Agents:

The Canadian Fairbanks-Morse Co., Limited, Montreal,
Toronto, Vancouver, Winnipeg, St. John, Calgary.

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

Shrapnel and High Explosive Sovereign Adjustable Type TAPS

Below is detailed uses for which
these Taps are adjustable—



- 2 x 14—Whitworth Right Hand, used for:—
Nose of 18 pr. High Explosive Shell.
Socket of 18 pr. Shrapnel.
Socket 4.5 H O W V.
- 2¼ x 14—Whitworth Left Hand, used for:—
Base of 18 pr. High Explosive Shells.
- 2.492 or 2.497 x 14—Whitworth Right Hand, used
for:—
Nose of 18 pr. Shrapnel.
- 2.5 x 14—Whitworth Right Hand, used for:—
Nose of 4.5.

- 3.375 x 14—Whitworth Left Hand, used for:—
Base of 4.5 H O W V.
- .250 x 20—Whitworth for fixing screws on all shells.
- 1.204 x 14—Whitworth for Primer Hole in Cart-
ridge cases made to suit buyer.
- 2.492—High-Speed Taps, Whitworth Right Hand,
used for:—
Nose of 18-pound Shrapnel.

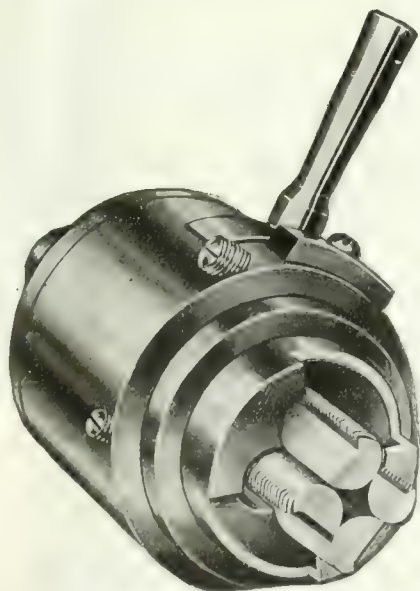
Anticipate your requirements by ordering at once.

Wood, Vallance & Co., Hamilton, Ontario

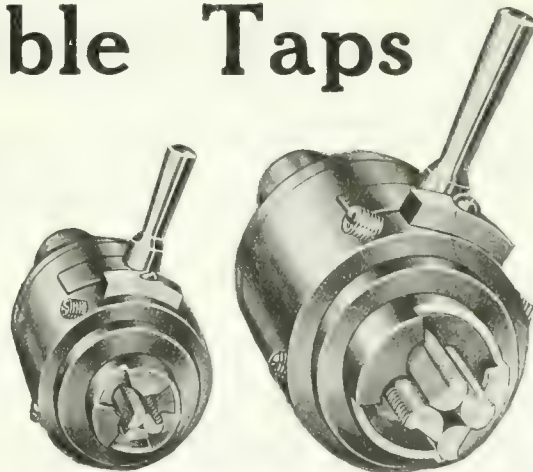
BRANCHES : Toronto Office, 25 Front Street East, Wood, Vallance, Limited
Winnipeg, Man., Wood, Vallance & Leggat, Limited
Vancouver, B.C., Wood, Vallance Hardware Co., Limited
Nelson, B.C., Wood, Vallance & Adams, Limited, Calgary, Alta.

M. E. C. Collapsible Taps

are the choice of many manu-
facturers of Shrapnel Shell Parts



—And they have
made a record
for themselves on
this work.



Ask the user, and profit by his experience. We gladly send you a list of our customers.

We have a very liberal proposition to offer you at this time.
Let us get acquainted—you will find it a very profitable connection.

WRITE US NOW.

Manufacturers Equipment Company

175-179 North Jefferson Street, CHICAGO

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

PRICE \$1000

A sample of our second-hand Turret Lathes. Send for full description of other tools.

Detailed description—8½" x 16" Potter & Johnson Automatic Chucking Lathe

Swing over bed, 20".

Swing over cross slide, 10".

Travel of cross slide, each way, 5½".

Greatest distance from turret face to end of spindle, 29".

Diameter of holes in turret, 2½".
Size of hole in spindle, 2½".

Size of front spindle bearing, 3 9-16" x 7".

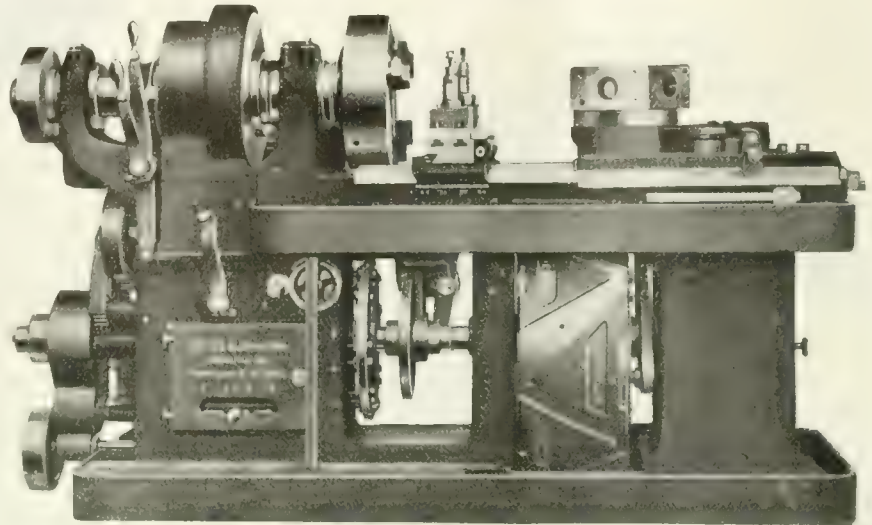
Size of rear spindle bearing, 3¼" x 5".

Distance between bearings, 25⅝".

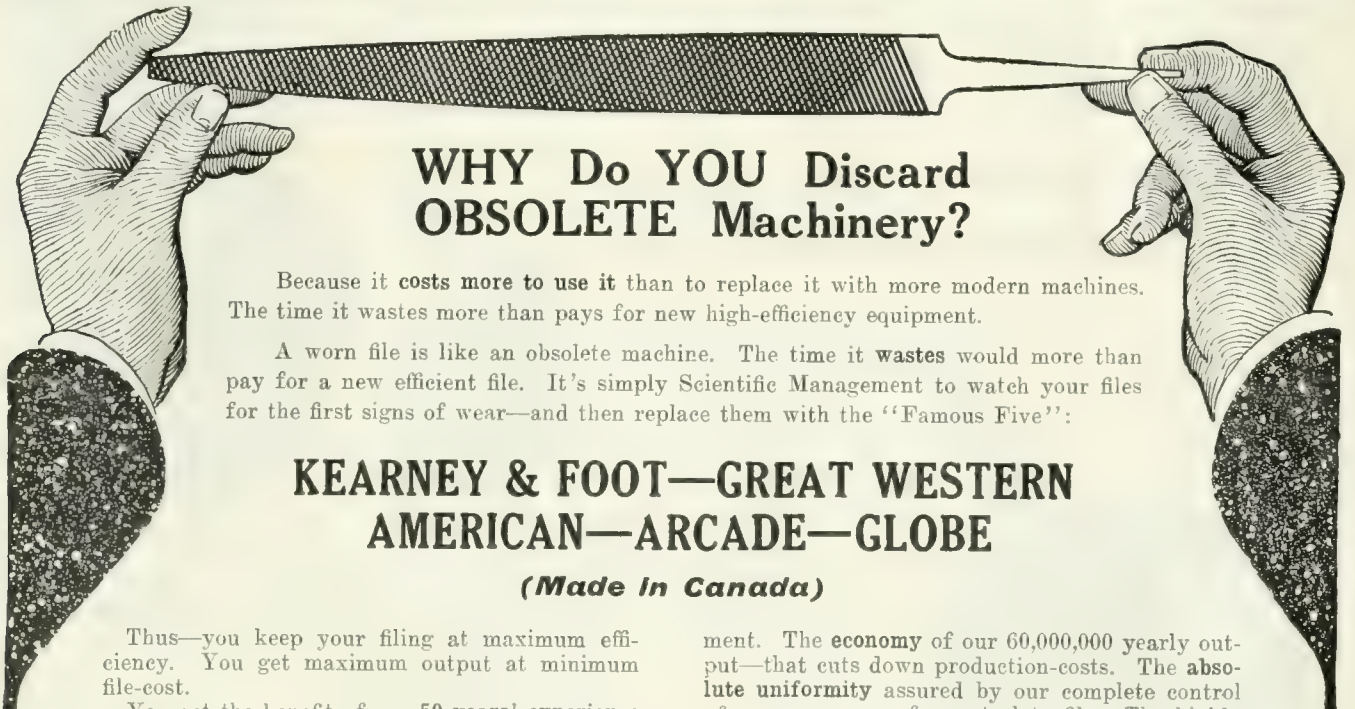
Spindle Speeds—Table on machine gives range of speeds which may be obtained by use of change gears, etc.

Net weight, 8,000 lbs.

Condition, Excellent.



MARSHALL & HUSCHART MACHINERY CO., 17 S. Jefferson St. CHICAGO, ILL.



WHY Do YOU Discard OBSOLETE Machinery?

Because it costs more to use it than to replace it with more modern machines. The time it wastes more than pays for new high-efficiency equipment.

A worn file is like an obsolete machine. The time it wastes would more than pay for a new efficient file. It's simply Scientific Management to watch your files for the first signs of wear—and then replace them with the "Famous Five":

KEARNEY & FOOT—GREAT WESTERN AMERICAN—ARCADE—GLOBE

(Made In Canada)

Thus—you keep your filing at maximum efficiency. You get maximum output at minimum file-cost.

You get the benefit of our 50 years' experience in producing World-Standard Files. The accuracy of our five great plants, with their modern equip-

ment. The economy of our 60,000,000 yearly output—that cuts down production-costs. The absolute uniformity assured by our complete control of every process—from steel to file. The highly specialized skill and training, acquired in supplying 90% of Canada's file-requirements.

It costs no more to use the "Famous Five." And then DO cut down filing costs. Let "File Philosophy" and our Catalog tell HOW and WHY.

NICHOLSON FILE COMPANY—PORT HOPE

(Dealers Everywhere)

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

Two Cuts at One Time

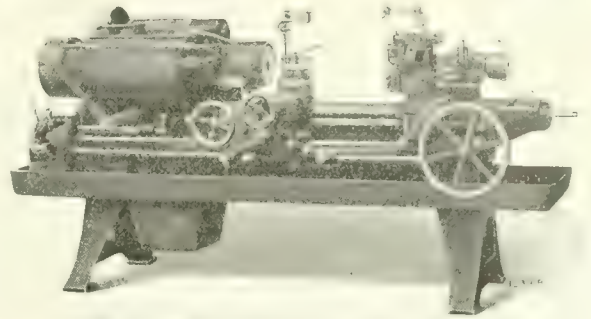
The ability to face, undercut or neck with the square turret while boring or turning with the hollow-hexagon turret contributes largely to the time-saving and economical output of the

Universal Hollow-Hexagon Turret Lathes

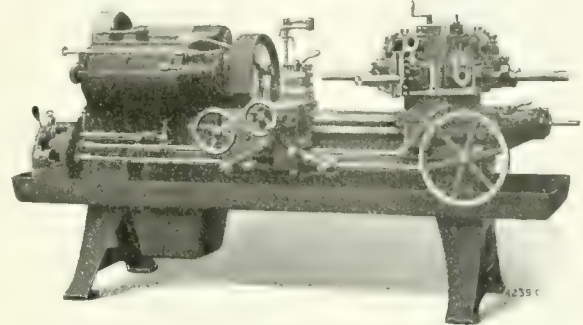
Separate feed shafts, each with ten individual feeds, operate the carriage and turret saddle independently, and provide the exact feed required for each.

And to this great advantage are added the other essentials for rapid and accurate production—excess power, extreme rigidity, great adaptability, and a power rapid traverse that saves time and conserves the energy of the operator.

Without obligation, ask us to show the saving on one of your typical jobs. Send blueprints with rough and finished samples.



No. 2-A—With “Bar Equipment”



No. 2-A—With “Chucking Equipment”

THE WARNER & SWASEY CO., Cleveland, Ohio, U. S. A.

Canadian Agents: A. R. Williams Machinery Company, St. John, Toronto, Winnipeg, Vancouver; Williams & Wilson, Montreal.

BETTER DO IT RIGHT AWAY

Consider them on your work.

BAKER DRILLS

They are POPULAR tools on Lyddite and Shrapnel.

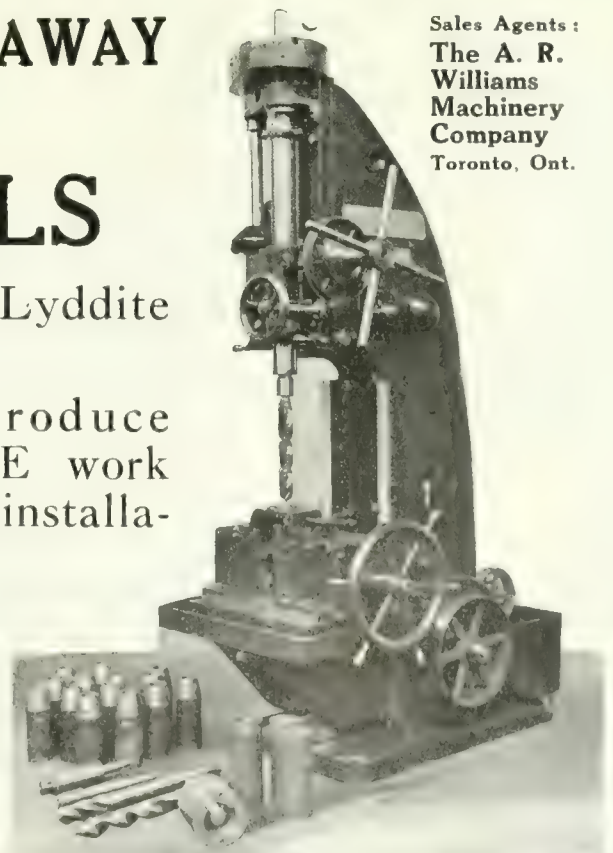
POPULAR because they produce ACCURATE—DEPENDABLE work at extremely low labor cost, low installation cost and small floor space.

SHELL OPERATIONS

READILY PERFORMED BY BAKERS.

Drilling, Boring, Reaming, Counterboring, Facing, Undercutting, Nosing, Tapping.

BAKER BROS., Toledo, O., U.S.A.



Sales Agents:
The A. R.
Williams
Machinery
Company
Toronto, Ont.

DO YOU need greater EFFICIENCY in your Plant? Never was there a better opportunity or more need for you to eliminate all uncertainty in the use of material and equipment. We will accomplish this for you.

There may be leaks in your business that a few tests will bring to light, enabling you to avoid them in the future.

If you would compete successfully against the strenuous tide of modern competition the methods of the past will not do. There must be an exact knowledge, an absolute certainty as to the materials you are using, and the equipment you are operating.

We will make the physical, chemical and engineering tests you need; make reports to you and help to establish your organization on a more stable foundation.

CANADIAN INSPECTION AND TESTING LABORATORIES, LIMITED

INSPECTING AND METALLURGICAL ENGINEERS AND CHEMISTS

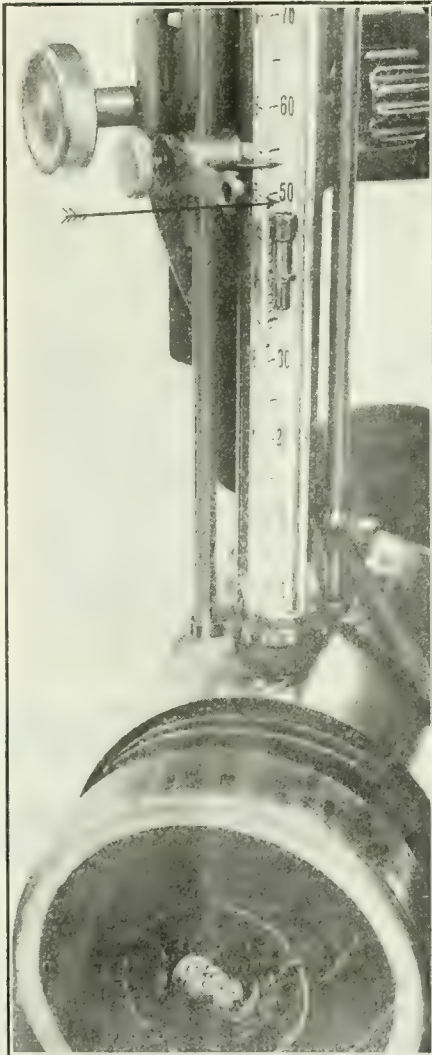
Head Office and Main Laboratories : MONTREAL

Branch Offices and Laboratories : Toronto, Winnipeg, Edmonton, Vancouver and New Glasgow

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

For Testing Shrapnel Parts

THE SCLEROSCOPE Is Used Universally



Scleroscope at Work.

The British Government specifications are that a shrapnel shell shall strike between 43 and 50 after heat treatment. Shells falling below this are rejected.

The scleroscope is depended upon to give accurate results. It does this or it would not be specified by the British Government.

The scleroscope has been adopted by the various governments for testing shells and projectiles because it is fast as well as dependable. If you want to *know* the physical qualities of steel, and other metals, use it.

Booklet on request.

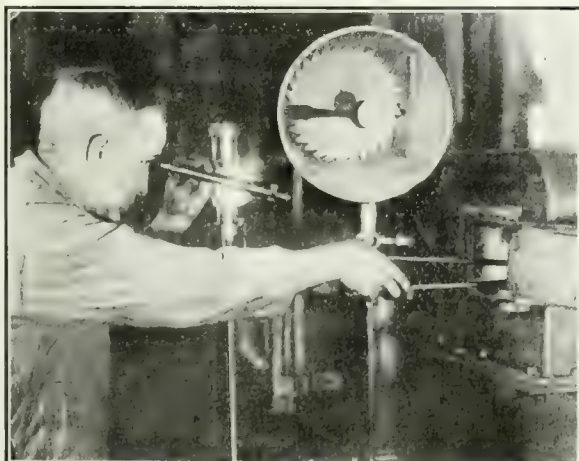
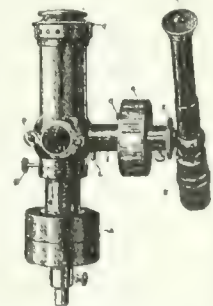


The Scleroscope on swing arm

For Heat Indication Use The PYROSCOPE

Is the common-sense heat measuring instrument that makes straight for results without fuss. Costs least of all; burns simple kerosene; never varies. It is the one available trusty in the grimy hands of furnace men, hardeners, carburizers. It is a pet in the laboratory, and is also being universally adopted by colleges for demonstration purposes owing to the correctness of the principle utilized. Our best customers are those who have tried all other means of heat measuring.

Send for our free circular P, and list of users in the United States.



Pyroscope in use.

SHORE INSTRUMENT & MFG. CO.

555-557 West 22nd Street NEW YORK

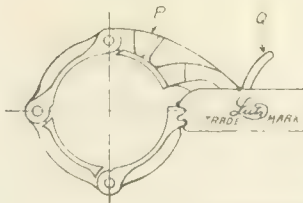
Agents in all Foreign Countries

SALES AGENTS:

The A. R. Williams Machinery Company, Limited
Toronto, Ontario

IF IT'S MACHINERY—WRITE "WILLIAMS"

LU TZ COMPRESSION WRENCH



The Lutz Compression Wrench is a universal tool. It will grip anything—anywhere and under any possible workable condition—without marring or slipping.

Its uses are as numerous as the varied jobs that confront the MACHINIST, the PLUMBER, the ENGINEER or the MANUFACTURER, with equal safety to the man and to the work.

It becomes indispensable the moment its universal use is understood. Its uses are multiplied by other Lutz Compression Tools. IT IS VITAL AS AN AID TO THE SHELL MANUFACTURER. WRITE FOR DETAILS.

LU TZ - WEBSTER ENGINEERING COMPANY, INC.

PHILADELPHIA, U.S.A.

Canadian Representative: R. B. STEWARD, 52 Wellington St. W., TORONTO

Buy an ALLEN Portable Pneumatic RIVETER

AND BE SURE OF THE **FASTEST AND TIGHTEST RIVETING AT THE LOWEST COST.** →

"Whatever the riveting, there's an ALLEN for the job."

Special riveters designed to meet all requirements.

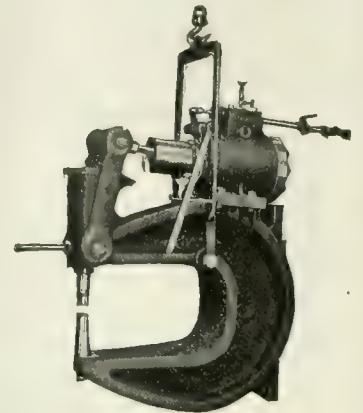
Send for Illustrated Catalogue.

JOHN F. ALLEN COMPANY, (Established 1872)

370-372 Gerard Avenue, NEW YORK

Liebers and W. U. Codes, "Riveter."

AGENTS—Canadian Ingersoll-Rand Co., Ltd., Toronto, Ont.; Montreal, Que.; Winnipeg, Man.; Vancouver, B. C.; Sydney, N. S.; Cobalt, Ont.; Lethbridge, Alta.; Nelson, B. C.; So. Porcupine



P. O. B.

Ford Motor Company

ORIGIN

DATE 2, 1915.

ORDER FROM Detroit Electric Welder Company, 255 Lafayette Ave. W., Detroit, Mich. MARK WITH SHIPMENT Our Order No. 7593 A

Ship Via F.O.B. DATE RECEIVED JUL 11 1915 Delivery

Terms Same as last order Dept. DISPOSITION Specified September 1st

Quantity	Description of Material Wanted	Price	Total
1	Vollans #119 Type K, 60-cycle, 440-volts, Electric Welder, to be duplicate of machines formerly supplied us.		
WRD-02F			

Acknowledgment of this order must be made in writing by return mail. No charges are allowed for boxing or crating unless previously arranged. We reserve the right to cancel our order if the material is not shipped within the time specified. There is no verbal understanding or agreement different than the conditions stated in this order. We will not receipt for material unless signed and marked with our Request on Number, Symbol Number and Department. Your invoices must also bear the above numbers and reach us by the time the goods arrive at our factory. Send separate invoices for freight.

Approved

Handwritten signature

Handwritten signature

Henry Ford knows

If he could find any better method to accomplish the same results that he gets by Volla-nizing, he would use it. If he could find a better welder than the Vollans, he would buy it. His meteoric rise in the manufacturing world came about through his ability to get immediately at the heart of things—to eliminate waste.

Many Other Big Business Men Are Doing the Same Thing—By Volla-nizing—Why Don't You?

The "Vollans" electric spot welder is one of the latest inventions in the electrical world, recognized as the greatest factor in reducing labor, time and material costs—where rivets and solder were being used—or where ordinary electric welding was the prevailing method employed.

Among some of the following users of Vollans spot welders we have effected savings from 10% to 300%:

- Theo. Kundtz Co. Reliance Motor Truck
- Horton Mfg. Co. Co. Portable Elevator Mfg. Cortland Carriage Gds. Co. Co.
- Gordon Lawless Co. A. J. Miller Co.
- Schranger & Johnston Reo Motor Car Co.
- Edwards Metal Mfg. Co. Gray Hawley Co.
- Novelty Mfg. Co. Ford Motor Co.
- Shaw Walker Co. Detroit Pressed Steel
- Crowfoot Mfg. Co. Co.
- Chevrolet Motor Co. Trio Mfg. Co.

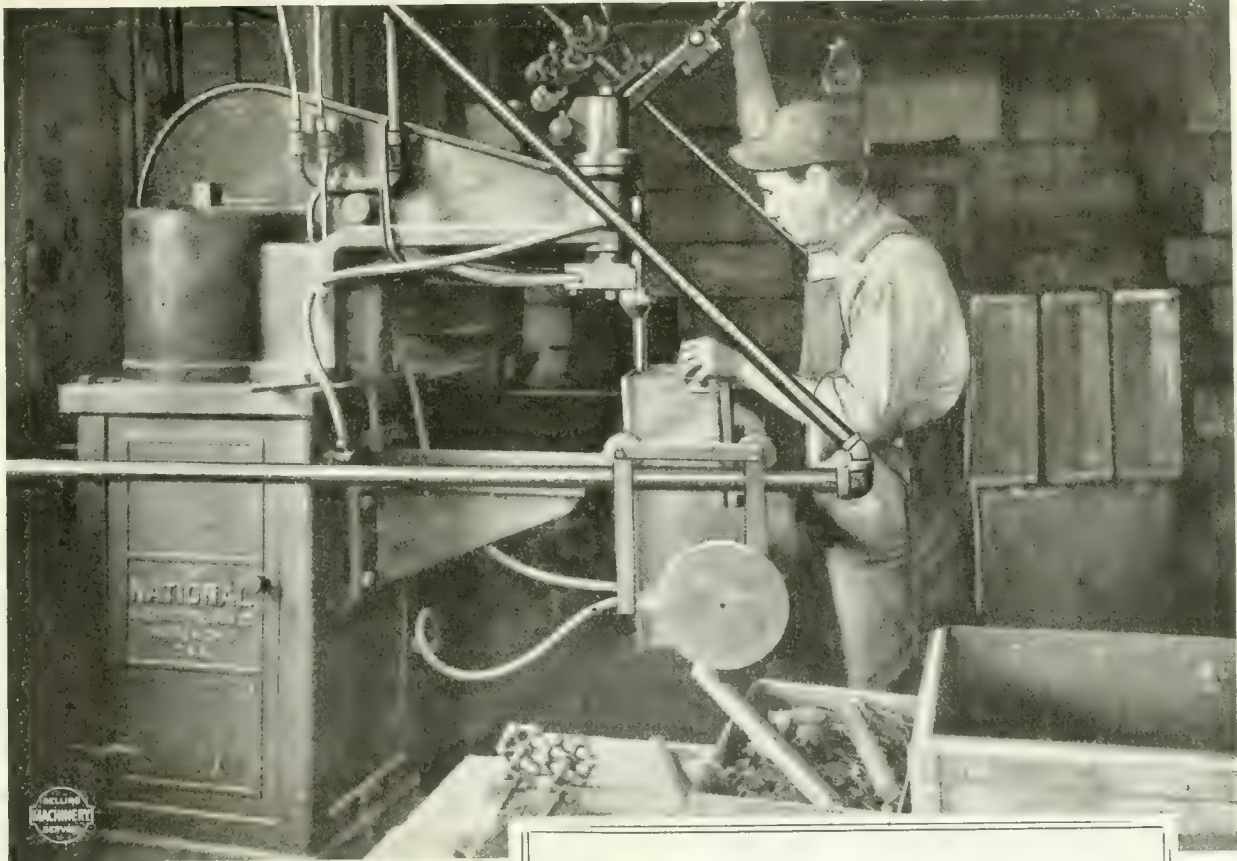
There is a difference between ordinary electric welding and Volla-nizing—You can Volla-nize Only on a Vollans Spot Welder.

DETROIT ELECTRIC WELDER COMPANY

253 Lafayette Ave. W.,

Detroit, Michigan

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



THE ABOVE CUT ILLUSTRATES ONE OF THE HEAVY TYPES OF SPOT WELDERS IN OPERATION.

We build lighter types of Spot Welders, also a complete line of standard Butt Welders.

The design and construction of special types of electric welding machines for hand operation, semi-automatic and full automatic is a specialty with us.

Won't you submit your welding problems to us to solve?

NATIONAL WELDING

National Electric Welder Company

WARREN

OHIO

Heavy Work, This— 3180 Welds Per Day

Don't confuse this work and the number of welds with the welding of light sheet metal parts. There's a big difference.

These boxes are of steel, 22" x 22" x 7³/₈" deep and weigh approximately 150 pounds each. Rings, stops, pins, plates, etc., make up a total of 212 welds to each box.

The National Welder, one operator and a cleverly designed holding fixture combine to finish 15 boxes per day, a total of 3,180 welds.

There are now four National Welding Machines in the McCaskey shops.

We are ready to demonstrate the advantages of National Welding. If other machines or methods have failed, or if you are not getting the results you should, send us your inquiries.

Catalog on request

Of Interest to Every Manufacturer of

N ails	E lectrical Goods
A brasives	L athes
T rucks or Trunks	E nameled Ware
I ron	V alves
O ils or Ovens	A nnunciators
N ewspapers	T ransformers
A gricultural Implements	I njectors
L eather or Lanterns	N ets
	G uns and Ammunitions
C abinets	
H ardware	T raps
A luminum Goods	R efrigerators
P aints	U mbrellas
M achinery	C offins or Caskets
A ids	K ettles
N etting, Wire, etc.	S hells and Munitions

Do you make out its name, and can you not see the opportunity of wonderful saving and improvement in your shop conditions?

The largest manufacturers of shells in Canada and the United States are using National-Chapman Elevating Trucks.

The new *MADE-IN-CANADA* Truck, under Canadian patents.

Note the Prices:—

Size	Capacity	Platform Clearance	Price
17" x 37 $\frac{1}{2}$ "	2,500 lbs.	6 $\frac{1}{2}$ "	\$65.00
17" x 37 $\frac{1}{2}$ "	2,500 lbs.	7 $\frac{1}{2}$ "	70.00

F.O.B. Brantford, Ont., Canada

Larger sizes and capacities accordingly.

Illustrated catalog **C-E** sent, or our Canadian representative will call upon request. Address all inquiries to

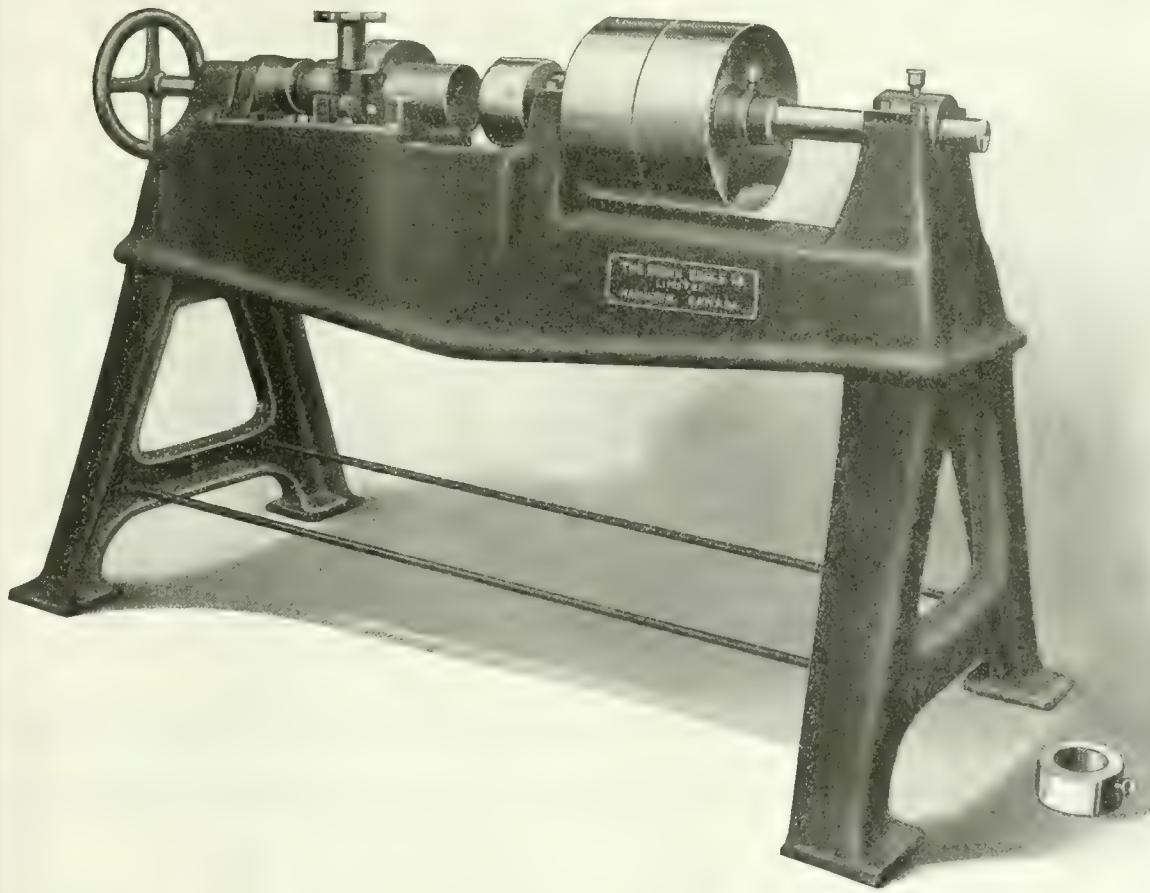
J. A. Hunter
Canadian
Representative

**National
Scale Co.**
BRANTFORD,
ONTARIO



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

SHELL BASE MARKING MACHINES



ONE OF THE MOST IMPORTANT OPERATIONS IN SHELL MANUFACTURING IS THE "MARKING." OUR BASE MARKING MACHINE WILL SOLVE YOUR MARKING TROUBLES. IT IS A WONDERFUL INVENTION.

The mechanical device employed in marking the base of Shells in this machine is somewhat of a departure from the general principles. It is so arranged that the entire pressure of the machine is exerted on each individual letter and figure successively.

By this action a very deep impression is obtained with very little power and consequently no crushing strain. The depth of the impression can be increased or decreased as desired.

The method of operation is exceedingly simple. First, the Marking Chuck (shown in cut) is fastened on the end of the Shell by means of Thumb Screw. The Shell is then placed on Saddle, clamped, and by the aid of Hand Wheel the Shell is moved up to the Revolving Pressure Chuck, whence the operation is completed.

It only requires a few seconds to do the marking: the balance of the time being consumed inserting and removing the Shell. An output of sixty Shells per hour should easily be obtained.

We make these machines for 3" Russian, 4.5 and 5" British High Explosive Shells. We can also make them for any size Shell desired.

BODY SHELL MARKING MACHINES

Our Body Shell Marking Machines are, without doubt, the most efficient on the market. Sixty Shells per minute is what we claim for it. *If interested, write for prices.*

The Brown Boggs Co., Limited, Hamilton, Can.

Tinsmiths' Tools, Sheet Metal Working Machinery, etc.

WESTERN AGENTS: Messrs. Bissett & Webb, Limited, Winnipeg and Edmonton

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



Would You Think of Throwing Dollars on Your Scrap Heap? *Certainly Not!*

Why then scrap castings that cost dollars to make just because of blow holes, sand holes, etc., when by using

SHELTON METALLIC FILLER

you can eliminate these defects and the expense of make-overs? You will not be delayed in filling orders—you will have no dissatisfied customers and no lost business.

Shelton Metallic Filler becomes part of the casting itself; is durable and can never be detected.

DON'T SCRAP ANOTHER DOLLAR BY SCRAPPING CASTINGS.

The fact that Shelton Metallic Filler has been used by many of America's leading manufacturing plants for years proves its reliability.



SHELTON METALLIC FILLER CO.

DERBY, CONN.

Agents: Webster & Sons, Limited, 31 Wellington St., Montreal

No, Stevens' Stopper won't stop a train, but it will stop the blow hole in a defective casting so that you cannot find it.

In this way, it helps your bank account. The casting that otherwise would have to go to the scrap heap can be converted into good coin of the realm.

Same color as the rest of the casting. Doesn't look like a blue patch on Casey's faded overalls.

How to use Stevens' Stopper, or Circle Cement:

Stevens' Stopper is a fine powder, used with a little water and made into a paste—the hole is easily filled with a putty knife or trowel. It takes anywhere from two to twenty-four hours, depending upon the size of the patch, for the filler to become as hard as the casting itself. When rubbed with a file it shows the color of the casting, hence it is the best filler and the one thing that saves your castings, and that means the saving of your dollars.

Another thing—I do not ask a fancy price for it.

A pound will save many dollars' worth of castings. Put up in 5-lb., 10-lb., and 25-lb. cans.

FREDERIC B. STEVENS

Manufacturer of
Foundry Facings and Supplies, Buffing Compositions
and Platers' Supplies

Corner Larned and Third Sts. DETROIT, MICH.

BRANCHES

WINDSOR, ONTARIO, 20 PITT STREET
INDIANAPOLIS, IND., 138-140 SOUTH DELAWARE STREET

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



START RIGHT NOW

And PLAN To Attend

The Foundry and Machine Exhibition

The biggest and most important Foundry
and Machine Exhibition ever held.

The Time: Sept. 25th to Oct. 1st, 1915

The Place: ATLANTIC CITY

It's up to every live Canadian Manufacturer to arrange to have his foremen—machinists—and purchasing agents attend this exhibition. It will prove worth many times the cost and the time. Remember this is

YOUR EXHIBITION.

Thousands of dollars are being spent by exhibitors and the management of the exhibition to provide you with every possible means for your profit and enjoyment.

If there is any information you might desire regarding the BIG EVENT such will be gladly furnished by

The Foundry and Machine Exhibition Co.

1949 West Madison Street, CHICAGO, ILL.

Our Newly Designed

Shrapnel Shell Cleaning Machine

**Cleans all Standard Sizes
and accommodates various other sizes**

The table of this machine has six shell pockets. Three of these are in the Blasting Department, and the other three, as shown in the illustration, are in the open. Thus, while three of the shells are being cleaned, the operator can remove the other three that have been cleaned, replacing them with three more to be blasted.

Consequently the machine can be kept in constant operation.

This machine, if connected to any exhaust system, will be nearly dustless and absolutely automatic in operation.

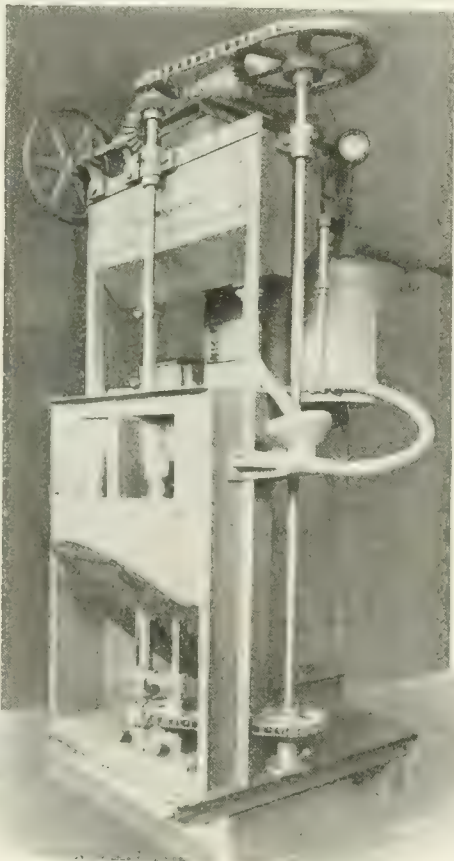
On the sand blasting table proper the division plates are lined with wood. This protects the steel plate. The wood is inexpensive and easily replaced.

The machine is so designed that the copper band groove is blasted on the exterior of the shell and another nozzle blasts the upper part of the exterior of the shell.

Its capacity for continuous running is from 150 to 200 shells per hour.

We are anxious to tell you all about it.

Write us.



We are manufacturers of Sand Blast equipment for any particular need. Also cleaning mills, dust arresters, roller mills, resin granulators and other foundry equipment.

**The W. W. SLY MANUFACTURING
COMPANY
CLEVELAND OHIO**



DO YOU GET IT ?

A monthly nugget of food, sunshine and entertainment.

The man who edits it writes it as a pleasure—not as a duty.

It says something every month and stops when through. It doesn't preach.

The text contains no advertising.

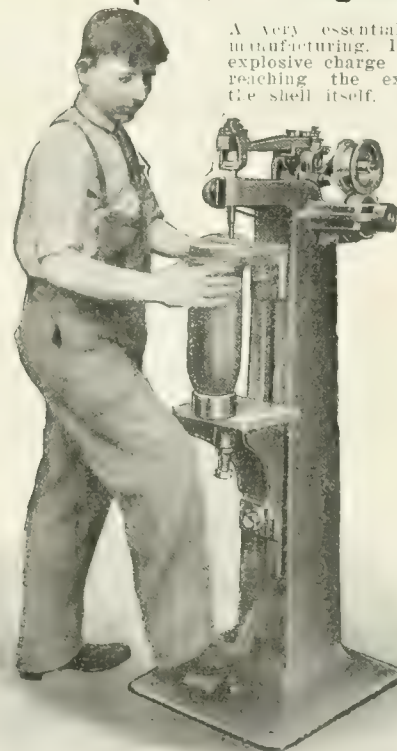
Sent free to anyone anywhere without obligation.

*Give us your name and
address and mention
"Canadian Machinery."*

**THE GLOBE MACHINE &
STAMPING COMPANY**

Cleveland, Ohio

Riveting Base of Explosive Projectile



A very essential operation in shell manufacturing. Prevents gas from the explosive charge behind the shell from reaching the explosive contents of the shell itself. Neglect of this operation would probably cause the shell to explode and kill or injure the gun crew.

After the shell is in position the machine is started and the shell is rotated one complete revolution by hand and, with the machine striking about 2,000 blows per minute, the plug can be riveted perfectly tight into the base in about 10 seconds.

CHANGE OF FIXTURE ENABLES MACHINE TO BE ADAPTED FOR 4.5", 38 LBS. OR SHELLS EVEN LARGER THAN 4.5".

Drop a line for further particulars.

**The Grant
Mfg. and
Machine Co.
Bridgeport, Conn.**

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

—And If You Grind Your Shells—

You will have an increased production—

A closer accuracy—

More uniformly finished shells—

A reduced cost of operation—

Aloxite Grinding Wheels For Shell Grinding

are the wheels that are making records for production for fast, free, clean cutting— for real grinding wheel efficiency in the shell manufacturing plants.

Either in grinding the bodies or noses or the entire shell in one operation they are giving real grinding production. They hold to the desired shape, stand up to the work requiring but little dressing and they show economy in length of life.

GRIND YOUR SHELLS WITH ALOXITE WHEELS

Suppose you get in touch with our service department and get the right wheel in the right place.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

NORMAN MAC DONALD, Toronto, Ont. WILLIAMS & WILSON, Montreal

A. R. WILLIAMS MACHINERY CO., St. Johns, N. B.

New York

Chicago

Boston

Philadelphia

Cleveland

Cincinnati

Pittsburgh

Milwaukee

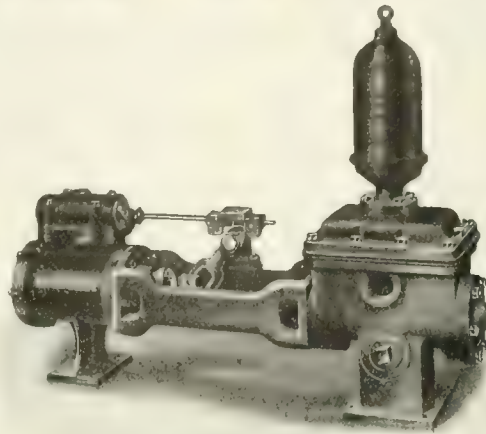


GRINDING SHRAPNEL. ALOXITE WHEEL ON A FORD SMITH MACHINE

BURNHAM STEAM PUMP

Of the thousands of steam pumps installed every year, a large percentage of them bear the name of "Burnham," the *Steam Pump* endorsed by leading Architects, Consulting Engineers and Heating Contractors as the best, simplest and most economical pump on the market.

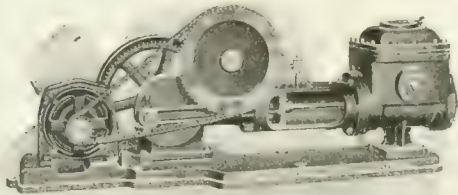
If you want a pump for handling hot water, use the "Burnham."



Thousands of Burnham pumps are in operation in connection with *Vacuum Heating Systems*; they are specially adapted for this service. Standard Burnham Boiler Feed Pumps and Burnham Vacuum Pumps are kept in stock and can be shipped promptly.

Ask for Catalog "P"

Burnham Boiler Feed Pump



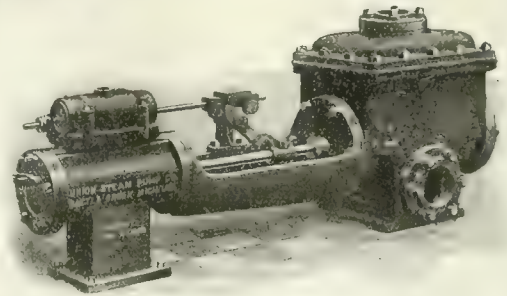
Union Electrically Driven Vacuum Pump

Darling Brothers

Limited

15 Ottawa Street
MONTREAL

Toronto Winnipeg



Burnham Vacuum Pump

MACHINERY MANUFACTURERS EVERYWHERE

should equip their metal-working machines with

TRAHERN ROTARY GEARED PUMPS

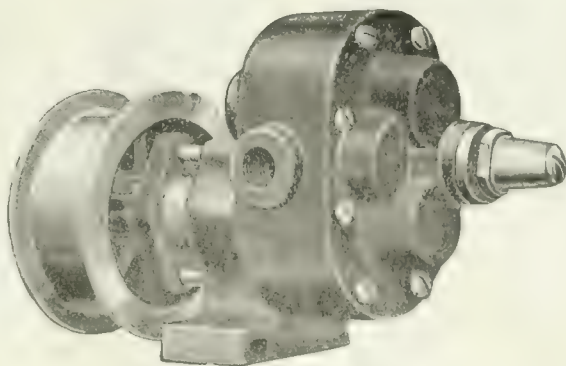


Fig. 1850 With relief valve

for
Water
and
Oil

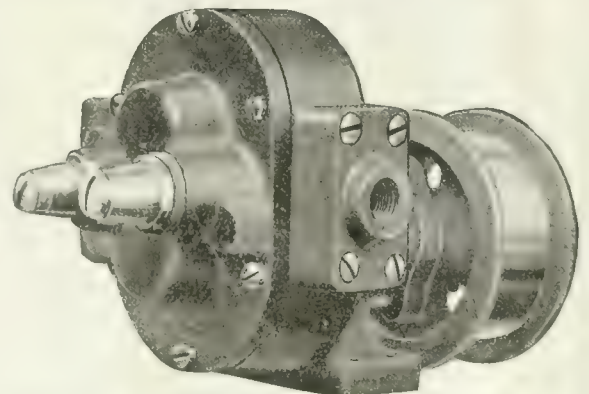


Fig. 1851 Reversible with double automatic relief valve.

They are universally adopted: WHY?

BECAUSE They are easily ATTACHED to machine.
Add to ATTRACTIVENESS of machine.
Operate with EQUAL EFFICIENCY and ECONOMY in water or oil.
AUTOMATIC RELIEF VALVE permits supply being cut off at discharge without stopping pump.

REMEMBER WE CAN MAKE DELIVERIES.

Write for prices and samples.

TRAHERN PUMP COMPANY,

Dept. II

ROCKFORD, ILLINOIS

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

Williams' "AGRIPPA" Tool Holders Won

THE HIGHEST AWARD

Our Panama-Pacific
Exposition Award

"THE MEDAL OF HONOR"

Confers Tool Holder
Supremacy



All our Tool-Holders Positively
Guaranteed.

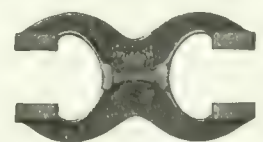
Money Refunded within 90 days
if unsatisfactory.

- | | | | | |
|--|---|---|---|---|
| <p>TURNING-TOOL HOLDERS
Cam lock.
Rapid and positive.
The greater the pressure, the tighter the lock.
No set-screws to strip or upset.
No holders to scrap.</p> | <p>CUTTING-OFF & SIDE-TOOL HOLDERS.
Cam lock.
Rapid and positive
The greater the pressure, the tighter the lock.
Interchangeable blades.
One holder for both cutting-off and side-tool work.</p> | <p>BORING-TOOL HOLDERS
Take multiple bars of all commercial shapes.
No bushings required.
SLEEVE BAR
Universal cap for straight or angle cutter.
No loose or extra parts.
PLAIN BAR
Simplicity itself—a solid bar.</p> | <p>THREADING-TOOL HOLDERS
Combination rigid and spring tool for rough or finishing cuts.
Lockable spring head.
Equally efficient for turning-tool work.
Alloy steel cutters.
Cam lock.</p> | <p>PLANING-TOOL HOLDERS
36 angles of adjustment—note serrations in the adjustment ring.
Perfect seating of cutters.
Uniform locking pressure.
Adjustment ring takes the strain, relieving holder of wear.
Excellent also for offset turning-tool work.</p> |
|--|---|---|---|---|

Williams' Vulcan Caliper Gauges For External, Internal and Eternal Use



Capacities 3" to 7 1/2".



Capacities 1/4" to 3".



Capacities 1" to 3"

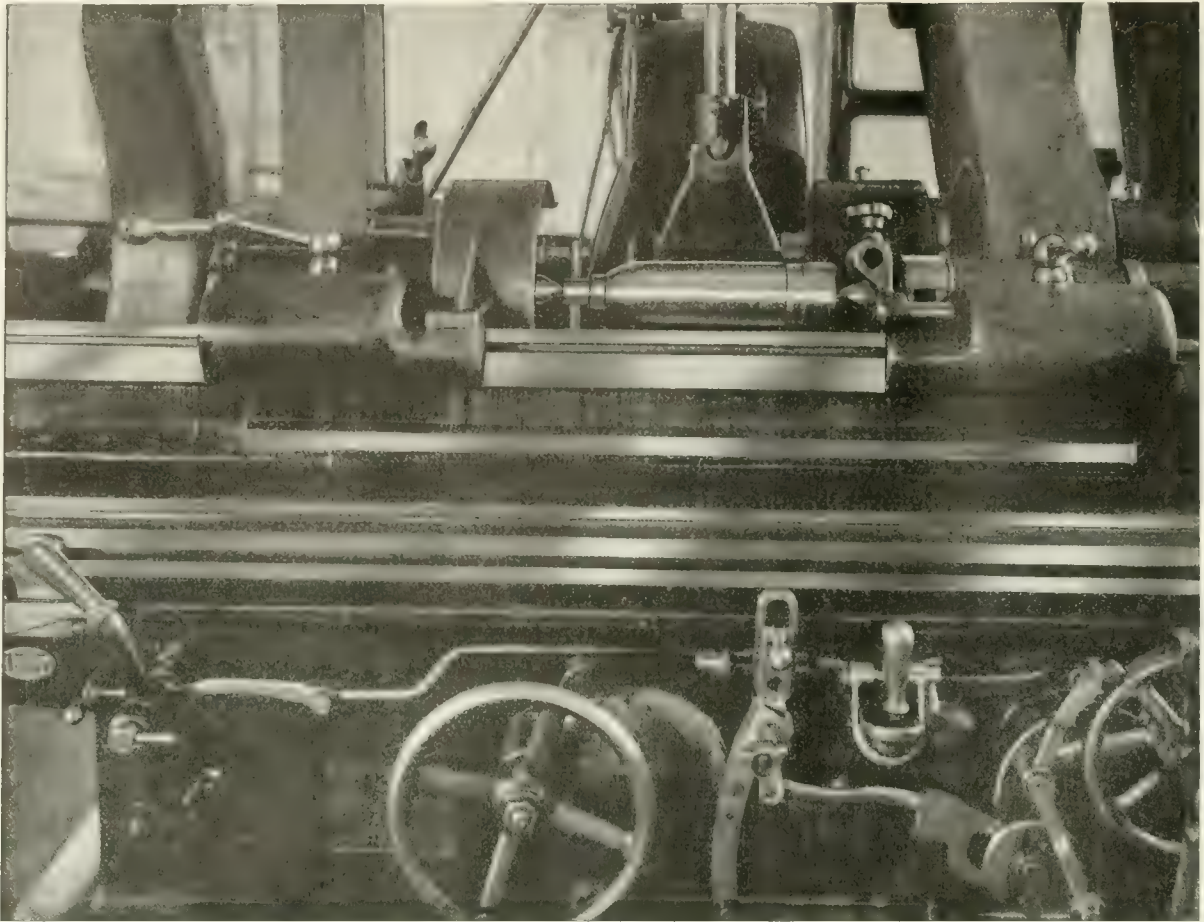
Factories
BROOKLYN
BUFFALO

Western
Warehouse
40 So. Clinton St.
CHICAGO

J. H. WILLIAMS & CO
43 Richards St., Brooklyn, New York

Exhibitors at
PANAMA-PACIFIC
EXPOSITION
Block 18, Machinery Building.
Your call will please us.

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



Shrapnel Work ?

Here's the Grinding Machine You Need

This Norton 10" x 36" Grinding Machine when equipped for shrapnel grinding carries a wheel 20" in diameter and from $5\frac{1}{2}$ " to $6\frac{1}{2}$ " face.

A 6" belt provides ample power for the wheel drive.

The cut is made by feeding the wheel directly into the work without table traverse.

Our larger machines are being used in many plants grinding projectiles from 10" to 14" in diameter.

Send B/p of shell and details as to stock left for grinding, material, limits, and number of pieces required per day of 10 hours and we will submit complete proposition for your consideration.

The Canadian Fairbanks-Morse Co., Limited

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

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

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

ALUNDUM FOR Shrapnel Grinding

Is solving the problem of rapid and economical shell production for more than one Canadian manufacturer to-day. Made in varying grades and temper, Norton Alundum Grinding Wheels are suitable for nearly every grinding operation and furnish an abrasive



material that is almost ideal. When properly selected for the work to be done, an Alundum Wheel will cut cleanly, rapidly and smoothly; it will not burn or heat, causing unequal expansion of the metal and consequent irregularities, but will make a true cut within close limits of accuracy.



The Canadian Fairbanks-Morse Co., LIMITED

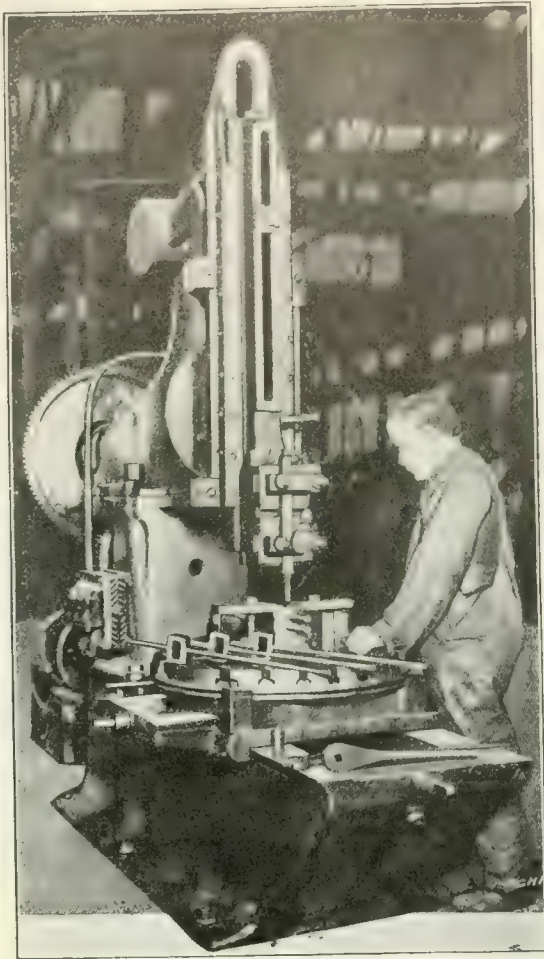
St. John, N.B., Montreal, Ottawa, Toronto, Winnipeg, Saskatoon
Edmonton, Calgary, Vancouver, Victoria.

F. H. Andrews & Sons, Quebec, P. Q.

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

268

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



The Dill Slotter

with its travelling bed is a wide range utility machine. It is said by some to be the most universal machine on the market. It will do work that is next to impossible on any other machine, with a 5-year average up-keep expense of 90 cents.

Accuracy, perfect alignment, rigidity of cut, together with many other vital features, are embodied in Dill construction.

We have a 15"-18" Dill Slotter in stock in Montreal ready for immediate shipment. Full specifications on request.

**The Canadian Fairbanks-Morse
COMPANY, LIMITED**



St. John
Quebec
Toronto
Winnipeg
Calgary
Vancouver

Montreal
Ottawa
Hamilton
Saskatoon
Edmonton
Victoria



St. John
Quebec
Toronto
Winnipeg
Calgary
Vancouver

Montreal
Ottawa
Hamilton
Saskatoon
Edmonton
Victoria



Machine Tools for Immediate Delivery

The following Machine Tools are in stock at our Montreal or Toronto Houses :

ENGINE LATHES:

- 1 Seneca Falls, 12" geared head.
- 1 Seneca Falls, 9" x 5'.
- 1 Seneca Falls, 12" geared head.
- 3 South Bend, 16" x 6'.
- 2 Rockford, 16" x 6'.
- 1 Seneca Falls 10" x 4' speed lathe.
- 1 Davis 20" turret lathe—plain head (second-hand).

SHAPERS:

- 1 18" Stockbridge two-pass crank-shaper with single pulley drive and power feed to head.
- 1 20" McDougall back-geared shaper.

SLOTTERS:

- 1—"Dill" 15"-18" belt-driven, slotter.

DRILLING MACHINES:

- 1 9" Hoefler friction bench drill
- 1 15" Hoefler friction drill.
- 1 45" Hoefler assembling drill, capacity up to 3/8".
- 6-20" McDougall plain drilling machines, lever feed.
- 2 20" McDougall plain drilling machines, power feed.
- 6-20" McDougall plain drilling machines, with back gears.
- 2-Barnes All Geared 24" back-geared drilling machines.
- 1-Sibley 24" sliding head drilling machine.
- 1 Henry & Wright No. B 8" ball bearing drill press.

PORTABLE ELECTRIC DRILLS:

- Made by the U. S. Electric Tool Company
- 1-Style "T," capacity to 3/8" for A.C., 110 volts.
 - 1-Style "CU," capacity to 3/8" for A.C. or D.C., 110 volts.
 - 1-Style "U," capacity to 1/2" for A.C., 110 volts.
 - 2-Style "EU," capacity to 7/8" for A.C. or D.C., 110 volts.
 - 1-Style "DEA," capacity to 1/2" for A.C., for 110 volts.
 - 1-Style "EA," capacity to 3/8" for A.C., 110 volts.
 - 1-Style "FA," capacity to 1" for A.C., 100 volts.

PIPE-THREADING MACHINES:

- 1-Oster No. 201 hand machine, capacity 1/4" to 2".
- 3-Oster No. 304A, capacity to 4", hand or power.
- 1-Oster No. 306A, capacity to 4", hand or power.
- 1-Merrill No. 512, capacity to 4", hand or power.

BOLT CUTTERS:

- 1-Wiley & Russell No. 42, capacity up to 1 1/4".
- 1-Acmo 1/2" bolt cutter.

POWER HAMMERS:

- 1-Fairbanks 75-lb. power hammer.
- 1-Fairbanks 100-lb. power hammer.

POWER HACK SAWS:

- 1 Robertson No. 3 High-Speed Hack Saw, capacity 8".
- 1 Robertson No. 5 High-Speed Hack Saw, capacity 8x15".
- 4-Fairbanks Power Hack Saws, capacity 5".
- 1-West Haven Power Hack Saw, capacity 6".

TOOL GRINDERS:

- 1 Walker No. 2 Universal Tool and Cutter Grinder, automatic feeds.
- 1-Blount 20" wet tool grinder.
- 1-Ford-Smith 20" wet tool grinder.

PORTABLE ELECTRIC GRINDERS:

- We have various sizes in stock, made by the U.S. Electrical Tool Company for internal and external grinding.

MISCELLANEOUS:

- 1 Hand Lever Punch, steel construction, capacity 5/8" hole in 3/4" plate.
- 1-Hand Lever Shear, steel construction, capacity 1 1/4" rounds, 3x3/4" plate.
- 1 Hand Lever Shear, steel construction, capacity 1/4" plates, 2x1/2" flats and 5/8" rounds.
- 1-Alligator shear, capacity 1" rounds, 4x1/2" flats.
- 1-Grabo 36" x 6" Grindstone and frame with tight and loose pulleys, complete with a stone water pot and truing device.
- 1-Gardner Disc Grinder, size 20 x 23".
- 1 No. 1 Greenall arbor press.
- 1-No. 80 Grant riveter, pedestal type.

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Combined Shrapnel and High Explosive Shell Manufacturing Plant

Staff Article

An installation such as here described puts the onus of successful production largely on the machine tool builder, and, as to how the latter has met the requirement as far as 3.3 shrapnel and high explosive shells are concerned, a careful study of the illustrations and text data will make the position clear. It will also evidence the ingenuity of the management.

THE plant here described is one of the most modern and up-to-the-minute mechanical engineering establishments in Canada. It is working night and day, producing both shrapnel and high explosive shells. Everything has been carefully planned, no detail having been overlooked in the placing of the multitude of machines required for the systematic handling of large numbers of shells. As these progress through the shop, the machines are so arranged that a minimum amount of effort is required in the removal of one series of shells from one operation to another.

Routine of Work.

The rough bars or billets enter the shop at one end and continue from one group of machines to another until they reach the other end; they are then transferred to the floor above and continue in the opposite direction until they again reach the entrance end. By this time they have been finally inspected and are ready for shipment.

Stock Yard.

The first view one

gets upon entering the yard leading to the shell department, impresses the observer with the extent of the operations that must successively follow. Fig. 1 shows a view of the stock as it is received from the mill. The pile of billets to the left of the track is for the making of 3.3 shrapnel shell, and the piles of steel bars to the right are to be cut into lengths for the production of 3.3 high explosive lyddite shells; in the background is a view of the shell department building.

Shell Shop Features.

The shell shop was especially erected for the manufacture on a large scale of both 3.3 shrapnel and high explosive shells. The building is a two-storey steel structure 400 feet long and 50 feet wide. The ground floor is of concrete and the upper floor double boarded.

Lighting.

Light is received from a row of large windows running along both sides while, in addition the top floor is lighted by a skylight the full length of the building. Directly above the large hydraulic presses is an opening which allows a considerable amount of light to penetrate to the lower floor. Artificial light is obtained from thirty-two globes at equal intervals along both sides of the shop, each globe containing a cluster of five tungsten lamps. Each individual machine is equipped with a Wallworks, Manchester England light stand, the wires from which are placed in pipes.

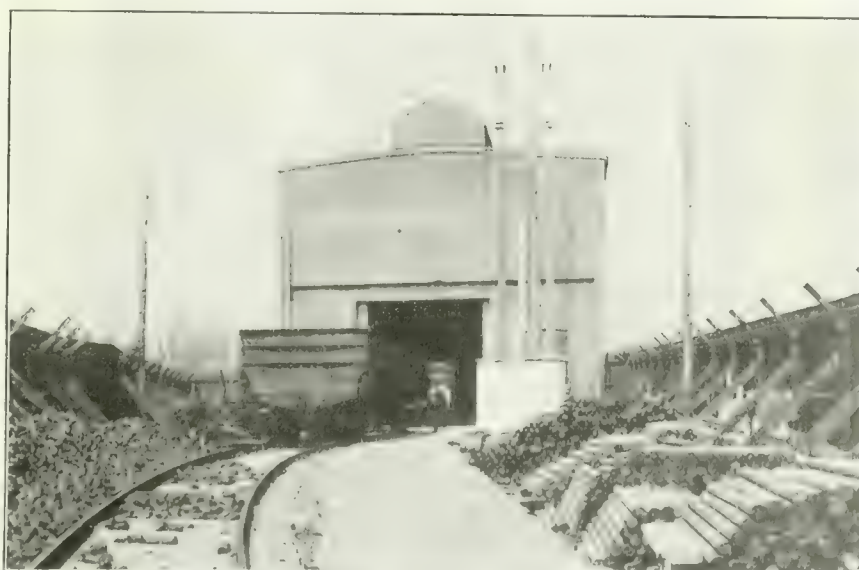


FIG. 1. VIEW OF YARD SHOWING STOCK OF SHELL BARS AND BILLETS SHELL SHOP IN BACKGROUND

and run beneath the cement floor to the walls on either side.

Heating and Fire Protection.

The building is heated by steam pipes running along the walls on both sides the full length of the shop. It is also fully equipped against fire, being furnished throughout with a sprinkler system and "Dominion" fire extinguishers, which are placed at intervals along each wall.

Grouping of Machines.

The machines are placed in a number of groups on either side of a centre aisle, each group being driven by a 30 or 35 horse-power "Vickers" motor, the belting for same being supplied by the Beardmore Belting Co., Toronto. The machines are so arranged that the shrapnel shells progress along one side, while the high explosive shells advance along the other side.

Shrapnel Shell Forging.

The shrapnel shell billets after entering the shop are taken to the three Mechanical Engineering Co. oil furnaces shown in Fig. 2, where they are heated and prepared for piercing. When ready, they are placed in one of the 250-ton Boomer & Boschert hydraulic presses shown in Fig. 3, leaving same in a shape similar to Fig. 4, and constituting the first piercing operation. The pierced billets are again heated and placed in a 200-ton B. & B. press, from which they emerge as finished forgings. A view of the drawing die is shown in Fig. 5 and the punch in Fig. 6.

The sketch Fig. 6A shows the device employed for cooling the punch. This is moved up and down around the punch while a strong stream of water is forced out of the small holes in the ring.

Cutting to Length.

After the shells are forged, they are tested for the thickness of the wall. Following this inspection, they are taken

to two "Hall" cutting-off machines where the rough open end is trimmed off.

Rough Turning.

They are then centered on a jig in several Foote-Burt drilling machines

length. The rough shell is, however, somewhat longer than otherwise, due to the required subsequent nosing operations.

Boring.

The shells are again tested for wall thickness and then taken to twelve 25-inch C.M.C. turret lathes where the powder recess is finished. The base is next finished on four "Hall" cutting-off machines.

Bottling.

The shells are now gathered into groups of 120 each, and are taken to the bottling presses in readiness for forming the nose. It might be stated that the hardening of the shells customary in most plants is dispensed with here as the nature of the steel as it comes to the shop and after drawing leaves the shell of the proper hardness. This is the only plant in Canada using 75 per cent. carbon steel. The latter is somewhat harder to work, but by using "Double Mushet" tool steel this disadvantage has been much minimized, an average of 45 shells being rough turned in ten hours with very little touching-up of the cutting tools.

The nosing or bottling is done in two operations, and the dies are so constructed that after the second operation the shape is almost the desired form, and requires very little machining. The dies for the two operations are shown in Figs. 8 and 9. When heating for the first operation, the open end of the shells in sets of four are placed in a vertical position in openings at the top of a "Mechanical Engineering Co." oil furnace, arrangements being made to revolve the shell while being heated. The first operation requires heating of about 2 inches or more back from the open end, and after the first process the nose is again heated in another M.E. furnace for a distance back of about $\frac{3}{4}$ of an inch, the nose being finished in the die shown in Fig. 9.

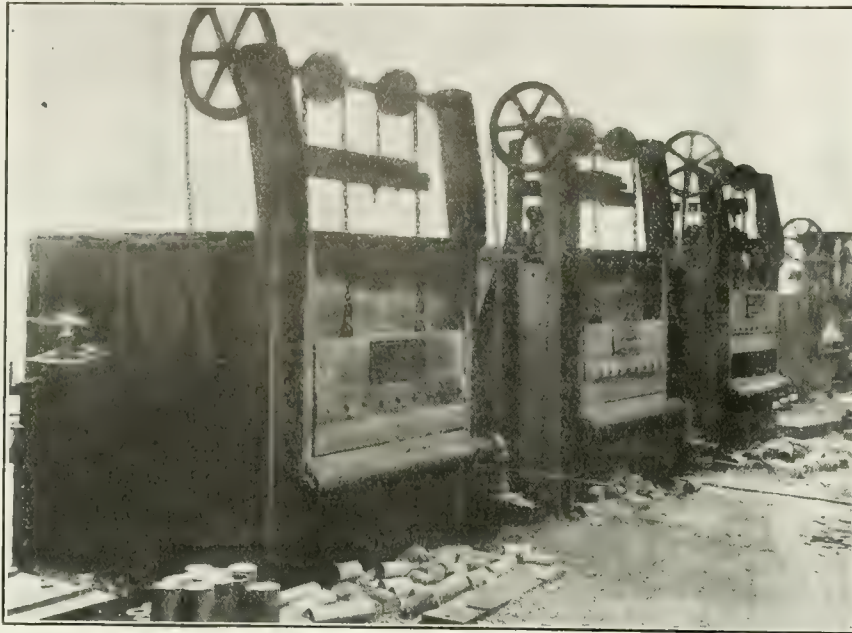


FIG. 2. "MECHANICAL ENGINEERING CO." FURNACES FOR HEATING AND REHEATING BILLETS.

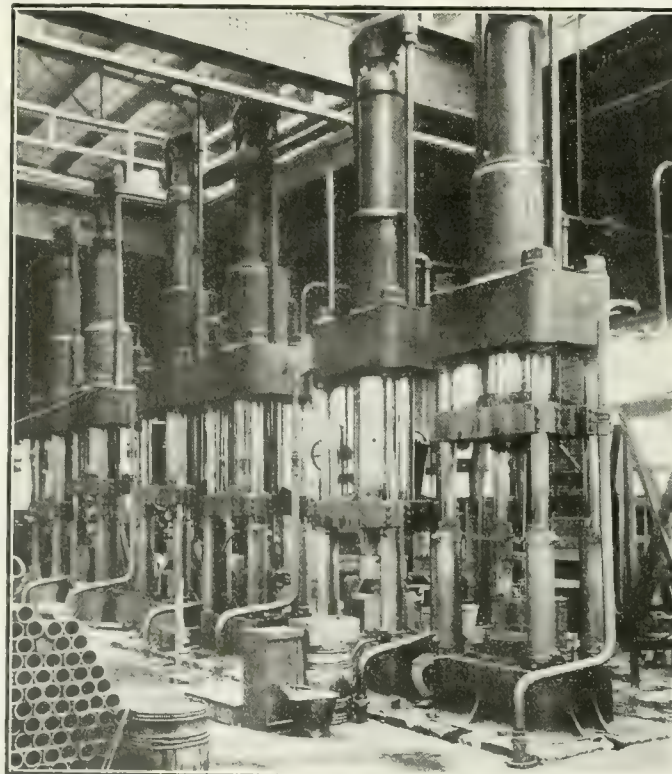


FIG. 3. THREE EACH, 250-TON "BOOMER & BOSCHERT" PIERCING AND DRAWING PRESSES.

Water-Cooled Oil Furnaces.

All these oil furnaces are water-cooled, each having a water chamber be-

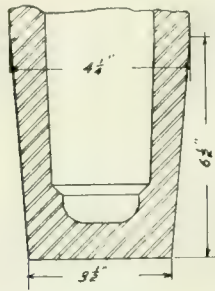


FIG. 4 SHRAPNEL BILLET AFTER FIRST DRAWING OPERATION.

tween the fire-brick and the outside casing. After the bottling operation is

Finishing and Threading Nose.

The shells are next taken to eight-16 inch. "C.M.C." lathes, fitted with turret heads and carrying a special chuck similar to Fig. 10. Thirty or forty of these chucks are in continual use. After the machining is done on the nose of the shell they go to two "Lees-Bradner" machines, where the thread in the nose is milled out. A view of these machines is shown in Fig. 11.

Finish Turning.

When threaded they are then finish-turned and the contour of nose formed by means of a fixed templet at the back of the lathe which takes care of the lateral movement of the tool-post rest.

Waving and Grooving.

The shells are now taken to five 16-

have the groove roughed out. They are afterwards taken to five 16-inch "C.M.C." lathes to have the waving and undercutting performed by means of a "Bertram" waving attachment. On account of the nature of the steel the

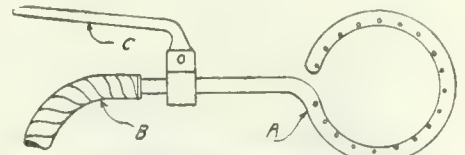
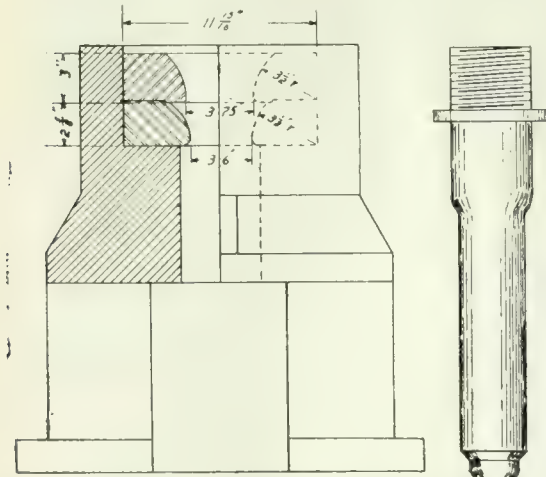


FIG. 6A. DEVICE FOR COOLING PUNCH OF FORGING PRESSES.

roughing and finishing are done on separate lathes to save the cutting tools.

Final Operations.

The foregoing completes the opera-



FIGS. 5 AND 6. DRAWING DIE AND PUNCH FOR FINISHED SHRAPNEL FORGING.

completed, the noses of the shells are annealed for further machining.

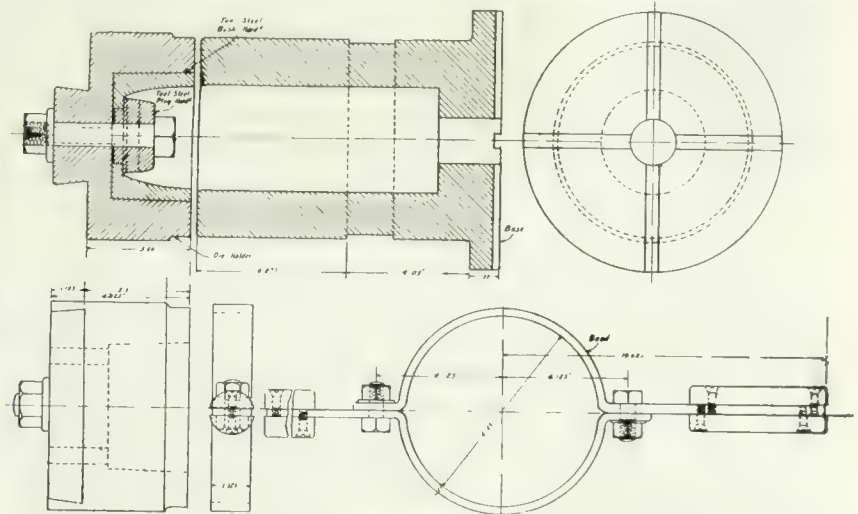


FIG. 8. DIES FOR FORMING SHRAPNEL SHELL NOSE - FIRST OPERATION

inch "C.M.C." lathes, where they are held in a chuck similar to Fig. 10, and

tions as performed on the ground floor. The shells are therefore transferred by means of "Chapman" and "Cowan" elevating trucks to an "Otis-Fensom" hoist and raised to the upper floor where they are filled with shot and resin and have the final operations completed. They are finally lowered on another hoist, ready for shipment.

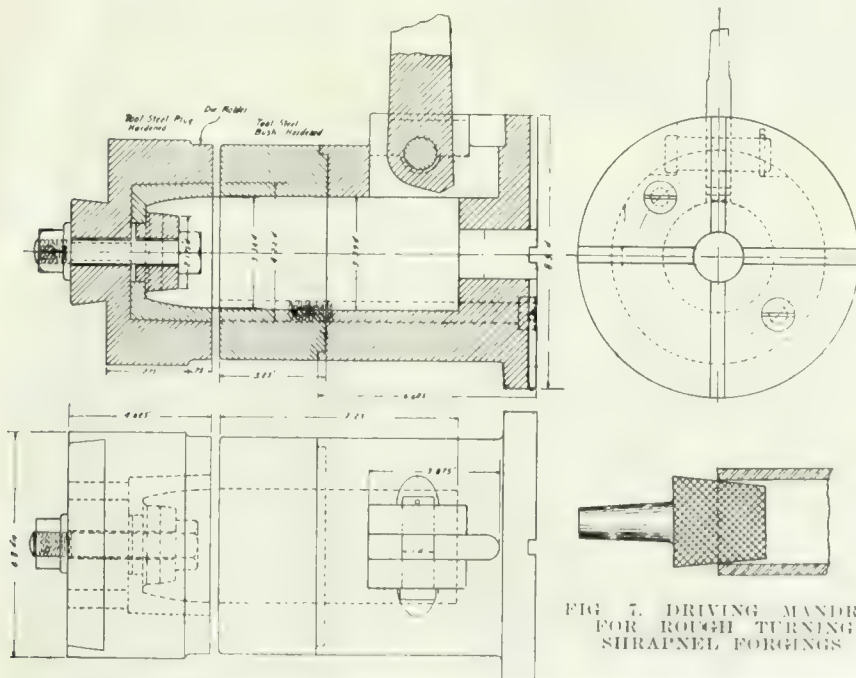


FIG. 7. DRIVING MANDRIL FOR ROUGH TURNING SHRAPNEL FORGINGS

FIG. 9. DIES FOR FORMING SHRAPNEL SHELL NOSE - SECOND OPERATION.

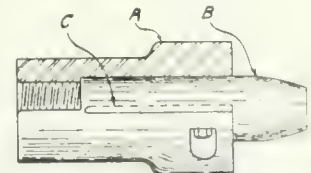


FIG. 10. SPECIAL GENERAL PURPOSE CHUCK.

A general view of shell shop with its multitude of tools is shown in Fig. 20, which is the illustration used in the title of our article.

High Explosive Shell Production.

The material for the production of 3.3 high explosive shells comes to the plant from the mill in bars as shown to the right of Fig. 1. These bars are brought into the shell shop and are first

cut into billets on an "Espin-Lucas" inserted tooth cold saw, driven by a 15 h.p. "Vickers" motor.

Rough Drilling.

The billets are placed in a jig and drilled in a battery of six "Foot-

Burt" drilling machines, the drills used being furnished by the Celfor Tool Co., and the Jno. Morrow Co. After they are

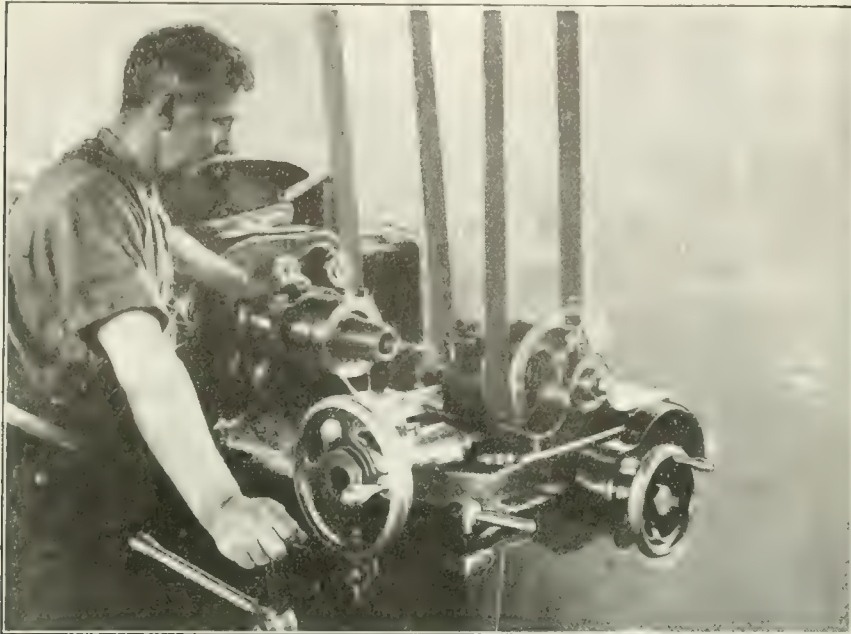


FIG. 11. THREADING NOSE OF HIGH EXPLOSIVE AND SHRAPNEL SHELLS ON A "LEES-BRADNER" THREADING MACHINE.

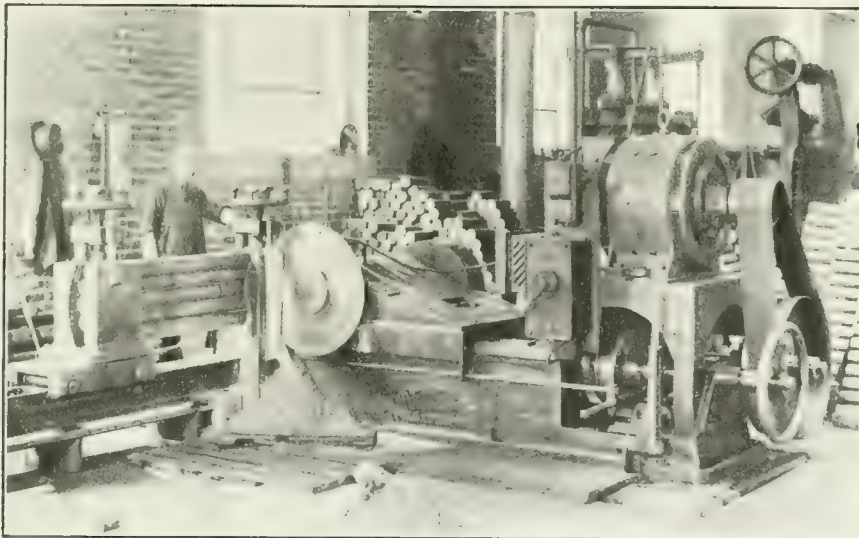


FIG. 12. "ESPEN-LUCAS" COLD SAW CUTTING-OFF BILLETS FOR 33 H E SHELLS.



FIG. 13. TURRET OPERATIONS ON NOSE OF 33 HIGH EXPLOSIVE SHELLS.

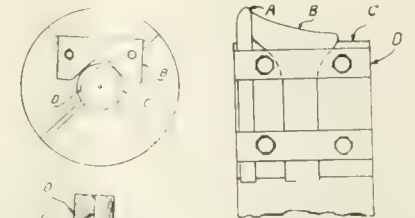


FIG. 14. NOSE FORMING TOOL.

FIG. 13. CENTERING JIG

rough drilled they are placed on a jig similar to Fig. 13 and centered.

Rough Turning and Boring.

The billets are then taken to eight 16-inch "C.M.C." lathes to be rough turned and have the contour of the shell nose formed by tools shown in Fig. 14; the tool A is for roughing, and tool B

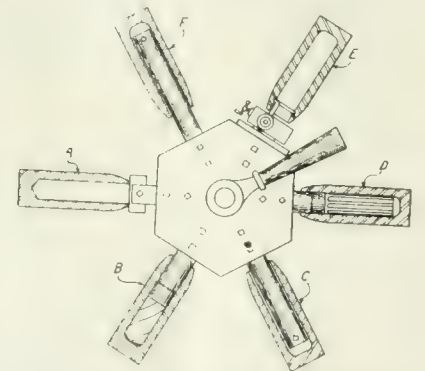


FIG. 15. TURRET LAYOUT FOR FACING "NOSE AND FINISHING INSIDE OF SHELL.

for finishing, the profile of nose. The shells are next taken to six "C.M.C." lathes fitted with turrets, and on these the boring and finishing of the inside of the nose is performed as shown in Fig. 15. The cycle of operations is shown in Fig. 15 A, and consists of facing, drilling, roughing powder chamber, reaming, recessing at bottom of thread, and finishing powder chamber.

Threading and Finish Turning.

The threading of the nose is done on



FIG. 16. DRIVING CHUCK FOR FINISH TURNING.

two "Lees-Bradner threading machines as shown in Fig. 11. The shells are then finish-turned on six "C.M.C." lathes, the driving being done by means of the chuck shown in Fig. 16. Grooving and waving are performed on six

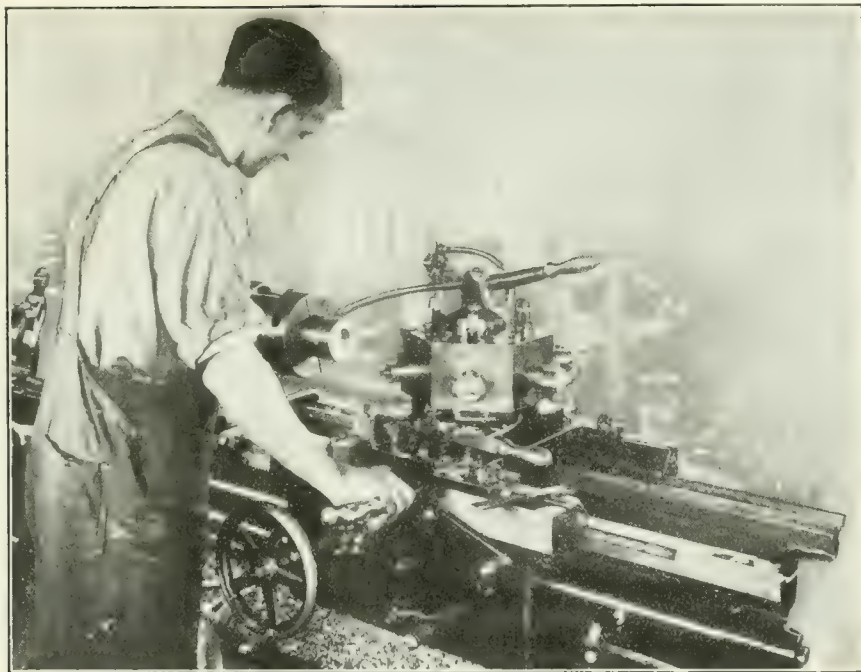


FIG. 17 FINISHING BASE OF HIGH EXPLOSIVE SHELLS ON "McDOUGALL" LATHE FITTED WITH TURRET HEAD.

"CMC" lathes fitted with a "Bertram" waving attachment.

Finishing Nose and Base.

Finishing the nose to receive the brass sockets is done on four R. McDougal Co.

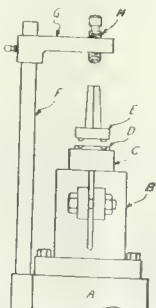


FIG. 18. JIG FOR SCREWING IN STEEL BASE PLATES.

18-in. lathes. The turret operation on the base of the shell to receive the steel disc is indicated in Fig. 17.

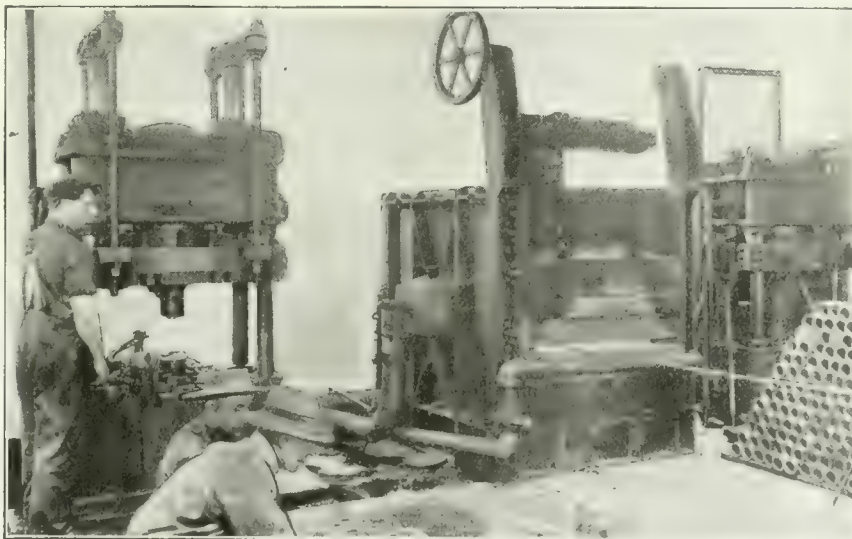


FIG. 21. "MECHANICAL ENGINEERING CO." OIL FURNACE AND "BOOMER & BOSCHERT" PRESSES FOR PRODUCING SHRAPNEL SHELL DIAPHRAGMS

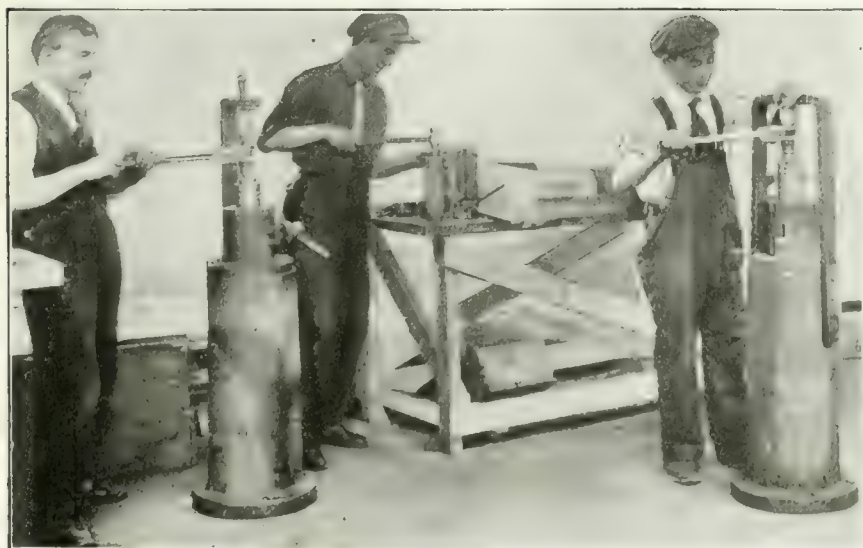


FIG. 19. SCREWING AND RIVETING REINFORCING DISCS INTO BASES OF HIGH EXPLOSIVE SHELLS.

Drilling and Tapping Nose.

The shells are now carried on "Chapman" and "Cowan" elevating trucks to the hoist where they are removed to the second storey. The grub screw holes are drilled and tapped in the nose and a finishing tap is run into the latter to bring the thread to the required size. The copper bands are next pressed on with a pressure of 700 to 800 lbs. per sq. in.

Screwing in Base Plates.

The steel base plates are screwed tightly in by means of the jig shown in Fig. 18. Two 1/2 inch holes are drilled diametrically opposite, flat bottomed and about 3-32 in. deep, so that they will be completely removed when plug is turned off flush. The stand A is firmly secured to the floor and the chuck B is bolted to the base. The shell C is rigidly clamped in piece B and the plug entered in its place; the support G for the ratchet is fastened to the piece E; the piece E having a shank which fits the socket of the ratchet and also fits the holes in the disc.

This arrangement can be made much more rigid by bridging the support as shown in Fig. 19. After the discs are screwed home, they are riveted in as shown in the centre of Fig. 19.

Finishing Base.

The projecting ends of the plugs are afterwards faced off on fifteen "Hall" cutting-off machines, these tools being specially adapted to this particular work.

Baking and Varnishing.

After the shells have been machined and inspected, they are ready for baking and varnishing. This operation is shown in Fig. 23. In the foreground is seen the arrangement for cleaning out the interior by means of a strong blast of air. The shells are next placed upon the hot plate shown in the background,

the next shell to be varnished, sufficient varnish adhering to the interior to leave the required coating. Heat dry-

ing immediately follows. A thin shell piece screwed into the nose serves to protect the thread from the varnish.



FIG. 23. AIR BLAST, BAKING AND VARNISHING.

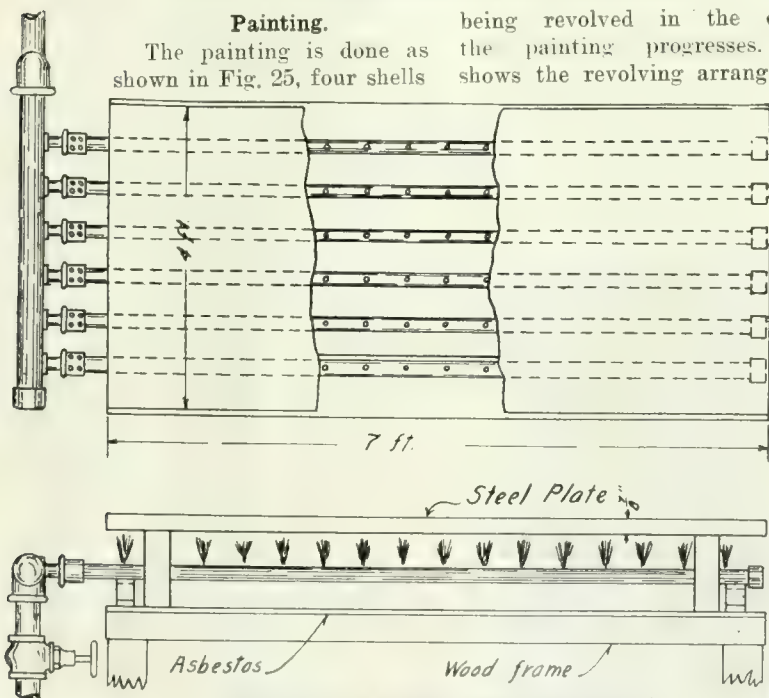


FIG. 24. HOT PLATE FOR VARNISHING



FIG. 25. PAINTING THE FINISHED SHELLS

shells C are placed on the piece B, this having a stem passing through the piece A which is secured to the bench. Attached to the bottom of each stem is the gear E which meshes with the intermediate gears F. Connected to the center shaft is an ordinary air motor which is supported in position by the cross piece of wood H. The same arrangement applies to the painting of the 3.3 shrapnel shells.

Shrapnel Shell Diaphragms.

The production of the diaphragm discs, which are placed inside shrapnel shells before the nose is formed, is one of the interesting features in connection with the manufacture of these projectiles. Punchings of 7-16 inch steel plate are forged to the desired shape and machined to fit the recess in the finished shell.

The punchings are placed in the Mechanical Engineering Co. oil furnace, shown in Fig. 21, and are heated and forged in the two Boomer & Boschert presses shown to the right and left of the furnace. A sketch of the forging die is shown in Fig. 21A. After being forged, they are taken upstairs and fin-

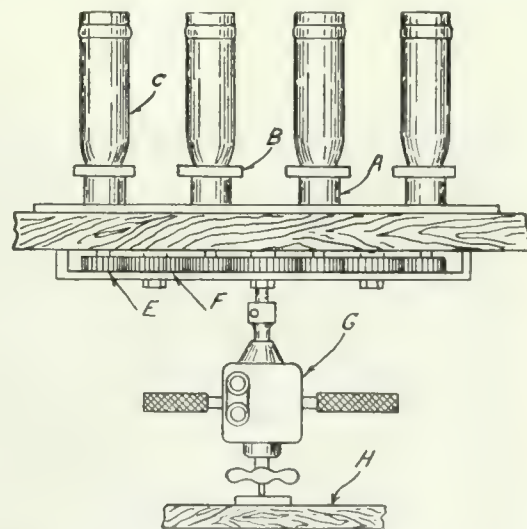


FIG. 26. PAINTING ARRANGEMENT

ished to the desired shape in the machines shown in Fig. 22.

When this plant is fully equipped an output of 5,000 each of 3.3 shrapnel and high explosive shells per week is expected.



The conversion of shipbuilding and marine engineering shops into shell factories proceeds apace in Great Britain, and still the demand for munitions exceeds the output. It is stated in this connection that for every soldier in the field there should be a munition worker at home, and that a battery of field artillery can use in a single day the output of 300 mechanics.

CARTRIDGE CASE COOLING CONVEYORS.

THE accompanying cuts show two special conveyors of 33 feet centres furnished by the Stephens-Adamson Mfg. Co., Aurora, Illinois, to the Metal Drawing Co., St. Catharines, Ont., for carrying red hot cartridge cases for 18-pdr. shrapnel shells from the annealing ovens to the pickling tanks prior to being re-drawn. The function of these conveyors is to afford a means whereby the cartridge cases can be cooled gradually while travelling from ovens to tanks.

Fig. 1 shows a pan of cartridge cases which have just been discharged from the annealing furnaces. These are picked off the pan singly or in pairs by means of long hand pinchers or tongs, and placed in a wire basket, which holds forty cases. The pan when empty is trucked around to the receiving end of oven ready to receive another batch of cases to be annealed. The conveyor is then put in operation and moves for a distance of two feet bringing an empty basket ready to receive its load.

Fig. 2 shows the discharge end of conveyor with basket laying in horizontal position (same as receiving end) ready for cartridge cases to be removed by hand and placed in pickling tanks for treatment.

The conveyors are spaced 14 ft. centres in line with the annealing furnaces, and between the conveyors is installed an exhauster for cooling the

cartridge cases emerging from conveyor thoroughly cooled. Edwin J. Banfield, Toronto, is the Ontario representative of the Stephens-Adamson Co.



FIG. 1. CARTRIDGE CASES BEING PICKED OFF PAN FROM ANNEALING FURNACE AND LOADED INTO WIRE BASKET ON CONVEYOR.

cartridge cases while in transit, the conveyors being started and stopped at will at either end by means of a friction clutch pulley on line shaft driving the same.

The capacity of each conveyor is approximately 1,400 shells per hour, and the time consumed between receiving and discharge end is thirty minutes, the

FORGING PLANT FOR 6-INCH SHELL FORGINGS.

THE cost of equipment for producing shells increases very rapidly with the size of the shell. While it is possible to extemporize to a great extent in the manufacture of 18-pdr. shrapnel and high explosive shells, the requirements of 4.5 inch shells demand more perfect machines. If the forging equipment be taken into consideration, the cost rises very rapidly. With 18-pounder shells, the forging has been done in heavy power presses or bulldozers, but 6-inch shells require a plant of a different type.

Recent estimates show that to produce 6-inch shell forgings, the following equipment is necessary. The shells are 30 inches long and the output is 30,000 per month, working 100 hours per week:

Five 450-ton vertical combined piercing and drawing presses, approximate weight 40 tons each; three 200-ton vertical cylinder pointing presses, approximate weight 8½ tons each; two 550-ton type banding presses, approximate weight 8½ tons each; three 200 brake horse-power, electrically driven, 3-throw hydraulic pumps, approximate weight 2¼ tons each; one 26-inch x 20-foot hydraulic accumulator, weight 90 tons.

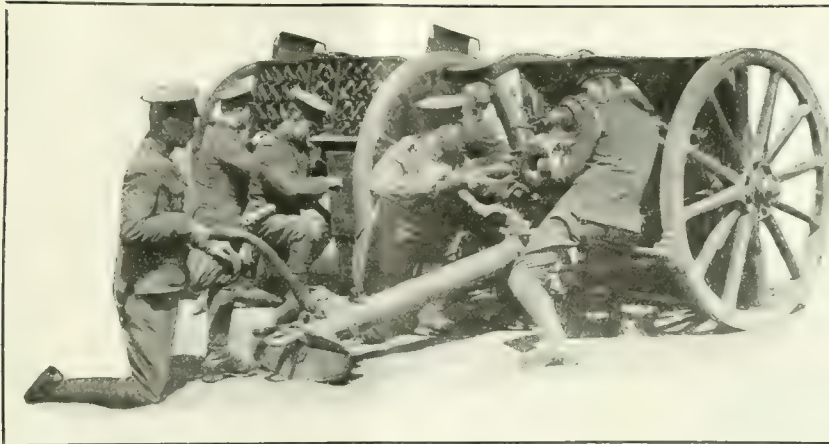


A method of making a submarine periscope invisible at sea at any considerable distance is to be tested on the K. 6, now in dry dock in Brooklyn Navy Yard. The periscope has been painted in parallel stripes in various colours of the spectrum and it is calculated that the colours when refracted will be converted into a white ray.



"S-A" Pan Conveyors assist in cooling cartridge cases for 18# Shrapnel Shells Metal Drawing Co., Ltd.

FIG. 2 DISCHARGE END OF CONVEYOR SHOWING CARTRIDGE CASES IN WIRE BASKET FOR REMOVAL TO PICKLING TANKS.



4.5 Howitzer Shell Production in a Structural Steel Plant

Staff Article

Uncertain as to the war duration, but with the desire to bear a part in furnishing our Empire with munitions of war while maintaining its normal manufacturing equipment practically intact, the institution here described has, by the investment of a moderate amount of capital and by drawing on the skill and aptitude of its staff, succeeded in achieving a highly satisfactory degree of success in the matter of shrapnel shell quality and quantity output.

IN many cases of shell manufacture the producers were formerly engaged in branches of engineering which called for a more or less complete machine shop equipment, consequently their personnel and plant were capable of adaptation to the shell business, promptly and effectively.

A structural steel works such as forms the subject of this article could not be expected to enter the list of producers on equal terms with machine shop establishments. Their energies had been devoted to an entirely different class of work, involving machines, material, and operations quite foreign to the average machinist. Besides being handicapped by the nature of their previous work, they had to go into the market for tools when it was a case of taking what one could get instead of getting what one wanted.

A study of the methods and machines as developed under these conditions

should be of considerable assistance to firms who are not yet advanced to the "shipping" stage. Most of our readers are now familiar with shrapnel manufacture, therefore, the points of variation will be easily noticeable.

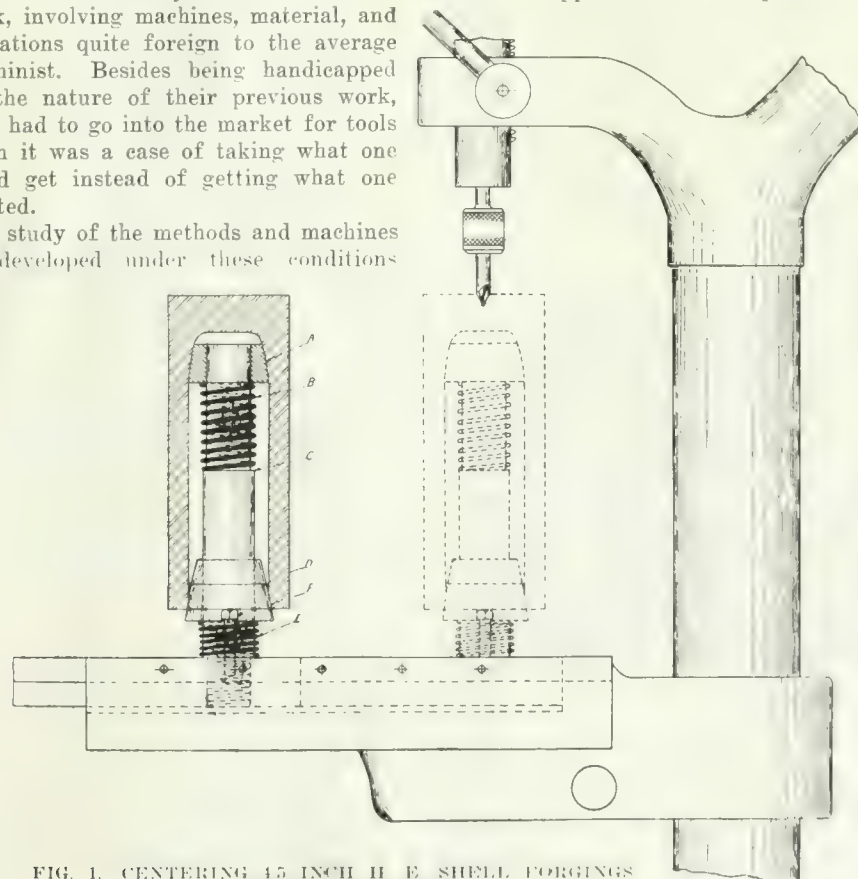
Many special attachments are now obtainable from different machine tool builders, either for use on their own product or adaptable to any standard type of machine. It is noteworthy in the plant in question that with the exception of collapsible taps all fixtures, jigs and other appliances are the product of

the shop. A consideration of the operations and the tooling equipment developed shows most creditable work by the tool room staff.

Table I. shows the sequence of operations as at present adopted.

Table I.

- 1 Cutting off open end only one spur geared constant speed cutting-off machine, built by Williams Tool Co.
- 2 Centering one 10-in. single geared drill press, built by W. F. & John Barnes.
- 3 Rough turn outside one 28-in. "New Haven" engine lathe and one 28 in. "Leblond" engine lathe, both fitted with special tool equipment.
- 4 Rough face base one 32 in. "American" engine lathe.
- 5 Bore and ream—three 24-in. "Davis" turret lathes.
- 6 Countersinking bevel on mouth one 36 in. "Fosdick" radial drill.
- 7 Nosing one "Hanna" pneumatic riveter.
- 8 Bore face and tap nose one 20 in. "Dreses" turret lathe.
- 9 Turn body and nose one 22 in. "Hill, Clarke" engine lathe.
- 10 Finish internal profile of nose one 20 in. "American" engine lathe.
- 11 Bore and tap recess one "Aeme" screw machine.
- 12 Insert plate and face off.
- 13 Groove, undercut and form waved ribs one "Whitcomb-Blaisdell" engine lathe.
- 14 Pressing driving bands one three-throw "Perrin" plunger pump and bending press.
- 15 Turning bands suitably equipped engine lathes.
- 16 Varnishing—steam heated oven.



**FIG. 1. CENTERING 4.5 INCH H. E. SHELL FORGINGS
DETAIL OF ARBOR.**

Reviewing the operations in rotation: The cutting off does not call for special mention, beyond the fact that the choice of a constant speed machine is justified by the small amount of tool travel due to cutting off the open end only, and leaving the facing of the base for a subsequent operation. The avoidance of friction discs and other accessories of variable speed machines is desirable in heavy work. Fig. 1 shows the detail of supporting arbor for centering shells on a small drill press. The bushing A slides on the arbor and rests on a spring B, which maintains it in a position near the top of the arbor. The spring B in turn rests upon shoulder C formed by the lower part of the arbor.

Bushing A is made an approximate fit

for the rough bore of the forging near the base. Bushing D is a sliding fit for the lower part of the arbor, and is maintained in its highest position by spring E. Bushing D is made with a suitable taper so as to rest half way into the open end of the forging. The arbor itself is fastened to a block which slides

Rough Turning.

After centering, the forgings are ready for operation (3), viz., rough turning this is done are standard engine lathes. They are fitted with special tool boxes which carry two cutting tools spaced half the length of the shell apart from

the ability of the tool steel to stand up under a high speed rather than by the amount of power required to remove the material. A speed of 60 feet per minute is easily maintained by the steel at present used.

The body of the rough turned shell is now of two diameters, the half of the shell next the base having just enough left on to take a final cut at a later stage, while the half next the mouth of the shell is left somewhat larger so as to have a safe margin of stock to allow for any variation in the profile of the nose after nosing-in.

The base of the shell must now be faced off to the proper thickness. Considerable variation is liable to occur in the forgings at this point, and in centering the forgings in operation (2), care must be taken to drill the center holes to a uniform depth, measured from the inside. The probability of excessive stock having to be removed at this point calls for a machine of ample capacity. The machine provided in this case is satisfactory.

An Interesting Tool Holder.

A feature of the equipment is the overhung side cutting tool holder with wedge adjustment for the cutting tool. This is clearly shown in Fig. 3. An L-shaped block is clamped on the tool box of the lathe, with one arm hanging downwards on the left side. A slot is provided in this overhanging arm to take the square tool B, which is inclined slightly from the vertical for clearance. The tool is adjusted vertically by means of the flat wedge or cotter C, the end of which can be observed in the illustration. A securely fastened side plate D holds tool and cotter in position. During this operation the shell is held in a collect chuck by the nose, while the base end revolves in the steady rest.

Boring the parallel portion of the inside, and reaming the tapering portion where the sides meet the bottom constitute the fifth operation. Heavy turret lathes are employed, having three boring bars fitted with a single cutter bar for the parallel portion of bore, and a roughing and finishing reamer for the tapering portion. The layout of the turret is shown in Fig. 4, from which it will be observed that the bars are fastened to the turret faces by flanges, into which the bars are tightly screwed and keyed. Holes on the top side of the flange communicate with a central hole which emerges at the point of the bar and allows the use of a copious supply of cutting compound at the proper point. The compound is supplied through a hose pipe with a nozzle to fit the holes in the flanges, and is changed round to each flange as its bar is brought into operation.

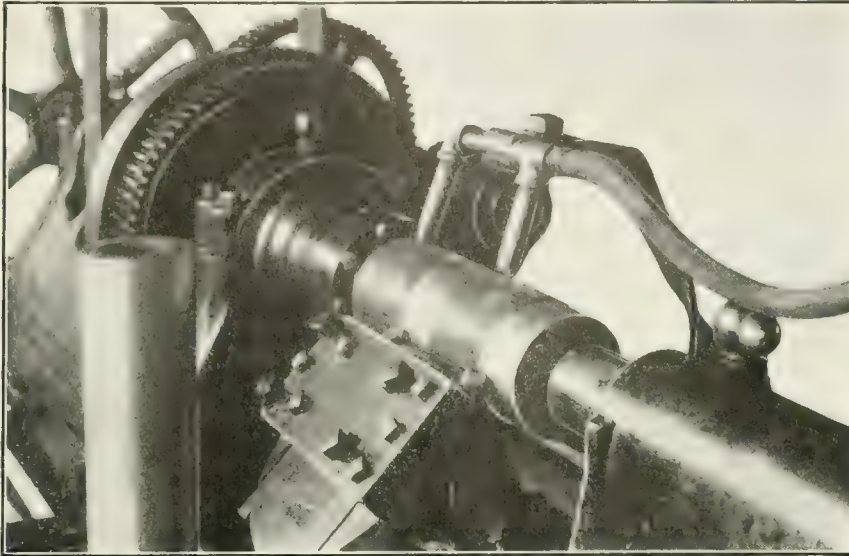


FIG. 2. ROUGH TURNING 4.5 H. E. SHELLS.

in vees formed on the table of the drill press. When the arbor is in the outer position it is well clear of the spindle and allows the forging to be placed over it. This being done, bushing A centres itself from the rough bore near the base while the mouth of the shell is centred on conical bush D. Both of these bushings now compress the springs B and E until the weight of the forging is taken

each other so that the time for the operation is halved. The tool box is of very substantial design, the tools being made of square tool steel inclined nearly to a vertical position so as to have a constant angle of clearance underneath, irrespective of the amount of top rake. The forging is driven by means of a tapered arbor with longitudinal grooves forming teeth on which the shell is

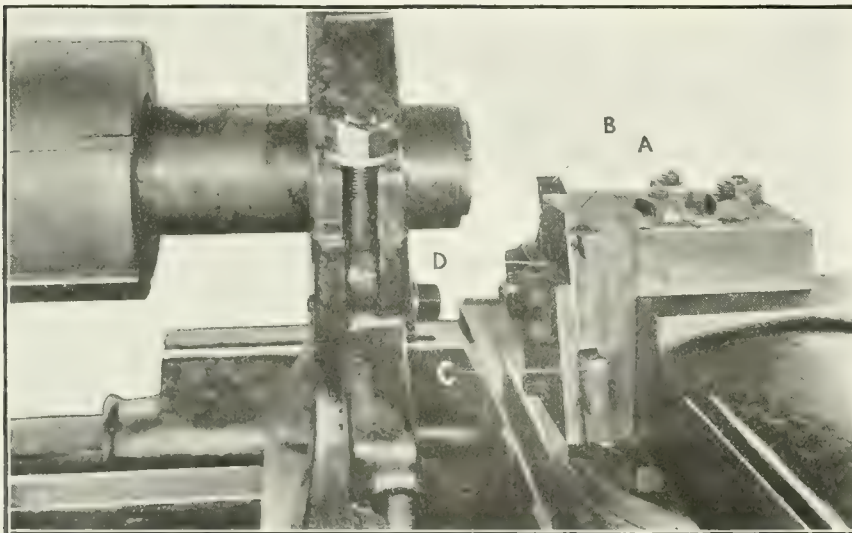


FIG. 3. OVERHUNG TOOL HOLDER FACING-OFF SHELL BASE.

by stop pins F. By sliding the arbor to the inner position where it comes against a stop the centre of the shell is brought exactly under the centre of the drill which drills the centre hole in the usual manner.

driven, and held by the centre in the tail stock. This machine is shown in Fig. 2. As the amount of stock to be removed from the forging is just over one-quarter of an inch on the diameter, the capacity of these machines is limited by the

Impromptu Nosing Press.

A radial drill for which suitable employment had not been found was utilized for shaping the mouth of the nose preparatory to nosing. The section of the shell before and after nosing is shown in Fig. 9. The exact outline required before nosing has been the subject of considerable experiment by most makers, and the shape shown here will be useful for comparison with present and proposed outlines. The cutter is shown in Fig. 5. This is of the flat double-edged type, and is provided with

a substantial pilot, which enables the full power of the drilling machine to be applied to the cutter without excessive vibration or chatter.

While to the casual observer nosing seems one of the simplest operations, there is probably a greater variety of machines used in this than in any other operation. In utilizing an existing pneumatic riveter, this firm has shown a further example of adaptation which is interesting. The machine is of the fixed horizontal gap type, with a vertical ram actuated by a compressed air cylinder operating toggle gear on the upper part of the frame. This nosing press is shown in Fig. 6, also the home-made furnace for heating the noses.

This furnace consists of an ordinary grate made of iron rods, surmounted by a semi-circular brick arch, well strapped down to the base. Three openings are provided for the graphite crucibles, which are supported on brick blocks, resting on the grate bars. A coke fire is used, which

surrounds the crucibles on all sides. No chimney is required, the draft being maintained by a gentle pressure of air from the air line, the products of combustion emerging through the space around the top edge of the

The eighth operation is performed with the shell chucked by the base and supported in a steady rest. A turret lathe is employed, two faces only being used. One is fitted with a boring bar having a cutter of suitable shape which bores the hole and faces the end of the nose. The other face of the turret carries a Murehey collapsing tap which threads the hole.

Profile Turning.

In the next operation, the shell assumes its final size and shape on the outside. The arrangement of the profiling

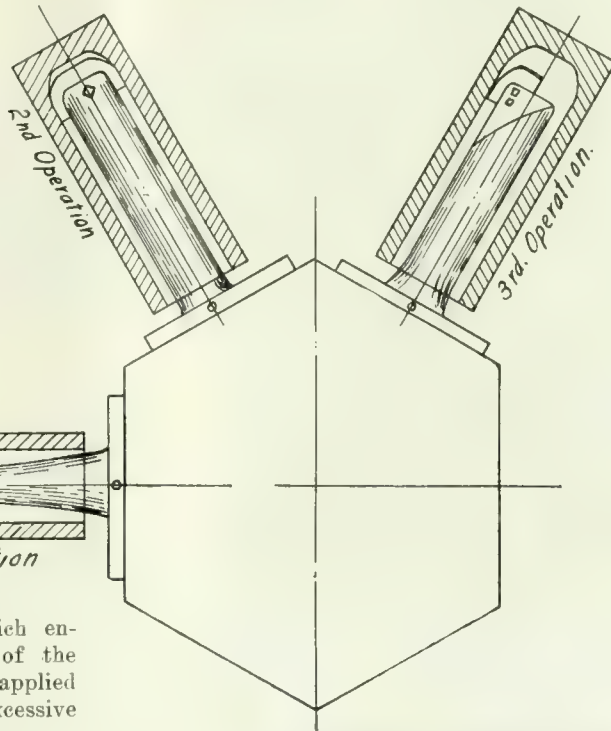


FIG. 4. LAYOUT OF TOOLS ON "DAVISS" TURRET LATHE.

crucibles. Such an arrangement would be objectionable in some shops, but in a spacious well ventilated building, such as is shown here, it is quite suitable. The work is all that can be desired, the resultant hole being parallel and close to size, while the profile also approximates very closely to the finished outline. During the operation, the shell is securely held in an open-sided vise-

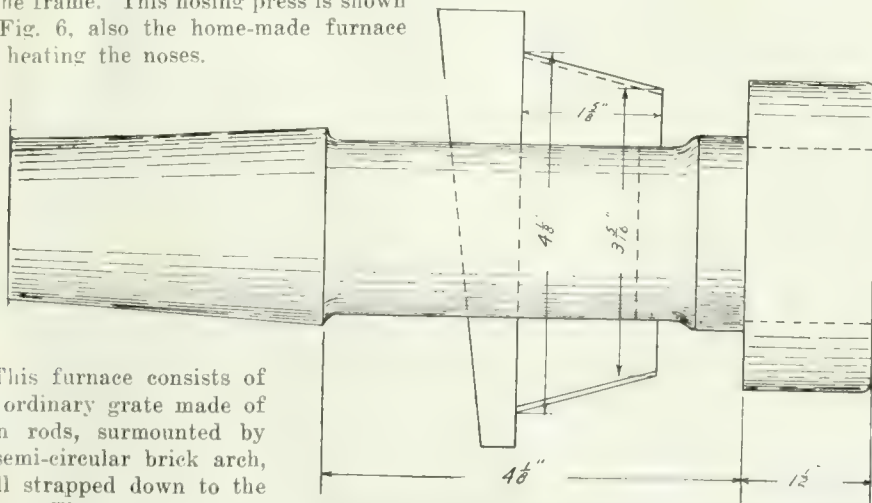


FIG. 5. CUTTER FOR BEVELLING INSIDE OF NOSE BEFORE CLOSING.

block, with a swing gate in front, which is tightened up by a lever with a cam end on the boss.

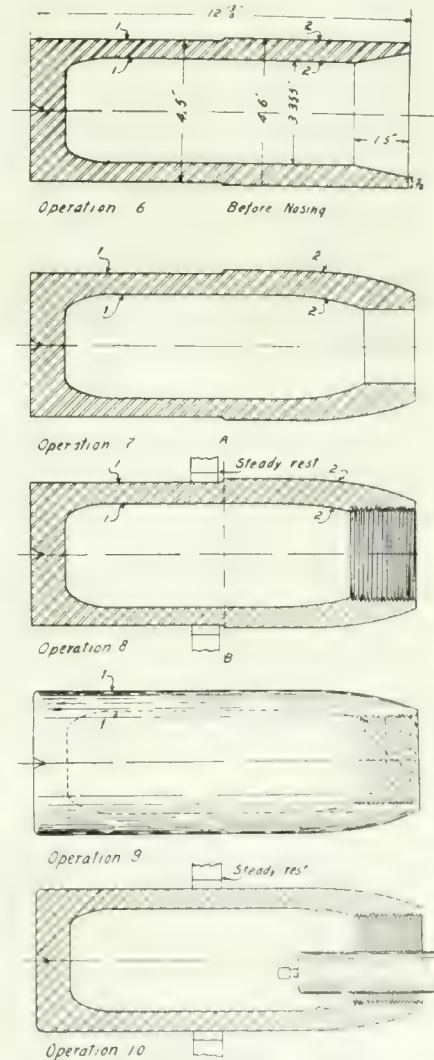


FIG. 9. ILLUSTRATING OPERATIONS 6, 7, 8, 9 AND 10.

attachment will be understood from Fig. 7. A supporting bar is fixed to two supporting blocks which are clamped over the front vees of the lathe bed at suitable points. A roller is mounted on the side of the cross slide. Two powerful springs pull the cross slide forward, and keep the roller in contact with the profile bar which is mounted on the supporting bar.

The means adopted for driving the shell is simple and efficient. At this stage of manufacture the shell has had

its overall length finally determined, the nose having been machined in relation to the base. In the operation under dis-

This plate C, is secured in position by a set screw. The nose of arbor A has a left hand thread 2.6 in. diameter,

The point of the arbor is provided with a hardened steel cap F, 2.5 in. diameter, which is threaded to fit the nose of shell. The unthreaded portion of the arbor between the left and right hand thread is made a good close fit for the unthreaded portion of hole in driving plate E.

In assembling the device, a spot is recessed on back of driving plate E. to receive plunger D, plate E being located on arbor A so that a suitable amount of right hand thread will be available for receiving the nose of shell. Index plate C is now securely fastened in place. A shell is now screwed on to the end of the arbor till it tightens up against edge of driving plate E. The left hand thread automatically locks the parts together, and any tendency of the driving plate E to revolve, simply causes the left hand thread to wedge the driving plate tighter against the nose of the shell.

When the shell has been machined, the spring plunger D, is withdrawn from the driving plate E, which is now slackened back by means of a wrench, suitable slots being provided. After the shell has been screwed off the arbor, the driving plate E is turned back to its original position and locked by plunger E, thus insuring the next shell occupying

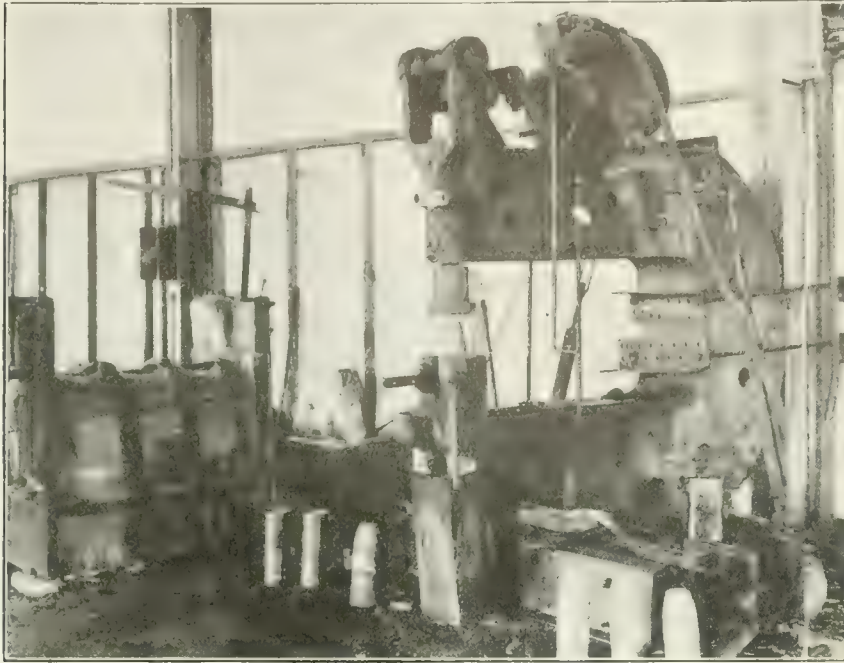


FIG. 6. PNEUMATIC RIVETER USED FOR NOSING 4.5 INCH H. E. SHELLS.

cussion, the shell is located by bringing the finished end of the nose in contact with a surface which has a fixed location in reference to the profile templet, so that each shell will occupy the same position in reference to the templet and insure a uniform thickness of wall in the nose.

Fig. 8 shows the arrangement of driving plate and method of locating it accurately again, after it has been slackened off to allow removal of shell. A cast iron arbor, A, is threaded to fit the nose of lathe spindles. Diameter B, is machined to fit the index plate C, which carries a spring index pin or plunger D.

which fits the threaded portion of hole in driving plate E.

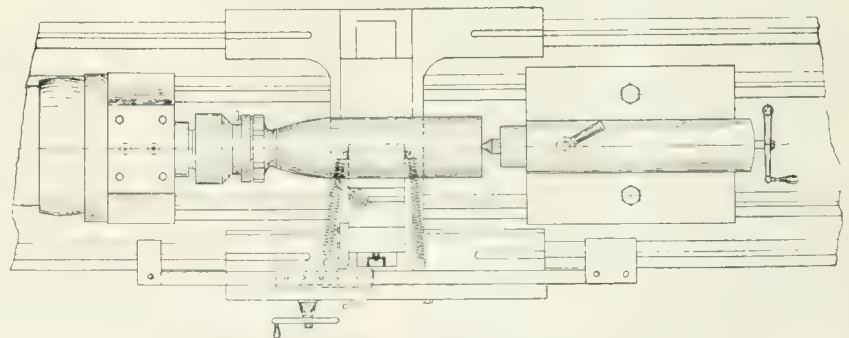


FIG. 7. PROFILE ATTACHMENT FOR TURNING OUTSIDE OF 4.5 INCH H. E. SHELL ON ENGINE LATHE.

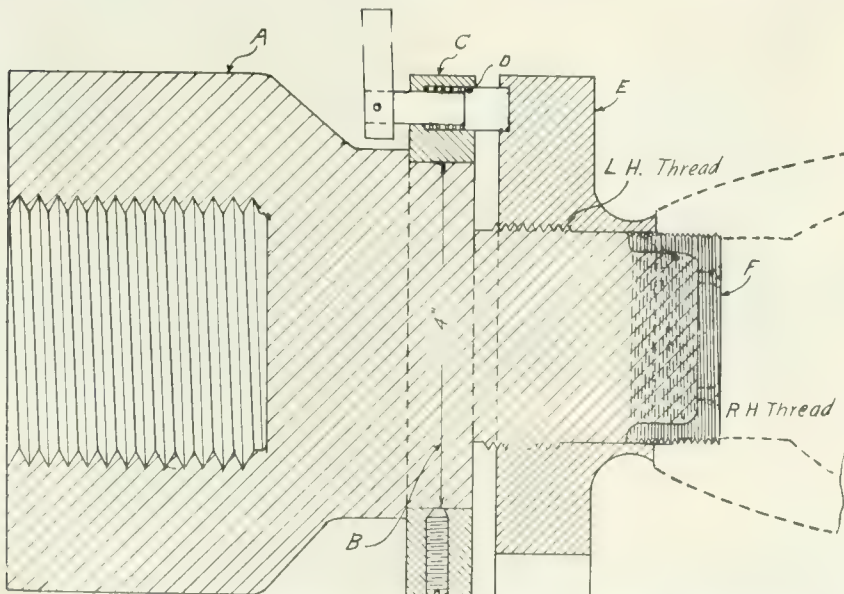


FIG. 8. DRIVING DEVICE FOR PROFILING LATHE, 4.5 INCH H. E. SHELLS

the same location in regard to the profile copy.

Operation 10 consists of machining the internal profile of the nose. This is a straight-forward job due to the fact that the curve is of a single radius thereby allowing the cross slide to be connected by a radius link of the specified length to a fixed point at the rear of machine. By fixing the line of this point at the correct distance back from the nose of the shell the internal curve is reproduced.

Interdependence of Operations.

Operations 7, 8, 9 and 10 should be considered carefully because the condition of the shell after operation 10 is entirely dependent on the degree of accuracy with which the previous operations have been performed. Fig. 9 shows the shell during these operations, from which it will be observed that be-

fore nosing, surfaces (1) are concentric with each other, and also with surfaces (2). After nosing, surfaces (2) may or may not be concentric with surfaces (1), while surfaces (1) will still be con-

centric with objectionable effects on the balance of the shell when fired from a gun.

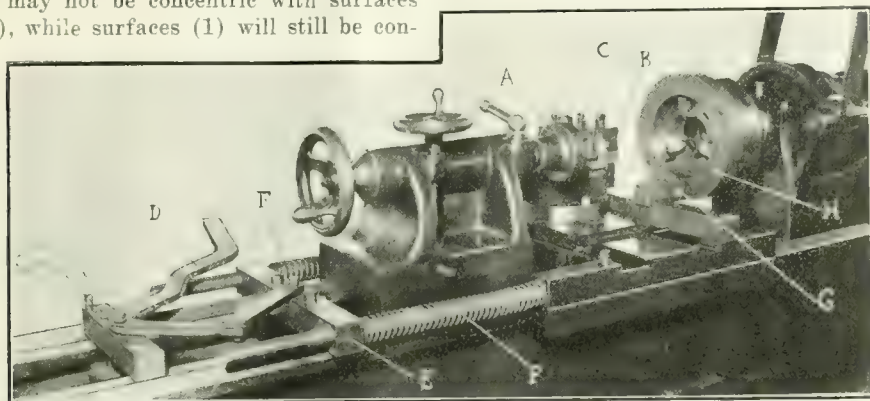


FIG. 10. WAVING EQUIPMENT ON ENGINE LATHE FOR 15 INCH D E SHELLS

centric with each other. In operation (8), therefore, care must be taken to see that the steady rest is sufficiently far back from the beginning of the curve so that the body of the shell from the base up to line A.B. is running true.

As the bore of the shell at this point is concentric with the outside, the thread which is now formed in the nose will be concentric with the parallel part of the bore. By working with a center plug in the nose for operation (9), the outline of the body is carried forward to the end of the nose in accurate relation to the thread. Therefore, when the shell is supported on the outside for operation (10), the parallel portion of the bore will still be running true as at the start. The action of the boring cutter is now to true up the inner wall of the nose making the wall concentric and of even thickness. Unless the sequence of operations at this stage be carefully planned and accurately carried out, the resultant product may easily get out of

Boring and tapping the recess in the base is done on a screw machine using a collet chuck and steady rest. "Murchev" collapsing taps perform this threading job in a satisfactory manner. The plug is next tightened home, the ends of joints riveted and then faced off in the usual way.

Efficient Waving Method.

Forming the groove, undercutting the sides, and waving the threads are done in an ordinary engine lathe which has been fitted with a well-designed combination tool box, and the now familiar cam ring on the chuck. Fig. 10 gives a good idea of the substantial nature of the equipment. The base of the shell is supported in a cup centre A, and is driven by a plug center, in the nose-end.

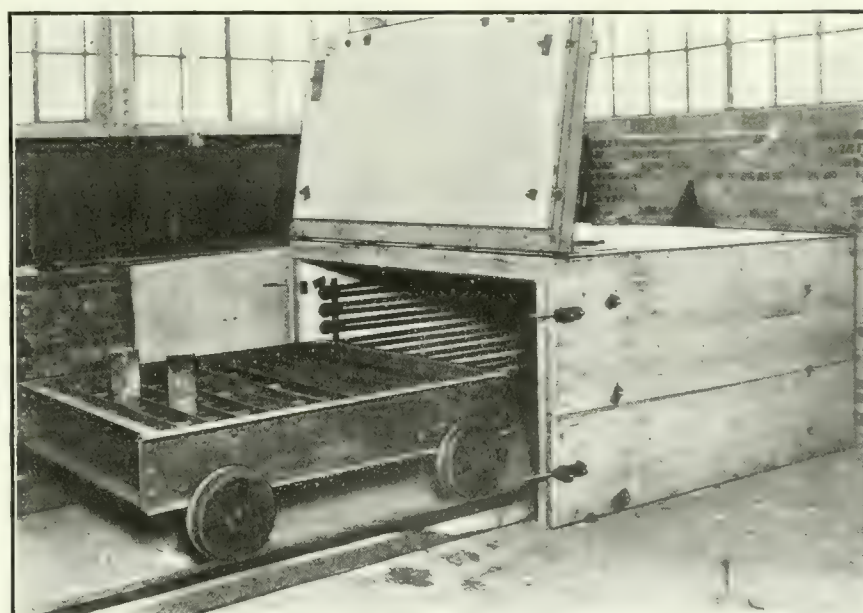


FIG. 11. STEAM HEATED BAKING OVEN.

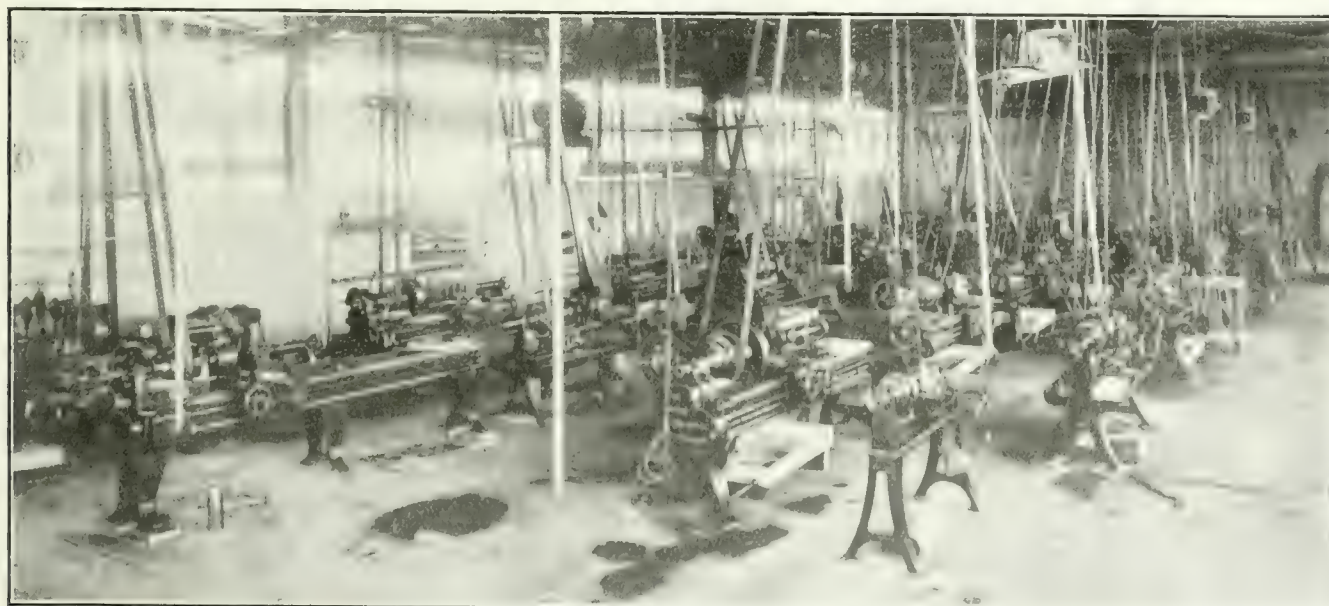


FIG. 12. GENERAL VIEW OF SHELL DEPARTMENT.

Tool B is formed of two parts so that if one corner is broken off in undercutting the whole tool is not scrapped, but just the broken half. In operation, tool B is fed straight into the shell to the required depth and then moved to each side to form the undercut.

A relieved portion in front of the tool leaves the proper amount of material which is formed into waved ribs or threads by tool C. After tool B has operated, the toggle joint is straightened out by moving hand lever D to position shown by dotted lines, causing cross-bar E to compress the springs F and maintain the roller G in contact with cam plate H, the revolving of which imparts the reciprocating motion to tool B necessary to form the required number of waves per revolution.

The remaining operations of banding, hand turning and varnishing the interior of the shell are performed in conventional manners and complete the making of the shell to the point where it is ready to be fixed. The thorough manner in which the work has been planned and carried out and the modern methods employed as evidenced by the use of "Cooper-Hewitt" mercury vapor lamps for lighting, and "Chapman" transfer trucks for handling material, show that the firm in line with other Canadian shell makers is fully determined to supply shells to the utmost capacity of the plant, and of satisfactory quality.

SOCKET DRIVING MACHINE.

THE use of a drill press instead of a hand wrench for driving home the brass socket in the nose of shrapnel shells effects a double saving. In the first place, a workman can maintain a higher rate of output for an indefinite period with far less fatigue; and, secondly, the tool employed can be used to reduce the amount of work necessary on subsequent operations. A large drill press, Fig. 1, with powerful double gearing, was used for this work. The shell (a) is held securely in the hinged vise (b) fastened to the table of the machine. A hollow mill (c) is fixed in the spindle, and, when fed down on top of the socket (d), the inserted teeth dig into the metal and take hold firmly.

Continued pressure on the feed lever screws the socket home, the point of tightening being indicated by the teeth of the cutter beginning to cut up the edge of the socket. The cutter is shown in Fig. 2, from which it will be noted that, when suitably designed and carefully operated, it does the work of a roughing tool for machining the outside edge of the socket. Owing to the close limits on the finished sizes of sockets, it is hardly practicable to complete the work at this point.

The heavy dotted lines in Fig. 2 show the outline of the rough socket, while the lighter dotted lines indicate the amount

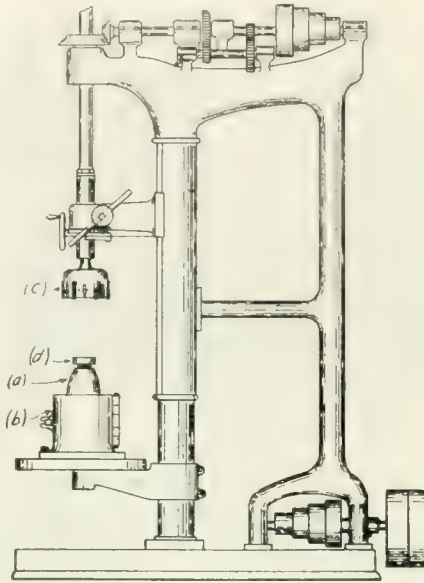


FIG. 1. TIGHTENING SHELL SOCKETS ON A DRILL PRESS.

left on for subsequent machining in lathe.

THE TEST OF WEAPONS

"IT is now the first birthday of the war, and as we look back the affairs of peace appear distant, vague and unreal. Once more the old world accepts violence and

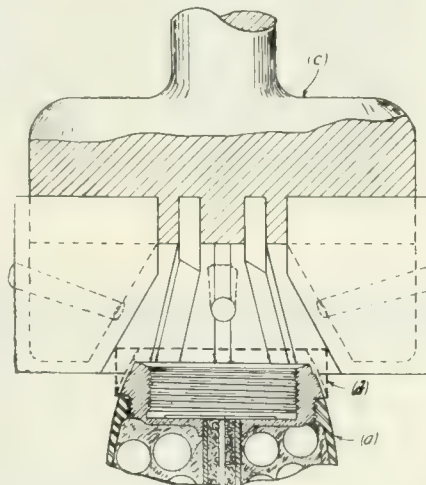


FIG. 2. HOLLOW MILL FOR SOCKET TIGHTENING MACHINE.

danger as its native element and puts everything to the test of weapons, and, if we may judge from the experience of a year, this great test shows mankind much as it always was and war much as it has always been. All the fine professions of peace have fallen away like a cloak, and nations fight after their customs of a thousand years.

"It may be food for the cynical philosopher to recollect that only eight years ago the delegates gathered at The Hague were full of busy ideas for making war

humane and for civilizing violence, and expressing fine sentiments about 'the luminous star of peace' and the 'progress of human solidarity.'

"To-day the German public have made a song about the sinking of the Lusitania. In 1907 the Baron Marschall von Bieberstein was telling an admiring audience that 'the principles of humanity will be the surest guides for the conduct of seamen' and that 'the officers of the German navy—I say it with a high voice—will always fulfil in the strictest manner the duties which flow from the unwritten law of humanity and civilization.'

"War reveals nations and men in their true colors: it throws a searching light upon these fine professions, and it proves among other things that Germans at heart are much as they were in the time of Frederick Barbarossa, and that war is in its nature essentially the same as it was in the days of Rome."—Morning Post.

CANADA'S GAS AND OIL RESOURCES.

THE Mines Department, under the direction of Dr. Eugene Haanel, has completed a comprehensive and exhaustive investigation of the oil and gas resources of the Dominion, and it will be issued shortly in book form. The work of investigation has been carried on for the past year or so by a field survey staff under Mr. Clapp, one of the ablest petroleum experts of the United States. The Alberta oil fields has been thoroughly gone over and, while no large producing wells have yet been developed, promising indications have been found of the existence of petroleum in several districts in the Province.

A considerable portion of the report deals with the commercial possibilities of the development of the extensive and rich oil shale deposits of New Brunswick. If these deposits are exploited it is believed that a great industry can be built up, and a substitute found in Canada for the large quantities of petroleum and its derivatives now annually imported from the United States.

So important are these deposits and so great is the market for petroleum products in Canada, that the Federal Government has provided for a bounty of 1½ cents per gallon on oil recovered from oil shales in Canada. The distillation of oil shales in Scotland has been for many years a successful and flourishing industry. New Brunswick shales are on the average richer than the Scotch shales.

The total domestic production of petroleum is now under eight million gallons, while last year imports of gasoline totalled 27,451,379 gallons, and of petroleum in other forms over 200,000,000 gallons.

Why Steel is the Most Suitable Material for Shells

By J. M. W.

The exclusive use of steel for shell casings has occasioned inquiry by ironfounders into the possibility of cast iron being used as well. While the features of the case which have been brought to light by the discussion are so greatly in favor of steel, it must not be forgotten that steel is not perfect, and that any relaxation of stringent inspection, such as exists at present might be productive of results which must be avoided at any cost.

OCASIONAL reports, chiefly from Belgium, that the Germans were using cast iron shells, have given rise to discussions on the merits of forged steel and cast iron as materials for shell bodies.

A momentary consideration of the requirements which must be met by either shrapnel or explosive shells is sufficient to make it obvious even to the lay mind why cast iron is quite unsuited for shell bodies except under extreme conditions such as now seem most unlikely to arise so far as the Allies are concerned. The purpose of shrapnel is to destroy men; the purpose of lyddite and other high explosive shells is to destroy the defences of the enemy so that infantry may attack. Entrenchments, fortifications, entanglements and other devices for defence are of such an effective nature that they must be literally blasted off the face of the earth before the opposing infantry can get into contact with each other. A hail of leaden bullets from shrapnel shell, no matter how fierce, has little or no effect on modern field works, consequently a copious stream of explosive shells must be distributed over the desired area so as to render the success of an infantry attack reasonably certain. Explosive shells which burst on contact may be used with delayed fuses, which allow a suitable space of time for the shell to sink into earth works to a desired depth, when the explosion of the charge resembles that of a mine. The immense hollows in the ground formed by the large siege guns firing half a ton of explosive are sufficient evidence of the power of high explosive ammunition. The disastrous results which would ensue from such an occurrence taking place in the barrel of a gun render necessary the absolute soundness of shell forgings, whether shrapnel or explosive.

Absolutely Safe Guns.

The absolute strength and safety of modern guns has been a wonder and mystery to the majority of laymen for many years; consequently the guns themselves have been discussed much more frequently than has the ammunition until the outbreak of hostilities.

Given good average material such as is procurable in the open market at the present moment, a good engineering edu-

cation, and a high class engineering plant—and any resourceful man will produce a formidable gun with his personal experience and skill. The knowledge of ammunition manufacture, however, has for obvious reasons never been so widespread and available as that of guns. Even now with all their experience in shell work many producers have still to develop that patriotic interest in their product which is necessary to make them appreciate the strict inspection, and which would cause many so-called hardships to be viewed in their true light of precautions instead of being looked upon as hindrances to profit accumulation.

Rigid Inspection for Shells.

A true appreciation of the painstaking care and watchful economy which is necessary in producing shells at the present moment can only be obtained by a close study of the entire process from the time the iron ore enters the

point of view, they would not be so disposed to condemn offhand a product which represents the application of so much specialized knowledge and labor.

Steel Maker's Troubles.

The steel maker is not desirous of losing the profit as well as the actual cost of shell forgings which develop defects in course of machining. Government and personal inspection of material in all stages of manufacture is planned and carried out with the object of insuring perfect material and workmanship.

The results of Sir Robert Hadfield's investigations are of prime importance at this time. Steel which has been cast in ingots by ordinary methods may appear perfectly sound while not actually so—it may be rolled into billets—it may be forged into shells—and at all stages up to heat treating it may pass all physical tests satisfactorily with the one possible exception of an examination of

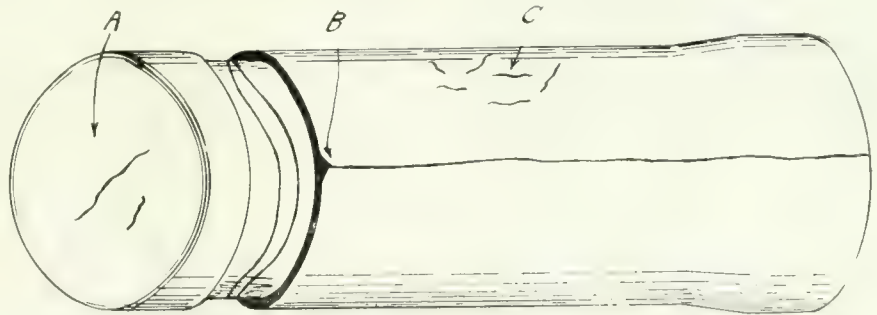


FIG. 1. DEFECTS IN SHELL FORGINGS

furnace until it leaves the muzzle of the gun as a shell. While the actual composition of the steel is decided on and controlled by a limited number of individuals, the mechanical and thermal treatment of the material is being performed by thousands of individuals, the majority of whom endeavor to effect every possible economy in time and material. That considerable economy in material has been accomplished is evident from published results obtained by a leading English metallurgist. Losses of 40 per cent. have been reduced to 15 per cent. with very little increase in cost, and no decrease in quality. The amount of labor lost on partly machined shrapnel forgings has been quite an item, but if shell makers calmly considered the matter from the steel makers

the microstructure. After an ingot is cast, it is not again heated to a high enough temperature to cause the removal of piping defects, consequently the lack of what may be termed "cohesive density" persists in the metal till such time as it is finally heat treated.

When Defects Appear.

At this stage of manufacture hitherto unnoticed defects in shrapnel forgings, occasionally begin to appear. Flaws of various kinds become quite evident, although the most careful inspection before heat treating failed to reveal the slightest evidence. This trouble has caused considerable loss to both steel works and manufacturers, and the fact that it has occurred in spite of all inspection, etc., would indicate that the

steel makers are continually confronted with a serious problem. The hypotheses which the writer advances in explanation of well-known and recognized defects in shell forgings are based on personal experience in producing many thousands of shells and the conclusions arrived at are offered to manufacturers in the hope that a clearer knowledge of their cause may assist in timely detection and, ultimately, their complete elimination.

In Fig. 1 is shown a shrapnel shell with three distinct flaws, which are due to three entirely different causes. At A is indicated what is perhaps the commonest flaw. One or more cracks may open up and become visible after the shell is hardened. They may be only one-eighth inch long, or they may be one inch and eight. They may be less than one sixty-fourth inch wide, or they may be one-sixteenth inch. While most parties who have experienced this trouble seem agreed that it is developed in forging, there has not been advanced, so far as the writer is aware, any definite theory which satisfactorily accounts for their occurrence.

A Crack Theory.

It would seem not improbable that these cracks are formed when a certain combination of circumstances occurs in the course of forging operations. In starting up forging after say a week-end stoppage, the drawing punch and dies would be well cooled down, while some pierced billets might be soaking at a high heat. The combination of the cold punch inside, and cold dies outside would chill the walls of the forgings much more quickly than after running steadily for some time. The probability of an extra long billet would call for extra power, causing excessive tension in the metal on the outer layers of the base, which as suggested might possibly be at a rather high heat. While a rupture might take place at this time, it would not weld together again, but the close contact of the surfaces due to shrinkage would conceal the defect until the tension induced in the outer layers by their sudden contraction when quenched, would open them sufficiently to make their presence noticeable.

Forgings, in which the thickness of the base was well oversize, would be more or less immune from this trouble, not only because the extra metal would provide increased resistance to rupture while passing through the drawing die, but also because the extra metal is removed from the outside of the bore more conveniently than from the inside. Even if there were any slight cracks, in spite of the thicker metal in the base, they would in all probability be removed in facing the base of the shell to the required thickness.

Other conditions under which they would occur would be when the forging shop was working too closely to the minimum thickness of base. This would be most likely to happen when the forge shop was getting low on material and endeavoring to work in billets which might be a trifle undersize.

Neglect to clean out the piercing die also causes trouble through scale remaining on the bottom and getting pressed into the base. Shells have been observed with quite large defects from this circumstance, the cavities caused by the scale or other foreign matter, sometimes extending completely through the base.

Flaws Due to Rolling.

At B, Fig. 1, is indicated a flaw which occurs previous to forging. In the particular shell referred to, this flaw extended from the nose to the driving band groove. About 1-64 inch in width it could be felt distinctly with the finger nail, and, where it terminated at the driving band groove, it had broken away on either side leaving a scaly surface exposed. While at first sight it might be considered due to piping, the fact that it was only 1-16 inch deep, and did not extend over the base, would indicate rather the presence of some foreign substance or material which got worked into the bar during rolling operations, the end of the affected part happening to terminate at the groove as described.

Flaws of this kind are not dangerous in the sense of being concealed or difficult of detection. Had there been a smaller amount of foreign matter rolled into the bar, it would have been entirely removed in machining, but an internal flaw due to lack of homogeneity in the ingot could quite well remain undetected at all stages of the work.

Fissures.

At C, Fig. 1, are indicated a number of minute hair-like cracks or fissures from one-quarter to three-quarters of an inch in length. In some particular makes of forgings these fissures would be quite numerous. Their behavior was similar to flaws A, with the difference that they were more noticeable when the shells were ground instead of turned. At one period in the business, considerable trouble was experienced with hard streaks which were attributed to segregation of manganese. While opportunity did not afford full investigation at the time, the conclusion was accepted as probable.

The matter of fissures in shrapnel shells has been the subject of recent discussion in England, the theory advanced being that regions of low carbon and high phosphorus resulted in layers of different hardness. The low

carbon layers being more elastic would accommodate themselves to strains brought about by quenching, while the high phosphorus layers owing to their different behaviour, would be subject to local strains which might develop in the form of fissures such as have been observed.

The fact that defects such as these mentioned can, and do occur in the handling of steel forgings, renders it obvious even to the lay mind, that the use of any material which is less reliable than steel, can only be justified by the exigencies of the situation.

Regarding Cast Iron.

The most that can be said for cast iron is that it is better than nothing. The almost entire absence of elongation results in such brittleness that in order to be absolutely safe, a cast iron shell would have walls so thick that the number of bullets contained would be so greatly reduced that the killing powers of the shell would be negligible. The probability of blow holes in the walls would disturb the balance of the shell during flight so as to destroy all accuracy of fire. The presence of cast iron shells on a modern battlefield indicates two possible contingencies:—either the demand for shells is so abnormal that a sufficient amount of raw material can not be obtained, or else the supply of steel is so much below normal that the normal consumption of shells cannot be met.

The inference is largely a matter of degree, but the results cannot be other than favorable to the cause of the Allies.



MUNITIONS INVENTION COMMITTEE

THE Minister of Munitions has constituted a Munitions Inventions Branch of the Ministry, and has appointed as Comptroller E. W. Moir, M. Inst. C.E., M. Am. Soc. C. E. The branch, which for the present is located in Armament Buildings, Whitehall-place, will have the duty of considering projects for inventions relating to munitions for warfare on land, or matters appertaining thereto. The Comptroller and staff of the branch will be assisted in their work of examination, and, if thought necessary, in the investigation and development of any projects that may be considered worthy of being developed, by a panel of honorary scientific and other experts.



In order to prevent time fuses from turning whilst in transit, Krupps solder a wire across them sufficient to hold them in place, but yielding easily to the pressure of a key in the gunner's hand.

H. E. Shell Production in Ventilating Equipment Plant

Staff Article

The plant which forms the subject of this article was among the first in Canada to undertake the production of 18-pdr. lyddite shells. Being accustomed, however, to manufacture machinery for special duty, little, if any difficulty was experienced in tackling successfully these war-time commodities. In addition to designing several ingenious fixtures and tools, a number of special machines have also been built and requisitioned for the work.

THE number of firms engaged in the manufacture of high explosive shells will no doubt increase, the demand for this type of shell having become quite insistent. Although some firms have reached the shipping stage and have overcome many of the difficulties with which they had to contend, there are others who have yet to go through the mill. The latter, however, will have the opportunity of benefiting from the experience gained by the pioneers and will no doubt take full advantage of it.

At the plant which is the subject of this article, 18-pdr. high-explosive shells are being made, the operations differing in many respects from those performed at plants which have already been described in **Canadian Machinery**. This feature will lend additional interest, especially in view of the fact that the results in most cases have been highly satisfactory. One feature worthy of notice is the method of centering the bar stock or billet at the base and using the centre instead of a chuck in practically all the more important operations, until the base recess is formed. This is done to obtain as concentric a shell as possible and at the same time increase production. The system of chutes between the machines in the earlier operations assists materially in speeding up production and reducing cost of handling.

The operations may be said to be di-

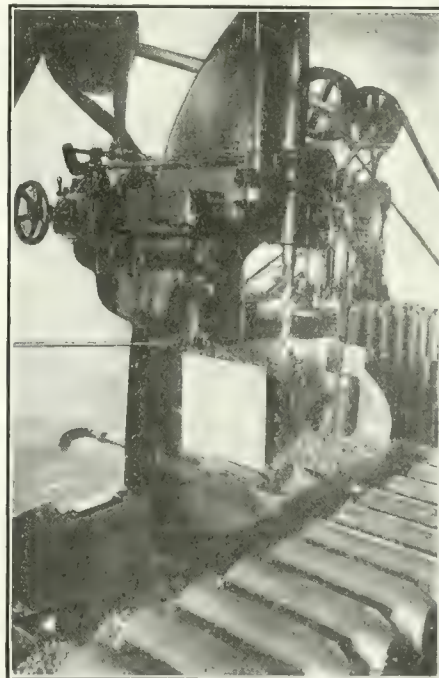
vided into two sections. The first series are performed with practically only one exception on drilling machines which occupy a corner of the main shop on the ground floor. The second series, including rough turning the body, to the final operation, are all taken care of on the gallery over one bay of the main shop and extending the entire length. This arrangement was found to utilize the available space to the best advantage without interfering in any way with the ordinary or normal business of the concern. The layout of the plant is such that labor entailed in handling the billets and shells is reduced to a minimum with a consequent saving of time and money. The section of the plant used for making shells was laid out for this purpose, and it was thus possible to install each machine in its proper location to suit the sequence of operations.

The drilling machines on the main floor already referred to are arranged as close together as is desirable, so that the shells can be conveyed from one machine to another by chutes in order to eliminate handling as much as possible. The billets are delivered to the shop and stored quite close to the machines, a supply thus being always at hand when required. In this section of the plant all the operations are performed from centering the bar stock to finishing inside, including threading the nose. A feature to be noted is the extensive use

of drilling machines for the initial operations.

Centering Billets.

The billets are first prepared for centering by grinding the corners and ends

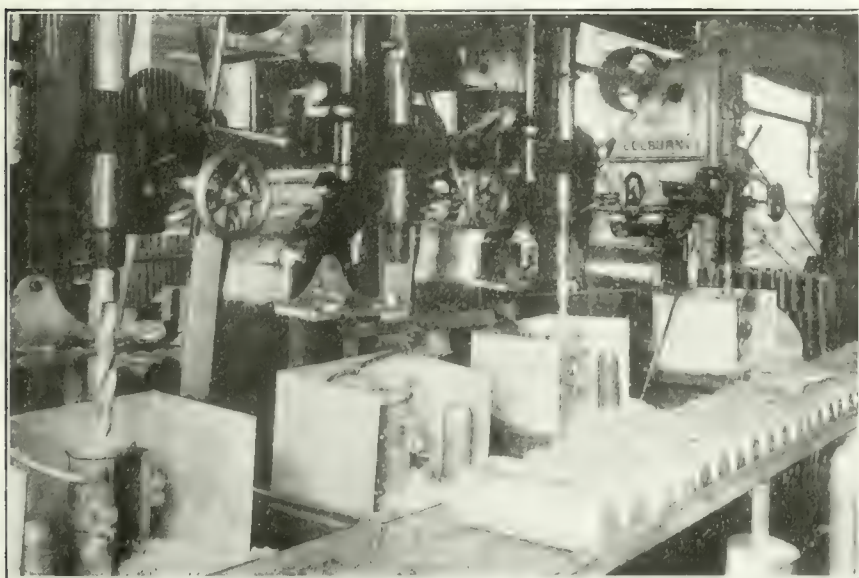


BORING OUT SHELL BILLETS ON A "COLBURN" DRILL PRESS

on a Canadian Buffalo Forge Co. grinder. They are then placed on a chute and passed along to a bench alongside which is a drill for centering the nose end of the billets. The drill was built by the Canadian Buffalo Forge Co., Berlin, Ont. The billet is held securely in a vise fastened to the drill table, and the centre drilled and countersunk in one end only. When this operation is completed, the billets are passed down another chute to the nosing machine. The nosing or rough turning the nose is done on three engine lathes. In this operation, one end of the billet is held in a collet chuck while the other end is being rough turned.

Rough Drilling Billet.

A battery of five heavy duty drilling machines is installed for the first drilling operation, which consists of a roughing cut only, the hole being finished later with a reamer. Four of these machines were built by Baker Bros., Toledo, O., and one by the Colburn Machine Co., Franklin, Pa. The "Baker" drills are all of the same type, and the "Colburn"



BATTERY OF DRILL PRESSES BORING SHELL BILLETS. TRANSPORTATION CHUTE SHOWN IN FOREGROUND

drill is very similar. Each machine is equipped with the same type of vise fastened to the table for holding the billet. The vise is a circular shaped device, one half being hinged and embracing a clamp. The stationary part of the vise has an extension bracket above with a hole in the centre through which the drill passes. The bracket supports a hardened steel collar used for keeping the drill central when beginning the cut.

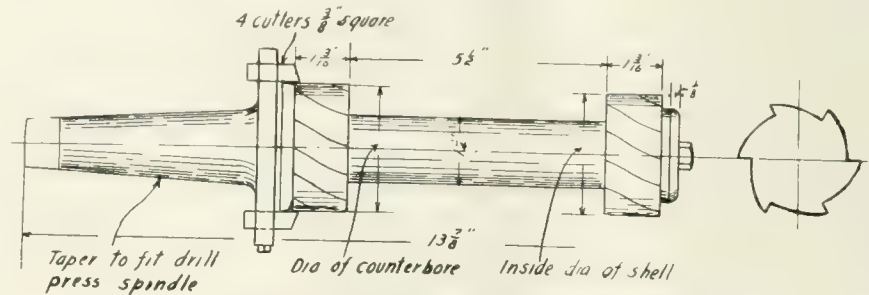
The billets are laid out on a chute in front of the drilling machines, and when drilled are passed along to a bench behind for the next operation. Some interesting figures are available on the drilling operation. The four "Baker" drills operate at 130 r.p.m. with .013 feed, and the "Colburn" at 160 r.p.m., .019 feed. Whitman & Barnes and John Morrow & Son twist drills are used with the above machines. The installation of more drill presses is contemplated, these to be made by the Buffalo Forge Co., of Buffalo, N.Y., and designed especially for this work to operate at 190 rev., .020 feed. The hole in the billet is 1 13-16 in. diameter by 8 3/4 in. deep, and with the new drills this operation will take 2 minutes and 30 seconds.

The bottom of the hole, after drilling, is of course the same shape as end of drill, and more metal must be removed in order to obtain the desired profile. For this reason the bottom of the hole is roughed out and reamed later. The roughing operation is done on a drill

press supplied by the Aurora Tool Works, Aurora, Ind. The billet is held in a vise the same type as is used for the first drilling operation. The bottom of the hole is roughed to relieve the finishing tool at a later operation.

Inside Finishing Operations.

The next operation consists of finishing the inside body, reaming the counter-



COMBINATION REAMER DETAIL.

bore, and roughing fuse plug seat. A 20-in. drill press built by the Canadian Buffalo Forge Co. is installed for this work. An interesting feature of the operation is the combination reamer designed by the Canadian Buffalo Forge Co. The reamer is about 13 7/8 in. long over all and has a taper shank for fitting into the drill press spindle. At the end of the shank the reamer widens out, and has slots for four fly cutters. These cutters are 3/8 in. square and have a bevelled cutting face for forming the fuse plug seat. The cutters are held securely in position by a ring with a set-screw for each. Under the set of cutters is a reamer for finishing the counterbore in the nose preparatory to being threaded. At the other end of the spindle, the exact distance away, is another reaming cutter for finishing the bore of the shell. The cutters are secured to the spindle by dowel pins. In operation, the bottom cutter starts at the top of the hole, and travels down with power feed, followed by the cutter above. When both have nearly finished their work, the four small cutters above begin the form of the fuse plug seat. This combination makes a very accurate and efficient tool.

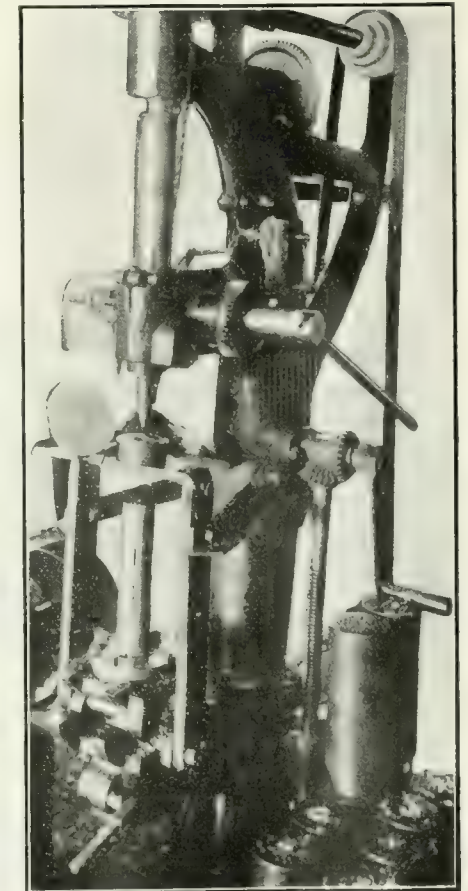
Finishing Base Inside.

The bottom of the hole is finished on a 20-in. Canadian Buffalo Forge Co. drill press. The reamer has a long shank and is made with radius to suit the profile inside of the base. The shell is held in a hinged vise as in the previous operation.

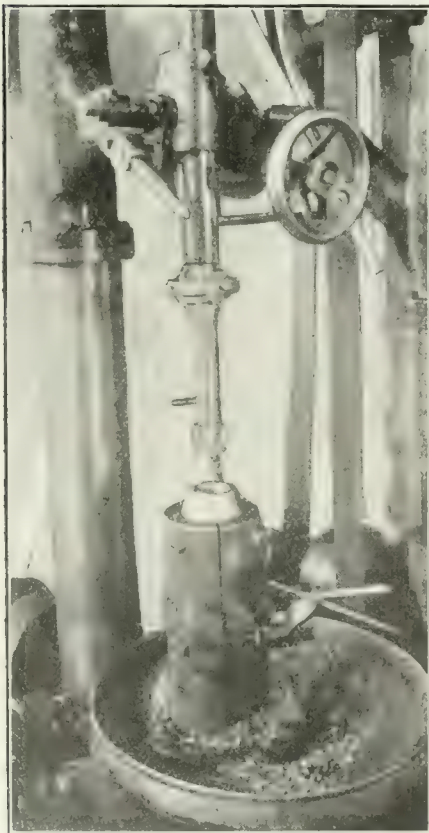
In using unskilled labor it has been found advisable to do only one operation at each machine, and this principle has been followed as much as possible. Three drill presses, however, are equipped with a quick change "Wizard" chuck made by the McCroskey Reamer Co., and at the one setting of the shell the combination reamer is first inserted followed by

the finishing reamer which can be inserted without stopping the drill.

The shells are now moved to an adjoining machine to have the undercut or recess formed in the nose at the end of the counterbore. This undercut is necessary to give clearance for the threads. A 20-in. Canadian Buffalo Forge Co. drill press is installed for this operation. An expanding mandril fits into the drill



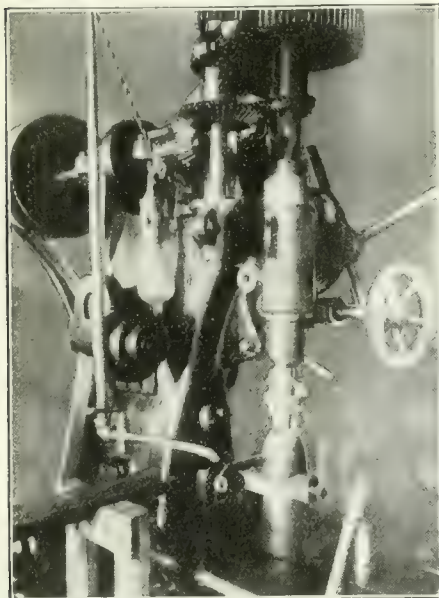
CENTERING OPERATION.



COMBINATION REAMER FINISHING BORE AND COUNTERBORE

Centering Base.

It is necessary to centre the base end, as during several of the subsequent turning operations this centre is used. By always working from this same centre greater accuracy can be obtained and the



THREADING SHELL NOSE WITH COLLAPSIBLE TAP.

shell will be concentric. This centering operation is done on a Canadian Buffalo Forge Co. drill press equipped with a special fixture for holding the shell. The base of the fixture is fastened to an arm extending from the drill press, and an expanding mandril is mounted on this base and works on a hinge so that the operator can swing it out to put the shell on. The mandril expands inside the shell and when moved into the vertical position holds the latter steady while being centered, the shell, of course, being nose end down. A bracket attached to the base of the fixture comes up over the shell and has a hole in the centre for a hardened steel guide to keep the drill and countersink central.

Threading and Tapping Nose.

The nose is threaded on a "Baker" drill, having a "Murehey" collapsible tap fitted in the spindle. A specially designed fixture for holding the shell is fastened to the table. This fixture has a floating clamp which holds the shell firm, but permits side movement, and is therefore self-centering. The centre in base of shell rests on a centre on drill table, while the shell is held in a clamp connected to a bracket at the side by means of a swinging hinge. A set screw in the clamp keeps the shell from turning round while the nose is being tapped.

The sizing of the thread is done on a Canadian Buffalo Forge Co. 20-in. drill press with a standard sizing tap. The shell is held as before on a centre, with a floating clamp to keep it from turning. In the drill spindle, a Modern Tool Co.

ball drive friction chuck is used, with a special bevelled facing milling cutter attached to the bottom of the chuck just above the tap. After the tap has been run down the full distance, the collar operating the ball drive is pushed up, which allows the milling cutter on the chuck to revolve, and there is sufficient clearance left to allow the cutter to be brought down to face the fuse hole seat on the end of the shell. This ensures a seat perfectly true with the thread. The drill is then reversed and the tap is backed off. One operator turns out 25 to 30 an hour.

After sizing, the shells are taken to a bench to have a centre plug screwed in the nose. They are then placed on a chute, at the end of which is a chain elevator, and are carried up to the floor above for the next series of operations. As the plugs are done with upstairs, they are sent back through a chute to be used again.

Rough Turning Shell Outside.

The lathes for performing this operation are situated at that end of the gallery above the drilling machines on the ground floor. They are, therefore, quite near the top of the elevator which brings the shells up to this floor. On leaving the elevator the shells travel down a chute within reach of the lathe operators. Four lathes, built by the Reed Prentice Co., Worcester, Mass, are installed for this operation, which consists of rough turning the body outside, roughing the copper band groove, and part of the base.

A centre plug has already been screwed into the nose of shell and fits the drive chuck. Both ends of shell are carried on the lathe centres. In front are two tool blocks mounted on separate cross slides, holding one and three tools respectively, the former for turning the nose, and the latter for the straight part of body. The tools are fed to the work by a cam device located under the cross slides, and attached to the lathe bed. A roller under the cross slide works in the cam. The left-hand tool rough turns the nose profile, the cam controlling the travel of cross slide. The three tools in the other tool block rough turn the straight part of body.

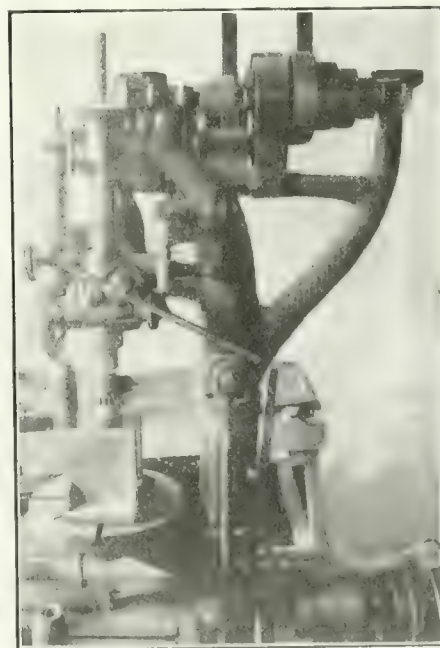
While the front tools are working, the back arm is brought forward with its two tools and roughs the groove for the copper band, also squaring up the base of shell. Sufficient metal is left in the groove for the undercut and wave lines, which are finished at the next operation. The arm is clamped to a heavy bar at the back of the lathe, working in bearing brackets on headstock and tailstock. A projecting piece from the bottom of the arm has a roller which moves in a cam attached to a bracket on the lathe carriage at the back. The cam deter-

mines the feed of the back arm tools by moving the arm forward as the carriage travels. A stop in the bed in front controls the travel of carriage. After this operation the shells are arranged in racks.

Waving and Undercutting Copper Band Groove.

The next operation consists of forming the wave lines and undercut in the copper band groove. This is done on two "Reed-Prentice" 14-in. lathes, equipped with suitable tooling fixtures for the work. The shell has a centre plug in the nose, and is carried on the lathe centres, as in the preceding operation. Each lathe is equipped with a combination three-point cam and drive chuck, the latter having a square hole in centre to take the head of plug centre in shell nose, the same method being used in the preceding operation.

The waving tool box is in front and moves in longitudinal slides, the whole fixture being mounted on a cross slide. A bracket with a roller projects from the left-hand side of the tool holder. The roller at the end of the bracket is held up against the cam face by a spring on the opposite side of the tool holder. The cam oscillates the tool and gives the necessary motion to the waving tool. The tool has a square face with two vees for forming the wave lines. For feeding in the tool a cam is fastened on the lathe carriage under the cross slide, which has a roller underneath moving in the cam. As the carriage travels along, the cam



SIZING THREAD IN NOSE AND FINISHING FUSE SEAT.

forces in the cross slide and also the tool.

The undercutting tools are carried in two holders mounted on a fixture at the back of the lathe. They are hook-nosed,

right and left-hand, and are inverted. The holders are located close together and move in diagonal slides. The feed is taken care of by a cam fixture similar to the one which operates the waving tool. When the tools are feeding in, they are gradually forced apart, thus forming the undercut.

Finish Turning.

For the finish turning operation the same type of "Reed-Prentice" lathe is used as for rough turning. There are four of these lathes installed, and they are tooled up in a similar manner as the lathes used for the rough turning operation, with the exception of the back arm tools. In this case there are two arms, one having a tool for forming the corner at the base and the other for forming the fuse cap seat outside the nose. Three tools in one tool box in front finish turn the straight part of shell body, while a single tool, also in front, finishes the nose profile. The feeding-in cam is arranged in the same manner as on the roughing lathes.

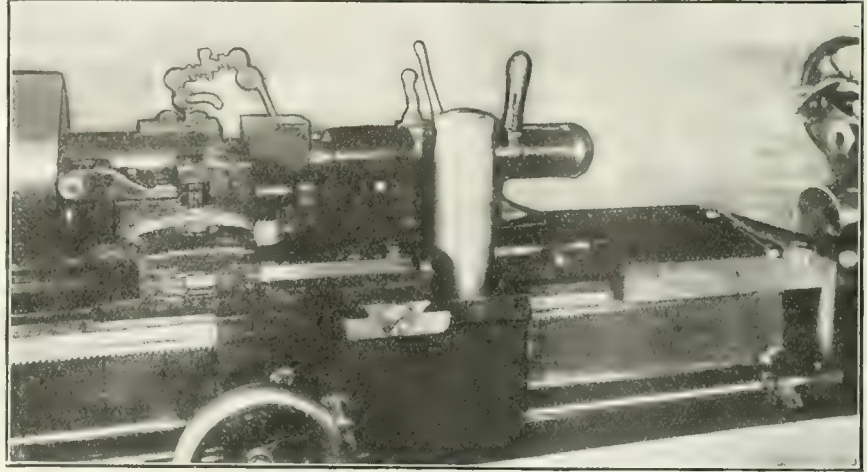
The back arms are operated, as in the roughing operation. The arm at the nose end holds a tool which forms the seat on the outside of the nose for the fuse cap, while the arm at the base end holds a tool for rounding the corner of base. These arms are brought forward when the front tools have nearly completed the travel. The shell has a plug centre in the nose, as in the two preceding operations, and is carried on the lathe centres, the same type of drive chuck being used

on the countershaft which throws over the belt. The time taken in this operation is 2 min. 15 sec. for one shell.

Driving Band Operations.

The shells now undergo the preliminary shop examination and Government

roughing, one under the work, also for roughing, and a tool at the back for finishing cut. The front tool and the one situated under the work are both operated by the screw under the front cross slide. The front tool feeds in towards the work, but the other feeds in



WAVING AND UNDERCUTTING.

inspection, when the body and wave lines are carefully examined. The wave lines are then nicked with a chisel and the shells taken over to the banding press. The latter was built by the Canadian Fairbanks-Morse Co., and is of standard design for shell work. The press is operated by hydraulic power from a belt-driven pump located close by. After the copper bands have been pressed on, the shells are taken over to a lathe for the bands to be turned.

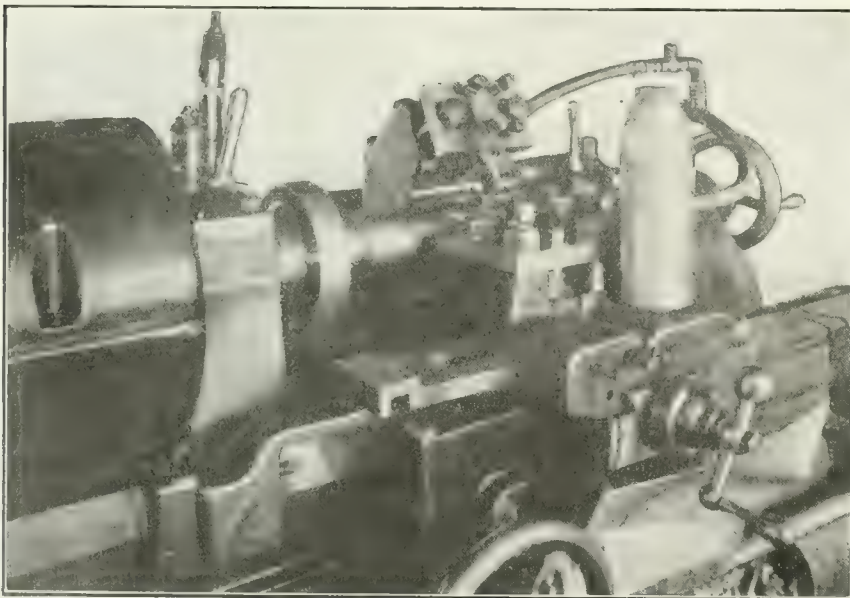
a direction parallel to it. The underside tool roughs the back of the copper band, where the most metal has to be removed. The front tool then roughs the whole width of band.

The finishing tool is in a tool holder on the back of the attachment. The tool holder moves in vertical slides, and is operated by a lever. The tool passes down behind the work and is set so that it shaves off the required amount of metal while passing. The plug centre is still in the nose of shell, which is carried on the lathe centres. The lathe is equipped with a driving chuck to take end of nose plug.

Base Recess.

The base of shell up to this stage has retained the countersunk centre which was used during the various turning operations. This centre now disappears when the recess in base is formed. Before the actual work on the base recess begins, a flat 1 13-16 in. hole is drilled in the base to remove some of the metal, and so relieve the tools at the next operation. This relieving work is done on a 20-in. Canadian Buffalo Forge Co. drill press.

Four turret lathes, built by the Davis Machine Co., Rochester, N.Y., are installed for forming the base recess. The shell is held in a chuck, while on the turret are mounted the tools required for the operation. The turret is mounted on a cross slide, this feature being taken advantage of when boring out the recess and forming the undercut. The tool in the first turret face rough bores the recess. This tool is in the form of a cutter and is held in a boring bar. A stop with a roller at the end is fastened to the boring bar to regulate the depth



ROUGH TURNING BODY, NOSE PROFILE, DRIVING BAND GROOVE AND BASE.

as for the roughing operation. The lathe stops automatically when the tools have finished cutting. As the operation begins to move the carriage back, a catch on back of the carriage engages with a vertical rod connected to an attachment

The copper driving bands are turned on a "McDougall" engine lathe, equipped with a band-turning attachment built by Lymburner, Ltd., Montreal. The attachment is fixed to the lathe carriage. It has three tools—one in front for

of the recess, the roller coming up against face of base, acting as a stop for cutter. The cross feed is taken care of by moving the turret. The second tool finishes the bottom of base and also the sides of recess for threading. This tool is of the same type as the roughing tool,

zontal mandril, which is a sliding fit inside the shell, the mandril having a tightening device for holding base end of shell rigid. One end of the vise projects over nose of shell and carries a steel collar for guiding and locating the drill in the correct position. On a bench

wrench. When the base plate has bottomed in the recess the square head is twisted off.

The shells are now taken over to a power riveter to have the joint between the base plate and base closed up. The riveter was built by the Grant Mfg. &

Shell Production Data

Operation	Machine	Operators	Speed	Feed	Time
Grinding	1 Double grinder				1 min.
Drill	5 -Buffalo heavy duty drills	1	190	.020	2 min. 30 sec
Ream bottom	1 -Buffalo heavy duty drill	1	190	Hand	1 min.
Nosing ream sides	3 -24-in. engine lathes	2	100	1 32	2 min.
Counter bore and bevel face	5 -Buffalo 20-in. drills	2	130	.040	2 min.
Undercut	2 -Buffalo 20-in. drills	2	80	Hand	1 1/2 min.
Ream finish bottom	2 -Buffalo 20-in. drills	2	120	Hand	1 1/2 min.
Centre base	1 -Buffalo 20-in. drill	1	...	Hand	1 min.
Tap fuse hole	2 -Buffalo heavy duty drills	2	40	Hand	1 1/2 min.
Size fuse hole	2 -Buffalo 20-in. drills	2	60	Hand	2 min.
Inspection of interior and insert drive plugs					
Rough turn	4 -Reed-Prentice automatics	2	100	1 64	2 min. 15 sec.
Wave ribs and undercut	2 -Reed-Prentice 14-in. lathes	2	100	Hand	1 1/2 min.
Finish turn	4 -Reed-Prentice automatics	2	100	1 64	2 min. 15 sec.
Banding	1 -Fairbanks-Morse press	1	...	...	1 min.
Cut copper band to form	2 -14-in. lathes with forming attachment	2	400	Hand	1 1/2 min.
Drill 1 13-16 recess in base	1 -Buffalo 20-in. drill	1	190	Hand	1 min.
Finish recess to 2 1/4-in. size	4 Davis 24-in. lathes	5	150	Hand	5 min.
Tap and size	1 -Gisholt 24-in. lathe	1	40	Hand	5 min.
Drill 1/4 fixing screw hole	2 -Buffalo 20-in. drills	2	...	...	1 1/2 min.
Tap 1/4 fixing screw hole	2 -Buffalo 20-in. drills	2	...	...	1 1/2 min.
Assemble base plates	2 -Jones & Lamson turret lathes	2	125	Hand	1 1/2 min.
Cut off base plates	1 -Hamilton gear machine	1	...	...	...
Marking	1 -Buffalo varnish tank and washing tanks				
Varnish	1 -Brantford Oven & Rack Co. oven				

and has a similar stop attached to the boring bar. The third turret face holds a boring bar, which has at the end a cutter for forming the undercut at the bottom of recess. In operation the tool is placed in position in the recess where the turret feeds across, thus forming the undercut. The fourth turret face holds a "Murehey" collapsible tap for threading the base recess.

Fixing Screw.

A number of minor operations now follow. The first is the sizing operation

near the drill the hole is hand-tapped and sized.

The shells are next cleaned and washed in a tank containing gasoline, afterwards undergoing another shop and Government inspection when the base recess is carefully examined.

Base Plate Operations.

The base plate operations consist of screwing the base plate into the recess, riveting the joint between base plate and base, and finishing the base. The

Machine Co., Bridgeport, Conn. The nose of the shell is placed on a cup-shaped block on the table while a bracket fixed to the frame above holds the shell steady. The hammer is operated by a friction pulley and is controlled by the operator by means of a foot lever. While the machine is working, the shell is turned round by hand one complete revolution.

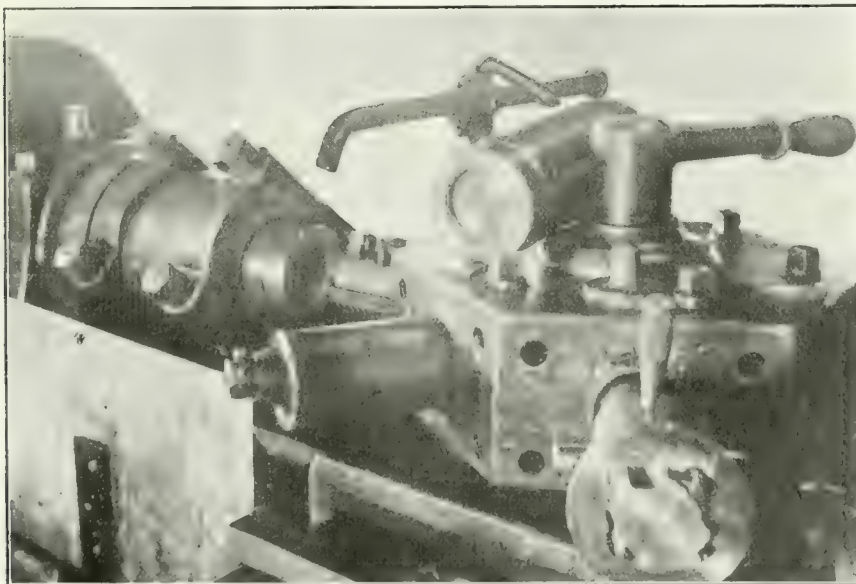
The bases of the shells have now to be finished up, this being the last machining operation. A No. 3B "Milwaukee" miller is installed for this operation. A fixture is fastened to the table for holding 24 shells, two rows of 12 each, the shells being placed back to back with sufficient room in between for the cutter, and clamped to the fixture. The one cutter turns both rows of shells.

Marking.

After the base has been finished, the shells are taken along to a bench for the markings to be put on. The machine is fixed to the bench and was built by the Hamilton Gear & Machine Co., Toronto. This type of machine is installed in several shell plants.

Varnishing and Baking.

The shells while still on the bench have a brass ferrule screwed into the nose to prevent the varnish from coming in contact with the threads, the ferrule being taken out after the shells have been baked. The shells are filled with varnish from a tank, the tank used having been built by the Canadian Buffalo Forge Co. It consists of a double compartment, each side having a capacity of one barrel of varnish. The varnish is forced up from one compartment by compressed air. It flows up a pipe situated over the other compartment and the action is similar to a bot-



FORMING BASE RECESS.

when the base is hand-tapped, the shells being moved along to a bench for this purpose. The 1/4-in. fixing screw hole is then drilled and tapped. The hole is drilled on a Canadian Buffalo Forge Co. drill press, equipped with a specially-designed vise. The latter has a hori-

zontal mandril, which is a sliding fit inside the shell, the mandril having a tightening device for holding base end of shell rigid. One end of the vise projects over nose of shell and carries a steel collar for guiding and locating the drill in the correct position. On a bench

the washer. The shell is simply slipped over the pipe, nose down, and, when lifted off, the inside is evenly coated with varnish free from air bubbles. The varnish runs down into the other compartment, and when the first compartment is empty and the other side full, the air pressure is diverted and the varnish is forced back in a similar manner.

It might be here stated that the object of the varnishing process is to protect the shell from the explosive, lyddite, which has a deleterious effect on steel. After the varnish has been poured out, the shells are placed nose down on a draining rack for a few hours preparatory to being baked.

A gas-heated oven built by the Brantford Oven & Rack Co., Brantford, Ont., is used for baking the shells. The oven is heated on the indirect system. On each side of the oven is a chamber with coils containing air which is drawn through ducts into the oven at the end by a Canadian Buffalo Forge Co. No. 2B exhaust-er. A gas burner is connected to each chamber and the hot gases flowing round the coils heat the air inside them. The air escapes through ducts located at the top of the oven. With this system, the gas fumes do not come in contact with the varnish in the shells, the hot air supplying the necessary heat. The shells remain in the oven eight hours, the temperature being 300 degs. Fah. The shells are arranged in racks before being placed in the oven.

Final Operations.

When the shells have cooled down, the ferrules are taken out and the shells are taken over to the Government inspector for final examination. The shells are carefully weighed, gauged and examined, and one from each series is selected for the firing test. The rest are then sent forward to the painting department where two coats of paint are applied, the priming coat being white and the second coat yellow ochre. A brass plug is then screwed into the nose, the threads being first covered with "luting." The shells next pass to the shipping room and are packed in boxes for shipment. The shell boxes used in this plant are made by the Hibner Furniture Co., Berlin, Ont., and the truck for moving the shell racks between the various operations on the gallery was supplied by the National Scale Co., Chicopee Falls, Mass.



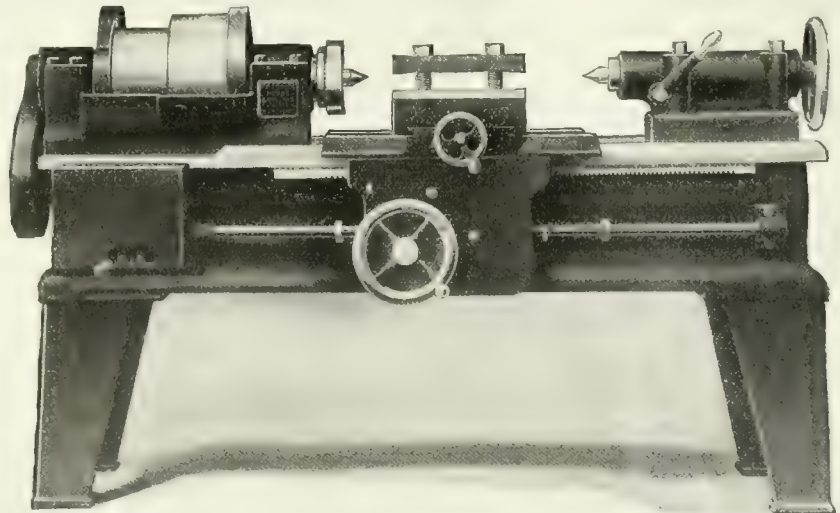
PROJECTILE MANUFACTURING LATHE.

THE opportunities afforded shell manufacture for the use of plain machines of limited capacity have been quickly recognized by machine tool builders. Among recent examples of these is the manufacturing lathe which has been put

on the market by the Canadian Fairbanks-Morse Co.

It is designed to meet the demand for a plain heavy standard lathe, which can be easily handled by non-skilled labor, and in order to insure satisfactory service under severe and continuous duty, the provision of ample wearing surfaces and reliable lubrication, are distinctive features. The steel gearing is cut from the solid, and the headstock bearings are fitted with brass bushings and ring oilers. The lathe is regularly furnished with a solid spindle, having the nose bored for No. 5 "Morse" taper centre, but when desired it can be furnished with a hole $3\frac{1}{8}$ inches diameter, and deep enough to hold a 3-inch shell.

The carriage has power longitudinal feed only. Automatic stops control this obtained by means of a shifting lever in the gear box. The feed is positively driven by gears from the spindle, all



16 INCH SWING, MANUFACTURING LATHE.

gears suitably covered. The tool box is of the European type, of ample proportions, and has hand cross-feed only. Two speeds only are furnished by the 6 in. wide cone steps, which are of 11 and 14 inches diameter respectively. The use of a two-speed countershaft provides eight speeds, the countershaft friction driving pulleys being both 16 x 6 inches.

The bed is 7 feet long and allows 21 inches between centres. A maximum swing of 16 inches diameter is available over the bed, and 10 inches over the carriage. The liberal proportions of spindle bearings—5 x $7\frac{3}{8}$ inches front and $4\frac{1}{2}$ feed in either direction; three changes of feed— $\frac{1}{8}$, 1-16 and 1-32-inch, being x $5\frac{3}{8}$ inches rear—insure ample rigidity under severe service. When desired, this lathe can be furnished with various attachments for different operations.

ENGINEERING IN GERMANY

THE Copenhagen correspondent of "Electrical Engineering" writes: "It is wrong to say that the electrical industry in Germany is disorganized. In my opinion it has never been so organized as at present, but the whole organization has been altered to meet the war requirements. The Government has taken over practically the whole supply of brass and copper and other metals useful for war purposes. A vast number of factories are working day and night on Government orders, and, as the German Government pays tremendous prices, the firms having this sort of work do not care for any other. However, in the electrical industry there are a large number of small firms, especially down in the Thuringen neighborhood. Most of these firms have no Government work, but they cannot supply the usual accessories because all their stocks of metals have been taken from them. Therefore,

they have now to make lamp-holders, lamp-sockets, switches, and, in fact, all accessories, of brass-covered iron. With their usual technical thoroughness and cleverness they have succeeded in producing an article of first-class quality. The finished article looks exactly like brass, can be polished like brass, and, I believe, withstands moisture and other rough treatment. For a long time the Germans have been using insulated iron wires instead of copper wires."



Cheap Ammonia.—Ammonia, as ammonium sulphate, is produced cheaply as a by-product in the manufacture of coke in by-product ovens.

Steel and Shrapnel Bullets.—The least thickness of hardened steel that will keep out modern shrapnel bullets at fairly close range is $\frac{1}{8}$ in. These bullets run forty-one to the lb.

Casting Steel Ingots for Production of 4.5 H.E. Shells

Staff Article

With a view to securing an increased output of 4.5 high explosive shells, cast steel billets are now being produced in our steel foundries through the medium of ingot moulds. Although in the earlier stages of the process considerable trouble and difficulty were met with, these have now been overcome and, in the particular plant under review, an output of over 4,000 shell blanks each 24-hour day is being achieved and continuously maintained.

WONDERFUL developments have been, and are still taking place in the iron and steel industry throughout the Dominion of Canada. While the manufacture of iron castings has for the most part in the past occupied the attention of foundrymen, that of steel castings is of comparatively recent date.

Prominent among Canadian concerns engaged in this production is to be noted the Canadian Steel Foundries, Ltd., of Montreal, etc. This company which was organized in 1910, have a large plant located at Longue Pointe on the outskirts of Montreal, for the express purpose of manufacturing steel castings of almost any size or shape, the meantime capacity being something over 3,000 tons per month.

The output had however been more or less restricted for some time owing to the generally prevailing industrial depression, but, on the advent of shell making, so great was the impetus imparted through the demand for shell steel billets, the plant is now running night and day to meet the new situation and at the same time do justice to its regular lines, among the latter of which may be mentioned locomotive frames, wheel centers, engine castings, high carbon rolls, dredge buckets, etc. A specialty is made of all kinds of steam and electric railway track work, such as

frogs, switches, diamonds, intersections, etc. Vanadium steel is prominent in all products where great strength is desired.

The plant is located about a quarter of a mile from the St. Lawrence river and about a mile east of Montreal city boundary. The buildings are of structural steel and brick, erected on concrete foundations. A detail description of the constructional features was given in our October, 1912, issue of Canadian Foundryman.

The Steel Foundry.

This building is 436 feet long and has a width of 264 feet. It consists of five sections there being an aisle across one end of the shop.

The open hearth charging stock is brought into the shop and taken to the furnaces by a Morgan 5-ton, four motor high type charging machine. The two 25-ton acid furnaces, using oil fuel, are of the most modern design and construction, and should the oil fuel fail or be cut off a gas producer is arranged as a standby.

The first aisle on the east side is equipped with a 20-ton Dominion Bridge Co. crane and also a 30-ton "Morgan" crane, while jib cranes fitted with air hoists are on each side of every aisle for handling the flasks and moulds, all of the flasks being of heavy cast steel and in a variety of shapes and sizes.

Mould Drying and Pouring.

After the moulds are made they are taken on trucks to a battery of drying ovens equipped with "Kinnear" rolling doors. Following the drying, the moulds are removed to the casting floor and placed in readiness for pouring. Two 35-ton and three 24-ton steel ladles built by the John McDougall Caledonian Iron Works, are used in transferring the molten steel from the furnaces to the waiting moulds. One 20-ton Dominion Bridge Co., and two "Morgan" cranes of 30 and 40-ton capacity transport the above mentioned ladles.

Fettling Shop.

When the castings are sufficiently set they are shaken out and removed to the fettling shop which comprises the aisle at the end of the foundry. Here a variety of equipment prepares the casting for machining by removing all gates, fins, etc. This aisle is served by a 15-ton Dominion Bridge Co. and a 30-ton "Morgan" crane as well as by a "Whiting" electric travelling wall jib crane. A general view of this floor is shown in Fig. 1.

Billets for Shell Production.

Owing to the great difficulty on the part of many plants in obtaining rolled steel billets for the production of shrapnel and high explosive shells required



FIG. 1. GENERAL VIEW OF FETTLING SHOP FLOOR

for the various European nations, our steel foundries have been scheming and experimenting with a varying amount of success so as to produce a grade of steel casting that would meet the requirements.

While the art of making steel in metal moulds dates back to the days when crucibles were first used in making small tool steel ingots, the more general adoption of metal moulds dates back only a few years.

On first thoughts it did not appear to be practicable to produce the desired grade of steel required for shells by the ingot moulding process, especially as the rough shell had to be forged from the cast ingot. However, after much time spent in experimenting, a stage has been reached at which almost every requirement is fulfilled. It was believed that the use of metal moulds would chill the steel and cause it to be unserviceable for shell making, but with moulds of proper proportions, results otherwise have been achieved. No annealing has been found necessary after the ingots are shaken from the moulds.

Government Specifications.

Government specification requirements for 4.5 shell steel call for the same standard of product as in the case of 15 and 18 pounder shrapnel shells. The steel must have a tensile strength of between 35 and 49 long tons, an elongation of about 20%, a percentage of carbon between 0.45 and 0.55; the quantity of nickel must not exceed 0.50, manganese to be between 0.40 and 1.00, and phosphorus not over 0.05 per cent.

A mixture that gives close results is composed of about 20 per cent. Chaotangua or a similar low phosphorus pig iron, 40 per cent. open hearth scrap steel and the balance of heavy melting steel scrap.

sure of 80 lbs. per sq. in. mixed with air at 100 lbs. per sq. in. The quantity of oil used is comparatively low, being

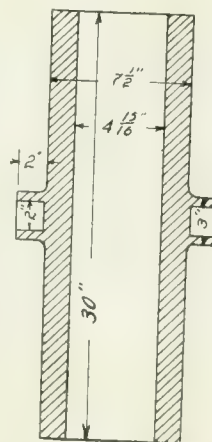


FIG. 3. INGOT MOLD.

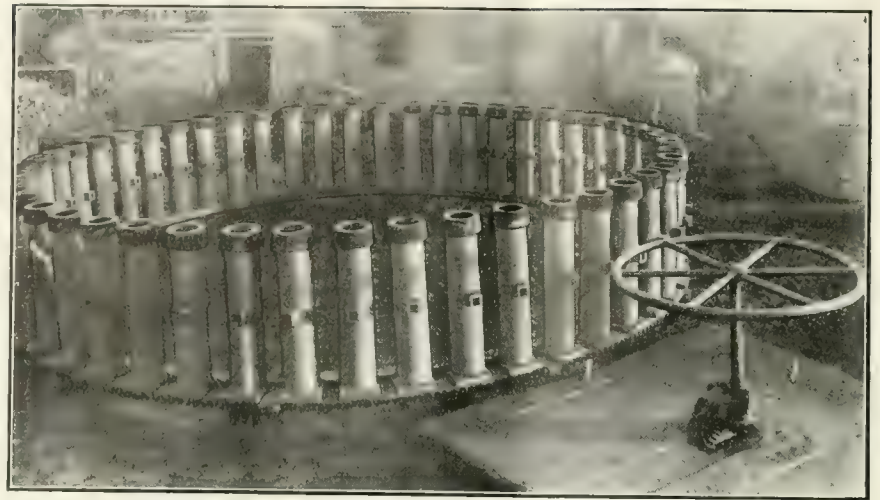


FIG. 4. BATTERY OF INGOT MOLDS READY TO BE Poured.

Melting the Mixture.

The steel is produced in two 30-ton furnaces by the open hearth process. They are fired with fuel oil at a pres-

about 3.3 or 3.4 gallons per ton of steel melted. One charge is melted in about 5 hours. The entire charge of about 25 tons is taken from the furnace by running it into a 40-ton bottom-pouring ladle shown in Fig. 2. This ladle, made by the John McDougall Caledonian Iron Works is built of heavy boiler plate lined throughout with fire-brick. The molten metal is poured from the ladle through an opening in the bottom which is stopped by a plug controlled by a series of rods and levers operated manually at some distance off. The stop plug which controls the flow of the metal from the ladle is made of graphite, the part entering the opening being conical in shape with the end somewhat rounded. This graphite plug is screwed on to a rod which extends down through the metal from the top of the ladle.

To protect this rod from the action of the molten metal, it is covered with a series of fire-brick discs throughout its length. Owing to erosion the graphite plugs will only stand about 300 openings after which they are replaced by new ones.

Shell Ingot Moulds.

A rough sketch of the moulds used for making the shell ingots is shown Fig. 3. At first the moulds were made somewhat shorter but as it was desired to get two blanks from each ingot, it became necessary to increase the length in order to get sufficient sound steel at the bottom. The trunnions are placed a little above the centre to facilitate handling with the crane, while both ends are faced off to obtain a good level surface. The caps for these moulds are made of facing sand in a core box and oven-baked. The general construction is shown in Fig. 6, the bottom end being narrowed down to facilitate removal.

Preparing the Moulds.

When the ingots were being first produced, it was the custom to stand them

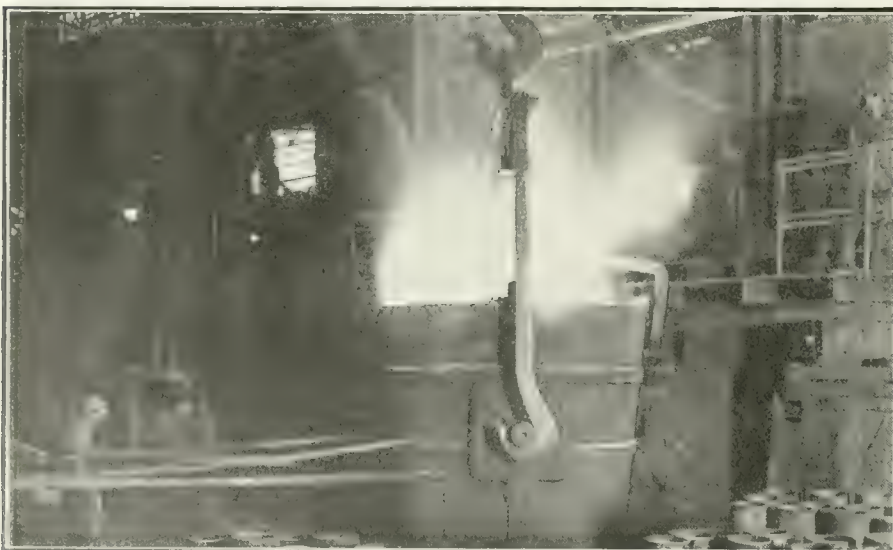


FIG. 2. TIPPING BOTTOM POURING LADLE AT OPEN-HEARTH FURNACE.

in hit-and-miss fashion about the floor. This method was found unsatisfactory, however, as the crane operator had considerable difficulty in placing the opening of the ladle in the desired position. To overcome this trouble and also to facilitate the operations generally, the method shown in Fig. 4 was designed and is giving excellent results.

A rotary table with rack underneath is constructed to run on a track, and is operated by bevel gears and shafts leading to the large hand wheel shown in Figs. 4 and 5. These rotary tables are 16 ft. 8 ins. inside and 18 ft. 4 ins. outside diameter, and have flat surfaces upon which the moulds rest; the latter being held in position entirely by their own weight. At present there are four of these tables in use, each having a capacity of 50 moulds. There is also under consideration a new design which will involve a table to accommodate 2 concentric rows of 50 moulds each. This will do away with the handling of the crane after the first mould has been located.

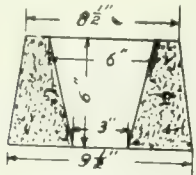


FIG. 6. INGOT MOLD CAP.

Pouring the Moulds.

After the charge has been taken from the furnace, the 40-ton ladle is picked

up by the crane and taken to a position directly over the revolving table. When the proper location is found and the first

heat by heavy blue glass goggles. The entire heat of around 25 tons is run off in about one hour.



FIG. 5. POURING A BATTERY OF INGOT MOLDS

mould poured, directions are given to the men at the controlling wheel and the table is revolved to the next mould. The man standing close to the ladle di-

The magnitude of these operations can be best realized when it is known that an average of seven heats of 25 tons each, which is about 4,000 shell blanks, are run off every 24 hours.

Removing the Ingots.

When the ingots have properly set, although still quite hot, they are removed from the mould so that the latter can be prepared for the next pour. The ingots are raised by means of the crane and in most cases they drop out without any trouble, as the shrinkage, which

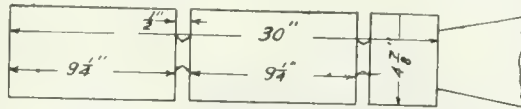


FIG. 8. SYSTEM OF CUTTING OFF BILLETS.

rects the movements of the crane operator and also the men at the wheel, his eyes being protected from the glare and

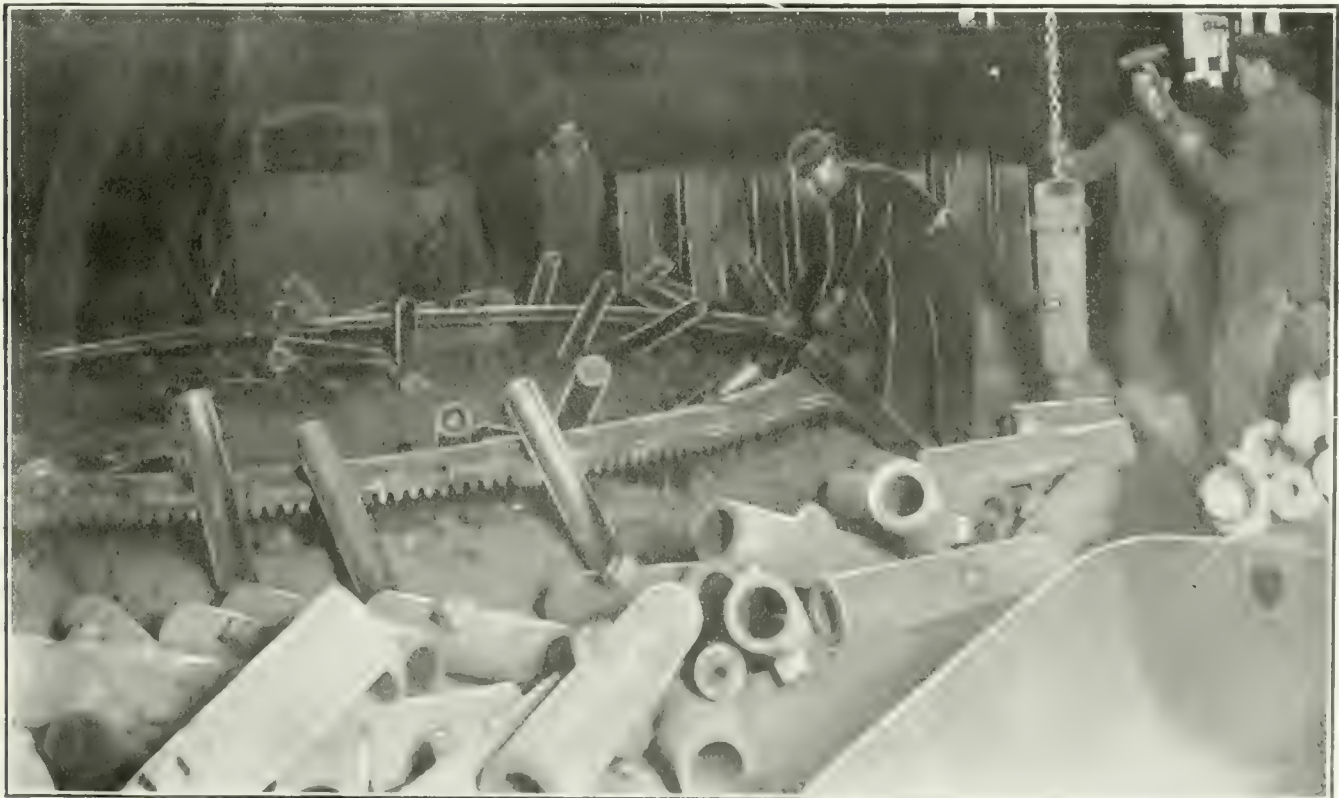


FIG. 7. SHAKING OUT THE INGOTS. SEVERAL OF WHICH MAY BE SEEN AGAINST THE TABLE

is about 3-32 of an inch in the diameter of 5 inches, is usually sufficient to thoroughly free the ingot from the mould.

ingot weighs about 156 lbs. and is handled by means of a jib crane and air hoist. The Government inspection calls

be examined for fracture. A sketch of one of these ingots as it comes from the lathe is shown in Fig. 8.

Heat No.	Description	Dia.	Area	Elastic limit		Max Strength		Elongation in percent.	Recd. dimension			Chemical Analysis					
				actual	per sq. in.	actual	per sq. in.		dia.	area	%	Car	Phos	Man	Sul	Si	Va.
	4.5 How.	.461			19.2		40.70	25.7					.42	.031	.72	.032	.28
	"	"			21.9	long turns	41.8	27.6	on 1.635"				.41	.036	.85	.032	.30
	"	"			22.3		42.0	26.3					.40	.036	.87	.034	.27

FIG. 9. RECORD SHEET COVERING CHEMICAL TEST.

Sometimes however, it is necessary to hit the ingot a blow with a sledge. If they do not come out with the sledge treatment they are taken to a "Bert-ram" horizontal hydraulic press and forced out.

Occasionally an ingot seizes in the mould, and when this happens the contraction will cause the metal of the mould to crack in one or more places; however, the loss in this respect is very slight, being less than 3 per cent. The walls are left thick enough to withstand the action of the heated metal, because, if too thin, the molten steel would tend to heat the mould so rapidly that the two surfaces would incline to weld together. After the ingots are shaken out, they are inspected for defects, such as fractures "piping," etc. The life of the average mould is about 200 heats. A view of the shaking out process is shown in Fig. 7.

Cutting Off the Billets.

After the ingots have passed the preliminary inspection they are cut into billets on several axle lathes; the length being 9 1/4 inches, and the width of cut being from 3/8 to 1/2 inch wide. The cutting off tools are of "Firth" high speed steel. Six lathes are employed in this operation, two of them being "Bridgeford" products and another two of "Bertram" make. The depth of cut is approximately 2 ins., the tools being fed in by hand. The average time for four cuts is twelve minutes, and about 200 billets are obtained in 10 hours. Each

for a portion equal to about 1-6 of the cross sectional area to be left in the centre, so that, when broken apart it can

Inspection.

The billets are broken apart by laying across a 3 x 4 block and striking with a sledge. The crop end is returned to the furnace for remelting and the billets again inspected for defects. If rejected at this stage they are stamped with the letter R. The buttons are removed by planing or shaping, or, if very shallow, by grinding. Two sample ingots are taken from each heat for analysis. Drillings are also taken for tests of carbon, sulphur, phosphorus and manganese. The carbon test is derived by combustion, as the color test gives only an approximation. Chemical and physical tests are made of each heat by the works chemist, also by the Government chemist, and records of these are preserved. One of these record slips is shown in Fig. 9.

General.

While this plant is busy at present supplying machine shops with steel billets for the manufacture of 4.5 high explosive shells a general line of heavy steel castings is also being turned out. An idea of these latter may be got from Fig. 10, in which is shown the pattern of a large herringbone gear of about 8 feet in diameter, and in Fig. 11, the mould for a large hydraulic press cylinder in course of preparation.

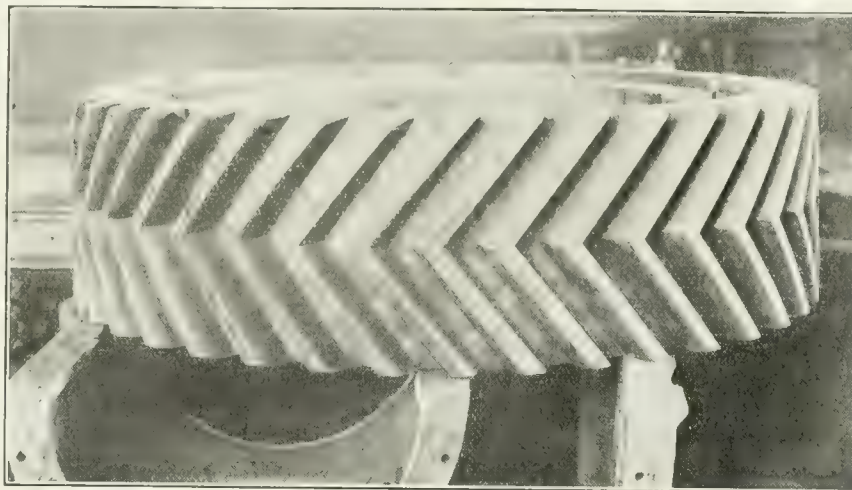


FIG. 10. PATTERN OF LARGE HERRING-BONE GEAR.



FIG. 11. PREPARING MOLD FOR LARGE STEEL HYDRAULIC CYLINDER.

The first contingent of volunteer munitions workers left Johannesburg, South Africa, on August 5, for England.

SHRAPNEL SHELL PRODUCTION



IN A

SHIPBUILDING AND MARINE ENGINEERING PLANT

Staff Article

The sudden call from the manufacture of articles of a peaceful commerce to that of supplying the gods of war with provender of a prodigious amount and such as we never dreamed of producing, has been met by the administrations of our iron and steel industries in a manner that demands our whole-hearted admiration for their enterprise and resourcefulness. This particular plant is now making arrangements to manufacture 4.5 high explosive shells.

FROM building ships to making shrapnel shells represents somewhat a switching between extremes, and naturally called for changes in and additions to equipment. At the plant under review, however, little difficulty was experienced in finding room for a shell department which would not interfere with the ordinary work. A portion of the ground floor of the machine shop was taken over for the purpose and equipped with the necessary machinery. The floor or gallery above was also utilized for the making of shells. The heavier tools are installed on the ground floor and the operations up to and including the finish turning are done there.

On the gallery above, a banding press and band-turning lathe, a socket finishing lathe and a milling machine represent the machines installed, the greater part of the space being devoted to the assembling, painting and other hand operations, and to the housing of the inspection department. The entire plant is laid out so that the shells start at one end and are handled progressively until finished. "Chapman" elevating trucks distribute the shells between the various operations. Cutting compound supplied by the

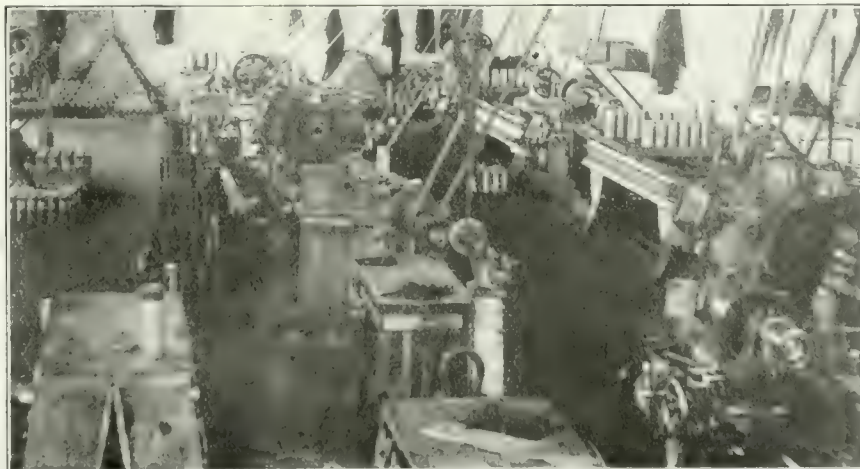
Cataract Refining Co., Toronto, Ont., is used exclusively on the various cutting tools. The heat treating department is located in a separate building outside of and adjoining the machine shop. This arrangement helps considerably in keeping the latter cool and free from fumes.

Although not among the first firms to undertake the manufacture of shrapnel shell, good progress has been made and little time has been lost in getting to the shipping stage. A number of "short cuts" and time-saving appliances have been introduced to increase production. The shops are equipped with electric motors using hydro power, and a spur from the G. T. R. runs through the yard to the machine shop, bringing the forg-

ings right up to the door. The forgings are stored just outside, and the cutting-off machines are located at that end of the shop within a short distance of the pile.

Cutting Off to Length.

The machining of the shell forging begins at the base, which is cut to length on a cutting-off machine supplied by John H. Hall & Son, Brantford, Ont. The advantage obtained by machining the base first before cutting off the open end is that it gives a square face to work to for the later operation, and also has the advantage of keeping the length of forging in a definite relation to the thickness of base. The machine is equipped with a universal chuck for holding the shell, and a bar stop inside the head-stock spindle locates the forging in the correct position. The stop, of course, comes up against the base of the shell inside. On the bed of the machine is a saddle, on which are mounted two cross slides, with holder on each, front and back. The cross slides are operated by a spindle threaded right and left-hand respectively, so that the tools always feed in when cutting. The back tool is set slightly ahead of the front,



PART OF MAIN FLOOR OF SHELL SHOP SHOWING MACHINES' LOCATION FOR FIRST SERIES OF OPERATIONS.

thus allowing a heavy cut being taken off. The hand screw at the right side traverses the saddle longitudinally.

Cutting Off Open End.

The open end of shell is cut off on the same type of machine as described above, the only difference being a shorter bar stop in the headstock and different cutting tools. The shell forging is placed in the chuck, the base end being up against the bar stop; the chuck is then tightened up. Both tool holders are used as in the previous operation, but in this case the parting tools are set in line with one another, the back tool being inverted to bring the cutting edge central. The shell forging is now the approximate length and ready for the body rough turned.

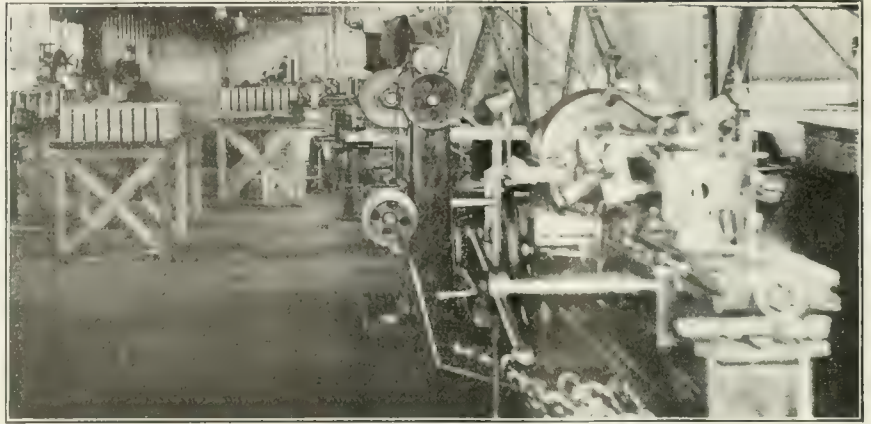
Rough Turning Body and Facing Up Base.

At the next operation the body is

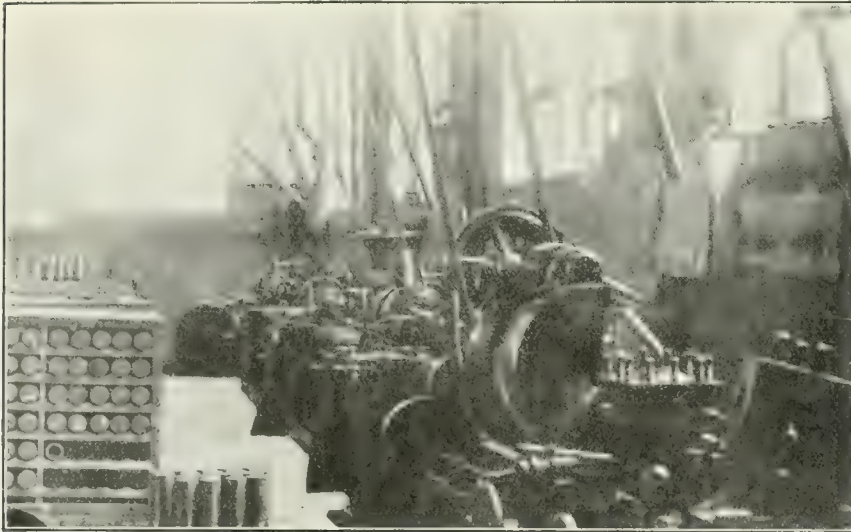
rough turned, the base faced up and corner rounded off, and the body up to the driving band groove finished. Two "Bertram" engine lathes are installed for this work, each being tooled up in

identically the same manner. In order to have the outside of forging concentric with the inside, the shell is held on a mandril with a draw-back mechanism. The open end is also gripped in a universal chuck, which rotates the shell by means of a ring attached to the latter by three set screws.

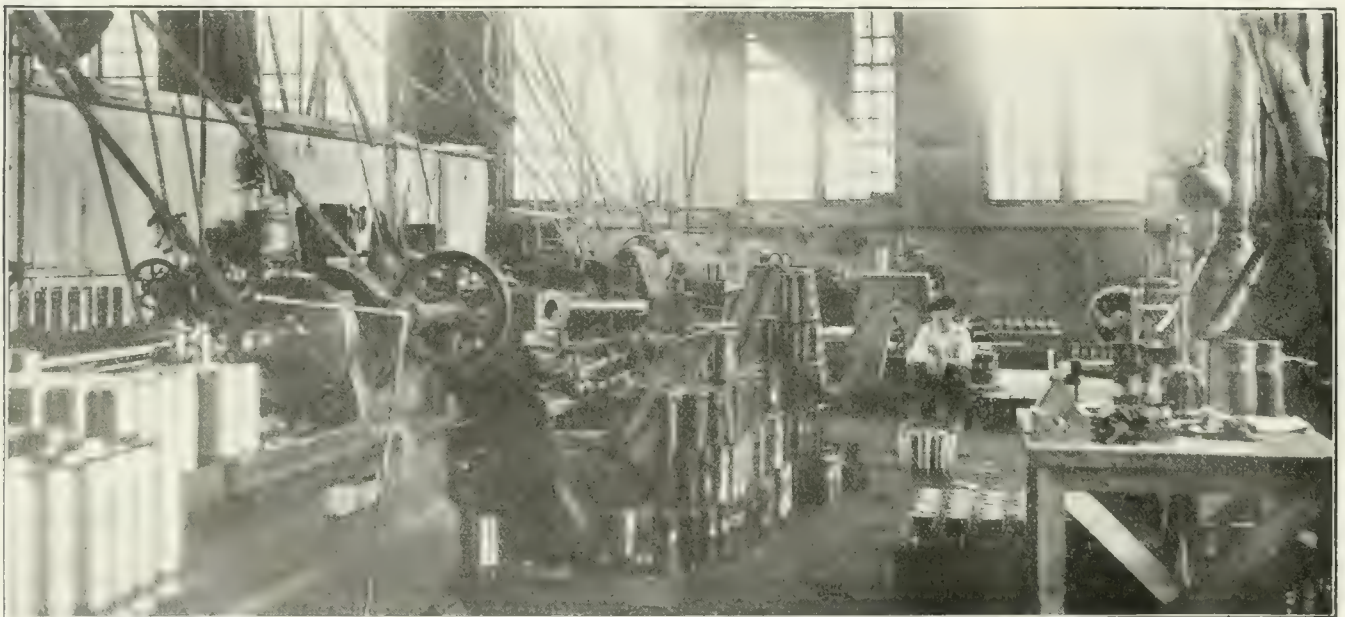
On the cross slide is mounted a specially-designed fixture for holding the three tools for performing the operation. Two of the tools are set in line with the side of the shell and the third behind the base. The first tool held in an ordinary tool-holder rough turns the body of the shell for a distance of about $7 \frac{5}{16}$ in. from the base, leaving the nose bevel to be machined later. The second tool, also at the side, is used for finishing the shell from the base to the driving band groove. This tool is held in a special holder, and can be moved back from the work at the end of the cut. The third tool is a broad cutter so formed that while the base is being finished, the corner is rounded off at the same time. This tool is, as has already been stated, lo-



SHELL SHOP GALLERY SHOWING ASSEMBLY.



CORNER OF SHELL SHOP, SHOWING "WAVING" AND FINISHING LATHES.



SHELL SHOP, MAIN FLOOR, BEFORE HEAT TREATING DEPARTMENT WAS MOVED TO A SEPARATE BUILDING.

cated behind the base of shell, and is shown at the right in the illustration.

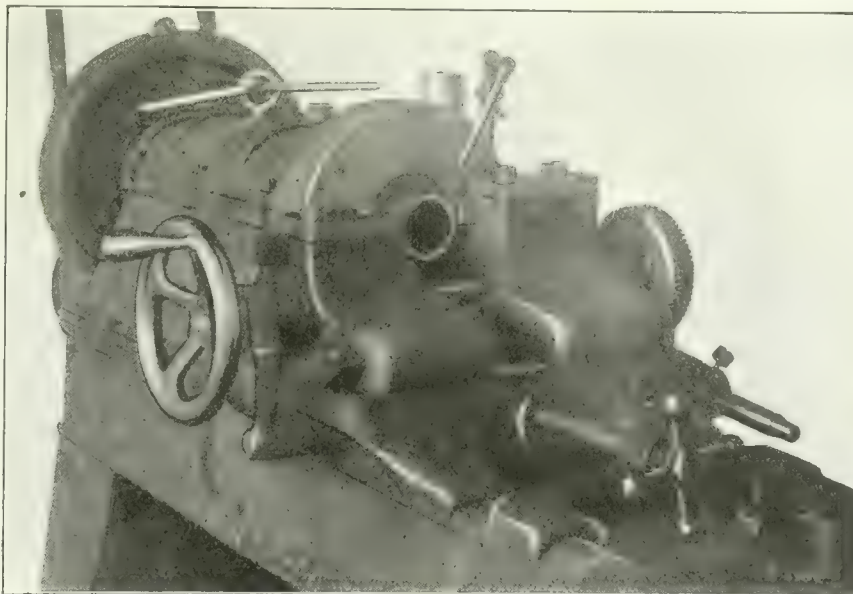
Machining Powder Pocket, Diaphragm Seat and Outside Nose Bevel.

This, the first operation on the inside of the shell, is performed on a "Warner & Swasey" turret lathe, the turret holding the tools for the inside work, while a tool holder on the cross slide contains three tools for machining the outside of nose. The shell is held in a universal chuck, which has a bush inside conforming to the shape of the shell base, and is used for locating the shell in the required position for machining. In this case it is immaterial whether the outside or inside work is done first. The usual method of procedure, and done in order to save time, is to reverse the order for each shell—that is to say, if the nose bevel was formed last on one shell it would be the first operation on the next, with the same rotation for the powder pocket, etc. By this means, one setting of the tools does for two shells. As an illustration the inside boring will be described first.

On the first turret face is a boring bar with a cutter for roughing out the powder pocket and diaphragm seat. The second boring bar has a cutter of similar shape, conforming to the profile of inside base of shell, for finishing the powder pocket and diaphragm seat. The inside work at the base is now finished and the turret is moved back out of the way to permit of the nose bevel being formed. The tool holder on the cross slide contains three tools for rough turning the nose outside and cutting to length. It should be stated that the nose at this stage must be of a certain shape or bevel so that after the closing in

operation it conforms to the required profile. The first tool cuts the shell to length, not, of course, the finished length, as this is done at a later operation. The second tool is a taper cutter for forming the bevelled part of nose behind the

machines are equipped with a "Bert-ram" waving and undercutting attachment with a three-point cam, also a bar stop in the centre of chuck for fixing the position of the shell. The nose end of the shell is, of course, held in the chuck.



TRIMMING OPEN ENDS AND BASES OF SHELLS

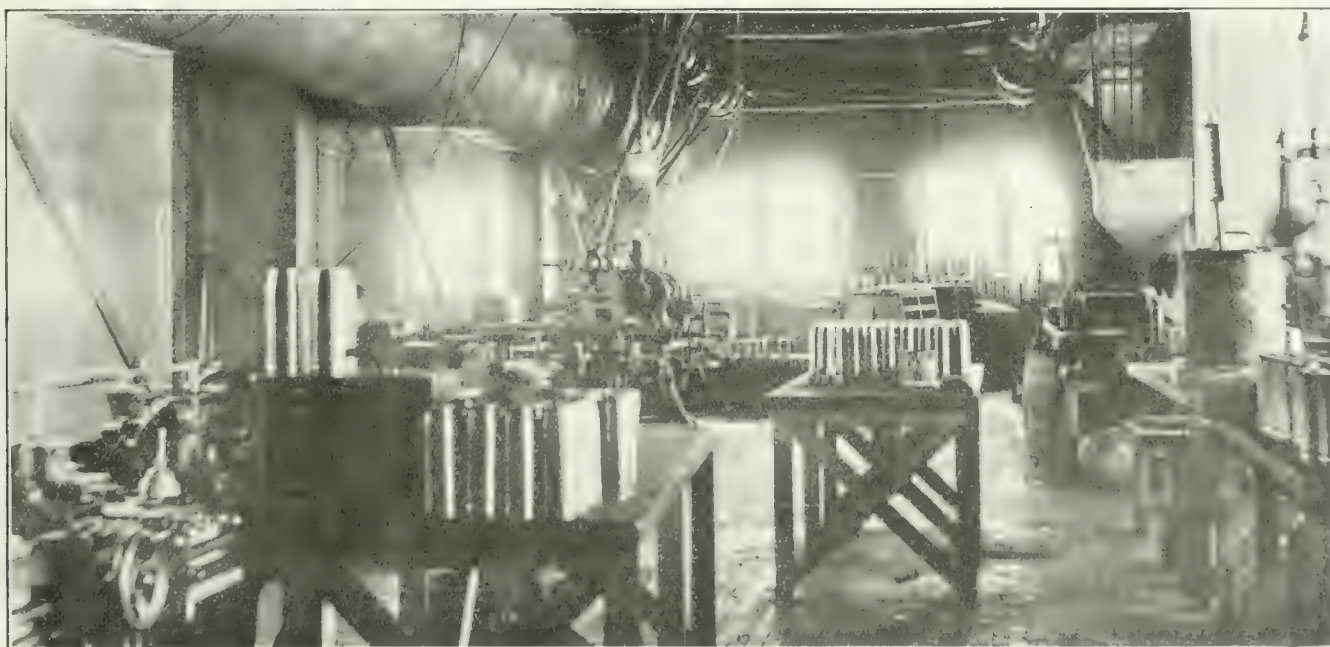
straight section at the front. This straight part is rough turned by the third tool. This operation is now completed, and when starting on the next shell, the nose bevel is machined first, followed by the powder pocket, etc.

Waving, Grooving and Undercutting.

For this operation two engine lathes are installed, built respectively by the Canada Machine Corporation, Galt, Ont., and Flather & Co., Nashua, N.H. Both

while the base is carried in a cup-shaped revolving centre on the tailstock mandril. The waving and grooving tool is situated in front, while the undercutting tools are at the back. All the tools are cutting at the same time, and the method of operation is as follows:—

The tool boxes are mounted on a fixture fastened to the lathe bed. The front tool is held in a specially-designed tool box mounted on a cross slide, the tool box working laterally in a slide. A



SHELL SHOP GALLERY SHOWING ASSEMBLY AND LOADING FEATURES

bracket projects from the left hand side of the tool box, and has a roller which is held up against the chuck cam by means of a strong spring at the right-hand side. The tool itself has a square face for cutting the groove with two

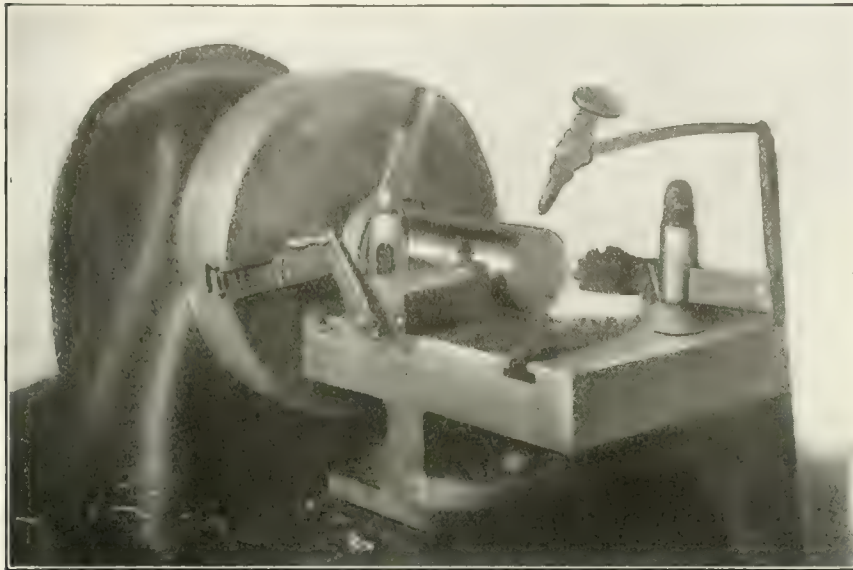
used; the air is supplied at 2 lbs. pressure by a "Roots" rotary blower. The oil quenching tank is situated alongside the furnaces, and the oil in the tank is agitated by a belt-driven propeller to keep the oil cool. For the same purpose

Fah. They are then cooled down gradually in a place free from draughts, the nose end standing in powdered lime. Previous to the drawing process, the shells are washed in a soda bath to remove the oil which clings to them after being quenched. A pyrometer, supplied by the Canadian Hoskins Co., Walkerville, Ont., is connected to all the furnaces in this department and indicates the temperature in each.

Sceroscope Test.

When sufficiently cool to handle, each shell is tested under a "Shore" scleroscope in order to ascertain the degree of hardness. By this means it is possible to tell the tensile strength of the metal, which should be approximately 80,000 pounds. The connection between the scleroscope readings and the tensile strength is that they bear a definite relation to each other, the degrees of hardness being proportional to the tensile strength of the metal. By keeping the hardness within certain limits it is possible to figure approximately what the tensile strength will be under test. This is definitely ascertained by having a test piece cut out of a shell and sent to a laboratory to be tested out on a testing machine. One shell is selected at random from each series of 120 and a suitably shaped test piece cut out of the shell at that part which has previously been tested on the scleroscope. The test piece is milled out on a milling machine supplied by the Ford-Smith Machine Co., Hamilton, Ont.

Before being tested on the scleroscope, the shells are cleaned on a polishing wheel, at the point to be tested, so that greater accuracy may be obtained in the readings. A number of the latter are taken at different points, the shell being turned round by the operator for this



ROUGH TURNING SHRAPNEL SHELL BODIES.

vees for forming the wave lines. The undercutting fixture is mounted at the back, and has two tool holders, each having a hook-nosed tool. The tool holders work in diagonal slides in order to feed in at an angle to form the undercut. The tools are left and right-hand respectively and are inverted when cutting.

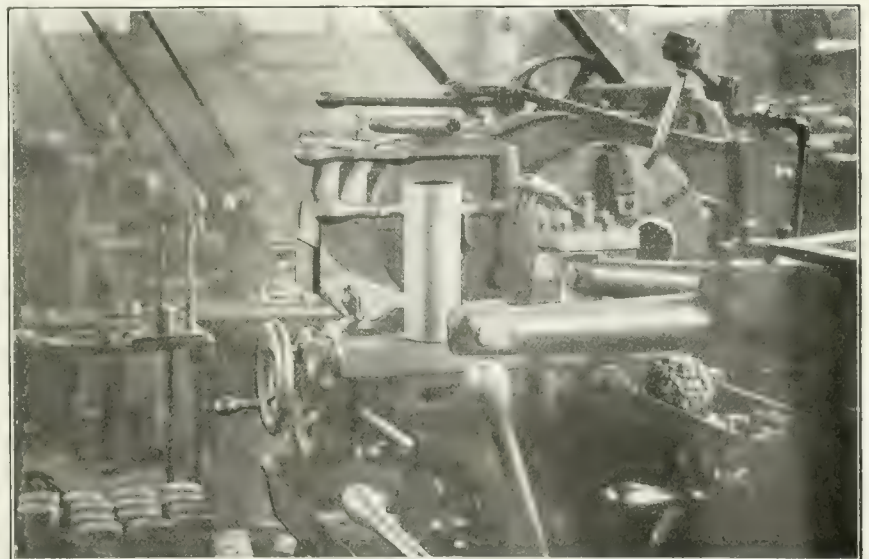
The feed is taken care of by cams on front and back brackets fastened to the lathe saddle. The cam on the inside of the front bracket engages with the cross slide of front tooling fixture, forcing the tool in as the saddle travels. The bracket at the back has two cams on the inside face, one for each of the undercutting tool holders. These cams also force the tools in as the saddle travels. The cam feeding in the waving tool operates on the cross slide underneath so as not to interfere with the oscillating motion of the tool box while the wave lines are being formed. This motion is imparted to the tool by the cam on chuck face.

Heat Treating.

The heat-treating department is in a separate building adjoining the machine shop. In this shop is the nosing press and also the scleroscope testing bench; the furnaces are thus all together. There are four gas furnaces, not including the nosing furnaces installed—two for hardening and two for the drawing process. One furnace was supplied by the Tate-Jones Co., Pittsburgh, Pa., and the other three were built by the Collingwood Shipbuilding Co. The furnaces are heated by gas and air, no lead pot being

a number of coils with cold water circulating through them are fitted around the side of the tank on the inside.

The shells on coming from the machine shop are first of all hardened. They are heated in the furnace for about 20 minutes in a temperature of approximately 1,560 degrees Fah. They are then quenched in the oil tank and put on racks on the tank for a short time to dry. The shells are next drawn or tempered to produce the required degree of hardness. For tempering, the shells are heated in a gas furnace for about 12 minutes at a temperature around 800 degrees



BORING POWDER POCKET AND DIAPHRAGM SEAT, FORMING OUTSIDE NOSE BEVEL.

purpose. All the shells are tested and afterwards arranged in their series.

Closing in Nose.

The nosing press is located in the heat treating department, the furnace being

to a bar held in the fourth turret face. The outside nose profile is then rough turned, a small cutter fixed in a boring bar being used. To obtain the correct profile, a roller is held in a piece projecting from the cross slide on which

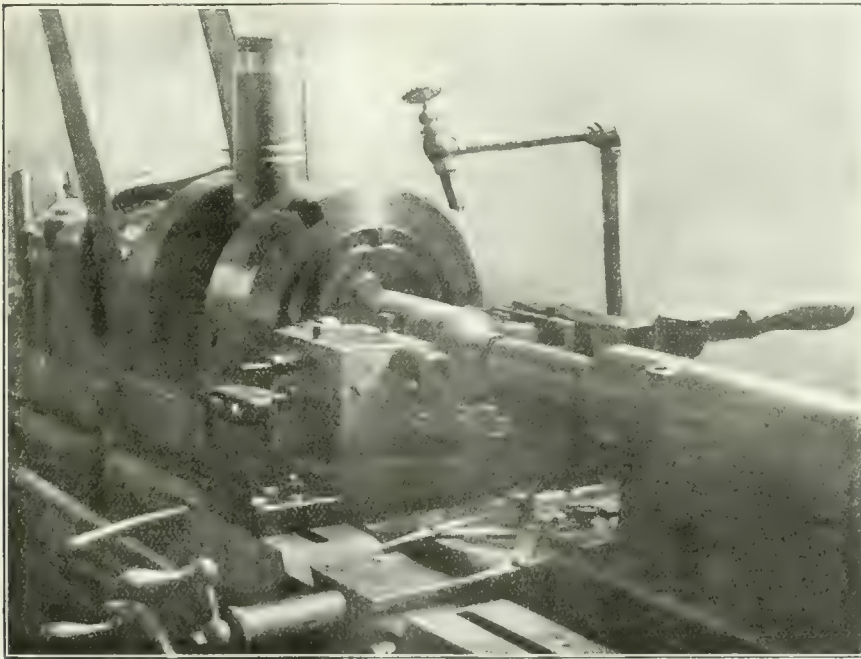
end of the nose, the part behind the groove, it will be remembered, having already been finished. Three engine lathes are installed for this operation, two built by the "Canada Machinery Corporation" and one by "Flather & Co." All the lathes are fitted up in the same manner, having the same type of chuck and a forming cam under the cross slide.

The chuck is of special design and holds the base of shell behind the driving band groove. In the nose of shell is a threaded plug for the tailstock centre. A forming cam is fastened to the lathe bed under the cross slide, while a roller underneath the cross slide projects and engages with both faces of the cam. As the saddle travels, the turning tool follows the direction given by the cam, and thus forms the body of shell to the required profile.

The shells are finished on a grinder built by the Ford-Smith Machine Co., Hamilton, Ont., the wheels being supplied by the Canadian Hart Wheels, Ltd., Hamilton, Ont. The base of shell is held in a chuck which has a locating stop for correct position, and the nose has the same plug screwed in as it had when being turned. The shell is ground from the driving band groove to the end of the nose at one operation, the grinding wheel being the same shape as the finished shell profile.

Copper Band Pressing and Turning.

The shells now undergo a preliminary Government inspection preparatory to being taken to another department where the copper bands are pressed on and turned. The banding press was built by the "Goldie & McCulloch Co." and is operated hydraulically at a pressure of about 900 pounds per square inch. The press is of standard design, as used in many shell plants; a full description is,



"BERTRAM" WAVERING, GROOVING AND UNDERCUTTING ATTACHMENT ON "C. M. C." LATHE.

in line with the others and connected to the "Hoskins" pyrometer already referred to. The press was built by the Goldie & McCulloch Co., Galt, Ont., and is hydraulically operated. The lead pot is heated by gas and air, and is beside the press. The nose of the shell is heated to a dull red, then placed on the press, the steel diaphragm having been dropped in. The press is put in operation and the nose closed in by being forced up into the die at the upper end, thus closing in the nose. The shell is now taken off the press and allowed to cool slowly previous to being taken back to the machine shop.

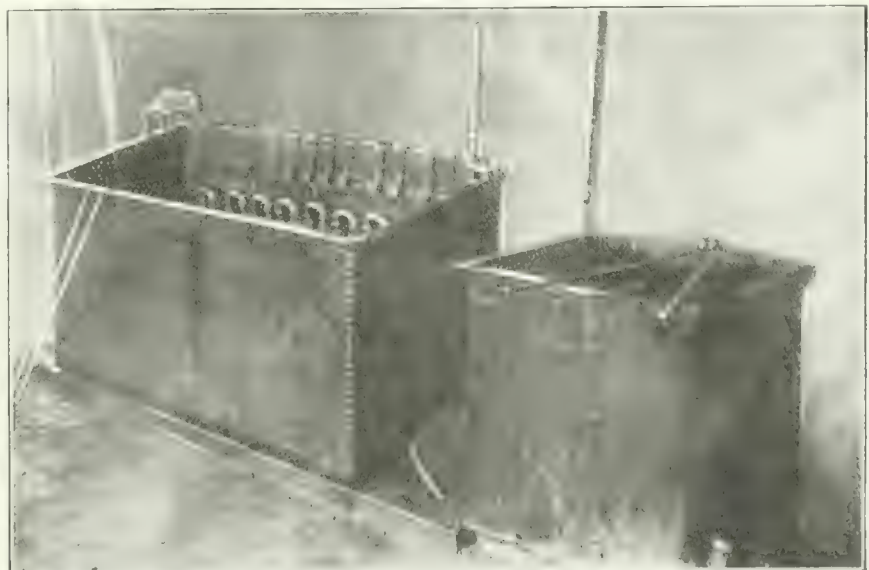
the turret is mounted. The roller engages with a small cam mounted on a bracket attached to the lathe bed, and, as the tool travels along, it follows the profile given by the cam. The sixth turret face holds a boring bar with a cutter for facing the shell to length.

Finish Body Turning.

In this operation, a light cut is taken off the body and nose in a lathe and finished on a grinder. The shell is finished from the driving band groove to the

Boring and Threading Nose, Inside and Outside Profiling.

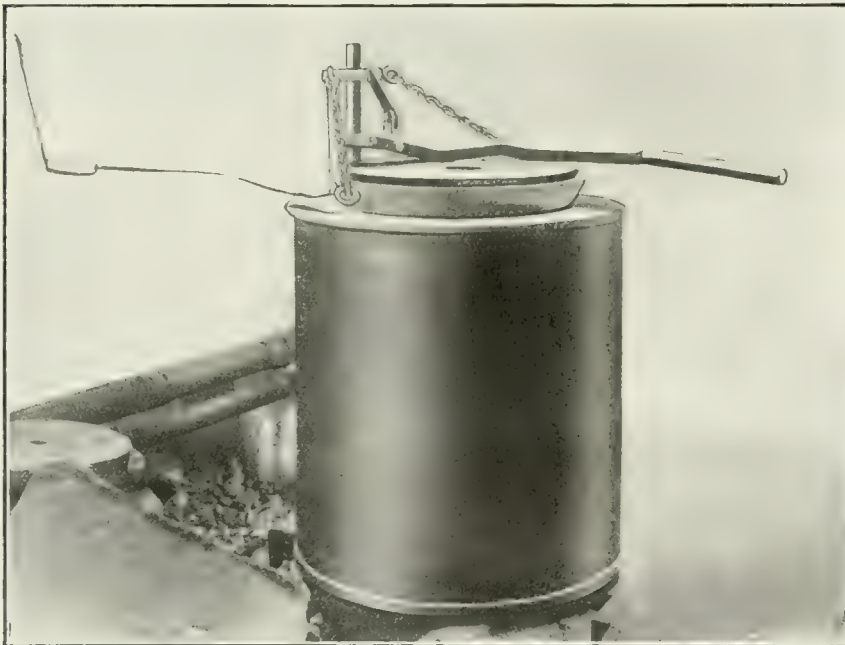
The next operation consists of rough boring and reaming the nose preparatory to threading, forming inside profile behind the threads, rough turning nose profile outside, and cutting to length. The work is done in the foregoing order. Two engine lathes built by Flather Co., Nashua, N.H., are installed, each being equipped with a turret. After the shell is chucked, the nose is first of all rough bored by means of a cutter fixed in a boring bar held in the first turret face. A reamer now reams out the nose preparatory to threading. The third turret face holds a "Murchey" collapsible tap for threading the nose. The inside profile behind the threads is next formed by means of a forming cutter fixed



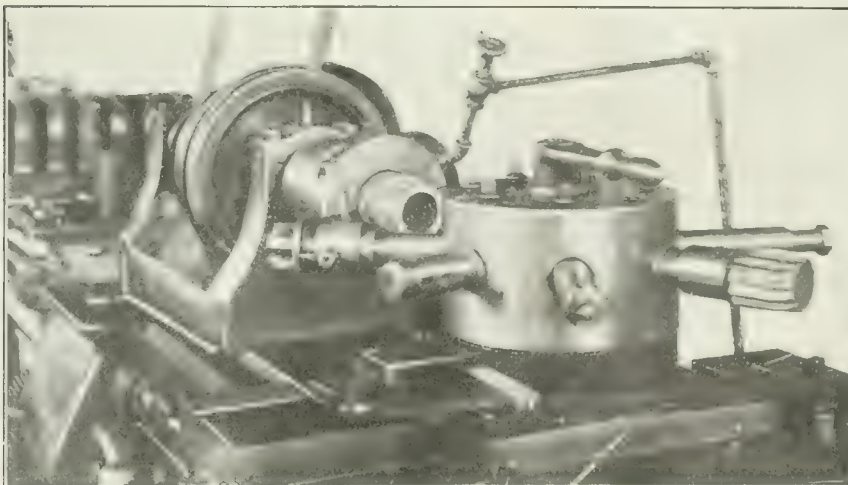
QUENCHING TANK TO LEFT AND SODA TANK ON RIGHT



INTERIOR OF HEAT TREATING DEPARTMENT.



"TATE-JONES" GAS AND AIR FURNACE FOR SHELL HARDENING OPERATION.



INSIDE PROFILING, THREADING AND FINISHING SHELL NOSE.

therefore, unnecessary at this juncture. In operation, the copper band is placed in the groove, the shell put on the press, and the pressure applied three times, the shell being moved around slightly after each. The band fills up the groove entirely, and is permanently in position.

The copper bands are turned on a "Warner & Swasey" turret lathe, which also has a cross slide for holding the turning tools. The turret holds a hollow centre which fits the nose of shells up to the shoulder, the centre revolving with the shell. This is the only purpose for which the turret is used. The base of shell is held securely in a collet chuck operated by a draw-back mechanism. The turning tools are mounted on the cross slide. The back tool makes the first cut, and the front tool then deepens the groove in the band, at the same time trimming the band at the edges. The back tool is set very low on the cross slide and cuts the band on the underside while travelling in a horizontal direction towards the operator, cutting the copper band as it passes underneath. This tool is of steel rolled to a special section to give the required form to the band, and only needs grinding on the cutting face to keep the cutting edge sharp. Above the back tool is mounted a gauge which projects over the work, and is used by the operator to place the back tool in the right position. The tool cannot be seen very clearly when cutting; for this reason the gauge, which is set in line with the tool, is used to place the latter in the correct position in relation to the band before beginning the cut. The front tool is set at the ordinary level, and is of special shape in order to deepen the groove in band and trim up the edges.

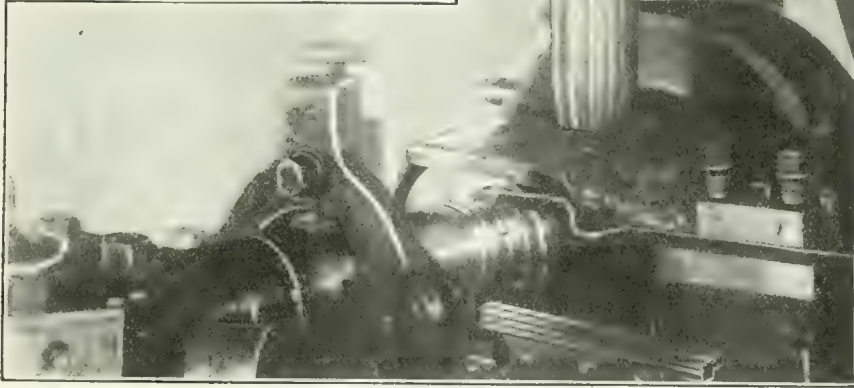
Assembling and Filling Shells.

When the shells arrive in the assembling department they are first of hand-tapped at the nose. The tin powder cup is then slipped in past the diaphragm in the powder pocket, and the brass fuse tube screwed into the diaphragm. The shell is then placed under an overhead box or hopper containing bullets. The shell when being filled is placed on a mechanical jarring machine, which causes the bullets to settle down or consolidate. After being weighed and having had necessary adjustment made, the shells are taken over to the resin kettle and filled with hot resin, following which they are weighed again. The brass socket is then screwed into the nose, a "Chapman" ball bearing tightening nut being used for this operation. Afterwards the fuse tube is plugged with a small piece of rope, and soldered to the socket by an electric soldering iron.

Finishing Socket.

The brass socket which has been screwed into the shell nose is now finished on the outside, and the fuse seat formed. The sockets when they arrive at the plant are finished with the exception of the outside face. The fuse fixing screw hole has also been drilled and tapped. The socket finishing operation is performed on a "Flather" engine lathe, equipped with a collet chuck and steady rest for supporting the shell.

The tool holder is mounted on the cross slide and is of special design to suit the tools used in this operation. A hook-nosed tool projecting from the side

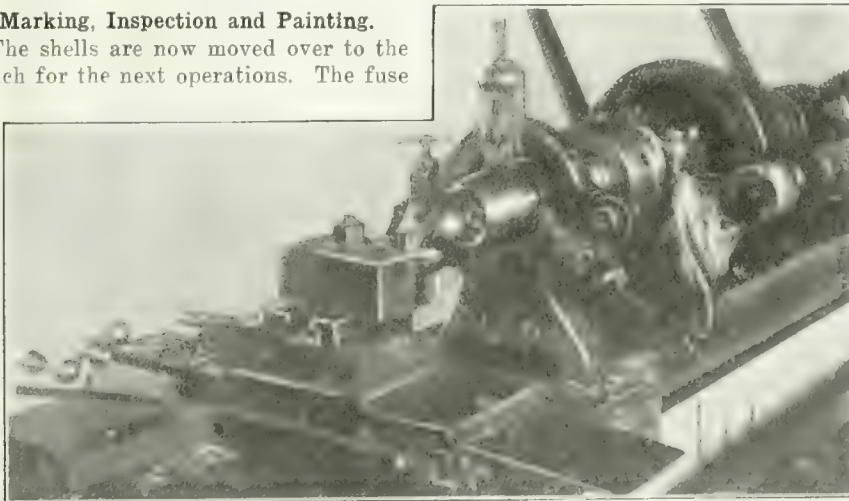


COPPER BAND TURNING

of the tool holder faces up the end of the fuse tube in the socket, and at the corner of the tool holder on the front face is a small bevelled cutter which forms the socket to the same profile as nose of shell. To the right of this cutter and on the same face of tool holder is another cutter which forms the fuse seat outside the socket. After the end of fuse tube has been faced up, the tool holder is moved back into position for the other tools to be used and cross slide locked.

Marking, Inspection and Painting.

The shells are now moved over to the bench for the next operations. The fuse



FINISHING BRASS SOCKET AND FORMING FUSE SEAT.

hole is first reamed out with a "Hisey-Wolfe" portable air drill, and afterwards the socket and fixing screw

hole are hand-tapped. The markings are put on by a "Holden-Morgan" marking machine. This is fixed on a bench, and is of the same type as is installed in several other, already described, shell plants.

After being cleaned inside with compressed air, the shells undergo the final Government inspection, during which they are weighed, gauged and carefully

the final coat black, the nose being painted red. When the shells are dry, a brass plug is screwed into the socket, the threads first being covered with a preparation called "lutring." Packing for shipment constitutes the final operation.



OUR SEA POWER TRIUMPH

WRITING in the Daily Telegraph of August 18, Archibald Hurd says:

The sinking of the British transport Royal Edward in the Ægean Sea suggests not the failure but the triumph of our sea power. Not until the war is at an end will the British public realize the harassing burdens which the transport services have thrown on their Navy, which was not planned on a scale corresponding with the liabilities which were suddenly thrown on it in August, to be still further increased when it was decided to land an Expeditionary Force in the Gallipoli Peninsula

The submarine—failure as the blockade has proved—has been an embarrassment. A little over a year ago not a naval officer would, I believe, have contemplated without serious misgivings the various tasks which in the course of the war have been allotted to our naval forces.

Let no one exclaim, Why was not this particular transport better protected? That is the comment of the armchair critic, who, for his own reputation's sake, had better stick to his armchair, and not venture to sea. War consists of a series of incidents, some favorable to one side and some to the other, until the tally is complete—and then the balance is cast up, and the nation which has been the least injured is the victor.

A people which learnt in one day of the sinking of three large cruisers in the North Sea, which heard of the battleship Bulwark and the Princess Irene being reduced to nought by violent explosions, which received calmly the news of the sinking of the Ocean, Irresistible, Majestic, Triumph and Goliath, and did not lose its balance of mind when the Good Hope and Monmouth went down in honor off Coronel will not be dismayed by this latest blow.

It is a success to the enemy, but it represents no such failure to us as can exert any permanent check on our victorious movement against the foe. The ship! What does it matter? The lives? They are irreplaceable. For those who will be mourning in the next few days—after a period of anxious hopes and doubts—for the brave spirits offered up on the altar of the highest cause in which any country waged war, the sympathy not only of the nation but of the Empire will be poured out. They have died for us and those who will come after us.

goes up the fuse tube and helps to keep the shell steady while being painted. Two coats are applied, the first grey and

The Production of Sound Ingots for Shell Requirements*

By Sir Robert A. Hadfield, F.R.S.

It is shown by the following detail of the research work carried out by the author during recent years that there is no necessity for unsound material being produced for either rail or shell purposes, slight, but highly important changes in procedure reducing losses to zero.

FIG. 1 represents two 18-in. ingots made by the Hadfield system, weighing about 2 $\frac{3}{4}$ tons each. These ingots were cast with the small end up, as in ordinary practice. The photograph is interesting, as it gives an excellent view of the cavity produced by the sound steel in these ingots as it settles down into the body of the ingot proper; that is, below the feeding head. In these ingots it is not necessary, in order to determine whether they are sound or not, that machining or other observation by mechanical methods should be carried out, and at least 88 per cent. to 90 per cent. of sound usable and saleable material is obtained.

Fig. 2 shows an ingot made in the present and ordinary manner; not even the most experienced expert could say whether the exterior of the ingot was sound or unsound, whereas the ingot in Fig. 1 shows the steel to have settled or sunk down. When steel so sinks it is a definite proof that the material is sound and free from blow-holes. The following results further illustrate this important advance in the production of sound steel:—

Measuring the Cavity.

To show how considerable is the cavity which forms in piping steel, nine 15-in.

*Abstract of paper communicated to the Franklin Institute.

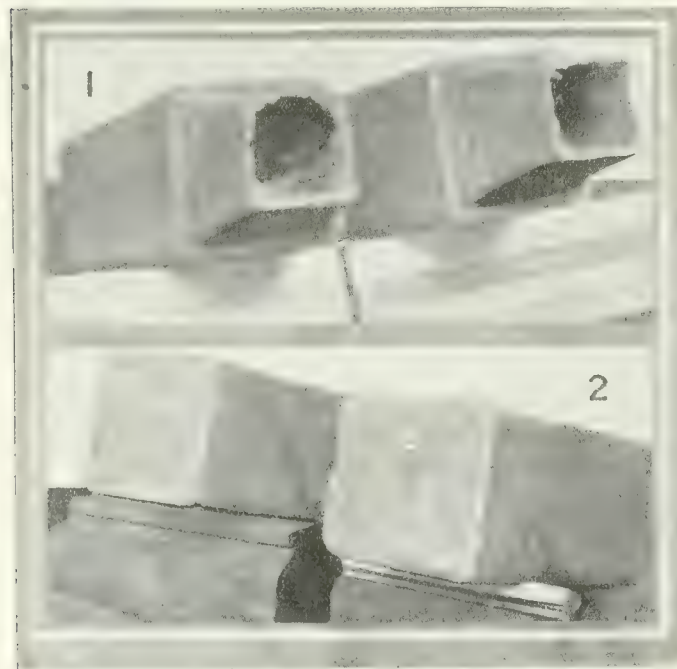


Fig. 1. 18-in. ingots of about 2 $\frac{3}{4}$ tons made by the "Hadfield" process. Fig. 2 18-in. ingots of about 2 $\frac{3}{4}$ tons. A—Unsound ingot. B Piped ingot

ingots were taken (weighing about 3,600 lbs. each), each of which had the sand head and the writer's method of feeding carried out on them. After the ingots had cooled down, the hollows or cavities in the sand heads were filled with water, then the water was poured out and carefully measured. Table I. shows the results obtained.

surely readily apparent why an ingot which is not fed must perforce be deficient in homogeneity.

There is, of course, a certain amount of feeding effect from the steel in the upper portion of the ordinary ingot, but this is not done efficiently, as the steel quickly freezes on the outside of the mould and on the surface of the liquid

Table I.

Ingot Number.	Cubic inches.	Lbs. of Steel.	Percentage of weight of ingot.
1	457	128	3.57
2	549	154	4.30
3	457	138	3.57
4	457	128	3.57
5	472	132	3.68
6	488	137	3.82
7	518	145	3.05
8	579	162	4.52
9	488	137	3.82
Average	496	139	3.88
Maximum	579	162	4.52
Minimum	457	128	3.57

Weight of ingot, 3, 600 lbs.

The average weight for the nine 15-in. ingots showed that 139 lbs., with a minimum of 128 lbs. and a maximum of 162 lbs., passed from the head portion into the ingot itself. This percentage is

represented by an average of 3.88 per cent. In other words, about 4 per cent., or 140 lbs. of of the total weight of the ingot or ingots cast passed from the upper or feeding head into the body of the ingot. Let it be assumed that the cubic capacity of each of the 15-in. ingots was approximately 12,500 cub. in. But for this feeding there would be a general want of solidity, chiefly at the upper portion of the ingot, to the extent of, say, 500 cub. in.—say, 4 per cent.—of the whole capacity. It is

steel exposed to the air. Moreover, there is always an uncertainty as to how good or how bad is the resulting material. In any case, as the steel solidifies in an ingot of this size, the natural law of contraction demands that about 500 cub. in. have to be dealt with on an ingot of the weight and size mentioned.

While the results necessarily vary slightly, because the sizes of the head portion nearest the top of the mould formed in sand are not always uniform in length, as the steel shrinks down slightly more on the outside in some cases than others, on the whole the maximum and minimum figures of 4 $\frac{1}{2}$ and 3 $\frac{1}{2}$ per cent. of the total weight of the ingot having passed from the head into the ingot itself show very uniform working; if the heads were absolutely the same depth in each case, there would be practically no difference. If not treated, the piping would have probably run down the ingot itself, requiring a discard of probably 25 to 33 per cent. Although water cannot be poured into the cavity of a red-hot ingot, yet the cavity can be determined in each ingot by a cursory examination while at a red or yellow heat, involving only a few seconds of time.

Upper Portion Defective.

While in ingots made in the ordinary way as above mentioned a certain amount of fluid steel passes from the upper portion to the lower, still in doing so, it is robbing the quality of the upper portion of the ingot itself, which has no fluid metal above it to feed or take the place and supply the deficiency thus created. It will readily be understood, therefore, why the upper portion of ingots is so seriously affected as regards their soundness, also why segregation occurs. This is shown in a remarkably clear manner by ingot B (fig. 4). The steel in the "fed" ingots being maintained fluid in the head portion continues to exercise its ferro-static pressure, whereas with ingots made in the ordinary way the ferro-static pressure on the centre portion of the ingot is so slight that it produces very little beneficial effect. Further, without the feeding head above the ingot proper, the outside of the ingot in the ordinary ingot mould becomes rapidly chilled and frozen, so that it cannot contribute its proper share to the feeding of the remaining portion of the ingot. It is not, therefore, to be wondered at that rails rolled from the A and B portions of an ingot made in the ordinary way are liable to unsoundness or piping, or both, and are also often full of impure segregated material. There would probably be more dangerous ingots but for the fact that the steel maker tries to avoid this type of steel, and aims to make steel which will not pipe when poured into the ingot. Nevertheless, he is still fighting against a natural law. If piping steel is checked or avoided, he runs

from the upper portion, the centre, or that portion on the axis line of the ingot, must be of inferior nature, as the piping characteristics persist for quite a long way down the ingot.

proper; that is, in the head.

The experiment, carried out by the writer some years ago, of pouring copper into the upper portion of an ingot 15 or 20 minutes after casting, showed



Fig. 3. Ingot made by "Hadfield" process; perfectly sound, free from blow holes, piping and segregation. Fig. 4. Ingot made in ordinary manner; unsound, having blow holes, piping and segregation. Fig. 5. Upper portions of three ingots made by the "Hadfield" process.

Ferro-Static Pressure Necessary.

This, as before mentioned, is for the reason that, owing to want of ferro-static pressure, the ingot lacks feeding from above, which, in the system of casting ingots now described, is maintained to a very late stage; that is, until or close upon actual solidification. There is always fluid steel in the upper portion of the ingot to feed the piping and shrinkage, both of which must occur, as they follow a natural law. Check or hinder ferro-static pressure, and segre-

how serious is this want of ferro-static pressure in the material situated on or near the centre or axis line of the ingot in ingots which have not been properly fed. The copper finds its way down to the bottom of the ingot, although added 15 minutes after casting. In any case, if there is no definite pipe at the bottom portion of such ingot, there is still material of loose or open structure, which means weak steel. Although this may not be apparent by fracture to the naked eye, nevertheless it exists, and can generally be detected by an examination of the micro-structure. In other words, notwithstanding that the product to be used may come from the lower half of the ingot, yet in unfed ingots it will be weak and not able to stand severe stresses.

It is true that some portions of the cavities in ingots have been measured, but probably not in the manner described by the writer. Although in the examination of the top of an ingot cast in the ordinary manner, and from steel which "settles" there is external evidence of some piping, this is irregular and varies considerably. Therefore, in the "best" ordinary ingot evidence is slight as to how much or how little the steel has piped.

Kinds of Piping.

Dr. Dudley has pointed out that such piping is divided into two kinds: the upper, or what may be termed the visible pipe, and the lower or hidden pipe, the extent and character of which can be determined only by cutting open the ingot. In the ingots cast under the writer's system, all the cavity or pipe is open and can be rapidly inspected from

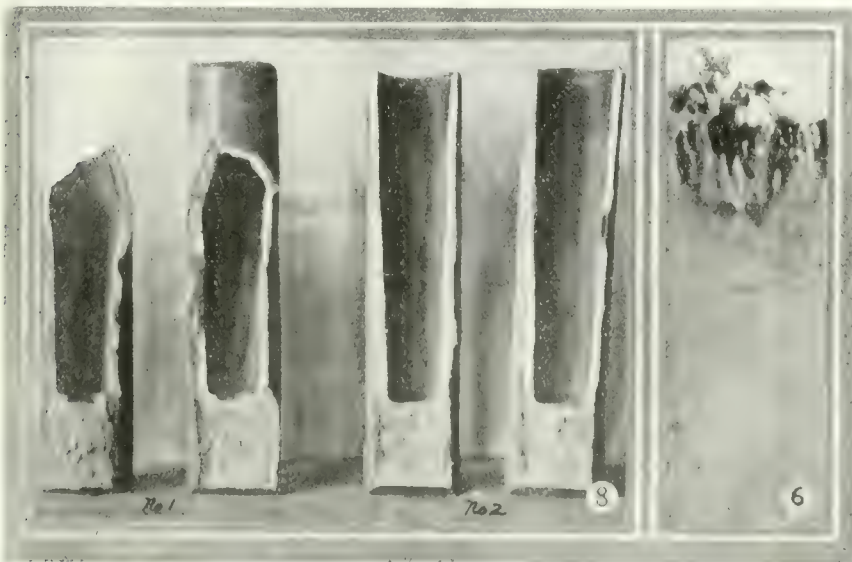


Fig. 6. Etching on axis line to determine amount of segregation. Fig. 8. Steel forgings from blanks (1) and (2) of Fig. 7, split open for inspection.

the risk of producing unsound steel, especially in the upper portion of the ingot, more or less permeated with blow-holes. Thus, owing to lack of feeding

gation with its bad effects at once commences. In the case of "fed" ingots, the smaller amount of segregation which occurs takes place outside the ingot

the top, its extent can be readily determined whether in the hot or cold condition. It is therefore not necessary to cut open the ingot.

Dr. G. K. Burgess, of the Bureau of Standards, Washington, is at present working with the writer on a joint research relating to this subject, and, though the full details of the work done cannot at the present time be given, it may be stated that ingots made under the writer's system were carefully cut up by the Bureau and compared with similar ingots produced at rail mills and made in the ordinary manner. The comparisons are shown in Figs. 3 and 4, in which A (Fig. 3) represents the ingot made under the writer's system, as described in the various papers, and B (Fig. 4) represents an average ingot made by one of the rail-makers.

Piping Defects Incurable.

While it is true that in unsound steel of very mild character the process of forging or rolling closes up the blow-holes, and probably, if the heating temperature for rolling or forging is hot enough, the blowholes are welded together, even then it is doubtful whether such material can ever afterwards possess exactly the same tenacity and ductility as the same steel worked up from a sound ingot. In the case, however, of rail steel in which the carbon percentage is high, the same amount of welding does not take place; in fact, it is doubtful whether the blowholes are more than merely pressed together.

Sound Steel Imperative.

As large quantities of high-explosive steel shell are used by various governments, it is most necessary to obtain steel of the highest quality and yet at not too high cost. In other words, there is required steel of superior quality to that ordinarily used for rails, ship and boiler plates, angles, bars, etc. The system of manufacturing ingots of sound steel, described in the present paper, exactly meets these special requirements. Moreover, it can be used for making the comparatively lower quality of steel referred to. Several important governments, after making exhaustive tests, have been so satisfied with the Hadfield system of making sound ingots that, both for their land and sea services, they have now authorised explosive shell being made from ingots (afterwards forged into necessary billets) produced in the manner described in this paper.

As will be understood, an explosive shell, whether of small or large calibre, must be absolutely safe; that is, it must be (a) sound (that is, free from blow-holes); (b) free from pipes; (c) free from segregation. Any flaw in the shell to its premature bursting would be most disastrous. In order to be absolutely

certain of obtaining this combination of desirable qualities, it has been insisted upon by the user concerned that something like 40 per cent. to 50 per cent. of the ingot made in the ordinary manner—in fact sometimes more than this—must be discarded. Ingots made by the writer's method, however, are now allowed after discarding only 15 per cent.

It would also be quite possible under the system to give perfectly safe shell steel with only 10 per cent. to 12 per

were not satisfactory the ingot would be rejected.

Ascertaining Soundness of Ingots.

The following demonstration was made to show the importance and efficiency of the system:—Fig. 5 shows the upper portion of three 15-in. ingots made under the Hadfield system. This place shows the soundness and freedom from piping of the ingots. If this is compared with the section of the ordinary rail ingot shown in B (Fig. 4), representing average and current practice, it will be seen how great is the difference. While sound material, whether rails or other articles, can be expected from ingots made as shown in Fig. 5, it can be well understood that if steel for explosive shell were made from an ordinary steel ingot cast in the usual manner, as shown in B (Fig. 4), there would have to be at least 50 per cent. discard in the ingot, and even then it is doubtful if the material could be safely used.

To further prove this, Fig. 6 shows an etching of the fractured portion of a 15-in. ingot (marked No. 3 in Fig. 5), on the centre or axis line, where segregation is usually met with to the greatest extent. This being so sound and free from segregation, it was necessary to continue the etching beyond the fractured portion. The analysis of this particular 15-in. ingot is shown in Table II. From this table it will be seen that there are no signs of segregation, unsoundness, or piping of any kind until the extraordinarily small discard of 7½ per cent. has been reached. Even in this case the difference in composition is very slight, whereas the composition of an ingot made in the ordinary manner and with only 7½ per cent. discard, to

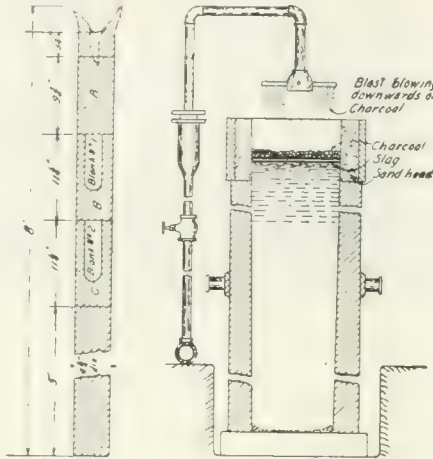


Fig. 7. Sketch showing upper portion of ingot forged and drawn out into a bar 4 3/4 in. diam and about 8 ft. long. Fig. 9. Apparatus employed in producing sound ingots.

cent discard, and to ensure the qualities under the headings (a), (b) and (c) just referred to. This means a reduction in discard from 40 per cent. to 15 per cent. This decision has been arrived at after carefully cutting up and examining over one hundred ingots made by the Hadfield system, produced in the ordinary course of working. Each of these ingots on being cut up, was found to be perfectly sound.

Table II.

	Analysis.				
	C.	Si.	S.	P.	Mn.
Original steel	0.36	0.19	0.031	0.031	0.96
A. Discard of 7½ per cent. (sand or feeding head of ingot)	0.54	—	0.056	0.031	—
B. Discard of 10 per cent.	0.46	—	0.040	0.031	—
C. Discard of 12½ per cent.	0.39	—	0.040	0.031	—
D. Discard of 15 per cent.	0.39	—	0.033	0.031	—
E. Bottom of ingot	0.38	0.19	0.031	0.031	0.96

It should be remembered that steel produce from the ingots to be used for the requirements of various governments is most critically examined by many inspectors supervising the material produced and the work done, not on the ingot only, but on each projectile, also including a considerable number of mechanical tests from each ingot, and from a certain number of projectiles made from each ingot. Moreover, each individual ingot is cut up and has to be passed on its own discard; if this

say nothing of the unsoundness, would show probably 0.60 to 0.70 per cent. carbon and 0.07 per cent. each of sulphur and phosphorus.

Table III. shows a number of analyses taken during the ordinary course of working) that is, they are not in any way special) from the centres of different ingots as above described, the drillings for analysis being taken exactly at the parting line where the 15-per cent. discard has been made. The figures obtained clearly show the important fact that the

steel is as pure and free from segregation at this part as it is at the bottom or at any other portion of the ingot.

As a further test, the following interesting experiment was made:—The portion of one of the ingots representing the usual 40 per cent. of the discard hitherto demanded in the manufacture of high-explosive shell was taken from an 11-in. ingot having the following analysis:—C, 0.38 per cent.; Si., 0.18 per cent.; S, 0.024 per cent.; P, 0.035 per cent.; Mn., 0.85 per cent. This was forged into bar 4¾ in. in diameter and about 8 ft. in length, as shown by Fig. 7. Projectiles were forged from this bar as indicated.

The length marked A is the portion of the material from the top part of the ingot head which, in the writer's system is cast in sand; that is, above the ingot itself. This portion, about 13 in. in

from this "Blank No. 2" (that is, with only 10.4 per cent. discard) a perfectly sound projectile was obtained.

The two projectiles from "Blanks Nos. 1 and 2" after being split open, are shown in Fig. 8. It will be seen that the fractures are sound, and that in each case, even including the blank from the portion of the ingot with only 7.1 per cent. discard, the material would have etched quite sound and free from segregation. The writer has now produced close upon 40,000 tons of ingots by the plan referred to in this paper.

Description of the Hadfield Process.

The following is a description of the author's method of casting steel ingots, castings, etc. which ensures soundness, freedom from piping, and absence of segregation: The process is illustrated in Fig. 9. As will be seen, it consists in heating the fluid steel in the upper

Belligerent Resources.

Of the ten munition metals, the enemy countries can certainly produce five without having resource to imports—namely, iron (the basis of the various steels used for war purposes), manganese, chromium, zinc, and lead; on the other hand, it is doubtful whether they can produce sufficient nickel, copper, aluminium, tin, and antimony from domestic ores. In view of the fact, however, that they prepared for this war with extreme care and foresight, it may safely be concluded that large stocks, either of ores or the corresponding metals or both, will have been accumulated in those countries.

However confident the higher German command may ostensibly have been of a rapid victory, they will quite certainly have laid their plans to wage a prolonged war if it should prove to be necessary,

Table III.

No.	Analysis made by Hadfield of drillings from the usual ladle ingot tests.					Analysis made by the inspector from drillings taken from the centre or axis line of each ingot after cutting off 15% discard				
	C	Si.	S.	P.	Mn.	C.	Si.	S.	P.	Mn.
1229	0.40	0.22	.030	0.033	0.89	0.37	0.24	0.031	0.035	0.87
1231	0.38	0.21	.031	0.037	0.88	0.40	0.21	0.029	0.036	0.88
1233	0.40	0.21	.033	0.035	0.90	0.39	0.20	0.035	0.036	0.88
1234	0.39	0.21	.032	0.033	0.89	0.39	0.21	0.036	0.038	0.88
1243	0.40	0.26	.034	0.029	0.91	0.39	0.23	0.026	0.034	0.88
1244	0.38	0.23	.031	0.032	0.93	0.43	0.22	0.038	0.034	0.91
1245	0.39	0.25	.030	0.030	0.99	0.38	0.24	0.030	0.032	0.91
1246	0.40	0.21	.029	0.029	0.95	0.39	0.19	0.025	0.030	0.87
1247	0.37	0.19	.030	0.032	0.89	0.39	0.18	0.025	0.033	0.81
1248	0.41	0.20	.026	0.036	0.87	0.45	0.20	0.027	0.029	0.81

length, and representing 7.1 per cent. of the discard, was cut off. Below this the projectile forging known as "Blank No. 1" was prepared, as shown by the dotted lines in Fig. 7. Below this, "Blank No. 2" was taken after 10.4 per cent. discard had been allowed. In other words, "Blank No. 1" was made from the material now not used (that is, after 7.1 per cent. of the whole ingot was discarded) and "Blank No. 2" after discarding 10.4 per cent. This is also not now used. The further and following blanks, No. 3, 4, and upwards, are not shown, because this is unnecessary, as such blanks then formed part of the current work. As will be seen, even "Blank No. 2" could also have been safely used.

It is remarkable to find that the fracture from "Blank No. 1" (that is, at the discard of only 7.1 per cent.) was perfectly sound, free from piping, and showed no signs of segregation. In the interior of the blank, after forging, there were some slight skin cracks proceeding from the hollow portion of the ingot top. The projectile from "Blank No. 2" was perfectly sound in every way, whether as regards surface fracture, freedom from segregation, piping, or any other defects; the interior was also perfectly sound. In other words,

part of the ingot or other mould, and maintaining it in a liquid condition by the combustion, in contact therewith, or in close proximity thereto, during the cooling and shrinkage of the metal in the lower part of the mould, of solid fuel, for example charcoal, by means of a blast of compressed air which is caused to impinge on the fuel while this is directly or indirectly supported by the metal below; and the interposition of a layer of fusible material, such as cupola slag, which has little or no injurious action on the metal, between the metal and the fuel. This slag largely prevents radiation of heat, the loss of which is much greater than is ordinarily supposed to be the case.



MUNITION METALS.

A PREPONDERANCE of raw material from which to manufacture munitions of war is of vital importance to a belligerent, and if, as many persons hope, the allies can maintain the advantage in this respect at the expense of the enemy, the raw material assumes a doubled value. Professor H. C. H. Carpenter, writing to "Nature," compares the resources of the different countries in munition metals, and sums up the position as follows:—

and such plans will have included the accumulation of munition ores and metal of which their countries produced an insufficient amount. There is, accordingly, no adequate reason for concluding that the enemy countries are likely—in spite of the prodigious scale upon which the war is being conducted—to run short of metals which are essential for war purposes for some time to come. Moreover, it may safely be concluded that their technical metallurgists will have been mobilized in the direction of discovering substitutes for any of the above metals of which a shortage is liable to occur in a long war.

The allies for their part can produce from their own resources all the iron, manganese, nickel, chromium, tin, and most of the aluminium they require; their command of the seas enables them to obtain, principally from the United States, their deficiencies in aluminium, copper, and lead; China furnishes the requisite antimony. Zinc is the only important munition metal of which there is a shortage, in spite of the great speed with which the American furnaces are being operated. Wherever it is possible to substitute another metal for zinc, it is of national importance that it should be done.

PROGRESS IN NEW EQUIPMENT

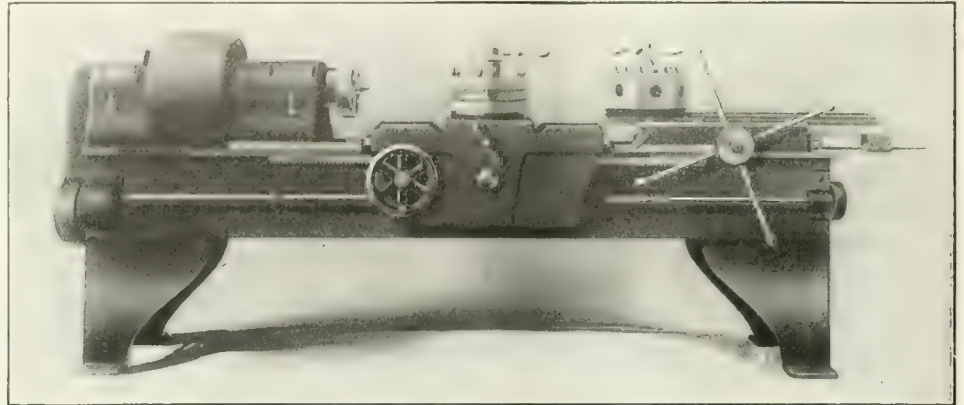
A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SINGLE PURPOSE SHELL LATHE

THE description and illustration refer to a new "Made in Canada" lathe which is being put on the market in response, we understand, to the demand for a heavy, sturdy tool with suitable attachments for producing the various machining operations required in shell work. This lathe is specially designed for the latter and is complete with all attachments necessary to rapid production of completely machined shells. Strength, rigidity, and weight, and a large swing just sufficient for the purpose for which it is designed, are the leading features of this product. The two sizes in which the lathe is to be built are reckoned to amply cover the requirements for machining shells up to and including 12 in., and the general scheme of manufacture is aimed to satisfy the present keen demand for quick delivery. The exclusive Canadian distributors of the lathes are Kellogg & Co., Traders Bank Building, Toronto.

nel or high-explosive shells. This tap may be used in a turret head or attached to a live spindle, working satisfactorily in either condition. It is manufactured and sold by the Victor Tool Co., Waynesboro, Pa.

subject of the supply of ingredients, without which high-speed steel cannot be produced. For metallic tungsten, the most important of them, the trade had for years relied upon the German metallurgical chemists to keep it supplied, but



NEW SINGLE PURPOSE SHELL LATHE.

THE ALLOYS OF HIGH-SPEED STEEL.

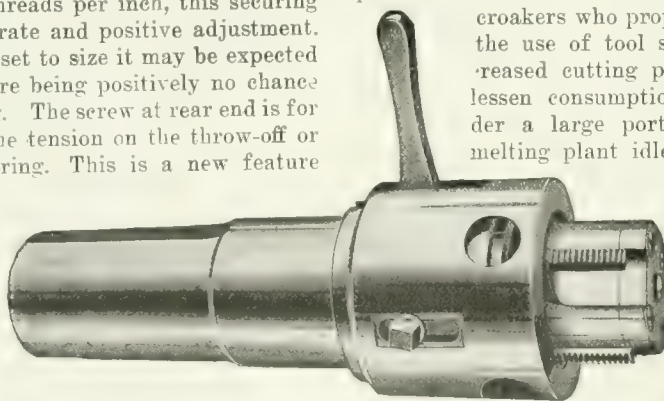
NO subject probably is receiving more attention in the steel trade of Sheffield to-day, says a correspondent of The Engineer, than that of alloys used for making high-speed steel. Since the discovery that certain rare metals gave to high-speed steel its essential property, and also the method of applying them successfully in manufacture, the trade in question has been revolutionized. The croakers who prophesied that the use of tool steels of increased cutting power would lessen consumption and render a large portion of the melting plant idle have been

the war has taught it a sharp lesson in the necessity of being in a position to meet its own needs, or at any rate, not to be dependent upon a single source. Whatever happens in the future, it is certain that an adequate supply of tungsten is assured, and the question of whether Germany ever resumes its premier position in the manufacture of the alloy is of secondary importance. Germany may influence the market, but it will never again control supplies. Half a dozen works in England are engaged in its manufacture, several of them turning out the alloy in its metallic form, which is preferred by the local users.

The production of the latter is the great problem facing the trade. There is a large and ample output of ferro-tungsten, but to make the metal of the high standard of purity required in the form of metal necessitates much experiment and experience. Four firms are grappling with the problem. One of them is sending out considerable quantities. A second has supplied a small quantity of the right quality, and a steady increase is promised until a maximum of some 30 tons a month is reached. That, we believe, exceeds the output of any of the German works in the past. Hence on the completion of the experiments and developments now in hand, steel makers will be under no necessity to go outside the country to get supplied. The factor of price may, of course, arise, but there is no reason to doubt that British makers will be in a position eventually to hold their own against Germany even in this matter.

COLLAPSIBLE TAP FOR SHELLS

THE accompanying cut shows the "Victor" collapsible tap which has been specially designed to tap shrapnel shells. It is made of a tough grade of machinery steel so as to stand the strain of hard usage. The tap is adjusted from the front end by means of a hardened set-screw, 32 threads per inch, this securing a fine, accurate and positive adjustment. When once set to size it may be expected to stay, there being positively no chance for slipping. The screw at rear end is for adjusting the tension on the throw-off or tripping spring. This is a new feature



COLLAPSIBLE TAP FOR SHELLS.

and a desirable one. All parts of the tap subject to wear are hardened and ground. The object in designing this tool was to make a tap that would cut threads accurately, and have sufficient strength and durability to make it an economical tool for the shell maker. The chasers are made of the best grade of high-speed steel; they are strong and heavy, and will stand the strain of threading shrap-

completely discredited. Although the modern variety of steel will do treble the work of the old, there has been a big increase of demand and output, and makers have enjoyed a measure of prosperity never dreamed of before.

Metallic Tungsten Production

With these facts in view, one can appreciate the anxiety that is felt on the

EXPLOSIVES AND GUNS.

THE establishment of factories in Canada to manufacture high explosives from raw material produced in the country, marks another step forward in the ammunition industry of this country. Cordite, which forms the propelling agency in British shells, is of special interest to thousands of Canadians engaged in shell making. This material gets its name from the form in which it is produced. It is a mixture of gun-cotton, nitro-glycerine and a mineral jelly. The jelly is employed to convert the gun-cotton into a plastic substance which can be squeezed or rolled into any form desired, but which becomes hard and horn-like when dried. When the material is in a suitable state it is put into presses which squirt it through dies of the required size suitable for any bore of rifle or gun.

Rifle cordite is produced in the form of a thin cord, and is wound on a reel; the thicker forms of cordite for guns are cut into suitable lengths. The final stage of manufacture is drying, which takes as long as two months in some cases.

John B. C. Kershaw, writing in *Casiers' Engineering Monthly*, makes the following interesting statements on the subject of modern explosives:

The required muzzle velocities and pressures for rifles and guns can be obtained, with variations that are exceedingly small. Thus for rifles, the velocity prescribed is 2,380 foot-seconds with a plus or minus of only 40 feet, and a pressure of 19.5 tons with a maximum of 20 tons per square inch; for larger guns it may be 1,500 foot-seconds, and the pressure must not exceed 19 tons per square inch.

Application of Explosives in Warfare.

Great developments have occurred in the application of explosives to warfare during the last thirty years, for the introduction of elongated projectiles, rifled guns, and high explosives has practically revolutionized land and naval warfare. It is difficult to realize now that at the battle of Waterloo the effective range of cannon was less than 2-3rds of a mile, and that as solid iron balls were employed, the destructive effect of artillery fire was confined to the individual or building hit. One round from a modern field-gun firing a 3-inch shell, in fact, will do more material damage, and kill or wound more men, than twelve hours' firing with the form of cannon used in 1815. It is also a fact that when the Dardanelles were last forced by a British fleet (in 1807) the Turkish guns were firing stone shot, and that in Nelson's day, naval actions were rarely commenced at a range of more than one thousand yards.

Explosives are divided into two distinct classes known as "high" explosives and "low" explosives, the chief function of the latter in warfare being as a propellant, while that of the former is to destroy life and fortifications, by the shattering effects of the explosion, which occurs when they are detonated. "Low" explosives, as a general rule, are employed in the form of cartridges in order to generate a steadily increasing force in the chamber of the rifle or gun, sufficient to project and carry the bullet or shell to its mark. "High" explosives are employed in a casing or canister of steel, and are detonated either by a time-fuse, or by percussion on striking the ground or the object aimed at.

The weight of the shell differs according to the size of the gun; that fired from the ordinary 3-inch field-gun varies in weight from 15 to 18½ pounds. An explosive shell differs from shrapnel in that it contains no bullets, and the damage done by it to buildings and human beings, when the charge is detonated, is due to the force of the explosion and to the flying fragments of the steel case when it bursts. The detonator employed for high explosives is fulminate of mercury mixed with potassium chloride and enclosed in a copper container.

Types of Guns.

The quick-firing 3-inch field-gun is the most important weapon used by the opposing forces, and it is estimated that Germany at one period of the war had 5,000 guns of this type in the field. The German gun is a converted breech-loader, and fires a 15-pound shell with a muzzle velocity of 1,525 feet per second. It is light and of simple construction, but possesses several disadvantages which render it a second-class gun.

The French 75-millimeter and the English 3-inch field-guns are of more modern type than the German gun; the rate of firing can be maintained at 20 rounds per minute, if desired, for a short period. The English gun fires a shell weighing 18½ pounds, whereas the French gun fires a shell of 15 pounds with a muzzle velocity of 1,740 feet per second. The Allies' 3-inch field-guns are superior, therefore, in range, accuracy and firing speed to the German guns, and it was only by their greater number that the Germans gained many of their successes in the early stages of the war.

It is reported that the Germans have developed a new type of field-gun which is fed automatically with shells on the machine-gun principle, and that this gun can fire double or treble the number of shells per minute that was possible with the older pattern. This new weapon, it is stated, will be used against the Allies on the Western battle front, and time will show how far

the claims for the new gun are substantiated.

The Howitzer.

A howitzer, it may be explained, is the short, heavy type of gun used for throwing shells at a high angle in order that they may fall vertically into the enemies' lines or entrenchments with a high striking velocity. Both the Allies and the Germans have been making great use of this type of gun in their attacks in Flanders and Northern France. The British field howitzer fires a 4.5-inch 35-pound shell, and has a range of 3,400 yards. The German weapon of this class is 4 inches in diameter and fires a shell weighing 31 pounds with a muzzle velocity of 985 feet per second. The projectile fired by this latter howitzer is shrapnel charged with bullets embedded in tri-nitro-toluol, and this is the shell which has accounted for many casualties in the British and French lines.

The British army in addition to the light field-howitzer, possesses a heavier gun, throwing a 60-pound shell with a range of 9,500 yards; while opposed to this the Germans have a 6-inch howitzer throwing a 90-pound shell, and capable of firing at an elevation of 65 degrees. The range to which a shell carries is, of course, diminished as the angle of fire is increased above 45 degrees, and the object of firing at such an acute angle as 65 degrees is to obtain a steep angle of descent, and to ensure penetration of any overhead cover by the shell when it strikes the ground.

Although it is not generally recognized, it is a fact that the application of explosives to warfare in the past has tended to keep the opposing forces far apart, and to diminish the amount of hand-to-hand fighting. This tendency has resulted in diminished casualty lists in proportion to the numbers engaged in conflict, for it is only when engaged at close quarters in hand-to-hand fighting that the proportion of killed and wounded in armies can rise to fifty or more per cent.

This stage of warfare appears, however, to be passing away, and with the development of trench warfare and the use of poisonous gases, in addition to hand grenades and bombs filled with high explosives, we are once more confronted with conditions of combat which resemble those of earlier time. How far this development will proceed it is impossible to say. The powers of destruction that have been placed by the advances of science in man's hands are terribly effective, and it is quite possible that the limit has not even yet been reached.

Machinery Display at the Canadian National Exhibition

Staff Article

Machinery and supplies exhibited are particularly interesting in view of the peculiar conditions which have existed during the past year. Exhibitors are to be congratulated on their efforts to maintain the former high standard of equipment display. Progress in standard lines, and muck that is new in special lines, are the two features which impress the visitor,

THE disturbing influence of the war is not so apparent as might be expected in the display of machinery and kindred equipment in the Machinery Hall and elsewhere at this year's Canadian National Exhibition in Toronto. A number of former exhibitors are unable to be present, but their places have been filled by several new comers, the variety of whose product augurs well for the future of the Canadian machinery industry.

Interesting Exhibits

The A. R. Williams Machinery Co. are to be found in their familiar location. Shell machinery and a "Williams" quick-firing field gun give quite a war-like atmosphere to the exhibit.

Cowan & Co. make their usual interesting exhibit of woodworking tools and machines, while the Preston Woodworking Machinery Co. show a tenoning machine in addition to their last year's products.

The Chapman Double Ball Bearing Co. exhibit a "Perrin" hydraulic pump and press in operation on actual shells destined for the battlefields in Europe. The Dodge Mfg. Co. are receiving visitors at their exhibit, which contains numerous examples of their widely-known products.

The Victor Saw Works, Hamilton, Ont., have two power hack saws working on shell material which make the exhibit attractive as well as instructive.

The Pratt & Whitney Co. show a special set of small tools for shell manufacture, while the Carter Welding Co. have a machine in operation, and carving armor plate quicker than the ordinary person can saw wood. L'Air Liquide Society again show the samples of work done by their apparatus in the welding and cutting metals.

At the Canadian Ice Machine Co. stand is a domestic ice box of ordinary proportions which is equipped with a complete automatic self-contained refrigerating plant of 1/2 horse-power capacity in operation. A further anti-heat demonstration is in constant operation at the exhibit of the Armstrong Cork & Insulation Co., where the benefits due to the use of their "Nonpareil" Insulating Brick are made evident through the use of an electric furnace.

Belting exhibits are staged in an effective manner by the Dominion Belting Co., Hamilton, Ont., and D. K. McLaren, Ltd., Montreal, while the many excellent features of the Elliot Wood Worker are again demonstrated under actual conditions of use.

Machinery Hall

Armstrong Cork and Insulation Co., Toronto.

Electric furnace in operation, demonstrating insulating power of "Nonpareil" insulating brick, specimens of diatomaceous earth, cork products, etc.; models of insulated furnace settings. Representatives: G. C. Albertson, J. Kent.

Aylmer Pump and Scale Co., Aylmer, Ont.—Hand and power pumps, scale trucks, domestic water supply systems.

L'Air Liquide Society, Toronto.—Demonstrating oxy-acetylene welding; hand and power welding machines, acetylene generators, specimens of work, etc. Representatives: A. Turnbull, M. Harch, N. Smith.

Boiler Repair and Grate Bar Co., Toronto.—20th Century Grate Bars; "Coppus" Steam Turbo Blower for chimney draft. Representatives: C. W. Andrews, A. H. Hettis.

British Aluminum Co., Toronto.—Aluminum products, samples of bauxite, cryolite, aluminum powder for bombs, etc. Representative: E. Pannel.

Baines & Peckover, Toronto.—Exhibit of "Triumph Superb" tool steel; crucible, vanadium and cold rolled steel; expanded metal, babbitt metal, chain, wire rope, etc. Representatives: W. M. David, T. A. Steven, H. W. Marshali, A. McGregor, W. P. Williams.

The Canadian Automatic Wrench Co., Toronto.—"Dickson" automatic pipe and nut wrenches. Representatives: H. L. Dickson, J. Henderson, Fred C. Fowler.

Cowan & Co., Galt, Ont.—Two chain morticers, power feed rip saw, four side molding machine. Representatives: W. Cowan, S. F. Barrows.

Canadian Mill Supplies and Steam Specialties, Ltd., Toronto.—"Morehead" back to boiler system, United States graphite preparations, "Griscom-Russel" heaters and generators, "Everlasting" blow-off valves. Representatives: J. G. Abraham, L. O. Smith.

Cling Surface, Buffalo, N.Y.—Apparatus demonstrating the efficiency of slack belt drives when treated with "Cling Surface." Representative: J. B. Faatz.

Cleveland Pneumatic Tool Co., of Canada.—New Cleveland stope drills, portable foundry grinding machines, and a full line of pneumatic hammers, drills, riveters, boxes and



CANADIAN NATIONAL EXHIBITION SHOWING SECTION IMMEDIATELY BEHIND MAIN ENTRANCE

Neverleak couplings, etc. Representative: J. A. Day.

Canadian Ice Machine Co., Toronto.—Domestic refrigerating plant in operation, installed in Arctic refrigerator. Various sizes of York ice machines, apparatus and fittings, etc. Representatives: C. E. Allison, C. H. Bower.

Canadian General Fire Extinguisher Co., Toronto.—Demonstration of automatic sprinkler system in operation. Control apparatus for both wet and dry systems, sprinkler heads, fittings, etc. Representatives: W. Roos, W. Kay.

Carter Welding Co., Toronto.—Davis-Bowmanville oxy-acetylene apparatus, generators, blowpipes, armor plate cutting demonstration, etc. Representatives: H. W. Carter, P. Sorley.

Canadian Pneumatic Tool Co., Montreal.—Pneumatic tools and fittings.

Geo. W. Cole Co., Toronto.—Cole heaters, boiler feeders and steam specialties. Representative: G. W. Cole.

Canada Machinery Corporation, Ltd., Galt, Ont.—Woodworking tools, viz: 48 in. band resaw, tenoning machine, 32 in. knife grinder, sash morticer and relisher, hollow chisel morticer, chain morticer, New Pattern light variety saw bench, set of sample knives; iron-working tools, viz: 36 in. vertical drill, 25 in. vertical drill, 24 in. backgeared crank shaper.

Ont. Woodworking machinery and saws.

The Holden Co., Montreal.—Complete line of portable electric and air tools, rock drills and railway supplies. Representative: J. B. Wilson.

The Hare Engineering Co., Toronto.—Full size installation, demonstrating the operation of the Fulton water-cooled mechanical stoker. Terry steam turbines, and Swartwout steam separators. Representative: J. F. Wood.

Jones & Glasco, Ltd., Montreal.—One 150 horsepower "Renold" silent chain drive, one 60 horsepower "Renold" roller chain drive.

Jones & Moore, Toronto.—Full line of electric motors, for 1, 2 and 3 phase and direct current. Shoe finishing machinery in operation. Representative: W. Dalton.

D. K. McLaren, Ltd., Montreal.—British oak tanned belting, D.K. balata belting, Phillips pressed steel pulleys, D.K. wood pulleys, etc. Representative: W. S. Hamilton.

J. L. Morrison Co., Toronto.—Full line of bookbinders' and paper machinery. Representative: W. Dolding.

The Massey-Harris Co., Toronto.—Portable saw outfits, gasoline engines in operation, 1 No. 15 self governing grinder driven by gasoline engine. Representatives: B. Graham, N. A. McIntosh, A. Verity.

Pratt & Whitney Co., of Canada, Ltd., Dun-

GENERAL SECTION.

The Canadian Fairbanks-Morse Co., Toronto, are exhibiting in the agricultural machinery section oil and gasoline engines for electric lighting, pumping and general purposes, also marine engines. A 25-barrel "Midget" mill is in operation. Representative, G. Wheeler.

The Dennis Wire & Iron Works Co., London, Ont., located in the Process Building, have an interesting line of "Dentasteel" clothes lockers, filing cabinets, safe cabinets and steel stools. Representative, M. B. MacNeely.

Consumers Gas Co., Toronto, have two exhibits in the Process Building, one being devoted to a display of gas-hardening furnaces for tool room, also forging and soft metal furnaces. "Tyco" and "Taylor" recording pyrometers are also to be seen. Representative, H. E. G. Watson.

The International Time Recording Co. of Canada, Ltd., Toronto, are demonstrating in the Process Building cost systems and time clocks. Representatives, F. Mutton, L. B. Morton, H. B. Lukens and J. F. MacBride.

The W. S. Mahaffy Co., Toronto, are exhibiting in the Grand Stand Section the "Lifton" transporting truck, also a number of warehouse and factory trucks of various types. Representative, F. G. Mahaffy.



CANADIAN NATIONAL EXHIBITION SHOWING SECTION OF THE GROUNDS AND LAKE FRONT

No. 19 geared power press. Representatives: D. King, P. V. Burton, W. J. Irving, M. Preston.

Chapman Double Ball Bearing Co. of Canada, Ltd., Toronto.—"Chapman" elevating trucks for factories and warehouses. Shell machinery in operation. Complete line of ball bearings for all purposes. Illuminated display board. Representatives: W. J. Murray, C. M. Murray, W. C. Hoekin and H. O. Edwards.

The Dodge Mfg. Co., Toronto.—Complete line of transmission machinery, including steel and wood pulleys, bearings, hangers, etc. Representative: J. F. Haas.

Dominion Belting Co., Hamilton, Ont.—Maple Leaf stitched cotton duck belting for power transmission and conveyors. Representative: J. Scott.

Len Edmonds, Smiths Falls, Ont.—Maple sugar evaporators and supplies for the industry made by Small Brothers.

Elliot Wood Worker, Ltd., Toronto.—No. 3 machine with tilting table and graduated index plate for revolving, wood drilling machine, scroll saw and shaper. Representative: W. A. Elliot.

General Machinery Co., Toronto.—G.M.C. automatic water systems; demonstration of Luitweiler pumps. Representative: W. McLachlan. **G. Walter Green Co., Peterborough,**

das, Ont. Special exhibit of small tools for high explosive and shrapnel shells, full line of milling cutters, taps, dies, drills, and reamers. Representatives: T. R. Whitehead, A. Webb.

Preston Woodworking Machine Co., Preston, Ont.—Tenoning machine, power feed saw, 12 in. molder, 36 in. band saw, 24 in. panel planer, 36 in. high speed ball bearing shaper and Newport attachment for molding machines. Representatives: W. J. Murray, W. E. Near, A. M. Kerr.

Talman Brass & Metal Co., Hamilton, Ont.—Arctic antifriction metal, brass and aluminum, wire and castings.

Twin City Oil Co., Berlin, Ont.—Food crushers in operation. Marzoni oil pumps and compressors. Representative: A. V. Phillips.

Victor Saw Works, Hamilton, Ont.—Power hack saws operating on shell material, Victor saw blades. Representatives: W. E. Pollock, A. V. Wilson.

A. R. Williams Machinery Co., Toronto.—Boyd boring machine for high explosive shells, Chapman transfer truck, Holden Morgan fluted milling machines, Ditch Le Blood engine lathe, Reeves wood pulleys, marine gasoline engines, power motors, etc. Representatives: Messrs. Cronk, Klechel and McDonald.

The James Morrison Brass Mfg. Co., Toronto, are exhibiting in the Process Building a full line of brass steam goods, including safety and reducing valves, gauges, locomotive injectors and valves, etc. Representatives, A. Bolton and W. Dobbin.

W. A. Drummond & Co., Toronto, are showing in the Grand Stand Section an extensive line of dairy and refrigerating machinery and supplies, including a 2-ton and 4-ton machine, the latter being in operation. Representative, A. F. MacDonell.

S. F. Bowser & Co., Inc., Toronto, have exhibits in the Transportation and Process Buildings. These include gas and oil lubricating oil systems, "Red Sentry" pump for automatic and other truck stations. Representatives: R. W. Williams, H. F. Stead and A. E. Moffatt.

A. H. Wynter-Joiner, Ltd., Toronto, are showing in the Transportation Building a full line of the well-known Weston portable counting instruments. Representative, S. E. Fife.

The Tygard Rotary Engine Co., Toronto, are demonstrating in the Agricultural Machinery Section the "Tygard" rotary engine. Two units, 22 h.p. and 30 h.p., are being shown. Representatives: Professor James W. Tygard and F. G. Moore.

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Vol. XIV. SEPTEMBER 2, 1915 No. 10

PRINCIPAL CONTENTS.

Combined Shrapnel and High Explosive Shell Manufac- turing Plant	215-221
General	222
Cartridge Case Cooling Conveyers...Forging Plant for 6 in. Shell Forgings.	
4.5 Howitzer Shell Production in a Structural Steel Plant.	223-228
General	228
Socket Driving Machine...The Test of Weapons... Canada's Gas and Oil Resources.	
Why Steel is the Most Suitable Material for Shells	229-230
General	230
Munitions Invention Committee.	
H. E. Shell Production in Ventilating Equipment Plant....	231-236
General	236
Projectile Manufacturing Lathes...Engineering in Germany.	
Casting Steel Ingots for Production of 1.5 H. E. Shells	237-240
Shrapnel Shell Production in a Shipbuilding and Marine Engineering Plant	241-247
General	247
Our Sea Power Triumph.	
The Production of Sound Ingots for Shell Requirements.	248-251
General	251
Munition Metals.	
Progress in New Equipment	252
Single Purpose Shell Lathes...Collapsible Tap for Shells.	
General	252-253
The Alloys of High Speed Steel... Explosives and Guns	
Machinery Display at the Canadian National Exhibition	254-255
Editorial	256
War Effect on Machine Shop Methods and Equipment	
Our Manufacturers' Honor Roll	257
Selected Market Quotations	258-259
The General Market Conditions and Tendencies	260-261
Montreal Letter...Toronto Letter...Allies' Purchas- ing Agents...Canadian Government Purchasing Com- mission...Ocean Tonnage Shortage...Machine Tool Opening in Russia...S.S. "Ontario" No. 2 Trial Trip ...Canadian Commercial Intelligence Service.	
Industrial and Construction News (Advtg. Section).....	121-132

WAR EFFECT ON MACHINE SHOP METHODS AND EQUIPMENT

IN the midst of numerous speculations as to the future of Canada's manufacturing industry, it may not be amiss to draw attention to the changed conditions under which in the coming time business problems will have to be approached and solved.

In a number of ways, the shell industry has been an eye-opener to us. Many firms which a year ago did but a limited business in machine work—iron foundries, tin-smiths, structural workers and others, are now running a modern machine shop on most modern lines.

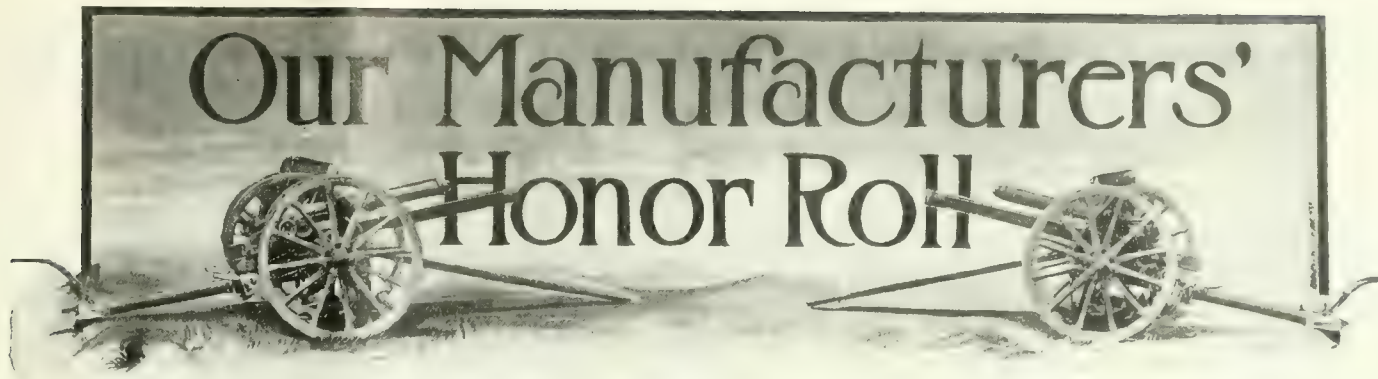
The requirements of a shop which must produce accurate work at a given figure, and also in a quantity, are understood more thoroughly now than ever before. Tool-makers are no longer frowned upon, the tool-room being recognized as something more than a mere luxury. The necessity for employing skilled help in maintaining output has been so borne in upon us that the application of scientific methods and labor-saving devices will be prosecuted with increased vigour when our manufacturing resources are again normally operated.

When such a time comes, there will doubtless be many who, having been fortunate in their selection of machines, will be able to adapt them to the more economical production of their various specialties. Plants, which have installed automatic and semi-automatic machines, turret lathes, screw machines, etc., may be classed in this reckoning.

In competition with these, however, will be found others, and they may constitute a substantial majority, who, having a more varied assortment of equipment, evidenced their ingenuity in converting, adapting, and utilizing in numberless fearful and wonderful ways, anything that happened to be available. Regarding such, instances have come to light where machines by standard makers have been put to work on shell operations, the proper performance of which required, according to existent ideas, the utilization of complex machinery of ten times the value. Further, and as if to add insult to injury, the amount of tooling necessary was cut in half as a result of judicious experiment in methods and selection of materials, until the output of obscure machines became many times greater and was obtainable at a trifling cost.

When shells are a thing of the past, the activities of our plants will diverge and radiate in many directions. There will be a parting of the ways, and only balanced judgment will decide between success and failure—between a continued activity, rich in progress and development, and a helpless floundering in the mire of misdirected effort and inexperience. While naturally proud of our new, modern tool equipped plants, we must bear in mind that not a few other people have been using these same machines for years past, earning their living through them, and know just what they can do, and how much it costs to do it. Shell work may pay a fair return on the investment, but it offers no wide field of experience on different classes of work, either as regards materials or labor. The results obtained in shell manufacture indicate in moderate degree what may be accomplished in the direction of specialization of operations rather than of machines.

Specialization of equipment is exemplified by some recent productions in the United States where machines of the multiple type have been developed to a marked degree. The use of such machines, or even a tendency in that direction can, however, be justified only by a demand which would keep a sufficient number of them busy, and warrant the employment of the expert help necessary for maintaining their operation reliability and up-keep expense.



Representative of Canadian manufacturers, their families and administrative staffs who have heeded the call of Empire for active service on our various overseas contingents.

MUNITIONS WORKER AND SOLDIER

SPEAKING recently at a meeting of employees of Swan, Hunter & Wigham Richardson, Wallsend-on-Tyne, Dr. Hunter challenged the accuracy of the oft-repeated assertion that men in the factory were as useful as those at the front, and declared: "It is not true. A man at the front is twice as good as a man in the factory. These men are making sacrifices, and it will be a shame and a crime if, through any slackness on our part, even one of these brave lives is lost."



LIEUT. W. S. DREWRY,
E. L. Drewry, Ltd., Winnipeg



CAPT. H. C. TRENAMAN,
Domestic Specialty Co., Hamilton, Ont.



CAPT. G. D. McLAUHLAN,
McLauchlan & Sons, Ltd., Owen Sound.



CAPTAIN J. STEWART GRAFTON,
Grafton & Co., Dundas, Ont.



LT. COL. J. BRUCE PAYNE,
J. Bruce Payne, Ltd., Granby, Que.

SELECTED MARKET QUOTATIONS

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

PIG IRON.

Grey forge, Pittsburgh	\$14 45	
Lake Superior, charcoal, Chicago	16.25	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	Toronto.
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glogarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron	26 00	.....
Victoria, No. 1	23 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 plain	22 00	19 00
Hamilton, No. 1	22 00	19 60
Hamilton, No. 2	22 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	1.90
Structural shapes	1.95
Plates	1.95
Freight, Pittsburgh to Toronto.	
18.9 cents carload; 22.1 cents less carload.	

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 to 1/2 in., 100 lb.	\$2 35	\$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	\$11 00	\$11 75
Copper, crucible	12 00	12 50
Copper, unch-bleed, heavy	12 00	12 50
Copper, wire, unch-bleed.	13 00	13 50
No. 1 machine compos'n	11 00	11 00
No. 1 compos'n turnings.	9 00	9 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings.....	11 00	11 00
No. 1 brass turnings.....	9 00	9 00
Heavy lead	4 50	4 75

Tea lead	\$ 3 25	\$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld	Lapweld
	Black	Black
	Gal.	Gal.
	Standard	
1 1/4, 3/8 in.	63	32 1/2
1 1/2 in.	68	41 1/2
3/4 to 1 1/2 in.	73	46 1/2
2 in.	73	46 1/2
2 1/2 to 4 in.	73	46 1/2
4 1/2, 5, 6 in.	70	43 1/2
7, 8, 10 in.	67	40 1/2
	X Strong P. E.	
1/4, 3/8 in.	56	32 1/2
1/2 in.	63	39 1/2
3/4 to 1 1/2 in.	67	43 1/2
2, 2 1/2, 3 in.	68	44 1/2
2 in.	63	39 1/2
2 1/2 to 4 in.	63	42 1/2
4 1/2, 5, 6 in.	66	42 1/2
7, 8 in.	59	35 1/2
	XX Strong P. E.	
1/2 to 2 in.	44	20 1/2
2 1/2 to 6 in.	43	19 1/2
7 to 8 in.	40	16 1/2
	Genuine Wrot Iron.	
3/8 in.	57	26 1/2
1/2 in.	62	35 1/2
3/4 to 1 1/2 in.	67	40 1/2
2 in.	67	40 1/2
2 1/2, 3 in.	67	40 1/2
3 1/2, 4 in.	66	39 1/2
4 1/2, 5, 6 in.	63	36 1/2
7, 8 in.	60	33 1/2
	Wrought Nipples.	
4 in. and under	77 1/2%	
4 1/2 in. and larger	72 1/2%	
4 in. and under, running thread.	57 1/2%	
	Standard Couplings.	
4 in. and under	60%	
4 1/2 in. and larger	40%	

MILLED PRODUCTS.

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

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	\$20 00	\$19 50
Electrolytic copper	19 75	19 25
Castings, copper	19 00	19 00
Tin	40 00	39 00
Spelter	19 00	19 00
Lead	6 25	6 25
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	\$22 00
Openhearth billets, Pittsburgh..	22 00
Forging billets, Pittsburgh	28 00
Wire rods, Pittsburgh	25 50

NAILS AND SPIKES.

Standard steel wire nails, base	\$2 40	\$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less.....	70
Machine bolts, 7-16 and over....	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass....	35 p.c.
Nuts, square, all sizes..	4 1/4c per lb. off
Nuts, Hexagon, all sizes..	4 3/4c per lb. off
Iron rivets	72 1/2 per cent.
Boiler rivets, base, 3/4-in. and larger	\$3.25
Structural rivets, as above.....	3.25
Wood screws, flathead, bright	85, 10, 7 1/2, 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.	Extra Strong.	D. Ex. Strong.
	Nom. Price.	Price	Price
	Diam. per ft.	Ins. per ft.	Ins. per ft.
1/8 in.	\$.05 1/2	1/8 in. \$.12	1/2 \$.32
1/4 in. ....	.06	1/4 in. .07 1/2	3/4 .35
3/8 in. ....	.06	3/8 in. .07 1/2	1 .37
1/2 in. ....	.08 1/2	1/2 in. .11	1 1/4 .52 1/2
3/4 in. ....	.11 1/2	3/4 in. .15	1 1/2 .65
1 in. ....	.17 1/2	1 in. .22	2 .91
1 1/4 in. ....	.23 1/2	1 1/2 in. .30	2 1/2 1.37
1 1/2 in. ....	.27 1/2	1 1/2 in. .36 1/2	3 1.86
2 in. ....	.37	2 in. .50 1/2	3 1/2 2.30
2 1/2 in. ....	.58 1/2	2 1/2 in. .77	4 2.76
3 in. ....	.76 1/2	3 in. 1.03	4 1/2 3.26
3 1/2 in. ....	.92	3 1/2 in. 1.25	5 3.86
4 in.	1.09	4 in. 1.50	6 5.32
4 1/2 in.	1.27	4 1/2 in. 1.80	7 6.35
5 in.	1.48	5 in. 2.08	8 7.25
6 in.	1.92	6 in. 2.86	.....
7 in.	2.38	7 in. 3.81	.....
8 in.	2.50	8 in. 4.34	.....
8 in.	2.88	9 in. 4.90	.....
9 in.	3.45	10 in. 5.48	.....
10 in.	3.20	.....	.....
10 in.	3.50	.....	.....
10 in.	4.12	.....	.....

COKE AND COAL.

Solvay Foundry Coke	\$5.75
Connellsville Foundry Coke...	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99
Net ton f.o.b. Toronto.	

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%
Discounts off new list. Warehouse price at Montreal and Toronto.	

MISCELLANEOUS.

Solder, half-and-half	24.75
Putty, 100-lb. drums ..	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll ..	0.95
Motor gasoline, single bbls., gal...	0.18
Benzine, single bbls., per gal. ...	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls. ..	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs. ..	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto	40%
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PROOF COIL CHAIN.

1/4 inch	\$8.00
5-16 inch	5.35
3/8 inch	4.60
7-16 inch	4.30
1/2 inch	4.05
9-16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45
Above quotations are per 100 lbs.	

TWIST DRILLS.

Carbon up to 1 1/2 in.	60
Carbon over 1 1/2 in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and e.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, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

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

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28.....	\$3 00	\$2 90
Canada plates, dull,		
52 sheets	3 25	3 50
Canada Plates, all bright..	4 40	4 60
Apollo brand, 10 3/4 oz.		
galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G...	5 75	5 75
Gorbal's Best, No. 28....	6 50	6 50
Viking metal, No. 28....	6 00	6 00
Colborne Crown, No. 28..	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	\$11 00	.....
1 1/4 in.	11 00	.....
1 1/2 in.	11 00	.....
1 3/4 in.	11 00	.....
2 in.	11 50	9 20
2 1/4 in.	13 00	.....
2 1/2 in.	14 00	12 10
3 in.	16 00	12 70
3 1/4 in.	.....	13 90
3 1/2 in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

	WHITE.	Cents per lb.
XXX Extra		0 11
X Grand		0 10 1/2
XLCR		0 09 3/4
X Empire		0 09
X Press		0 08 1/4
	COLORED.	
Lion		0 07 1/2
Standard		0 06 3/4
Popular		0 06
Keen		0 05 1/2

WOOL PACKING.

Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07

WASHED WIPERS.

Select White	0 08 1/2
Mixed Colored	0 06 1/4
Dark Colored	0 05 1/4

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard ..	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

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

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	\$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	\$.15
Acid, hydrochloric .....	.05
Acid, hydrofluoric .....	.06
Acid, Nitric .....	.10
Acid, sulphuric .....	.05
Ammonia, aqua .....	.08
Ammonium carbonate .....	.15
Ammonium chloride .....	.11
Ammonium hydrosulphuret .....	.35
Ammonium sulphate .....	.07
Arsenic, white .....	.10
Copper sulphate .....	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride .....	.20
Lead acetate .....	.16
Nickel ammonium sulphate .....	.10
Nickel carbonate .....	.50
Nickel sulphate .....	.20
Potassium carbonate .....	.40
Potassium sulphide .....	.30
Silver chloride	(per oz.) .65
Silver nitrate	(per oz.) .45
Sodium bisulphite .....	.10
Sodium carbonate crystals .....	.04
Sodium cyanide .....	.35
Sodium hydrate .....	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate .....	.14
Tin chloride .....	.45
Zinc chloride .....	.20
Zinc sulphate .....	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel .....	.47 to .52
Cobalt	1.75 to 2.00
Copper .....	.25 to .28
Tin .....	.45 to .50
Silver .....	.55 to .60
Zinc .....	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt.....	1.50 to 1.75
Polishing wheels, bullneck..	.80
Emery in kegs .....	.4 1/2 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., Aug. 30, 1915.—There is a firmer tone in the metal market, due to the fact that the demand is increasing without definite assurances of increased supplies. A general increase of \$1 a ton is announced on pig iron and an increase of \$1 a hundred on spelter. The demand for pig iron is fairly quiet, there being supplies available for all requirements.

High Speed Steel.

The high speed steel situation has reached a point that is looked upon by many as serious. It is becoming daily more difficult for dealers to fill orders, although some firms are fortunate in having a fairly large stock on hand. The representatives of one British firm are feeling very optimistic over the fact that they have a shipment on the ocean which will be due here shortly, but in this respect they seem to be entirely alone. It is freely prophesied that owing to the embargo against shipping steel from the Old Country containing tungsten or molybdenum the high speed steel situation here will become more and more acute, and two dollars a pound steel is looked for at a quite early date. In some cases larger-sized bars and unusual sizes have been re-rolled, but the amount of this additional supply of stock will not affect the situation to any extent. It would be wise for manufacturers to look into the future a little as far as their stock of high speed steel is concerned, and assure themselves that they will not have to suspend operations owing to the possible inability of securing a suitable supply.

A notable feature at present is that antimony which has been quoted around 40 cents has been steadily declining. There is little British antimony on the market, but recently it has become apparent that it is possible to secure fairly large quantities of Chinese and Japanese material. While 30 cents has been the figure quoted in the United States, this is even shaded at present by Montreal dealers. Another factor is also apparently affecting the situation, it being rumored that shrapnel bullets will be made in the near future without the use of antimony. A gentleman in close connection with the Government informed your representative that shrapnel bullets which were being tested by the Government were apparently giving most satisfactory results, and if these are adopted, the use of antimony will be eliminated from the manufacture of shrapnel shells altogether. This will have a tendency to

depress the market still further. British antimony is scarce at 40 cents a pound, and Chinese and Japanese is quoted at from 27 to 29 cents.

Machine Tools and Supplies.

A striking indication of the scarcity of machine tools is illustrated by the fact that a Montreal firm have a large order for Canadian-made machine tools from Great Britain. Although they have made a special effort to fill it, so far they have been unable to get any quotations representing what would be considered a reasonable time for delivery. As far as the Montreal market is concerned, Canadian-made machine tools,

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'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsief, care Military Attache, Russian Embassy, Washington, D.C.

except an occasional second-hand unit, are not to be had, and it is apparent that this condition will continue for some months to come. Some Montreal dealers are well supplied with second-hand tools, and a fair amount of new American machines; for these a good demand is reported.

Leather belting manufacturers report that the great scarcity of raw material has made it next to impossible to secure enough leather to enable them to fill orders. At the beginning of the war the saddlery manufacturers and boot and shoe dealers secured practically all the available stock, and in some instances were helped out by the leather belting manufacturers, who could now use large quantities to advantage, but are unable to secure same. There is demand

for all kinds of small belting in connection with the manufacture of war munitions; in fact, this market is extremely active. The demand for small-sized belts is greater in Montreal than it has been for a great many years, and there seems no sign of a diminished activity along this line.



Toronto, Ont., Aug. 31.—It is generally believed that the British Government will continue to place orders for war equipment in Canada while the need lasts. The prospects for further improvement in business are therefore bright, more particularly with regard to the export trade. The indications point, especially in the West, to a heavy crop, which will have an exceedingly beneficial effect on business generally. There have been no developments of importance in the shell industry recently, but there appears to be little doubt that further orders will be placed, particularly for high explosive shells as soon as Canadian plants are in a position to turn out fixed ammunition. It is understood that David A. Thomas, the representative of the British Government, is favorably impressed with what he has seen during his investigations as to what can be done in Canada towards making shells.

With regard to domestic trade, conditions generally speaking are quiet, but considerably better than earlier in the year. The large increase in the export trade will no doubt in time have a stimulating effect in the domestic business. There has lately been a more active demand for agricultural implements and consequently a few iron foundries have been doing better business; the majority of plants, however, are feeling the effects of the depression. The building trade locally has picked up a little, but is still considerably below normal. Municipal work all over Canada has been very light this season on account of the difficulty in financing improvements.

Steel Market.

Conditions in the steel trade continue favorable, due to the increase in the export business and the large demand for bars and forgings for shells. The recent orders for railway cars have also created a demand for steel. It is announced that the Nova Scotia Steel & Coal Co. are working day and night on shell orders and are also making a large number of forgings for Clyde shipbuilders. Prices on all steel products are holding very firm although there are no changes to note this week.

The recent strength in the spelter market has had an unsettling effect on the sheet market, and prices are irregular. Following the decline in the spelter market, prices of sheets weakened, but are

now firmer, and some mills are refusing to quote for contract delivery because of the uncertainty of the price for spelter.

The high-speed tool steel situation shows no improvement and prices for the finer grades of tool steel have advanced again due to the increasing cost of tungsten and scarcity of supplies.

Conditions in the steel trade in the States continue very active. The heavy demand for steel rounds for shells is the leading feature, and specifications are coming in so fast that the mills are getting further behind on deliveries, notwithstanding the heavy shipments. Prices on bars and shapes are firmer, and some business is being done at 1.35c Pittsburgh.

Pig Iron.

Pig iron prices in the States have advanced in all markets, grey forge being now quoted at \$14.45 Pittsburgh. The situation locally has not changed materially and the demand for foundry iron is light. Hamilton and Victoria brands are unchanged at \$19.

Scrap Metals.

Prices on various scrap metals are unchanged with the exception of heavy melting steel, which has declined and is now quoted at \$7; this is accounted for by an excess of supply over demand. Copper and brass scrap are in good demand and the market is firm.

Machine Tools.

There is no change in the situation, the demand for new tools is less active, but deliveries are no better. Prospective shell manufacturers are in many cases keeping out of the market until more orders for shells are distributed. Some firms already engaged in producing shells are buying tools from time to time to readjust their plants, or for extensions. There is a good demand for second-hand tools, and deliveries are better on this class of equipment, especially for lathes.

Supplies.

A brisk demand for small tools such as cutters, dies, taps, etc., is reported, and good business is being done in almost all lines of machine shop supplies. An advance in the prices of waste has been made, varying from 1/4c to 3/4c per pound. The new prices are given in the selected market quotations. The increased cost of raw stock is the reason for higher prices.

Metals.

The feature of the market this week is the recovery of spelter following heavy buying. Although there is a good demand, indications point to an attempt by sellers to advance the market. The tin market is unsettled with a weak tendency. The copper market is un-

settled, and prices are slightly higher. Lead is stronger and aluminum are quiet and firm at unchanged quotations. There is a good demand for metal for munitions, but ordinary business is only moderate.

Tin.—The New York market is dull and unsettled with a weak tendency. This dullness is caused by the failure of the London market to advance in this metal in proportion to copper and spelter. Local quotations are unchanged at 19c per pound.

Copper.—The market is unsettled and the situation uncertain owing to prices being advanced for no apparent reason. Copper consumers have been out of the market for some time and a buying movement may follow as a result. The market has advanced 1/2c locally, and lake copper is being quoted at 19c per pound.

Spelter.—The market has re-acted and prices are higher, some large orders having been placed in New York for prompt

up in its place a freight service that far surpasses any that Canada has owned in the past. The big liners have been replaced by large freighters.

Investigation has shown that at the present time the Cunard Company has four of these vessels, two of which have already visited the port of Montreal, although under changed names. This fact is also testified to by officials of Lloyds. In this way the absent passenger boats have to a considerable extent been replaced. That the available tonnage to carry grain will compare not altogether unfavorably with past years is illustrated by the fact that while the Victorian, one of the largest of the passenger boats (an Allan liner) could carry only about 4,000 tons of grain, the Monarch (one of the freighters replacing passenger ships) can accommodate between 8,000 and 9,000 tons. So, while the number of ships may be less, the carrying capacity will be much greater than has generally been believed.



MACHINE TOOL OPENING IN RUSSIA.

THE Department of Trade and Commerce, Ottawa is in receipt of a communication from the office of the High Commissioner for Canada at London, enclosing the name of an English firm, with connections in a number of the important centres of Europe, who desire to get into touch with a reliable Canadian merchant firm or manufacturing house to act as purchasing agents for machine tools and other plants. The firm in question has recently sold some machine tools to Russia for the manufacture of ammunition and have received additional inquiries for shell-making plant, but on account of the taking over of the English tool-makers by the English Government, it is not possible at present to offer English-made machines for some types of shells.

This English firm therefore would like to communicate with one large manufacturing house in Canada, which could supply the major part of the plant itself and get tenders for the remaining part, or else with a merchant house in Canada, who are thoroughly acquainted with the machine tool business and who could give them tenders for plant, getting the machines from the various manufacturers, with whom they are acquainted. Canadian firms, who may be interested in supplying the equipment that is asked for, will obtain the name and address of the firm in question, who are making the inquiry on behalf of their Russian clients, by applying to the Department of Trade and Commerce, Ottawa.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion \$100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

and early delivery. The market is excited and indications point to manipulation. The advance is 3c locally at a nominal quotation of 19c per pound.

Lead.—The market is more active and lighter. The Trust has advanced their price to 4.90c New York. Locally lead has advanced 1/4c and is quoted at 6 1/4c per pound.

Antimony.—The market is quiet but firm for future, and unsettled for spot delivery. Quotations are unchanged at 40c per pound.

Aluminum.—The market is quiet but firm and unchanged at 40c per pound.



OCEAN TONNAGE SHORTAGE.

IT is said that an agreement has been reached between the Governments of Great Britain and Canada whereby the former will recognize the urgency of the situation and refrain as much as possible from commandeering ships that are needed for grain. So far as the ocean tonnage is concerned, however, the shortage is by no means so serious as has been claimed in some quarters; but while the passenger service has in some cases vanished, and in general has been reduced to a minimum, there has sprung

S. S. "ONTARIO NO. 2" TRIAL TRIP. CAR ferry Ontario No. 2, which will ply between Cobourg and Port Charlotte in connection with the Grand Trunk Railway, made her initial trip, the builders' trial, on Saturday, Aug. 28, with about 200 guests aboard. The behavior of the new vessel was most satisfactory in every respect. The Ontario No. 2 was built and engined in Toronto at the yards of the Polson Iron Works, Ltd.

The new ferry is 318 feet long; beam moulded 54 feet; depth to main deck, 20 ft. 6 in.; draft loaded, 16 ft. 3 in.; tonnage, 5,400; horse-power, 4,500. She has two propellers, each driven by a jet condensing triple-expansion engine having cylinders 20½ in., 30 in. and 54 in. by 36-in. stroke, and making 110 r.p.m. The boilers are Scotch type, four in number, each being 14 ft. diameter by 12 ft. long, and giving a working pressure of 180 lbs. per sq. in.

Captain F. D. Forrest, Commodore of the Ontario Car Company's fleet, was at the helm, and W. H. Smith, manager of

the company, represented Vice-President Kelly of Chicago, who was unable to be present. The new ferry will go into commission on October 1, taking the place of the car ferry Ontario No. 1, which will be laid up for the winter.

The new vessel has accommodation for thirty cars, each carrying seventy tons, also accommodation for one thousand passengers. The guests were entertained to a buffet luncheon. A Boy Scouts' pipe band provided music as the visitors inspected the various sections of the new vessel. Upon the return of the ferry to her moorings at the Polson Iron Works, Ltd., yards, a vote of thanks was tendered Col. J. B. Miller, president and general manager of the latter company.

Guests.

Among those on board, which included a large number of ladies, were: Col. J. B. Miller, W. H. Smith, J. W. Griemer, fleet engineer of the Ontario Car Ferry Co., and W. F. Crawford, the chief steward;

Captain Harry Polson; William Newman, naval architect and works manager of the Polson Company, who superintended the construction of the new vessel; A. H. Jeffrey, A. E. Matthews, Captain W. J. Bassett, J. T. Mathews, Captain M. Corcoran, Mayor Church, Alderman Ramsden, Alderman Ryding, J. W. Somers, George Stevenson, Captain Evans, John Dodds; H. E. Wittenberg, General Superintendent, G. T. R.; W. H. Farrell, Superintendent of G. T. R. Terminals; E. C. Horning, District Passenger Agent, G. T. R.; Edmund Bristol, M.P.; W. C. Seeley, Master Mechanic of the Middle Division, G. T. R.; J. R. Leekie, Assistant Master Mechanic, G. T. R.; W. S. Wilson, Superintendent of Transportation, G. T. R.; W. Hamilton, L. Grabbel, Assistant General Baggage Agent, G. T. R.; J. D. O'Connor, J. W. McClintock, James Stewart, ex-Alderman James McCausland, Frank Ryding, Jack Edmunds, A. G. Webster, "Marine Engineering of Canada," etc.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

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

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.		Newfoundland.	
H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.		W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.	
Australasia.		New Zealand.	
D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.		W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.	
British West Indies.		South Africa.	
M. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.		W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.	
China.		United Kingdom.	
J. W. Ross, 6 Klukiang Road, Shanghai. Cable Address Cancoma.		E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.	
Cuba.		J. E. Ray, Central House, Birmingham. Cable address, Canadian.	
Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.		Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.	
France.		F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.	
Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona		Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.	
Japan.		Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.	
G. E. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.			
Holland.			
J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.			

CANADIAN COMMERCIAL AGENTS.

British West Indies.		Norway and Denmark.	
Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.		C. E. Sontum, Grubbed No. 4, Christiansa, Norway. Cable address, Sontums.	
R. H. Curry, Nassau, Bahamas.		South Africa.	
Colombia.		D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.	
A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.		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.



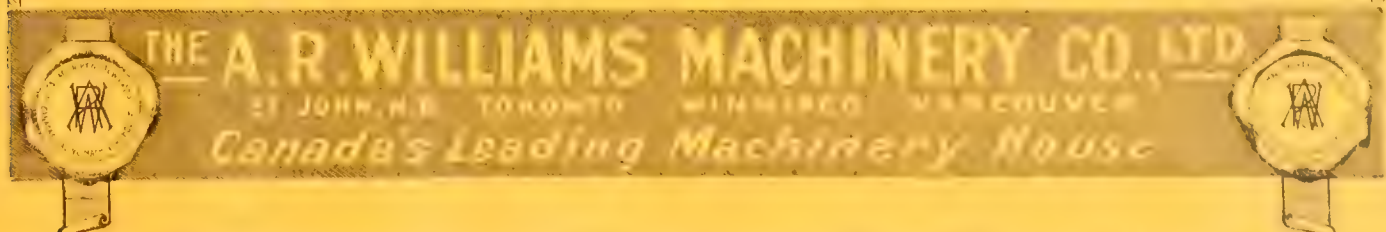
SERVICE: The Link that Binds the Chain of Mutual Interest, the Basis of Success and the Ultimate in All Things

- ¶ Expert information on machines and equipment to produce every type of shrapnel and high explosive shell.
- ¶ Special labor-saving devices and new machines for special operations to save you money and increase production.
- ¶ Large stock of equipment carried to give you prompt deliveries. Purchased under the supervision of our expert buyers. Re-manufactured tools a specialty.
- ¶ Consult our service department before placing your orders. There's no obligation incurred.

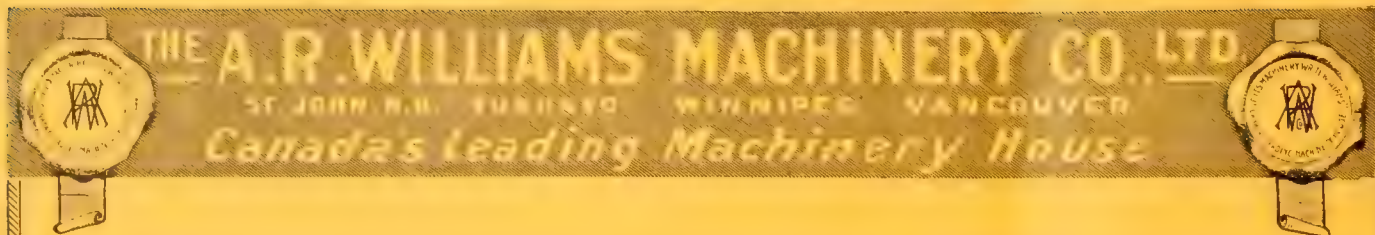
Look inside the pages of this insert for the tools that have made good. They carry our endorsement.

CAN WE SERVE YOU?

IF IT'S MACHINERY—WRITE "WILLIAMS"



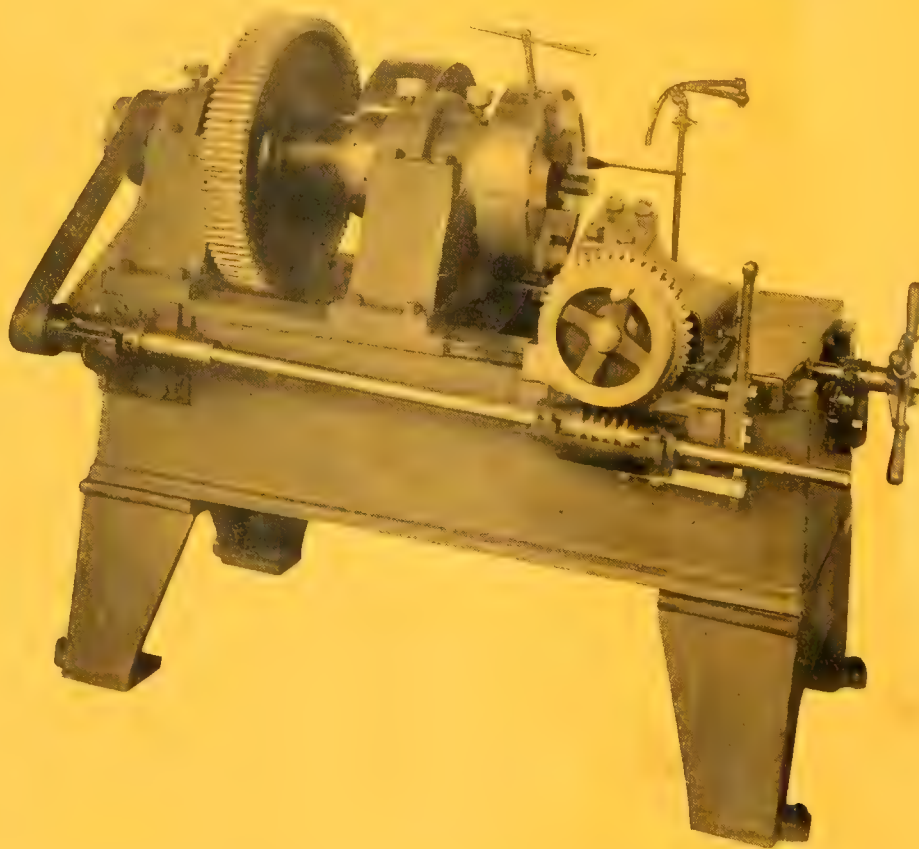
If what you want is not advertised in this issue consult the Buyers' Directory at the back.



HEAVY DUTY CUTTING-OFF MACHINE

For 4.5 Shell Work and Steel Ingots and Bars

Built with sufficient Strength and Belt Power to stand up to the latest High-Speed Steels.



PROMPT DELIVERIES

MANUFACTURED BY

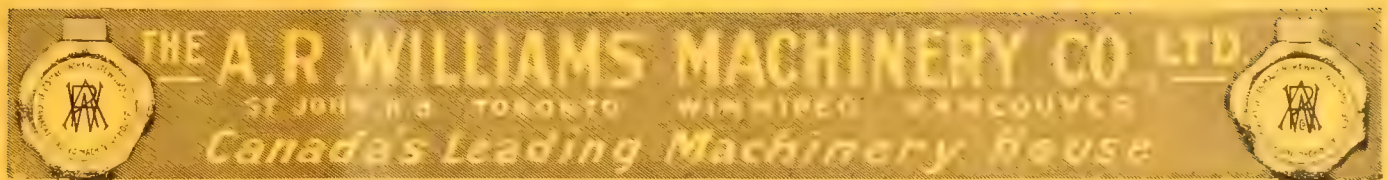
THE WILLIAMS TOOL COMPANY, ERIE, PA., U.S.A.

SALES AGENTS :

The A. R. Williams Machinery Company, Limited
Toronto, Ontario

IF IT'S MACHINERY—WRITE "WILLIAMS"

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



THREAD MILLING MACHINES FOR HIGH EXPLOSIVE SHELLS

Patents applied for in Canada, United States, Great Britain, France, Russia and Italy.

Designed for the purpose of milling the thread in the base and nose of high explosive shells.

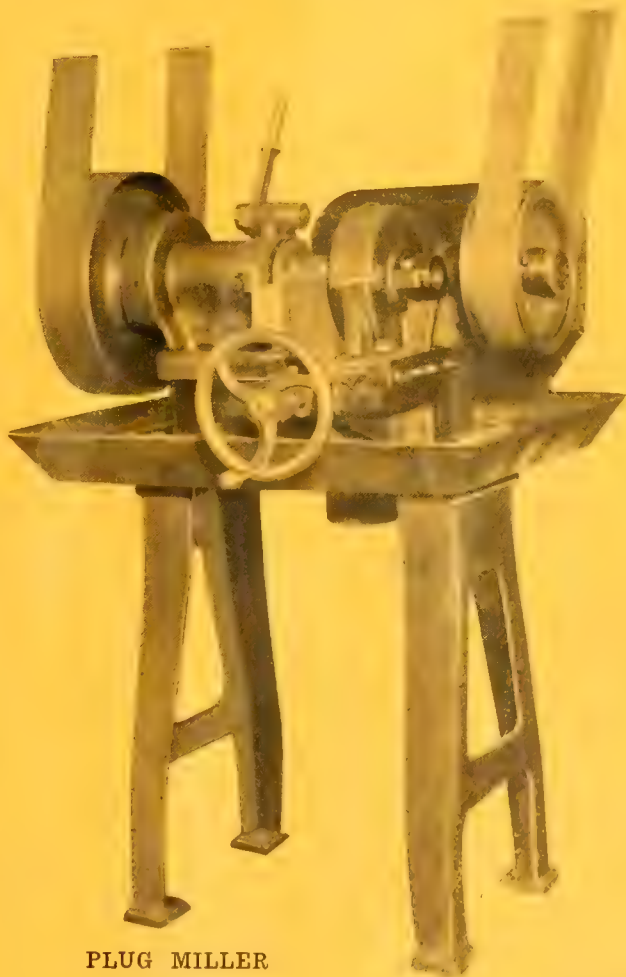
Shell is placed inside a revolving spindle and is self centering. A perfect thread is produced in base of shell in approximately 2½ minutes.

Milling Cutter is made from best high-speed steel, by Brown & Sharpe, from special design by Holden-Morgan Co., and is so shaped that it can be sharpened without changing the form. Cutter is designed to mill the top of thread as well as the depth.

Machines are fully equipped for work, including oil pump. Fitted with automatic stop motion, which stops machine when thread is completed. One operator can run several machines. Eliminates all risk of having shells rejected on account of thread being stripped, as is liable to be the case when tapped by the old method.



THREAD MILLER



PLUG MILLER

A MONEY-SAVING OPERATION

Before You Make a Contract for Your Base Plugs. Investigate the Holden-Morgan Plug Miller

This machine is specially designed for turning the gas check plug and milling the thread. A complete plug every three minutes. Machine equipped with quick draw in collet and automatic stops on all feeds.

Simple in design, rigidly built, economical in operation. It's cheaper to make your own plugs. Write us.

Write for complete particulars, prices, etc.

THE HOLDEN-MORGAN CO., Limited

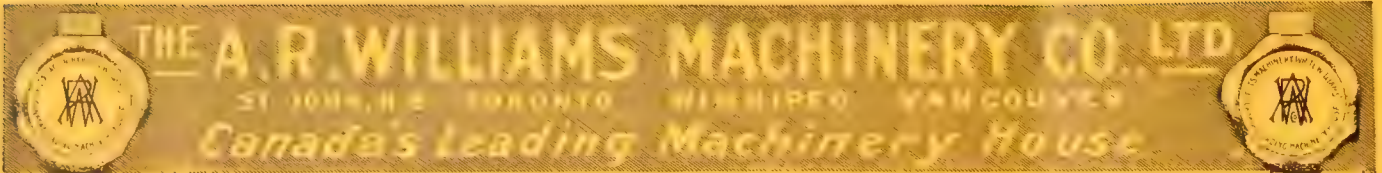
539 Richmond Street West

Toronto, Canada

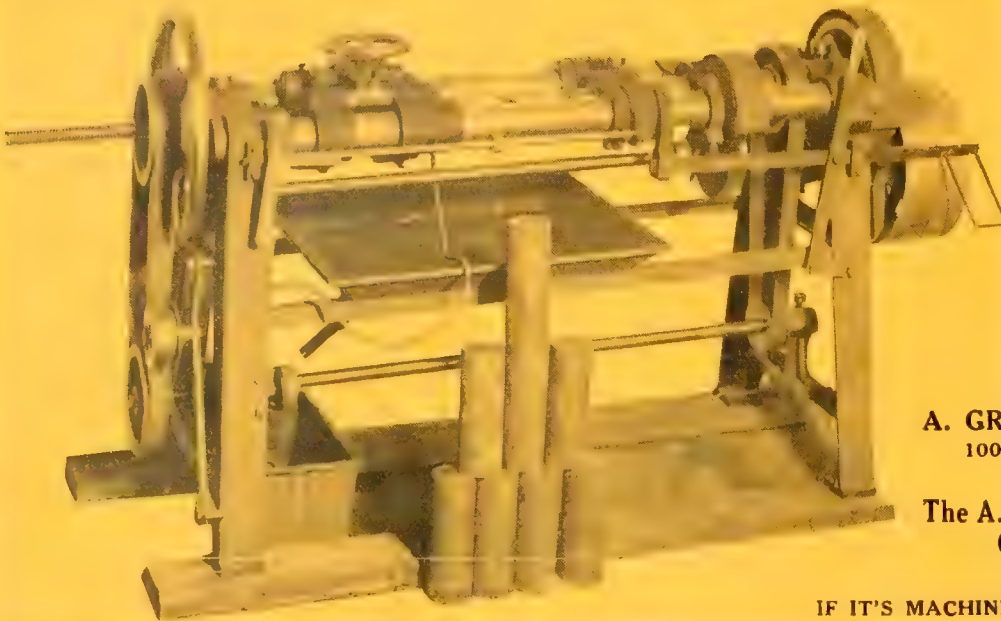
SALES AGENTS

The A. R. Williams Machinery Company, Limited
Toronto, Canada

IF IT'S MACHINERY WRITE "WILLIAMS"



**THE BOYD SINGLE PURPOSE HORIZONTAL DRILL FOR DRILLING
18-POUNDER HIGH EXPLOSIVE BILLETS**



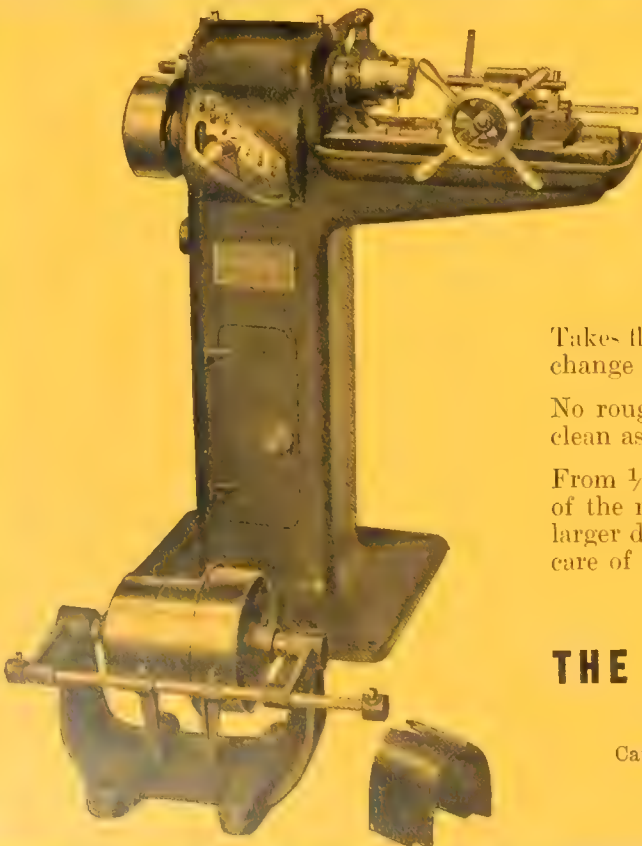
Simple in operation, rigidly built, does not require an expert. Billet can be placed in position, drilled and removed in four minutes. There are no drill chips to remove after the operation is completed. Requires less than half the power of the ordinary Heavy Duty Drill.

Write for full information.
Prompt shipment.

MANUFACTURED BY
A. GRAHAM BOYD & CO.
100 Front St. E., TORONTO

SALES AGENTS:
The A. R. Williams Machinery Company, Limited
Toronto, Ontario

IF IT'S MACHINERY—WRITE "WILLIAMS"



Don't Depend on Somebody Else

For Your Small Threaded Parts

THREAD THEM YOURSELF

**A GEOMETRIC THREADING MACHINE
SOON PAYS FOR ITSELF**

Takes floor space 2 ft. x 3 ft. and is complete with countershaft, change speed gear, adjustable stop for gauging length of thread.

No rough threads with the Geometric. They are as true and clean as can be produced on any Screw Machine.

From 1/8-inch pipe thread to 1-inch diameter is the usual range of the machine, but where fine pitch threads are to be cut on larger diameters, it can be fitted with a Die Head that will take care of the work.

Submit Your Threading Proposition to Us.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN, CONN., U.S.A.

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

INDUSTRIAL ^A_N^D CONSTRUCTION NEWS

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

Engineering

Embrow, Ont.—H. McDonald will establish a general blacksmith shop here.

Brampton, Ont.—The Pease Foundry has received an additional order for shells.

Ridgeville, Ont.—The Chippewa Gas Co. propose to lay gas mains from Cayuga to St. Catharines.

Ottawa, Ont.—The Russell Natural Gas & Oil Co. is in the market for drilling equipment and pumps.

Calgary, Alta.—The Canadian Western Foundry & Supply Co., with plants in Alberta cities, have received a large order for shells.

Brantford, Ont.—A building permit has been issued to the Brantford Emery Wheel Co. for a \$1,500 brick addition to their factory here.

Wingham, Ont.—Owing to increased business, the Western Foundry Co. expects to recommence operations in the new portion of their plant.

London, Ont.—The Wortman & Ward Co. will build an addition to its factory to cost \$20,000. The company manufactures iron force and lift pumps, etc.

Welland, Ont.—It is reported that the Electric Steel & Metals, Ltd., are considering building an extension to their plant and installing another furnace.

St. Mary's, Ont.—Additions will be made to the plant of the Thames Quarry Co. A new crusher building, 30 x 60 ft., will be built and new machinery installed.

Lake Megantic, Que.—P. H. Renaud is preparing plans for the erection of a pulp mill. New machinery, including "Baker" cut-off saws, a 70-h.p. engine, etc., will be required.

Nelson, B.C.—The Ivanhoe concentrator at Sandon, B.C., was totally destroyed by fire on Aug. 30. The plant, valued at about \$50,000, was treating ore from the Lucky Jim and Surprise mines.

Municipal

Brandon, Man.—The City Council has authorized the extension of the street lighting system.

Beeton, Ont.—The town council contemplate the purchase of boiler and power house equipment.

Guelph, Ont.—The city council will take immediate steps to secure a pulmotor, which will be placed at the fire-hall.

Oshawa, Ont.—The town council have passed the first reading of a by-law dealing with the steel plant which it is proposed to establish here.

Petrolia, Ont.—The town council has ordered the Hydro-Electric Power Commission to proceed with the construction of an entirely new outfit for the distribution of the hydro light and power.

Sudbury, Ont.—The town council have given permission for the Sudbury and Copper Cliff Suburban Electric Railway Co. to install an electric generating unit in the civic waterworks pumping station.

New Toronto, Ont.—The town will extend its intake 350 feet farther out in the lake, where the water is 25 feet deep. Upon the recommendation of Engineer E. A. James, a tender to do the work for \$5,000 was accepted.

Brockville, Ont.—Work is progressing favorably on the preliminary operations necessary for laying the new intake pipe for the Waterworks Department. The Donnelly Wrecking Co., of Kingston, Ont., are the contractors.

Prince George, B.C.—The ratepayers of this city passed four money by-laws as follows:—\$80,000 on waterworks; \$45,000 on electric light and power system; \$15,000 on street improvements, and \$10,000 on a city hall.

St. Catharines, Ont.—The ratepayers of St. Catharines will on September 21 vote upon a by-law to grant a franchise to the Relief Natural Gas Co., composed of local capitalists, for the supply of gas to the civic gas plant system.

Moose Jaw, Sask.—The council has decided to purchase from the Turbine Equipment Co., of Toronto, a new electrically-driven pump. The pump is to have a capacity of 700 Imperial gallons per minute, and is for use in pumping crude sewage at the disposal plant.

Markham, Ont.—The village council has decided to install new water mains in the village, also a new tank and collecting basin. The tank is to be 150 feet

high and the capacity will be 60,000 Imperial gallons. This new scheme, it is estimated, will cost slightly under \$15,000.

Berlin, Ont.—Plans for extension of Berlin's sewage disposal plant have been approved by the Provincial Board of Health. They were prepared by Engineer W. Chapman, of Toronto, and it is expected that when the work is completed the city sewage disposal problem will be solved for some years to come. The cost of the extension will be about \$75,000.

Markham, Ont.—At a special meeting of the village council held on Aug. 27, it was decided to submit a by-law to the ratepayers, authorizing the raising of \$20,000 for the construction and installation of a modern waterworks system, for both domestic and fire protection purposes. The measure will be given its first reading on Wednesday next, and the vote will be held on October 2nd.

Petrolia, Ont.—The town council on Aug. 23 ordered the Hydro Commission to proceed with the construction of an entirely new outfit for the distribution of the incoming hydro light and power. This action followed the expiry of the time set in which the Petrolia Co. had the option of selling to the town its plant for \$15,000. The council turned down the proposed compromise of \$16,200 offered by the company.

Weston, Ont.—Providing the Etobicoke Township Council will guarantee sufficient private contracts to secure the Weston Water, Power and Light Commission financially, the latter are quite willing to proceed with the proposed Hydro extension to Thistleton according to their decision at a special meeting held on Aug. 24. The linking up of Thistleton with the local system will involve an expenditure of about \$3,200.

Electrical

Granton, Ont.—The vote on the hydro by-law will be taken on September 28, and there seems no doubt that it will pass by a large majority.

St. Thomas, Ont.—The local Hydro-Electric Commission has purchased the property at the corner of Gas and St. Catharine streets for \$3,000, and will erect a modern power-house and transmission station. Plans and specifications for this structure are now being prepared by the Provincial Commission.

Rumely-Wachs Machinery Co.

121 N. JEFFERSON ST.

CHICAGO ILLINOIS

A Few of Our Second-Hand Tools in
Stock for Immediate Delivery:

LATHES

15" x 6' Von Wyck.
16" x 6' Porter.
18" x 12' Blaisdell.
20" x 10' Fifeild.
24" x 8' Sherman.
36" x 16' Fifeild.

TURRET LATHES and SCREW MACHINES

Pratt & Whitney No. 1 Screw Mach.
Garvin 1 1/2" Screw Machine.
Pearson 1 1/4" Screw Machine.
Cleveland 1" Automatic (6).
Cleveland 1 1/2" Automatic.
Cleveland 2 1/2" Automatic (2).
Acme 7/8" Automatic.
Lodge & Davis 18" Monitor.
Gisholt 24" Manufacturers' Turret.

PLANERS AND SHAPERS

36" x 36" x 8' American, 2 heads.
36" x 35" x 15' Powell, 2 heads.
14" Gould & Eberhardt Crank.
15" Hendey Tool Room.
16" Stockbridge Crank P.D.F.
21" Averbek B.G. Crank.

DRILL PRESSES

20" Miscellaneous Makes (20).
21" Cincinnati (2).
22 1/2" Barnes.
26" Sibley & Ware.
28" Barnes.
28" Sibley & Ware.
31" Barnes.
Avey 2-spindle ball-bearing.
Bausch No. 10, 16" Cluster.
Andrews 6-spindle, adjustable.
Bickford 3 1/2" Plain Radial.
Prentice 5" Plain Radial.

MILLING MACHINES

No. 3 Fox Hand and Power.
No. 0 LeBlond, plain.
No. 2 Owen, plain.
No. 3 Pratt & Whitney, plain.
No. 3-A Owen Universal.
No. 4 Becker Vertical.
Becker No. 7 Lincoln.
Phoenix No. 1 Lincoln.

PRESSES

Bliss No. 18 o.b.l.
Bliss No. 19 o.b.l.
Bliss No. 42 o.b.l.
Rockford No. 2 o.b.l.
American Can No. 3 o.b.l.
Walsh No. 4 o.b.l.
American Can, No. 4 1/2 o.b.l.
Bauroth No. 5 o.b.l.
Bliss No. 69-N Double Acting.
Adriance No. 12-A Double Acting.
Toledo No. 14 Hornung.
Toledo No. 94-A Double Crank.

MISCELLANEOUS

Bullard 42" Boring Mill.
Newark No. 2-A Auto Gear Cutter.
Landis 12 x 42" Plain Grinder.
Gisholt Universal Tool Room Grinder.
Acme 1 1/2" Bolt Cutter.
Acme 2 1/2" Bolt Cutter.
No. 2 and No. 3 M. & M. Keyseaters.
No. 3 Baker Keyseater with rotary table.

Trade Gossip

Hespeler, Ont.—The employees of A. B. Jardine & Co. have contributed over \$100 towards the purchase of a machine gun.

The Canada Forge Co. and Canadian Billings & Spencer Co. employees and officials have raised \$1,000 for a machine gun.

Owen Sound, Ont.—The Northern Bolt & Screw Co. have taken over the Dominion Bolt Co. of West Toronto and will remove the machinery here.

The Cleveland-Sarnia Sawmills have now in their booms in Sarnia Bay, Ont., about 12,000,000 board feet of logs, which are to be sawn up this fall and winter.

The Canadian Fairbanks-Morse Co., Montreal, have been awarded the contract for the conveying machinery for the addition to the No. 1 elevator for the Montreal Harbor Commission.

Windsor, Ont.—The Windsor Industrial Bureau was organized on Aug. 19 in the Board of Trade rooms. Ald. Winter was chosen chairman and T. C. Ray will be the secretary-treasurer. The Board of Trade has raised \$960 in subscriptions so far.

The Boving Hydraulic and Engineering Co., Ltd., has been reorganized with the following directorate:—President, Major R. W. Leonard; vice-president, Wm. Flavell; secretary-treas., T. H. Stinson; directors, Alex. Longwell, Sydney B. Kendall, W. K. George, Jens Orton, Boving, London, England.

Montreal, Que.—Bondholders of the Canadian Cereal and Milling Co. met here on Aug. 26 and decided upon definite plans of reorganization. It was decided to apply to Ottawa for incorporation papers and to organize a new company, which will start with a bond issue of \$300,000 and a common stock issue of about \$500,000.

The Canadian Locomotive Co., Kingston, Ont., are working on orders for thirty large locomotives for the Russian Government. Russia is thoroughly reorganizing its railway system, which will involve a standardizing of roads, and this will facilitate the filling of later orders by Canadian concerns. The Canadian Locomotive is also filling orders for the Federal Government.

Hamilton, Ont.—In addition to the 400-foot extension to the plant of the Steel Company of Canada, in which have been installed a number of presses for making shells, the company is at work now on a new open hearth furnace for the purpose of supplying raw material

for shell making. This new departure will enable the company to secure a primary profit in addition to that of mere assembling of shells.

The Canada Steamship Lines have about twenty per cent. of their vessels serving on the ocean traffic at the present time. While the passenger business of the company, taken altogether, has not been quite up to normal this season, revenue from ocean freight traffic has been substantial. Lake freight rates are high this season, and traffic from the west will be a paying proposition. It is stated that after the interlake season closes a considerable proportion more of the freighter fleet will be transferred to the ocean trade, and in this way a revenue will be maintained during some four months that is usually a blank on the company's books.

General Industrial

London, Ont.—Beatty Bros. will build an addition to their factory to cost \$3,000.

Ridgetown, Ont.—D. P. McNorgan of London, Ont., contemplates erecting a flour and grist mill here.

St. Marys, Ont.—William Weir has bought the old Brown Milling Co. property and will convert it into a knitting mill.

Hamilton, Ont.—The Frost Wire Fence Co. will build an addition to their factory. G. E. Mills is the general contractor.

East Toronto, Ont.—One thousand dollars damage was done by a fire which broke out in the drying plant of the Chapman Brock Co., Dawes Road, on August 30.

Vancouver, B.C.—The W. H. Malkin Co. will build a factory. Machinery for the manufacture of food products, etc., will be required.

Parry Sound, Ont.—A fire caused by lightning destroyed two drying houses at the Canadian Explosive Co. plant here on Aug. 24.

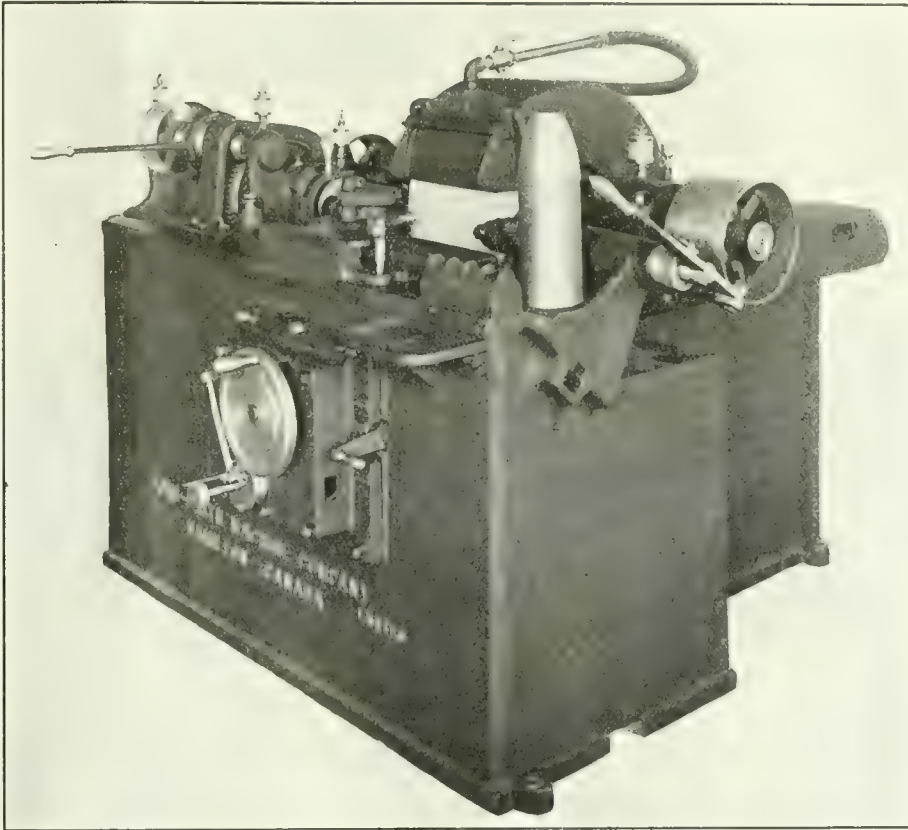
Montreal, Que.—C. H. Johnson & Sons, Ltd., will build an addition to its factory to cost \$3,000. The company manufactures wire guards for machinery and other wire goods.

Railways-Bridges

Hamilton, Ont.—A hydro-radial line to St. Catharines and intermediate points is projected.

Three Rivers, Que.—Operations have commenced on the construction of a

The Ford-Smith Shell Grinder



Cut shows truing device in position on machine arranged for finishing 4.5 shells in one operation.

Unskilled help only required to finish your shells accurately on this Grinder. Does the work of three to five lathes.

Operated entirely from one position; right in front of machine. Nothing to get out of order, and with Belt Power and rigidity to spare.

Our latest model, shown above, is the heaviest and most powerful Grinder on the market for finishing Shrapnel and High Explosive Shells.

Fifty-three of these Grinders are in operation in Canada, United States, and Great Britain, at least one-third of these being repeat orders.

We have evolved a very simple, efficient and inexpensive method of truing the wheel, using the diamond device only occasionally, and eliminating a big source of expense over earlier practice.

Shells ground in one operation on this machine are true and concentric from base to nose, and the finish is perfect.

We also arrange the machine to grind either body or nose separately for customers whose sequence of operations falls short in this respect.

This machine will solve your lathe question on the finishing operation, and release lathes more suited to roughing and other operations.

The machine is sold complete, ready to run on your particular shells, and our expert's service included. This is not a superficial showing off of the machine, but includes the instruction of your own operators to produce the output.

Get the price and further particulars to-day. Deliveries from stock or within one week.

List of users on application.

The Ford-Smith Machine Company, Limited
HAMILTON, CANADA

FOR SALE BY

The H. A. Stocker Machinery Co.
572 W. Randolph St., Chicago

LATHES

- 1-12" x 1' Pratt and Whitney R. & F. rest
- 1-12" x 5' Pratt and Whitney R. & F. rest and taper
- 1-14" x 6' LeBlond Comp. Rest
- 8-14" x 6' Hendey quick change gear
- 1-12" x 6' Perkins Comp. Rest and turret
- 1-16" x 6' Hendey
- 1-16" x 9' Hendey
- 1-14" x 6' Lodge and Shipley
- 1-18" x 12' Flather with turret
- 1-18" x 11' Lodge and Davis taper attachment
- 1-18" x 8' Fairbanks taper attachment
- 1-20" x 8' Putnam C. R.
- 1-20" x 6' Deaper C. R.
- 1-24" x 10' Hendey taper attachment
- 1-25" x 16' New Haven C. R.
- 1-26" x 14' Gleason C. R. and taper
- 1-30" x 12' New Haven C. R.
- 1-36" x 12' Bradford C. R.
- 1-38" x 18' Putnam C. R.

GRINDERS

- 2-No. 2 Lands Universal
- 1 No. 1 Brown and Sharpe Universal
- 1-Sellers Tool Grinders, Wet
- 1-No. 2 Norton Universal
- 1-Saxon Vertical Cylinder
- 1-Ransom 30" Disc
- 1-Ransom 14" Disc
- 2-Osterheim No. 2 Universal
- 1-Bath No. 1 Universal

SHAPERS

- 1-14" Gould and Eberhardt B.G.
- 1-15" Pratt and Whitney S. G.
- 1-15" Hendey Friction
- 1-15" Steptoe S. G.
- 1-16" Smith & Mills S. G.
- 1-16" Gould and Eberhardt B. G.
- 1-16" Walcott S. G.
- 1-16" Rockford speed box
- 1-24" Cincinnati B. G.
- 1-30" Hendey Friction
- 1-34" Walcott Geared

MILLING MACHINES

- 1-No. 26 Kempson Universal
- 1-No. 14 Becker Universal
- 1-No. 2 Owen Plain Vert. spindle
- 1-No. 15 Garvin Plain
- 2-No. 3 Fox Hand and Power
- 1-No. 2 American Plain
- 1-No. 25 Becker Plain
- 1-No. 2 Kearney and Trecker cone head vert. sp.
- 1-No. 5 Hendey Lincoln
- 1-No. 13 Pratt and Whitney Lincoln

POWER PRESSES

- No. 42 Robinson Geared Straight Sided Double Crank
- No. 5 R. & K. Open Back Incl. Geared
- No. 5 M.R. & K. Geared
- No. 95 Bliss Flywheel Straight Sided
- No. 40 Perkins
- No. P2 Ferracute
- No. 19 Bliss
- No. 3 Walsh
- No. 4 R. & K.
- No. 3 Toledo
- No. 34 Toledo Geared
- No. 2 Amer. Can Horn
- No. 5 L. & A. Single End Punch
- Humphrey Single End Punch, 1 1/2" capacity
- No. 5 L. & A. Multiple Punch
- No. 1 Bliss Double Action Toggle
- 400 lb. Bliss Board Drop Hammer

DRILLING MACHINES

- 20" Barnes wheel and lever
- 21" Aurora, complete with Tapping Attachment
- 24" Aurora Std. Hd. complete
- 24" Barnes Stat. Head
- 25" Cincinnati Speed Box and Tapping Attachment
- 25" Prentice Bros., complete
- 26" Barnes, complete
- 28" Hamilton, complete
- 34" Barnes, complete.
- 50" Prentice Bros.
- 26" Baker Bros. Heavy Duty Style F
- 2" Poschek Radial
- 2" Universal Radial Drill Co. Plain Radial
- 5" Western Full Universal Radial
- 20" Barnes 3 sp. Gang Drill
- 14" Barr 3 sp. Sensitive Drill

TURRET MACHINERY

- 16" Warner and Swasey 1 1/4" Cap. screw machine
- No. 12 Garvin wire feed screw machine
- 2 1/4" Pearson wire feed screw machine
- 5/8" Pratt and Whitney screw machine
- 5/8" Pratt and Whitney screw machine
- 1/2" Cleveland automatic screw machine
- 3/4" Cleveland automatic screw machine
- No. 52 National Acme automatic screw machine
- No. 54 National Acme automatic screw machine
- 21" Davis Turret Lathe Power Feed
- 21" Fay & Scott Turret Lathe
- 18" x 6" Lodge & Davis Turret Lathe, power feed

PLANERS

- 10" x 21" x 5 Pease
- 21" x 21" x 4 New Haven
- 21" x 7" x 6 Pease
- 21" x 20" x 8 Cincinnati
- 40" x 28" x 14 Putnam
- 42" x 42" x 12 New Haven
- 41" x 41" x 14 Detrick & Harvey Open Side
- 41" x 41" x 12 L. W. Pond
- Morton Portable

BORING MILLS

- 11" King Vertical 2 Heads
- 21" Colburn Vertical, 1 Turret Head
- Franklin Horizontal
- 48" Niles Car Wheel

GEAR CUTTER

- 20" Gleason Revol Gear Generator
- 26" Blasher Spur Gear Cutter

street railway. The Three Rivers Trac-tion Co. are the owners.

Guelph, Ont.—The Toronto Suburban Railway have almost completed the new electric railway from Toronto to Guelph. Some overhead construction has still to be finished at this end.

Trenton, Ont.—The council will probably submit a by-law shortly for the purpose of authorizing an issue of debentures for \$40,000 to cover the town's share of a new bridge. The total cost is estimated at \$127,183, the Government paying the balance.

Windsor, Ont.—Plans for a \$45,000 bridge on Wyandotte Street, across the M. C. R. tracks, have been approved of by the city council, and the city solicitor has been instructed to make application to the Dominion Railway Board for an order directing the work to be done.

Winnipeg, Man.—The laying of steel on the twenty-five miles of grade east of Foremost, Alta., on what will ultimately be known as the Lethbridge-Weyburn branch of the Canadian Pacific Railway will be started immediately, it has been announced. It is the intention of the company to rush the work to completion as fast as possible.

Refrigeration

Amherstburg, Ont.—The Falls Barron Co. will build a cold storage plant to cost \$10,000.

Victoria, B.C.—The establishment of a public abattoir is being considered by the city council. Estimated cost of plant is \$20,000.

Amherstburg, Ont.—The erection of a cold storage plant, at an estimated cost of \$10,000, is contemplated by the Falls Barron Co. of this town.

St. Thomas, Ont.—The St. Thomas Packing Co., Ltd., may rebuild a portion of their plant, which was recently destroyed by fire. General Manager, J. Moody.

Tenders

Tavistock, Ont.—Tenders will be called at once for the erection of a distribution station in Tavistock for hydro-electric power.

Winnipeg, Man.—Tenders are now being called for the construction of a bridge at Headingly, to be built by the municipality of Assiniboia, with assistance under the Good Roads Act.

Toronto, Ont.—Tenders will be received up to Tuesday, September 7th,

1915, for constructing radial brick chimney for incinerating plant on Don Roadway. Specifications and form of tender may be obtained at Street Commissioner's Office.

Regina, Sask.—Tenders will be received by the City Commissioners up till Monday, September 6, 1915, for the supply, delivery and erection of a 7,000,000-gallon pumping unit at the city power house. Specifications and other information may be obtained from J. M. MacKay, superintendent of waterworks, Regina, Sask.

Quebec, Que.—Tenders for storage dam at the outlet of Lake St. Francis will be received at the office of the Quebec Streams Commission, Room 264, Parliament Buildings, Quebec, until Tuesday, September 7, 1915. Plans and specifications can be seen at the above office or at the Quebec Streams Commission's office, Room 803, McGill Building, Montreal.

Berlin, Ont.—Tenders will be received by the City Clerk until Tuesday, September 7th, 1915, for the construction of sewage disposal works, comprising tanks, filters, sludge beds and pumping station. Plans and specifications may be seen at the office of the Consulting Engineers, Chipman & Power, 204 Mail Building, Toronto, also at the City Engineer's Office, Berlin.

Toronto, Ont.—Tenders for underground work, addressed to the Chairman of Toronto Electrical Commissioners, will be received until Tuesday, Sept. 7. Details of work to be performed consisting of laying cable ducts, building manholes and transformer vaults. Plans specifications and form of tender may be obtained at the Purchasing and Engineering Dept., 15 Wilton avenue.

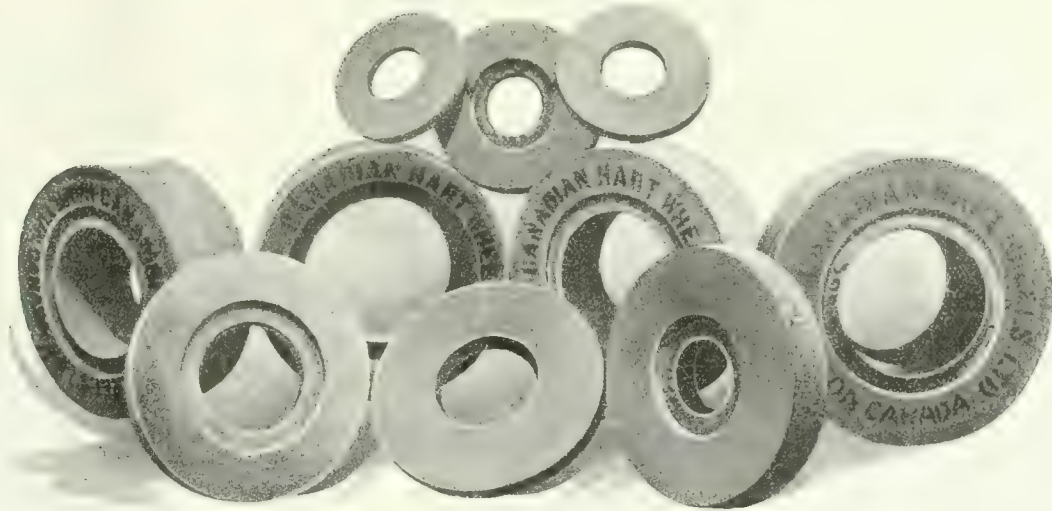
Ottawa, Ont.—Tenders will be received at this office until Wednesday, September 8, 1915, for the construction of station, water tank, engine-house, transfer platform, standpipe pit, ash pit and turntable foundations for the Carleton Point Car Ferry Terminal, Prince Edward Island. Plans, specifications, and form of tender may be obtained from the chief engineer, Department of Railways and Canals, Ottawa; the chief engineer, Canadian Government Railways, Moncton, N.B.; and the engineer in charge, Car Ferry Terminals, Carleton Point, P.E.I.

Personal

R. A. Spawton, of Halifax, N. S., is to be appointed purchasing agent of the Department of Marine and Fisheries at Halifax.

P. J. Flynn, present manager of the Winnipeg joint terminals, has been ap-

Shrapnel and High Explosive Grinding Wheels



Just a few of the many shapes and sizes we are making for this work are here illustrated, all made of our own artificial abrasive

“REXITE”

(CORUNDUM)

by either silicate or vitrified process, can give you the names of many satisfied customers for whom we have **increased production and lowered costs.**

Ask our Service Department for information concerning your grinding needs.

Canadian Hart Wheels, Limited

MANUFACTURERS OF GRINDING WHEELS AND MACHINERY

HAMILTON, CANADA

IMMEDIATE DELIVERY

We always carry a large stock of machine tools for general manufacturing purposes, and solicit inquiries requiring prompt delivery.

We call attention to the following, on which we will quote attractive prices. All in thoroughly first-class condition:

- Three 36" Fellows Gear Shapers.
- Two 36" Brown & Sharpe turret head vertical boring mills.
- One 30" throat Putnam heavy punch and shear, capacity 1" hole in 1" plate.
- One 72" King vertical boring mill with two heads.
- One 48" Bement car wheel borer with crane.
- One 38" Baush vertical boring mill, two heads.
- One 39" Niles vertical boring mill, two heads.
- Two 36" Snyder upright drills, power feed, etc.
- Two 5' Bickford radial drills.

Girard Machine and Tool Co.

491-493 N. Third Street, Philadelphia, Pa.

pointed superintendent at Winnipeg for the Canadian Northern Railway.

W. J. Doherty has resigned the position of general sales manager of the Northern Electric Co., Montreal, with a view to going into business in Chicago.

John McMillan, formerly manager of the Ontario factory of L'Air Liquide Society, Paris, France, is now handling the oxygen department of Lever Brothers, Ltd., Toronto.

Major C. N. Monsarratt, who is chief of the board of engineers of the Quebec Bridge, has succeeded Lieut.-Col. J. G. Ross as officer commanding the 5th Royal Highlanders of Canada.

Thomas R. Hilyard, surviving member of the original firm of Hilyard Brothers, shipbuilders and mill owners of St. John, N.B., died at his residence on Douglas avenue on Aug. 19. Mr. Hilyard was in his 74th year.

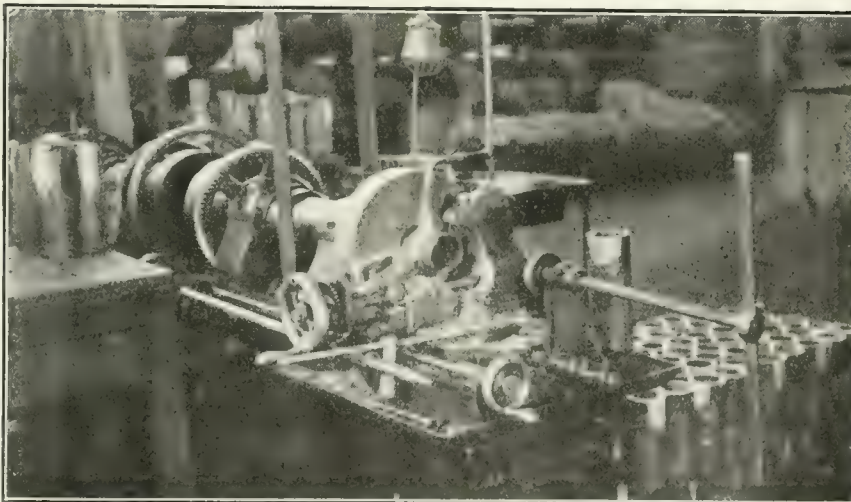
F. W. Wegenast, barrister, announces that he has severed his official connection with the Canadian Manufacturers' Association, and has opened an office for consultation and general practice at 901 Traders Bank Building, Toronto.

Hon. Frank Cochrane, Minister of Railways, leaves on the 5th of September for a tour of inspection of the Transcontinental and Grand Trunk Pacific Railways. It is expected that Mr. Cochrane will go through to the coast.

John A. Carrick of Port Arthur, and at one time assistant general manager of the Queen City Oil Co., died in Toronto on Aug. 24. Mr. Carrick was the father of Lieut.-Col. J. J. Carrick, M.P., of the headquarters staff of the Canadian Expeditionary Force.

William Leach, president and manager of the Leach Concrete Co., Toronto, died at his home, 353 Palmerston Boulevard, on August 27. He was in his 48th year. Deceased was born in London, Eng., and had lived in Toronto for 35 years, establishing the business fifteen years ago.

A. B. Stanbury, who has been measuring surveyor of shipping for the Port of Toronto since 1908, has resigned. William Evans, inspector of hulls and equipment; John Dodds, James B. Stewart and George M. Arnold, inspectors of boilers and machinery, all of Toronto, have been appointed as officers to superintend the survey and measurement of ships and surveyors of accommodation for seamen at the Port of Toronto.



Cutting off open ends of shells on a "Hurlbut-Rogers" machine.

DIVIDES CUTTING-OFF COSTS IN TWO

Stock cutting will cost approximately one-half as much as at present after you've installed a

Hurlbut-Rogers Cutting-Off and Centering Machine

A big producer because there are **two tools** instead of one, working in the same cut. One tool presses up and the other down, each one acting as a rest for the other. By means of a simple arrangement the speed of the spindle is gradually accelerated as the tools approach the center, thereby maintaining the most economical cutting speed throughout the operation.

It's a big paying investment for any shop. Actually pays its own cost within a few months. Ask us to send full details. Write to-day.

The Hurlbut, Rogers Machinery Company

South Sudbury,
Mass., U.S.A.

FOREIGN AGENTS—England, Chas. Churchill & Co., Ltd., London, Manchester, Glasgow and Newcastle-on-Tyne. H. W. Petrie, Toronto, Canada.



**FINISHING 18 Pr.
LYDDITE SHELL BASES**



C.M.C. ENGINE LATHES

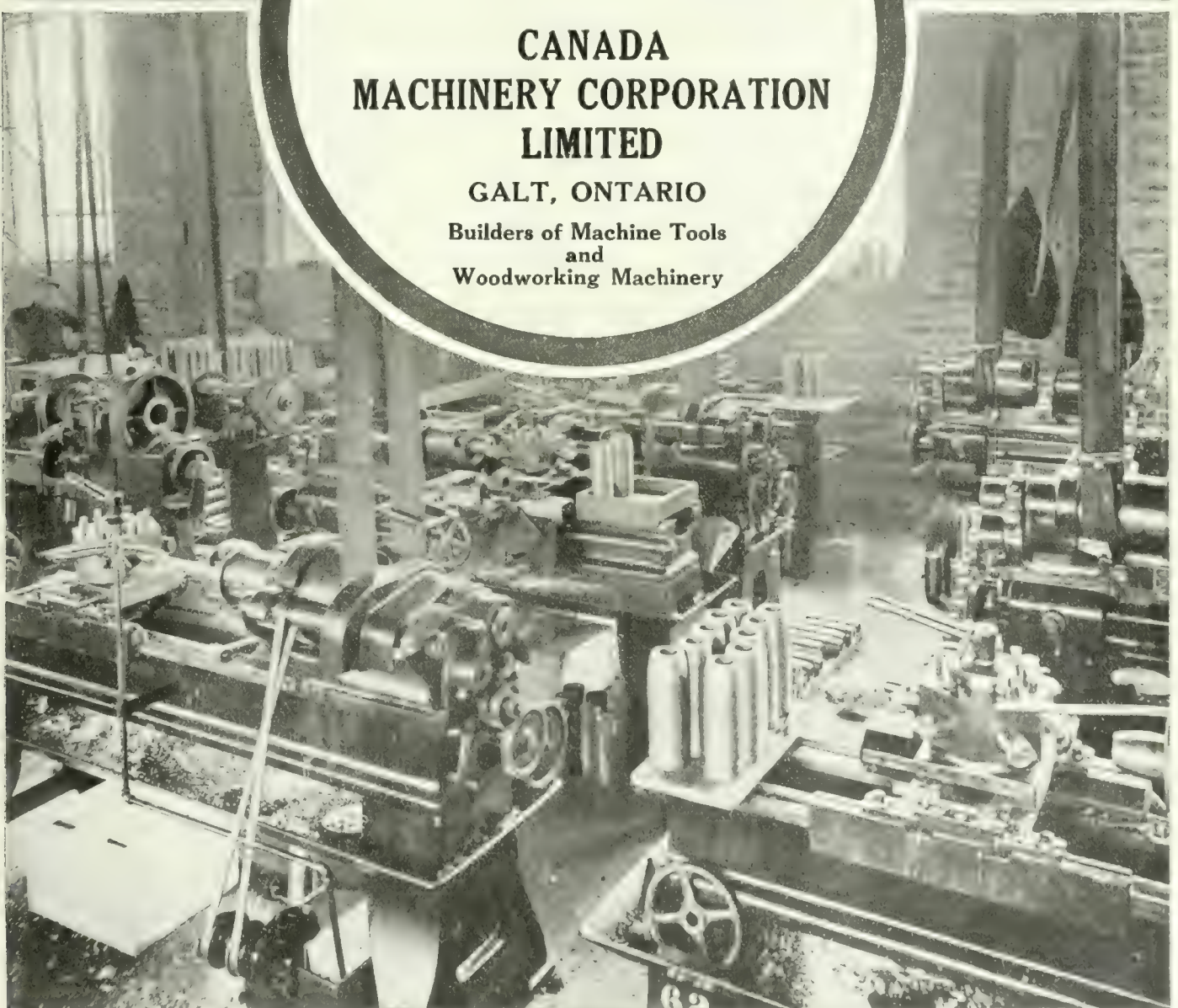
Our Lathes, with and without turrets, are installed in the works of the shell makers in Canada.

They are maintaining their reputation for accuracy and rigidity under the most severe service.

Write for prices and deliveries

**CANADA
MACHINERY CORPORATION
LIMITED**

GALT, ONTARIO
**Builders of Machine Tools
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Woodworking Machinery**



INGOT METALS

ANTIMONY,
TIN, COPPER,
LEAD, ZINC,
ALUMINUM

In stock and for
import.

A. C. LESLIE & CO.
LIMITED
MONTREAL

Costs and Output

are your difficult Factory problems this year. On War Munitions and Supplies, deliveries must be made. Every minute you can save in manufacture helps to reduce your Costs. On other lines, many of them with markets restricted, every possible cent of production cost must be saved. Competition must be met and men must be kept at work; this puts it right up to the factory.

SEE OUR EXHIBIT

at the Canadian National Exhibition, in the Process Building, right opposite the Hydro-Electric. Everything is connected up and working, and you will get suggestions of use to you.

Time and Cost Recording Apparatus.

Telephones for all purposes.

Bells, Annunciators, Fire Alarm Systems, Watchman's Clocks, and other Electrical Specialties.

We have the best in every line, and prices are right. It will be 10 minutes well spent.

LINTZ-PORTER CO.
27 Yonge St. Arcade TORONTO
Main 482

R. W. ASHCROFT HONORED

A NUMBER of American manufacturers, such as the Winchester Repeating Arms Co., the Yale & Towne Mfg. Co., Berry Brothers, Ltd., L. S. Starrett & Co., and thirty-six others, who are members of an organization known as the Rice Leaders of the World Association, have conferred a high honor on one of Montreal's business men.

Somewhat over a year ago, they offered nearly \$3,500 cash prizes for ideas and suggestions. This was open to anybody, and the ideas and suggestions could relate to production, sales, advertising or anything else.

The object of the offer was to develop suggestions that would tend to improve the methods or products of these American manufacturers.

But one idea could be submitted to each manufacturer, no two ideas could



R. W. ASHCROFT.

Manager of publicity for the Canadian Consolidated Rubber Co., Limited.

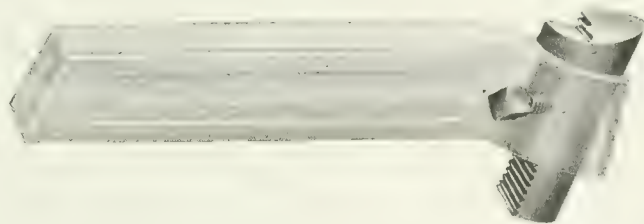
be alike, and each idea had to be compressed into fifty words.

Thousands of Americans entered the contest, together with a few Canadians, Britishers and others, and the Second Prize of \$500 cash has been won by a Canadian, R. W. Ashcroft, of Montreal, who is manager of publicity for the Canadian Consolidated Rubber Co., Limited, and Associated Companies.

In presenting the prize, Elwood E. Rice, president of the association, wrote Mr. Ashcroft as follows:

"To have earned this second prize in this international competition where people in all walks of life from all parts of the world entered, is cer-

For Turning Shrapnel



Correct cutting contour and angles.
Correct heat treatment.
No forging or tool dressing.
No heat treating.
Maximum output.
Tools for all operations.

SEND FOR CATALOG

The Ready Tool Company

BRIDGEPORT, CT.



“Hercules” Twist Drills

FOR HIGH EXPLOSIVE SHELLS

PROOF OF THE BACKBONE OF A DRILL IS IN DRILLING SHELLS.

IF A DRILL HAS ANY WEAKNESS THIS CLASS OF WORK WILL QUICKLY BRING IT OUT.

THE “HERCULES” HAS SCORED A WONDERFUL SUCCESS IN MUNITION PLANTS—A FACT THAT STRONGLY RECOMMENDS IT FOR ANY DRILLING JOB IN THE PLANT.

The “Hercules” superiority is due to the use of High Percentage Vanadium High-Speed Steel and the only “Twisted-While-Hot-Process” that retains all the strength of the steel in the finished drill. The backbone is all there because the grain of the steel is undisturbed, insuring longer edge-holding and greater resistance to the strains of drilling the toughest of metals.

We also make special Finishing and Roughing REAMERS for shells.

The Whitman & Barnes Mfg. Co.

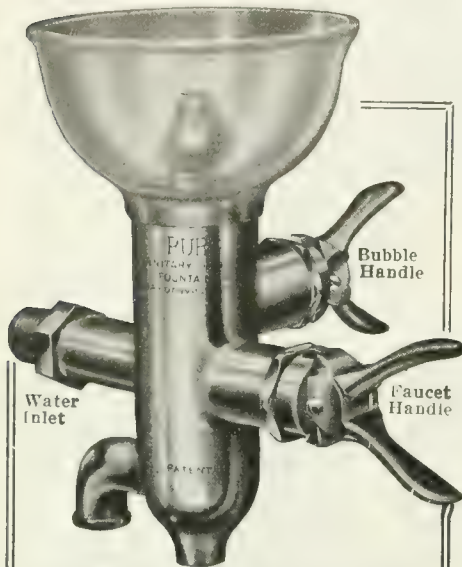
Established 1854

St. Catharines,
Ontario

I BELIEVE

*In Safety First and always.
In providing for the Health of my Fellow Workmen.
In Light and Air and Sanitary Working Conditions.
In clean, fresh drinking water for everybody.
In the Safety, Economy and Man-betterment of the*

PURO SANITARY DRINKING FOUNTAIN
(MADE IN CANADA)



The loss of a man through impure drinking water is a crime that "the front office" must bear.
An ugly statement, isn't it? But true, absolutely.
When a man comes to work in your factory he puts his health in your keeping.
Are you willing to take chances on such a trust?
Impure drinking conditions are responsible for more tragedies than any machine ever built.
Apply the "Safety First" Principles to your water supply; don't deny you men a clean, fresh drink of water.
Conserve their health and they will improve your profits; mark yourself as worthy of the name of "employer."
Install the Gold Medal winner Puro in your plant; office and shop alike.
The only Sanitary Drinking Fountain that is safe, sanitary, simple, automatic in control and easily attached.
Let us tell you just what it will cost you to

"PURO - FY"

YOUR WATER SUPPLY
Puro Sanitary Drinking Fountain Company
147 University Ave., Toronto, Canada

PATENT ATTORNEYS

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47 Central Chambers, Elgin Street,
OTTAWA, CANADA (Near Serv. Patent Office)
Associate work for the Legal Profession before the Government Patent Office, a specialty.
Cable address "Cquin Ottawa."

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In all countries. Ask for our Inventor's Adviser, which will be sent free.
MARION & MARION, 364 University St.
Merchants Bank Building, corner St. Catherine St., MONTREAL, Phone Up 6474 and Washington, D.C., U.S.A.

Save \$40 to \$90 on First Cost
With Dickow's 10-Inch Universal Index Centers
We are originators of design. You save from \$40 to \$90 on first cost, and many times that by their simple construction and consequent ease of operation.
Let's prove it to you.
Price Only \$85 Net, F.O.B. Cars Chicago
Get the Original—Accuracy Guaranteed
Sold by all dealers. Write to-day for particulars
Fred. C. Dickow, 37 So. Desplaines St., Chic 40, Ill., U.S.A.

tainly a great evidence of your unusual ability, and in which you are indeed justified in taking exceptional pride.

"I extend to you my best wishes for the continued success your able efforts so richly deserve."

This is not only a feather in Mr. Ashcroft's cap, but is also a compliment to the business ability of Canadians, particularly in view of the fact that Mr. Ashcroft only heard of the contest a few weeks before it closed last May, and therefore had but very little time in which to compile and submit his ideas.

No special publicity was given to the contest in Canada, so those resident in the United States, who had a whole year in which to evolve ideas, naturally had a better opportunity than Canadians to successfully compete.

Contracts Awarded

Brampton, Ont.—The Copeland-Chat-terson Co. have let the contract for an addition to their factory to Hill & McCulloch.

Renfrew, Ont.—The Renfrew Electric Co. recently received a large order from the Northern Electric Co., which hitherto had been buying these particular goods from an American concern.

Montreal, Que.—The contract for the structural steel for the addition to No. 1 elevator for the Harbor Commission has been let to the Dominion Bridge Co., Lachine, Que.

The Canadian Brakeshoe Co., of Sherbrooke, Que., have placed an order for the installation of a Snyder electric furnace for the melting of steel. The steel will be used for the manufacture of 4 in. rounds to be forged into shells for the British Government. The Snyder electric furnace is being installed under guarantee as to operating cost. These furnaces are built by the Snyder Electric Furnace Co., Chicago, Ill.

Wood-Working

Matsqui, B.C.—T. Z. Smith will build a factory for the manufacture of boxes.

Sidney, N.S.—Wrights, Ltd., will build a furniture factory to cost \$25,000.

Petrolia, Ont.—R. D. Hall will build a factory for the manufacture of gates and woodenware of all kinds.

Montreal, Que.—H. A. Brochu, 294 St. Catherine street, east, is asking information and prices on wood-working machinery, etc.

Bishops' Falls, Nfld.—The Albert F. Reed Co. plans the erection of a factory for the manufacture of wood pulp, lumber, timber, etc.

WANTED

NEW INVENTIONS

Send for full list of inventions wanted by manufacturers. Get a copy of our new Booklet "REFERENCE GUIDE FOR INVENTORS." It tells about how to obtain a patent and every inventor should have a copy. If you have any inventions worked out, make a sketch and number the parts. Send it with a description of it in your own words, referring to the parts by numbers. Tell how it works, and state its advantages. If you send model be sure that it bears your name, so that we can tell by whom it is sent. Free Search of Patent Office Records. It may mean your fortune. \$45,000 paid for some inventions. \$10,000 offered for others. Write us at once. Send names of others you know to be interested in inventions.

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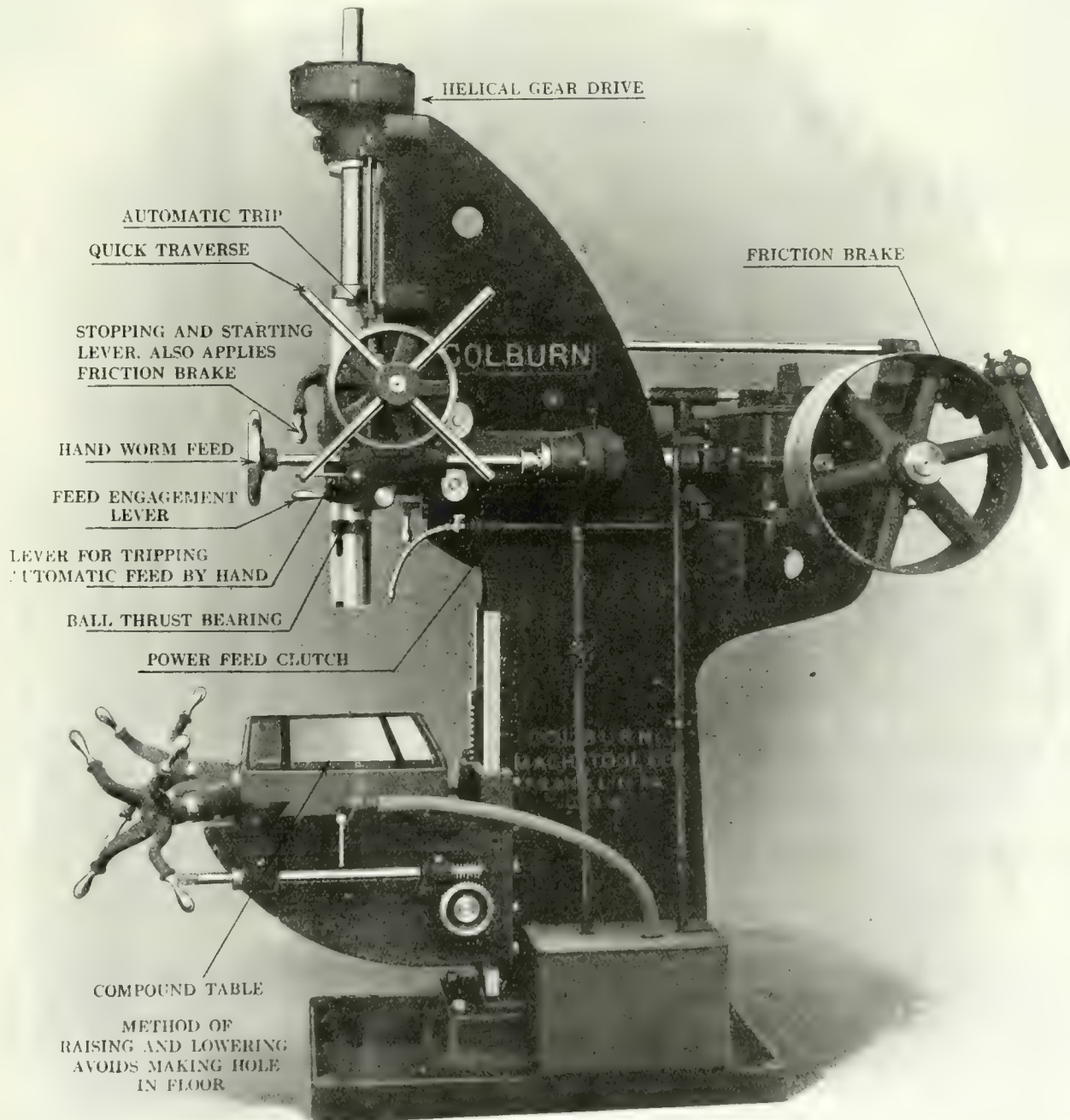
DRILLING SHELLS

That's "COLBURN" Work

"Colburn" work because it's hard work in tough metals — a case of drive, drive, drive, day and night. Speed is the thing—and these are conditions Colburn Drilling Machines were built to meet and do meet, for we are shipping lots of them to manufacturers here and abroad for shrapnel work and for drilling lyddite shells.

Colburn Heavy Duty Drill Presses are powerful, stiff and rigid. There is absolutely no spring, drill breakage is small and drills wear long between grinds.

Bulletins and complete description.



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

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

OUTGROWN EQUIPMENT — Lathes, Planers, Drill Presses, Bolt Cutters, Grinders, Blowers, Key Seaters, Millers, Steam Hammer, Punch Presses, Wood-working and Tinsmith's Machinery. Send for descriptive list. Attractive prices — prompt deliveries.

Port Huron Engine & Thresher Co.
PORT HURON, MICH.

Morton Manufacturing Co.

Draw Cut Shapers,
Special Draw Cut
R.R. Shapers,
Special Locomotive
Cylinder Planers.

Portable Planers,
Stationary & Portable
Key Way Cutters,
Finished Machine
Keys.

Office & Works, Muskegon Heights, U.S.A.

METAL STAMPINGS

We are manufacturers of stamped parts for other manufacturers.

We do any kind of sheet metal stamping that you require. Our improved presses and plating plant enable us to produce the finest quality of work in a surprisingly short time.

We can finish steel stamping in Nickel, Brass or Copper.

Send us a sample order.

W. H. BANFIELD & SONS
120 Adelaide St. W., Toronto

Classified Advertisements

† Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises, should not fail to use the Waut Ad Page of "CANADIAN MACHINERY."

ONE DOUBLE END PUNCH AND SHEARS, 22" throat, about 7,000 lbs. This is new; punched one bridge, \$700.00; also one 37" for at punch, 1 1/2". A. Dick & Sons, Alton, Ont.

WANTED—DRAWINGS OR BLUE PRINTS of turrets suitable to go on carriages and also on shears of 14", 16", 18" and 20" engine lathe. Box 154, Canadian Machinery.

IMMEDIATE DELIVERY

ENGINE AND TURRET LATHES.

14" x 5' Putnam (2).
16" x 6' Flather (6).
16" x 6' Flather, Taper Attach.
18" x 6' Barker (6).
18" x 8' Barker.
20" x 10' Porter.
28" x 12' Fifield.
2 x 24 Jones & Lamson Turret Lathe.
26" Draper Turret Lathe, 1 1/2" hole.
28" Pond Rigid Turret, 4" hole.
30" Lodge & Shipley Turret Lathe.
2" Bardons & Oliver Screw Machine.
2 1/4" Pearson Screw Machine.
1/2" Hartford Automatics (2).

MILLING MACHINES.

Whitney Hand Millers (13).
No. 3 Fox Hand and Power Millers (2).
No. 12 Garvin, Hand and Power (2).
No. 1 Brown & Sharpe Plain Millers (6).
No. 9 Kempsmith, plain.
No. 6 Grant Manufacturing Miller.

ABOVE PARTIAL LIST ONLY.

A. D. White Machinery Co.
108-114 N. Jefferson St., CHICAGO

Bury, Que.—L. H. Martin, whose saw-mill was recently destroyed by fire, with a loss of \$8,000, will rebuild and will be in the market for new machinery.

Catalogues

Norton Ball Bearing Jack made by A. E. Norton, Ltd., Coaticook, Que. Catalogue No. 28 describes a complete line featuring the various types of ball-bearing jacks. Tables give the principal dimensions, weight and list price of each size, and are accompanied by illustrations of the different types and repair parts. Interested readers may obtain copies by writing the company.

Link-Belt and Sprocket Wheels.—The Link-Belt Co., Philadelphia, Pa., are distributing Section A of general catalogue No. 110, dealing with the original "Ewart" detachable link-belt and sprocket wheels. A large number of full-size cuts are shown of standard and special sizes of "Ewart" link-belts and a number of attachments are also illustrated. The catalogue also contains a brief description and price list of attachments, also price lists of sprocket wheels and "Ewart" detachable link-belts.

Betson's Plastic Fire Brick for one-piece boiler furnace linings is the title of a 20-page booklet being distributed. The Betson Plastic Fire Brick Co. Rome, N.Y., make this material. The booklet tells how to construct a solid gas-tight, one-piece boiler furnace lining throughout from this plastic refractory material without the use of any special tools. It gives directions for the testing of boiler settings for air leaks, and for the immediate repair, without shut-down, of cracks and holes, to preserve the life of ordinary brick linings to the time when they can be replaced. Illustrations and diagrams show the one-piece lining as applied to the several types of boilers in general use. Copies of this book will be sent on request to those concerned with the management of boilers.



VULCAN CRUCIBLE STEEL COMPANY, ALIQUIPPA, PA.



HYDRAULIC BANDING AND NOSING PRESSES



FOR SHRAPNEL AND LYDDITE SHELLS

Illustration No. 1,

The Goldie & McCulloch Banding Press.

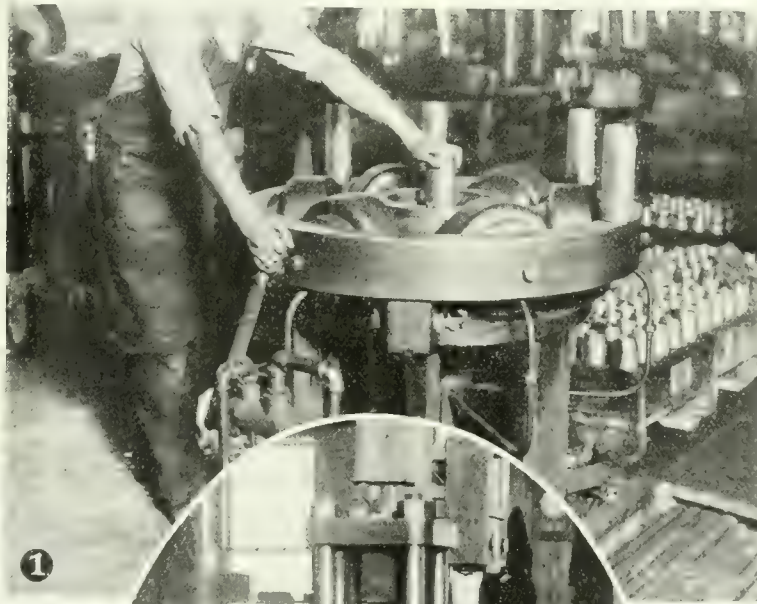
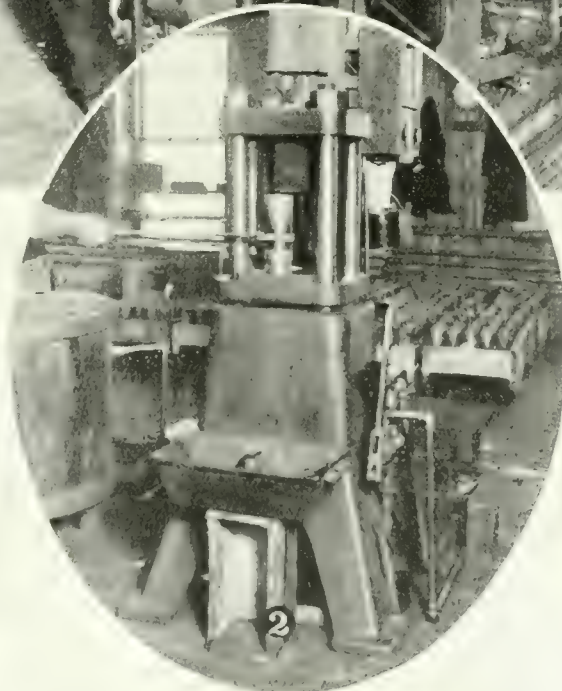


Illustration No. 2,

The Goldie & McCulloch Nosing Press.



MADE FROM THE BEST GRADE OF MATERIAL, AND EVERY STEP IN THEIR MANUFACTURE IS WATCHED WITH GREAT SCRUTINY TO ASSURE THE HIGHEST DEGREE OF EFFICIENCY, ACCURACY AND DURABILITY.

USED IN QUITE A NUMBER OF SHOPS IN CANADA, AND ARE GIVING HIGHEST SATISFACTION. DROP US A LINE FOR INFORMATION REGARDING THE NECESSARY HYDRAULIC EQUIPMENT FOR OPERATING THESE MACHINES.

The GOLDIE & McCULLOCH CO., Limited

Head Office and Works: GALT, ONTARIO, CANADA

Toronto Office:
Suite 1101-2,
Traders Bank Bldg.

Quebec Agents:
Ross & Greig,
412 St. James St.,
Montreal, Que.

Western Branch:
248 M. Dermott Ave.,
Winnipeg, Man.

British Columbia Agents:
Robt. Hamilton & Co.,
Vancouver, B.C.

Builders of High-Grade Power Equipment, Steam Engines, Turbines, Water Tube and Return Tubular Boilers and Transmission Machinery

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

Why go to the expense of buying new machines for the manufacture of

SHELLS?

We have already shipped some 75 car-loads of

Rebuilt Machine Tools

to CANADA since the outbreak of the war, with absolute satisfaction in each case.

If you need any equipment it will be to your advantage to get in touch with us as our facilities for furnishing rebuilt machinery are second to none on the continent.

EVERY MACHINE WE BUY IS PUT THROUGH OUR OWN SHOPS AND COMES OUT IN ABSOLUTELY PERFECT ORDER—AND WE STAND BEHIND EVERY ONE WE SELL.

The demand is enormous, but we are not taking advantage of the war by putting on exorbitant prices—our aim is a good, square deal to everybody all the time. You can often get something practically equal to a new machine at a very great saving in price.

As we carry a large stock, we can likely supply you from stock, or if we cannot do this, we will take your order for future delivery, specifying a definite time when we will supply you with such tools as you may require.

New York Machinery Exchange
50 Church St., New York

ACCURACY



Because a small diameter screw enters the tapped hole is no guarantee that it fits properly.

The pitch may be long or short, and therefore cause resistance, but be a poor fit.

Cap and Set Screws should fit all the way like a shaft in its bearing.

"Galt Screws do. Try them."

Specialists in Cap and Set Screws.

THE
GALT MACHINE SCREW CO.,
GALT, ONTARIO LIMITED

For Rapid Production and Accurate Work

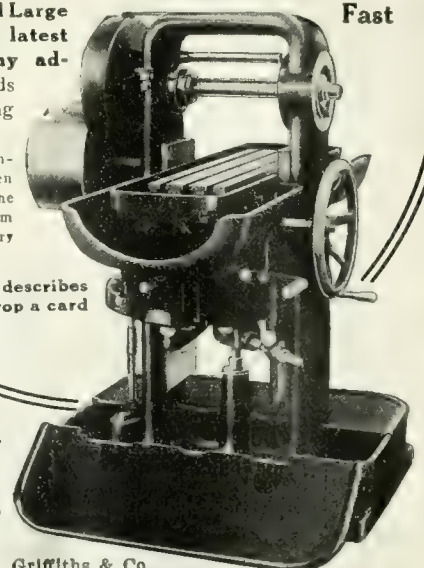
USE THE "BRIGGS"

The Briggs Miller handles work no other machine of its size can touch. It is a manufacturing machine. On account of its rigid construction it will produce accurate work when running at a high rate of speed and feed.

The Base Tank and Large Gear Pump is the latest addition to its many advantages. Tank holds 20 gallons of cutting lubricant.

Pump never requires priming and will deliver ten gallons per minute to the cutters, keeping them cool when run at very high speed.

Our booklet describes fully. Drop a card for it.



Gooley & Edlund
Inc.

Cortland, U.S.A.
Foreign Agents: Allied Machinery Company of America, France, Belgium, Italy, Switzerland, Russia, Scandinavia. C. W. Burton, Griffiths & Co., London, Manchester and Glasgow. Barandaran, Metvier, Gazeau & Cia, San Sebastian, Spain.

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

Specially designed to tap Shrapnel Shells

Made of very tough grade of machinery steel and will stand the strain of rough usage.

Adjusted from the front by means of a hardened set screw, 32 threads per inch, this securing a very fine, accurate and positive adjustment.

When once set to size, it must stay, positively no chance of slipping.

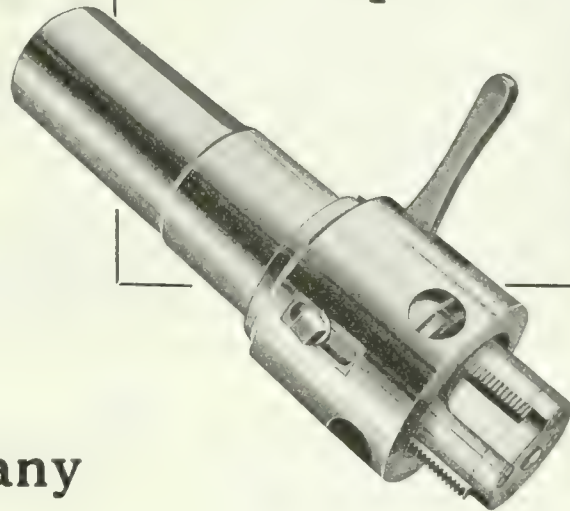
The screw at the rear end is for adjusting the tension on the throw-off or tripping spring. This is a new feature, and a very desirable one.

The object in designing this tool was to make a tap that would not only cut threads, but cut them accurately and have sufficient strength and durability to make it an economical tool for the shell maker.

The chasers are of the best grade of High-Speed Steel; they are strong and heavy and can and will stand the strain of threading shrapnel or high explosive shells.

This tap may be used in a turret head or attached to a live spindle and will work satisfactorily in either condition.

“VICTOR” Collapsing Tap



The Victor Tool Company

Waynesboro, Pa.

For Cutting SHELLS

ATKINS KWIK KUT

No. 7 SHRAPNEL SPECIAL

Fastest cutting reciprocating machine. Automatically uses entire blade at each stroke. Quick return. Blade lifts on return stroke. Hydraulic raising device—regulates pressure of blade. Guide insures accuracy. “Free from chips.” Lubricating system.

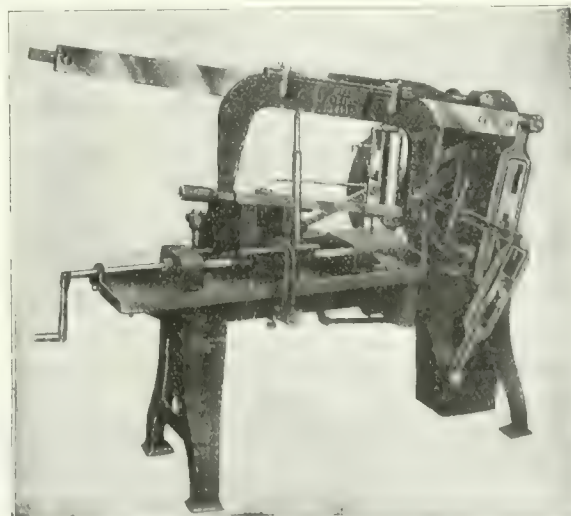
The No. 7 Shrapnel Special installed in batteries, so that one hand serves a number of machines, using AAA Special Shrapnel Hack Saw Blades, is the most **ECONOMICAL** way of cutting off Shrapnel material. Labor and tool cost much below Inserted Tooth Metal Saws, Cut-Off Machines, Shafting Lathes, etc. Write for ATKINS Metal Saw Booklet.

E. C. ATKINS & COMPANY

The **STERLING QUALITY** Saw People

Works: Hamilton, Ont. B.C. Branch: Vancouver, B.C.

A Perfect Saw for Every Purpose.



ATKINS ALWAYS AHEAD

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

Think
it
Over
—
Write
Us
To-day



Do Trade-Marks Pay? YES!

Get our new Booklet
"Trade-Marks That Pay"

(Sent to Manufacturer free of charge)

This shows how Trade-Marks have paid other manufacturers, and will give you some suggestions how it would pay you to have a Trade-Mark for your goods. Give your goods some mark of distinction so that the buyers will know and ask for YOUR SPECIAL LINE OF GOODS. Familiarize your goods by your Trade-Mark. Let us show you how it pays.

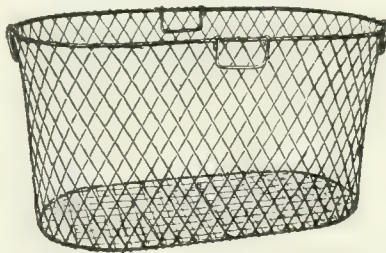
Write for Your Copy To-day.

HAROLD C. SHIPMAN & CO.
PATENT ATTORNEYS

20 Elgin Street, Ottawa (Next door to Canadian Patent Office)

**SEND YOUR PATENT WORK DIRECT
TO OTTAWA—SAVE TIME AND MONEY**

Prompt and personal attention given to all matters placed in our hands.



Dipping Baskets

Our Copper Baskets will withstand ACID. Can be made to any shape or size. Draining facilities of our wire baskets are much greater than sheet metal construction.

CANADA WIRE & IRON GOODS COMPANY
Hamilton, Ontario

AUTOMATIC WOOD SCREW MACHINES

Cable Address:
Cook, Hartford, U.S.A.

Asa S. Cook Co.

Hartford,
Conn.



WE MANUFACTURE RIVETS of every description, 1/2 inch. dia. and smaller.

PARMENTER & BULLOCH CO., LTD.
GANANOQUE, ONT.



NORTHERN CRANE WORKS, Limited
WALKERVILLE, ONT.

BUY IN CANADA!

NORTHERN CRANES

ELECTRIC AND HAND POWER
ALL SIZES, CAPACITIES AND TYPES
ALSO ELECTRIC AND AIR HOISTS
Foundry Equipment—Cupolas, Ladles, Etc.





Partridge Grinders ARE GOOD GRINDERS With The Price Ground Down.

If you don't write for full particulars, you will miss something good.

MANUFACTURED BY
E. O. PARTRIDGE
2039 Lake Street West CHICAGO

Good Canadian Agents Wanted—WRITE NOW.

This COUPON →

will bring you our **NEW BOOKLET** which will demonstrate to you the **unlimited Ways of Using an**

L'AIR LIQUIDE SOCIETY
Maisonneuve Montreal, P. Q.

Send, without obligating me, postpaid, your **NEW BOOKLET**, which I promise to read.

NAME
ADDRESS
Province Date
Business C M

OXY-ACETYLENE WELDING and CUTTING PLANT

Our **LATEST** Portable Dissolved Acetylene Plant

TWO CYLINDERS ONLY
(1 Oxygen, 1 Acetylene)

Handy, Clean, Ever-Ready, Pure Gas, Safe, Low-Priced

MADE-IN-CANADA GOODS



Welded Collector, with Flanges also Welded on.

L'AIR LIQUIDE SOCIETY
(Paid-Up Capital \$2,200,000)

26 Boler St. WEST TORONTO Maisonneuve—MONTREAL 325 William Ave. WINNIPEG

EVERYTHING in the OXY-ACETYLENE LINE, the ONLY GAS COMBINATION, worth while consideration for successful Welding and Cutting.

The Lancashire Dynamo & Motor Company, of Canada, Limited

107-109 Duke Street, TORONTO


ELECTRICAL MACHINERY for all Purposes.

ELLIOTT BROS. { INSTRUMENTS
RECORDING GAUGES



PIPE VENTILATED A C MOTOR FOR VERY DIRTY PLACES

ANACONDA BELTING



will give better service on **Grinders, High-Duty Drills, Turret Lathes** that use liquid oil composition than Waterproof Leather Belting.

WHY ?

Because it is heat, acid and water-proof.
The initial cost is 50% less than leather.

SEND US A TRIAL ORDER.

Main Belting Co. of Canada Limited
10½ St. Peter St., Montreal

WATCH FOR OUR MESSAGE IN NEXT WEEK'S ISSUE

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

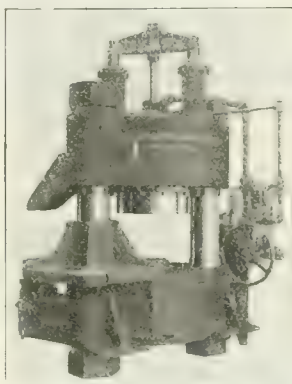
If you are hot-forging SHRAPNEL CASES you cannot afford to overlook the merits of

"HAWK" D CHROME VANADIUM STEEL

for both first and second operation Punches. This steel comes to you heat-treated and ready for use. It gives exceptional production. Many cases have been reported to us where each Punch turned out over 2,000 Shells. It does not stick to the work. This enables you to turn out more Shells, per machine, per day.

STEEL OF EVERY DESCRIPTION.

HAWKRIDGE BROTHERS COMPANY, 303 Congress St., BOSTON, MASS.



ELMES HYDRAULIC PRESSES

Rapid-acting hydraulic drawing presses, piercing presses, pumps, and accumulators for making Shells, etc. High pressure fittings and valves, quick shipment.

Send for our illustrated catalog to-day

Charles F. Elmes Engineering Works

217 N. Morgan Street, Chicago, U.S.A.

Over 50 years' experience building hydraulic machinery.

Portable Emery Grinder

Take the Tool to the Work and Save Heavy Handling

We are inventors of the Flexible Shaft For all Purposes.

The oldest and largest manufacturers in the world.



CAN FURNISH MOTOR DRIVEN WHEN DESIRED

Write Us for Catalogue and Prices.

STOW MFG. CO. BINGHAMTON NEW YORK

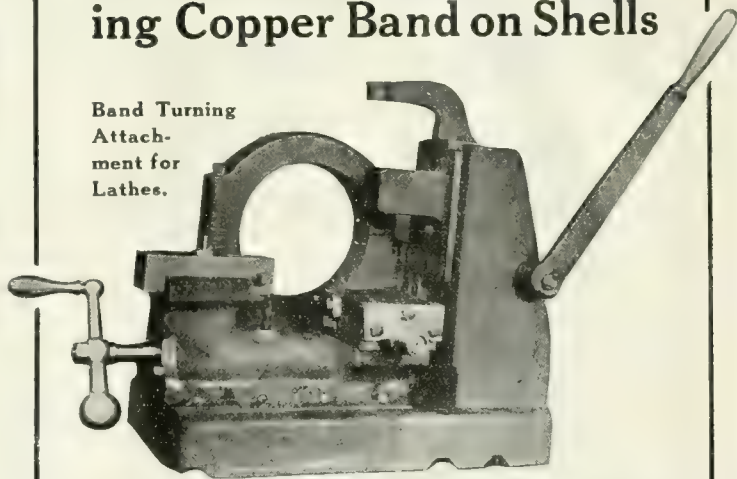
Established 1875

Oldest Portable Tool Manufacturers in America.

General European Agents—Selson Engineering Co., Ltd.
85 Queen Victoria St., LONDON, ENG.

A Time-Saver for Turning Copper Band on Shells

Band Turning Attachment for Lathes.



This attachment will fit any engine lathe, and with its use you can turn the copper band on Shrapnel Shells down to size required and burnish them *all in one operation.*

With this device we will guarantee an output of

50 Turned Copper Bands per Hour

Used with a specially constructed steel chuck, casting of which can be finished on the lathe on which the attachment will be used.

Castings are supplied by us.

WRITE FOR PARTICULARS.

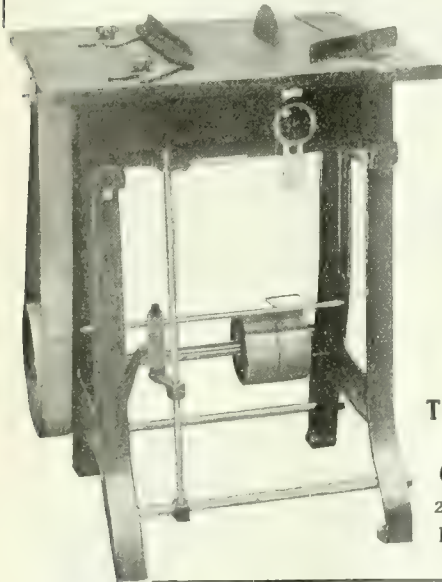
LYMBURNER LIMITED

5-15 Commissioners St. Montreal, P. Que.

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THE ACME METAL SAW TABLE

is needed in your plant if you have work to do in the shape of cutting Brass and Copper Tubing, Hard Rubber, and BRASS CART-RIDGE CASES.



It has other uses, and we will acquaint you with them, if you will let us know your requirements.

Either Belt or Motor Driven.

Built in Two Sizes.

Write for full specifications and price.

The HUB Machine Welding and Contracting Co.

22nd and Race Sts. Philadelphia, Pa.

TAYLOR-NEWBOLD COLD SAWS



Fast Cutting Powerful Economical

WRITE FOR BULLETIN

TABOR MANUFACTURING COMPANY
PHILADELPHIA, PA., U.S.A.

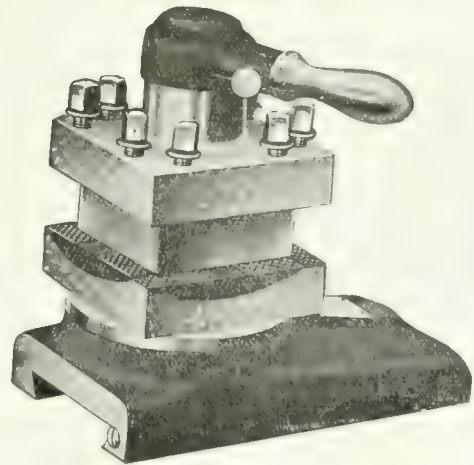
"Victoria" PIG IRON

Foundry
Soft and Strong
Malleable

Shipments from
The Canadian Furnace Co.,
Port Colborne, Ont.

M.A. HANNA & Co.

Sales Agents Cleveland



Particularly Adapted to the Manufacture of Shrapnel

Your Lathe Needs A NEW TOOL POST. One of the Modern Multiple Type.

You can no longer afford to use the old style single tool holder.

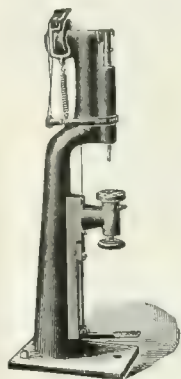
Give us the size of the dovetail on your lathe carriage and height to lathe center; we will quote you price on a Modern Tool Holder that we guarantee will increase your production, and give you some interesting facts about Lathe Turrets.

No matter what make or size of lathe—we can fit it.

Fay & Scott, Dexter, Me.



HINTS TO BUYERS



IS YOUR RIVETING PROFITABLY DONE?

Our Elastic Rotary Blow Riveting Machine does profitable work, because one machine will do the work of several hand riveters, and do it better.

Every head is perfectly formed, any shape, round, flat, oval, rectangular, etc. Catalogue C tells more about it.

The F. B. SHUSTER COMPANY
New Haven, Conn.

Formerly John Adt & Son, Established 1866

Also makers of Wire Straighteners and Cutter, Cotter Pin Machines, etc.

THE DUPONT Patent Power Hammer

BEST FOR Durability, Economy of Power, Simplicity of Adjustment.

Seven Sizes
from 35 to 300 lbs.

Only High-Class Material Used and Satisfaction Guaranteed.

ASK FOR CATALOGUE.
SENT FREE

The PLESSISVILLE FOUNDRY

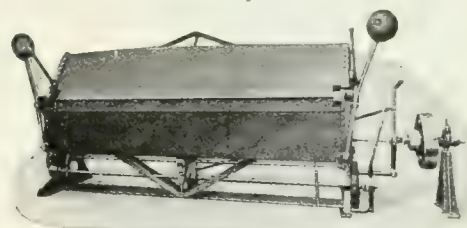
Plessisville, Que.

Ontario and Western Agents:
The General Supply Co. of Canada Ltd.
Ottawa Toronto Winnipeg



Chicago Steel Bending Brakes

We are exclusive Manufacturers of Steel Bending Brakes, and our product shows it.



10 ft. for 10 Ga.

The Steel Bending Brake Works, Ltd., Chatham, Ontario

Only about three horsepower is required to operate this brake full capacity.

Catalog giving full description mailed upon request.



Allen

Safety Set Screws

Any length, point or thread. We make a specialty of short lengths.

ALLEN SOCKET CAP SCREWS

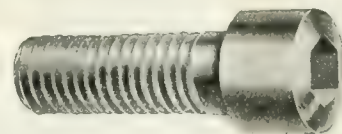
are very neat in appearance and exceedingly strong.

Send for circular No. 3 and free sample screws.

The ALLEN MFG. CO.

Hartford, Conn.

173 Princess St.,
Manchester, England



Genuine Armstrong Stocks and Dies

Hinged Pipe Vises.

Pipe Cutters. Steam and Gas Fitters' Tools.

Pipe Machines for Threading Pipe.

Either Hand or Power.

Manufactured by

THE ARMSTRONG M'F'G CO.

328 KNOWLTON ST.

BRIDGEPORT, CONN.

NEW YORK, 248 CANAL ST.

The Garvin Machine Co.

Manufacturers of

Milling Machines; Profiling Machines; Cam Cutting Machines; Screw Machines; Monitor Lathes; Die Slotting Machines; Screw Slotters; Tapping Machines; Duplex Horizontal Drills; Gang Drill Presses; Four-Head Right-Angle Drills; Wrenchless Chucks; Spring Coilers; Cutter Grinding Machines; Surface Grinders; Hole Grinders; Hand Lathes and Special Machinery.

We Want All To Have Our Catalog—Send For It To-day.

Spring and Varick Streets NEW YORK CITY

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



PUMPS FOR EVERY SERVICE

Send us your inquiries for Hydraulic Pressure Pumps and Accumulators for SHELL WORK.

The Smart-Turner Machine Company, Limited
Hamilton, Canada.



NORTON JACKS

For all kinds of heavy lifting
Send for complete catalogue showing 50 styles
10 to 100 tons capacity.

Made only by
A. O. NORTON, LIMITED
Coaticook, Prov. Quebec - - - Canada

PULLEYS

ALL WOOD—COMBINATION—IRON—STEEL

Every pulley fully guaranteed.
Write for interesting printed matter.
The Positive Clutch & Pulley Works, Ltd.
Montreal - - - Factory: Aurora, Ont. - - - Toronto

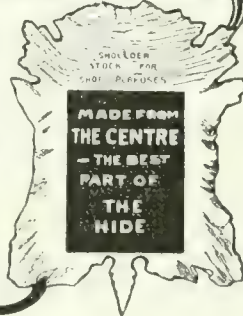
J. C. McLAREN BELTING



Will Save You Money
In Every Day of Service

Modern plant and thorough knowledge of requirements of belting guarantees perfect satisfaction to all buyers. Our belts are the result of using best leather, and our 57 year's experience.

Ask for Quotations.
J. C. McLAREN BELTING CO.
Limited
Montreal Toronto Winnipeg



PRESSES—ALL TYPES

Press Attachments, Automatic.
Metal and Wire Forming Machines.
Tumblers—Large Line.
Burnishing Machines, Grinders.
Special Machines.

Baird Machine Co., Bridgeport, Conn.



Detective and Stop Watch Combined.

"We have a counter on every one of our presses, even the foot presses." This from a satisfied user of our counters. If you use presses our counters would save you money. Ask for catalog 25.

The C. J. ROOT CO., 125 Bridge Street, Bristol, Conn

20 TIMES THE SERVICE

That's what this self-hardening, high-speed steel chaser does for the LANDIS DIE. Four long cutters tangentially disposed to the work carried in suitable holders make an ideal cutting condition. This, along with its many other distinctive characteristics, has established for us a world-wide reputation.

WRITE FOR CATALOGUE NO. 21.
Landis Machine Co., Waynesboro, Pa.
Exclusive Canadian Representatives,
Williams & Wilson, Montreal, Canada.



Electric Traveling Cranes

Any span or capacity.
For foundry and every service.

Send for Catalog 110

Complete
Foundry
Equipments



Cranes
of all
Kinds

Toronto Testing Laboratory

METALLURGISTS - CHEMISTS - FUEL ENGINEERS
160 Bay St., Toronto.

Tests of Metals, Fuels, Oils, Water, Etc.
SPECIAL ATTENTION TO ALL SHELL MATERIALS

You can afford to use High-Speed Steel in Armstrong Planer and Shaper Tools



They require no forging Minimum Grinding and Mighty Little Tool Steel.

Our complete line is on exhibition in Block 41, Palace of Machinery, Panama-Pacific Exposition, San Francisco.

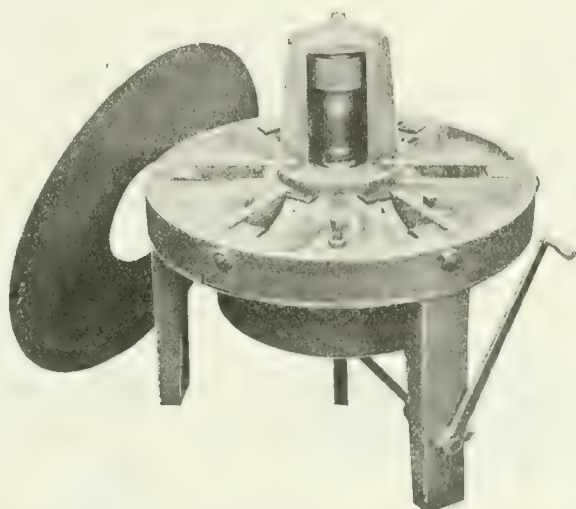
Catalog sent for the asking.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
306 N. Francisco., Chicago, U.S.A.



'WE ARE PREPARED'

TO CUT DOWN YOUR EXPENSES STILL FURTHER



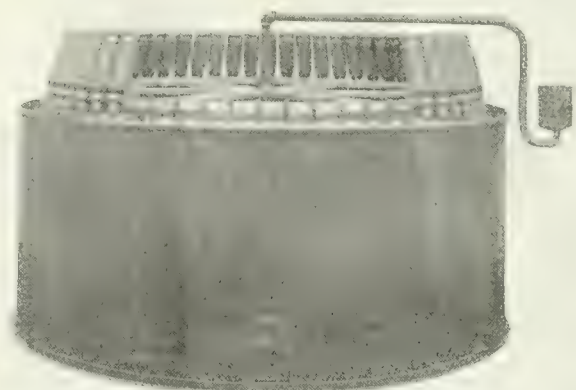
4.5 and 60 POUNDER SHELL BANDING and
STAMPING MACHINE

Our Shell Banding, Stamping and Painting Machines are accurate and work rapidly.

These machines are operated by air, are so easily controlled that a child can run them.

BANDING PRESS is sold without stamping attachment if desired.

PAINTING MACHINE is operated with an ordinary air drill.



PAINTING MACHINE

Don't Delay—Write To-Day

Canadian Locomotive Company, Limited
Kingston, Ontario

The John Bertram & Sons Company, Limited, Dundas, Ontario, are our agents for these machines

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

CANADIAN MACHINERY BUYERS' DIRECTORY

TO OUR READERS—Use this directory when seeking to buy any machinery or power equipment. You will often get information that will save you money.

TO OUR ADVERTISERS—Send in your name for insertion under the headings of the lines you make or sell.

TO NON-ADVERTISERS—A rate of \$5 per line a year is charged non-advertisers.

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Carborundum Co., Niagara Falls, N.Y.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
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Gardner Machine Co., Beloit, Wis.
Norton Co., Worcester, Mass.
Stevens, F. B., Detroit, Mich.

Acetylene.

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

Acetylene Generators.

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

Accumulators, Hydraulic.

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Mesta Machine Co., Pittsburg, Pa.
Wm. E. Perry Co., Toronto.
Wm. Tool Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
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Smart-Turner Machine Co., Hamilton, Ont.

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Whiting Foundry Equipment Co., Harvey, Ill.

Air Hose.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
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Tallman Brass & Metal Co., Hamilton.

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H. A. Drury Co., Ltd., Montreal.
Haworth Bros. Co., Boston, Mass.
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Lintz-Porter Co., Toronto.

Arbors.

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

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Skinner Chuck Co., New Britain, Conn.

Automatic Chucks.

Garrin Machine Co., New York.

Asbestos Packing.

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

Autogenous Welding and Cutting Plants.

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

Automatic Index Milling Machines.

Garvin Machine Co., New York.
National Machinery and Supply Co., Hamilton.

Automatic Machinery.

Baird Machine Co., Bridgeport, Conn.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Mott & Merryweather Machy. Co., Cleveland, O.
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Windsor Machine Co., Windsor, Vt.

Automatic Wood Screw Machines.

Asa F. Cook Co.

Axle Cutters.

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

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Magnolia Metal Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

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Oven Equipment & Mfg. Co., New Haven, Conn.
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Ball Burnishing Machines.

Baird Machine Co., Bridgeport, Conn.

Banding Machines, Hydraulic.

West Tire Setter Co., Rochester, N.Y.

Barrels, Steel Shop.

Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

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Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.

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

Bar Benders, Hydraulic.

Charles F. Elmes Eng. Works, Chicago, Ill.
Watson-Stillman Co., Aldene, N.J.

Bar Twisting Machines.

Mesta Machine Co., Pittsburg, Pa.

Batteries and Accessories.

Lintz-Porter Co., Toronto.

Belt Systems.

Lintz-Porter Co., Toronto.

Belt Benches.

Taber Mfg. Co., Philadelphia, Pa.

Belt Dressing and Cement.

Graton & Knight Mfg. Co., Montreal.

Belt Lacing, Leather.

Graton & Knight Mfg. Co., Montreal.

Beltling, Chain.

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

Beltling, Cotton.

Dominion Belting Co., Hamilton.

Beltling, Leather.

Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.

Graton & Knight Mfg. Co., Montreal.
Main Belting Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
D. K. McLaron Ltd., Montreal.
F. R. Hawes & Co., Montreal.

Beltling, Stitched Cotton Duck.

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

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John Bertram & Sons Co., Dundas.
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Brown, Boggs Co., Ltd., Hamilton, Canada.

Can. Buffalo Forge Co., Montreal.
Can. Machinery Corporation, Galt, Ont.

Charles F. Elmes Eng. Works, Chicago, Ill.
Jardine, A. B., & Co., Hespeler, Ont.

National Machinery Co., Tiffin, Ohio.
National Machinery & Supply Co., Hamilton.

Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.

Toledo Machine & Tool Co., Toledo, O.

Steel Bending Brake Works, Chatham, Ont.

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

Bins, Steel.

Dennis Wire & Iron Works Co., Ltd., London, Canada.

Toronto Iron Works, Ltd., Toronto.

Bit Brace Tools.

Wells Bros. Co., Greenfield, Mass.

Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Blast Gauges, Cupola.

Can. Buffalo Forge Co., Montreal.

Sheldons, Ltd., Galt, Ont.

Whiting Foundry Equipment Co., Harvey, Ill.

Blocks, Lifting.

Northern Crane Works, Walkerville.

Blowers.

Can. Buffalo Forge Co., Montreal.

Can. Sirocco Co., Ltd., Windsor, Ont.

Chicago Flexible Shaft Co., Chicago, Ill.

Girard Machine & Tool Co., Philadelphia, Pa.

Sheldons, Ltd., Galt, Ont.

Southwark Foundry & Machine Co., Philadelphia.

Blow Pipes and Regulators.

L'Air Liquide Society, Montreal, Toronto.

Lever Bros., Toronto.

Bluing Ovens.

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

Boilers.

Can. Locomotive Co., Kingston, Ont.

National Machinery & Supply Co., Hamilton.

Owen Sound Iron Works Co., Owen Sound.

Plessisville Foundry, Plessisville, Que.

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Jno. F. Allen Co., New York.

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Bolts.

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London Bolt & Hinge Works, London, Ont.

Bolt and Nut Machinery.

A. R. Williams Machy. Co., Toronto.

John Bertram & Sons Co., Dundas, Ont.

Owen Sound Iron Works Co., Owen Sound.

Gardner, Robt., & Son, Montreal.

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National Machinery & Supply Co., Hamilton.

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MacLean Publishing Co., Toronto.

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Colburn Machine Tool Co., Franklin, Pa.

Girard Machine & Tool Co., Philadelphia, Pa.

H. H. Clarke & Co., of Chicago, Chicago, Ill.

Mott & Merryweather Machy. Co., Cleveland, O.

National Machinery & Supply Co., Hamilton.

Newton Machine Tool Works, Philadelphia, Pa.

Niles-Bement-Pond Co., New York.

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Can. Ingersoll-Rand Co., Montreal.

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Cleveland Wire Spring Co., Cleveland.

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Can. Sirocco Co., Ltd., Windsor, Ont.

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Wm. Tod Company, Youngstown, O.
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Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.
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Owen Sound Iron Works Co., Owen Sound.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
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Smart-Turner Machine Co., Hamilton, Ont.
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Gardner, Robt., & Son, Montreal.
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 Murchey Machine & Tool Co., De-
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 Can. Sirocco Co., Windsor, Ont.
 A. B. Jardine & Co., Hespeler, Ont.
 Pratt & Whitney Co., Dundas, Ont.
 Sheldons, Limited, Galt, Ont.

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 Garvin Machine Co., New York.
 Girard Machine & Tool Co., Phila-
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 Niles-Bement-Pond Co., New York.
 A. R. Williams Machinery Co., To-
 ronto.

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 John Bertram & Sons Co., Dundas.
 Can. Buffalo Forge Co., Montreal.
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 Colburn Mach. Tool Co., Franklin, Pa.
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 Girard Machine & Tool Co., Phila-
 delphia, Pa.
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 John Bertram & Sons Co., Dundas.
 Can. Fairbanks-Morse Co., Montreal.
 Motch & Merryweather Machy. Co.,
 Cleveland, O.
 Niles-Bement-Pond Co., New York.
 Turner Machine Co., Danbury, Conn.

Drilling Machines, Sensitive.

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

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 Colburn Mach. Tool Co., Franklin, Pa.
 A. R. Williams Machy. Co., Toronto
 W. F. & John Barnes Co., Rockford.
 John Bertram & Sons Co., Dundas.
 Girard Machine & Tool Co., Phila-
 delphia, Pa.
 A. B. Jardine & Co., Hespeler, Ont.
 Rockford Machine Tool Co., Rockford.
 R. McDougall Co., Galt.
 Motch & Merryweather Machy. Co.,
 Cleveland, O.
 Niles-Bement-Pond Co., New York.

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

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

Drills, Blacksmith and Bit Stock.

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 Cleveland Twist Drill Co., Cleveland.
 A. B. Jardine & Co., Hespeler, Ont.
 Morse Twist Drill and Machine Co.,
 New Bedford.
 Wilt Twist Drill Co., of Canada, Ltd.,
 Walkerville, Ont.

Drills, Centre.

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

Drills Corner (Pneumatic).

Cleveland Pneumatic Tool Co. of
 Canada, Toronto.

Drills, Electric and Portable.

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

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

Drills, Multiple Spindle.

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

Drills, Oil Tube.

Cleveland Twist Drill Co., Cleveland.
 Morse Twist Drill and Machine Co.,
 New Bedford.

Drills, Pneumatic.

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

Drills, Ratchet and Hand.

Armstrong Bros. Tool Co., Chicago.
 Can. Buffalo Forge Co., Montreal.
 Can. Fairbanks-Morse Co., Montreal.
 Cleveland Twist Drill Co., Cleveland.
 A. B. Jardine & Co., Hespeler, Ont.
 Morse Twist Drill and Machine Co.,
 New Bedford.

**Drills, Radial and
Multiple Spindle**

National Forge & Tool Co., Erie, Pa.
 Pratt & Whitney Co., Dundas, Ont.
 Wilt Twist Drill Co. of Canada, Ltd.,
 Walkerville, Ont.

Drills, Rock.

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

Drills, Track.

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

Drills, Twist.

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

Drill Holders.

Wells Brothers Co., Greenfield, Mass.

Drill Sockets.

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

Drying Appliances.

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

Drying Out Barrels.

Baird Machine Co., Bridgeport, Conn.

Drying Ovens.

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

Dump Cars.

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

Dust Separators.

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

**Dust Arresters (for Tumbling
Mills).**

Whiting Foundry Equipment Co.,
 Harvey, Ill.

Dynamics and Electrical Supplies.

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

Electrical Supplies.

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

Elevator Enclosures.

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

**Elevating and Conveying
Machinery.**

Can. Mathews Gravity Co., Toronto.
 Plessisville Foundry, Plessisville, Que.

Emery Grinders (Pneumatic).

Cleveland Pneumatic Tool Co. of
 Canada, Toronto.
 Stow Mfg. Co., Binghamton, N.Y.

Emery and Emery Wheels.

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

**Emery Wheels, Dressers and
Stands.**

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

Emery Wheel Safety Flanges.

Canadian Hart Wheels, Hamilton,
 Ont.

Enameling Ovens.

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

**Engines, Corliss, Compound,
Pumping.**

Mesta Machine Co., Pittsburg, Pa.
 Wm. Tod Company, Youngstown, O.

Engines, Gas and Gasoline.

Can. Fairbanks-Morse Co., Montreal.
 Jones & Glasco, Montreal.
 Mesta Machine Co., Pittsburg, Pa.
 National Machinery & Supply Co.,
 Hamilton.
 Wm. Tod Company, Youngstown, O.

Engines, Horizontal and Vertical.

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

Engines, High-Speed, Automatic.

Can. Buffalo Forge Co., Montreal.

Engines, Steam.

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

Engines, Stationary and Marine.

Southwark Foundry & Machine Co.,
 Philadelphia, Pa.

Engineering Books.

The Maclean Publishing Co., Ltd.,
 Toronto.

Engraving Machines.

Geo. Gorton Machine Co., Racine,
 Wis.

Elevators and Buckets.

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

Equipment Shop.

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

Escutcheon Pins.

Parmenter & Bulloch Co., Gananoque.

Evaporators' Machinery.

Brown, Boggs & Co., Hamilton, Can.

Exhaust Heads and Hoods.

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

Exhausters.

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

Experimental Machinery.

Owen Sound Iron Works Co., Owen
 Sound.

Extractors, Ingot.

Mesta Machine Co., Pittsburg, Pa.

Fans.

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

Feed Water Heaters.

Can. Fairbanks-Morse Co., Montreal.
 The Smart-Turner Machine Co., Ham-
 ilton.

Fence, Iron Factory.

Canada Wire & Iron Goods Co.,
 Hamilton, Ont.
 Dennis Wire & Iron Works Co., Ltd.,
 London, Canada.
 Standard Tube & Fence Co., Wood-
 stock, Ont.

Files.

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

Fire Alarm Apparatus.

Lintz-Porter Co., Toronto.

Fire Extinguishers.

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

Fire Escapes.

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

Flash Lamps.

Lintz-Porter Co., Toronto.

Flexible Shafts.

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

Flumes.

Toronto Iron Works, Ltd., Toronto.

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.,
 Willand.
 Mesta Machine Co., Pittsburg, Pa.
 Ready Tool Co., Bridgeport, Conn.
 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.

Eric Foundry Co., Erie, Pa.

Forging Machinery.

John Bertram & Sons Co., Dundas.
 Bliss, E. W., Co., Brooklyn, N.Y.
 Brown, Boggs Co., Ltd., Hamilton,
 Canada.

National Machinery Co., Tiffin, Ohio.

Plessisville Foundry, Plessisville, Que.

Wm. Tod Company, Youngstown, O.

Watson-Stillman Co., Aidsen, N.J.

Foundry Equipment.

Northern Crane Works, Walkerville

W. W. Sly Mfg. Co., Cleveland, O.

Whiting Foundry Equipment Co

Harvey, Ill.

Friction Leathers.

Graton & Knight Mfg. Co., Montreal.

Friction Clutch Pulleys, etc.

American Pulley Co., Philadelphia,
 Pa.
 Baird Machine Co., Bridgeport, Conn.
 Eastern Machinery Co., New Haven,
 Conn.
 D. K. McLaren, Ltd., Montreal.
 Owen Sound Iron Works Co., Owen
 Sound.

Positive Clutch & Pulley Works,
 Toronto.

**Furnace Engineers and
Contractors.**

Whiting Foundry Equipment Co.

Harvey, Ill.

Furnaces, Blast.

Toronto Iron Works, Ltd., Toronto

Furnaces, Oil, Coal, Gas and
 Electric.

Canadian Hoskins, Limited, Walker-
 ville, Ont.

Chicago Flexible Shaft Co., Chicago,
 Ill.

Mechanical Engineering Co., 55 Cote
 St., Montreal, Que.

Tate, Jones & Co., Pittsburgh, Pa.

Whiting Foundry Equipment Co.,
 Harvey, Ill.

**Furnaces, Steel Heating and
Brass Melting.**

Can. Hoskins, Ltd., Walkerville, Ont.

Chicago Flexible Shaft Co., Chicag-
 o, 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.**
 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.**
 Oven Equipment & Mfg. Co., New Haven, Conn.
- Furnace Lining.**
 Can. H. W. Johns-Manville Co., Limited, Toronto.
- Fuse Cap Machinery.**
 Noble & Westbrook Mfg. Co., Hartford, Conn.
- Gang Planer Tools.**
 Armstrong Bros. Tool Co., Chicago.
 Ready Tool Co., Bridgeport, Conn.
- Gaskets, Leather, etc.**
 Graton & Knight Mfg. Co., Montreal.
 Can. H. W. Johns-Manville Co., Limited, Toronto.
- Gas Blowers and Exhausters.**
 Can. Buffalo Forge Co., Montreal.
 Can. Sirocco Co., Ltd., Windsor, Ont.
 Sheldons, Limited, Galt.
 Southwark Foundry & Machine Co., Philadelphia, Pa.
- Gas Burners.**
 Oven Equipment & Mfg. Co., New Haven, Conn.
- Gas Machines.**
 Brown, Boggs & Co., Hamilton, Can.
- Gas Producer Plants.**
 Can. Fairbanks-Morse Co., Montreal.
- Gauges, Hydraulic Pressure.**
 Charles F. Elmes Eng. Works Chicago
 Watson-Stillman Co., Aldene, N.J.
- Gauges, Standard.**
 Can. Fairbanks-Morse Co., Montreal.
 Cleveland Twist Drill Co., Cleveland.
 Greenfield Tap & Die Corporation, Greenfield, Mass.
 Holden-Morgan Co., Toronto.
 Morse Twist Drill and Machine Co., New Bedford.
 Pratt & Whitney Co., Hartford, Conn.
 Garvin Machine Co., New York.
 National Machinery & Supply Co., Hamilton.
- Gear-Cutting Machinery.**
 Girard Machine & Tool Co., Philadelphia, Pa.
 Hamilton Gear & Machine Co., Toronto.
 Hill, Clarke & Co., of Chicago, Chicago, Ill.
 Motch & Merryweather Machy. Co., Cleveland, O.
 National Machinery & Supply Co., Hamilton.
 A. R. Williams Machy. Co., Toronto.
 Sheldons, Limited, Galt, Ont.
 The Smart-Turner Machine Co., Hamilton.
 Wm. Tod Co., Youngstown, O.
 D. E. Whiton Machine Co., New London, Conn.
- Gears, Cut, Mortise, Angle, Worm.**
 Gardner, Robt. & Son, Montreal.
 Hamilton Gear & Machine Co., Toronto.
 Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
 Jones & Glasco, Montreal, P.Q.
 Mesta Machine Co., Pittsburg, Pa.
 Philadelphia Gear Works, Philadelphia, Pa.
 Smart-Turner Machine Co., Hamilton, Ont.
 Wm. Tod Co., Youngstown, O.
- Gears, Rawhide.**
 Gardner, Robt. & Son, Montreal.
 Hamilton Gear & Machine Co., Toronto.
 Jones & Glasco, Montreal, P.Q.
 Philadelphia Gear Works, Philadelphia, Pa.
 Smart-Turner Machine Co., Hamilton, Ont.
- Generators, Electric.**
 A. R. Williams Machy. Co., Toronto.
 Can. Fairbanks-Morse Co., Montreal.
- Lancashire Dynamo and Motor Co. Ltd., Toronto.**
 Toronto and Hamilton Electric Co., Hamilton.
- Grain for Polishing.**
 Norton Co., Worcester, Mass.
- Graphite.**
 Can. H. W. Johns-Manville Co., Ltd., Toronto.
 Jos. Dixon Crucible Co., Jersey City.
 Stevens, F. B., Detroit, Mich.
- Grinders, Automatic Knife.**
 W. H. Banfield & Son, Toronto.
- Grinders, Centre, Pedestal and Bench.**
 Canadian Hart Wheels, Ltd., Hamilton, Ont.
 Cleveland Pneumatic Tool Co. of Canada, Toronto.
 Ford-Smith Machine Co., Hamilton.
 Foss & Hill Machy. Co., Montreal.
 Gray Mfg. & Machine Co., Toronto.
 Niles-Bement-Pond Co., New York.
 Modern Tool Co., Erie, Pa.
 Morse Twist Drill and Machine Co., New Bedford.
 New Britain Machine Co., New Britain, Conn.
 Norton Grinding Co., Worcester, Mass.
 Stow Mfg. Co., Binghamton, N.Y.
 United States Electrical Tool Co., Cincinnati, O.
- Grinders, Cutter.**
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Foss & Hill Machy. Co., Montreal.
 Greenfield Machine Co., Greenfield, Mass.
 Pratt & Whitney Co., Dundas, Ont.
- Grinders, Die Chaser.**
 Bignall & Keeler Mfg. Co., Edwardsville, Ill.
 Landis Machine Co., Waynesboro, Pa.
 Modern Tool Co., Erie, Pa.
- Grinders, Disk.**
 Armstrong Bros. Tool Co., Chicago, Ill.
 Gardner Machine Co., Beloit, Wis.
 Norton Grinding Co., Worcester, Mass.
- Grinders, Drill.**
 Garvin Machine Co., New York.
 United States Electric Tool Co., Cincinnati, O.
- Grinders, Cylinder, Internal.**
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Foss & Hill Machy. Co., Montreal.
 Girard Machine & Tool Co., Philadelphia, Pa.
 Grant Mfg. & Machine Co., Bridgeport, Conn.
 Greenfield Machine Co., Greenfield, Mass.
 Hill, Clarke & Co. of Chicago, Chicago, Ill.
 Landis Machine Co., Waynesboro, Pa.
 Modern Tool Co., Erie, Pa.
 Motch & Merryweather Machy. Co., Cleveland, O.
 Norton Grinding Co., Worcester, Mass.
 Rivett Lathe & Grinder Co., Boston, Mass.
- Grinders, Electric.**
 Lintz-Porter Co., Toronto.
- Grinders, Pneumatic.**
 Cleveland Pneumatic Tool Co. of Canada, Toronto.
 Independent Pneumatic Tool Co., Chicago, Ill.
- Grinders, Portable, Electric, Hand, Tool, Post, Floor and Bench.**
 Baird Machine Co., Bridgeport, Conn.
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Foss & Hill Machy. Co., Montreal.
 Grant Mfg. & Machine Co., Bridgeport, Conn.
 Greenfield Machine Co., Greenfield, Mass.
 Hill, Clarke & Co. of Chicago, Chicago, Ill.
 Hisey-Wolf Machine Co., Cincinnati, O.
 Landis Tool Co., Waynesboro, Pa.
 Motch & Merryweather Machy. Co., Cleveland, O.
 Norton Co., Worcester, Mass.
 United States Electrical Tool Co., Cincinnati, O.
 A. R. Williams Machy. Co., Toronto.
- Grinders, Swing, Portable, Electric.**
 Hisey-Wolf Machine Co., Cincinnati, O.
 United States Electrical Tool Co., Cincinnati, O.
- 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.
 Ready Tool Co., Bridgeport, Conn.
 Tabor Mfg. Co., Philadelphia, Pa.
- Grinders, Universal, Plain.**
 Girard Machine & Tool Co., Philadelphia, Pa.
 Landis Tool Co., Waynesboro, Pa.
 Modern Tool Co., Erie, Pa.
- Grinders, Vertical Surface.**
 Brown & Sharpe Mfg. Co., Providence, R.I.
 Can. Fairbanks-Morse Co., Montreal.
 Girard Machine & Tool Co., Philadelphia, Pa.
 Pratt & Whitney Co., Dundas, Ont.
- Grinding and Polishing Machines, Portable, Pneumatic and Spring Frame.**
 Can. Fairbanks-Morse Co., Montreal.
 Canadian Hart Wheels, Ltd., Hamilton, Ont.
 Gardner, Robt. & Son, Montreal.
 Garvin Machine Co., New York.
 Girard Machine & Tool Co., Philadelphia, Pa.
 Gray Mfg. & Machine Co., Toronto.
 Greenfield Machine Co., Greenfield, Mass.
 Hall & Sons, John H., Brantford.
 Hill, Clarke & Co. of Chicago, Chicago, Ill.
 Motch & Merryweather Machy. Co., Cleveland, O.
 Niles-Bement-Pond Co., New York.
 Norton Co., Worcester, Mass.
 Stow Mfg. Co., Binghamton, N.Y.
- Grinding Wheels.**
 Can. Fairbanks-Morse Co., Montreal.
 Canadian Hart Wheels, Ltd., Hamilton, Ont.
 Carborundum Co., Niagara Falls.
 Ford-Smith Machine Co., Hamilton, Canada.
 Gray Mfg. & Machine Co., Toronto.
 Norton Co., Worcester, Mass.
- Guards, Window and Machine.**
 Canada Wire & Iron Goods Co., Hamilton, Ont.
 Dennis Wire & Iron Works Co., Ltd., London, Canada.
 Standard Tube & Fence Co., Woodstock, Ont.
- 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.**
 E. C. Atkins & Co., Hamilton, Ont.
 Ford-Smith Machine Co., Hamilton, Canada.
 Garvin Machine Co., New York City.
 Muscens, 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.
 Pittsburg Pneumatic Co., Canton, Ohio.
- Hammers, Steam.**
 John Bertram & Sons Co., Dundas.
 Girard Machine & Tool Co., Philadelphia, Pa.
 National Machinery & Supply Co., Hamilton.
 Niles-Bement-Pond Co., New York.
- Hand Hoists & Trolleys.**
 Whiting Foundry Equipment Co., Harvey, Ill.
- Hand Leathers or Pads.**
 Graton & Knight Mfg. Co., Montreal.
- Hangers.**
 Baird Machine Co., Bridgeport, Conn.
 Gardner, Robt. & Son, Montreal.
 The Smart-Turner Machine Co., Hamilton.
- Hardness Testing Instruments.**
 Shore Instrument & Mfg. Co., New York.
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 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.
- Hinge Machinery.**
 Baird Machine Co., Bridgeport, Conn.
- Hinges.**
 London Bolt & Hinge Works, London, Ont.
- Hoists, Hydraulic.**
 Southwark Foundry & Machine Co., Philadelphia.
 Watson-Stillman Co., Aldene, N.J.
- Hoisting and Conveying Machinery.**
 Northern Crane Works, Walkerville.
 Owen Sound Iron Works Co., Owen Sound.
 Southwark Foundry & Machine Co., Philadelphia.
 Whiting Foundry Equipment Co., Harvey, Ill.
- Hoists, Chain, Electric and Pneumatic.**
 Northern Crane Works, Walkerville.
 Whiting Foundry Equipment Co., Harvey, Ill.
- Hoists, Electric.**
 Northern Crane Works, Walkerville.
 Whiting Foundry Equipment Co., Harvey, Ill.
- Hoppers.**
 Toronto Iron Works, Ltd., Toronto.
- Hose Clamp Tool.**
 Cleveland Pneumatic Tool Co. of Canada, Toronto.
- Hose, Pneumatic.**
 Cleveland Pneumatic Tool Co., of Canada, Toronto.
- Hose, Steam, Suction and Water.**
 Can. H. W. Johns-Manville Co., Limited, Toronto.
- Holders for Dies and Drills.**
 Wells Brothers, Company, Greenfield, Mass.
 Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
- Hydraulic Accumulators.**
 Can. Boomer & Boschert Press Co., Montreal.
 Can. Fairbanks-Morse Co., Montreal.
 Niles-Bement-Pond Co., New York.
 Wm. R. Perrin Co., Toronto.
 The Smart-Turner Machine Co., Hamilton.
 Southwark Foundry & Machine Co., Philadelphia.
 Watson-Stillman Co., Aldene, N.J.
- Hydraulic Machinery.**
 Can. Boomer & Boschert Press Co., Montreal.
 Charles F. Elmes Eng. Works, Chicago.
 Niles-Bement-Pond Co., New York.
 National Machinery & Supply Co., Hamilton.
 Southwark Foundry & Machine Co., Philadelphia.
 Wm. Tod Co., Youngstown, O.
 Watson-Stillman Co., Aldene, N.J.
- Indicators, Speed.**
 Brown & Sharpe Mfg. Co., Providence, R.I.
 L. S. Starrett Co., Athol, Mass.
- Index Centres.**
 Fred. C. Dickow, Chicago, Ill.
 Garvin Machine Co., New York.
- Ingot Metals.**
 A. C. Leslie & Co., Ltd., Montreal.
- Intensifiers.**
 Mesta Machine Co., Pittsburg, Pa.
- Iron Filler.**
 Can. H. W. Johns-Manville Co., Ltd., Toronto.
- Iron Ore.**
 Hanna & Co., M. A., Cleveland, O.
- Jacks, Hydraulic.**
 Charles F. Elmes Eng. Works, Chicago.
 Southwark Foundry & Machine Co., Philadelphia.
 Watson-Stillman Co., Aldene, N.J.
- Jacks.**
 Can. Fairbanks-Morse Co., Montreal.
 Northern Crane Works, Walkerville.
 Norton, A. O., Coaticook, Que.
 Plessisville Foundry, Plessisville, Que.
- Jacks, Pneumatic.**
 Northern Crane Works, Walkerville.
- Jacks, Pit and Track.**
 Can. Fairbanks-Morse Co., Montreal.
 Northern Crane Works, Walkerville.
 Watson-Stillman Co., Aldene, N.J.
- Japanning Ovens.**
 Oven Equipment & Mfg. Co., New Haven, Conn.
- Jaws, Face Plate.**
 Cushman Chuck Co., Hartford, Conn.
 Skinner Chuck Co., New Britain, Conn.

IMMEDIATE DELIVERY

MACHINE TOOLS

2-10"x4' South Bend
 1-11"x4' Monarch
 1-13"x6' Robbins
 1-13"x6' Blaisdell
 1-13"x5' Reed
 1-13"x5½' C. J. Quick-Change, new
 1-14"x6' C. J. Quick-Change, new
 1-14"x8' C. J. Quick-Change, new
 1-14"x10' Hendey, taper attachment
 1-new 14"x6' Cisco
 1-14"x6' Blaisdell
 1-15"x6' Wood & Light
 1-15"x6' Kelly
 1-15"x7' Porter
 1-15"x6' Bradford
 6-new 16"x8' 3-step cone D B C
 2-16"x6' Reed
 1-16"x6' Harrington
 1-18"x10' Lodge & Davis, rod feed
 1-18"x10' Cincinnati
 2-19"x7' Blaisdell, rod feed
 2-19"x9' Blaisdell, rod feed
 1-20"x12' Fifield
 1-24"x12' New Haven
 1-24"x12' Ames
 1-24"x40"x14' McCabe, double spindle
 2-22"x10' Pond
 1-26"x13' Bement
 1-27"x22' Pratt & Whitney
 1-33"x13' Bement
 1-33"x12' Gap
 1-84"x30' Bement
 Subject to prior sale.

SPECIAL ATTENTION

Patterns, Drawings and partly finished stock of a set of 14" 16" 18"-20" Standard Engine Lathe for sale, reasonable prices.

TURRET LATHES

40" Conardeon Turret Lathe, 3¼" hollow spindle
 2-1" Bardon & Oliver automatic chuck
 1-1" Bardon & Oliver wire feed screw machine
 1-11" Gridley automatic
 No. 2 Pratt & Whitney
 No. 1 Garvin
 1-14"x4' Dresco Lathe with cut-off slide
 2-11"x5' Warner & Swasey box lathes
 1-15"x5' Johnson turret lathe
 1-16"x5' Windour turret lathe, with cut-off slide
 1-21" Gisholt
 1" Cleveland Automatic screw machine

MILLING MACHINES

36"x12' Heavy duty Slab milling machine
 No. 13 Brainard universal, with index centres, 6½"x43" table.
 No. 23 Brown & Sharpe plain, 51"x7" table.
 No. 2 Cincinnati universal milling machine
 No. 8 Kempsmith full Universal
 Brainard plain No. 1, table 50"x12".
 Brainard No. 3 plain, table 30"x7".
 Vertical milling machine, table 15"x24".
 2-No. 3 Garvin plain, table 24"x6".
 Pratt & Whitney horizontal, will mill 27" wide, 6' long.
 No. 3½ Fox
 No. 3 set universal dividing heads complete, like new.
 Several hand feed milling machines.

SHAPERS

8" stroke Bement.
 12" Springfield
 12" stroke Fitchburg
 14" Walcott
 16" Pratt & Whitney
 16" Friction drive
 18" Bement traveling head
 21" B. G. Smith & Mills.

PLANERS

11"x9"x19" Old Style
 54"x48"x8½" Sellers, 2 heads
 48"x48"x15" Sellers, 2 heads
 48"x36"x12" Betts, 1 head
 42"x36"x12" Cincinnati, 2 heads
 33"x33"x12" Woodward & Powell

(Planers continued)

2-36"x36"x14' Cincinnati, 2 heads
 36"x32"x12' New Haven
 35"x42"x8' Putnam, 1 head
 32"x28"x11' New Haven, 1 head
 32"x32"x14' Ponds, 2 heads
 30"x30"x12' Standard, 1 head
 30"x30"x9' Whitcomb, 1 head
 30"x24"x6' Freeland, 1 head
 28"x28"x8' New Haven, 1 head
 24"x24"x6' Flatber
 18"x18"x5' Pond, 1 head
 12" Moore, crank.

BORING MILLS

2-36" Bullard vertical, 2 heads
 Baker Bros. vertical boring mill style 01
 40" Beaman & Smith, Horizontal cylinder borer, 2¾" spindle
 48" Bement horizontal, 5" spindle
 48" Sellers, vertical, 2 heads
 60" Sellers, vertical, 2 heads
 60" Harrington pulley boring mill, upright, single spindle
 No. 0 Deitrick & Harvey, horizontal boring, drilling and milling machine, 4" spindle.

RADIAL DRILL PRESSES

48" Dreses
 42" Prentice Gear Box
 33" from wall to centre of spindle, boiler maker's wall drill
 2-12" Betts
 36" Hilbert
 3' Bickford plain radial.

MULTIPLE SPINDLE DRILLS

2-2-spindle plain drill press, power feed to spindle
 3-spindle Barr sensitive drill
 2-spindle Pilton sensitive drill
 Several 3 and 4-spindle drills, old style.

DRILL PRESSES

2-10" Dwight Slate sensitive drills, column type
 10" sensitive, square table
 10" friction drive drill press, column type
 12" sensitive, including chuck
 13"-16" Avey sensitive drill, high speed
 14"-16" Pilton sensitive drill
 14"-16" Barr
 14" sensitive drill, column type
 15" Barnes, plain
 20" Snyder, plain upright
 20" plain drill press, old style
 20" wheel and lever feed Superior, plain
 20" Barnes, back-geared and power feed
 20" Sibley & Ware, plain
 20" Silver plain wheel and lever feed
 20" Prentice
 21" Hoefler B. G.
 22" Blaisdell
 22" Dodge & Day, back-geared
 22" Barnes, back-geared and power feed.
 22" Cincinnati, sliding head
 3-24" Sibley & Ware
 24" Bement
 24" Barnes, sliding head, back-geared
 24" Cincinnati, plain
 24" old style
 24" Lathé & Morse, plain
 28" stationary head, plain drill
 1-30" Prentice, back-geared and power feed.
 36" Snyder sliding head, back-geared and power feed.
 Hisey & Wolf Electric drill press.

POWER AND FOOT PRESSES

No. 5 Stiles
 No. 22 Adriance combined horning and wiring press.
 Power press, table is 21"x24", bed is movable
 C-2 Ferracute
 No. 126 Max Ams
 No. 110 Max Ams
 Mossburg & Granville Pendulum press
 Ferracute heavy foot power press
 Several foot power Ferracute presses, with and without stand.

GRINDERS

11"x20" Landis plain grinder
 Hisey & Wolf Electric Internal Grinder
 10" Builders' Iron Works plain emery grinder
 2-2½" spindle Blount Grinder
 No. 3 Besley disc
 Diamond Combination wet and surface
 Wilmarth & Norman twist drill
 3 Lancaster ½" spindle grinders
 Barnes wet 14"x2" wheels
 Barnes wet 20"x1¾" wheels
 Armstrong tool and cut-off grinder
 16" Challenge, double end
 Whitney wet, 15"x2" wheels.
 Morse twist drill
 Sellers twist drill
 Diamond twist drill
 Gisholt twist drill
 Washburn No. 1 twist drill
 Springfield surface, table 34" between pockets, wheel is 12"x4"x1½"
 14" Builders' Iron Foundry head, column and countershaft (2).

SAWS AND HACK SAWS

6" capacity Quincy, Manchester & Sargent Co., cold saw.
 All sizes of second-hand hack saws
 5" capacity North Wales
 6" capacity North Wales
 7" capacity North Wales
 5" Marvel
 6" Marvel
 5' Capacity Cochrane, Blye, Civailar Saw.

HAMMERS

100-lb. Little Giant Belt
 250 lb. Bement Miles, single frame
 350-lb. Bement Miles single frame
 600-lb. Pratt & Whitney Board Lift
 3500-lb. Bement Miles & Co., double frame.

HYDRAULIC PRESSES

15062—Ten 350-ton Boomer & Boschert extra heavy downward pressure Hydraulic Presses, steel beams, steel cylinders, iron platens. Inside diameter of cylinder 20". Diameter of steel rods 4½". Width between rods 72". Movement of rams about 48". Platen 62" square.
 15063—One 350-ton Boomer & Boschert extra heavy downward pressure Hydraulic Press, steel beams, steel cylinder, iron platen. Inside diameter of cylinder 15". Diameter of steel rods 4½". Width between rods 72". Movement of ram about 48". Platen 62" square.

MISCELLANEOUS

No. 4 Williams & White Bulldozer
 Whiton Hand Feed Gear Cutter
 Die Filing Machine
 Bar Universal tool grinding machine
 30" Niagara foot power squaring shear
 Mossburg & Granville pendulum foot press
 Putnam Nut Facing Machine
 Hand rotary circular shears
 30" Peck, Stow & Wilcox tinners' rolls.
 1 Press for disc grinder wheels
 No. 3 set of universal dividing heads for Cincinnati milling machine.
 63"x8" Boring Bar
 6 15 16"x67" Boring Bar
 12"x10" Boring Bar
 Hand power lever shears, 10" blade
 Hand screw press, ¾" screw
 96" Cornice Brake
 1 Knuckle joint hot press complete with burner and brass plate
 22" swing lathe head
 Hisey & Wolf Horizontal Tapping and Boring Machine mounted on bed
 2" to 1" frame combination, tool and die
 Patterns and drawings for 16"x6' lathe, and castings for 4 lathes
 2 spindle Pratt & Whitney Profiling Machine
 10" Lowell slotter.

PARTIAL LIST. SEND FOR COMPLETE BOOKLET.

FRANK TOOMEY, Inc., 127-131 N. 3rd Street, Philadelphia, Pa.

- Jigs, Tools, etc.**
Hamilton Gear & Machine Co., Toronto.
- Joints, Expansion.**
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
- 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.
- Laquering 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.**
Lutz-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.
Ready Tool Co., Bridgeport, 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, Hand Turning.**
Jencks Machine Co., Sherbrooke, Que.
- Lathes, Engine.**
American Woodworking Machy. Co., Toronto.
Canada Machinery Corp., Galt, Ont.
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.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
R. McDougall Co., Galt.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
- Lathe Pans.**
New Britain Machine Co., New Britain, Conn.
- Lathes, Patternmakers'.**
J. G. Blount Co., Everett, Mass.
Fay & Scott, Dexter, Maine.
Foss & Hill Machy. Co., Montreal.
Mussons, Limited, Montreal.
- Lathes, Screw Cutting.**
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Cincinnati Iron & Steel Co., Cincinnati, O.
Girard Machine & Tool Co., Philadelphia, Pa.
Mesta Machine Co., Pittsburg, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
- Lathes, Spinning.**
Bliss, E. W., Co., Brooklyn, N.Y.
Toledo Mach. & Tool Co., Toledo, O.
- Lathe, Turret and Speed.**
American Woodworking Machy. Co., Toronto.
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.
Garvin Machine Co., New York.
- Girard Machine & Tool Co., Philadelphia, Pa.**
Mesta Machine Co., Pittsburg, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
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.**
Lutz-Porter Co., Toronto.
- Link Belting.**
Can. Fairbanks-Morse Co., Montreal.
Graton & Knight Mfg. Co., Montreal.
Jones & Glasco, 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, Railroad.**
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.
Crestar Refining Co., Toronto.
Crescent Oil Co., Inc., New York.
- Machine Tools.**
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Can. Machinery Corp., Galt, Ont.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.
- Machinery Dealers.**
Can. Fairbanks-Morse Co., Montreal.
Cooperative Used Machy. Co., New York.
Hill, Clarke & Co., of Chicago.
Marshall & Husehart Machinery Co., Chicago.
National Machinery & Supply Co., Hamilton.
Frank Toomey, Inc., New York.
A. R. Williams Machy. Co., Toronto.
New York Machinery Exchange, New York.
- Machinery Guards.**
Jones & Glasco, 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.
National Forge & Tool Co., Erie, Pa.
Ready Tool Co., Bridgeport, Conn.
Frank H. Scott, Montreal.
J. H. Williams & Co., Brooklyn, N.Y.
- Magnetos.**
Lutz-Porter Co., Toronto.
- Mandrels.**
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
- Marine Engines.**
Cunningham & Sons, St. Catharines, Ont.
- Marking Machinery.**
Brown, Boggs Co., Hamilton, Ont.
Holden-Morgan Co., Toronto.
Noble & Westbrook Mfg. Co., Hartford, Conn.
- Marqueises.**
Dennis Wire & Iron Works, London, Ont.
- Measuring Tapes and Rules.**
James Chesterman & Co., Ltd., Sheffield, Eng.
- Metallurgists.**
Canadian Inspection & Testing Laboratories, Ltd., Montreal.
Toronto Testing Laboratory, Ltd., Toronto.
- Metal Cutting Machines.**
Racine Tool & Machine Co., Racine, Wis.
- Metal Stamping.**
Duncan Electrical Co., Montreal.
- Meters, Electrical.**
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Lutz-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, R.I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Hendey Mach. Co., Torrington, Conn.
Kemp Smith 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, R.I.
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.
Kemp Smith Mfg. Co., Milwaukee, W. Mesta Machine Co., Pittsburg, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
- Milling Machines, Plain, Bench and Universal.**
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
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, Conn.
Kemp Smith Mfg. Co., Milwaukee, Wis.
Mesta Machine Co., Pittsburg, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
A. R. Williams Machy. Co., Toronto.
- Milling Machines, Profile.**
Brown & Sharpe Mfg. Co., Providence, R.I.
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.
Pratt & Whitney Co., Dundas, Ont.
- Milling Tools.**
Brown & Sharpe Mfg. Co., Providence, R.I.
Geometric Tool Co., New Haven, Conn.
Kemp Smith Mfg. Co., Milwaukee, W.
- Mine Cars and Hitchings.**
Pratt & Whitney Co., Dundas, Ont.
Modern Tool Co., Erie, Pa.
Can. Fairbanks-Morse Co., Montreal.
- Vining Machinery.**
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.
- Mixers, Hot Metal.**
Mesta Machine Co., Pittsburg, Pa.
- Mortising Machines.**
Jones & Glasco, Montreal.
- Motors, Electric.**
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lutz-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.
John Morrow Screw Co., Ingersoll, 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. B. 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, Ont.
- Oil Stones.**
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
- Oil Filtering Systems, Etc.**
S. F. Bowser & Co., Fort Wayne, Ind.
- Ovens for Baking, Bluing, Drying, Enamelling, Japanning, and Laquering.**
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.**
Graton & Knight Mfg. Co., Montreal.
- 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 & Marlon, 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.**
Taffan Brass & Metal Co., Hamilton.
- Pig Iron.**
Hanna & Co., M. A., Cleveland, O.
Stevens, F. B., Detroit, Mich.
- Pinions, Mill Cut.**
Mesta Machine Co., Pittsburg, Pa.
Wm. Tod Co., Youngstown, O.

MACHINERY—IMMEDIATE DELIVERY

PARTIAL LIST OF MACHINES RECENTLY PURCHASED AND FULLY DESCRIBED IN OUR NEW GREEN LIST JUST PUBLISHED

ENGINE LATHES.

- 1-12" x 5' Fitchburg Lo-Swing.
- 1-14" x 7' Fitchburg Lo-Swing.
- 1-10" x 5 1/2' Seneca Falls.
- 1-10" x 5' Reed.
- 1-10" x 5' Pratt & Whitney, T. A., O.P., Draw Bar.
- 1-12" x 5' Reed.
- 3-12" x 5' Fay & Scott.
- 1-12" x 5' Hendey, T.A., O.P., Q.C.G.
- 1-13" x 5' Bames.
- 1-13" x 6' Sebastian.
- 1-13" x 6' Willard.
- 1-13" x 8' Willard.
- 1-14" x 6' Lodge & Davis.
- 1-14" x 6' Flather.
- 1-14" x 6' Hendey.
- 1-14" x 7' Lodge & Davis, T.A.
- 1-14" x 6' Lodge & Shipley.
- 1-14" x 6' Reed.
- 1-14" x 6' Prentice, Q.C.G.
- 2-14" x 6' Casco, Q.C.G.
- 1-14" x 6' Hendey, T.A., Q.C.G.
- 1-14" x 8' Lodge & Shipley, Pat. Hd., Q.C.G.
- 1-15" x 6' Seneca Falls, Q.C.G.
- 1-15" x 6' Flather.
- 1-15" x 6' LeBlond.
- 1-15" x 6' Davis.
- 3-15" x 6' Von Wyck, T.A.
- 1-15" x 6' Von Wyck, Q.C.G.
- 1-15" x 6' Walcott.
- 1-15" x 6' Whitecomb Blaisdell.
- 1-15" x 6' Whitecomb Blaisdell, Q.C.G.
- 1-15" x 6' Walcott.
- 1-15" x 6' Von Wyck.
- 1-16" x 6' Forsaith.
- 1-16" x 6' Reed.
- 1-16" x 6' Blaisdell, T.A.
- 1-16" x 6' American.
- 1-16" x 6' Flather.
- 2-16" x 6' Walcott.
- 1-16" x 8' Pratt & Whitney.
- 1-16" x 8' Porter.
- 1-16" x 8' Flather, Mot. Drive.
- 1-16" x 8' Flather, Turret.
- 1-16" x 8' Lodge & Shipley, Pat. Hd., Q.C.G.
- 1-16" x 8' Lodge & Shipley, Q.C.G.
- 1-16" x 8' Lodge & Shipley, Mot. Drive, T.A., Q.C.G.
- 1-16" x 8' Putnam.
- 1-16" x 8' Graves & Klusman.
- 1-16" x 8' Beaman & Smith, Turret.
- 1-16" x 8' American.
- 1-16" x 8' Silk-Anderson.
- 1-16" x 10' Von Wyck, T.A.
- 1-16" x 10' Davis.
- 1-17" x 6' Blaisdell.
- 1-17" x 6' Rockwell.
- 1-17" x 6' Blaisdell.
- 1-17" x 8' Graves & Klusman, T.A., Turret.
- 1-17" x 8' Graves & Klusman, Mot. Drive, T.A.
- 1-17" x 8' Prentice, Q.C.G., Turret.
- 1-17" x 10' Cincinnati.
- 1-17" x 10' Silk-Anderson.
- 1-18" x 12' LeBlond, Q.C.G., Turret.
- 1-18" x 6' Whitecomb Blaisdell.
- 1-18" x 8' Reed.
- 1-18" x 8' Walcott.
- 1-18" x 8' Wheeler.
- 1-18" x 8' Davis & Egan, T.A.
- 2-18" x 8' Bradford.
- 1-18" x 8' American, T.A., Q.C.G.
- 1-18" x 8' American, Q.C.G.
- 1-18" x 8' Flather.
- 2-18" x 8' Whitecomb Blaisdell.
- 1-18" x 12' Davis & Egan.
- 1-18" x 12' Champion.
- 2-19" x 8' Rahn.
- 2-19" x 8' Silk-Anderson.
- 1-19" x 8' Graves & Klusman, Turret.
- 1-19" x 10' LeBlond.
- 1-19" x 14' Bridgford, double-axl.
- 1-20" x 8' Rahn.
- 1-20" x 8' Flather.
- 1-20" x 8' LeBlond, heavy duty, Q.C.G.
- 1-20" x 12' Porter.
- 1-21" x 10' Fitchburg.
- 1-21" x 10' Schumacher & Boye.
- 1-21" x 14' Flather.
- 1-21" x 6' Flather.
- 1-21" x 6' LeBlond.
- 1-22" x 8' Blaisdell.
- 1-22" x 8' American, G.H. Turret, Q.C.G.
- 1-22" x 10' Schumacher & Boye, T.A.
- 1-22" x 16' Schumacher & Boye.

Engine Lathes Continued.

- 1-22" x 10' Parkins.
- 1-22" x 12' Economic.
- 1-24" x 12' Economic, Q.C.G.
- 1-24" x 12' Schumacher & Boye.
- 1-24" x 16' Schumacher & Boye.
- 1-24" x 16' Davis & Egan.
- 1-25" x 10' Bradford.
- 1-25" x 12' Lodge & Shipley, Turret, Q.C.G.
- 2-25" x 14' Bradford.
- 1-25" x 20' Muller.
- 1-28" x 12' Schumacher & Boye.
- 1-26" x 12' Gleason, T.A.
- 1-28" x 16' Fay & Scott.
- 1-30" x 14' Blaisdell.
- 1-30" x 16' Reed.
- 1-32" x 10' Bradford.
- 1-32" x 12' American.
- 1-36" x 12' Fifield.
- 1-36" x 12' Schumacher & Boye.
- 1-38" x 16' Fifield.
- 1-42" x 12' Putnam.
- 1-46" x 16' Putnam.
- 1-60" x 16 1/2' Fitchburg.

HAND TURRET AND SCREW MACHINES.

- 1-Brown & Sharpe, No. 1 Monitor.
- 1-Brown & Sharpe, No. 1 Screw Machine.
- 1-Flather, 13" Turret.
- 1-Wood No. 2, Monitor.
- 1-Gisholt, 13" Turret.
- 1-Garvin 14" Turret.
- 1-Pratt & Whitney, 14" Monitor.
- 1 American 15" Fox Lath.
- 3-Pratt & Whitney, 16" Monitor, F.B.G.
- 4-American No. 2 Fox Lathes.
- 1-Lodge & Davis 18" Cabinet.
- 1-Springfield, 18" Cabinet.
- 1-Garvin, No. 22 1/2.
- 1-Gisholt, 21" Turret, R.T., T.A.
- 5-Potter & Johnson 22".
- 2-Gisholt 24", R.T., T.A.
- 1-Eddy, 36".
- 3 Pratt & Whitney, 5 1/2".
- 1-Warner & Swasey, 5 1/2".
- 1-Bardons & Oliver, 11-16".
- 2-Bardons & Oliver, 3 1/2".
- 2-Pearson, 3 1/2".
- 2-Garvin, 3 1/2".
- 1-Bardons & Oliver, 15-16".
- 1-Garvin, 1 1/2".
- 1-Foster, 1 1/2".
- 1-Wood, 1 1/2".
- 2-Bardons & Oliver, 1 1/2".
- 2 Bardons & Oliver, No. 2 Monitor.
- 1-Pratt & Whitney, 1 1/2".
- 1-Pearson, 1 1/2".
- 1-Wood, 1 1/2".
- 1-Pearson, 1 1/2".
- 1 Dress, 1 1/2".
- 1-Brown & Sharpe, 1 1/2".
- 1-Pratt & Whitney, 1 1/2".
- 1-Lodge & Davis, 1 1/2".
- 1-Bardons & Oliver, 1 1/2".
- 1-Davis & Egan, 2".
- 4-Bardons & Oliver, 2".
- 1 Warner & Swasey, Hol Hex.
- 1-Pratt & Whitney, 2".
- 2 Jones & Lamson, 2", Cone.
- 2-Jones & Lamson, 2 1/2", Cone.
- 1 Jones & Lamson, 3" x 3", Geared.
- 2-Warner & Swasey, No. 8, 3 1/2".

AUTOMATIC TURRET AND SCREW MACHINES.

- 1 No. 6 Hartford Automatic.
- 1 No. 1 Acme Automatic.
- 1 " Cleveland Automatic.
- 1 " Cleveland Automatic.
- 7-No. 53 National Acme-4-spindle.
- 1 No. 54 National Acme-4-spindle.
- 1 No. 55 National Acme-4-spindle.
- 1-No. 56 National Acme-4-spindle.

SENSITIVE AND UPRIGHT DRILLS.
Over 100 items from 10" sensitive to 12" upright.

MULTIPLE DRILLS.

- 1 item.

RADIAL DRILLS.

- 2 items, 2" to 6 1/2" Am.

VERTICAL BORING MACHINES.

- 1 Bost. B. 20".
- 1 P. O. B. 20" spindle.
- 1 Backus, 24".

Vertical Boring Machines Continued.

- 1 " Bar. 2-spindle.
- 2-Foot-Burt, 2-spindle cylinder.
- 2-Foot-Burt, 4-spindle.
- 1-Moline, 4-spindle.
- 1-Bullard, 24", Vertical Turret.
- 1-E. J. Flather, 30".
- 1-Baush, 30".
- 1-Bullard, 32".
- 1-Bullard, 34".
- 2-Rogers, 34".
- 2-Brown & Sharpe, 36".
- 1-Baush & Harris, 37", 2-Hds.
- 1-King, 42", 2-Hds.
- 1 " Bost. 48", 2-Hds.

HORIZONTAL BORING MACHINES.

- 1 Pratt & Whitney, No. 1, 2-spindle, Rifle Barrel Drilling Machines.
- 1-Niles, 2-spindle, car brass machine.
- 1-Flather.
- 1-Barnes, No. 3.
- 1-Niles, No. 1.
- 1-Newark.
- 1-Warner & Swasey.
- 4-Bement.
- 1-Binsse.
- 1-Beaman & Smith.
- 1-Busse.
- 1-Bement Miles & Co.
- 1-Binsse.
- 1-Sellers, No. 3.
- 1-Bement.
- 1-Rochester, No. 2.
- 1-Beaman & Smith.
- 2-Beaman & Smith Cylinder-2-spindle.
- 1-Coffman, No. 2.

MILLING MACHINES.

- 13 Hand Millers.
- 62 Lincoln Millers.
- Also about 30 cone-driven and single pulley drive, knee type Milling Machines.

SHAPERS.

- About 35 items from 14" to 24".

PLANERS.

- About 25 items, 24" to 50".

GRINDERS.

- 18 Plain and Universal Grinders, 4" to 16".
- 7 Surface Grinders.
- 10 Internal Grinders.
- 11 Disc Grinders.
- 17 Cutter & Drill Grinders.
- 75 Buffers and Emery Stands.

SAWING MACHINES.

- 11-Hack Saws.
- 1-3" Davis Cutting-off Machine.
- 1-3" Burke Cold Saw.
- 1-3" Hurlbut & Rogers Cutting-off Machine.
- 1-3" Hurlbut & Rogers cutting-off Machine, accelerated speed.
- 1-4" Cochrane-Bly Cold Saw.
- 1-3" Higley Cold Saw.
- 1-Burke 5" Cold Saw.
- 1-Cochrane-Bly 8" Cold Saw.
- 1-Higley 8" Cold Saw.

PRESSES.

- 1-No. 13 Bliss.
- 1-No. 0 Stiles.
- 1-No. 2 American Can.
- 1-No. 2 R. & K.
- 1-No. 31 Swain.
- 1-No. 18 C Bliss.
- 1-No. 3 Falkenau & Sinclair.
- 1 No. 10 C Bliss.
- 1-No. 3 Rockford.
- 1-No. 3 American Can.
- 1-No. 3 Stiles.
- 1 No. 3 Stiles Geared.
- 1-No. 3 Stiles.
- 1-No. 3P R.&K.
- 1-No. 4 Adriance.
- 1-No. 4 Consolidated.
- 1 No. 5 R&K.
- 1 No. 5 Bliss.
- 1-No. 6 Adriance.
- 1-No. 79 Bliss Geared.
- 1-No. 57 Adriance Geared.
- 1 No. 6 Bliss Geared.
- 1-No. 74 1/2 Bliss.
- Also about ten other items.

GEAR CUTTING MACHINES.

- About 35 items.

MISCELLANEOUS.

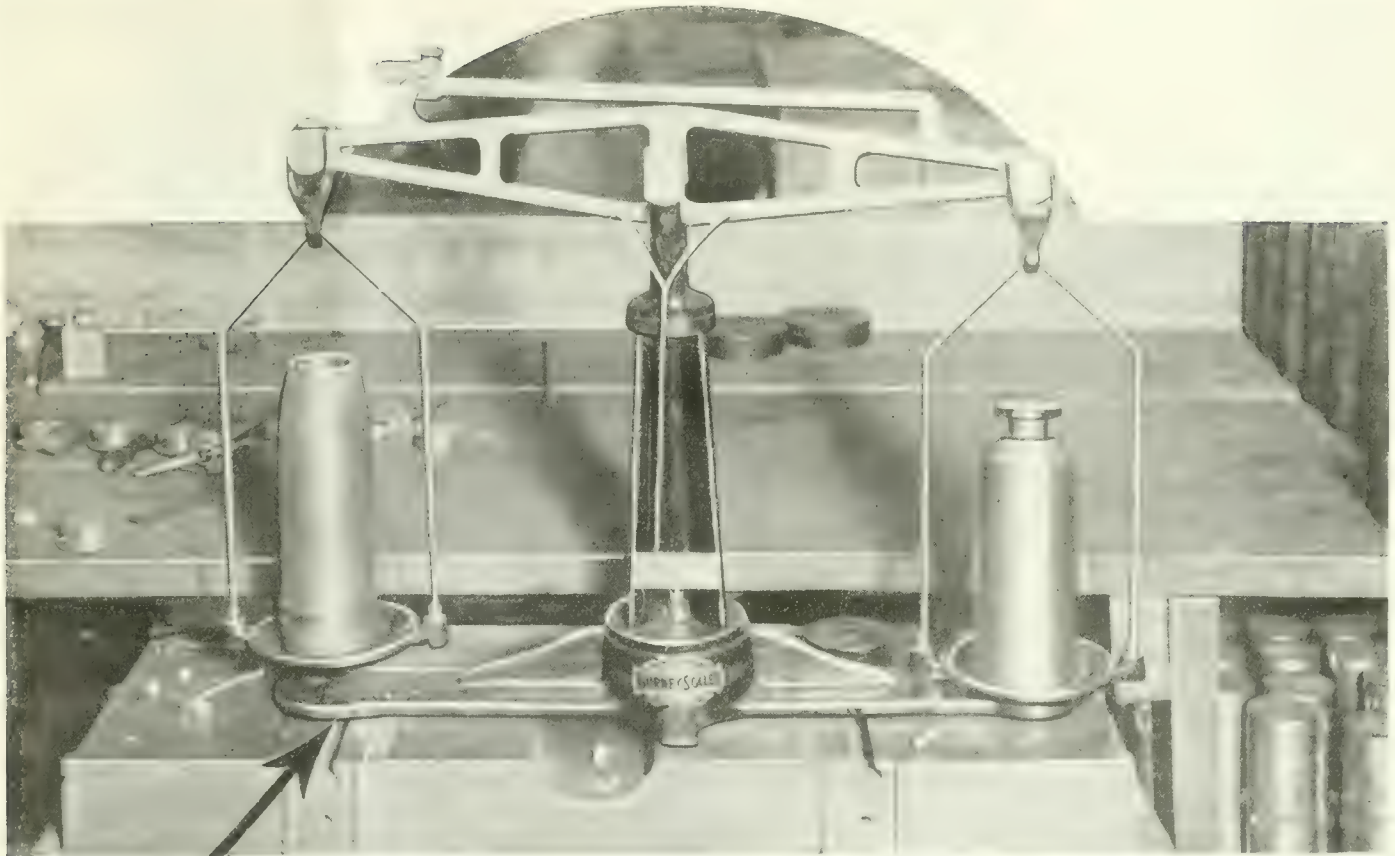
- About 100 items.

HILL, CLARKE & CO., OF CHICAGO

125 N. CANAL STREET

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- Portable Steel Tool Racks.**
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- Portable Steel Work Stands.**
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Niles-Bement-Pond Co., New York.
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Charles F. Elmes Eng. Works, Chicago, Ill.
Geo. Gorton Machine Co., Racine, Wis.
Girard Machine & Tool Co., Philadelphia, Pa.
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Southwark Foundry & Machine Co., Philadelphia, Pa.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
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Watson-Stillman Co., Aldene, N.J.
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Toledo Machine & Tool Co., Toledo.
Brown, Boggs & Co., Hamilton, Can.
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- Pumps, High Pressure.**
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Southwark Foundry & Machine Co., Philadelphia, Pa.
Watson-Stillman Co., Aldene, N.J.
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Can. Fairbanks-Morse Co., Montreal.
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National Mach. & Sup. Co., Hamilton.
Wm. R. Perrin Co., Toronto.
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- Southwark Foundry & Machine Co., Philadelphia.**
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Can. Buffalo Forge Co., Montreal.
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Capacity 25 and 60 lbs.

This Scale not only gave satisfaction to CANADIAN makers of shells, but AMERICAN makers of shells ordered Scales here for use in UNITED STATES, and paid 45% duty on the CANADIAN price.

Buy the Best

Automatic Scales

Something new for general use in factory and warehouse.

The use of this Scale prevents clerical errors, and saves the time of men, the loss of money and good-will.

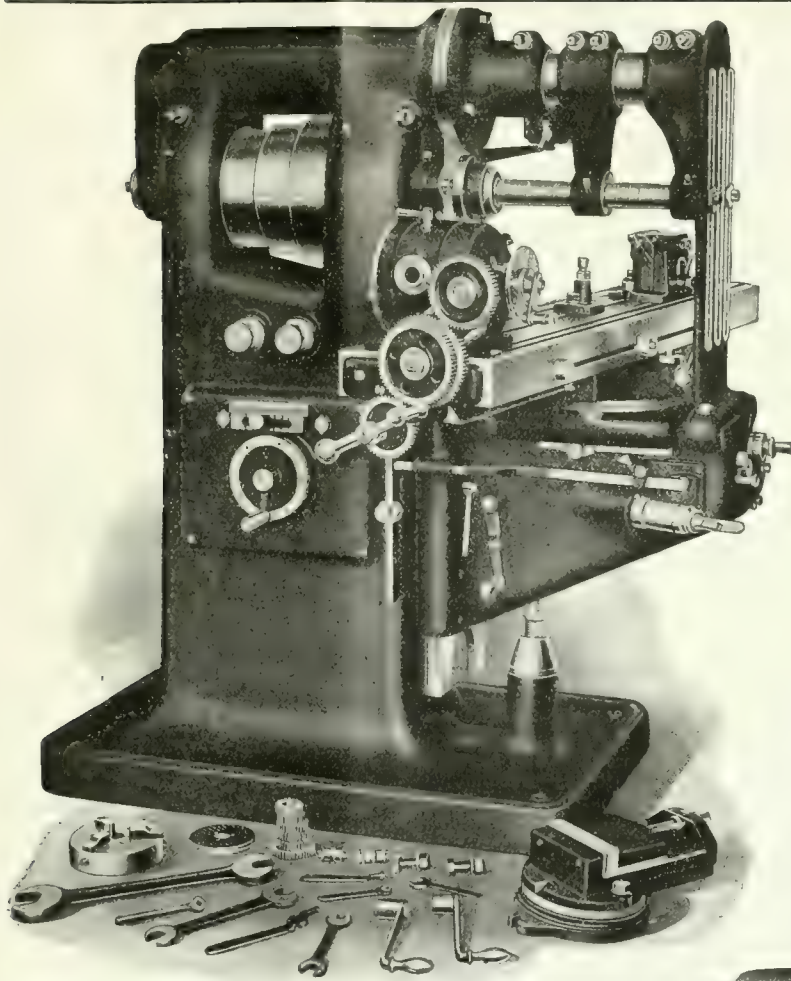
Write for circular.

The Gurney Scale Co.

Hamilton, Ontario, Canada

**Weighing
Shells
with a
Gurney
Bullion
SCALE**

MADE IN
CANADA



THE MASSIVE, CLEAN-CUT CONSTRUCTION THROUGHOUT AND THE CONVENIENCE OF CONTROL ALLOW A SPEED OF OPERATION WHICH IS PRACTICALLY LIMITED ONLY BY WHAT THE CUTTER WILL STAND.

Rockford Attachments are also of heavy construction, bolted to seat of column, and provided with patented flanged support. These attachments can be used to the full cutting capacity of the machine.

There's a new circular which describes this machine fully. Jot down a line for it now.

Rockford Milling Machine Company

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Sales Agents for Canada: The Canadian Hardware & Machine Co. Ltd., Montreal, St. John, Toronto, Winnipeg, Calgary, Saskatoon, Vancouver.

FOREIGN AGENTS: A. A. Jones & Shipman, Ltd., Leicester, England; F. G. Krietschmer & Co., Frankfurt, a. M., Holland and Switzerland; Barancharan, Metivier, Gezeau & Cie, San Sebastian, Spain; Aktiebolaget Rylander & Asplund, Stockholm, Sweden; The Brazilian Representation Co., Rio de Janeiro, Brazil; Roku-Roku Shoten, Tokio, Japan.

A big increase in stiffness and rigidity over ordinary construction.

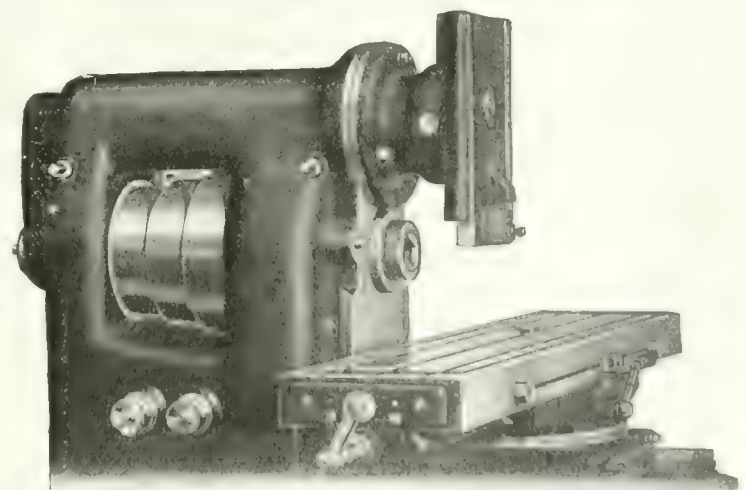
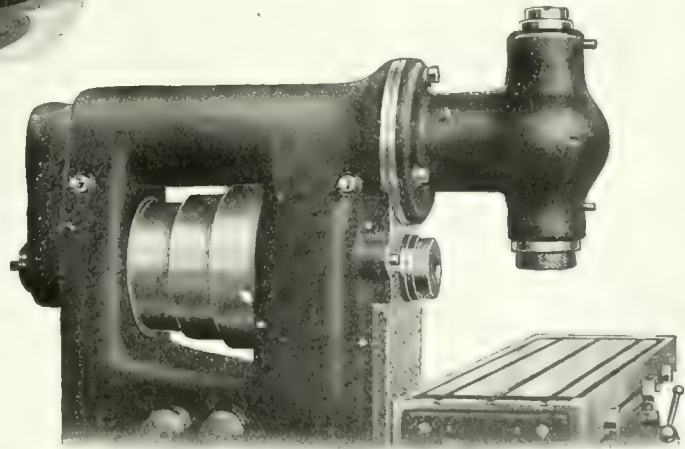
The No. 2 ROCKFORD "UNIVERSAL" HEAVY DUTY DOUBLE BACK GEARED CONE MILLING MACHINE

makes fast, deep cuts equal to those produced by the average No. 3 Miller.

The **Double Back Gearing** furnishes great power to spindle.

The **Patented Flanged Overhanging Arm** gives an exceptionally rigid support that reduces vibration and increases cutting capacity.

Hyatt Roller Bearings save the power loss of friction, eliminate wear and keep the center of gears constant and reduce friction.



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Manufacturers Equipment Co., Chicago, Ill.
Murphy Machine & Tool Co., Detroit.
Victor Tool Co., Waynesboro, Pa.
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Can. Tap & Die Co., Galt, Ont.
Cleveland Twist Drill Co., Cleveland
Geometric Tool Co., New Haven, Conn.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Murphy Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Victor Tool Co., Waynesboro, Pa.
Wells Brothers Co., Greenfield, Mass.
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Shore Instrument & Mfg. Co., New York City.
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Garvin Machine Co., New York.
Geometric Tool Co., New Haven, Conn.
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Lania Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
National Machy. Co., Tiffin, Ohio.
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Used in the coating of H. E. Shells

Passed and approved by the Consulting Chemist
for the Shell Committee

Samples and prices submitted upon request.



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THE AULT & WIBORG CO. OF CANADA, LIMITED

VARNISH WORKS

Montreal

TORONTO

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Manufacturers of

Varnishes, Japans, Enamels and Colors for all Systems and Purposes

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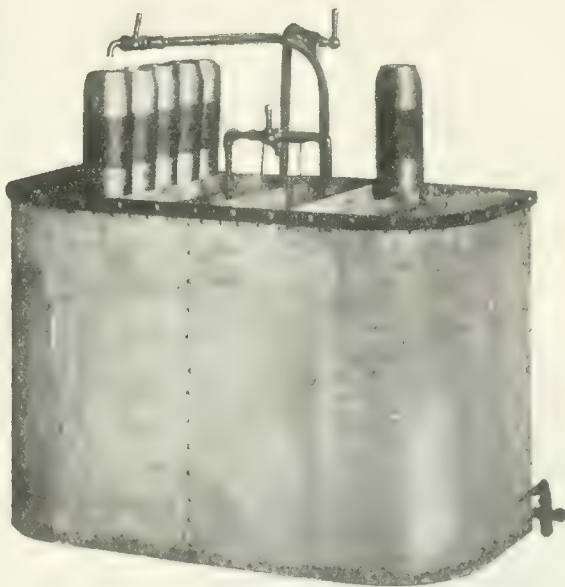
Heavy and Light Drills

for

Shrapnel and Lyddite Shells

Our Compressed Air VARNISHING TANK

for High Explosive Shells is low in cost, simple and quick in operation, and guarantees a uniform coating without waste. Can be furnished with or without air compressor for operating. Capacity, 60 per hour.

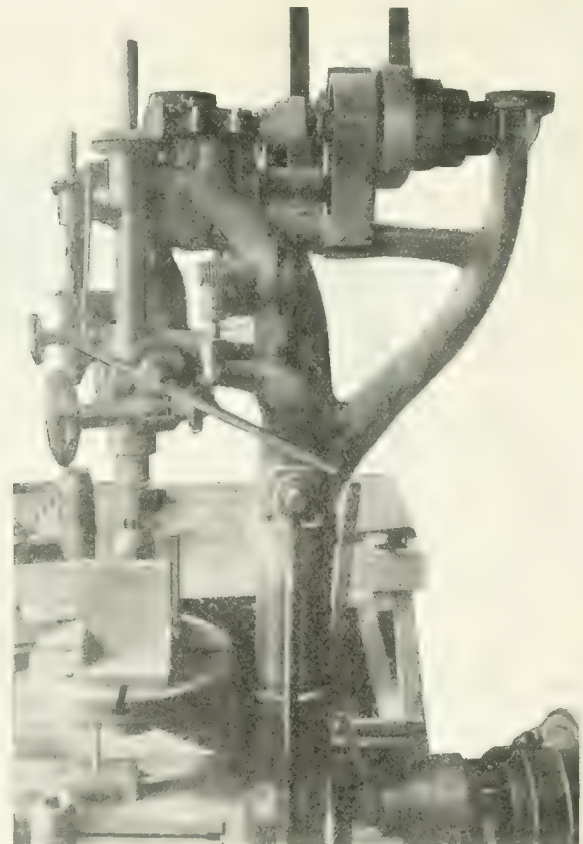


Standard 20" Drill Press

used for the various operations of reaming, sizing, centering, tapping, etc., on High Explosive Shells.

Adapted to meet the severe demands of Shell manufacturers and is fulfilling all requirements for specialized work.

Full particulars on request.



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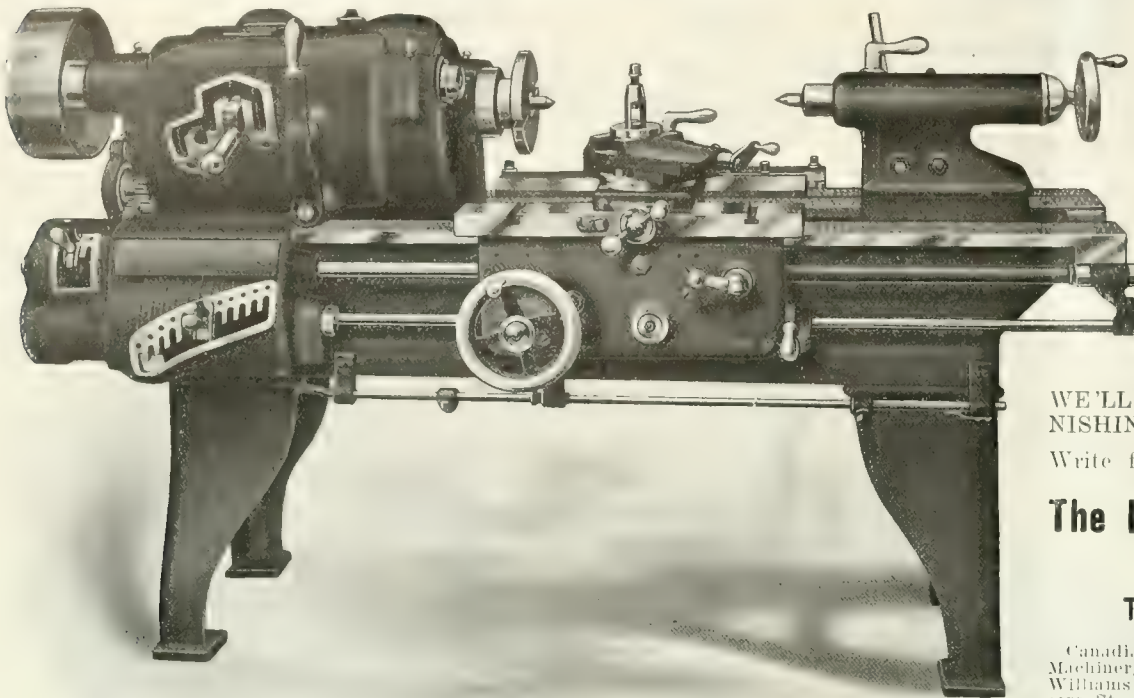
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MONTREAL

HENDEY 18-Inch GEARED HEAD LATHE

8 mechanical changes of speed for spindle with driving shaft running at constant speed, 4 direct and 4 through back gears.



36 DIFFERENT THREADS AND FEEDS are had through Mounted Change Gearing, each change being quickly made through controlling handles in Gear Boxes.

BEFORE PURCHASING A NEW LATHE INVESTIGATE THE HENDEY SERVICE.

WE'LL HELP YOU BY FURNISHING LIST OF USERS.

Write for descriptive circular.

The Hendey Machine Company
Torrington, Conn.

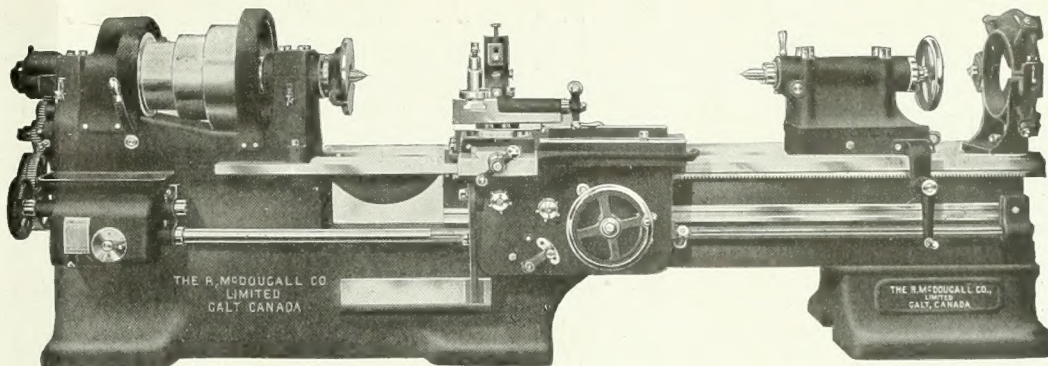
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ADVERTISING INDEX — (Continued)

Lackawanna Steel Co.	8	Norton Co.	67	Southwark Foundry & Machine Co.	24-25
Lane Dynamos & Motor Co.	137	Nutter & Barnes	26	Standard Tube & Fence Co., Ltd.	35
L'Air Liquide Society	137	Oven Equipment & Mfg. Co.	4	Starrett Co., L. S.	49
Lambis Machine Co.	141	Parmenter & Bulloch Co., The	136	Stow Mfg. Co.	138
Leslie, A. C., & Co.	128	Partridge, E. O.	137	Stevens, Frederic B.	60
Lever Bros.	34	Perrin, Wm. R.	32	Steel Bending Brake Works, Ltd.	140
Lintz Porter Co.	128	Pittsburg Pneumatic Company	48	Stocker, H. A., Machinery Co.	124
Lutz Webster Engineering Co., Inc.	56	Plessisville Foundry	140	Tabor Mfg. Co.	139
Lymburner, Ltd.	137	Pittsburg Valve Foundry & Construction Co.	35	Tate-Jones & Co., Inc.	21
McLaren, D. K., Ltd.	47	Port Huron Engine & Thresher Co.	132	Toomey Inc., Frank	149
McDougall Co., R. Inside Back Cover		Positive Clutch & Pulley Works	141	Tod, Wm. Co.	23
McLaren Belting Co., J. C.	141	Pratt & Whitney Co. Inside Front Cover		Toronto Iron Works, Limited	29
Main Belting Co. of Canada	137	Puro Sanitary Drinking Fountain Co.	130	Toronto Testing Laboratory	141
Manufacturers' Equipment Co.	51	Racine Tool & Machine Co.	10	Trahern Pump Co.	64
Marion & Marion	130	Ready Tool Co.	128	Turner Machine Co.	50
Marshall & Huschart Machy. Co.	52	Reddaway, F. & Co.	46	Vanadium Alloys Steel Co.	9
Mesta Machine Co.	16	Pickert Shafer Co.	145	Victor Tool Co.	135
Mechanical Engineering Co.	5	Ridout & Maybee	139	Vulcan Crucible Steel Co.	132
Modern Tool Co.	38	Rockford Milling Machine Co.	155	Warner & Swasey	53
Morton Mfg. Co.	132	Root, C. J. Co.	141	Watson-Stillman Co.	26
Motch & Merryweather Machinery Co.	28	Rumely-Wachs Machy. Co.	122	Wells Bros. of Canada, Ltd.	50
Murchev Machine & Tool Co.	36	Shelton Metallic Filler Co.	59	West Tire Setter Co.	28
National Electric Welder Co.	57	Shipman, Harold C., & Co. 130 and 136		Whiting Foundry Equipment Co.	141
National Forge & Tool Co.	48	Shore Ins. & Mfg. Co.	55	White, A. D., Machinery Co.	132
National Scale Co.	58	Shuster Co., F. B.	140	Whitman & Barnes Mfg. Co.	129
New York Machinery Exchange	134	Simonds, Canada Saw Co.	12	Williams Tool Co.	118
New Britain Machine Co.	14	Skinner Chuck Co.	34	Williams Machinery Co., A. R. 117-120	
Nicholson File Co.	52	Sly Mfg. Co., W. W.	62	Williams Co., J. H.	65
Northern Crane Works	136	Smart Turner Machine Co.	141	Woods, Vallance Co.	51
Norton, A. O.	141				
Norton Grinding Co.	66				

**McDougall
Gap Lathes**

**Strength
Accuracy
Quality**



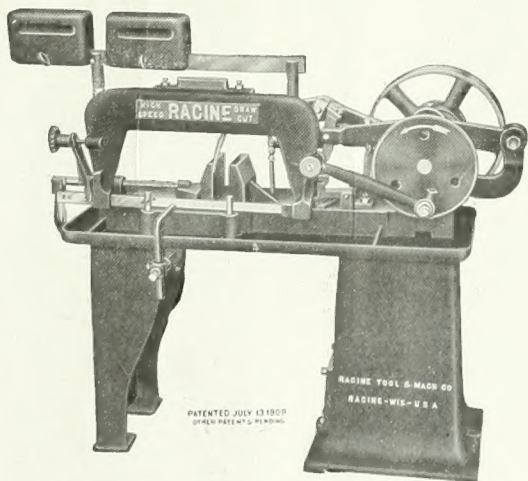
Take a look at the next money you intend to invest in a Lathe. Then, take a look at the money's worth we offer you in our machine. Your money will soon come back to you in increased production and we will have the pleasure of having a satisfied user. Our machines are just as good as they look and they look good too. We invite the closest inspection.

Particulars on request.

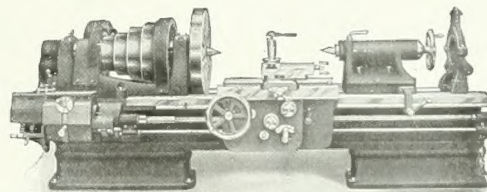
The R. McDougall Company Limited
Manufacturers
GALT, Ont., Canada
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A few of our leaders that have made good in some of the most successful Shell Plants



No. 1 Racine High-Speed Metal Cutting Machine.



Boye & Emmes Lathes.



Tungsten Hack Saw Blades.

We also furnish Nosing and Banding Presses, Band Turning Machines and Attachments, Marking Machines, Nosing Furnaces, Baking Ovens, Automatic Opening Dies, Collapsible Taps, Etc.

Stock List of new and used Machine Tools, suitable for shell work, mailed upon request.

The Foss & Hill Machinery Company, 305 St. James Street, Montreal

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

We are interested in your **SHELL OUTPUT**

and can help you increase it.

Our Hydraulic Press for Shell Banding

IS A STRONG, SIMPLE AND RELIABLE MACHINE AT LOW COST. Power is obtained from continuous running belt-driven pump located near the press, and is applied to the ram underneath the table.

TABLE RISES AND FORCES STEEL TAPER WEDGES EIGHT IN NUMBER UP INTO THE HOLLOW CASTING AT THE TOP, THE WEDGES CONFORMING TO THE SHAPE OF THE COPPER BAND ARE THUS PRESSED IN EQUALLY AGAINST SAME. PRESSURE IS THEN RELEASED AND THE SHELL READILY TAKEN OUT.

Operates by lever shown on left-hand side.

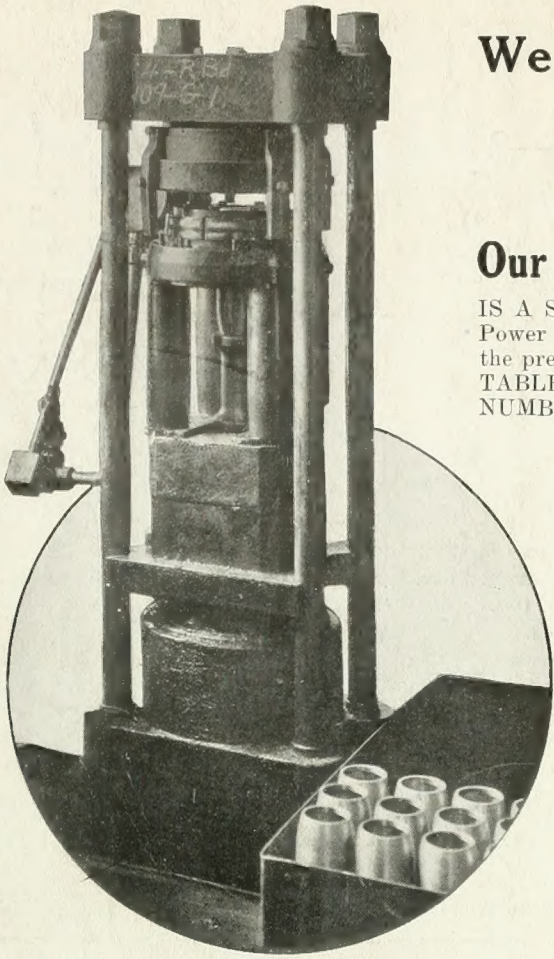
Pressure gauge behind.

As this machine is a Standard Hydraulic Press it can be used in any other capacity.

Factory handling operations are a specialty of ours. Look at this

ELEVATING TRUCK

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. When hauled to the desired position the button is pressed and the handle raised, lowering the platform to the floor. The truck is then drawn from underneath and is ready to move another platform.

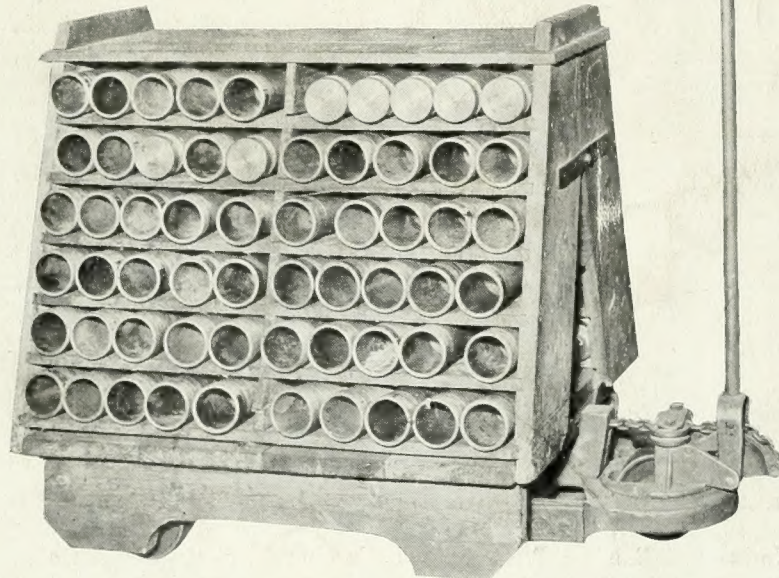


RAISING AND LOWERING OF THE TRUCK CAN BE OPERATED WITH ONE HAND ONLY

—can be raised or lowered at any angle.

Specially designed ball-bearings throughout.

We also manufacture **LOADING FUNNELS, BALL - BEARING TIGHTENING NUTS, BELT - DRIVEN LOADING VIBRATORS, BENCH VISES.** WE SHALL BE PLEASED TO SUBMIT PRICES AND GIVE ANY PARTICULARS REQUIRED.



The Chapman Double Ball Bearing Co. of Canada, Limited

339-351 Sorauren Avenue, Toronto, Canada

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

