

CANADIAN MACHINERY

AND MANUFACTURING NEWS ✓

A weekly newspaper covering in a practical manner the mechanical, power, foundry and allied fields.
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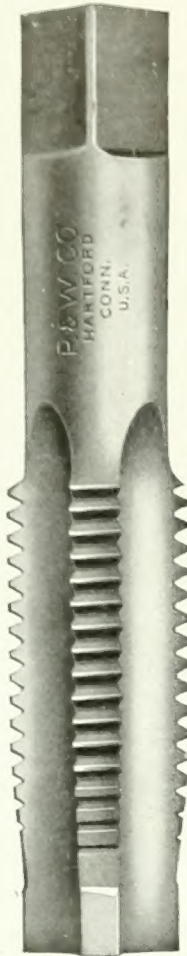
SKF



These three letters marked on a ball bearing are a guarantee of satisfaction. Such bearings are used wherever a reputation is to be maintained and where quality and service are a requisite.

Canadian SKF Co.
LIMITED
TORONTO, CANADA

SMALL TOOLS

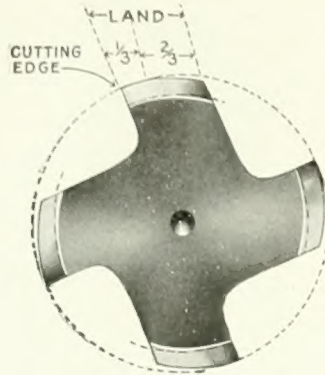


PROMPT SERVICE

is assured at our nearest store where P. & W. Small Tools are carried in stock. Place your order there to-day.

P. & W. TAPS

Insure the Greatest Accuracy



The Taps
with the
Con-eccentric
Trade-Mark Registered
Land

As will be seen by the cross-section cut above, one-third of the land from the cutting edge is concentric. The remaining two-thirds is eccentrically relieved. A tap made in this way can be ground for sharpening at the only correct point—on the face of the cutting edge. Sharpening in no way affects its size or the form of the thread.

The Taper Tap has a cylindrical pilot and on the chamfered portion of the tap the top of the thread is relieved clear to the cutting edge to secure keen cutting qualities.

The construction of Pratt & Whitney Taps not only insures greater accuracy and refinement than has heretofore been possible to obtain in a commercial tool, but also insures the freest cutting tap with the longest life—an exclusive P. & W. Combination.

Precision Machine Tools, Standards & Gauges

PRATT & WHITNEY CO.

of Canada, Limited

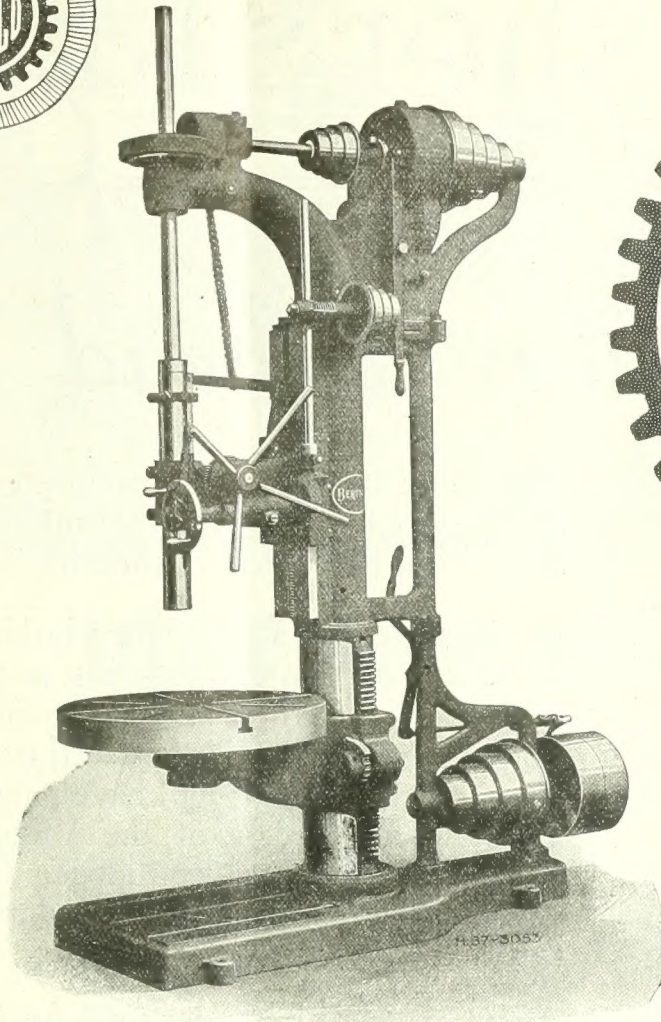
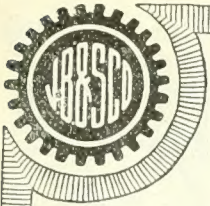
Works: DUNDAS, ONTARIO

MONTREAL
723 Drummond Bldg.

TORONTO
1002 C.P.R. Bldg.

WINNIPEG
1205 McArthur Bldg.

VANCOUVER
B.C. Equipment Co.



**Locomotive and
Car Shop Equipment**

**Structural and
Bridge
Shop Machinery**

**Repair Shop
Machinery**

**General Machine
Shop Equipment**

**30-inch Vertical
Drilling Machine**

Photographs and full particulars gladly
mailed upon request.

WRITE US NOW

We'll be pleased to submit
photographs and full details
on any line or lines in which
you are interested.

**The John Bertram & Sons Company
Limited**

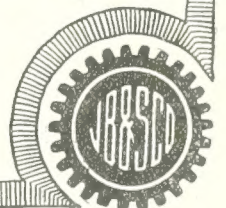
DUNDAS, ONTARIO, CANADA

MONTREAL
723 Drummond Bldg.

TORONTO
1002 C.P.R. Bldg.

VANCOUVER
609 Bank of Ottawa Bldg.

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1205 McArthur Bldg.



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

The Publisher's Page

TORONTO

December 13, 1917

Big Business Ahead

AS announced in Canadian Machinery recently, Canadian munition makers are receiving orders which will carry them far into the new year. This means more buying.

The United States Government is placing contracts with our manufacturers for immense quantities of a certain type of shell. This means more buying.

Canadian firms are securing large orders for ship deck machinery, such as steering gears, windlasses, winches, cargo hoists, etc., as well as engines, pumps and lighting sets. This means more buying.

Shipbuilding is booming and will continue to boom. This, too, means more buying.

Next year will probably be the busiest our metal working industries have ever had. Much buying of equipment will undoubtedly take place. How are you going to influence *your* share?

For the sake of the small investment required you cannot afford to miss the opportunity offered by the Annual Review Number of Canadian Machinery, December 27.

An advertisement in it—large enough to properly present your selling mes-

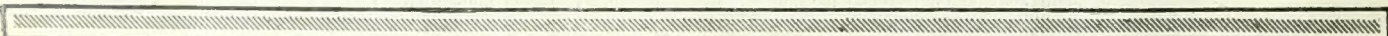
sage—will enable you to reach buyers all over the country, and in a number that will be preserved for months.

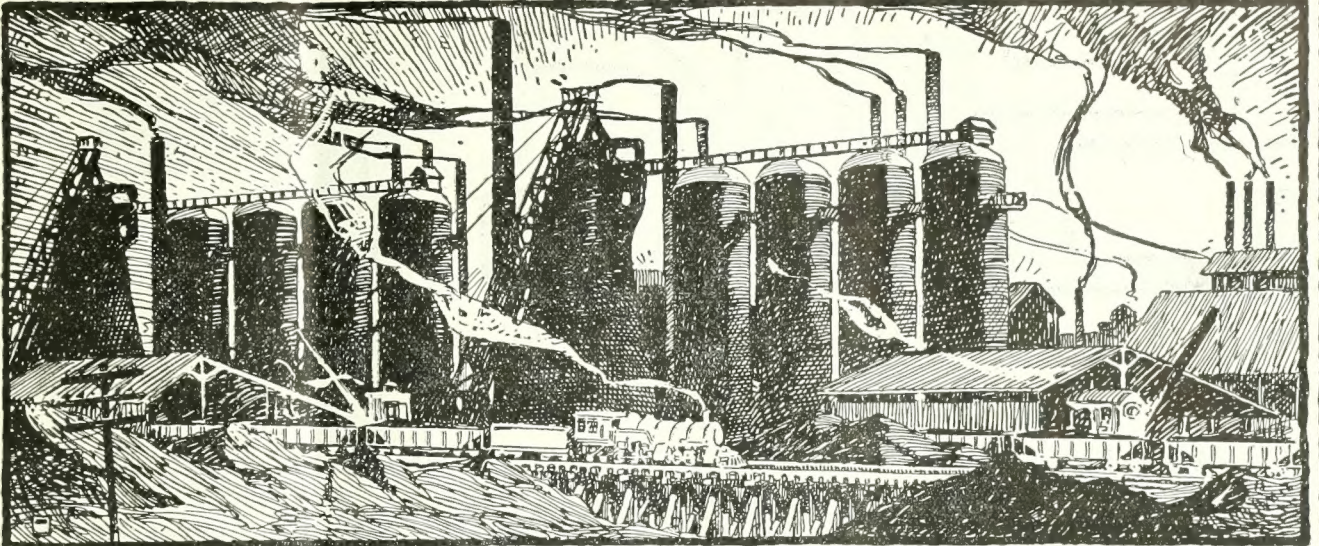
It will appear at a time when buying will commence in earnest—just at the beginning of the new year. The elections will be over and much of the unrest they are creating will have passed away. The success of the Victory Loan will give fresh confidence and will stimulate buying to a wonderful extent.

There could be no better time for the appearance of our Annual Number. And there is no better medium for reaching buyers. It is significant that many firms who used our last Annual Number have reserved increased space this year. One firm will have twenty-four pages, another twelve, others eights, fours, etc. Many advertisements will be in two or more colors.

Copies will be sent abroad to our export list.

First forms went to press December 1st; last forms close December 20th. Rush your space reservation and send copy as soon as possible. And send your cuts by *mail*.





LITTLE WORDS WITH BIG MEANING



According to "Webster,"
Quality is "an excellence
of character; natural
superiority."



Webster's definition of
"Service" is; "The per-
formance of labor for the
benefit of another."

We use these words advisedly—fully understanding their definitions—and realizing the obligation we place upon ourselves by their continued use in connection with our products of Iron and Steel, and our attitude to the people we serve.

THE
STEEL COMPANY
OF
CANADA
LIMITED
MONTREAL HAMILTON

Pig Iron,
Steel & Iron Bars,
Horse Shoes,
Steel and Iron Products.

Steel Billets,
Track Spikes &
Bolts, Forgings, Wire
of every description.

If interested, tear out this page and keep with letters to be answered.

SKF

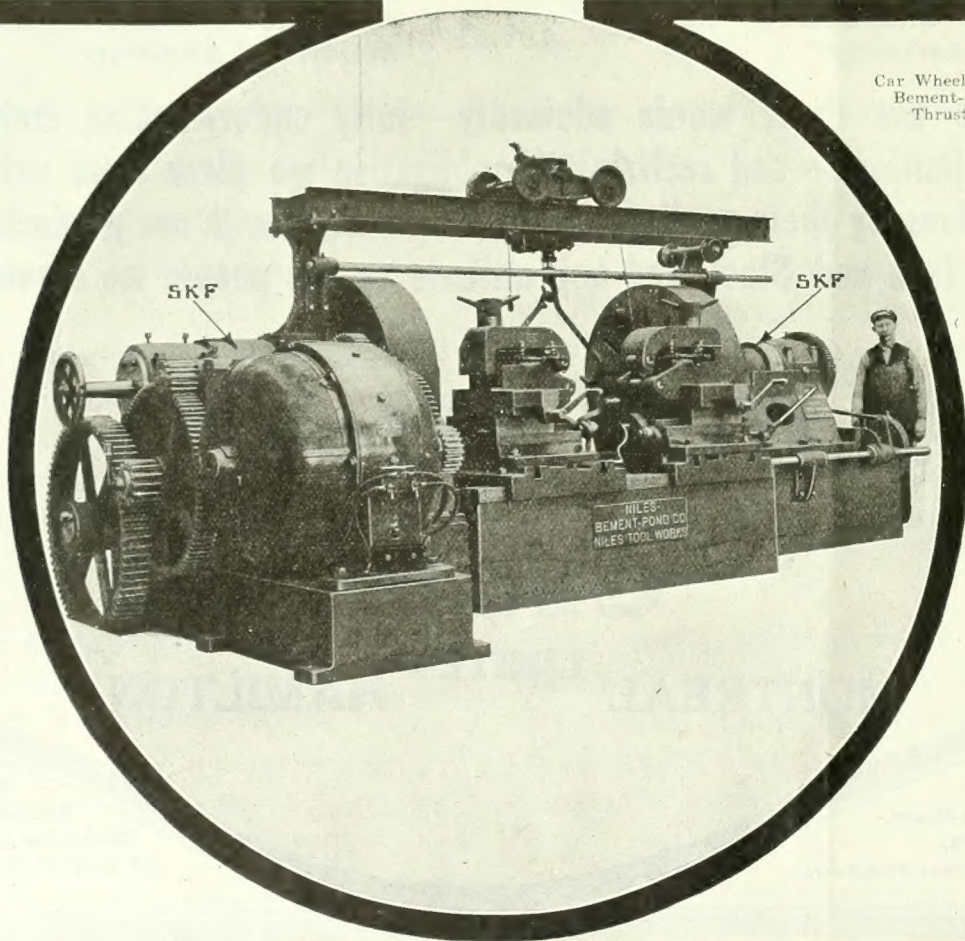
No. 2 of a Series of SKF Equipped Lathes **STRENGTH**

A single SKF carries the total thrust load, 125,000 pounds, in the lathe shown below. To stand this tremendous thrust in this Niles Lathe, the bearings must have capacity for heavy loads. SKF Thrust Bearings are designed to accept heavy loads without heating.

Your lathes must withstand thrust equally well. SKF will help solve your problem. The SKF engineering service department has helped others. It can help you.

Canadian SKF Company, Limited
TORONTO, ONT., CANADA

BALL BEARINGS



Car Wheel Lathe built by Niles-Bement-Pond, SKF equipped.
Thrust is 125,000 lb.

STELLITE

SAY, WHAT IS STELLITE?

THE HARDEST, TOUGHEST, FASTEST CUT-
TING METAL KNOWN.

EVER TRY IT?

LUCKILY, YES.

LIKE IT?

I SHOULD SAY.

THEN WHAT DOES IT CUT?

EVERYTHING,—STEEL, IRON, BRASS,
BRONZE, IVORY, CELLULOID, SHELL, ETC. *

FOR ALL PARTICULARS WRITE TO

Deloro Smelting & Refining Co., Ltd.

HEAD OFFICE AND WORKS—DELORO, ONTARIO

TORONTO
200 King St. W.

MONTREAL
315 Craig St. W.



SaBeN ExTra
HIGH SPEED STEEL

*The most
Economical
and Efficient
Steel for
Machining
Shells*

"Extra" Die Steel another good one

Manufactured by
**SANDERSON BROTHERS &
NEWBOULD, Limited**
SHEFFIELD. ENGLAND

H.A. DRURY COMPANY
LIMITED

MONTREAL TORONTO NEW YORK



A
Keen
Cutter

WOLFRAM
Is Both

VULCAN CRUCIBLE STEEL CO.
Aliquippa ESTABLISHED 1900 Pa. U.S.A.
Represented in Canada by Messrs Norlon
Callard & Company Que.
MONTREAL

Strong
in the
Neck

**ELECTRITE-
URANIUM**
High-Speed Steel

Will amaze you in its ability to remove metal

The introduction of this rare element—"URANIUM"—into the mixture of our already superb cutting product, has supplied the final perfection of the qualities of toughness and durability which has been the hitherto impossible goal of metallurgical hopes. Electric Furnaces, Automatically regulated, produce inevitably similar results at every melt.

We are ready to assist your inquiry in every way possible.

Write
Latrobe Electric Steel Company
Latrobe, Pennsylvania

MALLEABLE CASTINGS

Capacity

Two Thousand Five Hundred Tons per Month

*Our Prices, Quality and Delivery
are Right*

Send Us Your Inquiries.

THE PRATT & LETCHWORTH COMPANY, Limited

P.O. BOX 1630, MONTREAL

Works: BRANTFORD, ONTARIO

**Air Chucks for 6" Shells
in Stock**

**General Machine Work
of All Kinds**

Gear Cutting, Etc.

**Hyde Engineering
Works**

27 William St., Montreal

P.O. Box 1185

Telephones: M.1899 & M.2527

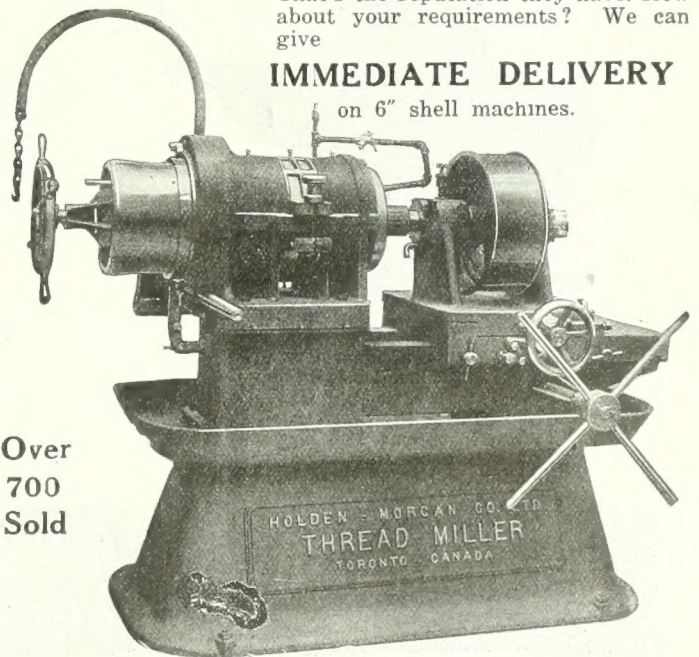
70 Holden-Morgans in One Plant

Another firm would not accept a contract until assured they could get HOLDEN-MORGANS.

That's the reputation they have. How about your requirements? We can give

IMMEDIATE DELIVERY

on 6" shell machines.



Over
700
Sold

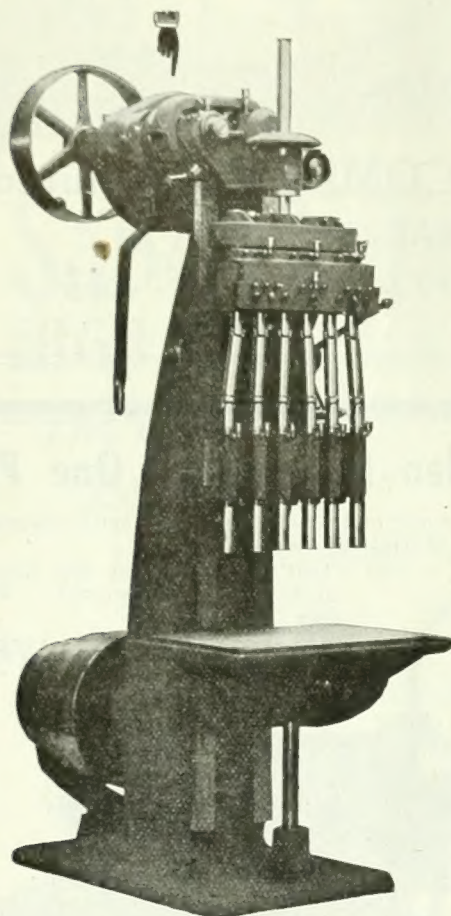
HOLDEN - MORGAN CO. LTD.
THREAD MILLER
TORONTO, CANADA

THE A. R. WILLIAMS MACHINERY CO.
W. FRONT ST. (Limited) TORONTO

If interested, tear out this page and keep with letters to be answered.

The Johnson Friction Clutch Is Being Used As A Part Of This Machine

Here



Courtesy of Foote-Burt Co.,
Cleveland, Ohio

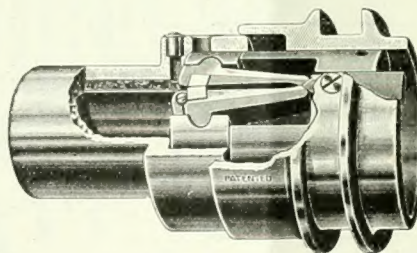
The Johnson Friction Clutch is used in the throw-out back gears in this new 15½ Foote-Burt Multiple-Spindle Machine.

“Records Are Much Better Than Promises”

That is the reason why we run the cut at the top of the page, driving home the record, “the Johnson Friction Clutch is being used as a part of this machine.”

Week after week has the evidence been piling up as to the extensive use of the Johnson Friction Clutch in various types of machines.

And this record of wide use is duplicated by another record of satisfactory service.



Single Clutch—Interior.

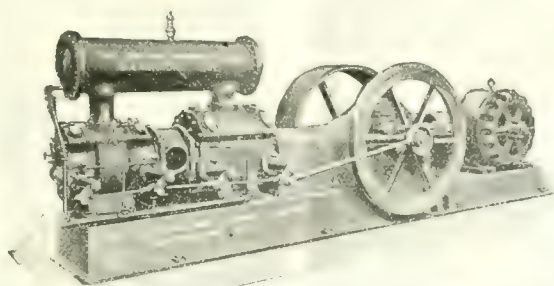
The Johnson Friction Clutch embodies all the principles which make a perfect friction clutch. Our YELLOW DATA SHEETS and Booklet, “Clutches as Applied in Machine Building,” explain this fully. Will you have them?

THE CARLYLE JOHNSON MACHINE CO.

MANCHESTER, CONN.

Canada: Williams & Wilson, Ltd., 320 St. James St., Montreal; Can. Fairbanks-Morse Co., Ltd., Toronto.
England: The Efandem Co., 159 Gt. Portland St., London, W., Sole Agents British Isles.
Australia: Edwin Wood, Pty., Hardware Chambers, 231 Elizabeth St., Melbourne, Victoria.

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



Compressor Problems Vanish

In a comparative test the quality of a machine will then be judged fairly. We invite your comparison. Our confidence that these machines excel is not only based on our knowledge

of their construction, but also because of the manner in which they appeal to our customers. We know they are built right. Our patrons have proved it. Let us get together.

Jenckes Machine

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



Company, Limited

Sales Offices: 710 C.P.R. Bldg., Toronto; 908
F. T. Bank Bldg., Montreal; West Chester Ave.,
St. Catharines; Cobalt, Ont.

URANIUM

HIGH SPEED STEEL

We have often been asked, "What gives Uranium High Speed Steel the toughness and strength not found in the ordinary high speed steel?" The answer is that by combining the proper amount of uranium to our mixture a high speed steel of the finest quality is produced—a steel that works at greater speeds, takes deeper cuts and lasts longer.

Consult your steel man or write us for full details.

STANDARD ALLOYS COMPANY

FORBES AND MEYRAN AVES.

PITTSBURGH, PENNA.

"ULTRA CAPITAL" HIGH SPEED STEEL
Balfour's Tool Steel
 "CAPITAL" HIGH SPEED TWIST DRILLS

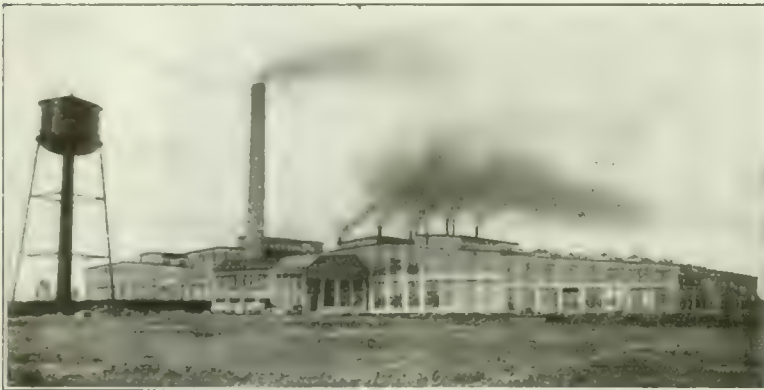
MANUFACTURED BY
Arthur Balfour & Co., Limited
 Dannemora Steel Works,
 Sheffield, England.

The Eagle & Globe Steel Company, Limited

Head Office and Warehouse, Canada and U.S.
 Ontario Office and Warehouse
 Winnipeg Stock
 Vancouver Stock

128 Craig Street West, Montreal
 36 Colborne Street, Toronto
 Dominion Equipment & Supply Co. Limited
 Frank Darling & Co.

W. A. BRADBURY, Agent, 128 Craig Street West, Montreal



Works: LONGUEUIL, QUE.

**Armstrong, Whitworth
 of Canada Limited**

Standard Sizes of
HIGH SPEED STEEL

Carried in Stock
CARBON AND ALLOY STEELS
 Shop Tools, Gauges, etc.

HEAD OFFICE: 298-300 St. James St., Montreal

Dominion Bank Bldg., TORONTO
 Branches: 27 King William Street, HAMILTON
 McArthur Bldg., WINNIPEG, MAN.

**Coal
 Coke
 Iron Ore**

Pig Iron

Victoria FOUNDRY & MALLEABLE

Made by The Canadian Furnace Co.
 Port Colborne, Ontario, Canada.

M.A. HANNA & Co.

Sales Agents, CLEVELAND

Canadian Office:

703 C.P.R. Bldg., Toronto

We guarantee shipment
within 24 hours of
receipt of order

"Extra"
"Special"
"High
Speed"

Tool Steels

Sisco

*Made in
Sweden
from selected
Dannemora Ore*

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

Swedish Steel & Importing Co., Ltd.
MONTREAL, QUE.



HIGHEST IN
QUALITY

NATIONALLY
KNOWN

OUR Country requires the extreme
limit of production from every lathe,
planer, miller or other machine tool.

BE PATRIOTIC

"Red Cut Superior"

The Nationally Known
First Quality

HIGH SPEED STEEL

Will enable you greatly
to increase your output

"IT'S THE BEST FOR ALL MACHINE WORK"

VANADIUM-ALLOYS STEEL CO.

PITTSBURGH, PA. Works at LATROBE, PA.

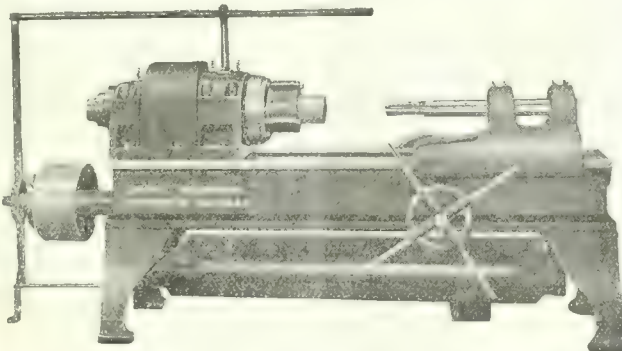
CARRIED IN STOCK AT THESE WAREHOUSES
 E. T. WARD & SONS 44 FARNBORTH ST. BOSTON, MASS.
 GEO. NASH CO. 304 HUGGON ST. NEW YORK, N. Y.
 FIEBIGER & CO. INC. 727 ARCH ST. PHILADELPHIA, PA.
 VANADIUM ALLOYS STEEL CO. PITTSBURGH, PA. AND 648 WASHINGTON BLDG. CHICAGO, ILL.
 650 PEARSON ST. LATROBE, PA.

INVESTIGATION PROVES

that many lathes fail to perform creditably on shell work; for at the time designed, the extraordinary demands of shell work were not known, let alone provided for. Natural rather than remarkable is it, therefore, that a NEW STYLE BORING LATHE of extra rigid build and specially designed to meet shell-making demands should hold an unbeaten record for quality output and unflinching accuracy. Write for all particulars about this—the

Hepburn Lathe

WE REBUILD LATHES



John T. Hepburn, Limited

18-60 Van Horne Street

Toronto, Ontario

If interested, tear out this page and keep with letters to be answered.

DOUBLE MUSHET

High Speed Steel

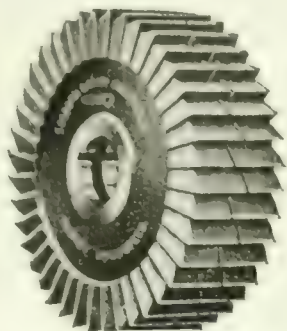
Carbon Steel

Gauge Steel

Alloy Steels

SOLE MAKERS

Samuel Osborn & Co. Ltd.
SHEFFIELD



*Twist Drills and
Reamers, Milling
Cutters and Slit-
ting Saws*



Sam'l Osborn (Canada)
Limited

Head Office and Works: Montreal, P.Q.
Branch Office: Toronto, Ontario

STEEL for Shrapnel Shells and Shell Blanks

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

**Nova Scotia
Steel and Coal
Co., Limited**

Head Office:
New Glasgow, N.S.

Western Sales Office:
Room 14 Windsor Hotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

TRADE MARK

of the Famous

“WACO”

BRAND

HIGH SPEED STEEL

AND

TWIST DRILLS

“DOUBLE WACO” Quality

Specially Adapted for Munition Work

“TURTLE” BRAND

High Class Tool Steel, Files, etc., of all descriptions.

ESTABLISHED 1870

W^{M.} ATKINS & C^{O.} L^{TD.}

TRADE MARK



Reliance Steel Works
SHEFFIELD, ENG.

TRADE MARK:



For particulars apply to our
Sole Representatives for Canada

GEO. A. MARSHALL & CO.

70 Lombard Street Toronto, Ontario

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

IF YOU WANT THE

BEST
BASE PLUGS,
BUY
BANFIELD'S

Have in stock for immediate shipment either threaded or bevel Plugs for 4.5", 5" and 6" High Explosive Shells. These are shipped subject to acceptance of Government inspector at your plant.

Capacity, 3,000 per day.

Write for prices.

EDWIN J. BANFIELD
STAIR BLDG. . . . TORONTO, ONT.

Manufacturer of Plug Milling Machines for above size shell. Prices and deliveries on application.

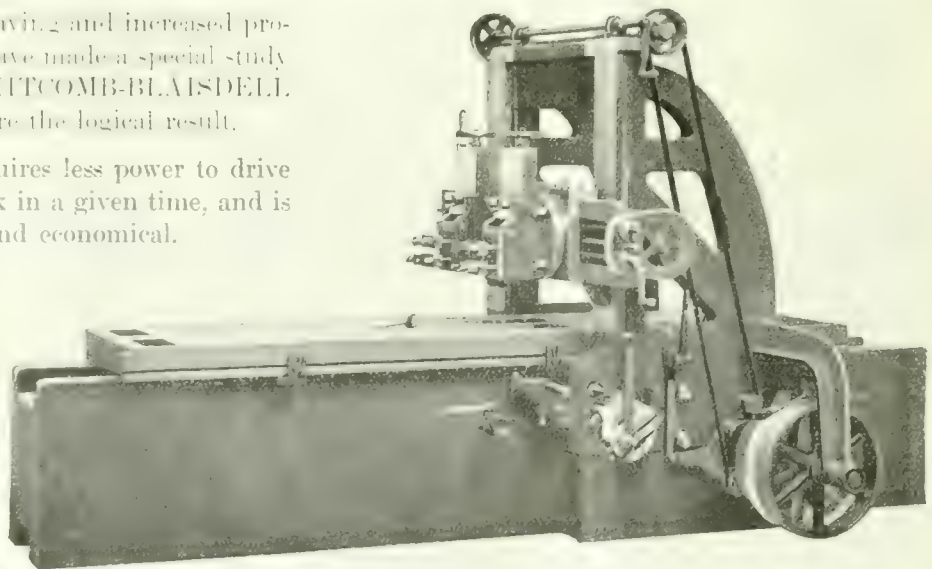
WHITCOMB-BLAISDELL
Second-Belt Drive Planers

Does power saving, time saving and increased production interest you? We have made a special study of these points and WHITCOMB-BLAISDELL Second-Belt Drive Planers are the logical result.

The second-belt drive requires less power to drive the machine, does more work in a given time, and is noiseless, smooth running and economical.

Write for new catalogue.

30" x 30" x 8"
PLANERS



WHITCOMB-BLAISDELL MACHINE TOOL CO.

Worcester, Mass., U. S. A.

"CoCo" Turning Steel



"CoCo" Goes on Working Long After Other Steels Stop

"CoCo" will do the same in your shop—will cut faster or longer than other steels. Here are some proofs:—

"CoCo" is cutting Semi-steel Castings at 100 ft. per minute, cut $\frac{1}{2}$ " deep. 30 hours continuous service between grinds.

"CoCo" is turning Cast Iron Hydrant Caps at 169 ft. per minute, feed $\frac{1}{8}$ ", cut $\frac{3}{8}$ " and turns 4 hydrants per grind where less than one per grind used to be standard.

"CoCo" is turning .40 Carbon O. H. Forged Rams at 95 ft. per minute, feed $\frac{1}{4}$ ", cut $\frac{3}{32}$ " turning 3 rams in the same time it formerly took to do one.

CAN YOU BEAT IT?

"CoCo" Steel does not do stunts—It does the work. It will do yours as well. Ask us.

COLONIAL STEEL COMPANY

PITTSBURGH BOSTON DETROIT NEW YORK PHILADELPHIA ST. LOUIS CHICAGO



THE Crank Shafts of all Consolidated Presses are made from .50 to .60 carbon steel hydraulic forgings, accurately machined and ground to size. The body bearings are carefully scraped to fit, thus insuring a perfect bearing.

The Crank Pins are larger in diameter than the main bearings. This has always been a Consolidated feature. Crank cheeks are liberal and guarantee strength and rigidity in the shaft; this, together with the enlarged crank pin, materially resist torsion when the press is in operation.

You cannot ignore these features.

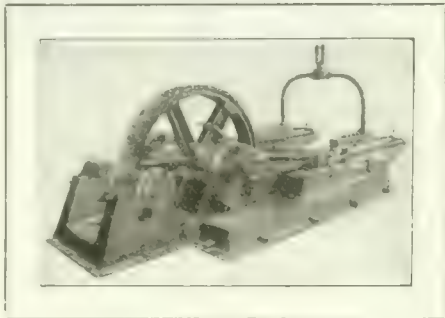
Consolidated Press Company

HASTINGS

LARGEST EXCLUSIVE MANUFACTURERS OF POWER PRESSES IN U.S.A.

MICHIGAN

Canadian Representatives: A. R. WILLIAMS MACHINERY CO., Limited, Toronto, St. John, Winnipeg, Vancouver



ELMES

18" Stroke Hydraulic Pump

for maximum pressures and capacities, for 250 horse-power motor—a pump designed to meet the demand for a high-pressure outfit of large capacity, and one able to withstand the severe usage of present-day practice.

Other designs for all pressures and capacities.

Charles F. Elmes Engineering Works

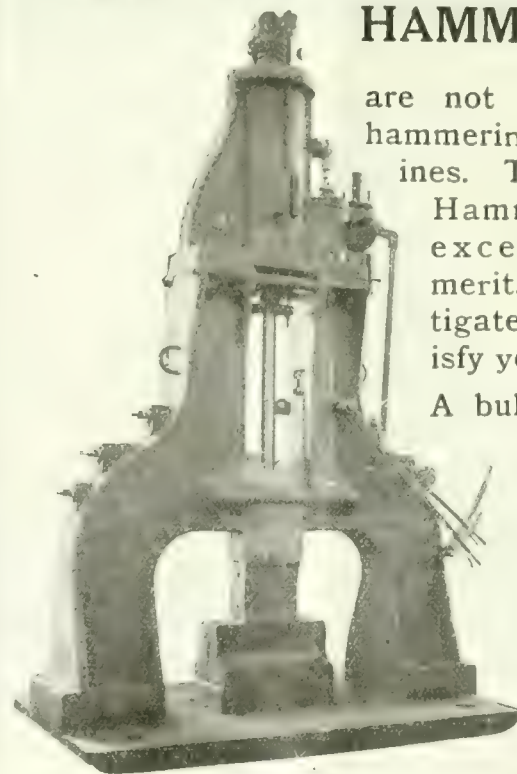
217 No. Morgan Street

CHICAGO, ILL.

"ERIE" STEAM FORGING HAMMERS

are not ordinary hammering machines. They are Hammers of exceptional merit. Investigate and satisfy yourself.

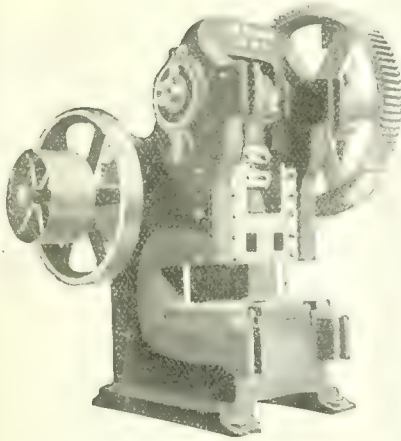
A bulletin for the asking.



ERIE FOUNDRY COMPANY
ERIE, PENNSYLVANIA, U. S. A.

THE "TOLEDO"

Open Back Power Presses



The choice of shrewd buyers who make a study of press construction as regards efficiency and durability.

For over 30 years the dominant press for punching, shearing, perforating, bending and forming operations, trimming drop forgings, etc.

Many exclusive features have been added from time to time with-

out any radical change in the design. We ask you to test our ability to solve your sheet metal problems.

The Toledo Machine & Tool Co.
Toledo, Ohio

Representatives Allied Machinery Co. of America, 19 Rue de Rocroy, Paris, France; Via XX Settembre 12, Turin, Italy; 16 Seidengasse, Zurich, Switzerland.

BLISS

PRODUCT

"Getting it out—and right" goes further back than the selection of the machine. It may go back 10 or 20 or 40 years to some point or problem solved in our 60 years' development of Presses that produce.

If you want machines with production capacity based on longest practical experience, buy "Bliss."

BLISS **E. W. BLISS CO.** **BLISS**
Brooklyn, N.Y., U.S.A.

1857 CHICAGO OFFICE 1917 DETROIT OFFICE
People's Gas. Bldg. Dime Bank Bldg.
CLEVELAND OFFICE Union Bank Bldg.
LONDON, S. E., ENGLAND POCKOCK ST., BLACKFRIARS ROAD
PARIS, FRANCE 100 Blvd. Victor-Hugo St. Ouen



Reg. U. S. Pat. Office.

TEST PRESSES

For Applying Internal Pressure
Physical Test to Shells

BANDING PRESSES

For Pressing in Copper Rotating Bands on Shells.

Metalwood Manufacturing Co.

Detroit, Michigan

Designers and Builders of High Speed Hydraulic and Special Machinery for all Purposes

Complete Hydraulic Installations

Canadian Fairbanks-Morse Co., Ltd., Sales Representatives for Canada

R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago, Ill., Sales Representatives. For Great Britain and Continent, address Gaston E. Marbaix, Coronation House, 4 Lloyds Ave., London, E.C., England.

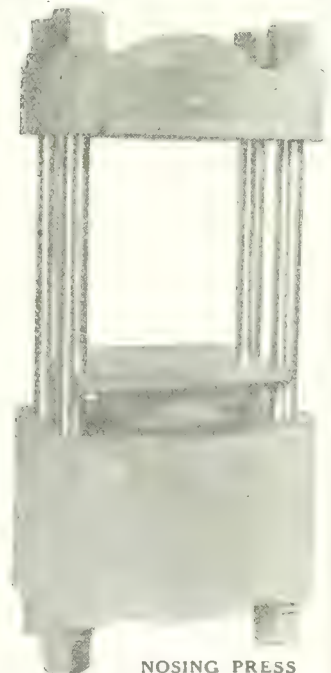
PRESSES

Pumps
and
Accumulators

FOR ALL
PURPOSES

Made in
Canada

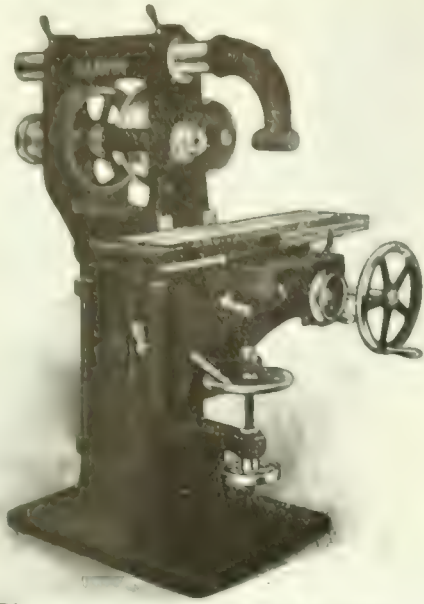
WILLIAM R. PERRIN, Limited
TORONTO



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

GARVIN No. 21 Plain Miller

Back Geared



NO. 21 PLAIN MILLING MACHINE
Back Geared
Use Code - Subject

For Plain and Gang Milling for general manufacturing, and is used mostly in gangs of 5 or 6 machines to one operator. Spindle runs in adjustable bronze boxes, and is driven by a 3" belt through back gears (3 to 1).

Knee is our improved solid top design, rigid and stiff to resist side pressure of heavy cuts.

DIMENSIONS:

Automatic Feed at Table	18 in.
Adjustment in line with Spindle	6 in.
Vertical adjustment under Spindle	13 in.
Table, inside Oil Pockets	6 x 10 in.
Changes of Speed	6
Changes of Feed	6
Net Weight, Skidded	1,575 lbs.

For Further Information **ASK YOUR DEALER**
or **WRITE US DIRECT**

IMMEDIATE DELIVERIES

Send for Complete Catalog

MANUFACTURED BY

THE GARVIN MACHINE COMPANY
Spring and Varick Streets (Visitors Welcome) 50 Years New York City

Bilton Automatic Gear Millers—Spur or Bevel Gears

CAPACITY

- No. 1 - 14 Pitch
- No. 2 - 10 Pitch
- No. 3 - 8 Pitch

The Bilton Machine Tool Company

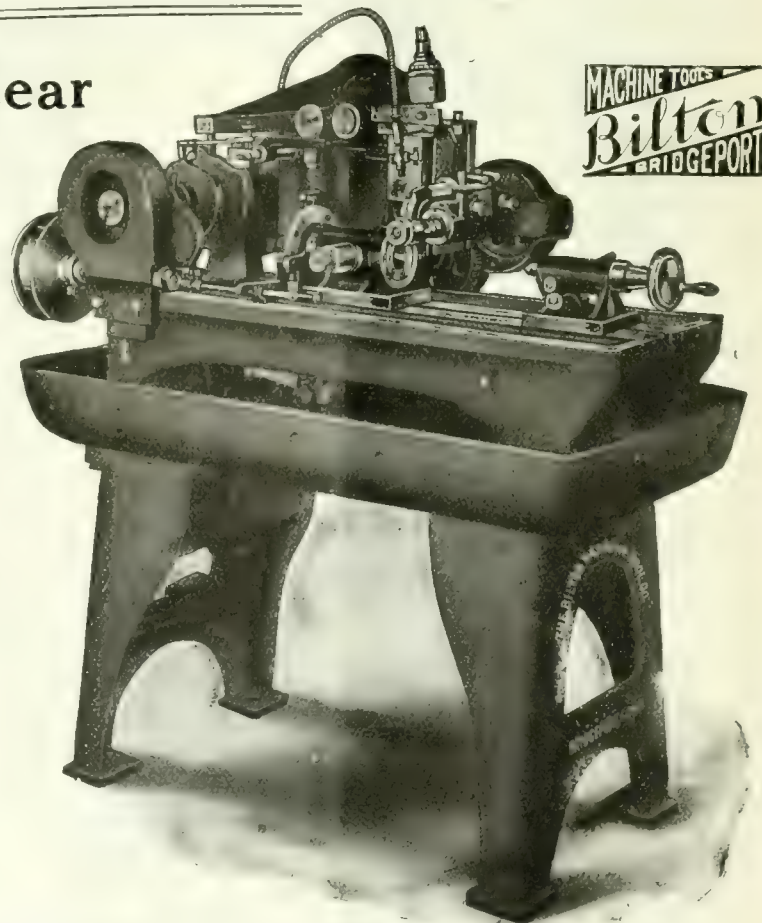
Succeed The Standard Mfg. Company
Housatonic Ave., Bridgeport, Conn., U.S.A.

- Also Manufacturers of
- Plain, Horizontal Millers
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LOOK—Lodge and Shipley Engine Lathes

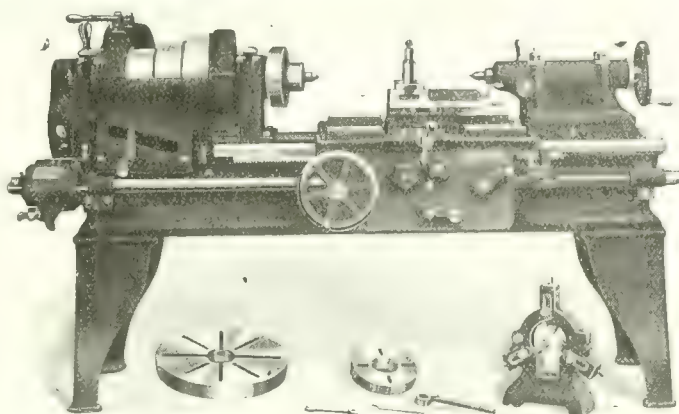
IMMEDIATE SHIPMENT

SIZE

14" x 6' or 8' Bed.

Double Back Gears
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Gear Box.

If you can use this size lathe,
write for specifications and
prices. Remember these are
the highest quality tools manufactured.



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"EVERYTHING IN MACHINERY"

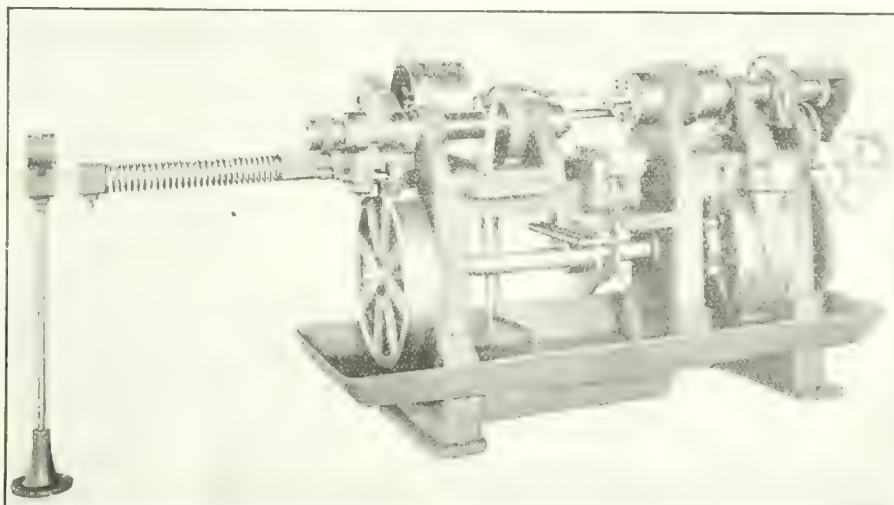
*Power
is Costly---
Don't
Waste It*

**John MacNab
Machinery Co.**

90 West St., New York
John MacNab, Hyde, England

A STRIKING feature of the Chicago Automatic is the 100 per cent. utilization of power. Operated by a single belt run direct from the lineshaft, troublesome overhead belting and countershafts, with the power they waste, are eliminated, making it easy to install one or a battery of these machines.

Equally as important is the general simplicity of construction; there is no reversing or belt shifting, no complicated mechanisms, and all parts are readily accessible. Action is positive, results unvaryingly uniform and accurate. The machine is extremely well built in every particular and produces fine work at very low costs. Made in 3/4", 1 1/2", 1 5/8", 2" sizes. Catalog for full particulars.



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W. E. W. BABBITT

These Babbitts are the result of years of experience and have a world-wide reputation for uniformity and reliability.

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Gasoline Engines, Steam Engines and Boilers, new and second-hand. Castings in iron or brass. Forgings. Machine and Boiler repairs. Cold Rolled Shaftings.

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Works the noiseless, no-blow way. It rolls the heads on rivets under pressure at a speed as fast as you desire.

Women Operators

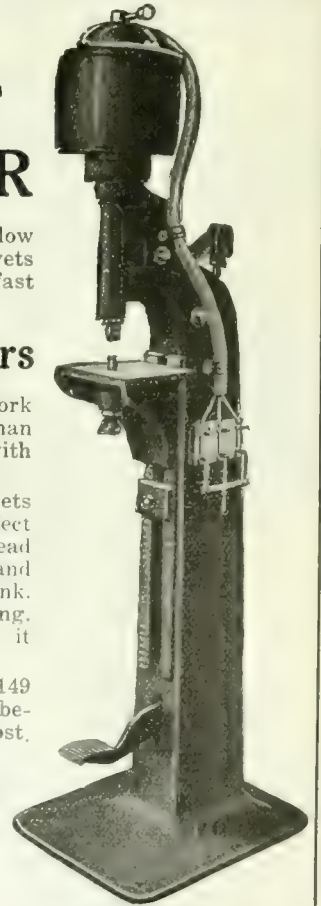
produce far more work—work far superior in finish—than either they or men could with any other riveter.

Use rivets of soft brass or rivets of steel for equally perfect results. It spins the rivet head to polished smoothness, and never bends the rivet shank. Can't break or scar the casting. Strong, swift and noiseless, it should be in your shop.

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Roelofson 6-in. Banding Machine

YOU couldn't imagine a more sturdy, compact, serviceable machine than this! A glance at the illustration will show you for yourself. It has been used in Canadian munition plants since the munition business started, and is still giving absolute satisfaction. It's the machine you need if you make shells.

Look over the following outstanding features of its construction:

Integral (en bloc) construction assures perfect rigidity, permanent accuracy and desirable compactness.

Chucking with spring collet chuck insures accurate and speedy chucking.

Graduated feed dial, two cutting tools, and ample belt power insure output of accurate work in least possible time.

Machines are built for 15, 18, 60-pdr. and 6" shells.

Roelofson Machine & Tool Co., Ltd.

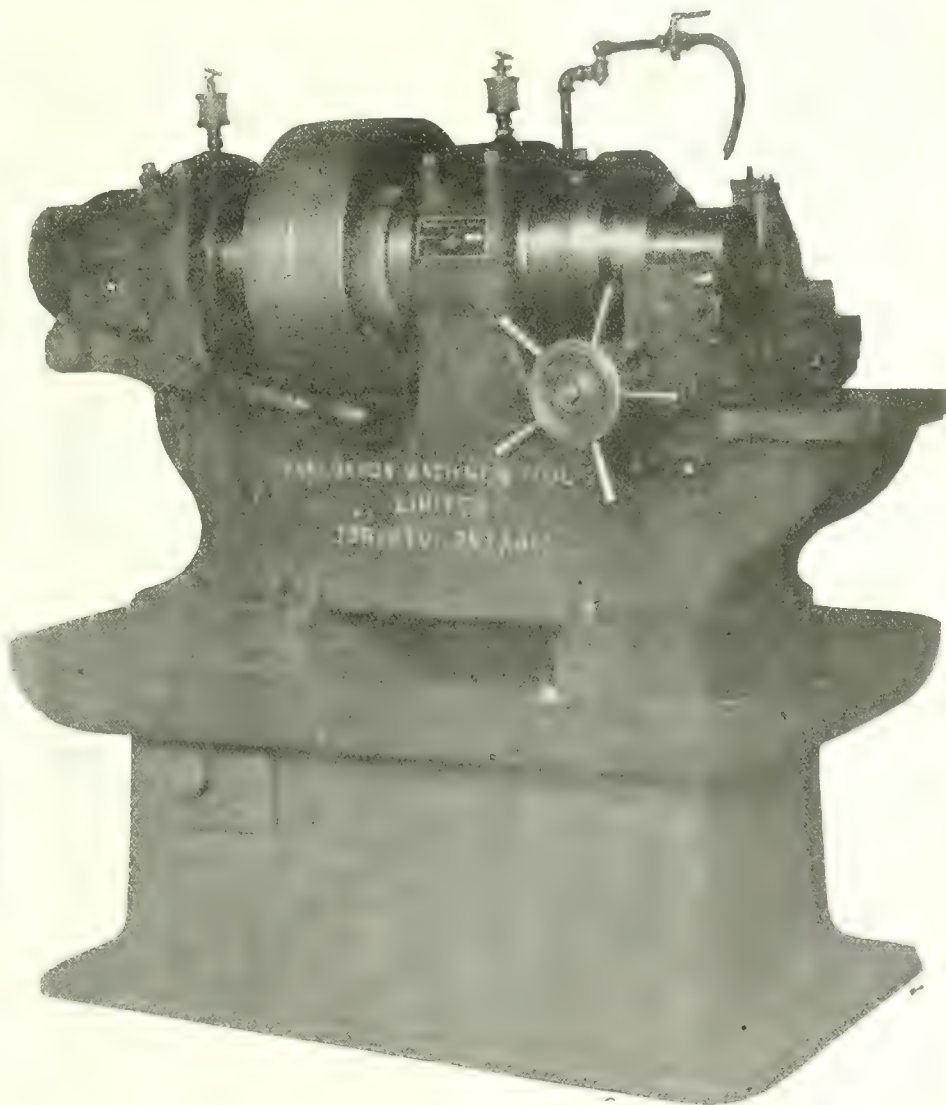
Head Office: 1501 Royal Bank Building, Toronto, Canada

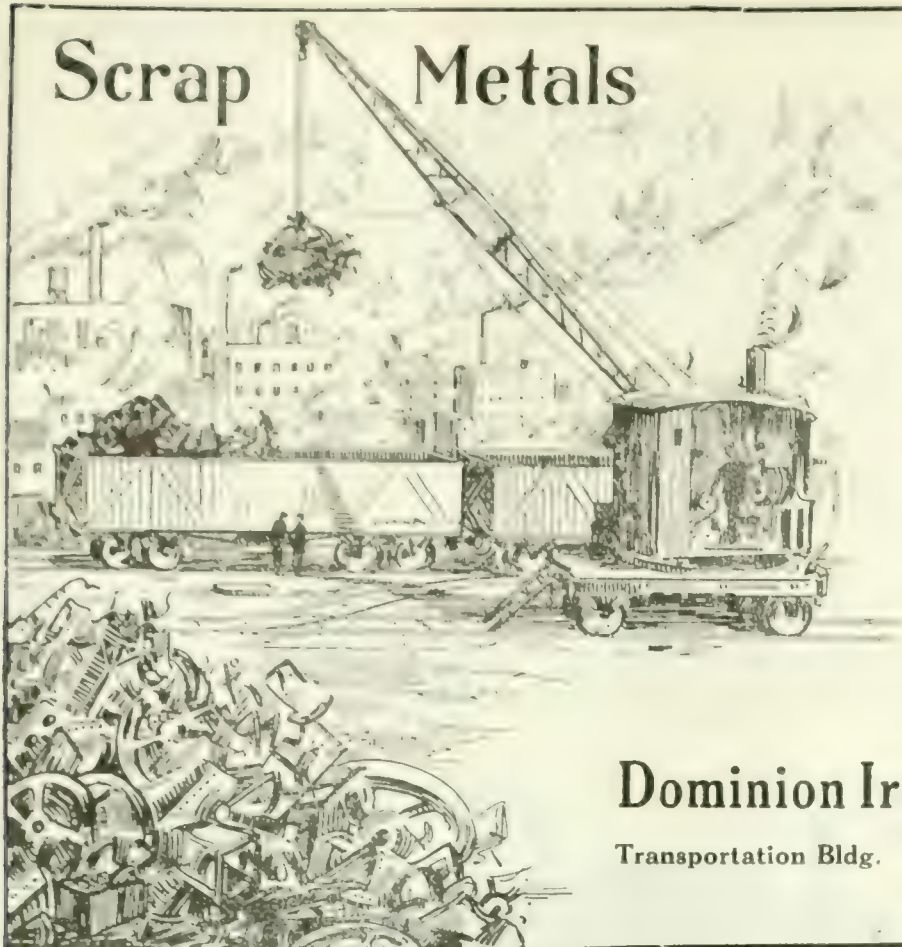
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Immediate Delivery

To shell plants changing over from the manufacture of the larger sizes to 6" shells, our ability to make **immediate delivery** should be of especial interest.

And remember that the Roelofson is one of the few banding machines that have stood up from the first of the munition game and are still doing duty.





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Scrap Iron, Steel and Metals

No undertaking is too large for us. We are Scrap Metal Specialists, and can co-operate with you in the dismantling of railway equipment, bridges, plants, steamers, mills and will take your rails and machinery.

Shell Makers. We can take care of all your scrap materials, at highest prices.

Give us particulars and we will relieve you of all worry.

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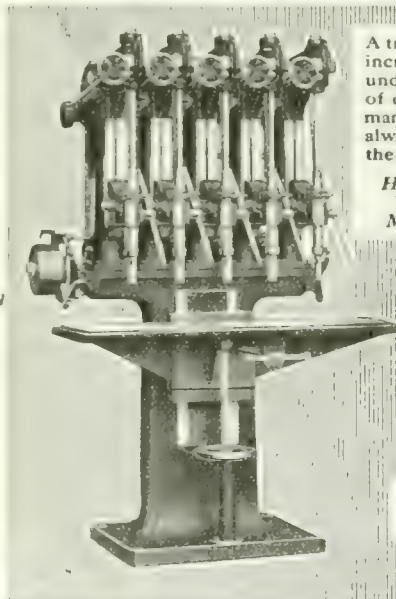
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HENRY & WRIGHT Drilling Machines



A tremendous increase in the understanding of drilling for manufacturing always follows the use of all

Henry and Wright Machines

Class K
Number 5

The Henry & Wright Mfg. Co.
Hartford, Conn.

Carry Your Grinder to the Work Not Your Work to the Grinder

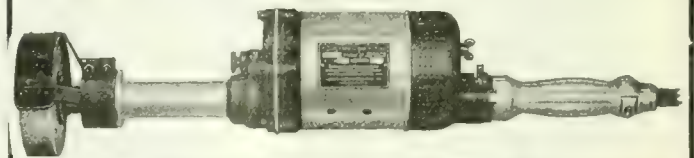


Portable Electric GRINDER

Equipped with Universal Motor for Operating on Direct or Alternating Current

110 TO 250 VOLTS

(Licensed Under Burke Universal Motor Patent.)



No. 6 Grinder-Wheel 4" x 3/4" x 1/2"

ATTACH TO ANY LAMP SOCKET

Thor Portable Electric Grinder is equipped throughout with ball and roller bearings, and has a specially constructed motor, insuring speed, power, ease of operation and increased capacity.

IT RUNS AT 4,500 R.P.M.

Independent Pneumatic Tool Company

Office: 334 St. James Street, MONTREAL, QUE.
Toronto: 32 Front St. W.; Winnipeg: 123 Bannatyne Ave. E.;
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A New Rockford Column Type Machine

This High-Powered, Heavy Duty Rockford Drilling Machine—is our new box column type machine with capacity for driving high-speed drills up to 2½ inches diameter.

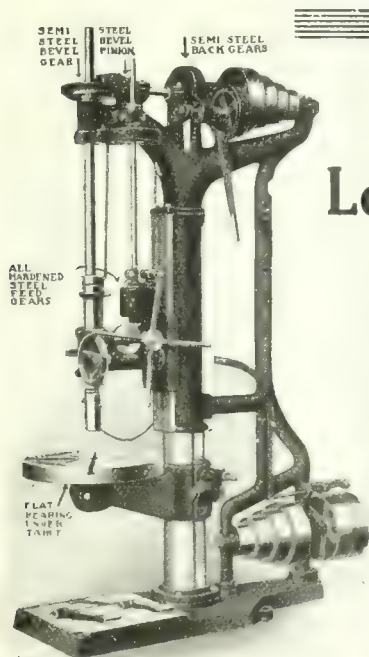
It is built in three styles, each possessing distinct constructive points that render positive rapid production, quality work and economy.

Just as powerful as it looks.

Investigate the New Rockford before you buy. Write us and get full particulars by return mail.



Rockford Drilling Machine Co.
Rockford, Illinois U.S.A.



**Lower Your
Production
Cost!**

**AURORA
Drilling Machine**

Strength is the word that distinguishes this machine. Special care has been used in bringing this Drill up to its present point of efficiency. If you are in the market for drills which must have speed and accuracy, consult us. This is an ideal machine for HIGH EXPLOSIVE SHELLS. Inquire—we have the goods.

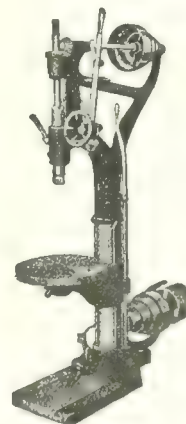
Stationary head sizes—20", 21".
Sliding head sizes 22", 24".

The Aurora Tool Works
AURORA, INDIANA, U.S.A.

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Complete line. 8-inch to 50-inch swing
Gang Drills.—Horizontal Drills.

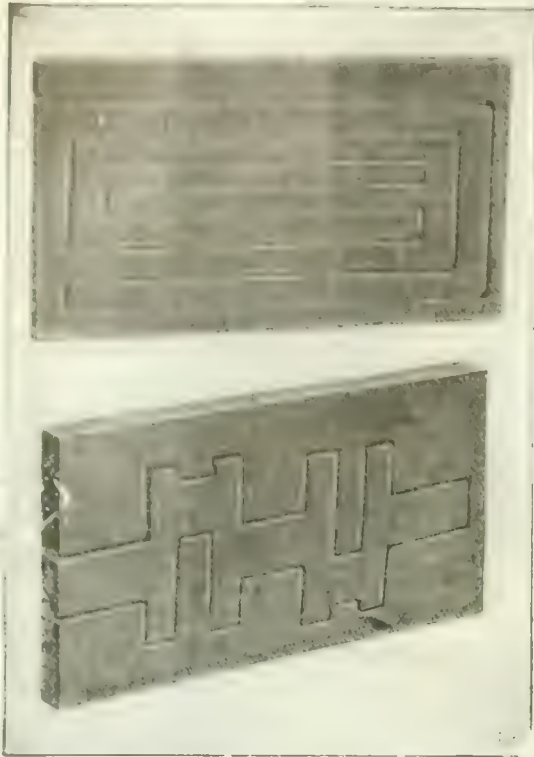
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Examples of Cutting by an "A.L.S." Oxy-cutter.

Whenever the Cutting of Iron and Steel is necessary, this method is universally adopted, with a Saving of Time, Money and Labor. An "A.L.S." Oxy-Acetylene Welding Outfit may be instantly converted into a portable cutting unit by the addition of an "A.L.S." Oxy-cutter.

For cutting notches and portholes in Steel Plates; Burning off rivet heads before driving out rivets; and hundreds of other similar operations, the Oxy-Acetylene Process is more economical and efficient than any other method, and sometimes performing work otherwise impossible.

WHY NOT LET US TELL YOU HOW MUCH YOU CAN SAVE?

Many firms have not yet realized all that Oxy-Acetylene Welding and cutting will do for them. You may be one of them. If so, write to-day, we shall be pleased to give you all the information necessary to enable YOU to judge how much YOU may benefit by the Process. An ordinary purchaser of an Outfit saves the cost many times over during a year, many save the cost on the first job. Is this not worth investigation?

A few minutes of your time will enable us to put before you the result of years of experience.

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WINNIPEG

HALIFAX (under construction)

Double-Quick Cutting-Off

THE HURLBUT-ROGERS CUTTING-OFF AND GRINDING MACHINE has the advantage of two cutting tools.

Each tool is rigidly supported in a stationary block which will permit a strong shearing cut.

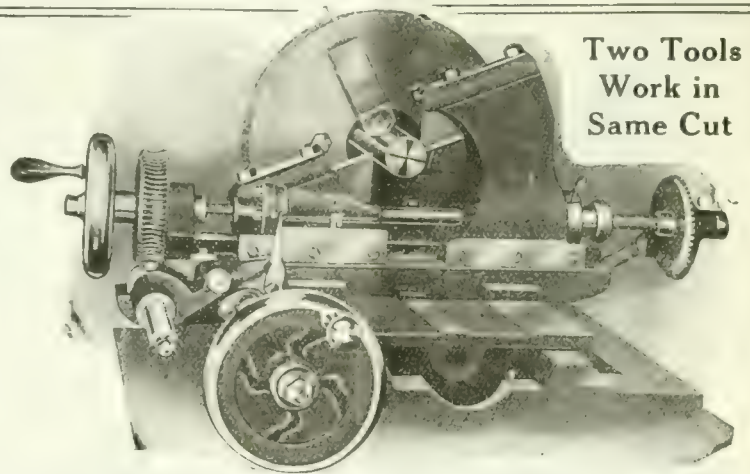
WITH THIS MACHINE PRODUCTION CAN BE NEARLY DOUBLED, and the utmost accuracy maintained under the hardest of work.

Read full details. Write for catalogue.

Hurlbut-Rogers Machinery Company

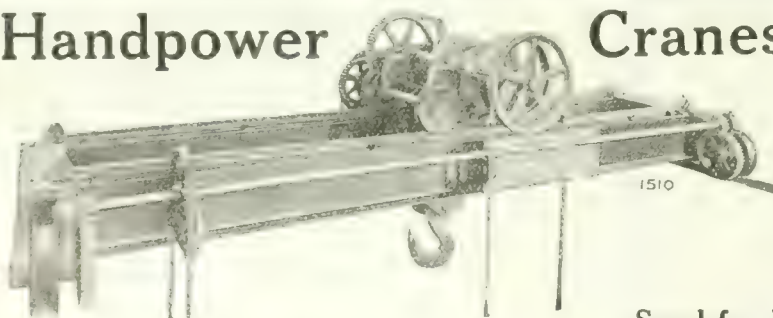
South Sudbury, Mass., U. S. A.

FOREIGN AGENTS—England, Chas. Churchill & Co., Ltd., London, Manchester, Glasgow, Newcastle-on-Tyne. H. W. Petrie, Toronto, Canada.



Two Tools
Work in
Same Cut

Handpower Cranes for quick delivery



Can make quick shipment of short span handpower cranes of medium and light capacity, single or double I-beam.

Our rope-drum trolley has two speeds and automatic brake. Load held at all times. Floor control.

Complete Foundry Equipment
CRANES OF ALL TYPES

Send for New
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If you are not a subscriber to our Buyers' Directory and write advertisers listed under proper heading.

"Over the Top"



Right down in the front trenches of metal working, in the no-man's land of production, the

Starrett Hack Saw

is doing its bit. The sharp, hardened tungsten steel teeth cut their way through rod or sheet, steel or copper as a machine gun cuts its way through opposing infantry.

While the excellence of Starrett blades has long been an accepted fact, never before have they been accorded the confidence they enjoy to-day. The rush and bustle attendant upon forced production have created a demand for a hack saw blade that will "stand up"—cut quicker and last longer.

Because we have made careful and thorough tests we are able to tell you just which numbered blade is best suited for each class of work. The result of these important tests, together with the unexcelled quality of Starrett Hack Saws, have placed our blades in the first rank of industrial preparation.

What blade to use is indicated on page 208 of our Catalog No. 213. Send for your copy.



The L. S. Starrett Company

THE WORLD'S GREATEST TOOL MAKERS

ATHOL, MASS.

NEW YORK

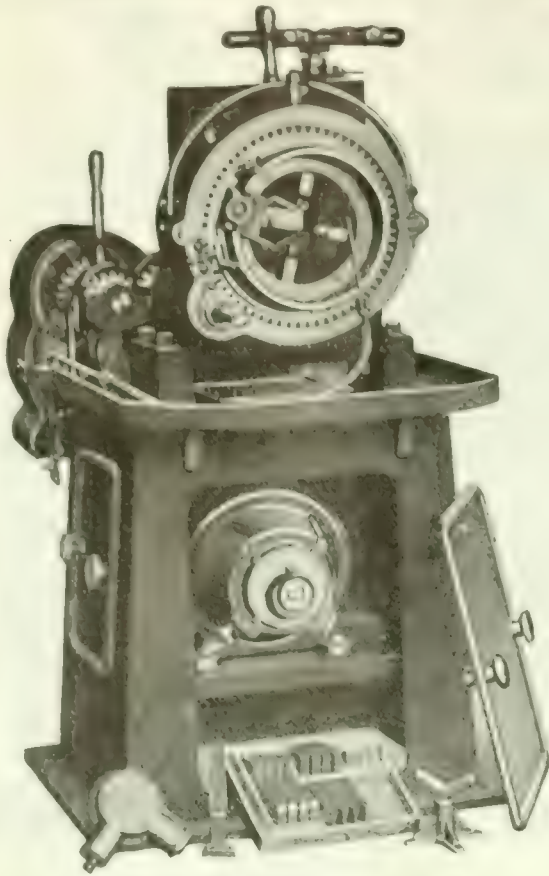
LONDON

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12-719

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“Forbes Facts”

1. One man can do the work of six against the old stock and die method of cutting.
2. It is the only machine on the market with receding gear.
3. It is self-contained and motor-driven.
4. It is portable.

These are convincing arguments for the construction and utility of this machine. Thread cutting can be performed fast, clean and true. Equipped with self-centering vise.

The Curtis & Curtis Co.
115 Garden St., Bridgeport, Conn.

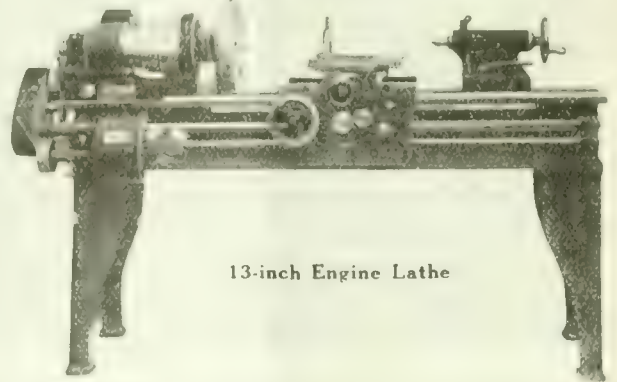
Decidedly Quality

That is the verdict of our clients.

In construction, operation and results, quality is evident. That is the reason why Filsmith has occupied the foreground in lathedom. In Canada and United States you will find Filsmith quality is based on what it is now doing, not on history. Pull webbed headstock, 50-point carbon steel spindle, and rigidly clamped tailstock.

An enquiry will secure you full information.

THE PHILIP SMITH MFG. CO.
SIDNEY, OHIO, U.S.A.



13-inch Engine Lathe

For Rapid Production and Accurate Work

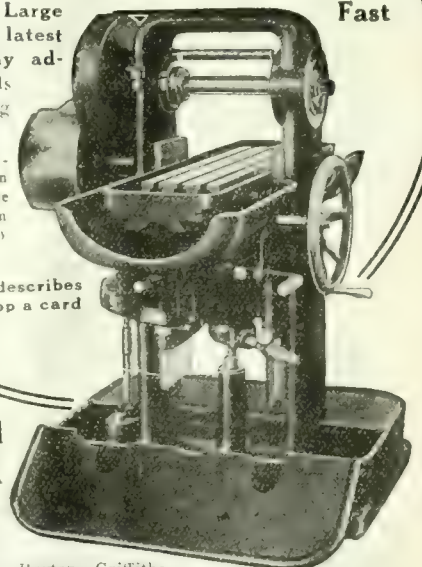
USE THE “BRIGGS”

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.

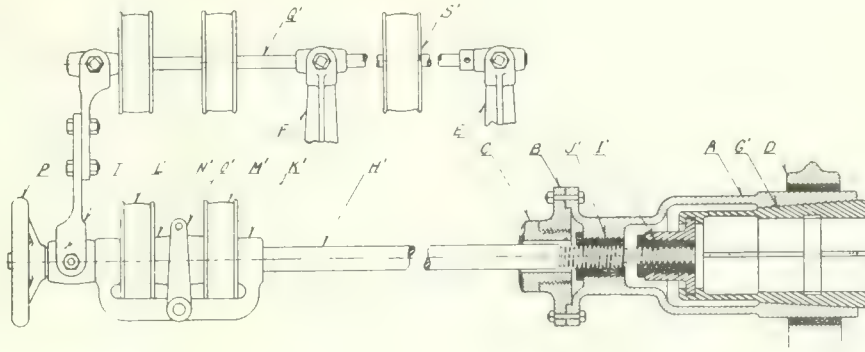


Fast

Gooley & Edlund
Inc.

Cortland, N.Y., U.S.A.

Foreign Agents: Allied Machinery Co., of America, Paris; Petrograd, Turin; Machinery Company of Russia, Scandinavia; C. W. Burton, Griffiths Co., London, Manchester and Glasgow; Barandiaran, Metivier, Gazeau & Cia., San Sebastian, Spain



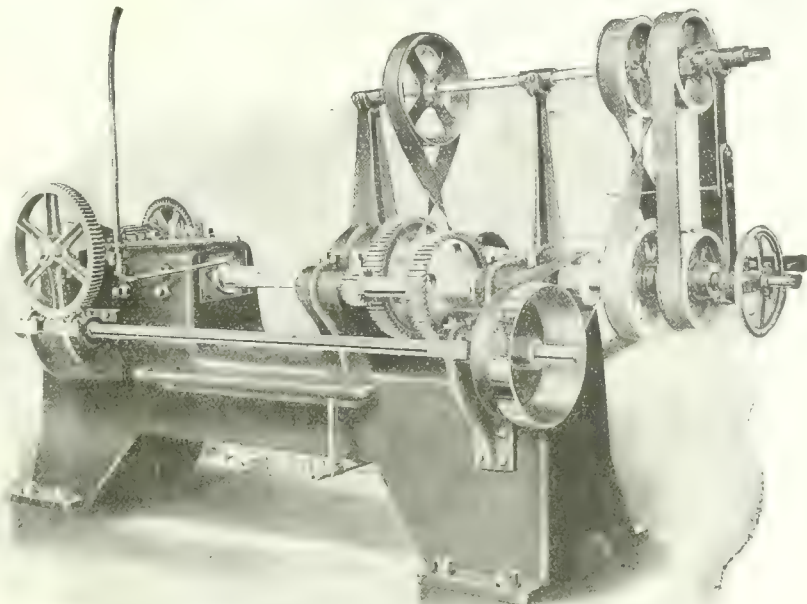
6" Boring = 75 Rough 100 Finish

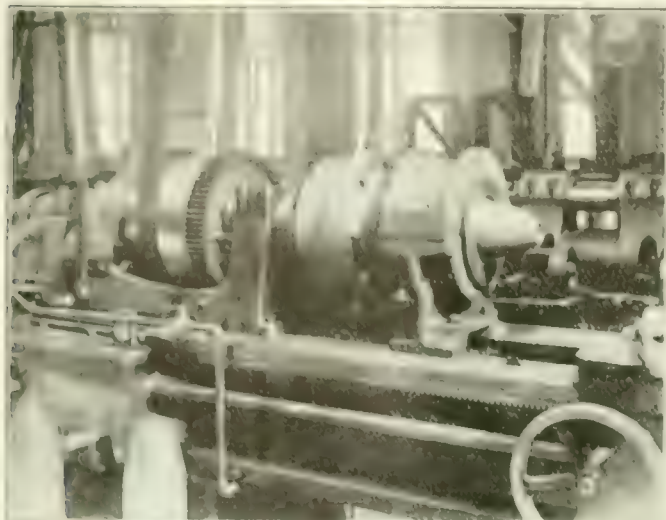
10 HOUR DAY

A close study of the above chuck will reveal strength that enables this machine to give this production *all the time* in 10 hours. The illustration below shows the wonderful sturdiness of the machine. Inquire of us. The prices are exceptional. Made in Canada.

The Plessisville Foundry

PLESSISVILLE, QUEBEC





A Big Efficiency Unit in Your Shell Plant

A. J. LAVOIE'S LOW PRESSURE Compressed Air Chuck

This chuck can be applied to any make of lathe, without alteration to the machine, and will increase production from 25% to 75%. It grips and releases the shell while in motion—no need to stop your machine.

It is a single unit combination attached to the face plate of lathe, supported by an additional heavy duty bearing, thus making a heavy duty lathe out of a light machine. A small lever operates the chuck. Will operate with a pressure of 60 lbs. per sq. in.

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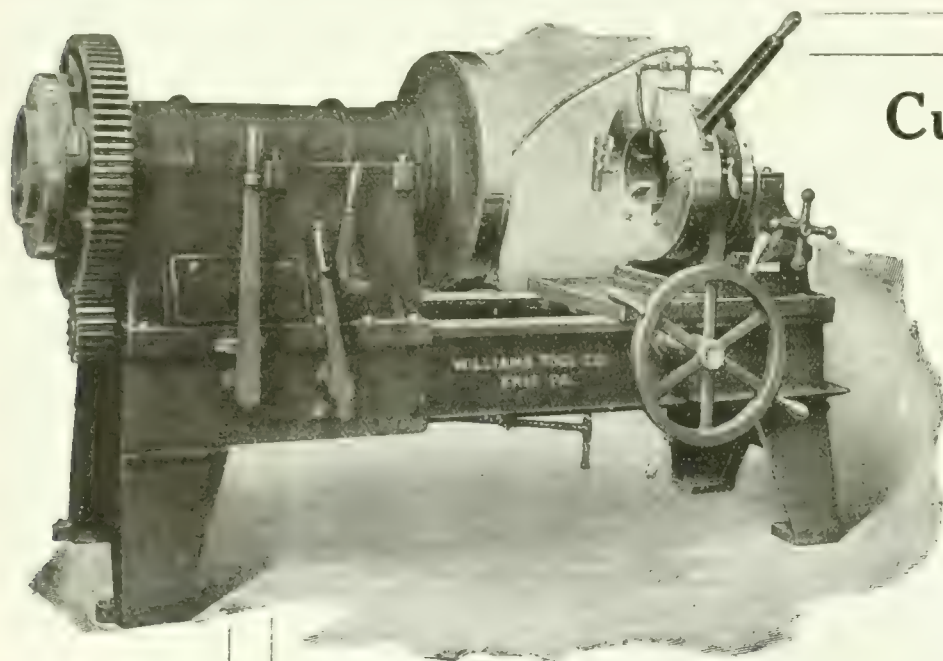
The Montreal General Tool Co.
673-5 Notre Dame Street, Maisonneuve, Montreal, P.Q.

Also manufacturers of shell tools, and special machine attachments of all kinds made to order.

This chuck is built on the duplicate part system. It is simple, sturdy and foolproof.

It grips the shell in a predetermined position. The jaws will not slip on the shell. It has shell interior and exterior adjustable stops.

A trial on one of your lathes will convince you that this is THE chuck for shell work.



Cutting-off and Threading

By the decree of expert judges Williams Cutting-off Machine has been declared the most efficient.

We have made this claim all along and this judgment only verifies it.

Made in 11 sizes and each size has a range of 8 to 10 consecutive sizes between $\frac{1}{4}$ " and 18" diameter.

Write us about them. They will save you money, time, and increase the quality of your product.

Williams Tool Company

Erie, Penn., U.S.A.

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Co., Ltd., Toronto, Canada

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London, England

INGOTS

Brass, Bronze and Composition
Any Alloy According to Your Formula



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INGOT-COPPER

99.9% PURE

For High-Grade Castings

Wire or Write for Prices

We are Purchasers of Copper Bearing Material

**BROWN'S COPPER & BRASS ROLLING
MILLS, LIMITED**

NEW TORONTO,

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Near Toronto



Grinding Rings For Silent Knight Motors

is a small job and yet a big one, which demands the correct grinding wheel and the utmost care on the part of the operator.

The casting is rough turned—internally ground—slotted on a roller—and then finished to a limit of .00025" with an ALUNDUM wheel removing .015 to .020 of stock.

Just as this concern's grinding problems have been successfully solved by using ALUNDUM so can each one of yours.

Send us your address for a number of interesting and helpful pamphlets on grinding.

NORTON COMPANY
Worcester, Mass.

ELECTRIC FURNACE PLANTS
Niagara Falls, N.Y.
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Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria; F. H. Armstrong & Son, Quebec, Que.



Your Mark

On your product—is it the kind that proves your pride in the product? If your product is good, if its service is likely to recommend it, mark it so any one can easily tell who made it.

We make any form of a steel lettering die or stamp to mark your name, address, trade-mark, or any distinctive mark you desire to show on your product. Sixty-seven years in business as the largest manufacturers of our kind is the record behind Matthews steel lettering dies and stamps.

Our catalogue illustrates and describes a complete line of dies and stamps for every marking purpose. Send for it to-day

Jas. H. Matthews & Co.

Established 1850

Pittsburgh, Pa.

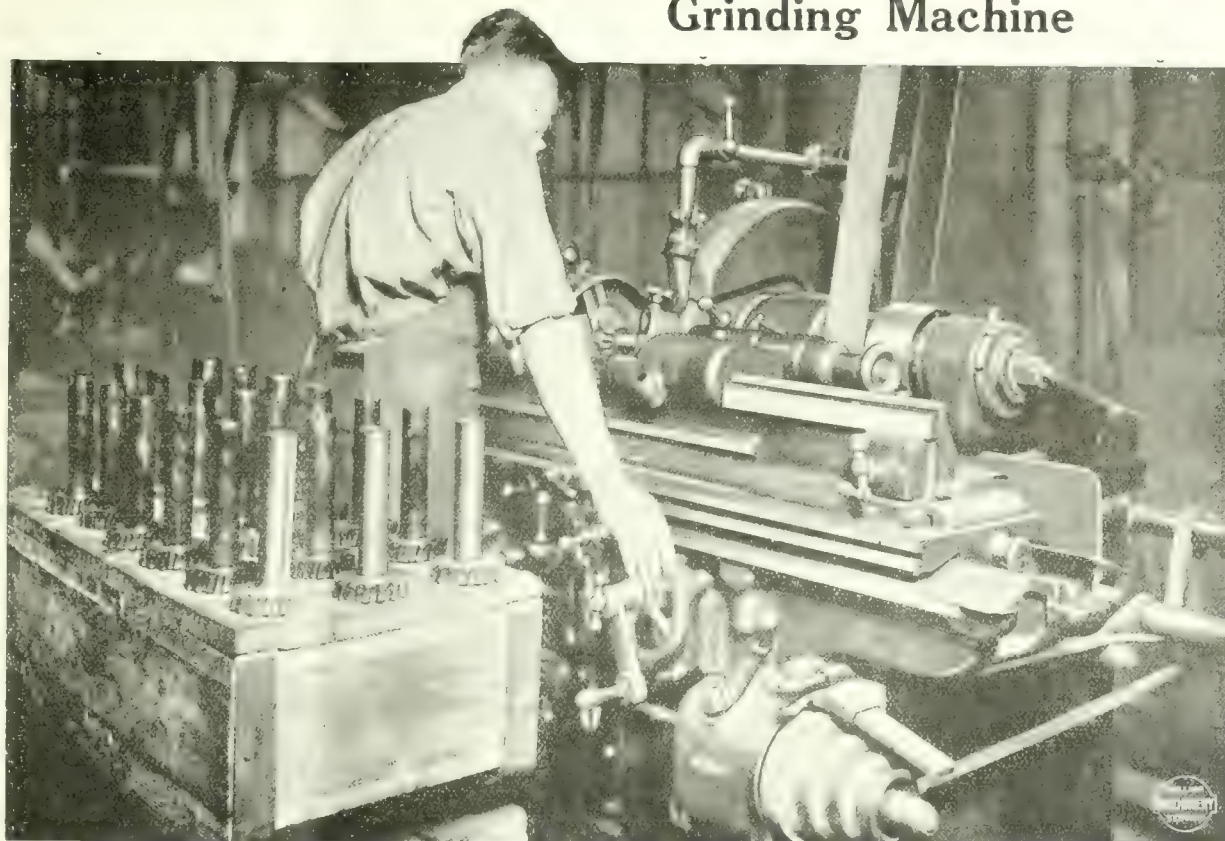
Distributors for Canada

The Canadian Fairbanks-Morse Co.

Montreal, St. John, Toronto, Winnipeg,
Calgary, Vancouver, Ottawa, Quebec,
Saskatchewan, Victoria.



400 Shafts and Shoulders in 10 Hours on a **NORTON** Grinding Machine



If you are doing roughing or finishing in a lathe, these figures will be interesting—and may open your eyes! This record is not a sprint, stunt or stampede—simply an every day, all day, steady jog with the Gemmer Mfg. Co., Detroit

The subject shown is part of an automobile steering worm mechanism. Shaft is $5\frac{1}{8}$ -in. long, $1\frac{1}{8}$ -in. diameter. Carries a shoulder 2-in. diameter by $\frac{3}{8}$ -in. wide which must be at right angles to the shaft. The limit is very close. Production is 400 in 10 hours.

Do you know the Norton Grinding Machine in very many shops is superseding **both roughing** and **finishing** on the lathe? Doing the work in less time, with less labor and greater ease in handling? The finished result admits of no comparison.

The advantages of Norton Grinding Machines are past enumeration here. If you will just write us we'll go into the subject as far as you like.

NORTON GRINDING COMPANY

Worcester, Mass.

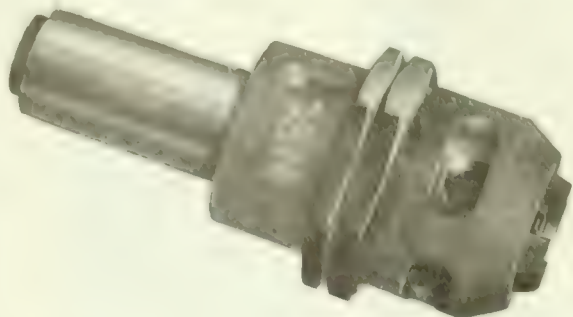
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St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

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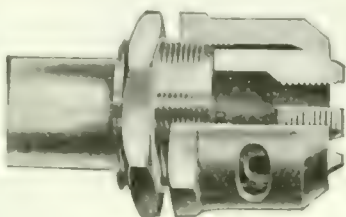
A Time And Money Saver



THE ACORN DIE

It will save time and money for you because the wear is done equally by all four lands—due to the automatic method of adjusting—consequently the die lasts longer.

It will save money for you because there will be fewer rejections for poor threads.



It will save time spent in grinding because it will run longer between grindings—another result of the adjusting feature, which distributes the wear equally on all lands.

It will save time in "set-up" because when a dull die is removed from the holder for grinding, a new one can be substituted, the cap screwed on and the machine is ready for work again.

It will save time on repairs or breakdowns because it is simple and there is nothing to get out of order.

Extremely accurate adjustment is obtained by turning the cap—see illustration—which forces all four lands an equal distance towards a common center.

Investigate this time and money-saving die at once.



Send for a copy of our Acorn Die booklet.

Wells Bros. Co. of Canada, Ltd.
GALT, ONT.

SALES AGENTS: The Canadian Fairbanks-Morse Company, Limited, Montreal, Toronto, Vancouver, Winnipeg, St. John, Calgary

That Wear-Longer Argument

It is claimed that the length of service of a file is proportional to the work done quickly which counts.

Our files agree with the cutting argument, but— they are a little faster. They cut quickly first, last and all the time, and, like tried friends—

THEY WEAR

They have the teeth and they have the stock. Remember this brand and cut your filing costs.



TRADE MARK

QUALITY FILES

PORT HOPE FILE MFG. CO., LIMITED

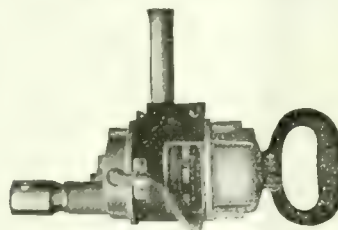
Port Hope, Ontario

"Ask your jobber"

(26.)

U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

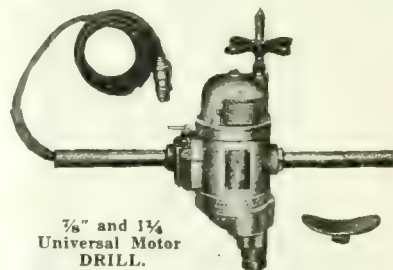
3 SIZES

- 3-16 in., W.G.T., 6 lbs.
- 1/4 in., W.G.T., 9 lbs.
- 5/8 in., W.G.T., 12 lbs.

All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



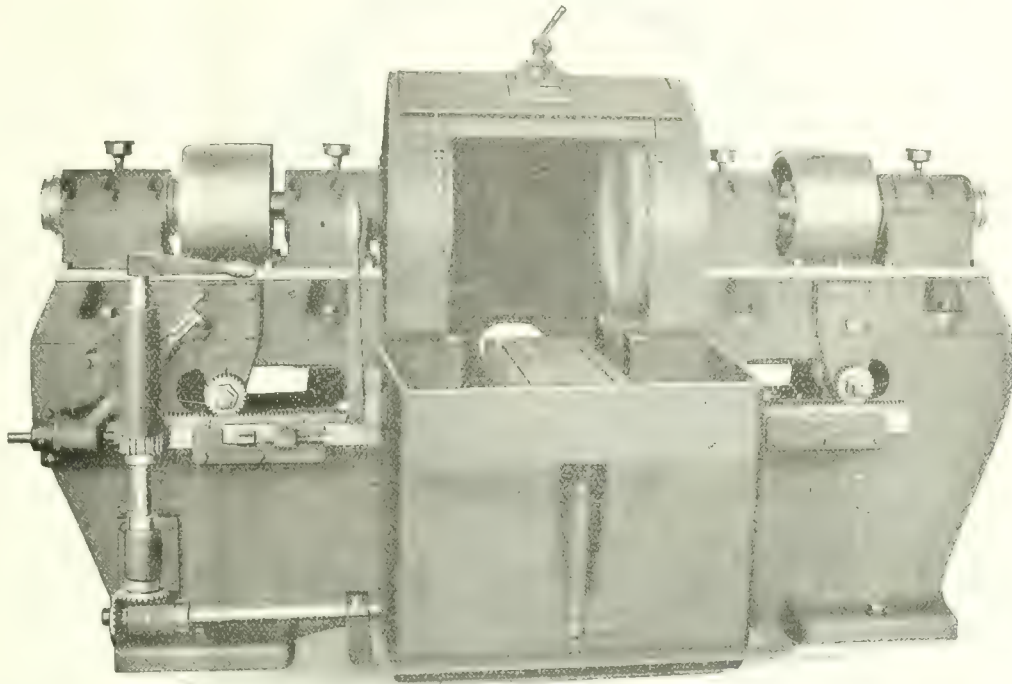
7/8" and 1 1/4" Universal Motor DRILL.

For Sale By

The Canadian Fairbanks-Morse Co., Limited

Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO



Solve Your Grinding Troubles

Possibly your trouble is that you are "letting well enough alone." Your grinding may not be up to the grade of efficiency desired. You have no doubt thought about that. Have you ever sought information or help from a firm who feature their organization by the service they render? If not, we would welcome your starting out with us.

This No. 15 Double Spindle Grinder is but one of a great number we

manufacture. It is specially adapted for builders of guns, ammunition and motor cars. It carries 24" disc wheels or 2" ring wheels. It has 8 1/2" face pulleys, giving abundant driving capacity and all other dimensions are proportionately large and powerful. Both types of grinding wheels are interchangeable. Get in touch with us on any grinding problem. Give our Service Department a test.



GARDNER MACHINE COMPANY

Beloit, Wisconsin, U.S.A.

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Notes on Machining Operations on 75 mm. U.S. H.E. Shell

By M. H. Potter

While similar in general principle to known types of high explosive shells already produced in this country, the 75-mm. U.S. high explosive shell varies in detail,—the provision of a base protecting plate, walls of comparative thinness, a nosed-in mouth, and the acceptance of a forged interior finish are among the principal features of the design. The knurled band seat is already familiar through Russian work, but the internal hydrostatic test is an additional requirement not hitherto met with in other shells.

IN the following description of machine work on the 75 mm. shell as now being produced in this country for the United States government, the sequence of operations is such as to be readily adaptable by the majority of existing shell shops. Change of sequence, and subdivision of any particular operation into two or three stages may be undertaken if rendered advisable by special individual conditions.

When women operators are employed it has been found more practical and better results have been obtained when each operation is as simple as possible. The shells are light and therefore easily handled. This of course is only true when air operated chucks are used.

The principal dimensions and working limits of this shell are as follows: Diameter of body proper and base 2.925 in. + .005 — .010; diameter of body above shoulder 2.938 in. + .00 — .005; diameter at nose 1.88 in. + .010; length over all 10.39 in. + .08; width of groove (no undercut) .48 in. + .01; thickness of walls .318 in. + .01 in.; over all diameter of driving band 3.008 + .003; thickness through nose .83 in., (not habitually gauged); length of threads in nose 1.397 in. + .000 — .006; the threads are U.S. standard form, 12 per inch; diameter over threads 1.397 in. + .000 — .006; diameter fuse hole rear of threads 1.54 in. + .20; angle of fuse hole 60 deg.

The base cover plates consist of one disc of lead 2.22 in. dia. and one sheet of brass 2.56 in. dia. with the edge turned at 45 deg.

The shells are heat treated practically the same as the British shrapnel, and the accompanying illustrations show the shell during the various machining operations, the details which apply to each operation being enlarged in the sketches to facilitate reference.

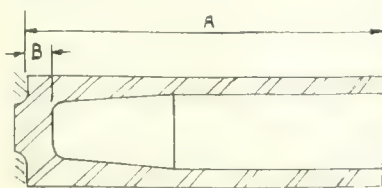


FIG. 1.

Cut Off

1st operation, Fig. 1. Special cut off machine or engine lathe with plain barrel chuck having four set screws to tighten against shell. The two cut off tools are opposite each other and fed

towards the centre. The depth of bore is gauged (see A. Fig. 1). B is checked before this operation to make certain that the forging will clean-up on the base.

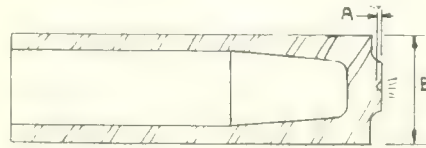


FIG. 2.

Centre

2nd operation, Fig. 2. Engine lathe with expanding mandrel having two sets of three jaws each, one set to grip shell close to the closed end the other just forward of the open end. The special fixture consists of a drill spindle with racks and pinion mounted in a casting having a vee slide to enable operator to slide the fixture to the rear when placing or removing shell. The base is clamped to the ways of the lathe. A special drill with no body clearance and a 60 deg. point is used. The shell is gauged for concentricity before this operation (see B Fig. 2), and A (see Fig. 2) is gauged.

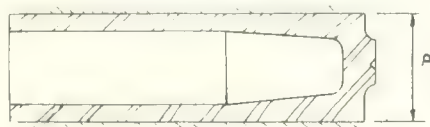


FIG. 3.

Rough Turn

3rd operation, Fig. 3. An engine lathe is used with a mandrel having three fixed tool steel hardened jaws set at a slight taper in a machine steel shank to fit lathe spindle centre. The tail stock centre is applied to the centre in the closed end of shell. The cutting tool employed consists of a machine steel shank with a welded stellite tip—A (see Fig. 3) is gauged.

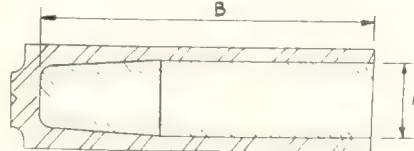


FIG. 4.

Bore

4th operation, Fig. 4. Rough and finish bore on a turret lathe. Three or four boring bears employed. The shell is held in a clamp or collet chuck. The first bar, which may be omitted, has a

short cutter for removing the scale from the bottom of the bore, the second bar has the cutter for the straight part, the third bar the contour cutter for roughing (old cutters from the fourth turret

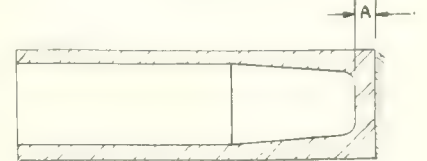


FIG. 5.

Face Base

5th operation, Fig. 5. The shell is held in a collet chuck, it being forced against a stop fixed in the centre of the chuck. This enables the operator to set the tool the required distance from the stop, another stop on the carriage is then set which prevents a low base. Although a lathe can be used to advantage, special open end machines are more suitable. A is gauged (see Fig. 5).

Re-centre

6th operation, Fig. 6. This operation

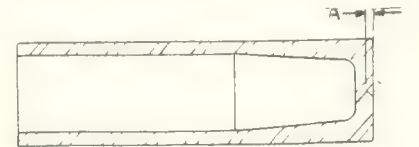


FIG. 6.

is carried out the same as operation 2. A (see Fig. 6) is gauged. This operation is necessary as the centre is used for re-rough turning and grinding the outside of the shell.

Re-rough Turn

7th operation, Fig. 7. The shell is held on an expanding mandrel as in operation 2. A is gauged (see Fig. 7).

Bevel and Face Open End to Length

8th operation, Fig. 8. The shell is

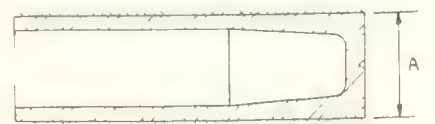
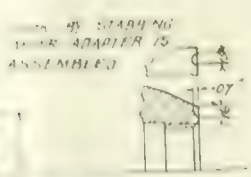
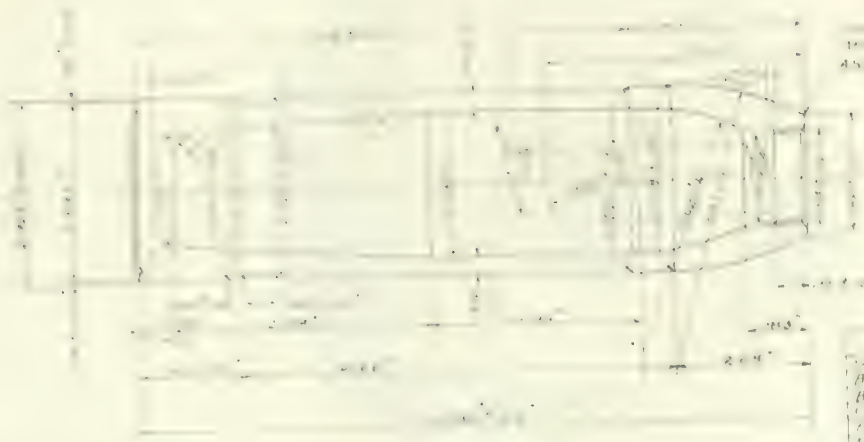


FIG. 7.

held as in operation 5 but with the open end protruding. A special block tool holder is used. The chamfering tool is held at right angles to the shell (in front). The facing tool is in line with the shell. This operation is taken care

USE = 21.476 GRAINS

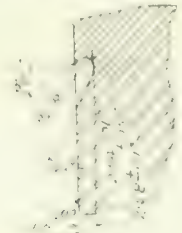


SECTION SHOWING STABBING.

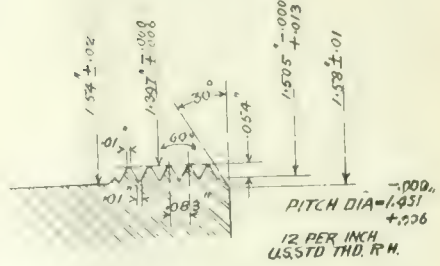
NOTE: THREAD TO BE SUITABLY PROTECTED UNTIL LOADED AND ADAPTER IS ASSEMBLED.

PART	POUNDS	
SHELL BODY	9.47	± 15 LBS.
BAND (COPPER)	.18	
BASE COVER COMPLETE	.08	
CHARGE (CAST T.M.T.)	1.75	
LINE POINT (APPROXIMATE)	.4	
ADAPTER BOOSTER (HARL. ADP)	.63	± 2 LBS.
TOTAL	13.47	

SHELL BODY
 ONE SHEET STEEL
 INNER SURFACE TO BE SMOOTH AND FREE FROM HOLES. SURFACE MAY EITHER BE MACHINED OR POLISHED BY COILING IN OF SUITABLE MATERIAL WHICH IS NOT OBTAINED.

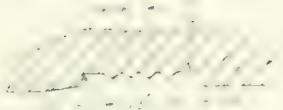


DETAIL OF BASE COVER GROOVE

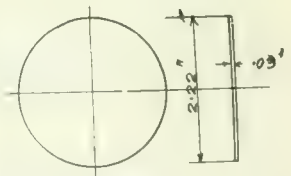


SECTION SHOWING DETAIL OF THREAD ON SHELL

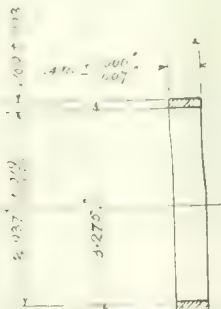
MARK WITH "25 LETTER" AND
 DATE OF MANUFACTURE ON THE
 BAND



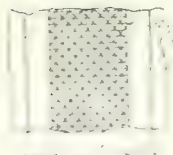
DETAIL OF BASE AND SEAT



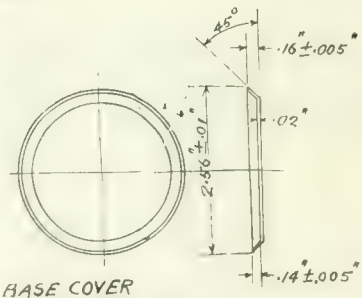
LEAD DISC. ONE-SHEET LEAD



BAND
 ONE-COPPER TUBING
 TO BE ASSEMBLED COLD
 WEIGHT .26 LBS. MAXIMUM



75 MM. COM. STEEL SHELL MARK - J



BASE COVER ONE-SHEET BRASS. COM

of by a lathe, the tools being set and the carriage feed put on. When the carriage almost reaches the stops, the operator releases the feed and runs the carriage up against the stop by hand. The cross feed is not required. A, B and C are gauged (see Fig. 8).

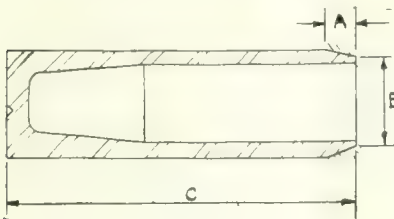


FIG. 8.

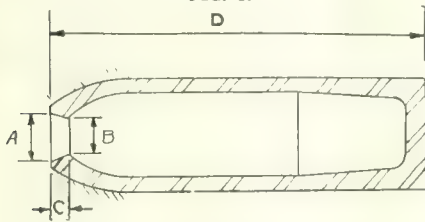


FIG. 9.

Nose in

9th operation, Fig. 9. A hydraulic press is used. The open end of the shell is heated in an oil or gas furnace, an oil furnace being preferable. The shell is then placed in the press against three locating pins, the die brought down and the shell nosed in. Although cast iron dies are successfully used, machine steel case hardened ones stand up to the work better. Two upright stops, (one at each side) determine the length of the shell. The pin in the centre of the die determines the size of the fuse hole. A, B, C and D are gauged (see Fig. 9).

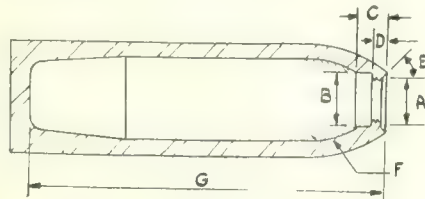


FIG. 10.

Finish Fuse Hole and Inside Contour

10th operation, Fig. 10. A turret lathe equipped with a collet chuck as in operation 5 but with the nose end protruding. The first tool rough bores and faces to length, it carries a stop which strikes the bottom of the bore. The second tool recesses the rear part of the fuse hole (rear of threads). The third tool (forming cutter) bores the inside contour, a roller at the end of the cutter in line with same brings this cut in line with the bore. The fourth tool, a rose reamer, reams the hole over the threaded portion. The fifth tool, a collapsible tap, is next run in. A, B, C, D, E, F and G are gauged (see Fig. 10).

Form Outside Contour

11th Operation, Fig. 11.—The shell is held by its base diameter in a collet chuck and a screw centre in the nose end supported by the tail stock centre.

The profiling tool (a flat forming cutter) is held in a box tool holder. A stop prevents the operator from making the shell too small at the nose. A and form of nose are gauged (see Fig. 11).

Grind Body and Shoulder

12th Operation.—A grinder is employed for this operation. A, B and C are gauged (see Fig. 12).

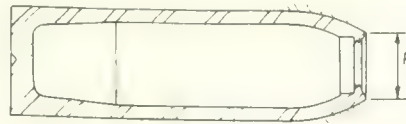


FIG. 11.

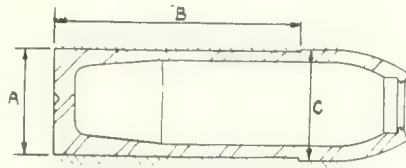


FIG. 12.

Finish Face Base

14th Operation, Fig. 13.—The shell is held as in operation 5, the inside of the base being set against a stop as in that operation. A stop on the lathe bed is in line with this stop. By means of blocks, as explained in operation 13, the operator has a fixed thickness to work to. The carriage is brought up to this stop and the tool then fed across the base. A is gauged and B checked (see Fig. 13).

Weight

13th Operation.—By means of an ordinary pair of scales or special basket scales. A table of weights calculated from a finished shell is tabulated in accordance with each thirty-second of an inch across the base of the shell, between the high and low limits. The amount of stock to be removed to bring the shell within the required weight is stamped on the base, i.e., 1-32, 2-32, etc. Any shells over weight must be returned to operation 10 and have stock removed from the inside contour by means of a similar contour tool (third tool, operation 10) with a cutter having a larger radius, care being taken not to make a thin wall. By taking a trial shell through to the last operation, the desired weights at this stage can be ascertained.

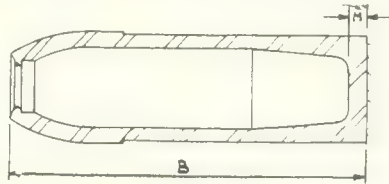


FIG. 13.

Check Weight

15th Operation.—Scales similar to those used in operation 13.

Groove and Knurl Barrel Recess and Chamfer, Also Chamfer Base

16th Operation, see Fig. 14.—Engine lathe or special open end machine hav-

ing a four-way tool holder. First tool grooves, leaving a raised portion in the centre of the groove. The second tool chamfers the back edge of the groove. The third tool chamfers the base. Stops are used to determine the diameters and the proper distance from the base. A, B, C, D, E, F and G are gauged (see Fig. 14).

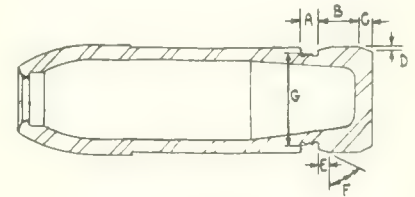


FIG. 14.

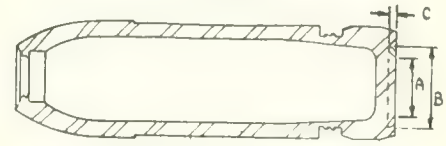


FIG. 15.

Groove Base

17th Operation, Fig. 15.—The shell is held as in operation 5, a similar stop being used inside the bore. A flat forming tool held in a block tool holder is used. A stop on the carriage fixes the depth of cut. A, B, C and the form of groove are gauged (see Fig. 15).

Wash and Sand Blast

18th Operation.—Special machines are now on the market, the use of which saves time and insures first class results.

Preliminary Shop Inspection

19th Operation.—The shells are arranged according to serial numbers and then submitted. The following gauges are used to check the shell: high body

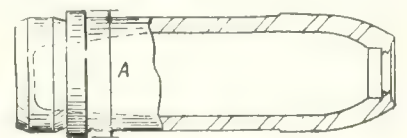


FIG. 16.

ring gauge; low body ring gauge; high base ring gauge; low base ring gauge; snap gauge high and low diameter driving band recess; snap gauge high and low diameter of knurling; width of driving band recess; high and low distance from base (combination gauge); length and angle of driving band recess chamfer; length and angle of base chamfer; form of base groove; high and low diameter of base groove; calliper gauge for thickness of wall; calliper gauge for thickness of base.

Preliminary government inspection immediately follows the foregoing.

Applying Base Cover Plates

20th Operation.—The shell is held in a special hand champ with lead pad at bottom for nose of shell to rest on, its base being upwards. The lead plate is placed over the base and the brass disc, with its flange in the groove, is placed over it and planed into the base groove.

Apply Driving Band

21st Operation, Fig. 16.—The band is applied cold by means of a special banding press. A is gauged occasionally (see Fig. 16).

Stamping

22nd Operation.—The required stamping is done just above the driving band. The shell is placed in a groove in the bench. The stamps are held in a special holder.

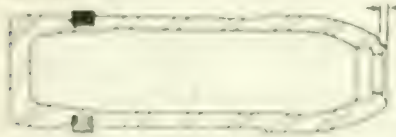


FIG. 16.

Mill Slot in Nose

23rd Operation, Fig. 17.—The shell is held in two vee blocks and fed into the milling cutter. Both dimension and form of slot are gauged, see Fig. 17.

Hand Tap and Reseat

24th Operation.—The shell is held as in operation 20, but with its nose upwards. A hand tap is used to insure a clean smooth thread and also for sizing purposes. A nose reamer is employed to smooth the angle of the fuse hole. Its shank is threaded at the bottom to suit the threads in nose of shell; at the upper end (above the reamer) are two threaded collars to keep the reamer against the shell. A combination gauge for the threads and angle of seat is used.

Wash and Clean

25th Operation.—Special washing machine as used in operation 18.

Varnish and Bake

26th Operation.—The shell is varnished while rotating on belt-driven rollers, a varnish spray gun being used. The shells are then placed nose downwards in a rack mounted on rollers and run into a gas oven.

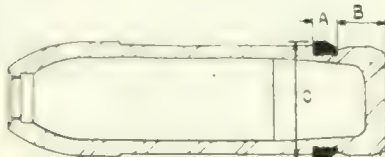


FIG. 18.

Turn Bevel

27th Operation, Fig. 18.—The shell is held as in operation 5. A special open end machine or engine lathe is used. At the forward end of the carriage is a block tool holder which holds the two trimming tools (operated separately by hand screws) which turn the band to the proper width. The holder which supports the two shaving tools (roughing and finishing) is mounted at the back of the carriage and passes under the shell. A, B, C and form of band are gauged (see Fig. 18). As no cutting compound is used the shell does not become dirty again. This operation is placed last as the driving barrel is easily damaged.

Final Shop Inspection

28th Operation.—The shells are now submitted for final inspection. It is

again weighed and the following gauges used: one gauge high base, profile of nose; concentricity (cylinder) gauge.

Final government inspection concludes the work on the shell which is most directly connected with machine shop methods.



MAN POWER BIGGEST FACTOR IN INDUSTRY

WHAT is going to happen if the output of steel is not increased? The fate of the war depends largely upon the steel production of the United States, and the out-turn is being seriously retarded by lack of fuel, iron, transportation facilities and labor.

The seat of the trouble which is hampering production at this time is labor. There are not enough men to man the steel plants. There is also not sufficient fuel to operate them for the same reason, and the facilities of transportation have proven entirely inadequate to the extra strain. The consequence has been that production instead of increasing is declining, and the out-turn of some mills is reported to have been reduced to 50 per cent. of normal capacity.

As for iron, the outlook is still more serious. The lack of man power is holding up production of ore, of fuel, and consequently of iron and steel. In the Eastern market recently there were inquiries for upward of 25,000 tons of basic and foundry iron. The great bulk of this demand must disappear because there is nothing with which to satisfy it. It is estimated that of the tonnage asked for probably not more than 5,000 tons will be found available for distribution.

The inquiries are for large and small lots for delivery from now to next July. The furnaces are also growing cautious about extending their engagements for next year, as they are already well sold up and behind on their present contracts for the year. Steel makers and foundry men are clamoring for iron all over the country, and the market has probably never before been subjected to such a combing process with so little tangible result. It is well for industry in general that the price is fixed or the market would undoubtedly be thrown into an unprecedented state of panic.



WASHINGTON DISTRIBUTES WAR ORDERS

ORDNANCE Bureau has distributed orders for about five hundred thousand 200-millimeter and seven hundred and fifty thousand 155-millimeter shells. Contracts for forgings for nine hundred thousand 240-millimeter projectiles have also been awarded, and contracts for machining these will probably be concluded within a few days. Further contracts for guns and gun forgings have also been let.

The order for seven hundred and fifty thousand 155-millimeter went to American Brake Shoe & Foundry Co., which also is expected to secure a contract for about half the 240-millimeter shells to be placed. American Car & Foundry Co.

will also get contracts for 240-millimeter shells.

The half million 200-millimeter shells have been awarded to Westinghouse Electric Co. and McMyler-Interstate Co. of Cleveland.

Orders for forgings for the 155-millimeter, 200-millimeter and 240-millimeter shells were divided among following companies: Bethlehem Steel, Midvale Steel, Pollack Steel, American Steel Foundries, Taylor-Wharton Steel & Iron, Curtis & Co., Whitaker Glesner Co., Carnegie Steel, Pennsylvania Steel, American Rolling Mills, and Cape Ann Anchor Works.

Some of these concerns already have substantial orders for guns or shells. Bethlehem and Midvale, it is known, have a record-breaking volume of business from the United States Government, most of it of this character, but details of the contracts are being withheld. American Brake Shoe has a contract for three thousand 155-millimeter howitzers, closed August 24, and is now actually producing these guns. Westinghouse Electric has a contract for 1,800,000 six-inch shells (practically the same size as the 155-millimeter) for Great Britain and for 75-millimeter shells for this Government.

Pollack Steel has contracts for forgings for 1,000,000 British six-inch shells and for gun forgings and battleships and destroyer forgings.

It is estimated that the ordnance department has placed total contracts since beginning of war for 60,000,000 shells of different sizes, of which about 29,000,000 were 75-millimeter, and for over 20,000 guns from 75-millimeter up.



TWENTY-FIRST ANNUAL MEETING OF NATIONAL FOUNDERS' ASSOCIATION

ON the occasion of its twenty-first annual meeting, held at the Hotel Astor, New York, Nov. 14 and 15, the National Founders' Association demonstrated as far as possible in a meeting of this nature the loyalty and patriotism of its members. A new high record was set for attendance, this event being largely influenced by the great amount of labor disturbance throughout the United States. The apprehension felt by the members regarding results likely to arise from the attitude of labor unions was strongly evidenced by the president, William H. Barr, who stated that national efficiency and prosperity rested upon that foundation of industrial equality and liberty known as the open shop, and he further insisted that in time of war the 8-hour day is an economic waste and a grave menace.

Increased Output With Reduced Labor

The question of maintaining normal production of castings despite reduced labor facilities was discussed to a large extent. The opinion was expressed that jobbing foundries are not producing in excess of 50 per cent. of their capacity, and president Barr emphasized the patriotic duty of jobbing casting manufacturers to maintain their normal production in spite of the labor shortage.

The results obtained through the installation of moulding machines and similar labor-saving equipment were convincingly shown in a series of motion pictures taken in various progressive plants in the United States and Canada. Moulding, pouring and shaking-out work when performed with suitable equipment had yielded increased output up to four and fivefold, and in some of the shops shown the skilled labor had been replaced entirely by handymen. Piece-work payment prevailed and combined with the increased output, had resulted in greatly enhanced wages. Operations at the following plants were shown by the pictures: King Sewing Maching Co., Buffalo; Buick foundry of the General Motors Co., Flint, Mich.; Eddy Valve Co., Waterford, Conn.; McClary Mfg. Co., London, Ont., and the Lumen Bearing Co., Buffalo. In connection with the latter plant it was stated that the employes are now averaging an output of 1,108 pounds of castings each, of an average weight of less than three pounds per casting.

Officers and Council

New officers of the N. F. A. are: President, William H. Barr, Lumen Bearing Co., Buffalo; Vice-President, Samuel L. Moore, Moore Bros. Co., Elizabeth, N.J.; Secretary, J. M. Taylor, Chicago; Commissioner, A. E. McClintock, Chicago.

The following members of the seventh district committee were chosen: George W. Watts, Canada Foundry Co., Ltd., Toronto, Ont.; A. R. Goldie, Goldie McCulloch Co., Ltd., Galt, Ont.; H. Cockshutt, Cockshutt Plow Co., Brantford, Ont.; J. C. Russell, John McDougall, Caledonian Iron Works Co., Ltd., Montreal, Que.; W. M. Gartshore, McClary Mfg. Co., London, Ont.



MORE FUEL OIL FOR STEAMERS

AN important change which has been comparatively lost sight of owing to the stress of war conditions is the increasing use of crude oil as fuel for steamships. Without a great deal of publicity having been given to the fact, a not unimportant portion of the American merchant marine has been turned into oil burners. The navies of the world, of course, have been using oil as fuel much longer than the merchant services. In this connection it may be noted that at a recent conference held at Washington between representatives of the American and British governments. Standard Oil officials and the Shipping Board, an ample supply of oil for the British navy was assured.

The chief advantages claimed for oil as fuel are a saving of bunker space in the ship and a saving of dead-weight. Up to comparatively recent years the drawback has been the price of oil, but with the unprecedented enhancement in the price of coal which war conditions have brought with them the economic opportunity to use oil has presented itself. Speaking generally the increase in the Texan, Mexican, and Californian oil supply which has taken place during recent years has made possible a greater use of oil for generation of steam on ships.

Hitherto oil was usually too valuable to be used in ships furnaces.

Particularly on the Pacific Coast and in trade with the Orient has the war promoted the use of oil as fuel on ships, the source of supply in the Gulf region and California being relatively near at hand.

Five steamers now in course of construction for the New York-Valparaiso service are to be oil burners. Eighty per cent. of the Standard Oil steamers now afloat are equipped as oil burners. The Southern Pacific Railway, which has oil fields of its own, has been the leader in this country in the use of oil fuel for locomotive engines. In 1915 the company had 1,927 oil-burning locomotives out of a total of 2,046 engines. The Southern Pacific is also using oil as fuel for its steamers to a very considerable extent.

The Luckenbach Steamship Co. has a couple of oil-burning steamers. There was launched last month at the yards of the Fore River Shipbuilding Co., Quincy, Mass., a large oil-burning freighter of 10,000 tons dead-weight intended originally for the Luckenbach Steamship Co., but now taken over by the Government. The fuel oil is carried in the double bottom and in the forward and after peak tanks.

The Atlantic, Gulf & West Indies Steamship Lines have seven or eight oil-burners. Most of the newer ships have been equipped to use liquid fuel, the policy being to build all new ships with facilities for the use of either coal or oil. The Munson Line has two or three oil burners of 7,500 tons dead-weight, and other American companies have one or more vessels equipped in this way, as for instance the United Fruit Co. Some of the Cunarders will be oil-burning ships.



RECENT DEVELOPMENTS IN POTASH PRODUCTION

THE influence which it is possible for the cement and iron industries to exert on the production of potash is of considerable importance at this time, and the possibility of this influence increasing in the future is the belief of Richard K. Meade, expressed in an article in the "Manufacturers' Record." The necessity for development work on this continent has been growing more urgent with the continuance of the war, some idea of the urgency being conveyed by the statement that the imports of pure potash from Germany before the war amounted to 250,000 tons, while 10,000 tons only were produced in the United States last year, as estimated by the Geological Survey.

Recent reports in Canada indicated the probability of production being increased by suitable treatment of feldspar in connection with cement manufacture. It seems, however, that the loss of potash by volatilization from rotary cement kilns was pointed out as far back as 1903, and that from blast furnaces still earlier, but before 1914 nothing was done to collect the substance from either source.

Some ten years ago a dispute arose between the orange growers in South California and the cement mills over the question of the damage caused by the dust from the mills being deposited on the fruit trees, and to settle the matter the Riverside Portland Cement Company installed a process for precipitating the dust by the Cottrell electrical system. This process not only proved efficient as a dust-catching device, but also collected the potash with the dust. Most of the potash being water-soluble, it can be dissolved out of the dust by leaching with water. Before the war the raw materials used at Riverside were low in potash, and hence the amount volatilized was small, but after the outbreak of war the company found they could increase the output of potash from their kilns by the aid of feldspar, which can be used without injury to the cement. They also found that mixing fluorspar with the raw materials increased the amount of potash volatilized to 90 per cent. of the amount contained in the raw materials, as against 50 per cent. volatilized under usual conditions. They next extracted the potash from the dust, and by crystallization obtained a potash salt containing at least 35 per cent. of potash. The crust which collects in the stacks of the rotary cement kilns contains from 6 to 12 per cent. of potash, and of this large quantities have been sold to the fertilizer companies since 1914.

In the summer of last year the Security Cement and Lime Company put the Cottrell process into operation in order to catch all their kiln dust. They found that the addition of salt to their raw materials increased the yield of potash, and at present they are obtaining about 20 tons of dust a day, averaging 10 per cent. of water-soluble potash. The Santa Cruz Portland Cement Company are recovering 700 lb. of potash daily from their kilns by a process of their own, and a number of other cement companies are installing or have installed Cottrell plant. When all these plants are in operation Mr. Meade estimates that they will yield about 10,000 tons of potash annually, and this amount, he states, could be very greatly increased by using feldspar as a raw material.

As to potash from blast furnaces, the only iron company in America, so far as he is aware, selling potash at present is the Bethlehem Steel Company. Up to the present only the dust which can be collected by means already at hand has been sold, the amount being estimated at about 4 per cent. of the total potash liberated; but the chemist of the company believes that apparatus could easily be installed to catch at least 50 per cent. of the potash now lost, and that the apparatus, so far from interfering with the operation of the plant, would benefit it through the better cleaning of the gas for the engines. It is estimated that of the potash volatilized in the blast furnaces the amount recoverable will average at least 10 lb. per ton of pig iron, so that with an annual production of 25,000,000 tons of pig iron the blast furnaces of the United States would produce, say, 125,000 tons of potash

Heat Treating and Annealing Furnace with Oil Fuel Equipment

Staff Article

Despite the variety of equipment now available for all lines of manufacture, and the degree of perfection attained in the design and production thereof, circumstances occasionally arise where individual requirements influence the production of articles more or less at variance with standard types. The furnace described hereunder is an apt example of personal initiative combined with adaptation of such equipment.

OPPORTUNITIES for heat treating and annealing in furnaces burning coal, oil and gas, have been particularly numerous since the steel industry came to this country. Previous to that time there were, of course, many plants which employed furnaces on a large scale—steel works, enamelling plants, and specialized factories of various kinds. The great majority of machine shop establishments, however, had their requirements capably met by small and medium sized gas fired furnaces, and in some cases coke fired furnaces were used.

Features of Fuels

The beginning of munitions making resulted in a widespread activity, mostly of an experimental nature at the start, which embraced the three fuels mentioned, and finally resulted, in probably the majority of cases, in the adoption of oil fuel. The less general availability of gas militated against its use except in the larger industrial centres, where its convenience, cleanliness, and the comparatively greater familiarity of most workmen with its operation influenced its frequent adoption. For use on a large scale the cost is sufficiently high to compel consideration being given other fuels.

Coal Displaced

With careful manipulation and suitable furnace construction, anthracite coal has in one particular instance given very satisfactory results but here again the installation was of medium size and under more or less constant operation. Such conditions, however, did not obtain in the case of the plant where the furnace shown in the accompanying illustrations is installed. Previous to recent reconstruction, this furnace was of the old side fired type, using soft coal.

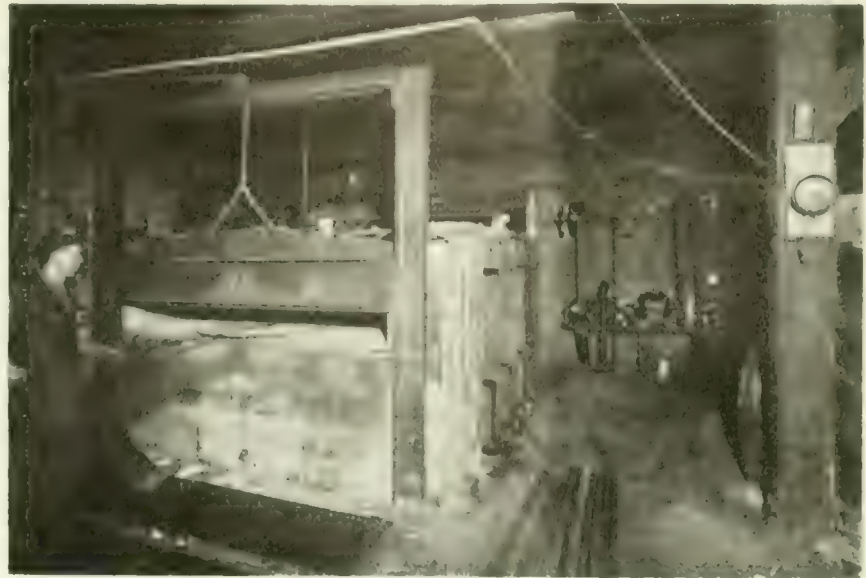


FIG. 1. GENERAL EXTERIOR VIEW OF FURNACE, OIL TANK IN FOREGROUND AND PUMPING EQUIPMENT AT BACK.

The fire chamber extended along the right hand side where the oil burners are now located, giving a long narrow grate, difficult to fire properly, and increasing the width of the furnace by about 50 per cent. over that shown. In addition, a brick stack was carried up through the floor above. The lighting up of such a furnace was never a pleasant proposition. The amount of smoke around the room till the draft caught on properly, the length of time heating up to a working temperature and the unavoidable variation in temperature, all combined to render it unsuited for the work on which it was employed by the Radcliff Saw Mfg. Co., of Toronto, and an investigation of numerous oil fired furnaces in the

surrounding district convinced them of the merits of that fuel.

Features of Design

While the general principles of oil firing are more or less similar, there are opportunities for the exercise of individual judgment, both in the manner of consuming the fuel and in the arrangement of combustion chamber, baffles and flues which exercise an important influence over the distribution and control of temperature. The design of the furnace proper is the work of the company's superintendent, J. C. Hills, while the fuel burning apparatus is Tate-Jones & Co.'s low pressure system. Owing to cost of materials, etc., the foundation and brick-work were executed by local furnace builders, the burners and pumping equipment being erected by the Radcliff Co.

The general appearance of the exterior is shown in Fig. 1. A cross section is shown in Fig. 2, while Figs. 3, 4 and 5 are respectively a part longitudinal cross section and elevation, sectional view of burner, and view of pumping equipment. The hearth is 7 ft. 2 in. wide by 11 ft. 2 in. long, and is composed of tiles 18 in. by 13 in. by 3 in. laid with their length across the furnace, and supported by eight cross walls. These cross walls are of standard size fire-brick spaced as shown; and a burner set opposite each alternate one so that the flame, after striking on the large renewable baffle brick (shown cross hatched), percolates through the spaces into

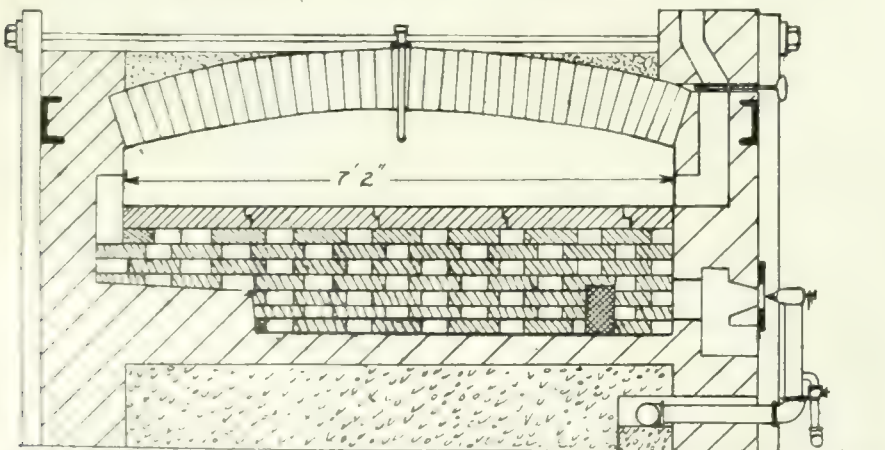


FIG. 2. CROSS SECTION OF FURNACE SHOWING ARRANGEMENT OF BURNER PASSAGE AND BAFFLE BLOCK.

the adjacent flues and meets the hot gases from the next burner.

Action of Gases

The hot gases thus distributed pass across to the opposite side of the combustion chamber under the influence of

zle, its exit from which is controlled by a needle valve adjusted by a star wheel.

This internal nozzle is movable bodily to or from the mouth of the burner casing by means of a threaded bushing having a suitable handle, which therefore

arch is swept by the hotter gases and the resulting radiation of heat down on to the work gives excellent uniformity of temperature throughout.

Individual Dampers

A simple type of slide damper is fitted in each discharge flue and thus permits

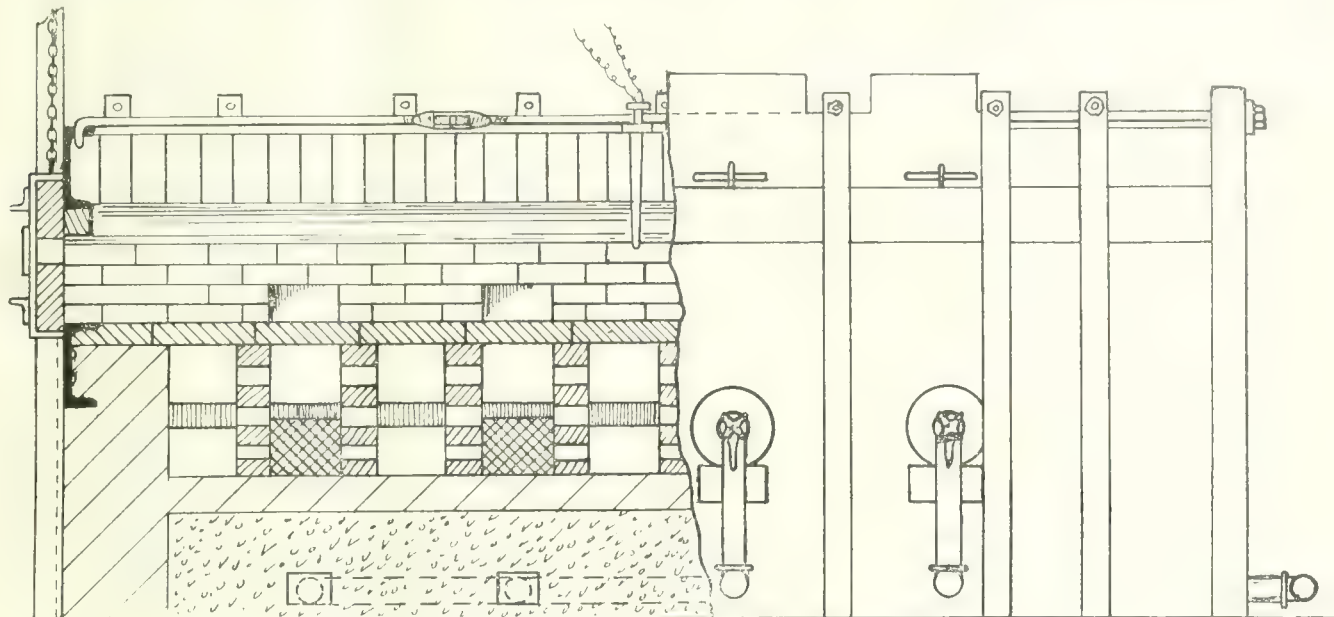


FIG. 3. PART SECTION AND ELEVATION SHOWING PERFORATED SUPPORTING WALLS UNDER HEARTH.

the draft from the four flues shown. It will be noticed that the perforations in the cross walls extend into the flue area and thus allow it to draw on the outer cross passages. On ascending into upper or work chamber, the gases flow across the surface of the arch and make their exit by four similar flues in the right hand wall, each flue having a separate passage to atmosphere with individual dampers. See cross section, Fig. 2.

Low-Pressure System

The low-pressure system of burners is so termed because of the small air pressure required for operation. Those installed are Tate-Jones L-1 type, operating with air at approximately 2 lbs. pressure per sq. in., while the fuel is supplied at a pressure of 20 lbs. per sq. in. As shown in sketch Fig. 4, the fuel is supplied through the 3/8 in. pipe which enters the 2 in. air pipe near the ground, and extends upward to an internal nozzle,

allows the proportion of air to be increased or diminished without altering the fuel valve setting, the inside fuel pipe readily springing the maximum distance traveled by the bushing in adjusting the air supply.

Auxiliary Air Supply

The openings in the wall through which the fuel and air pass to the combustion chamber are of enlarged conical section for one-third of the distance, when they are joined by extra air passages from below, so arranged as to surround the ingoing streams of air and oil with an additional body of air, the entire product then passing through the remaining straight third of the wall and impinging on the baffle blocks previously referred to. The resulting combustion is extremely good, the complete atomisation of the fuel being assured, while the auxiliary air flues, described reduce the possibility of danger when a flare-back occurs as may happen once in a great while through careless adjustment.

The tendency of the heat to rise gives every chance for the hearth to get well saturated at high temperature and thus prevents undue cooling when the furnace is loaded up; the heating is also correspondingly more rapid. During operation the roof

the heat to be distributed or localized according to the shape and size of work being heated. The combustion gases pass upward to a large hood, Fig. 1, whence they escape to atmosphere through a small steel pipe which replaced the former massive brick shaft.

Toward the back of Fig. 1 is seen the pumping equipment which is remarkable for its compact arrangement. Fig. 5 shows this in more detail. Just below the lower right hand corner the oil storage tank is sunk in the ground, the oil being drawn therefrom and pumped to the fuel burner by a small De Laval rotary pump which maintains a steady pressure of 20 lbs. per sq. in. An overflow relief valve on the discharge side prevents damage or trouble when all of the burners are shut off suddenly. At the far end of the bench is a No. 4 P.H. and F.M. Roots positive pressure blower

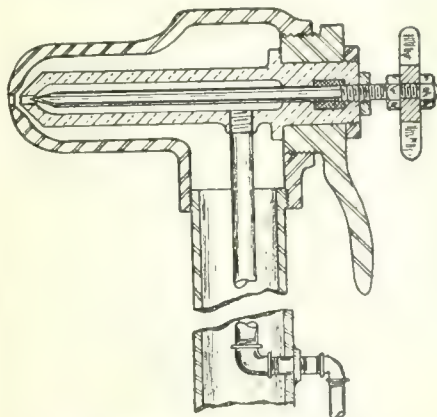


FIG. 4. SECTION OF BURNER SHOWING INTERNAL OIL PIPE AND NEEDLE VALVE.

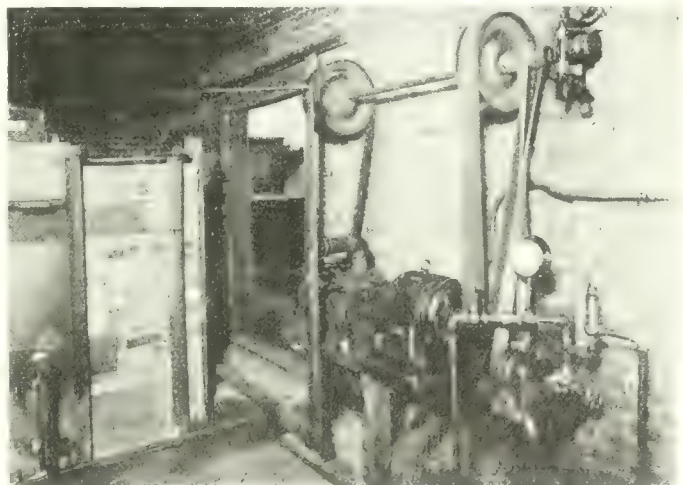


FIG. 5. COMPACT ARRANGEMENT OF MOTOR, PRESSURE BLOWER AND OIL FUEL PUMP FOR FURNACE

supplying air through a 2-in. pipe to a 10-in. diameter boiler. This arrangement is fully described in the accompanying diagram and is a very satisfactory arrangement for use in small shops.

A three-phase 100-volt, 60-cycle, Chapman and Walker motor is used to drive the machine. The motor is of the standard type and is of the small size.

Quenching Facilities

The quenching facilities provided for this machine are of the standard type and are of the standard size. The quenching tank is 9 ft. by 18 in. and is set in the floor below the operator. Suitable overhead tackle enables the operator to handle the work and quench it at a proper speed while being quenched. A Taylor Instrument Co.'s pyrometer is used to measure the temperature of the work. The range of all of the work at present. Considerable special work has been done, however, such as heat treating aeroplanes, and several other things in the foreground of Fig.

1, while the annealing of special sheet steel stock is handled to great advantage, the fuel system enabling the composition of the gases to be kept free from oxidizing effects on the metal.

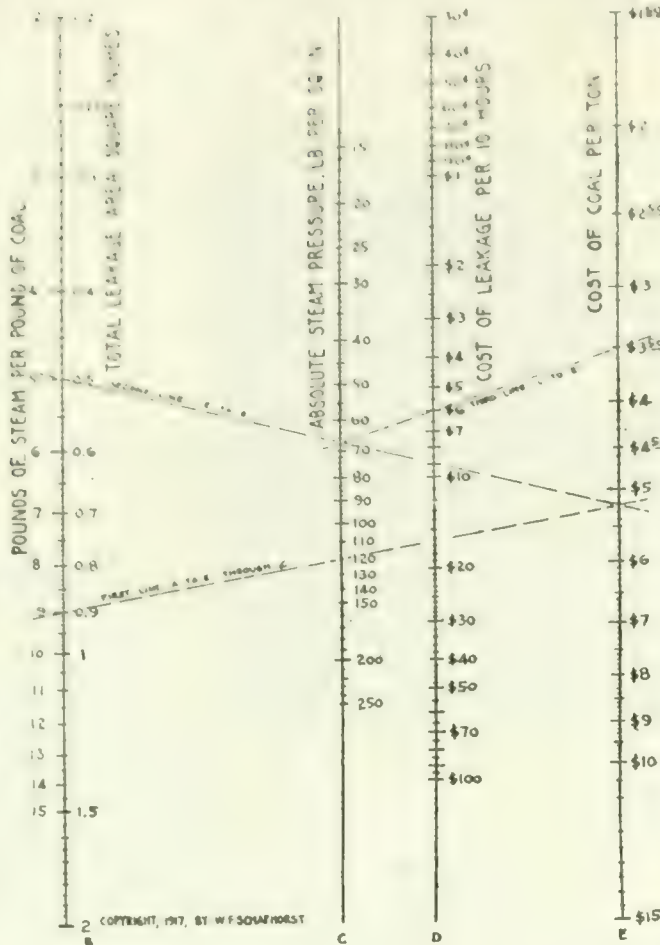
THE COST OF LEAKING STEAM

By N. G. Near.

TO determine the cost of leaking steam with any degree of accuracy we must know at least four factors: (1) The number of pounds of steam evaporated by 1 lb. of coal; the greater this is the less is the cost of leaky pipes, other conditions being the same; (2) the total area of leakage; (3) the absolute steam pressure, which is equal to the gauge pressure, plus the atmospheric pressure; at sea level this is usually reckoned as gauge pressure, in pounds per square inch, plus 14.7; and (4) the cost of coal per ton of 2,000 lbs.

For example, how much money is lost every 10 hours under the following conditions: Nine lbs. of steam are generated by each pound of coal. The total area of leakage is $\frac{1}{4}$ sq. in. The gauge pressure is 105 lbs. per square inch (making the absolute pressure very close to $105 + 14.7 = 120$ lbs. per square inch). The cost of coal is \$3.50 per ton.

Referring now to the chart, lay a straightedge across the chart three times as indicated by the dotted lines and the problem is solved. Run the first line from the 9 (column A) through the 1.2



(column C) and locate the intersection in column E. Run the second line from that point of intersection to the 0.5 (column B) and locate the intersection in column C. From that point of intersection run the third line to the \$3.50 (column E) and the answer is found at the intersection with column D. The answer is \$6 loss per 10 hours.

In case it is found that the total leakage area is less than shown in column B, the chart may be used by shifting decimal points. For example, if, in the above problem, the leakage area had been 0.05 instead of 0.5 sq. in. the answer would be 60 cents instead of \$6 per 10-hour day.

When using the chart, the steps must follow in the order shown and above described. First line, A to E through C. Second line, E to B. Third line, C to E.

The range of the chart is great enough to easily handle any ordinary problem.

BRONZE FINISHED BUTTONS

ARMY buttons are made from solid copper with a brass screw back fastener. The finish is a rich dark brown tone without lustre. Navy buttons are made from brass and finished in ormolu gold

by a combination of mercury or fire gold and electro-gilding.

In producing the military bronze finish, the button and fastener are made entirely of copper, they must be copper plated, says Charles H. Proctor in "The Metal Industry." After plating the buttons are washed and dried. A saturated solution of copper nitrate is prepared by dissolving all the copper nitrate possible in water heated to 180 degrees. The buttons are then placed in a tumbling barrel, revolved at from 4 to 6 revolutions per minute, and a sufficient amount of the copper nitrate solution applied so the buttons will be covered uniformly by rotation. An excess of the copper nitrate will come out patchy in the final finish. After tumbling for a few minutes the buttons will have a dark stained appearance.

Remove the buttons and place upon sieve pans made from iron wire mesh, then heat the buttons to a temperature of 700 or 800 degrees in a closed retort with provisions for carrying off the smoke fumes. After the smoke fumes have all been eliminated the heating operation is finished and as a result the copper nitrate is converted into brownish black oxide of copper, which proves to be a permanent finish.

It is a whole lot easier to tell how a thing ought to have been done than to tell how it ought to be done—and there still remains the difficulty of doing it.

AN alloy that has proved very satisfactory for ships' propellers is turbadium bronze. This material has a tensile strength of about 35/42 tons with an elongation of 14/20 per cent. on a 2-in. test piece, and it is not appreciably corroded by seawater. Its composition is, approximately, copper 48 per cent., zinc 46.45, tin 9.5, lead 0.1, iron 1, aluminum 0.2, manganese 1.75, nickel 2.

The United States super-dreadnought Tennessee will be driven by four alternating-current motors, one to each propeller shaft, supplied by current at 3,400 volts from two 13,500 horse-power turbo-generators. The motors will be wound for both 36 poles and 24 poles, operating on the former as squirrel-cage machines and on the latter as wound-rotor machines.

To deaden the noise from trucks rumbling over a concrete floor, a factory has successfully used a heavy tar paper pasted to the floor by paint. The method of application is as follows: The floor to be protected is first given one coating of grey cement paint. On the following day, when the paint is thoroughly dry, a second coat is applied. At the same time one side of a five-ply tar paper is painted and when both paper and floor are still wet the paper is carefully laid, wet side down, on the floor and rolled with either a roller or wide tired truck until all signs of air pockets beneath the paper disappear. The surface seems to improve with age and very effectively reduces upkeep to an extremely low cost.

PRODUCTION METHODS AND DEVICES

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

SPECIAL GRINDING ATTACHMENT By J. H. R.

THE maintenance of forming cutters for boring operations has given many manufacturers considerable trouble, particularly in production of shells, the machining of which has necessitated the use of large numbers of these flat cutters. Much of the difficulty experienced has been due to inability to maintain the desired shape and dimensions of the tool, owing to the rapid wear of the cutting edge.

The more efficient method of grinding boring cutters is to give an eccentric or convex shape to the clearance face, as shown to the right of Fig. 1. By this method it is possible to grind for ample top rake and yet retain a cutting angle that will give sufficient strength and metal to resist the pressure or the heat generated by the cut. It can be seen that the "cutting" qualities of the tool

the spindle, and with sufficient length to allow the longest cutter to pass the grinding wheel. The wheel B is dressed to fit the recess in A and is afterwards clamped by the nut C. The bearings of the lathe upon which these grinders were used were redesigned somewhat, and the machine belted to give a surface cutting speed of about 5,000 ft. per min.

In order to get the desired eccentric clearance on the cutter, the turret was raised equal to half the thickness of the blade, and one of the holes bored to fit the shank F, so that when the turret was returned to its proper position the upper face G of the forming cutter was in the same horizontal plane as the lathe spindle, but the center line D-E of the cutter arbor was lower by half the thickness of the blade. Locating points H were provided in the shank to determine the proper position for grinding either side of the cutter. Facilities were also provided to swing and lock the turret at a slight angle to grind the tapering end of the forming cutter.

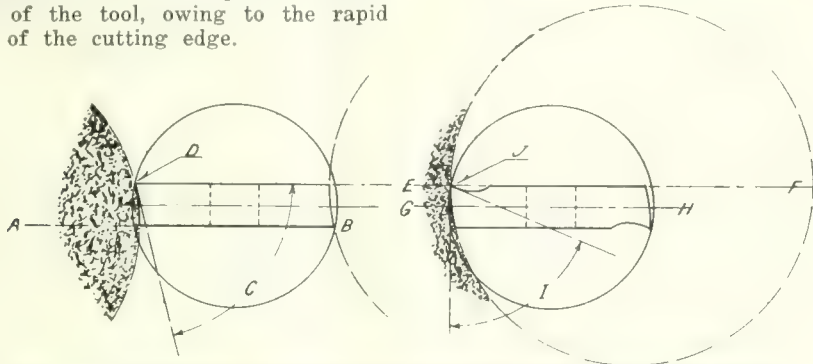


FIG. 1. ILLUSTRATING PRINCIPLE OF GRINDING FLAT BORING CUTTERS.

General practice in grinding this type of cutter is to use a wheel that cuts on its outer circumference, as shown to the left of Fig. 1, leaving the side with a concave appearance. In order to obtain sufficient clearance at the heel of the cutter it is necessary to grind in such a manner that the actual clearance angle is often very pronounced, as indicated by the angle C. If this clearance was from a diametrical point on the cutter, the cutting qualities of the tool would not be greatly affected, but without top rake the point D has a scraping rather than a cutting tendency, owing to the edge being one-half the width of the

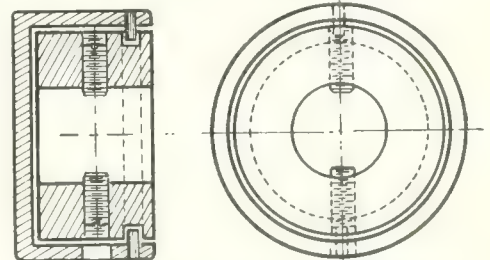
the right are much better than those of the other. The cutting angles C and I are about the same but the advantages of the eccentric ground tool are readily appreciated by a glance at the cutting edges D and J.

Application of Principle

Fig. 2 illustrates the method adopted for grinding shell boring cutters in a plant known to the writer. Discarded wheels from a Landis grinding machine were utilized for this purpose, these wheels having an interior diameter of about 5 in. When the Landis machine is through with these wheels the outer

SAFETY-COLLAR FOR EXPOSED SHAFT ENDS By J. Wright.

A VERY suitable protective means for preventing workmen from getting caught on the exposed ends of overhead shafting is the end safety-collar, shown in sketch. It consists of an inner collar having two headless screws for fastening this to the shaft. A loose fitting outer collar is placed over this. The inner collar has a square groove near the edge, cut reasonably deep, and wide enough so that the two pins fastened in the outer collar will



SAFETY COLLAR FOR EXPOSED SHAFT ENDS

hold it in position, while allowing the shaft and inner collar to revolve freely.

The shaft hole in the inner collar can be made large enough so it can be used on shafts of different diameters, it being only necessary to adjust the screws, and for this purpose a hole is made in the outer collar to insert a screw-driver.

It is readily seen that pressure on the outer collar from a workman's arm or sleeve will cause it to stop instantly, preventing damage such as would be done by the bare end of a revolving shaft.

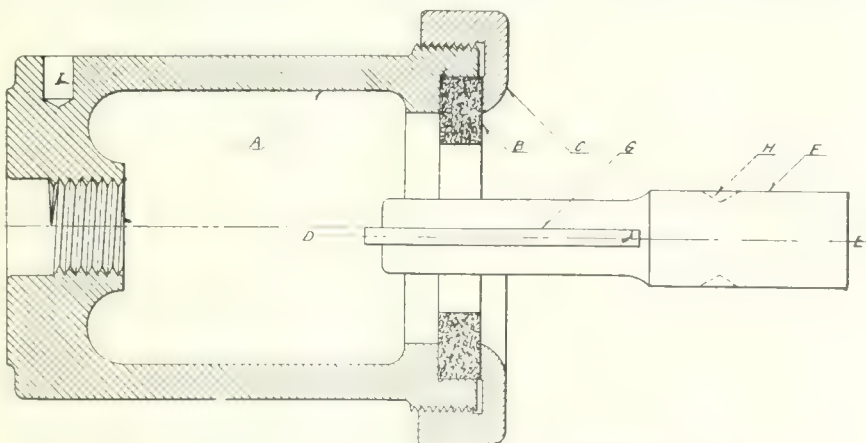


FIG. 2. DEVICE FOR APPLYING PRINCIPLE SHOWN IN FIG. 1.

blade above the center line. To give the proper rake to this tool the cutting angle must be reduced, and in doing so the effectiveness of the edge is further destroyed, owing to the increased possibility of chipping or over-heating.

diameter has been reduced to about 8 in., so that they were readily adapted for their new duties. The fixture for holding these wheels, so as to provide an interior grinding surface, consists of a box casting A threaded to fit the nose of

MANUFACTURE OF HARDENED THREAD GAUGES. IV.

E. G. Durrakker

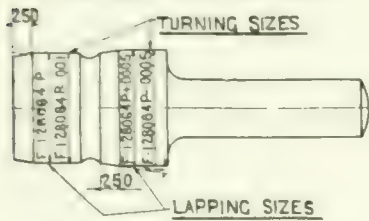
If does not require any special checks for measuring male screw gauges. All diameters are obtained by using a micrometer. The outside or major diameter can be taken directly. The minor diameter is taken over one or three wires fixed by using a micrometer. The pitch or wire diameter can be taken with a micrometer by the aid of the attachment shown in Fig. 22. For verifying male screw gauges that have been put out on 90 deg. advantage to have a final full thread female check, which has, of course, to be inspected for all the dimensions like a female gauge. From practice it will be found satisfactory to allow a shrinkage and lapping allowance of .001 for medium and large gauges and .0005 for small gauges.

Checks for Female Gauges

It requires several checks to test a female screw gauge effectively. (1) Check for minor diameter; (2) check for major diameter; (3) check for pitch diameter; (4) check for full thread.

Check for minor diameter.—The minor diameter can be measured with a plain plug gauge with two diameters, a "go" and a "not go" diameter. The "go" diameter is made the required size of the gauge and the "not go" diameter one-

LIMIT GAUGE FOR MINOR DIA OF FEMALE SCREW GAUGES



F = FINISHED MAJOR DIA OF FEMALE SCREW GAUGE.
FIG 27

half thousands over the required size. A lead of 2 deg. included angle is ground about 1/4 in. up on both diameters.

As hardened female gauges require lapping out, and have also a tendency to open out slightly in hardening, we require two gauges for every size, a turning gauge and a lapping gauge. It has been found good practice to allow .001 in. between the turning size and the lapping size for medium-sized gauges.

Fig. 27 represents the checks for the minor diameters.

The material is mild steel, which is carbonized hardened and ground.

Example.—The diameters for the checks for minor diameter for a female gauge 1.998 = 14 R.H. are—

Minimum diameter of turning check = F - 1.28064 P - .001 = 1.998 - .09148 - .001 = 1.90552.

Maximum diameter of turning check =

$$F - 1.28064 P - .0005 = 1.998 - .09148 - .0005 = 1.90702$$

Minimum diameter of lapping check = F - 1.28064 P - 1.998 = .09148

$$F - 1.28064 P + .0005 = 1.998 - .09148 + .0005 = 1.90702$$

Checks for major diameter. The major diameter of a female screw gauge must be measured with a check that touches the radius only and is free everywhere else. The flanks of the thread are cut with a sharp pointed tool with an included angle of 50 deg. and the radius is cut with a female master tool. The gauges are made of mild steel and kept soft all over except on the thread, where the carbon is left in so that the thread will be hard.

Fig. 28 shows two types of these checks, the principle of which is the same, only Type 1 is for the larger diameters and Type 2 for the smaller diameters.

The hole H in Type 1 is made to suit a handle shown in Fig. 29. Dimension G for both types is turned under the bottom diameter of the thread. Dimension W is in both cases 1/2 in. + 8 P. These checks are again required for turning and lapping sizes. Assume F the finished major diameter of the female screw gauge, then:

For the turning check—
 A = F - .001 in.
 B = F + 2x - .001.
 C = F - .0005.
 D = F + 2x - .0005.

For the lapping check—
 A = F.
 B = F + 2x.
 C = F + .0005.
 D = F + 2x + .0005.

The value of x is calculated as follows:—

In Fig. 30, in triangle D B E:
 D B = 1/2 P.
 D E =

$$\frac{D B}{\tan 25 \text{ deg.}} = \frac{P}{2 \tan 25 \text{ deg.}}$$

In triangle A B C:
 A C = R.

$$A B = \frac{R}{\sin 25 \text{ deg.}}$$

$$D G = A B - R = \frac{R}{\sin 25 \text{ deg.}} - R.$$

$$E G = \frac{D E - D G}{P} = \frac{R}{P}$$

$$\frac{2 \tan 25 \text{ deg.}}{+ R} = \frac{\sin 25 \text{ deg.}}{\sin 25 \text{ deg.}}$$

In triangle E M F:

$$\frac{M E}{\sin 25 \text{ deg.}} = \frac{F M}{2 \sin 25 \text{ deg.}}$$

F H	E M	M H	d
			d
			2 sin 25 deg.
X	E H	E G	1
			1
2		sin 25 deg.	

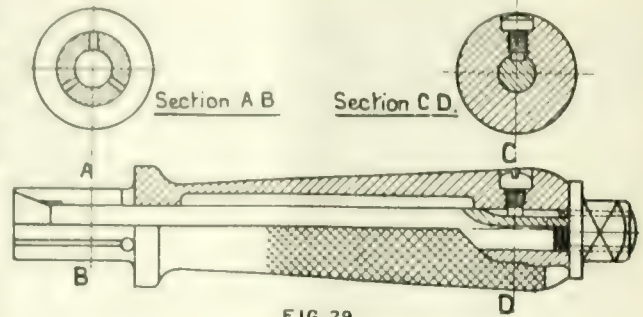
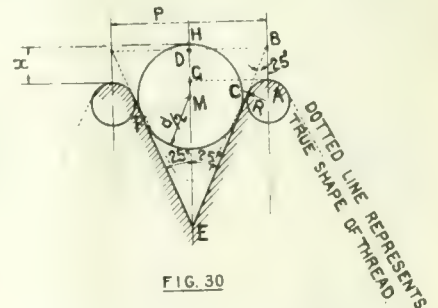


FIG. 29

$$\frac{2 \tan 25 \text{ deg.}}{\sin 25 \text{ deg.}} + R.$$

Example.—The diameters for the checks for major diameter for a female gauge 1.998 = 14 R.H. are:—
 Diameter wire d = .040.
 .020
 X sin 25 deg. + .020
 .035714 .0098 + .0098
 tan 25 deg. sin 25 deg.
 = .067324 - .063200 = .004124.

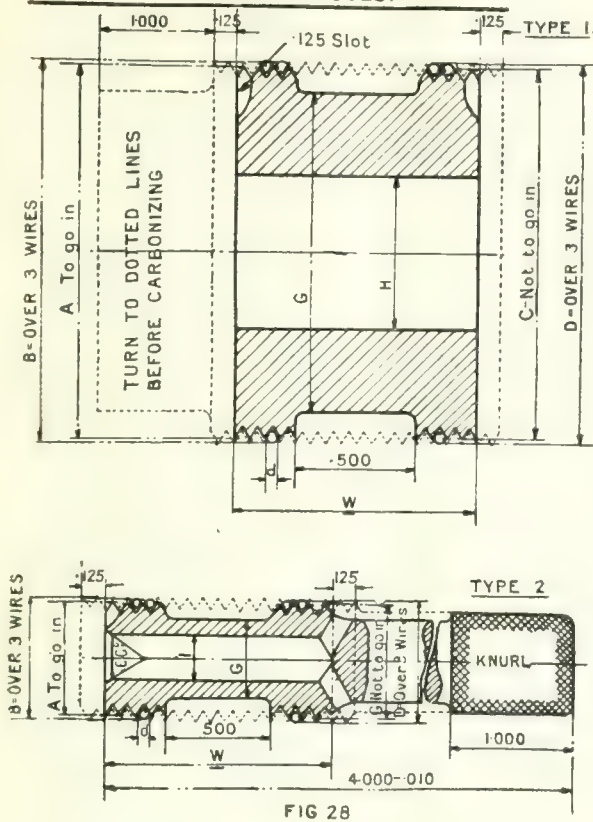
For the turning check,
 A = 1.998 - .001 = 1.997.
 B = 1.998 + .0082 - .001 = 2.0052.
 C = 1.998 - .0005 = 1.9975.
 D = 1.998 + .0082 - .0005 = 2.0057.
 For the lapping check,
 A = 1.998 = 1.998.
 B = 1.998 + .0082 = 2.0062.
 C = 1.998 + .0005 = 1.9985.
 D = 1.998 + .0082 + .0005 = 2.0067.



The 50 deg. sharp pointed tool is ground on the fixture shown in Fig. 3 by using a packing piece or a bush of a certain thickness between the tool and the bottom pegs. The thickness of the bush or the packing piece to obtain a 50 deg. angle is calculated as follows:—In Fig. 31 A B = .188. The new angle of inclination with the vertical is 65 deg. B D is a line drawn parallel with A C. B D therefore makes an angle of 2 deg. 30 min. with the line joining the centres of the pegs. D C = A B. In triangle B D E: D E = 2.624 x sin 2 deg. 30 min. = .114457. E C = D C + D E = .188 + .114457 = .302457.

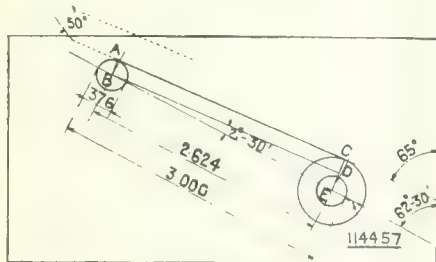
*Contributed to a recent number of "The Engineer" No. 22

LIMIT GAUGES FOR MAJOR DIA. OF FEMALE SCREW GAUGES.



The thickness of the bush or the packing piece is therefore $.302457 - .188 = .114457$.

The operations on type 1 are as follows:—(1) Cut off. (2) Grind off tit. (3) Centre both ends. (4) Turn shank. (5) Turn diameter thread. (6) Rough thread (to about two-thirds of depth). (7) Carbonising. (8) Heat up to 800 deg. and cool four times in water. (9) Anneal in charcoal. (10) Bore hole. (11) Cut off boss. (12) Face off one side (face to be smooth). (13) Face off to width (dead size, see operation 29). (14) Turn groove in middle. (15) Grind diameter thread maximum side (.0025 over size). (16) Grind diameter thread minimum side (.0025 over size). (17) Rough screw maximum end with 50 deg. sharp pointed tool. (18) Rough screw minimum end with 50 deg. sharp pointed



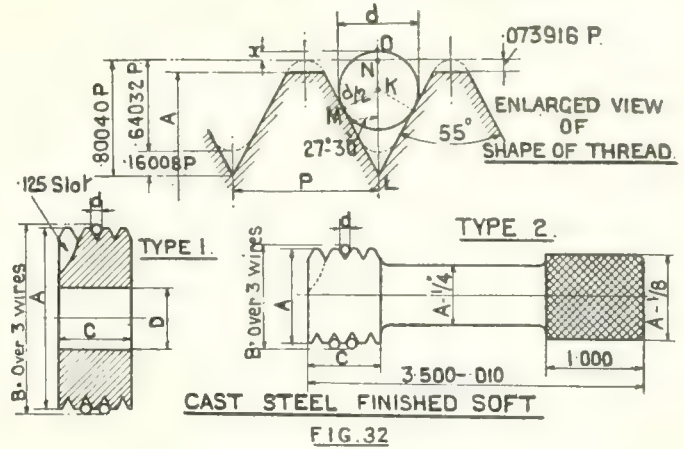
tool. (19) Finish screw maximum end with 50 deg. sharp pointed tool. (20) Finish screw minimum end with 50 deg. sharp pointed tool. (21) Radius top maximum end (allow one thousandth for lapping). (22) Radius top minimum end (allow one thousandth for lapping).

(7) Rough thread (to about two-thirds of depth). (8) Carbonising. (9) Heat up to 800 deg. and cool four times in water. (10) Anneal in charcoal. (11) Drill hole and countersink (note $\frac{1}{8}$ in. has to be faced off. (12) Turn down middle. (13) Face $\frac{1}{8}$ in. off front (to dead size, see operation 30). (14) Turn groove middle. (15) Drill vent hole (for hardening purpose). (16) Grind diameter thread maximum side (.0025 over size). (17) Grind diameter thread minimum side (.0025 over size). (18) Rough screw maximum end with 50 deg. sharp pointed tool. (19) Rough screw minimum end with 50 deg. sharp pointed tool. (20) Finish screw maximum end with 50 deg. sharp pointed tool. (21) Finish screw minimum end with 50 deg. sharp pointed tool. (22) Radius top maximum end (allow .001 for lapping). (23) Radius top minimum end (allow .001 for lapping). (24) Mill slot minimum end. (25) Turn away part thread. (26) Burring and marking. (27) Heat up to 800 deg. and harden in oil. (28) Cleaning. (29) Sand blasting. (30) Test for shrinkage lengthways. (31) Lap radius.

Check for Pitch Diameter.—This check must only touch the flanks of the thread, so there must not be a radius on the major diameter and the root must be sharp pointed. It is cut with a 55 deg. sharp pointed master tool ground on the fixture shown in Fig. 3. As the pitch of these checks must be absolute, it is best to make them out of cast steel and to finish them soft throughout.

Fig. 32 shows an enlarged view of the shape of the thread and the check it-

CHECKS FOR PITCH DIAMETER.



self. The diameter over the three wires B is major diameter of the female gauge $+ 2x$ where x is calculated as follows: For Fig. 32:

$$x = \frac{L O - L N}{d}$$

$$L O = \frac{K L + \frac{1}{2} d}{2 \sin 27 \frac{1}{2} \text{ deg.}}$$

$$L N = \frac{.8004 P}{d}$$

$$X = \frac{.8004 P}{2 \sin 27 \frac{1}{2} \text{ deg.}} + \frac{1}{2} d$$

.8004 P. A = major diameter of female gauge $- 2 \times .073916 P$ (see Fig. 1). The checks are again divided in two types.

Dimension D is made to suit the handle and the width C is made to suit the gauge to be checked. This check must enter the female and be a good fit without any slack.

Example.—Wanted a check for pitch diameter for a female gauge $1.998 = 14 R.H.$

$$\text{Diameter wire} = .404$$

$$A = 1.998 - .0106 = 1.9874 \text{ in.}$$

$$B = 1.998 + \frac{.4617486}{.11434} + .040 = 2.01028 \text{ in.}$$

Check for Full Thread.—The last and final check has a full thread that checks the entire shape. The distance over the three wires is the same as for the check for the pitch diameter. The major and minor diameter are exactly the same as for the female gauge. It has to enter the female gauge tightly like the check for the pitch diameter.

These checks are again divided in two types according to size.

The hole in type 1 and the width C are the same as for the check for the pitch diameter.

The material used is cast steel and it is finished and used soft.

The setting of the 55 deg. master tool for cutting upright is accomplished by a setting piece, similar to the one shown in Fig. 16, only the angle in a section through the centre must be 55 deg. and the gap is ground central.

Example: Wanted a full through truck for a female gauge, 1998 — 14 R H

Outside of major diameter — 1980

Dimension from top of barrel one side to root of thread other side — 1998 — 04574 — 196236

Dimension over three 1/2" wires — 1998 — 01228 — 001228

EFFORT TO CONSERVE FUEL SUPPLY

THE U.S. Fuel Administration is making an energetic effort not only to stop the waste of fuel but to conserve as much as it is possible to use, as the condition of this country requires. A great deal of coal is used for purposes that can be easily dispensed with, even when there is not a great waste.

The official directions sent out to practically all the industries in the East and Middle West require preference to be given to the Government orders, railway fuel, household needs, public utilities, steel plants, coke ovens and munition plants, in that order.

The assumption seems to be that all of these may be adequately supplied if preference can be given to them in deliveries. Their importance is obvious enough, though in the case of household requirements many exceed what is really necessary for health and comfort.

One of the savings proposed is to be effected by the conservation of electric power, which is developed by a large consumption of coal. Among other things it is proposed that railroads which use that power, as most local and short lines do, shall limit their schedules and dispense with extra cars as far as feasible. It is also proposed that they use in cars less heat and light derived from electricity, which is generated by consuming coal. This is likely to be acceptable to operating companies as it will reduce their expense, but it rather comes in conflict with some demands, not only of those using the facilities but of local authorities.

Within that same period of memory not so very long, there was no electric light at all. Now it is squandered on a huge scale in cities, not in a comfortable degree of lighting merely, but in extravagant illumination of many kinds, kept up the greater part of long winter nights.

BOARD TO HANDLE EXPORT STEEL TRAFFIC IN U.S.

THE entire export traffic of the Eastern railroads in the United States in the unmanufactured forms of iron and steel, except those articles designed for use by the American Government, has been placed in the hands of a newly appointed committee of seven railroad presidents, representing Atlantic ports from Boston, Massachusetts, to Norfolk, Va.

These unmanufactured forms include billets, bars, plates, scrap and pig iron.

The committee's offices will adjoin those of the representatives of the Executive Government in New York, who

are in charge of purchase and transportation of munitions from this country.

At an organization meeting in New York the committee planned to take over ultimately all the overseas traffic of the Eastern roads, if the Government approves. Such traffic will include other commodities besides iron and steel.

George D. Ogden, freight traffic manager of the Pennsylvania Railroad, was appointed chairman of the committee. The committee was organized after a conference attended by British, French and Russian representatives interested in overseas traffic, and representatives of the railroads' war board and the trunk line association, together with officials of fourteen railroads.

ELECTRICALLY-CONTROLLED MOTOR BOATS

THE British Admiralty recently made the following statement on the subject of electrically-controlled motor boats:

The electrically-controlled motor boats used on the Belgian coast are twin petrol engined vessels partially closed in, and travel at a high speed. They carry a drum with between 30 and 50 miles of insulated single core cable, through which the boat is controlled electrically. The forepart carries a considerable charge of high explosive, probably from 300 lb. to 500 lb. in weight. The method of operating is to start the engine, after which the crew leave the boat.

A seaplane, protected by a strong fighting patrol, then accompanies the vessel at a distance of three to five miles, and signals to the shore operator the helm to give the vessel. These signals need only be "starboard," "port," or "steady." The boat is zig-zagged while running; this may be either intentional or unintentional. On being steered into a ship the charge is exploded automatically.

The device is a very old one. A boat similarly controlled was used in H.M.S. Vernon—the torpedo experimental ship—as far back as 1885. The only new features in the German boats are petrol engines and W.T. signals, neither of which existed then.

On November 3 the Admiralty announced that on the same day an attack by an electrically-controlled high speed boat was defeated and the boat destroyed. It was then pointed out that electrically-controlled craft, whether surface boats or torpedoes, were no novelty, and that in trials made in Stokes Bay in 1892 with an electrically-controlled torpedo the length of wire cable used was about 4,500 yards.

"HUSH" SHIPS DESCRIBED

A. ROUSSEAU, the naval critic of the "Temps," who returned recently to Paris from visiting the Grand Fleet, has been permitted by the British Admiralty (says a "Times" Paris telegram) to give French readers the first description of the famous "hush" boats, about which the authorities have succeeded in maintaining hitherto a profound secrecy.

"We were passing in front of ships of unusual aspect, specially constructed craft for war purposes, when certain of these vessels caught our attention, especially by their outline and dimensions. They were very long, with immense decks fore and aft. They appeared to lie low on the water. In the middle of the vessel rises a very squat central castle, at the extremities of which are heavy artillery turrets for two guns of biggest calibre.

"The secondary artillery, the calibre of which is the same on all vessels of the same type, is at the limit of the average of small artillery. The stem of these craft is tapered more like the stem of a yacht than that of a battleship, and has certainly been determined in order to realize very high speed, and as a matter of fact these vessels are very swift, much faster than the fleet test of pre-war cruisers.

"These craft—we may call them battle cruisers—are of two types, or rather dimensions, for their elements of power are, we believe, the same except as regards protection. These vessels have been created since the war. Inspired by the lessons of the war, they were begun in 1915, and have been in service twelve months, an admirable result of the organization of labor in British dockyards.

"Other vessels of the kind are under construction, their dimensions being yet more considerable. We were received on two of these vessels, and visited the fighting quarters, blockhouse, look-out station for submarines, a turret with its enormous guns, which fire two shells a minute, weigh 96 tons, and throw a shell weighing 1,947 pounds.

"Everything is organized to have fire control in one and the same hand and the laying by one and the same eye. The system invented by Sir Percy Scott a few years ago has made progress; heavy artillery and secondary artillery are no longer autonomous. Everything acts under one and the same direction. It is a truly remarkable system, and one which beyond all doubt has produced highly satisfactory results. Its installations on the new ships show that it has stood the test.

"These ships are capable of surprise action against which the enemy cannot guard himself, and their speed is a guarantee against a torpedo; but nevertheless they are fitted with devices to neutralize the explosion as far as possible. They are proof of the confidence of the British Navy in the powerful surface vessel, capable of heavy hitting, the only one which is able to assure mastery of the seas."

"THIS is a queer little hole of a country of yours, Pat," said one of the Fly boys to our friend the other day.

"Begorra, an' as quare as it is," replied Pat, "there's wan thing ye can do in it that ye can't do in yer own country."

"And what is that?" asked the draft evader.

"Hide!" replied Pat.

PROGRESS IN NEW EQUIPMENT

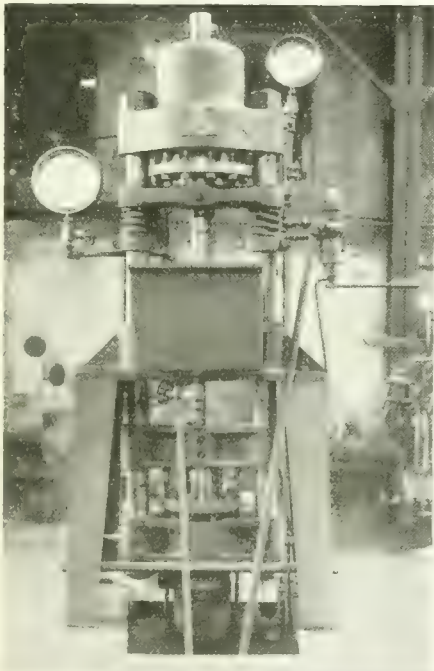
There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

HYDRAULIC TEST PRESS FOR 75 MM. SHELLS

AMONG the more or less novel features characterizing the manufacture of 75 mm. shell now being produced for the United States Government is the internal hydraulic test, and with a view to the rapid and efficient performance thereof a hydraulic press has been specially designed and is now being built by the Metalwood Mfg. Co., Detroit.

The purpose of the press is to provide suitable and convenient apparatus which will enable the shell to be filled, sealed, brought up to pressure and held there for the specified 15 seconds' duration of test. Observing this requirement, the press has a capacity of over two shells per minute, allowing an average of 1,200 to 1,500 shells per 10-hour period; the actual output varies somewhat with the ability of the operators to handle the work to and from the press.

The machine is so arranged that it combines both direct and intensified systems of operation based on a constant pressure of 1,500 lbs. per sq. in. in the accumulator reserve line. This is accomplished by having a suitably proportioned intensifying cylinder having a resistance head against which the nose of the shell is held. The intensifying cylinder is carried in a cross head, supported by two side frames, while the small ram



HYDRAULIC TESTING MACHINE FOR APPLYING INTERNAL PRESSURE TO 75 MM. U.S. SHELL.

which generates the intensified pressure is connected to the crosshead of the lower cylinder which extends below the floor level. The lower end of the lower

cylinder is provided with a pull-back ram for withdrawing the intensifying plunger.

The cross-head referred to supports entire assembly of cylinders, which are two turned steel columns or tension members. The cylinder at the upper end of the columns clamps the shell against the resistance head in the bottom of the tank and is returned by pull-back springs.

In operating the press, the shell is immersed open end up to insure escape of all the air. It is then inverted and placed on the resistance head and clamped down tightly by the upper cylinder. The lower cylinder, which, as well as the upper one, operates under 1,500 lbs. pressure, forces the intensifying ram into the high pressure cylinder, the resulting pressure being communicated to the interior of the shell through the resistance head which seals the nose and maintains the internal pressure at the required amount, viz., 18,500 lbs. per sq. in. for 15 seconds. The remaining part of the test consists of a reversal of the foregoing.

Cast alloy steel is used for the high pressure cylinder, and a steel casting for the pull-back cylinder; the crosshead carrying the intensifying ram is a semi-steel casting, with bronze bearings.

The press is piped up complete for connecting to regulating valves, and the operation of intensifier and sealing clamp cylinder are controlled simultaneously by a single quick operating valve. High and low pressure gauges are included in the equipment.



EXCESS ELECTRIC POWER CONVERTED INTO STEAM

A TYPE of electric steam generator which for some years past has been in use in large numbers in many Italian works is illustrated in Figs. 1 to 5. The apparatus according to "Engineering," to which we are indebted for the illustration, is an invention of Engineer Revel,

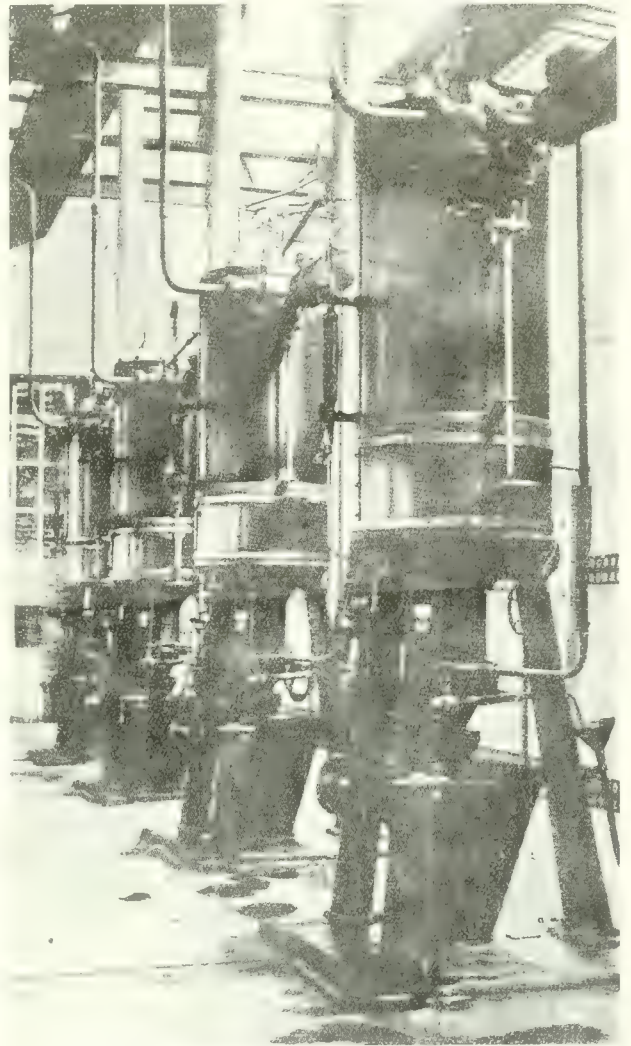


FIG. 5. EXTERIOR VIEW OF BATTERY OF ELECTRIC STEAM GENERATORS

Colonel in the Italian Army, the manufacturing rights being held by Messrs. Luigi Boselli & Co., Milan.

The principle on which it works is the evaporation of water into steam by means of the heat dissipated in overcoming the resistance of the water to the passage of an electric current. As the flow of current depends on, and varies directly as, the volume of contained water acting as a conducting medium, the control is entirely automatic and demands no attention. Thus lack of feed water would only result in a decrease or stoppage in the production of steam until the supply of water to the boiler was resumed. An efficiency as high as 98 per cent. is characteristic of this type of boiler since the whole of the heat generated by the electrical energy is absorbed by the water, the only loss being that caused by radiation from the body of the apparatus.

Alternating current of from 200 volts

to 3,600 volts may be applied, the only difference between the first Thomson type and the low pressure type being a small variation in the design of the electrodes and the pressure of the steam used. Fig. 3 illustrates the full set of installations of 500 At. High, taking three phases cur-

rent, the valve *l* is opened, and a small quantity of soda solution is introduced from the small receiver to give a suitable conductivity to the water. When the water has reached the height of the lower edge of the electrodes the current flows through the water and commences

the valve *g* is opened by acting upon the hand lever *h* until the ammeter has returned to zero.

When the feed water leaves a calcareous deposit it is advisable, every five or six hours, to free the boiler of the sediment deposited at the bottom of the truncated cone. This is obtained, without interrupting the working of the machine, by increasing the water feed and by acting at the same time on the handle *h*, the excess water washing away the sediment; this operation, by a suitable action upon the valves *i* and *g*, and by following closely the ammeter and maintaining the current intensity constant, is carried out without changing the water-level and without impairing the working of the apparatus.

The Revel generators are constructed to work at any pressure up to 14 atmospheres, and can be connected up at any time with the steam pipes from the ordinary steam boilers; owing to the rapidity of their action they take up any excess of hydro-electric energy which may be available even for a short time. They may, in fact, be considered as serviceable appliances for turning to account any superfluous hydro-electric power available, and as such they were utilized in numerous installations in Italy before the war, when the price of coal did not exceed 32s. per ton. At the present time they are also found to be practical and economical, even in cases where hydro-electrical power has to be paid for at the rates now ruling.



GUN-METAL FINISH

GUN-METAL finish consists in giving the surface of the material a thin coating of a chemical solution applied with a brush or sponge. After coating, the work is placed in a steam bath and maintained at a temperature of 100 degrees F. After a slight rust appears covering the entire surface, the work is taken out, placed in boiling water for about 20 minutes and then dried. When this is done a coating of black oxide will appear covering the surface. The operation must be repeated several times, scratch brushing the surface between each coating.

Several chemical solutions may be used to produce this gun-metal finish, of which the following represent good practice, according to Brass World:

Eight parts alcohol, 1 part ferric chloride, 8 parts water; or 3 parts hydrochloric acid, 4 parts nitric acid, 2 parts copper sulphate and 80 parts perchloride of iron; or 1 part each of chloride of copper and chloride of bismuth, 2 parts chloride of mercurv, 6 parts hydrochloric acid and 50 parts of water.

With all of the above methods a very thin coating is formed on the surface of the steel. A process adopted by the French Government consists in applying chemical solutions which act on the metal, causing a thin laver to change its color, the shade depending upon the time of treating and the temperature. The exact formula for the chemical solutions used is not known.

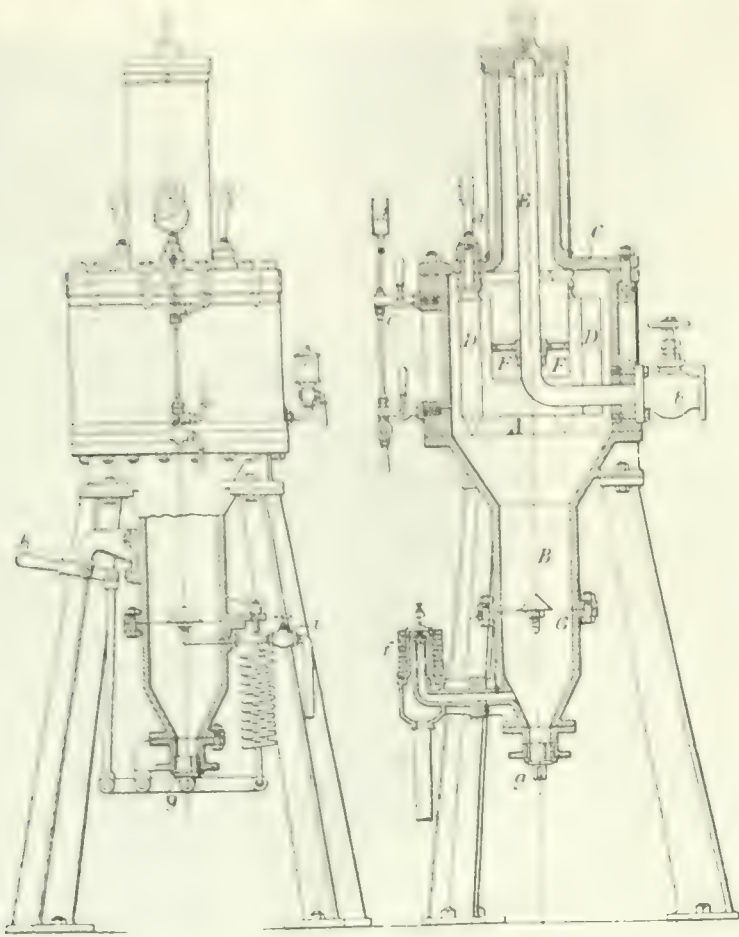


FIG. 1.

FIG. 2.

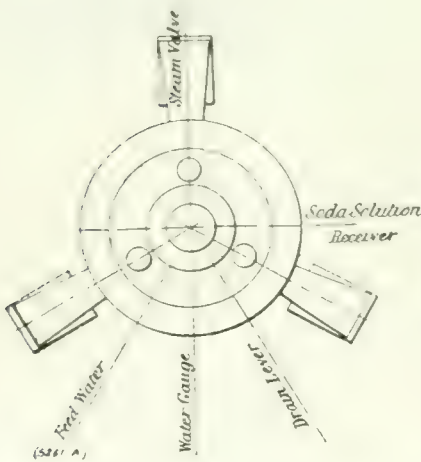


FIG. 3.

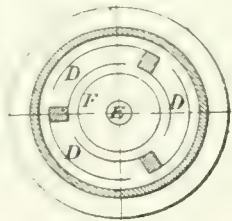


FIG. 4.

rent at 6,000 volts, each apparatus being capable of generating 405 pounds to 450 pounds of steam per hour.

Figs. 1 to 4 illustrate a similar apparatus designed for 500 volts, the arrangement of the component parts being clear from the explanatory notes accompanying the illustration. For starting the generator the circuit-breaker is clos-

ed, the valve *l* is opened, and a small quantity of soda solution is introduced from the small receiver to give a suitable conductivity to the water. When the water has reached the height of the lower edge of the electrodes the current flows through the water and commences to raise steam, the steam production increasing as the water-level rises, until it reaches the working pressure required. At this moment the regulator *f* enters into action, and the water-level and hence the steam production remain constant. In order to stop the apparatus the feed-water valve *i* is closed, the steam valve *b* is closed slowly, and the

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IS ENGINEERING ABILITY APPRECIATED AT ITS TRUE WORTH?

THE extent to which engineers of all grades have been called upon to participate in the war,—not, it is true, in the fighting line pure and simple, but in the production, supply and maintenance of all the gear necessary for the conduct of operations on present-day lines,—has done more to inform the world of its indebtedness to the engineering industry than would have been accomplished in fifty years of agitation along constitutional lines. Acknowledgement, however, must be made to Germany for having recognized the potential and active value of engineers, and for having encouraged to the point of insistence their education and training as part of the nation's business. That their value as wealth producers in peace and destroyers in war was also most fully recognized by that nation has been borne in upon the Allies only too well.

In considering the engineer as a factor in civilization, it is convenient to classify his efforts under three sections—first, the pure scientist who reasons and deduces; second, the applied scientist who searches, develops and demonstrates; third, the commercial scientist whose ability influences every line of industrial effort from making tanks to building "tanks." The third section embraces the great bulk of the profession, yet, except in the case of well-known men who have achieved fame as manufacturers and also of notable subordinates employed by them, its members are not brought prominently into the fierce glare of general publicity, while, in discharging their duties in any large aggregation of employees, their natural reservedness and acceptance of conditions as they are militates against a true recognition of the real value of their services.

The buoyant, assertive salesman, glibly recounting totals from his sales sheets, impresses all with his indispensability to his employer. Without him there would be no sales, with no sales no money, with no money no job. Therefore, all hail the salesman. How often though does the real and primary state of affairs dawn on those in authority? That the truth does occasionally come home is known to a few close observers, but that the man, who produces the wherewithal for the salesman to juggle with, gets, on the average, anything like the same thanks, tangible or otherwise, is a very rare occurrence.

Take a case in point,—during the depression before the

war, a factory decided to add a certain apparatus to their product, and like many others before them copied, as a start, a competitor's design. Certain defects coupled with the prospect of litigation compelled them to drop the design, but the superintendent and draftsman were "ordered" to get out something to circumvent the competitive article. In other words they had to invent to specification. Success attended their efforts, but while done with the company's time and the company's money, the resulting design owed its success to a principle far removed from anything else of the kind and which would not have been thought of or successfully developed had not the superintendent and draftsman drawn upon their years of experience in other fields.

It is from this point onward that the inadequate recognition of the engineer becomes apparent. Produced in dull times, the device met with a favorable reception, entirely merited, and in actual fact had a great influence on the company's ability to weather the first few months of the war, but circumstances at the time were sufficiently unpropitious to induce the inventors to accept the promise of a very moderate sum in acknowledgment.

Soon after, trade improved; every other munition shop and other kinds of shops as well found the device useful, and the salesman began to smile for the first time in months. At the end of the year a good fat commission and a raise were his, also three weeks' vacation till orders were caught up on. The bargain with the other parties having been made when times were dull was out of all proportion to the respective merits of producers and salesman. Not only so, but a continual harassing for production to fill the orders turned in by the aforesaid salesman was the recoil effect suffered by the two engineers, while his resulting personal profits and prestige dwarfed their's completely.

The unfairness is obvious, yet the facts are substantially as stated. When times are good and everybody buys, the salesman is king, while the producing engineer is chased for deliveries. When times are dull and the salesman keeps out of sight, the designer has to both worry over goods which will induce sales and also reduce his cost of production. Yet of the two, which is the more indispensable?

The extent to which civilization has rested on the industrial accomplishments of man, the degree in which science and industry have contributed to the physical welfare and comfort of humanity has engendered, so gradually as to be almost unnoticed, a complete dependency on the engineer. The deprivation of numerous essential commodities, the excess of demand over supply, the search for equipment and materials for new processes, all these and other contributory conditions have to a considerable extent reversed the roles of salesman and engineer, and the man who can design and produce is, for the first time in years, valued at something approaching his true worth.

The chief feature in future business will be the ability to deliver the goods. For years to come the salesman must play the part of a man who goes out to look for known conditions, not to produce unsound demand and inflated sales. His success will be directly dependent on the confidence with which he can rely on the producer at home—if he knows that varying conditions will be met with cheerful adjustment, that unfair opportunities for excessive profits will not be snatched up viciously to the undoubted detriment of future business, if he will realize that without the goods he is helpless, then, perhaps, he may reconcile himself to being placed on an equal footing, both as to reward and prestige, with the man who gives him the wherewithal to barter.

ELECTRIC WELD COIL CHAIN B.B.

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

Prices per 100 lbs.

FILES AND RASPS.

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	37 1/2
Disston	50
Whitman & Barnes	50

COAL AND COKE.

Solvay Foundry Coke	
Connellsville Foundry Coke	
Steam Lump Coal	
Best Slack	

Net ton f.o.b. Toronto.

BOILER TUBES.

Size.	Seamless	Lap-welded
1 in.	\$36 00	\$
1 1/4 in.	40 00	
1 1/2 in.	43 00	36 00
1 3/4 in.	43 00	36 00
2 in.	50 00	36 00
2 1/4 in.	53 00	38 00
2 1/2 in.	55 00	42 00
3 in.	64 00	50 00
3 1/4 in.		58 00
3 1/2 in.	77 00	60 00
4 in.	90 00	75 00

Prices per 100 feet, Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	25
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26 1/2

Black oil, per gal.	15
Cylinder oil, Capital	45 1/2
Cylinder oil, Acme	36 1/2
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37 1/2
Imperial quenching oil	39 1/2
Petroleum fuel oil	12 1/2

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	30-35
Standard	40%
Cut leather lacing, No. 1	1 95
Leather in sides	1 75

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

WASTE.

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

Colored.

Lion	14 1/2
Standard	13
No. 1	13
Popular	11 3/4
Keen	10 1/2

WOOL PACKING.

Arrow	25
Axle	20
Anvil	15
Anchor	11

WASHED WIPERS.

Select White	12
Mixed colored	10
Dark colored	09

This list subject to trade discount for quantity.

RUBBER BELTING.

Standard	40%
Best grades	20%

ANODES.

Nickel	.50 to .54
Cobalt	1.75 to 2.00
Copper	.44 to .46
Tin	.49 to .56
Zinc	.23 to .25

Prices Per Lb.

COPPER PRODUCTS.

Montreal Toronto	
Bars, 1/2 to 2 in.	55 00 53 00
Copper wire, list plus 10.	
Plain sheets, 14 oz., 14 x28 in.	55 00 53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00 54 25
Copper sheet, planished, 14x60 base	64 00 60 00
Braziers', in sheets, 6 x 4 base	55 00 52 00

BRASS.

Brass rods, base 1/2 in. to 1 in. rod	0 55
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless	0 57
Copper tubing, seamless	0 58

PLATING SUPPLIES.

Polishing wheels, felt	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	06
Emery glue	15 to 20
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09

Rouge, silver	35 to 50
Rouge, powder	30 to 35

Prices Per Lb.

LEAD SHEETS.

Montreal Toronto	
Sheets, 3 lbs. sq. ft.	\$18 00 \$18 00
Sheets, 3 1/2 lbs. sq. ft.	18 00 18 00
Sheets, 4 to 6 lbs. sq. ft.	17 50 17 50
Cut sheets, 1/2c per lb. extra.	
Cut sheets to size, 1c per lb. extra.	

PLATING CHEMICALS.

Acid, boracic	.15
Acid, hydrochloric	.05
Acid, hydrofluoric	.14 1/2
Acid, nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.40
Ammonium sulphate	.07
Arsenic, white	.12
Copper, carbonate, anhy.	.35
Copper, sulphate	.17
Cobalt, sulphate	.70
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.12
Nickel carbonate	.35
Nickel sulphate	.15
Potassium carbonate	.75
Potassium sulphide (substitute)	.20
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.55
Sodium bisulphite	.10
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.41
Sodium hydrate	.04
Sodium hyposulphite, per 100 lbs.	5.00
Sodium phosphate	.14
Tin chloride	.60
Zinc chloride	.60
Zinc sulphate	.09

Prices per lb. unless otherwise stated.

Market Condition and Tendency

Iron and Steel Shortage Continues—Pig-Iron Unchanged, Coke Scarcity Reduces Output—Lead and Spelter Prices to be Fixed.

AS was to be expected, the coming general election is having an unsettling effect on business. In spite of this, however, there is considerable activity in most industries although the shortage of raw materials is tending to restrict production. This is particularly true of manufacturers using iron and steel. The shortage of iron and steel is becoming serious, more especially in materials imported from the United States, where the extraordinary industrial activity is causing an enormous demand for steel. The large tonnage required for war purposes is placing the private consumer in a difficult position in regard to getting supplies for manufacturing purposes. This situation is reflected in Canada and is becoming more acute. There has been no change in prices of steel products this week and the market continues firm. Business in the steel trade is quiet and will likely remain so for the balance of the year. The mills on the other hand are very busy and continue to operate at capacity. The situation in the pig-iron market is unchanged, there still being a scarcity of basic iron for steel-making. The shortage of coke continues to cause considerable anxiety. In the States it has caused a serious reduction in the output of pig-iron, and in turn, of steel. Prices of non-ferrous metals are all unchanged. It is expected that prices of lead and spelter will be fixed shortly at Washington, which will steady the market. Tin continues in short supply although an effort is being made to relieve the situation.

MONTREAL, Que., Dec. 8, 1917.—Twice in as many weeks has Canada been brought face to face with two of the most important factors in the prosecution of a war; that of the raising of stupendous sums of money and the devastating character of the creations arising therefrom. The death and destitution which has been brought to our very door through the Halifax tragedy may give us a fuller realization of what the actual conditions must be in some of those European countries that have been overrun by the contesting armies, and thereby encourage us to "carry on" with renewed energy, so that our every effort may bring us nearer to an enduring and lasting peace. The activities that are likely to follow the closing of the loan are already in evidence and in all possibility business will receive added impetus before the opening of the New Year.

Pig Iron

The supply of pig iron for existing requirements is still a question of vital importance and conditions show little signs of improvement. Recent difficulties in connection with furnace operation and the inability to obtain sufficient raw materials for maximum production has intensified the acute situation that has been more or less marked for a considerable period. The action of the Government in endeavoring

to relieve the transportation situation so very pronounced in certain districts may soon result in a better regulation of the distribution of materials and supplies; how this will be effected is as yet problematical but with the co-operation of the railroad companies the result undoubtedly be improved facilities in transportation.

Steel

The steel situation may be said to be nearing another milestone in the uncertain developments that have marked the movement of prices during the past six months. The time is approaching when the expected revision of prices as previously arranged will receive the consideration of the American Government, and with this end in view the War Industries Board and the heads of the copper and steel interests are expected to hold separate meetings within the next two weeks, at which conditions will be thoroughly investigated, and any readjustment for early future regulation will be determined on. While it has been stated that the beginning of the year would probably see some readjustment in various lines of steel commodities, the general feeling appears to be that, as the prices now ruling have only been in effect for a comparatively short time, no changes will be made in the immediate future. Some effort may be made to so regulate the price of steel that relief may be given to the domestic situation, but with the war demands ever on the increase, this development can only be a possibility, in view of the fact that every facility must be provided to maintain the production of essentials at the highest possible maximum. In this connection it is interesting to note that the American Government has taken steps to study the industrial situation with a view to curtailing such activities as are not directly associated with the prosecution of the war. The local situation has developed no features of consequence and dealers report unchanged conditions with prices holding firm at last week's quotations.

Metals

The metal trades are awaiting the outcome of the conference that will take place this week between the leading copper interests and the Government, at which meeting the question of revising the price of copper will be taken up. Other metals are expected soon to be placed under Government regulation, and this has the tendency to keep the market in a nervous condition. Tin is the all-absorbing question for the immediate present as the market is completely demoralized and prices are soaring. Spelter is unsettled but relatively firm. Lead is quiet with an easier tone. Antimony is in a stronger position and aluminum is firm.

Copper.—Without known exception, all trading in copper from the producer to the dealer or large consumer is now carried on under the regulations imposed by the Government, and as far as can be learned no transactions of any importance are carried on under the

competitive basis. Small consumers are now in a better position to obtain desired supplies owing to the concession given to the dealers to dispose of small quantities of metal at a 5 per cent. commission over the fixed price of 23½ cents per lb. During the coming week a meeting will be held between the War Industries Board and the leading copper interests to consider the question of revising the price now governing the sale of copper. Maximum production is the essential factor at the present time and if a higher price would increase the available supply it is not unlikely that the Government may concede a better figure than that now ruling. War requirements, however, will receive the priority consideration even at the cost of lowering the prevailing price or maintaining it at the present level. Serious deliberation should nevertheless be given to the requirements of those users who, though not directly connected with the manufacture of war necessities, are in dire straits for lack of metal. A better figure on the open market would no doubt induce the

CANADIAN GOVERNMENT PURCHASING COM- MISSION

The following gentlemen constitute the War Purchasing Commission appointed by the Canadian Government: Hormidas Laporte, Montreal, chairman; George F. Galt, Winnipeg; William P. Gundy, Toronto. Thomas Hillier is secretary, and the Commission headquarters are at Ottawa.

smelters to produce more tonnage without materially affecting the demands for war purposes. The local market is devoid of features, and dealers are quoting last week's price of lake and electro, and 32 cents for castings.

Tin.—The market is in a position of extreme nervousness over the increasing shortage of tin supplies, and the inability to obtain reliable information regarding tin shipments from abroad. The situation in the States is becoming very acute and measures will soon have to be taken to avoid a condition fast approaching a tin famine. What little tin is now available is practically controlled by the Government and this is being conserved to the utmost. The London market has continued to rise to a record high position but has shown a slightly easier tone during the past few days. An advance of 4 cents per lb. has been noted on the New York quotations, the nominal price now asked being 85 cents per lb. The demand on the local dealers has shown an increase and prices have been advanced to 78 cents, this being 6 cents higher than last week.

Spelter.—The situation is still marked by the unrest that has been characteristic for many weeks, owing to the delay on the part of the Government in

fixing prices to control the sale and distribution of the metal. While this uncertainty is so pronounced, the situation will continue to be more or less demoralized, as producers are not anxious to operate their plants at capacity under prevailing conditions, or until the Government announce the volume of their future requirements. The New York market is quiet and weak; dealers here report a steady market with prices firm at 10½ cents per lb.

Lead.—The market is quiet pending the action of the American Government towards the regulation of prices, a feature that is expected to develop in the very near future. It is anticipated that a one-price-for-all will be the basis of the regulations, but some concession may be given to dealers for their part in the handling of the metal. The New York market is being well maintained but price quotations show an easier tone, particularly on the part of the independents. Local lead is selling at about 9½ cents per lb. on a quiet but steady market.

Antimony.—The market has taken on a firmer tone and prices are stronger. Dealers appear to be acquiring metal but apparently the consumer demand has shown little increase. Generally the situation is better with an undertone of early activity. Prices in New York have advanced 1½ cents during the week, the current price being 15½ cents per lb. The local market is a little more active and dealers have advanced to 18 cents, this quotation being one cent higher than last week.

Aluminum.—The situation is quiet but with a better undertone; prices are unchanged and firm at 60 cents per lb.

Machine Tools and Supplies

The expected revival of munitions activity has renewed the interest in the machine tool industry, the importance of which has been reflected in the gradual increase in business that has been noted in this direction, much of recent demand being for equipment suitable for shell production. Plants that have received contracts for American shells are rapidly being equipped and manufacturing operations will soon be in full swing. Inquiry for general tool equipment has not been so active during the past week but the volume is still of an encouraging character. A feature of the present situation is the increasing difficulty experienced in obtaining machinery from the States, this being due to the abnormal demand for equipment in Government plants there, and those plants that are exclusively operating on Government work. Even work on order for Canadian buyers may be commandeered for use in the States on the priority claim of the American Government. These conditions are expected to give considerable impetus to the production of Canadian-made tools when further orders have been placed for additional shells. A more stabilized condition exists in the market for machine tool supplies, this no doubt resulting from the more uniform condition prevail-

ing in the prices of the raw and semi-finished materials. Quotations on supplies are, however, very firm with the demands slightly on the increase.

Scrap

The failure of the scrap dealers to agree regarding the fixing of a reasonable price to govern the sale of various scrap materials is delaying the action of the American Government in setting prices on old materials. It was thought that the scrap situation would automatically adjust itself to the conditions that would arise from the fixing of steel and metal prices, but the market in scrap has been in a very unsettled state for the past two months, everyone uncertain as to what the next move was to be. Tin scrap of all kinds is very strong and higher prices are asked but the general market is unchanged with quotations uncertain but nominally the same as last week.

Toronto

TORONTO, Ont., Dec. 11.—The coming general election is affecting business in that it is tending to create unsettled condition inevitable under the circumstances. Business is as active as the shortage of raw materials will permit, and in this respect there are no indications of improvement.

The unfortunate fire at the Polson Iron Works has not stopped operations in any of the departments, except the pattern shop. The most serious loss was a large number of patterns. About fifty plates on a freighter under construction were damaged and will have to be replaced, while the furniture and rigging for this vessel were also destroyed. A new pattern shop is being built on another site.

Steel

There have been no developments of importance in the iron and steel market during the week. There is a general complaint concerning the shortage which appears to be affecting everybody in the trade, merchant and consumer alike. What will eventually happen is difficult to say, but the situation is getting more acute as time passes. It is becoming more apparent that little relief may be looked for in regard to supplies of iron and steel from the United States, for even consumers in that country are experiencing considerable difficulty in obtaining steel for purely domestic purposes. This being so, consumers in Canada can hardly expect preferential treatment, except when the material is required for war purposes. The outlook for the manufacturing consumer is not at all encouraging, the demand for steel for war purposes getting heavier all the time, with the result that manufacturing operations will become even more restricted than at present.

The Canadian steel companies continue to enjoy unusual prosperity and have plenty of business on hand. Considerable of this business is for munitions and other war purposes; as a result, consumers not engaged upon war work are finding it

difficult to get material as quickly as they would like. It is more than likely that the mills will get further behind on deliveries on account of the new munition contracts. There have been no price changes announced during the week and the market continues firm. Prices of imported material have not undergone any change. Although the fixed prices on semi-finished and finished steels are being quoted on all new enquiries in the United States market, buyers find it almost impossible to get any material for prompt delivery. Canadian importers are, therefore, unable to meet the demand and business is suffering in consequence. The fixed price schedule comes up for revision in January, but there are no indications that any change will be made from the prevailing level. The continued decline in new business in the States is shown in the further decrease in the U.S. Steel Corporation unfilled tonnage. The unfilled orders of this Corporation on November 30 last were 8,897,106 tons, representing a decrease of 112,569 tons as compared with the orders on October 31.

Pig Iron

The pig iron market is quiet and prices continue unchanged. Foundry irons are in fair supply, but there is a shortage of basic pig iron and, as a result, steel mills have been importing basic iron from the States. There is practically no relief in the coke situation which is causing much uneasiness among users of imported coke. In the States, on account of the shortage of coke, it is feared that operations at the furnaces will be further restricted, thus seriously affecting the steel mills.

Scrap

The market continues dull with no business to speak of. Conditions in the scrap market are much the same as they have been for some weeks. The scarcity of cast iron and steel scrap is keeping prices firm for these materials, but copper, lead and zinc, etc., are weak, although prices are unchanged.

Machine Tools

The situation in the machine tool market is unchanged. Business continues good with prospects of increased activity in the near future. It is becoming more difficult than ever to obtain machine tools from the States, owing to the heavy demand there. Government business predominates to the exclusion of everything else, with the result that private buyers have to wait.

Supplies

Business in machine shop supplies continues good at firm prices. There is an upward tendency in some lines on account of the high cost of raw materials, but as a rule the market is steadier than it was a few months ago. Maple Leaf cotton duck belting has advanced, the new discount being 25 and 5 per cent. off list, the former discount being 25 and 10 per cent. off. The principal grades of crude oil have advanced in the States, ranging from 10c to 25c per barrel, according to grade. Pennsylvania crude advanced 25c to \$3.75 per barrel. Local prices of gasoline and oils have not changed.

Metals

The situation in the metal markets is the same as last week and prices are unchanged. There is no apparent relief in the tin situation, there being no spot tin available and considerable uncertainty in regard to future supplies. The copper market is quiet and situation unchanged. The pending orders for shrapnel have not as yet produced any activity in lead and antimony, although a heavier demand for these metals is anticipated.

Copper.—The copper situation is improving, although the market continues quiet and prices unchanged. Production of copper is gradually increasing and prospects are that there will be soon sufficient metal to meet the general commercial demand. Lake and electrolytic are quoted at 32c and castings at 31c per pound.

Tin.—The scarcity of tin continues to be acute, there being practically no spot metal obtainable. The industry is anxiously watching the result of negotiations between Washington and London, in the hope that existing regulations may be modified and a more liberal supply of tin be allowed to come forward. Tin is unchanged and nominal at 80c per pound.

Spelter.—The market is quiet and there is very little demand. It is expected that the U.S. Government prices for spelter will be announced in a few days. Local price 10½c per pound.

Lead.—Government prices are also expected for lead in a few days which should have the effect of stabilizing the market. The market is quiet and is likely to remain in this conditions for balance of the year. Lead is quoted locally at 8½c per pound.

Antimony.—The situation in antimony is unchanged and the market is quiet, although prices are firm at 10c per pound.

Aluminum.—The market is steady and quotations unchanged at 62c per pound.

Pittsburgh

PITTSBURGH, Pa., Dec. 8.—Official announcement was made during the week by the Council of National Defense that representatives of the steel and copper industries had been invited to meet the War Industries Board on Monday, Dec. 10 and Friday, Dec. 14, in view of the fact that the price agreements were upon the understanding that the prices were subject to "possible revision" at the expiration of four months in the case of copper and "prior to Jan. 1" in the case of iron and steel. Early in the price fixing operation the iron and steel producers had an idea that the Washington authorities would be disposed to contend for further reduction Jan. 1 or soon thereafter, but as costs have been mounting and manufacturing difficulties increasing they have lately doubted whether any serious effort would be made to secure reductions. It is pointed out that even if there is no definite desire that a change be made in prices it is necessary that some action be taken prior to Jan. 1, otherwise the trade would be left in doubt. The balance of

probability is that next Monday's conference will result in no price change, the agreement being continued either to a specified date or indefinitely. Another is some possibility of the Government and steel firms fixing the percentage in law, now that Congress is ready to session. The Washington authorities might prefer to have the agreement confirmed without any definite date.

Greater Scarcity

The iron, iron and steel, and the general use of greater steel products are still scarcer. It is practically impossible to buy any Bessemer or basic iron in this district, and little if any foundry iron except for shipment after April 1. In billets and sheet bars there are only occasional odd lots available, chiefly steel, off in analysis, which must seek a consumer who can use the particular material. There are almost unlimited offerings of discard steel, and even when the mill will roll to sizes desired, even down to 14-gauge billets, there is only occasional demand. Such discard steel is offered at the set prices for soft steel by at a sharp loss. In bars, shapes and plate there are scarcely any offerings. Wire products are in moderately fair supply, as are sheets, while tubular goods are extremely scarce.

Practically all the trade reports in the past three weeks have been of the tenor that there has been such a great restriction in the production of both pig iron and steel, due chiefly to shortage of coke, that a fresh scarcity has resulted. The conclusion was based largely upon theory and partial information. The supply of Connellsville coke has been extremely scant, and furnaces depending upon the region have had to bank in many cases for longer or shorter periods. The amount of steel consumed for ordinary commercial purposes has continued to decrease. Nevertheless steel has grown scarcer if anything, and certainly has not grown more plentiful. The conclusion in most quarters has been that the supply has been feeling the effects of restricted production. This is not correct. What has been lost in production in some districts has been made up in others. Production of pig iron in November was at a slightly greater rate, on an average, than production in October. The Pittsburgh district gained a trifle, the Youngstown district and some others losing, while Chicago made quite a gain. The steel ingot statistics for November are not yet available, but they will in all probability show an increase, for there has been decreased consumption of pig iron by iron foundries and pig iron on the ground has been well cleaned up.

The unknown element, which apparently has confused the judgment of so many, is the tonnage of war steel being produced. There are various reports as to Government orders placed, mentioning specific tonnages, but it should strike one as curious that those who make these interesting reports never stop to add up the tonnages, nor do they state the period of time in which delivery is to be

made. The fact is that nobody knows how much steel per month the war is using, or is about to take. From the fact that the rate of production is well maintained, and the further fact that the commercial consumption of steel is constantly decreasing, it is evident that the war tonnage has greatly increased. While there seemed to be reason two or three months ago to conclude that the amount of steel required by the Government and its Allies for war purposes, direct and indirect, would not be less than 30 per cent. or more than 40 per cent. of the total production, on the basis of a rate of production of finished rolled steel of 33,000,000 gross tons a year, it is well to conclude now that the tonnage is going to be greater, if it is not already

fore Congress by the report made last Wednesday by the Interstate Commerce Commission, looking to the Government taking over the operation of all the roads, or the roads being allowed freely to form a general pool. The prospect distinctly is that there will be continually improved freight movement, except for restrictions imposed by winter weather (there has been a heavy snowfall in the past few hours), with consequent better movement of coal and coke and heavier production of pig iron and steel, also that there will be some large orders placed for locomotives and cars, under Government priority orders throughout, as to the furnishing of the materials and despatch of the work in the car and locomotive shops. In other words, prospects are that there will be more steel produced and still more war steel required.

Markets Inactive

The markets have been quite inactive, there being scarcely any material to offer. Output is fully taken up with Government orders and requirements in commercial steel against old contracts, even though specifications against contracts are as a rule at a relatively light rate. The set prices are being well observed in the case of buying by the Government, its Allies, and the domestic trade. They do not apply to export sales of ordinary commercial steel.



TO RETURN CARS TO CANADA

U. C. GILLON, Chairman of the Administration Board of the Canadian Railway Association for National Defence; Sir George Bury, vice-president Canadian Pacific Railway Co., and W. M. Neal, general secretary of the Association, were in New York, December 6, to have a conference with members of the American Railway Association in an endeavor to have the American railways send to Canada the Canadian cars that are now in the United States or an equivalent number of cars owned by railroads in the United States.

They pointed out at the meeting that there were 20,000 more Canadian-owned cars in the United States than there are American-owned cars in Canada, and that, although promises have been made that Canadian or American cars would be sent from time to time, yet in two months, notwithstanding several thousand American-owned cars have been sent to Canada, the Canadian roads had gained less than 990 cars.



ITALIAN MARKET FOR PIPE FITTINGS

A REPORT from the United States Consulate at Florence published in Commerce Reports for April 27, 1915, stated that the Italian market for pipe fittings was controlled by German and Swiss manufacturers and that fittings made by American manufacturers had been found unsatisfactory.

At the present time there is an urgent demand throughout Italy for fittings. Stocks of German and Swiss goods have been sold out, Great Britain requires

MARKET LETTER DEVELOPMENT

The attention of metal working plant executives is directed to the enlargement of the scope and usefulness of our Market Letter Department. In New York and Pittsburgh, expert correspondents have been engaged, and are already furnishing each week concise reports of production activities, price movements, etc., within the territory served by each of these important centres. During the next few weeks, further additions will be made to the number of our United States correspondents, embracing other industrial centres, and enlarging thereby the scope of the meantime service being rendered.

greater. A proportion of 35 per cent. would be one million tons a month.

Capacity

While production is maintained, it is well below capacity, because capacity is increased. The country may be making steel ingots at the rate of more than 44,000,000 tons a year, the rate shown for October, but the capacity is estimated at 50,000,000 tons, whereas the production of 41,400,000 tons in 1916 represented very nearly the entire capacity available in that year. In pig iron, too, the rate of 39,300,000 tons a year shown for the past few months is probably 2,500,000 tons short of what could be done if all conditions were favorable, particularly as to transportation.

Better Freight Movement

The General Operating Committee, conducting a pooling of the facilities of the railroads east of Chicago so as to produce maximum freight movement, issued certain orders, as noted in last report, aimed particularly at clearing the congestion in the Pittsburgh district. These orders have already borne a little fruit, conditions being visibly improved, though not much as yet. The whole matter has been put in broader form be-

its goods for its own use, and France seems to be unable to pick up the Italian trade. A good market is offered to American manufacturers if they will conform to local requirements. The principal requirement is that fittings must have right-hand threading of English standard. Even left-hand thread might be used if of English standard. The differences between English and American standard thread is shown in the following table:—

Size of pipe, in inches—	Threads per inch	
	English	American
$\frac{1}{8}$	28	27
$\frac{1}{4}$	19	18
3-5	19	18
$\frac{1}{2}$	14	14
$\frac{3}{4}$	14	14
1	11	11 $\frac{1}{2}$
1 $\frac{1}{4}$	11	11 $\frac{1}{2}$
1 $\frac{1}{2}$	11	11 $\frac{1}{2}$
1 $\frac{3}{4}$	11	11 $\frac{1}{2}$
2	11	11 $\frac{1}{2}$
2 $\frac{1}{2}$	11	8
3 to 6	11	8

These standards for pipe up to 2 $\frac{1}{2}$ inches look so much alike that without actual counting and measurement careless employees are apt to get them mixed, with consequent cutting of threads or jamming of fittings. It must be said, however, that this market is accustomed to and wants fittings with English standard threading. This is true of most of Europe. American manufacturers who hope to compete with European manufacturers must make up their minds to this fact.

The American practice of threading sleeves at each end does not obtain here. Sleeves in Italy carry a right-hand thread through their length. Furthermore, this market uses quantities of bends, particularly 90 deg. bends, which seem to be no longer made in the United States. Before the war, these could be obtained in any desired quantity from German and Swiss manufacturers. At the present time there is a tremendous demand for wrought iron flanges, which seem to be unobtainable.

With one or two exceptions, the materials used in and the finish of American fittings are said to be markedly inferior to those of Swiss and German manufacture. It is claimed that roughly finished moulds are used in castings and a poor quality of iron employed, with the result that the finished product has numerous pits inside and out. These cause rough threads and rust. Swiss and German fittings are of better material, stronger, and of lighter weight. Owing to the use of better moulds in casting, fittings have smooth, even surfaces. As to splitting, the consulate has been told that they seldom split, whereas this is of frequent occurrence with American fittings.

Other complaints of American fittings are that those for pressure use have flat bands instead of the round bead wanted in this country; and that reducers, instead of carrying the same thickness of metal throughout in proportion to the diameter of the several openings, carry the same outside diameter, which, according to Italian taste, makes a bulky, ugly piece of work. This taste requires a careful finish and proportion in all metal work. Whether or not American work is as strong or stronger is not the

question. The point is that work must be turned out to suit the market. Any American manufacturer willing to do this can get a hold on this market at the present time that will insure him a permanent outlet for his goods.

Fittings and pipes are not separately classified in Italian import statistics but are lumped with other manufactures of iron. Pipes of American manufacture are the best in this market and have commanded the trade for years. If care were taken with fittings, American fittings, helped by the reputation of American pipe, would soon have the same enviable position here.



THE INVENTION OF THE STEAM HAMMER

NASMYTH invented his huge steam hammer to forge the paddle shaft of the Great Britain on Nov. 24, 1834, but Brunel recommended the screw propeller after the trials of the Archimedes by Francis P. Smith, and this upset all the arrangements for the use of the hammer, but the iron trade which had been slack for some time revived and Nasmyth used and patented his hammer in 1842 after his return from France. The hammer was so accurately made that he showed the Lords of the Admiralty at Devonport Dockyard, how a blow could be made so gentle as to crack the end of an egg placed in a wine-glass, as if done by an egg-spoon, and the next blow so violent as to rattle all the china in a home a quarter of a mile distant.

Another of Nasmyth's inventions was riveting by compression. One wet wintry Sunday afternoon he went to his workroom to perform some repairs to a small stone which required to be riveted, and as the noise of riveting might be heard he solved the difficulty by using the jaws of his bench vice to press in the hot rivets. This system of riveting was long afterwards patented by Smith of Deanston, with William Fairbairn of Manchester. It is extensively used in boilers, girders, and all other wrought-iron structures where sound riveting is absolutely essential, and by hydraulic power a considerable portion of iron shipbuilding is carried out by the silent squeeze system in place of hammers. When Nasmyth continued the silent and very effective method of riveting, he named it "The Sunday Rivet."



INDUSTRIAL DEVELOPMENT IN JAPAN

THE following observations regarding the formation of industrial companies in Japan since the outbreak of the war have been furnished by E. F. Crowe, Acting Canadian Trade Commissioner, Yokohama:

Metals

Although the iron industry of Japan is still in its infancy, it gives promise of assuming considerable importance in the future. Before the war the annual production of Japan was about 260,000 tons of iron, this being around one-half of its consumption. Since the war several new companies have been formed

for the production of iron. Six companies with a combined capital of 40,000,000 yen have established new works.

With regard to steel, three new companies have commenced operations and four new works have been established. Their total combined capital is estimated at 5,000,000 yen. One company is producing steamer shafts, railway wheels, and tires as well as supplying the home trade. They have received orders from China and India. It is stated that the intention of this company is to devote all its energy to the export trade rather than to the domestic field.

It is generally conceded that the future of the zinc industry of Japan is good and that a large export trade is to be expected after the war. One company is already manufacturing zinc for exportation. Japanese zinc ore contains many other metals, such as gold, silver, and copper and the refining of these metals is carried on along with the treatment of the ore. Five new zinc companies are operating six works for the treatment of Japanese zinc ore and have a total combined capital of 7,600,000 yen.

In March, 1916, a company was formed with a capital of 1,000,000 yen for the manufacture of aluminum. It is stated that the process to be used is different from that in vogue in Europe and the United States. The alumina is obtained from a clay which is a product especially of Japan and is treated by an electrolytic process.

A company was formed in January, 1917, with a capital of 100,000 yen for the purpose of producing sheet lead for the use of chemical industries. Sheets are being turned out measuring ten feet by four feet and it is claimed that they are superior to any which have hitherto been manufactured in Japan.

Metal Goods

A company which was first established in 1913 for the manufacture of galvanized iron sheets and galvanized iron wire has increased its capital from 300,000 yen to 700,000 yen. Up to the present its output has been confined to the home market but it intends to export its products later.

Two companies with a combined capital of 1,500,000 yen have been formed for the purpose of manufacturing wire netting.

Machinery

For the manufacture of machinery, three new companies with a combined capital of 2,300,000 yen have been established. In addition to the manufacture of munitions, rotary printing machines, etc., and gun metal are also being manufactured.

Electrical Supplies and Accessories

There have been formed during the period under review six companies for the manufacture of electrical supplies and accessories, such as electric motors, dynamos, switches, lamp bulbs, carbon electrodes, carbon brushes, etc. Their total combined capital is 4,530,000 yen and they operate eleven factories. An improved process for the manufacture of micanite has enabled a Japanese com-

pany to turn out insulators both for the domestic and export trade.

Mining

There have been several strikes and mining operations with a combined total of 1,100,000 tons. One company is also producing zinc in large quantities. In December, 1917, a company was formed with a capital of \$100,000 to exploit a nearby mine. A special process is used in treating the zinc material.

Note: A year means approximately 30 parts of the normal rate of production.



TRADE ENQUIRIES

The following trade enquiries have been received by the Department of Trade and Commerce, Ottawa. Further particulars may be obtained on application to the Department.

1470. Agency. A firm of Government contractors in South Africa who are also contractors for a number of large concerns throughout the country wish to arrange to act as agents for Canadian motor-cars, tires and tubes and motor-cycle tires. They are particularly anxious to make connections for after-the-war business.

1473. Acetate of cobalt and manganese.—A London company asks to be placed in touch with Canadian producers of acetate of cobalt and of manganese, who can offer supplies.

1475. Raw potash felspar.—A Midlands company asks to be placed in communication with Canadian producers of raw potash felspar who are favorably situated for export to the United Kingdom.

1482. Wire for bedstead manufacturers.—A firm of Birmingham, Eng., bedstead manufacturers requires large quantities of wire of the following kinds: Coppered hook wire; bright spring wire; galvanized mat wire; tinned hood wire; 1C4 bright spring wire, quality as the japanned spring; galvanized strip. Further particulars and samples of wires may be had on application to Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa.

1486. Sulphite lye.—A London manufacturing company wish to ascertain if they can obtain sulphite lye, a by-product of the pulp industry, from Canada, and would be glad to hear from producers able to offer regular supplies. Full particulars obtainable at Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa.

1488. Acetate of soda.—A Lancashire firm asks for names of Canadian manufacturers of acetate of soda.

1495. Sulphite (wood) pulp.—London firm ask for quotations c.i.f. Bilbao, Spain, or Genoa, Italy, for 100 tons and 1,000 tons of strong, easy bleaching and bleached sulphite (wood) pulp.

1497. Heating Appliances, flooring, etc., paints and oils.—An inquirer in Newfoundland wishes to be placed in touch with Canadian manufacturers of church and house-heating appliances, maple flooring and cedar shingles, paints

Enlarged Canadian Trade Intelligence Service

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

CHILE—Valparaiso, British Consul General.	PANAMA—Colon, British Consul. Panama, British Vice-Consul.
COLOMBIA—Bogota, British Consul General.	PERU—Lima, British Vice-Consul.
CUBA—Havana, British Consul General.	PORTUGAL—Lisbon, British Consul.
ECUADOR—Quito, British Consul General. Guayaquil, British Consul.	RUSSIA—Moscow, British Consul General. Petrograd, British Consul. Vladivostok, British Consul. Odessa, British Consul General.
EGYPT—Alexandria, British Consul General.	SPAIN—Barcelona, British Consul General. Madrid, British Consul.
FRANCE—Paris, British Consul General. Marseilles, British Consul General.	SWEDEN—Stockholm, British Consul.
INDIA—Calcutta, Director-General of Commercial Intelligence.	SWITZERLAND—Geneva, British Consul.
ITALY—Genoa, British Consul General. Milan, British Consul.	URUGUAY—Monte Video, British Vice-Consul.
MEXICO—Mexico, British Consul General.	VENEZUELA—Caracas, British Vice-Consul.
NETHERLANDS—Amsterdam, British Consul.	BRAZIL—Bahia, British Consul. Rio de Janeiro, British Consul General.

Canadian Commercial Intelligence Service

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

CANADIAN TRADE COMMISSIONERS.

ARGENTINE REPUBLIC—B. S. Webb, Acting Canadian Trade Commissioner, Reconquista, No. 46, Buenos Aires. Cable address, Canadian.
AUSTRALIA—D. H. Ross, Stock Exchange Building, Melbourne. Cable address, Canadian.
BRITISH WEST INDIES—E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.
CHINA—J. W. Ross, 13 Nanking Road, Shanghai. Cable address, Cancoma.
CUBA—Acting Canadian Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.
FRANCE—Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.
ITALY—W. Mc. Clarke, c/o H. M. Consul, Milan.
JAPAN—E. F. Crowe, Acting Canadian Trade Commissioner, P. O. Box 109, Yokohama. Cable address, Canadian.
HOLLAND—Ph. Geleerd, Acting Canadian Trade Commissioner, Zuidblaak, 26, Rotterdam. Cable address, Watermill.
RUSSIA—C. F. Just, Canadian Government Commercial Agent, Alexandrinskaja, Plosh 9, Petrograd. L. D. Wilgress, Canadian Government Commercial Agent, Bukhgozka Ulitza No. 4, Omsk, Siberia.
NEWFOUNDLAND—W. W. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.
NEW ZEALAND—W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.
SOUTH AFRICA—W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.
UNITED KINGDOM—Harrison Watson, 73 Basinghall Street, London, E.C.2, England. Cable address, Sleighing, London. N. D. Johnston, Sun Building, Clare Street, Bristol. Cable address, Canadian. J. E. Ray, Central House, Birmingham. Cable address, Canadian. J. Forsyth Smith, 31 North John Street, Liverpool. Cable address, Cantracom. F. A. C. Bickerdike, 4 St. Anne's Square, Manchester. Cable address, Cantracom. J. Forsyth Smith, Acting Canadian Trade Commissioner, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

CANADIAN COMMERCIAL AGENTS.

AUSTRALIA—B. Millin, Royal Exchange Building, Sydney, N.S.W.
BRITISH WEST INDIES—Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian. R. H. Curry, Nassau, Bahamas.
NORWAY AND DENMARK—C. E. Sontum, Grubbeget No. 4 Christiania, Norway. Cable address, Sontums.
SPAIN—J. F. Roberts, Hotel Cuatro Naciones, Barcelona.

CANADIAN HIGH COMMISSIONER'S OFFICE.

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

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

Thorold, Ont.—A hydro-electric by-law will be submitted to the ratepayers.

Calgary, Alta.—The Calgary Rolling Mills are building an addition to their plant.

Owen Sound, Ont.—It is understood that J. H. Cole has selected a site for the proposed screw factory.

Toronto, Ont.—A building permit has been issued to the Canada Metal Co., for a factory addition at 17 Fraser Ave., to cost \$2,000.

Chatham, Ont.—The T. H. Taylor Co. is in the market for a complete outfit of Jones under feed stokers, and for two boiler installations, including engines and fans, etc.

Toronto, Ont.—A building permit has been issued by the City Architect to the Liquid Air Society to erect a one storey tile and steel addition to their factory at 18 Boler street. The cost will be \$2,600.

Toronto, Ont.—The Hydro-Electric Commission propose making extensions to the Ontario Power Co's. plant at Niagara Falls, so that by July next some 25,000 extra horse-power will be available and another 20,000 a month or so later. The cost is estimated at \$1,000,000.

Toronto, Ont.—Fire on Friday evening destroyed the pattern shop and pattern storage, and also damaged one end of the plate shop at Polson Iron Works. A large number of valuable patterns were destroyed and a freighter which was under construction was damaged. The loss is estimated at about \$200,000, which is covered by insurance. The company have already started building a new pattern shop.

GENERAL

Winnipeg, Man.—The Prest-O-Lite Co. will build a factory at St. Boniface, to cost \$10,000.

Oshawa, Ont.—A shoe factory may be established here if satisfactory arrangements can be made with the council by the company interested in the project.

Sault Ste. Marie, Ont.—Fire on Dec. 3 of unknown origin caused a loss of several thousand dollars to the Standard Chemical Co. plant. The loss in the latter fire was \$7,000.

Orangeville, Ont.—It is reported that the local cement plant, which has been idle for four years, has been sold to a Kingston concern who propose manufacturing a fertilizer.

Toronto, Ont.—The Massey-Harris Co. have taken out a permit to build a

dry kiln on the west side of Shaw street, near Strachan avenue and King street, to cost \$5,000.

MUNICIPAL

Lumsden, Sask.—The Town Council will appropriate \$7,000 to acquire the plant and equipment of the local electric light and power company.

Whitby, Ont.—The by-law granting a loan of \$25,000 to the United Rubber Mfg. & Reclaiming was passed by the ratepayers by a large majority.

Galt, Ont.—The City Council have passed two by-laws, one to pay \$45,000 on extensions to the hydro-electric system and another to extend the waterworks system at a cost of \$18,558.

Sherbrooke, Que.—The city attorney has been instructed to prepare a by-law authorizing the city to issue debentures to the amount of \$150,000. This sum is made up as follows: New power dam, accessories, generators and turbines, on Frontenac street, \$116,000; turbines, transformers, regulators, tools and apparatus at Rock Forest power station, \$34,000.

Toronto, Ont.—Works Commissioner Harris has recommended that the Board of Control instal air chambers at the main waterworks pumping station. He explained that the air chambers were needed to safeguard the works from damage to the machinery in case of any temporary suspension of the Hydro service which might occur. Commissioner Harris estimated that the work would cost about \$50,000. He was authorized to receive tenders for the work.

Montreal, Que.—The Canadian Machine Co., who contemplate building a factory at Maisonneuve, have asked the city council for a guarantee of \$250,000 debentures. The council stated that no action could be taken on this matter until it was known how much the company would invest, and that the company would have to conform to the city by-law in the matter of securing aid. It was stated that the company had factories at Nashua, N.H., and Boston, Mass.

BUILDINGS

Toronto, Ont.—City Architect Pearse has granted a building permit to the Bank of Hamilton to erect a three-storey brick bank building at 341 Yonge street at a cost of \$4,000.

Toronto, Ont.—Permission has been granted the T. Faton Co. to erect a one-storey brick delivery building, to cost \$45,000, at the corner of Coxwell avenue and the G.T.R. right of way. Building operations have already been commenced.

PERSONAL

L. W. Adam of Bethlehem, Pa., has been appointed to the position of General Superintendent of the Nova Scotia Steel & Coal Co's. plant at Trenton, N.S. Mr. Adam will reside at New Glasgow, N.S.

Lawrence Russel, who for several years has been sales manager of the Armstrong, Whitworth Co. of Canada, Montreal has been appointed assistant general manager of the company.

Herbert Johnston of the sales staff of the Armstrong, Whitworth Co., Montreal, has been appointed city sales manager, to succeed L. Russel, recently appointed assistant general manager.

John Ross, general superintendent of the mill of the Abitibi Power & Paper Co. at Iroquois Falls, Ont., was caught in the transmission and instantly killed recently. Mr. Ross was one of the highest paid paper experts in America and had been employed at the Abitibi about one year. He was forty-two years of age.

Capt. Arthur J. Latornell, B.A.Sc., at one time city engineer of Edmonton, Alta., has died of wounds received in action in France. Capt. Latornell, a Huguenot by descent, was born in Meaford, Ont. After graduating with honors in civil engineering, Capt. Latornell became city engineer of Edmonton, an appointment which he gave up early in 1916 to qualify for an overseas commission.

Henry J. Fuller, president of the Canadian Fairbanks-Morse Co., has been elected president of E. & T. Fairbanks & Co., of St. Johnsbury, Vt. The election of Mr. Fuller to this office will unite more closely the Canadian and American organization. Mr. Fuller is also a director of the Canadian Bank of Commerce, the National Trust Co. and other industrial concerns in the Dominion. Although born in St. Johnsbury, Vt., Mr. Fuller came to Montreal in 1897, two years after completing his education at Worcester Polytechnic Institute, and established a branch of the Fairbanks Co., which later developed into the Canadian Fairbanks-Morse Co., of which he is now the chief executive.

TRADE GOSSIP

Aikenhead Hardware, Ltd., are now distributors for Canada of the Simplex two-speed chain hoists manufactured by J. G. Speidel, Reading, Pa.

November Fire Loss.—The "Monetary Times" estimate of Canada's fire loss during November is \$959,059, as compar-

ed with the October issue of \$1,000 and \$2,000 for November of last year.

U.S. Steel Corp. Unfilled Orders.—Unfilled orders of the United States Steel Corporation on Nov. 30 last were \$8,571,000 less according to its monthly statement issued last Monday. This is a decrease of 11.6 per cent. compared with the order of October 31.

Japan Needs Steel Plates.—Japan cannot manufacture enough plates to suit the Japanese Army and Marine forces permitted to import steel plates from the United States. Baron Megata, head of the special Japanese finance commission, said at a recent session by Japanese bankers in New York recently.

Firm Changes Back to Old Name.—The directors of the International Engineering Works, Ltd., Amherst, N.S., have decided to change the name of the concern to Robb Engineering Works, the former title. A meeting of shareholders will be held in Montreal on Dec. 19 to confirm this arrangement.

First Train Over Quebec Bridge.—The first freight train crossed the Quebec Bridge on Dec. 5, composed of eighteen cars. The total weight of the train was 1,245 tons and it was just the length of the central span. When the full weight of the train was on the span the deflection of the structure was only 5/16 inch.

S.S. Turbinia for Overseas.—The steamer Turbinia has been sold at a reported price of \$300,000 and is now being overhauled in preparation for trans-Atlantic service. She was the first steamer of the turbine type to be operated on the Canadian lakes, and was built in Glasgow, Scotland, at a cost of \$220,000.

To Build Shell Plant.—Negotiations have been completed between the chamber of commerce of Batavia, N.Y., and a Canadian interest for the establishment of a shell factory in that city. The Canadian company, which has secured a contract from the United States Government for shells, plans to have the new plant operating about January, 1918.

The Dominion Bridge Co., Montreal, have obtained a controlling interest in the International Engineering Co., Amherst, N.S., and will carry on the business as a subsidiary. It is understood that the Dominion Bridge Co. have secured contracts for steam turbines and boilers in connection with the marine end of the business.

Montreal, Que.—At the annual meeting of the Mechanics' Institute held at Montreal recently, it was decided to begin the erection of the new building on the site purchased on the corner of Atwater avenue and Tupper streets, next spring. The building will include a reading room, library, lecture room, class or club rooms and a smoking room. The building, fully equipped, will cost in the neighborhood of \$100,000.

Heavy Copper Contracts.—Contracts being placed by United States Government for copper are reported as enormous, and the trade has figured that ap-

proximately 90 per cent. of the available supply is being taken for war purposes. Regular consumers are still endeavoring to get their orders booked but dealers are fighting shy of agreeing tentatively to make deliveries.

U.S. Price-Fixing Power.—Early enactment of legislation extending the United States Government's price-fixing power is expected by administration officials to follow President Wilson's declaration in his message to Congress that authority in this respect is now too limited. The feeling has been growing here that more power is needed to keep down rising prices; and industry, speaking through the Chamber of Commerce of the United States, has declared for the widest possible powers for the Government in this respect.

Grecian Magnesite Exports in 1916.—Magnesite exports of all grades from Greece in 1916 are given as 176,383 tons. Of raw magnesite the United Kingdom took 60,511 tons; the United States, 56,504 tons; France, 24,607 tons; Italy, 3,100 tons; the Netherlands, 320 tons. Of the caustic and calcined mineral the United Kingdom took 13,127 tons, the United States 9,514 tons, and the Netherlands 730 tons. Of the dead burned grade, the United Kingdom took 3,975 tons and France 3,462 tons.

Lake Superior Ore Shipments.—A record for the month of November in the movement of ore from the Lake Superior district was established last month, when the cargo carriers on the lakes loaded 7,331,804 tons, according to figures just issued. This is an increase over November, a year ago, of 1,616,351 tons, and brings the season's total to December 1, up to slightly more than 61,500,000 tons. The season's total, however, is approximately 2,000,000 tons less than for the same period last year.

Production of Explosives in U.S.—The production of explosives in the United States during 1916 was in excess of 500,000,000 pounds, an increase of about 44,000,000 over 1915. The total included 215,575,615 pounds of black powder, 253,154,780 pounds of "high" explosives other than permissible explosives, and 34,685,240 pounds of permissible explosives. The value of the exported explosives, which in 1914, the first year of the war, were valued at about £2,000,000, reached a total value in 1916 of some £144,000,000.

Four Steamers Ordered.—The first war order to come to Vancouver since the floating of the Victory Loan is, by coincidence, for \$7,254,000, almost exactly the amount of the city's contribution to the loan issue. The contract came from the Imperial Munitions Board to Coughlan's, Ltd., and provides for the construction of four additional 8,800-ton steel freight steamers, turbine propelled, similar to the six already under construction in the yards. The Coughlan yards have now building contracts to the value of more than \$15,000,000.

Coal Shipments on Lake Superior.—The up-lake coal movement to Decem-

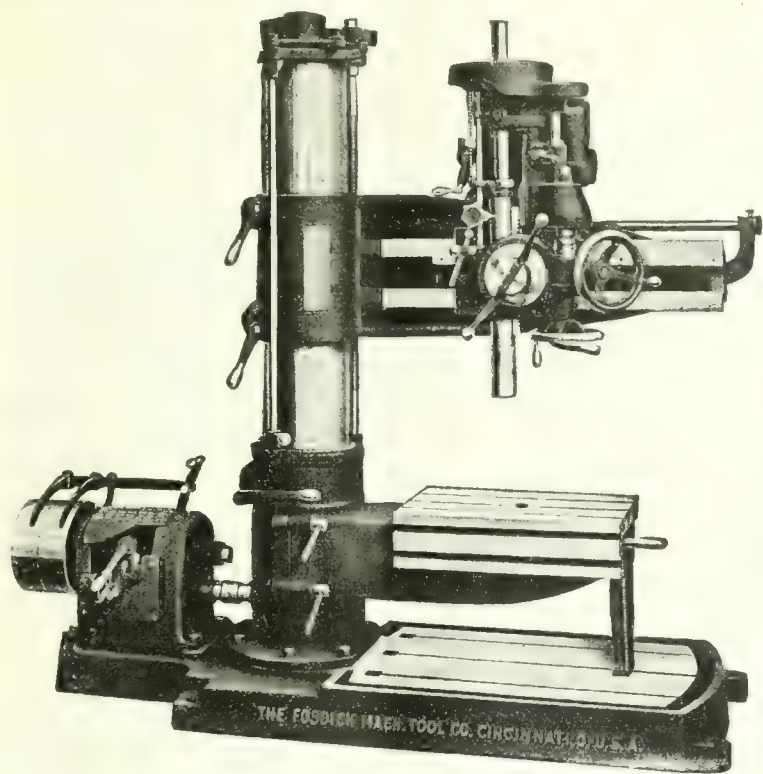
ber 1, was 25,855,737 tons, or 1,938,675 tons greater than for the corresponding 1916 period. Coal movements have virtually ceased, but the year's total likely will exceed 26,000,000 tons. Abnormally heavy uplake coal movement offers a partial explanation for the shortage which prevailed in eastern Ohio and western Pennsylvania industrial districts for months past, greatly crippling operations and reducing the iron and steel output. Coal movement virtually stopped on Dec. 1.

Big Harbors Needed When War Over.—Improvement in sea transportation was discussed at the London, England, Chamber of Commerce, on Dec. 5, when Lord d'Abernon emphasized the need of bigger ships of great speed after the war. He suggested the government should start the provision of big harbors. About \$20,000,000 would provide for vessels of 38-foot draught at practically all the leading harbors from Great Britain to the furthest dominion. The report of the Dominion Royal Commission just issued gives memoranda and tables as to harbors throughout the Empire.

Traffic Heavy at the Soo.—Freight shipments of all kinds through the locks at Sault Ste. Marie in November totalled 11,154,508 tons which is a new traffic record for that month. The figures have just been made public by the United States engineer's office. They show a heavy movement of grain, wheat shipment totalling 37,992,913 bushels. Flour shipments eastward amounted to 1,293,410 barrels. Shipments of soft coal through the locks for the month amounted to 1,685,586 tons; hard coal 332,210 tons. The figures on iron ore show a movement of 7,214,058 tons. Vessel passages through the locks for the month totalled 2,772.

Forest Survey in Ontario.—The Commission of Conservation hopes soon to undertake a survey of the forest resources of Ontario, similar to the investigations it has already made in British Columbia and Saskatchewan. Only the most fragmentary data respecting the forests of Ontario are now available, although there is a vast amount of detailed information in the possession of timber owners, Government officers and railways, which could probably be secured. The commission is handicapped in undertaking such an investigation by the scarcity of competent foresters. Last year at the height of the fire season its staff consisted of about 1,000 men.

Manganese Ore Prices.—Indian manganese ore has sold recently in the United States as high as \$1.30 per unit, seaboard, for high-grade material. Brazilian ore has been quoted at \$1.10 to \$1.20 per unit, seaboard. For domestic ores a leading dealer is now offering the following prices: \$1.20 per unit for ore containing 50 per cent. or more manganese; \$1.10 per unit for ore averaging 46 to 49.99 per cent.; \$1 per unit for 42 to 45.99 per cent. ore, and 90c per unit for 38 to 41.99 per cent. ore. For all these grades



Radials in Stock

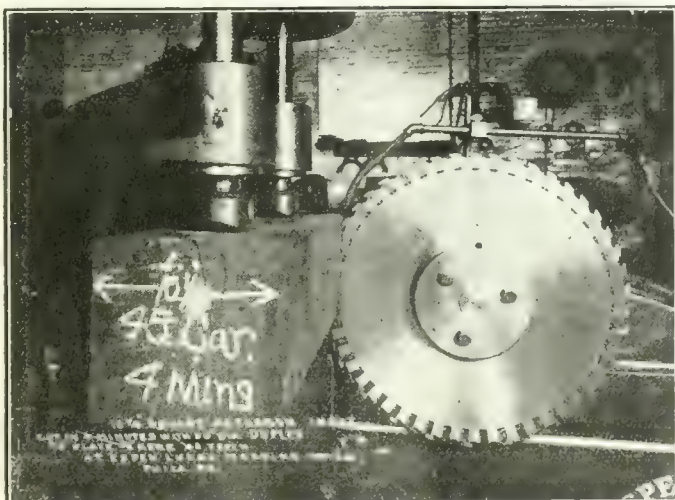
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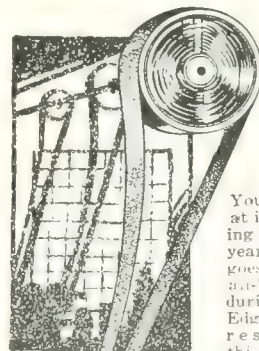


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British Need More Iron Ore.—Sir John Ferguson, of the Iron Mines of Belgium, Verviers, & Co., made a valuable contribution to the discussion on iron ore. He stressed the importance of securing the source of supply for the industrial countries of Europe before they, with all nations in themselves, and the international trade, get together in securing the source of supply of the industrial countries of the world, and he suggested that the Government interest itself in the matter. There are very large deposits in Brazil which from a national point of view should be secured for future use.

Dominion Resources Directory.—The first comprehensive and authoritative directory of Canada's natural resources is to be published without delay by the Commission of Conservation. Sir Clifford Sifton, the chairman, gave the first intimation of this at the annual meeting of the Commission last week. Inventories of the various sections of the country will be arranged, and published geographically, provinces having similar resources being grouped together. One division, for instance, will cover the Maritime Provinces, another the Prairie Provinces, another Ontario, etc. The information to be published, it is believed, will be of the utmost importance in the solution of after the war problems.

Shortage of Hydro Power.—The increasing shortage of hydro power has prompted the Hydro-Electric Commission of Ontario to develop an additional 45,000 h.p. at the Ontario Power Co.'s plant at Niagara Falls. It is expected that this will relieve the situation until the Chippewa Creek development is in operation. The Chippewa development will furnish 300,000 horse-power and will cost something in the neighborhood of \$23,000,000. The Western Ontario natural gas, which has been providing the motor power for many important industries, is falling down, and unless these people can get Hydro power several flour mills will have to suspend operation. Several companies are appealing to the Hydro to help them out now that they can't get natural gas.

Magnesite Production in 1916.—Normally about 6 lbs. of magnesite was formerly used for every ton of steel made by the basic open-hearth process, but now not more than ½ lb. is used, and at some steel plants cheaper and less satisfactory refractories have been substituted, says Hoyt S. Gale in a U. S. Geological Survey Bulletin 666-BB on "Magnesite." More raw magnesite was produced in the United States in 1916 than ever before. Last year's output was 158,759 net tons as compared with 30,499 tons in 1915 and 9,632 tons in 1913. Imports for consumption of the raw mineral were 75,345 tons in 1916, also exceeding any previous record, but the imports of calcined magnesite were only 9,270 tons as compared with 167,094 tons in 1913. The total consumption calculated as calcined mineral in 1916 was 126,322 tons as compared

with 66,000 tons in 1915 and 178,530 tons in 1913.

The International Business Machines Co. has been launched with a capital of \$2,000,000. The new concern will take over the plants and stocks of the International Time Recording Co. and the Computing Scale Co., both Toronto concerns, and the Canadian Tabulating Machine Co., of Montreal. The operations of this latter concern will be at once transferred to this city. By bringing these three companies together a great saving in the cost of management and operation will be effected. Thomas J. Watson will be the president of the new combination, and F. E. Mutton the vice-president and general manager. J. S. Ogsbury is the secretary. L. A. Davidson has been appointed sales manager for the scales division and St. George Bond, of Montreal, will have charge of the tabulating section. The company has \$100,000 in cash available for immediate expansion.

Entertained Employees.—The employees of the Hall Engineering Works, Montreal, were recently given a dinner by the directors of the concern at Cooper's restaurant, there being about one hundred persons present. Toasts were given and a musical programme provided. A toast to the employees was proposed by T. Fisher, and responded to by W. F. Fletcher, director, and Wm. Forbes. In the course of the remarks it was evident that a fine spirit existed between employers and employees. A toast to the army, navy and mercantile marine was proposed by W. S. Johnson, and responded to by Lt. Matthews and Capt. Reed. Other toasts were "Our Guests," proposed by Thomas Hall, president of the company, and responded to by Thomas Arnold, and "Our President," proposed by F. H. Fox, secretary-treasurer.

Included among the guests from outside were Mayor Ballantyne, of Montreal West; Messrs. C. W. Baker, Geo. G. Fox, W. S. Johnson, C. A. Bishop, W. Stewart, D. J. S. Tyrer, Lt. Matthews, Geo. Wood, W. Graveley, W. J. Alderson, and Capt. Archibald Reed.

TENDERS

Toronto, Ont.—Tenders will be received, addressed to the Chairman, Board of Control, City Hall, Toronto, up to January 15, 1918, for the construction of a drainage system (wrought iron pipe) for the Don Bridge, Bloor Street Viaduct. Specifications and forms of tender may be obtained upon application at the Bloor Street Viaduct Field Office, 89 Castle Frank Road.

Ottawa, Ont.—Tenders will be received until December 17 for the electric conduits, outlets and fittings required in the reconstruction of the Parliament Building. All tenders to be based on the supplying and delivering on the site of the quantities of the schedule of material for electric conduit, outlets and fittings, in strict conformity with the specifications and the samples submitted and to the satisfaction of the architect. De-

liveries to commence so far as possible immediately after the signing of contract and to continue as directed in such quantities as to ensure complete delivery by March 1, 1918. The schedule of material, specification and any other information required can be obtained at the office of the P. Lyall & Sons Construction Co., Ottawa.

MARINE

Victoria, B.C.—The C.P.R. steamer Princess Ena is again in commission after an overhaul at the Victoria Machinery Depot, and has left for the North. The Princess Royal will resume service at the end of the week.

Sarnia, Ont.—The Imperial oil tanker Royalite has arrived here from up lake ports and will go into winter quarters at once. The crew reports that it encountered floating ice in Lake Huron.

Hantsport, N.S.—The Noel Shipbuilding and Transportation Co. now have under construction a 450 ton (net) schooner, 138 feet long with a beam of 35 feet and a 13 feet hold. This three-master was begun in October and will be framed by Christmas.

Victoria, B.C.—The Victoria Whaling Co. tender Gray, which has been undergoing repairs at Yarrows, Ltd., for the past month, has been turned over to the owners, and will begin at once loading empty oil drums for Sechart, Kyuquot and other West Coast stations.

Victoria, B.C.—The Cameron-Genoa Mills Shipbuilders, Ltd., have laid the keel for the fourth wooden steamer to be built at the Point Ellice yards to the order of the Imperial Munitions Board. This is the tenth keel to be laid by the company since it was established last spring, the other six being the auxiliary wooden schooners built for the Canada West Coast Navigation Company.

Victoria, B.C.—The Dominion fisheries patrol vessel Alcedo, which is at Yarrows yards, has been hauled out on the slip for repairs to its keel, necessitated by the accident on November 27, when it ran aground in Houston's Passage, close to Cowichan Gap. The fishery vessel Restless has also been placed on the ways for general overhaul. Both vessels will probably be in the water again in the course of a week.

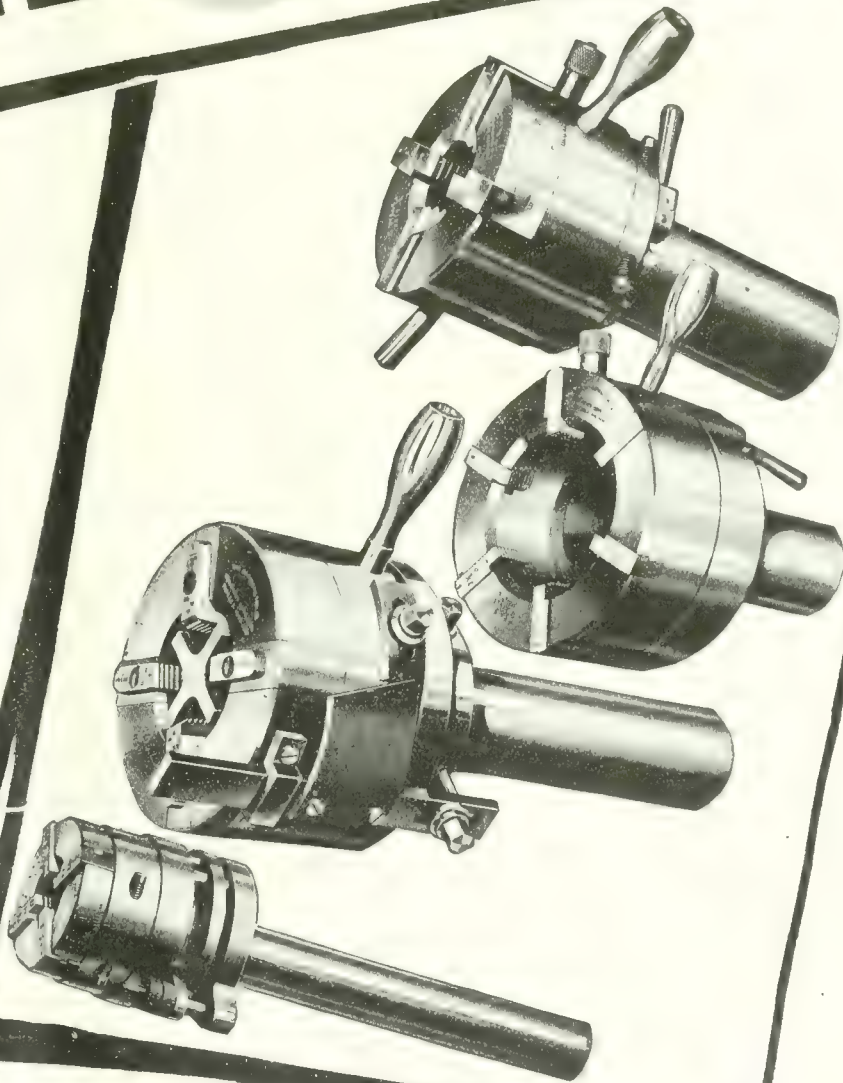
Victoria, B.C.—Announcement was made at the offices of the B. C. Coast Service of the C.P.R. recently that the fast passenger liner Princess Victoria has been withdrawn from service to be overhauled. A cracked tail-shaft, which has to be drawn and replaced, and run-down cylinders which have to be bored, are some of the things that will have to be given attention by the repair crew when the vessel goes on the ways. The entire machinery will undergo a complete overhauling, and it is expected that the job will occupy about six weeks.

New Westminster, B.C.—Although delayed at the start by a shortage of material, the New Westminster Construction and Engineering Co., which is building four wooden steamers for the Im-

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HERE'S a quartet of die heads that means death to threading trouble. They are worthy representatives of the Geometric family — among which can be found a Self-Opening Die Head or Collapsing Tap for any thread you could possibly want.

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perial Munitions Board at the Poplar Island yard, in fully confident of launching the first of them by Feb. 1, the date scheduled. The work is now progressing at a satisfactory rate. Planking is under way and the first of the hulls is nearly ready for the beams. The second hull is about ten days behind the first, and will probably be launched about a week later while the third will come on shortly thereafter. The keel of the fourth boat is laid and the sternpost set up.

Vancouver, B.C.—The John Coughlan Co. have been offered a contract for four steel steamers by the Imperial Munitions Board. The four vessels would be identical in construction with five now being built for the Imperial Munitions Board in the Coughlan yards here. These vessels are valued at \$1,250,000 each, so that if four more are added to the fleet, it will mean an additional \$5,000,000 worth of ships for this city. The Coughlan programme at the present time represents between \$7,000,000 and \$8,000,000. With the addition of the new contracts, approximately \$13,000,000 worth of shipping will be turned out of these yards within the next year or two. The vessels will be of 8,800 tons and of the same type as the Luis Nielsen and the Niels Nielson, launched at Seattle yards this year.

CONTRACTS

Hamilton, Ont.—P. H. Secord & Son, Brantford, have been awarded the contract for factory addition for the Frost Wire Fence Co., to cost \$25,000.

Hamilton, Ont.—The general contract for an addition to a factory for the Canadian Shovel Co. has been given to George E. Mills, Hamilton, at \$25,000.

Galt, Ont.—P. H. Secord & Son, Brantford, have the general contract and the Hamilton Bridge Works Co., Hamilton, the steel contract for \$30,000 addition to foundry for the Canada Machinery Corporation.

INCORPORATIONS

Eastern Chemical Co. has been incorporated at Ottawa with a capital of \$200,000 to manufacture pumice stone and chemicals of all kinds. The head office is at Montreal, and the incorporators are J. O. Dion, J. W. Pion, and A. Coutant, all of Montreal.

British Molybdenite, Ltd., has been incorporated at Ottawa by Kenneth McRae, Cecil E. Dillistone, and Charles W. Milburn, all of Toronto, to own and develop mineral deposits and treat ores of all kinds. The head office is at Toronto, and the concern is capitalized at \$100,000.

International Business Machines Co. has been incorporated at Ottawa by Frank E. Mutton, Edmond B. Ryckman, and John S. Denison, all of Toronto, to manufacture all kinds of tabulating, recording and adding machines. The head office is at Toronto and the company is capitalized at \$2,000,000.

WOODWORKING

Cobalt, Ont.—Fire on Nov. 30 destroyed the lumber mill at Moose Lake belonging to C. J. Price. The loss is estimated at \$8,000; there was no insurance.

CATALOGUES

Brass and Copper Products.—The Tallman Brass & Metal Co., Hamilton, Ont., have distributed a stock list of brass and copper products, ready for immediate shipment. The product includes brass and copper rods, sheets, tubing and bars, etc.

Torsion Meter.—Catalogue describing and illustrating the Gary-Cummings torsion meter made by the Cummings Ship Instrument Works, Boston, Mass. This meter, which is used on ships for measuring shaft horsepower, is described at length in regard to its construction, care and operation. The catalogue also contains an equation for calculating the horsepower and a calibration data sheet. The illustrations show the instrument in detail and also installed.

Cochrane Precision Meter.—Engineering Bulletin No. 21 deals with the Cochrane precision meter, volumetric type, made by the Harrison Safety Boiler Works, Philadelphia, Pa. A comprehensive description is given of the meter while reference is made to installations on United States battleships. Copies may be obtained on application from Canadian Allis-Chalmers, Ltd., Toronto, agents for Canada.

Industrial Motors.—The second of a series of catalogues of industrial motors has just been distributed by the Westinghouse Electric & Mfg. Co. of East Pittsburgh, Pa. This is known as catalogue 30 and covers the company's complete line of direct current motors and generators for industrial service. After several pages giving general information regarding the ordering, classification and selection of direct current motors there follows complete description, rating and dimensions for type SK commutating-pole motors, various modifications of type SK elevator motors, reversing planer motor equipment, type CD motors, headstock equipment for woodworking plants, type SK and CD motor generators and arc welding equipment. Much new information is given especially on such subjects as arc welding, headstock equipment, motion picture service and battery charging service. The new catalogue is identical in size and will fit the binder for the company's line of catalogues covering supply apparatus and small motors.

Arctic Explorer (recounting adventures of his last expedition. "We certainly could have reached the Pole had not our dogs given out at a critical moment.")

Fair Listener (breathlessly): "Why, I thought that the Eskimo dogs were perfectly tireless creatures!"

Arctic Explorer (gloomily): "I—er—speak from a culinary view, madam."

Aikenhead's Wahlstrom

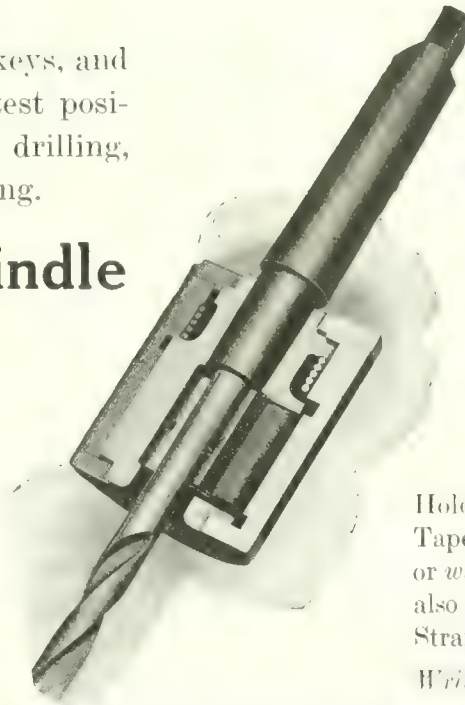
It has neither collets, sockets nor keys, and is undoubtedly the strongest, fastest positive drive automatic chuck for drilling, reaming, tapping and counterboring.

You Don't Stop Spindle

And waste minutes putting in or taking out the drill. In just two seconds you make tool changes, the Wahlstrom perfectly centering the tool automatically.

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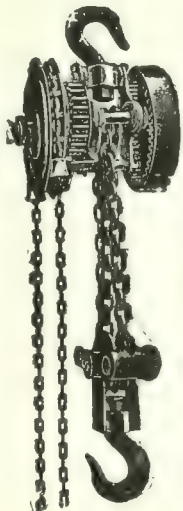


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Automatic
Chuck

Holds No. 1, 2 or 3 Morse Taper Shank Drills, with or without a Tang. There's also a Wahlstrom for Straight Shank Drills.

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Fast Speed for Light Loads

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SECTION

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SIX COMPRESSORS FOR SALE - VERY CHEAP. The National Quartz, 81 St. Peter St., Quebec. c22m

FOR SALE - NEW ONE TURBO WING Compressor, turbo with one Mason hydraulic driven regulator No. 1, one ten inch air cylinder and two-way valve for air chuck, one No. 3, two No. 2, Arrow and motor steam engines. All new. Hancock, main bud. Reliance Machine Company, Toronto. c24m

THREE TONS COLD ROLLED STRIP STEEL. Drawing size 36" wide, 0.65 thick. Dillon Manufacturing Co., Oshawa. c1m

PUNCHING MACHINE - POWERFUL BELT- driven geared multiple punching machine; capable of punching 30 holes $\frac{3}{4}$ " dia. at 2 1/2" pitch through $\frac{3}{4}$ " plate, distance between housings 6' 0", having two bed plates, one 24' long, fitted with adjustable screw-driven plate carriage for feeding plates to punch, and one 26' long, fitted with plain plate carriage, which is operated by hand-power draw winch, machine has large equipment, including punches and bolsters, for 1", 1 1/2", 2", 2 1/2", 3", 3 1/2", and 4", and one rack of fixed punches and bolsters 11-32" at 1 1/4" pitch; made by Hanna, Donald & Wilson; f.o.b. Glasgow. William C. Wilson & Co., 21 Camden Street, Toronto. c23m

FOR SALE - ONE INGERSOLL-RAND AIR Compressor with receiver. Displacement 64 cubic feet per minute. In good shape. \$300.00. Perfection Stove Co., Ltd., Sarnia, Ont.

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FOR SALE CHEAP 16" SHAPER: 24 x 24 x 6 planer; two heavy duty roughing lathes for 6" shells; 1 Hall No. 6 cut-off machine; 1 2-ton heavy Morris chain block all guaranteed and in first class condition. Dominion Machinery Co., Toronto. c24m

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in Manitoba, one of the best Equipped Foundries in Western Canada for Gray Iron and Brass Casting. Also Machine Shop, Pattern Shop and Blacksmith Shop (3 fires.)

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New England Butt Co. and R.I. Braiders in perfect working condition. Write for particulars. Greenwood Braiding Co., Greenwood, R.I. (c23m)

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MECHANICAL AND CONSTRUCTION EN-gineer desires change; twenty years' general experience, specialty steam power plants, knowledge pulverized coal. Box 343, Canadian Machinery. c21m

GENERAL SUPERINTENDENT, WITH PRA-ctical shop as well as efficient production experience, desires change. One having considerable munition experience, principally shells of various sizes. Box 358, Canadian Machinery. (c25m)

GENERAL SUPERINTENDENT DESIRES position—years of machine shop and tool-room experience, efficient production methods, as well as extensive experience with various sizes of shells. Box 350, Canadian Machinery. c22m

SITUATIONS VACANT

ASSISTANT WANTED WITH PRACTICAL, technical and commercial machine tool experience, by large exporters of machine tools; give age, experience and salary. Box 361, Canadian Machinery. (25)

WANTED

WANTED - SECOND-HAND CUPOLA AND other foundry equipment. State full particulars and price. Box 346, Canadian Machinery. c21m

WANTED - A GOOD, HEAVY, POWERFUL, single purpose lathe for 4.5 shells. Send fullest particulars and best price at once. Box 359, Canadian Machinery. (c24m)

WANTED - COMPLETE BOLT AND NUT machinery to manufacture sizes $\frac{1}{4}$ -inch diameter and up. Advise offerings in either second-hand or new. Box 360, Canadian Machinery, Toronto. (c2m)

WANTED - VERTICAL MILLING MACHINE with table not less than 26" x 10", minimum distance centre of spindle to face of column 14". Reply, giving full particulars, price and where machine can be inspected. Box 352, Canadian Machinery. c21m

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A responsible American Concern desires to arrange with a reliable Canadian Machinery Manufacturer for the production in quantities of a small Marine Motor, for the Canadian and Export Trade. A modern equipment, with knowledge of economical production of interchangeable machinery and parts, and good shipping facilities essential. To such party a very favorable, if not continuous, contract is offered. Address Box 353, Canadian Machinery. (c22m)

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WANTED - LIVE REPRESENTATIVE TO handle good specialty; one who hasn't too many irons in the fire. Apply Box 348, Canadian Machinery, stating lines you now represent and the ground you are prepared to cover. c23m

WANTED - BY STEEL WORKS IN PENNSY-lvania, United States, producing exclusively crucible cast steel, principally high speed steel, a representative in Canada who is thoroughly familiar with the tool steel business and will devote his entire attention to same. Reply Box 354, Canadian Machinery. c24m

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- 1-16" x 6' Reed Engine Lathe, plain rest.
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- 1 18" x 8' Porter Engine Lathe.
- 1 22" x 10' Nicholson & Waterman Engine Lathe.
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- 1 30" old-style Brainerd Automatic Gear Cutter.
- 1 5" x 4 1/2" Pratt & Whitney Plain Grinder.
- 1 No. 3 Lees-Bradner Thread Miller.
- 1 15" Jungst Shaper.
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- 6" x 30" Dalton, B.G., bench.
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- 16" x 8" Porter, B.G., comp. rest.
- 18" x 10" Putnam, back geared.
- 20" x 8" Fifield, B.G., plain rest.
- 21" x 8" Bawden, heavy duty (4).
- 22" x 8" Pond, B.G., plain rest.
- 24" x 11" Pond, B.G., comp. rest.
- 26" x 14" Gleason, D.B.G.
- 30" x 10" Ames, B.G., plain rest.
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- 14" Excelsior, sliding head, lever feed (5).
- 15" Avey, high-speed, ball-bearing.
- 16" Barr, sliding head, lever feed.
- 20" Barnes, 3-spindle, lever feed (2).
- 20" Baker, tapping attachment
- 24" Foote-Burt, heavy duty.
- 24" Kerkhoff, back geared, power feed
- 32" Cincinnati, heavy duty.
- 40" Bickford, back geared.
- 46" Allfree, back geared, power feed.
- No. 10a Baush, 16-spindle.
- D-8 Colburn, heavy duty

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- 10" x 30" Landis, universal.
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Punches and Shears.

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Single, 9" tht., cap. 1 x 1", belted (3).

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Double 15" tht. cap. 3/4 x 3/4" Fischer.

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Double 12" blades, bar shear, cap. 2" sq., crucible.

Univ. Plate Shear, 18" blades, cap. 3/4", Cleveland belted.

Univ. Plate Shear, 26" blades, cap. 1/2", Lewis belted.

Guillotine Shear, cap. 2 1/2" sq., belted, Perkins No. 6.

Guillotine Shear, No. O. H. & J., 6 and 7" blades (2).

Guillotine Shear, Fisher, 21" blade, cap. 8 x 2".

Squaring Machine 120", cap. 3/16".

Miscellaneous.

Bolt Cutter, Acme 2", Class A, single head, dies.

Boring Mill, 10' Niles, Vertical, 2 heads.

Forging and Upsetting Machine, 1 1/2" Acme, with dies.

Forging and Upsetting Machine, 2 1/2" Ajax.

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Hammer 35-lb. Maggowan & Finigan (Perfect), belted.

Rotary Planer, 36" Cleveland, motor driven.

Rotary Planer. 60" Cleveland, motor 60 cv., 440 V.

Milling Machine, No. 24 Osterlein Universal.

Pine Machine, 8" E. C. & B.

Pipe Machine, No. 11 Jarecki.

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Single 15" tht., cap. 3/4 x 1/2" (hand) new Doty.

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Single, 32" tht., cap. 1 x 1", belted.

Double 15" tht. cap. 3/4 x 3/4" Fischer.

Double, Queen City, 12" thts., cap. 5/8" x 5/8".

Double 12" blades, bar shear, cap. 2" sq., crucible.

Univ. Plate Shear, 18" blades, cap. 3/4", Cleveland belted.

Univ. Plate Shear, 26" blades, cap. 1/2", Lewis belted.

Guillotine Shear, cap. 2 1/2" sq., belted, Perkins No. 6.

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Guillotine Shear, Fisher, 21" blade, cap. 8 x 2".

Squaring Machine 120", cap. 3/16".

Miscellaneous.

Bolt Cutter, Acme 2", Class A, single head, dies.

Boring Mill, 10' Niles, Vertical, 2 heads.

Forging and Upsetting Machine, 1 1/2" Acme, with dies.

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- 1—No. 5 Bliss Spinning Lathe,
- 4—Ford Smith Shrapnel Tool Grinding Machines,
- 1—No. 23 1/2 B Niagara Toggle Drawing Press,
- 1—No. 66 Consolidated Press,
- 1—100 pound Bliss Drop Hammer,
- 1—No. 5 American Gas Forge,
- 1—No. 16 American Oven Furnace,
- 1—12 x 42 Landis Grinder,
- 1—10 x 30 Landis Grinder,
- 3—No. 3 Waymoth Variety Lathes,
- 2—Waymoth Pointing Machines,
- 1—Crescent Universal Borer,
- 1—35 H.P. "Heer" Stationary Gasoline Engine,
- 1—15 H.P. International Portable Gasoline Engine,
- 1—15 H.P. International Stationary Gasoline Engine,
- 1—7 x 10 Double Cylinder Single Drum Hoist,
- 2—6 x 8 Double Cylinder Single Drum Hoists,
- 1—7 x 10 "Jenckes" Special Winding Engine (for Cableway)
- 1—20 K.W., D.C. Generator, 115 Volts,
- 1—8 x 10 Ideal High Speed Steam Engine,
- 2—40 H.P. Locomotive Type Boilers,
- 1—60 H.P. Locomotive Type Boiler,
- 1—75 H.P. Return Tubular Boiler, with full front fittings,
- 1—15 H.P. Upright Boiler,
- 3—150 H.P. Return Tubular Boilers, full front fittings,
- 15-Ton 20 lb. Rail with fasteners,
- 1—1/2 Yard London Concrete Mixer mounted on trucks, complete with water tank and automatic loading skip,
- 1—12 x 18 1/2 x 12 x 10 Worthington Steam Pump,
- 1—14 x 12 x 14 Worthington Steam Pump,
- 1—20 H.P., 2 phase, 440 volt, 1200 R.P.M. Electric Motor,
- 1—75 H.P., 3 phase, 2200 volt, Electric Motor,
- 1—450 H.P. Goldie & McCulloch Corliss Engine,

We would be glad to hear from you with regard to the above.

The General Supply Co. of Canada, Ltd.
Ottawa, Canada

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DRILLING MACHINES.

- 30" Lodge & Davis, S.H., B.G., P.F.
- No. 0 Bickford Radial, tapping attachment.
- 4" Mueller Plain Radial.
- Four No. 310 Baker Heavy Duty.
- 3-spindle Rockford.
- 4-spindle Rockford.
- 4-spindle Washburn, with power feed.
- 4-spindle Allen.
- No. 11 Pratt & Whitney, 10 spindles.

GEAR CUTTERS.

- 24" x 7" G. & E., spur gears.
- No. 3 26" B. & S., spur gears.
- 30" x 9" G. & E., spur and bevel gears.
- 36" x 9" G. & E., spur and bevel gears.
- 36" Walcott, spur gears.
- No. 1 Schuchardt & Schutte Gear Hobber.

GRINDERS.

- No. 1 Cincinnati Universal Tool and Cutter.
- No. 1 1/2 Cincinnati Cutter and Tool.
- No. 2 Woods Tool and Cutter.
- Brainard Cutter.
- Leland Universal, with power feed.
- No. 2 Landis Universal.
- No. 6-A Diamond Universal.

LATHES.

- 10" x 5' LeBlond, C.R., with chuck.
- 14" x 6' Hamilton, C.R., chuck.
- 14" x 6' Rockford, C.R.
- 15" x 6' Rockford Tool Co., C.R.
- 15" x 6' Prentice Lathe, C.R.

- 16" x 8' Bradford, C.R.
- 18" x 6' Bradford, C.R., taper attachment.
- 18" x 8' Lodge & Shipley, pat. head, C.R., taper attachment.
- 20" x 14' Blaisdell, C.R.
- 21" x 12' New Haven, C.R.
- 24-27 1/2" x 14' Lodge & Shipley, selective geared head, Q.C.G., 18" chuck fitted.
- 24-27" x 12' Reed-Prentice, geared head, single pulley drive.
- 32" x 12' Schumacher & Boye, 28" chuck, fitted.
- 36" x 18' Schumacher & Boye, T.B.G., Q.C.G.
- 36" x 20' American, T.B.G.

PLANERS.

- 24" x 24" x 6' American, one head.
- 26" x 26" x 8' Pease, one head.
- 36" x 36" x 8' Powell, 2 heads.
- 36" x 36" x 14' Sellers, one head.
- 39" x 39" x 12' New Haven, one head.

SCREW MACHINES.

- No. 1 Warner & Swasey, plain head.
- No. 2 P. & W., friction head.
- No. 3 Pratt & Whitney, B.G., double friction head, A.C. and W.F.
- No. 3 Bardons & Oliver, plain head, A.C. and W.F.
- No. 4 Pearson, friction head, A.C. and W.F.
- No. 5 Foster, geared friction head, A.C., P.F. to turret slide, and P.F. to cross slide.

TURRET LATHES.

- No. 2 Foster-Kimball, plain head.
- No. 22 Garvin, plain head.
- 16" Lodge & Davis, back geared.
- 16" Warner & Swasey, friction head.
- 2 x 24" J. & L., cone head.
- 24" Gisholt, 4 1/4" spindle hole, taper attachment.
- No. 3-A Warner & Swasey, bar attachment.

PUNCHES AND PRESSES.

- No. 2 Rockford, O.B.I.
- No. 20 Thiem, O.B.I.
- No. 3 Loshbough-Jordan, O.B.I.
- No. 3 Loshbough-Jordan, O.B.I.
- No. 4 Rockford, O.B.I.
- No. 4 American Can., O.B.I.
- No. 74 1/2 Bliss, str. side, geared.
- Blake & Johnson Embossing.

MISCELLANEOUS.

- 7'-10' Betts Boring Mill.
- No. 2 Garvin Auto. Tapper.
- No. 2 1/2 Hendey Lincoln Type Miller.
- No. 24 Oesterlein Universal Miller.
- 4" Nutter & Barnes Cutting-off Machine.
- 6 x 48" P. & W. Thread Miller.
- No. 3 Cincinnati Vertical Milling Machine.
- 20 H.P. Nash 2-cylinder Vertical Gas Engine.
- 6 H.P. Fairbanks-Morse Horizontal Gas Engine.

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CHICAGO, ILL.**

**Complete 18-pr. Shrapnel
Plant for Sale**

PRINCIPAL ITEMS AS FOLLOWS:

- 1-Cutting-off Machine, with 15" three-jawed chuck.
- 1-Lathe, 28" swing, 8' bed.
- 1-Air Chuck, Double End Rough Turning Lathe.
- 1-Single End Rough Turning Lathe.
- 1-Single End Lathe, for base roughing.
- 1-Single End Base Facing Machine.
- 1-Double End Tool Grinder.
- 1-Jenckes Grinder.
- 2-Roring Machines, C.M.C., with turrets.
- 2-C.M.C. Lathes, equipped for nosing and tapping.
- 1-22" Davis Turret Lathe.
- 1-Jenckes Copper Band Lathe.
- 1-Gisholt Lathe, with 15" three-jawed chuck.
- 1-Lo-Swing Lathe for turning profiles.
- 1-Tool Grinder, 24" wheel.
- 1-Lathe, 14" swing, 6' bed.
- 2-Ford Smith Shell Grinders, complete.
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- 1-Jenckes Air-operated Copper Band Press.
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- 1-30 H.P. Westinghouse Motor, 550 volts, complete with starting box.
- 1-40 H.P. Canadian General Electric Motor, 2,200 volts, complete with starting box.
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- 1-Nosing Press, for nosing shells.
- 1-6 H.P. Canadian General Electric Motor for same.
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FOR SALE

- 1 90' Thomas Spacing Table complete with indicator carriage, trolley carriage, stands, adjustable roller, racks, etc. Capacity: Plates, 48" long x 48" wide; angles, 8" long x 8" wide. Further particulars on application.
- 1-40 H.P. Horizontal Gasoline Engine complete and in running order.
- 1-30 H.P. Horizontal Gasoline Engine complete and in running order.
- 1-Air Compressor driven by Twin Cylinder Fairbanks Gasoline Engine. (Mounted).
- Complete equipment for machining 4.5 H.E. Shell Nose Plugs. Capacity, 10,000 per day.
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**Machine Tools For Immediate
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- No. 6 and No. 1 Burke Bench Saws Drills.
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- No. 188 Grayson B.G. Horiz. Drill with pump and pump.
- No. 150, 151, 152 Buffalo Blacksmith Post Drills.
- No. 4 B. Horny & Wright H.S.B.B. Drills, 8" overhang.
- No. 2 B. Horny & Wright H.S.B.B. Drills, 8" overhang.
- H' Revolver Sensitive Drill
- No. 7 15" Barnes Drills with tappers.
- No. 7 3" Buffalo Drill with power feed.
- No. 102 Harrington S.S. Drill with elev. table, oil pump and pump.

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- Geometric Chaser Grinder.
- No. 2 Oakley Universal Cutter and Tool Grinder.
- No. 2 No. 1, No. 6 Gardner Pl. Bearing Disc Grinders.
- No. 1 and No. 6 Blount Double End Emery Grinders.
- No. 1 Gardner B.B. Polishing Lathe, type B.
- No. 2 Diamond Auto. Surface Grinder, belt driven.
- No. 2 Wilmuth & Mearns Auto. Surface Grinder.
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- No. 30 Swan & Crane Passenger Bench Lathe.
- 17" x 6" Swan & Crane Passenger Bench Lathe.
- H' A.C. Motor, Q.C., D.B.G. Engine Lathe with taper attachment.
- 17" x 7" O'Brien Q.C. D.B.G. Engine Lathe with oil pump equipment.
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MISCELLANEOUS

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All-Steel Quick- Change Gear-box	26-in Swing —18-ft. Bed		
	26 " " 16 " "		
3-step Cone— Double Back- Gears	26 " " 14 " "		
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26-48-in. SWING; 12-ft., 22-ft. and 24-ft. Beds in stock.

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J. J. McCabe

149 BROADWAY - NEW YORK

MACHINE TOOLS IN STOCK

- No. 4 Cincinnati Universal Miller with vertical attachment and power feed Rotary Table.
- No. 3 LeBlond Universal Miller.
- No. 1½ NEW American plain Millers.
- 5—No. 0 NEW Steptoe Hand Millers.
- 1 x 15 Pratt & Whitney Screw Machine.
- 28 x 16 Reed Lathe.
- 24 x 10 NEW Carroll-Jamieson heavy duty lathe.
- 20 x 6 Davis lathe.
- 20 x 10 Hamilton lathe.
- 6—19 x 8 NEW, Sidney D.B.G. quick change lathes, swing 21" over V's.
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- 15 x 6 NEW, Sidney D.B.G. quick change lathe, swings 17" over V's.
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- 15 x 6 NEW, Carroll-Jamieson, quick change.
- 48" Harrington plain Radial Drill.
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- 1 Landis No. 3 Universal Grinder
12" x 42", complete equipment, less
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These machines are particularly good value, and may be seen at our works.

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 2-32" Balfords, 1 turret head.
 1-37" Balford, 2 heads.
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 1-42" Bullard, 2 swivel heads, quick change.
 1-42" Bullard, two swivel heads.
 2-10" Niles, 2 swivel heads.
- BORING MACHINES—Horizontal.**
 1-2 1/2" bar, Niles.
 1-No. 2 Barrett, 5" bar.
- BULLDOZERS.**
 1-No. 2 Williams & White, 16" stroke.
 1-No. 4 Ajax, 20" stroke.
 1-No. 9 Williams & White, belt drive.
 1-No. 12 Ajax, single pulley drive.
 2-No. 23 Williams & White, belt drive.
 1-No. 25 Williams & White, belt drive.
 1-No. 29 U Williams & White, arranged for motor drive.
- CRANES—Traveling.**
 1-8-ton Chisholm & Moore, 13 1/2" span, hand power.
 2-10-ton Electric, 47" span, 25" lift, 3 motors.
 1-10-ton Toledo, 3 motors, 30" span.
 1-10-ton Whiting, 48" span, 30" span.
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 3-10-15-ton McAlister Broad gauge Steam Locomotive, 60" boom, bucket, 3 drums.
 1-15-ton Browning, 8-wheel, 38" boom.
 1-15-ton Brown Hoist Locomotive, 36" boom, bucket, 8 wheels.
 1-20-ton Orton & Steinbrenner, steam locomotive 8-wheel, double drum, 37" boom, bucket.
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 1-20-25-ton Industrial, 8 wheel, 50" boom, bucket.
 1-25-35-ton McAlister, 8 wheel, 70" boom, bucket.
- CUTTING-OFF MACHINES.**
 1-4" Hurlburt & Rogers.
 30-4 1/2" Davis.
 10-4 1/2" Williams.
 1-5" Hurlburt & Rogers.
 6-8" Automatic.
- DRILLING MACHINES—Radial.**
 3-NEW 3" Mueller, speed box drive, January del.
 3-NEW 3" American, Sensitive, tapping attachment.
 1-4 1/2" Full Universal, cone drive.
 1-NEW 5" Western Plain, with motor.
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 4-No. 25 Foote-Burt, heavy duty, 2 1/2" capacity.
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 10-Mohr Hole Hogs, heavy duty, 2 1/2" cap.
- DRILLING MACHINES—Sliding Head.**
 2-NEW 25" Cleveland, heavy duty.
 5-NEW 28" Sibley.
 2-NEW 30" Sibley.
 2-NEW 34" Barnes.
- DRILLING MACHINES—Multiple Spindle.**
 1-4-spindle, 30" Barnes, all geared.
 1-No. 5 Fox, 12-spindle, 1 1/2" capacity.
 1-6-spindle Rockford, Economy type.
- GEAR CUTTING MACHINES.**
 1-No. 1 Schuchardt & Schutte Gear Hobber, spur and bevel.
 3-No. 3 Brown & Sharpe Auto Gear Cutter, spur 1" Newark.
 1-36" Whiton, for spur gears.
 2-36" x 9" Gould & Eberhardt, new type, spur gears.
 1-NEW 6" Standard Gear Cutter, spur.
 1-15" Gleason Bevel Gear Planer.
 1-20" Grant-Lees Gear Hobber, bevel spur and spiral attachment.
 1-36" Fellows Gear Shaper.
 1-37" Rhenania Gear Hobber, spur and worm gears.
 2-NEW 36" Flatner, solid pattern.
 1-NEW 37" Gleason Gear Bevel Planer, Feb. delivery.
- 1-72" Gould & Eberhardt, spur and bevel.
GRINDERS—Universal for Cutters, Drills, Reamers, Etc.
 3-NEW No. 190 Wells.
 2-No. 1 Cincinnati.
 1-NEW Gisholt Universal.
 1-NEW Brown, Universal.
 1-NEW Wilmarth & Moran, style B K.
 1-NEW Walker No. 1, outfit B.
 1-NEW Walker No. 2, outfit K, capacity 3" x 20".
 2-NEW No. 2 Oestelman Universal.
- GRINDERS—Cylindrical, Plain.**
 3-NEW 8" x 30" Modern Self-contained.
 2-NEW 10" x 24" Modern Self-contained.
 4-12" x 30" Modern Self-contained.
 2-12" x 42" Landis Self-contained.
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 1-12" x 66" Landis.
 1-NEW 16" x 48" Landis, crank shaft.
- GRINDERS—Cylindrical, Flanged.**
 1-NEW No. 12 Landis, 10 x 40 capacity.

- 1-NEW No. 2 Walker, 9" x 30".
 1-NEW Thompson, 10 x 30".
 1-12 x 30" Cincinnati.
 1-No. 4 Cincinnati; capacity 12 x 72".
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 1-No. 75 Heald.
- GRINDERS—Disc.**
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 1-3" Pratt & Whitney Vertical, Magnetic Chuck.
 12-Carriage type, mag. chuck.
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 3-30-lb. McWilliams.
 1-No. 4 Standard Machinery Co., 400-lb.
 1-50 W Bliss, 800-lb.
 1-1500-lb. Toledo.
 1-3000-lb. Williams & White.
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 1-600-lb. Niles, single frame.
 1-1000-lb. Niles.
 1-7500-lb. Morgan Special Double Stand.
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 1-No. 1 Catlin.
 1-Columb 47", capacity 43" stroke.
 1-No. 2 Knowles, 60" stroke.
- LATHES—Manufacturing, not Screw Cutting**
 2-NEW No. 3 Harding Brothers, Bench Lathes.
 1-16" x 6" Prentiss, gearsl head, quick change, taper attach.
 70-NEW Simplex 16" x 8".
 14-Reed-Prentice Shell Lathes for 4" or 18-lb. American Shells.
- LATHES—Engine.**
 3-NEW 16" x 6" Cleveland Tool Room Lathes, complete equipment.
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 12-NEW 17" x 8" LeBlond Pan Bed, Quick Change Gears.
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 7-22" x 10" Putnam, oil pan and pump.
 1-NEW 24" x 10" American, high duty, quick change.
 2-24" x 10" Lodge & Shipley, quick change.
 1-24" x 10" Schumacher & Bore, quick change, taper attachment.
 1-NEW 26" x 18" x 12" McCabe Double Spindle.
 1-NEW 26" x 48" x 22" McCabe Double Spindle.
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 1-81" x 18" Special Purpose Lathes.
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 8-NEW 21" Gisholt H-2.
 2-21" Gisholt, 18" chuck, quick traverse taper attachment.
 5-21" x 24" Jones & Lamson.
 1-NEW 18" Libby.
 3-24" Libbey, Universal Facing Head, 3-jaw chuck.
 18-24" Potter & Johnson.
 1-NEW 34" x 12" Greenlee.
 1-34" Brown & Sharpe Vertical chucking mach.
 1-42" Davis.
 1-No. 4 New Britain arranged for motor drive, almost new.
- MILLING MACHINES—Knee Type, Universal**
 1-No. 2 Kempsmith, Vertical Attachment.
 1-No. 2 Kempsmith 13" Dividing Head.
 1-NEW No. 2 Kempsmith.
 1-No. 1 1/2 Cincinnati.
 1-NEW No. 2 Rockford High Power.
 1-NEW No. 2 Garvin.
 1-No. 2 Cincinnati.

- 1-No. 2 LeBlond.
 1-NEW No. 3 Cincinnati High Power, Jan. del.
 1-NEW No. 3 Kempsmith.
 1-No. 25 Oestelman.
 1-NEW No. 34 Oestelman Heavy Duty, latest type.
- MILLING MACHINES—Knee Type, Plain.**
 1-No. 0 Cincinnati.
 1-NEW No. 2B Brown & Sharpe, heavy type.
 1-NEW No. 2 Rockford.
 1-No. 2 Cincinnati.
 1-No. 3 Cincinnati, single pulley drive.
 1-No. 5 LeBlond.
 1-NEW No. 3 Cincinnati.
 2-No. 3 Kempsmith.
 1-No. 15 Garvin.
- MILLING MACHINES—Thread**
 4-Morris-Thompson, arranged for motor drive.
 5-No. 5 Lutz Radner.
 5-No. 3C Lees-Bradner, for 9.2" English shells.
 2-Archdale, Taft, Pierce, for 6" English shells.
- MILLING MACHINES—Hand**
 1-No. 1 Bickett.
 1-NEW No. 2 Pratt & Whitney.
 1-NEW No. 3 Garvin.
 1-NEW Becker, table 20" x 5 1/2".
- MILLING MACHINES—Vertical**
 1-No. 2 Cincinnati, latest type with circular table, as good as new.
 1-No. 2 Pratt & Whitney.
 1-No. 3 Cincinnati Heavy Duty.
 1-No. 3 Ingersoll.
 1-NEW No. 4B Becker.
 1-NEW No. 5B Becker, Rotary Table.
 1-New on Vertical, Continuous, Motor Driven, for shell work.
- MILLING MACHINES—Planer Type**
 1-No. 2 Beaman & Smith.
 1-Ingersoll Slab Bed, 48" capacity.
 1-NEW 17" x 5" Eason Planer Type.
 1-22" x 22" x 5" Ingersoll.
 1-24" x 24" x 12" Bument & Niles.
 1-30" x 30" x 8" Ingersoll No. 98, Single Spindle with Motor.
- MILLING MACHINES—Lincoln Type.**
 2-Briggs type, high duty.
 3-NEW No. 4 Sterling.
 14-No. 7 Becker.
- PLANERS.**
 1-24" x 12" Detrich & Harvey, open side, one head also milling attachment.
 1-25" x 8" Detrich & Harvey, open side, good as new, one head.
 1-27" x 22" x 10" Gray, one head.
 1-30" x 30" x 10" American; 2 Heads.
 1-32" x 30" x 12" Detrich & Harvey, open side, 2 heads.
 1-36" x 36" x 14" Pond, one head.
 1-36" Rotary Planer, Motor Driven.
 1-36" x 28" x 8" Gray, One Head.
 1-42" x 36" x 14" American, 2 heads.
 1-42" x 42" x 12" Butler, high speed 3 heads, almost new.
 1-48" x 48" x 12" Scott, Heavy Type, Milling Attachment, on Rail.
 1-60" x 60" x 16" Bots, 2 Heads.
 1-60" x 60" x 21" Pond, 3 Heads.
 1-62" x 62" x 20" Canada Tool Works Planer; 2 Heads.
 1-72" x 60" x 14" Smith Globe; 2 Swivel Head.
- PUNCH AND SHEARS.**
 1-Waterbury-Farnell Alligator Shears, cap. 2 1/2".
 1-Cincinnati Gap Shears, 17" gap, 78" blade, 1/2" capacity.
 1-No. 411-G Toledo Squaring Shears, capacity 97", weight 12,600 lbs.
 1-Cleveland Punching Shear, 36" throat, capacity 1 1/2" x 1 1/2".
 1-Providence Steam-driven Punch, 48" throat, cap. 3" through 1 1/2", almost new.
- SCREW MACHINES—Hand.**
 2-No. 0 Brown & Sharpe.
 1-1" Pierce.
 16-NEW No. 2 Owens Kent, wire feed, automatic chuck, 1 1/4" capacity.
 4-20" Cincinnati Acme, friction geared head.
- SCREW MACHINES—Automatic**
 2-NEW 8" Cleveland, Model A.
 3-14" Cleveland, Model B, full auto.
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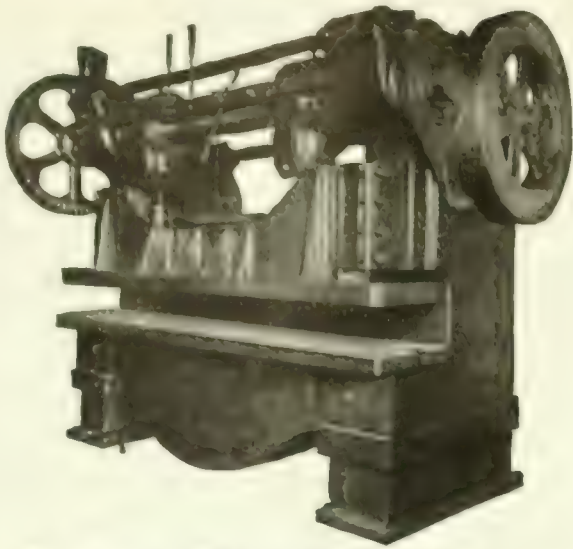
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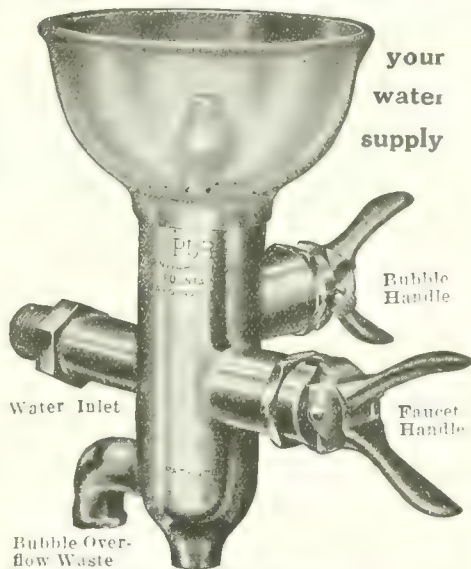
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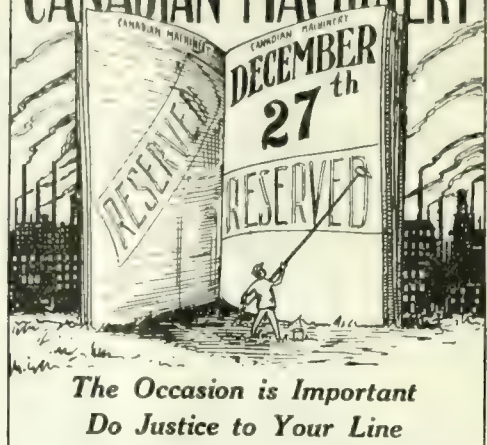
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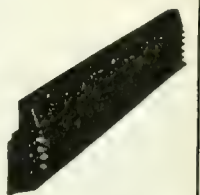
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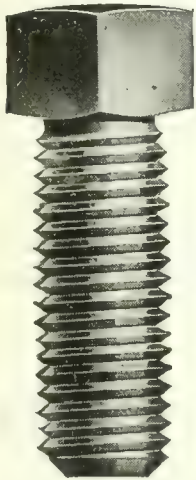
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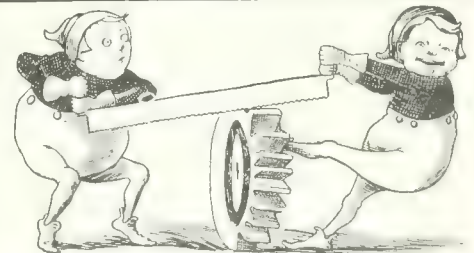
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Your second-hand machinery.
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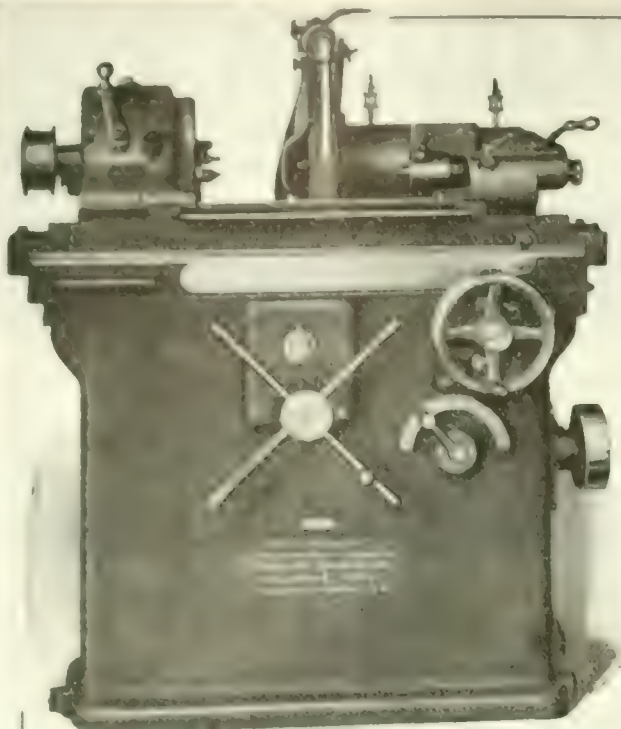


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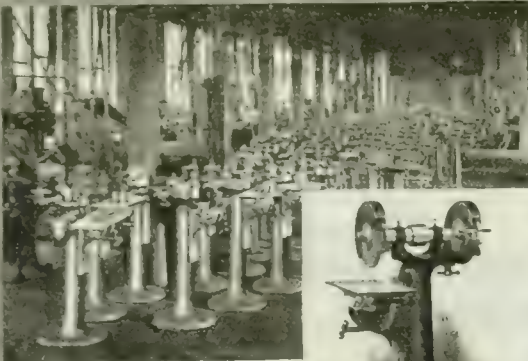
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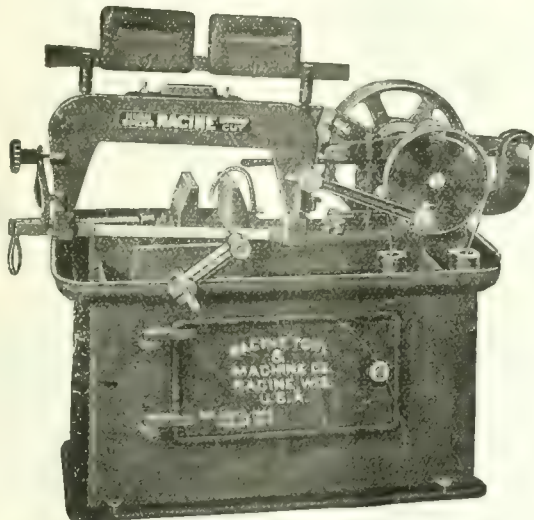
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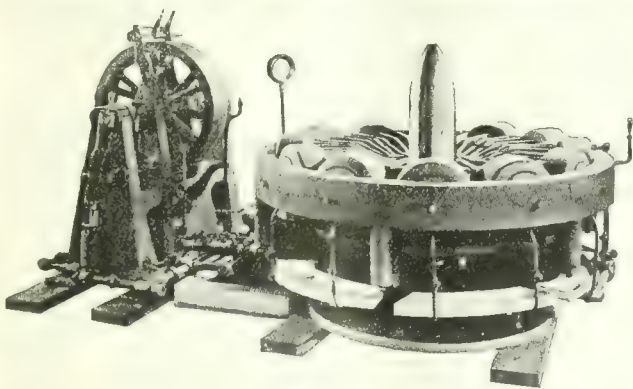
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For 9.2" and 8" shells

12 Cylinders; Ample Power; Ample Strength; Reasonable Price.

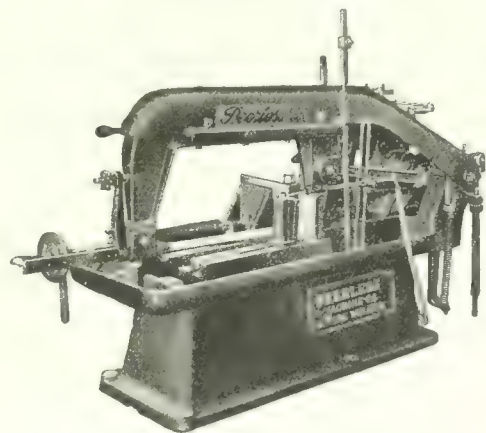
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Then don't expect your men to file with blunt files.

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That costs *you* money any way you look at it.

Give your men "Famous Five" files to work with, and you'll get good results; because "Famous Five" files are hard, sharp and retain their keen cutting qualities for the longest time.

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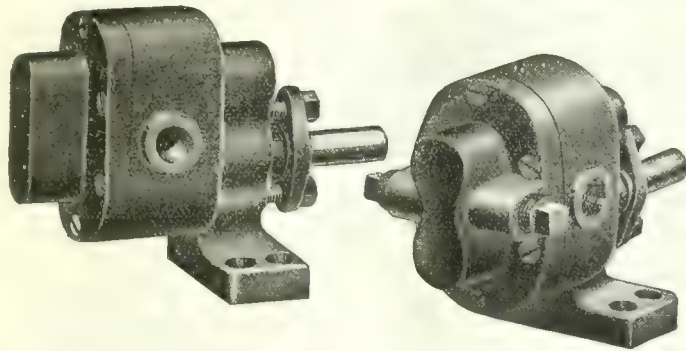
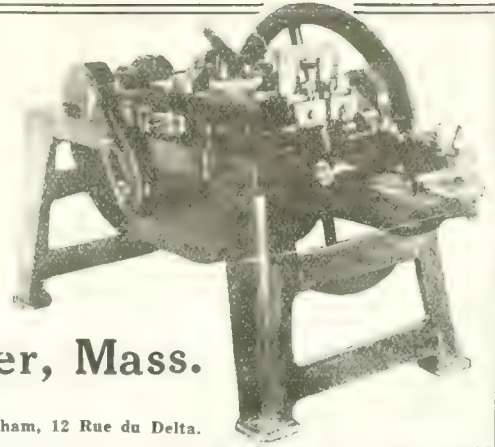
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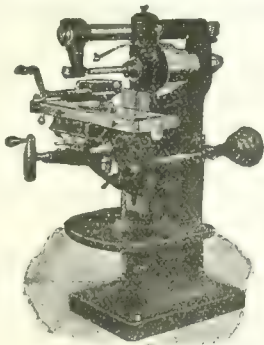
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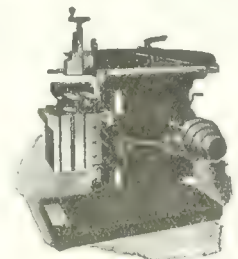
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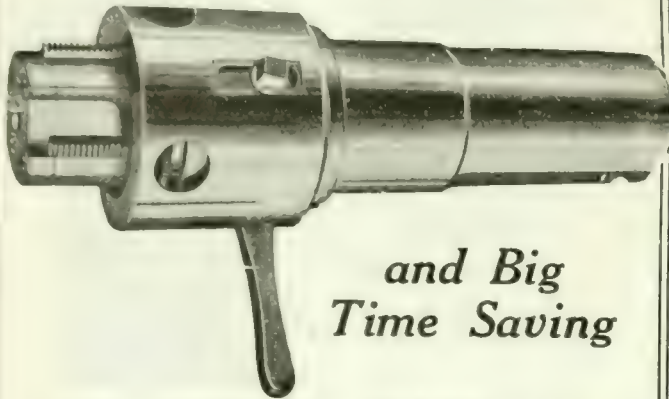
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For Positive Accuracy—



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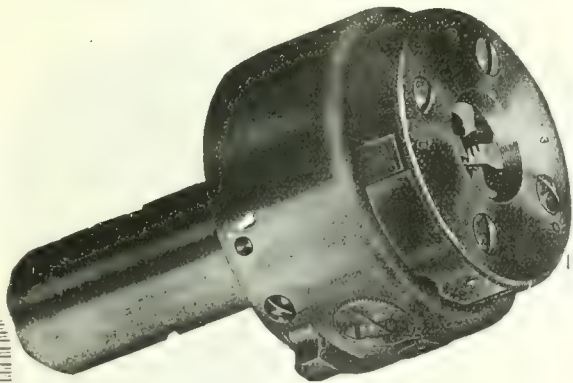
The ordinary line shafting consumes from 15 to 60 % of power developed—

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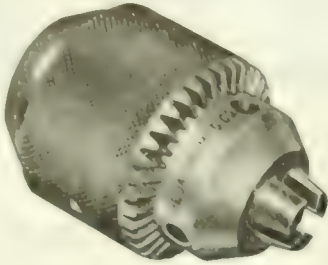
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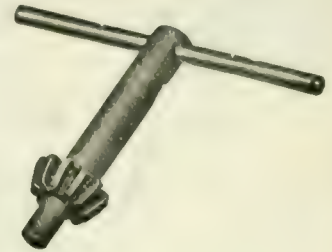
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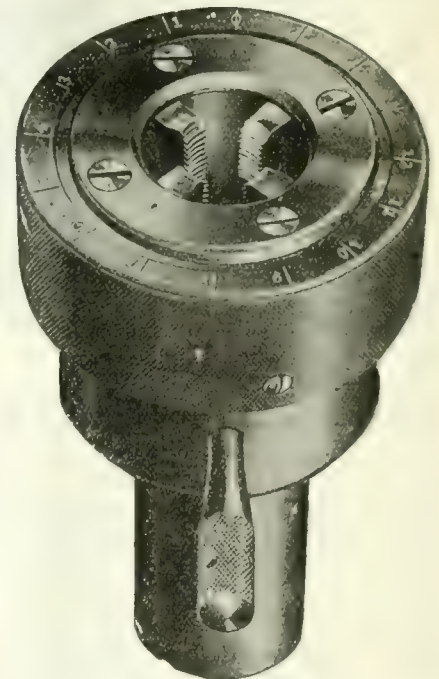
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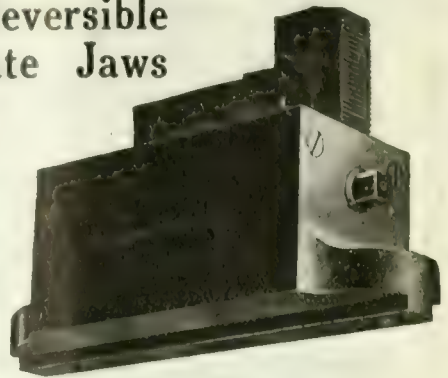
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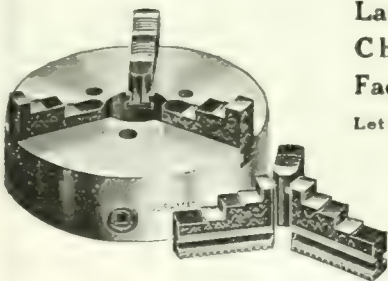
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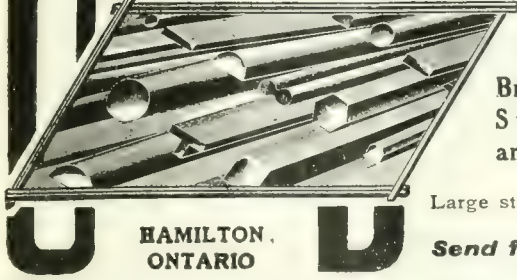
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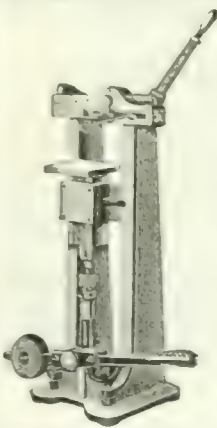
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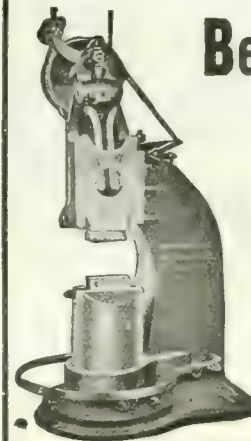
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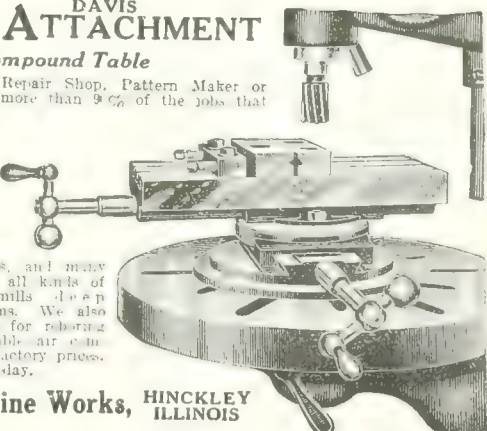
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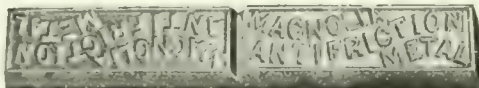
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Cunning & Son, J. W., New Glasgow, Canada
Galt Machine Screw Co., Galt, Ont.
London Bolt & Hinge Works, London, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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

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Landis Machine Co., Waynesboro, Pa.
Victor Tool Co., Waynesboro, Pa.

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Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
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Stow Mfg. Co., Binghamton, N.Y.

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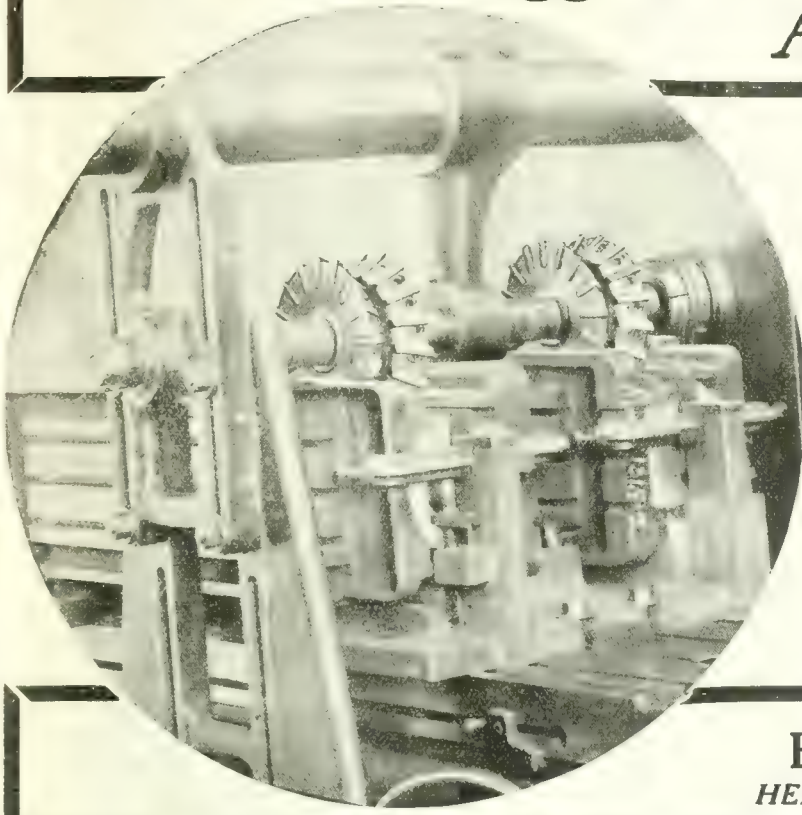
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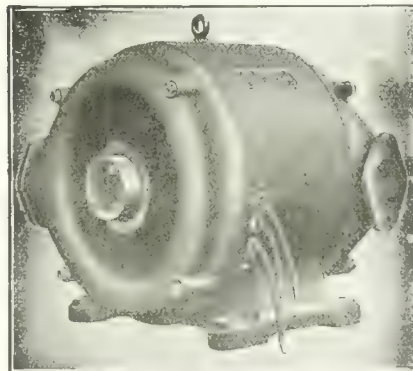
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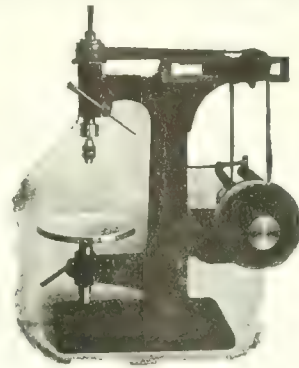
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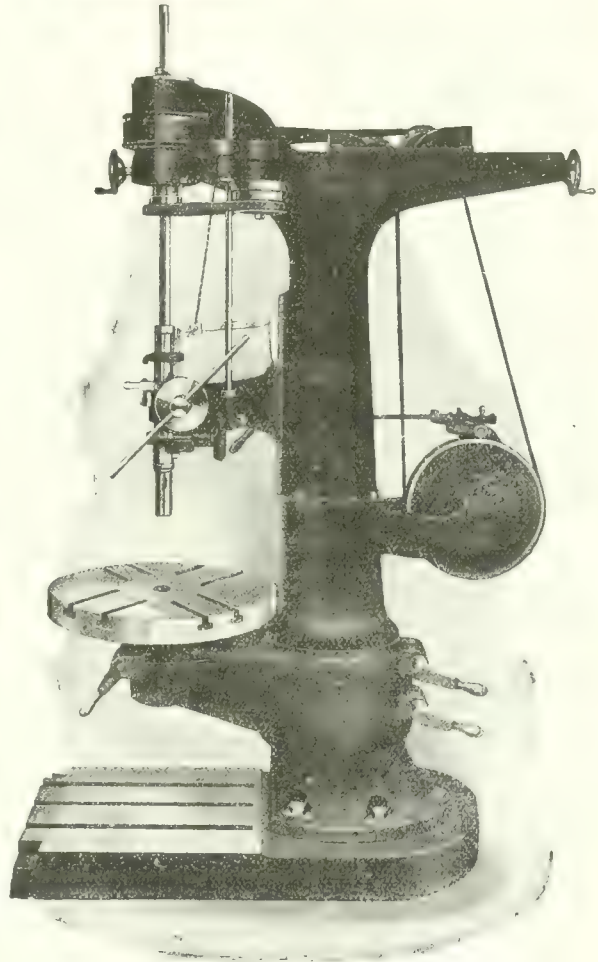
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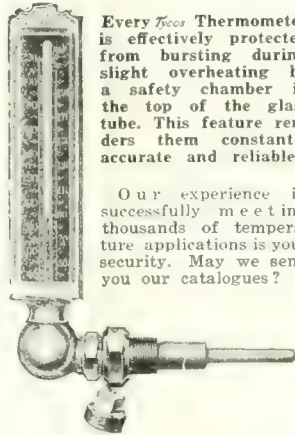
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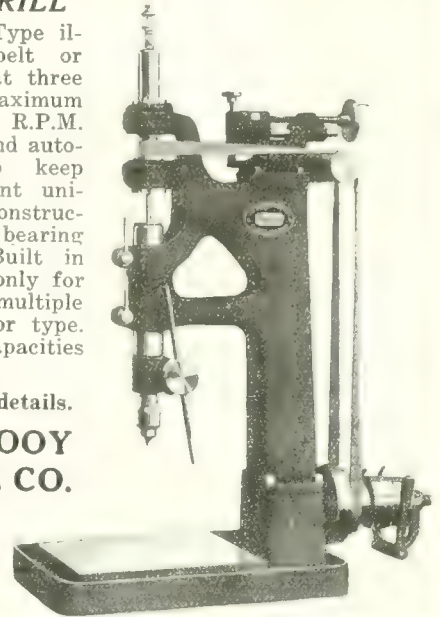
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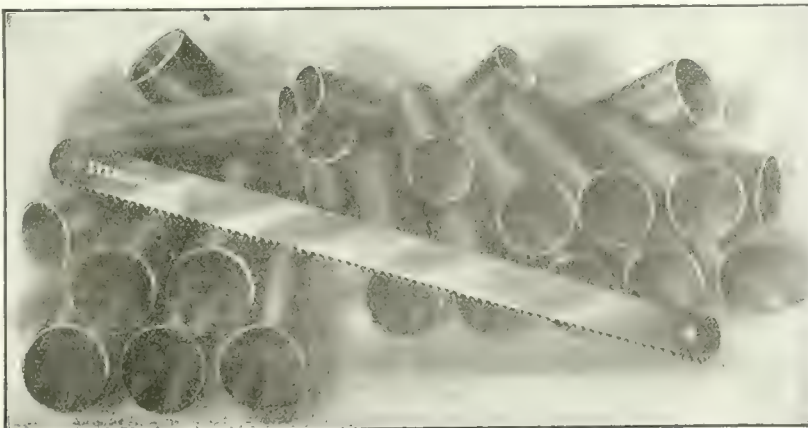
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A SNIPER is back in Canada—a star sniper, who has 34 marks on his rifle, every mark meaning a German life. Most of us know absolutely nothing of the work of the sniper, but the story—a remarkable one—is told in the Christmas (December) MACLEAN'S by the champion sniper of the Canadian Expeditionary Forces. This man was buried by a shell-explosion, was dug out by two comrades, and has lived to tell his wonderful story, in MACLEAN'S. It's worth 15c to get this story alone.

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TRUST Leacock to see a chance for his witty and humorous pen. He deals with the humorous phases of electioneering in Canada in his usual vein.

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THIS contribution, by Col. John Bayne Maclean, goes backward many years—to the time of the South African War in 1899-1900. That was when Canada first took up arms for the Empire. Politics, of a high order, was back of the decision to send Canadian troops to the Antipodes. It is “inside” history.

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Robt. W. Service is back again

BACK in MACLEAN'S, that is—in body, he is still in Flanders—where the fighting grows uglier all the time. Service has taken time to write verse for MACLEAN'S. You know well the virility of his style, and the gripping, human character of his verse. It is about life and men in the trenches he writes—about our boys far from us. It is worth something to see our boys as Service sees them. Read “The Shape at the Wheel” in the December MACLEAN'S.

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STRINGER is a wonderful man—wonderfully versatile, wonderfully human. He is a master of the short-story and of the detective and mystery type of story; and he can climb the heights of literary endeavor, as he has in this passing sweet poem—Christmas Bells in War-time. Your heart is tender these times of horrible slaughter and of heroic achievement, and you'll be grateful to Stringer for putting beautifully your innermost thoughts and feelings.

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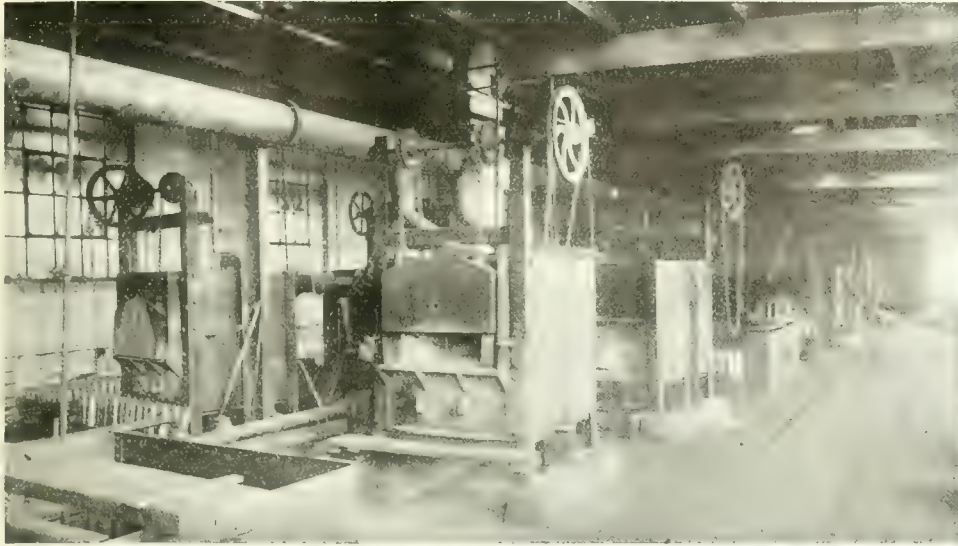
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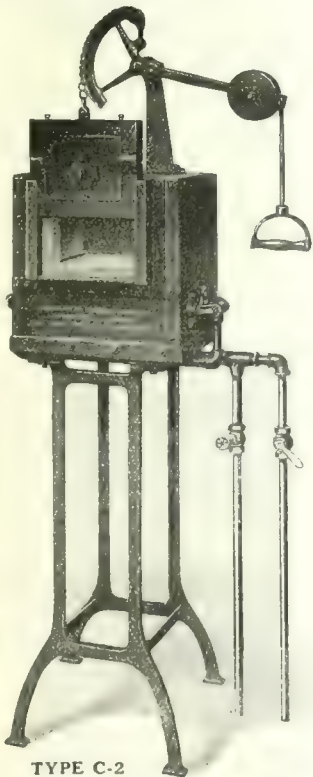


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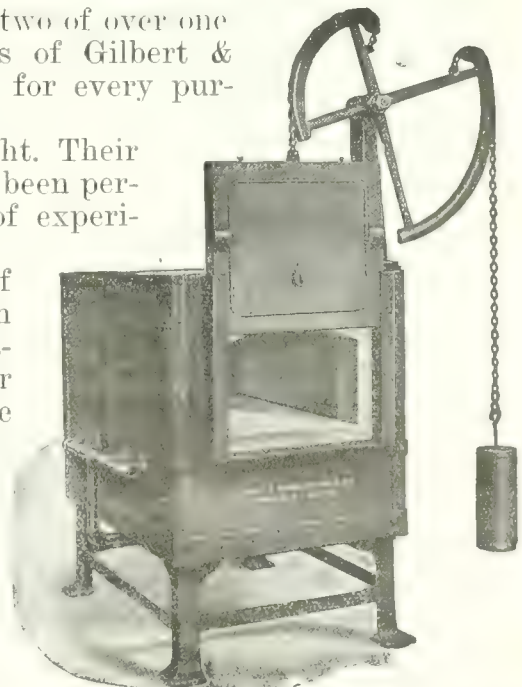
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Green Machine Co., New York.

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Eaton Co., W. W. Toronto, Ont.
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Osborn (Canada), Ltd., Sam'l., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
H. E. Strueter, New York Bldg., Montreal, Que.
Whitman & Business Mfg. Co., St. Catharines, Ont.

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Butterfield & Co., Rock Island, Que.
Eaton, W. F. & John Co., Rockford, Ill.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland, Ill.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, PIPE, CYLINDER AND LOCOMOTIVE
Butterfield & Co., Rock Island, Que.
Eaton, W. F. & John Co., Rockford, Ill.
Cleveland Twist Drill Co., Cleveland, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Eaton, W. F. & John Co., Rockford, Ill.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland, Ill.
Illinois Tool Works, Chicago, Ill.
A. B. Janine & Co., Hespeler, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.

REAMING MACHINES, PNEUMATIC
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Garlock-Walker Machinery Co., Toronto, Ont.

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

REGULATORS, PRESSURE, TEMPERATURE
Eaton, W. F. & John Co., Rockford, Ill.
Taylor Instrument Co., Rochester, N.Y.

RFSPRATORS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

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Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Grant Mfg. & Machine Co., Bridgeport, Conn.
National Machinery Co., Tiffin, O.

RIVETS, TUBULAR, BIFURCATED
Farmer & Bulloch Co., Gananogue, Steel Co. of Canada Ltd., Hamilton, Ont.

RIVETS, IRON, COPPER AND BRASS
Aikenhead Hardware Co., Toronto, Ont.
Farmer & Bulloch Co., Gananogue, Steel Co. of Canada Ltd., Hamilton, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Eaton, W. F. & John Co., Rockford, Ill.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York City, Ltd., H. W. Toronto, Ont.

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Grant Mfg. & Machine Co., Bridgeport, Conn.
High-Speed Hammer Co., Rochester, N.Y.
F. B. Shuster Co., New Haven, Conn.

ROLLER CHAINS
Jones & Glasse, Montreal.

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Brown, Boggs Co., Ltd., Hamilton, Canada.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo, O.

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RUBBER MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland

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

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Strong, Kennard & Nutt Co., Cleveland, Ohio.

SAFETY APPLIANCE GOGGLES
T. A. Wilson, Reading, Pa.

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

SANDING MACHINES
Canada Machinery Corp., Galt, Ont.

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Eaton, W. F. & John Co., Rockford, Ill.
Canada Machinery Corp., Galt, Ont.
Gardner, Robt., & Son, Montreal.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Petrie, Ltd., H. W. Toronto, Ont.
Petrie of Montreal Ltd., H. W. Montreal, Que.

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Naper Saw Works, Springfield, Mass.
Taber Mfg. Co., Philadelphia, Pa.

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SAWS, INSERTED TOOTH
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Naper Saw Works, Springfield, Mass.
Taber Mfg. Co., Philadelphia, Pa.

SAWS, BAND AND COPING
Naper Saw Works, Springfield, Mass.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York City
H. E. Strueter, New York Bldg., Montreal, Que.

SCREW MACHINE PARTS
Johnson Mach. Co., Dryden, Manchester, Conn.

SCREW MACHINE PRODUCTS
Eaton, W. F. & John Co., Rockford, Ill.
Eastern Mach. Screw Corp., New Haven, Conn.

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R.I.
Eaton, W. F. & John Co., Rockford, Ill.
Eaton, L. E. & Co., Hamilton, Ont.
Eaton, W. F. & John Co., Rockford, Ill.
Eaton Co., W. W. Toronto, Ont.
Eaton, L. E. & Co., Hamilton, Ont.
W. H. Phipps Ltd., Toronto.

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Riverside Machinery Depot, Detroit, Mich.

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Can. B. K. Morton, Toronto, Montreal
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio
Steel Co. of Canada, Ltd., Hamilton, Ont.
Wilkinson & Kompas, Hamilton, Ont.

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Butterfield & Co., Rock Island, Que.
A. B. Janine & Co., Hespeler
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wells Bros. Co. of Canada, Galt, Ont.
Wilkinson & Kompas, Hamilton, Ont.

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

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Davis Machine Tool Co., W. E., New York
Dominion Machinery Co., Toronto
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Hill, Clarke & Co., Chicago, Ill.
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New York Machinery Exchange, New York
Petrie, Ltd., H. W. Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Strelinger Co., Chas. A., Detroit, Mich.
Stocker-Rumely-Wachs, Chicago, Ill.

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Aikenhead Hardware Co., Toronto, Ont.
Allen Mfg. Co., Hartford, Conn.
Wilkinson & Kompas, Hamilton, Ont.

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

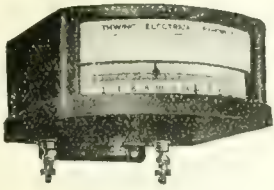
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Eaton, W. F. & John Co., Rockford, Ill.
Canada Machinery Corp., Galt, Ont.
The Geo. F. Foss Mch. & Supply Co., Montreal
Gardner, Robt., & Son, Montreal
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton, Ohio
Petrie, Ltd., H. W. Toronto, Ont.
Petrie of Montreal Ltd., H. W. Montreal, Que.
Rhodes Mfg. Co., Hartford, Conn.
Stephens Co., John, Cincinnati, Ohio

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Eaton, W. F. & John Co., Rockford, Ill.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Ltd., Toronto, Ont.
The Jencks Mach. Co., Ltd., Sherbrooke, Que.
Jones & Glasse, Montreal.
Niles-Bement-Pond Co., New York
Petrie, Ltd., H. W. Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sterling Engine Works, Wynnepex, Man.
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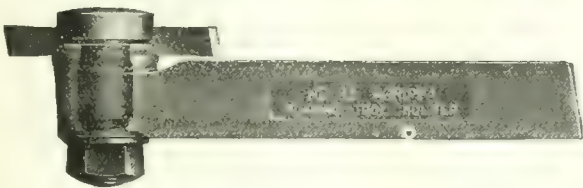
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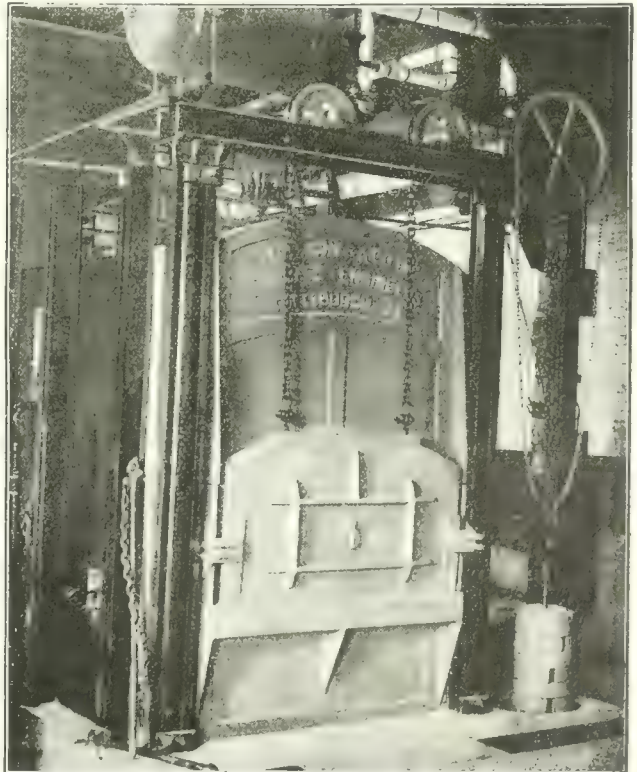
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 Niles-Bement-Pond Co., New York.
 Rhodes Mfg. Co., Hartford, Conn.

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 Keystone Mfg. Co., Buffalo, N.Y.
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 Morse Twist Drill & Mch. Co., New Bedford, Mass.
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 Tomp Forge & Stamping Co., Walkerville, Ont.
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 Ferracuta Mach. Co., Bridgeton, N.J.
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 Can. Fairbanks-Morse Co., Montreal.
 Sheltons, Ltd., Galt, Ont.
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 Can. B. K. Morton, Toronto, Montreal.
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 Colonial Steel Co., Pittsburgh, Pa.
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 Eagle & Globe Steel Co., Montreal, Que.
 Fairley Davidson Steel Co., New York, N.Y.
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 Latrobe Electric Steel Co., Latrobe, Pa.
 Marshall & Co., Galt, A. Toronto, Ont.
 Osborn (Canada), Ltd., Sam'l, Montreal, Que.
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 St. Lawrence Welding Co., Montreal, Que.
 Toronto Iron Works, Ltd., Toronto.

TANK WAGONS

Jencks Mach. Co., Sherbrooke, Que.
 MacKinnon, Holmes & Co., Sherbrooke, Que.
 St. Lawrence Welding Co., Montreal, Que.
 Toronto Iron Works, Ltd., Toronto.

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 J. H. Hall & Sons, Brantford, Ont.
 A. B. Jardine & Co., Hespler, Ont.
 Landis Machine Co., Waynesboro, Pa.
 Manufacturers Equipment Co., Chicago, Ill.
 Modern Tool Co., Erie, Pa.
 Murchey Machine & Tool Co., Detroit.
 Niles-Bement-Pond Co., New York
 Petrie Ltd., H. W., Toronto, Ont.
 Petrie of Montreal, Ltd., H. W., Montreal, Que.
 Rickert-Shafer Co., Erie, Pa.
 L. S. Starrett Co., Athol, Mass.
 Whitney Mfg. Co., Hartford, Conn.

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 Butterfield & Co., Rock Island, Que.
 Geometric Tool Co., New Haven.
 Manufacturers Equipment Co., Chicago, Ill.
 Murchey Machine & Tool Co., Detroit.
 National Acme Co., Cleveland, Ohio.
 Osborn (Canada), Ltd., Sam'l, Montreal, Que.

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Butterfield & Co., Rock Island, Que.
 Geometric Tool Co., New Haven.
 Manufacturers Equipment Co., Chicago, Ill.
 Murchey Machine & Tool Co., Detroit.
 National Acme Co., Cleveland, Ohio.
 Osborn (Canada), Ltd., Sam'l, Montreal, Que.
 Victor Tool Co., Waynesboro, Pa.

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 Can. Fairbanks-Morse Co., Montreal.
 Cleveland Twist Drill Co., Cleveland.
 The Geo. F. Ross Mch. & Supply Co., Montreal.
 Geometric Tool Co., New Haven.
 A. B. Jardine & Co., Hespler, Ont.
 Landis Machine Co., Waynesboro, Pa.
 Morse Twist Drill & Mch. Co., New Bedford, Mass.
 Murchey Machine & Tool Co., Detroit.
 Osborn (Canada), Ltd., Sam'l, Montreal, Que.
 Petrie, Ltd., H. W., Toronto, Ont.
 Pratt & Whitney Co., Dundas, Ont.
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 Geometric Tool Co., New Haven.
 Landis Machine Co., Waynesboro, Pa.
 National Acme Co., Cleveland, Ohio.
 National Mach. Co., Tiffin, Ohio.
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Deloro Smelting & Refining Co., Toronto, Ont.

H. A. Drury Co., Montreal.

Eagle & Globe Steel Co., Montreal, Que.

Hawkridge Bros. Co., Boston, Mass.

Latrobe Electric Steel Co., Latrobe, Pa.

Marshall & Sons, A. Philadelphia, Pa.

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

Sleeper & Hartley, Inc., Worcester, Mass.

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Vulcan Crucible Steel Co., Alliquippa, Pa.

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

Garlock-Walker Machinery Co., Toronto, Ont.

Independent Pneumatic Tool Co., Chicago, Ill.

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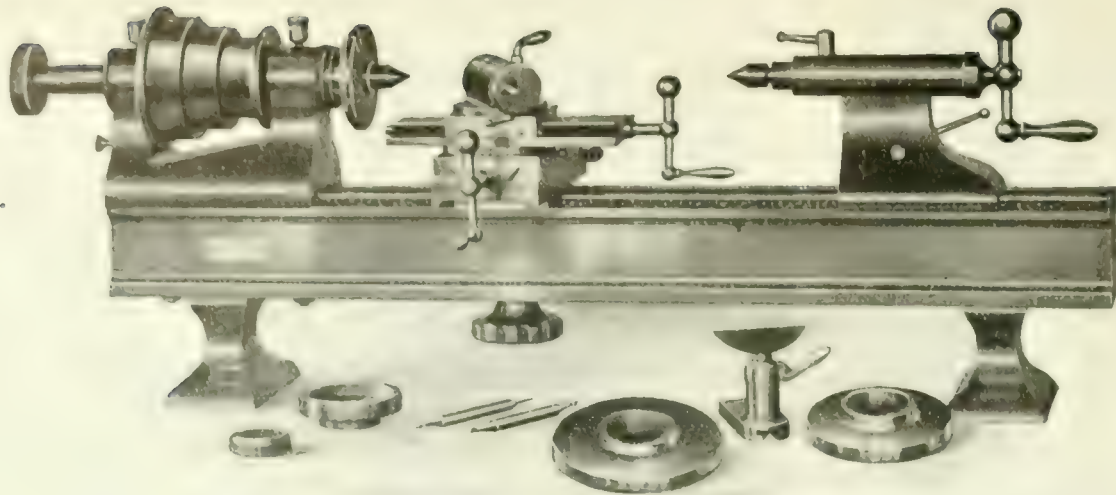
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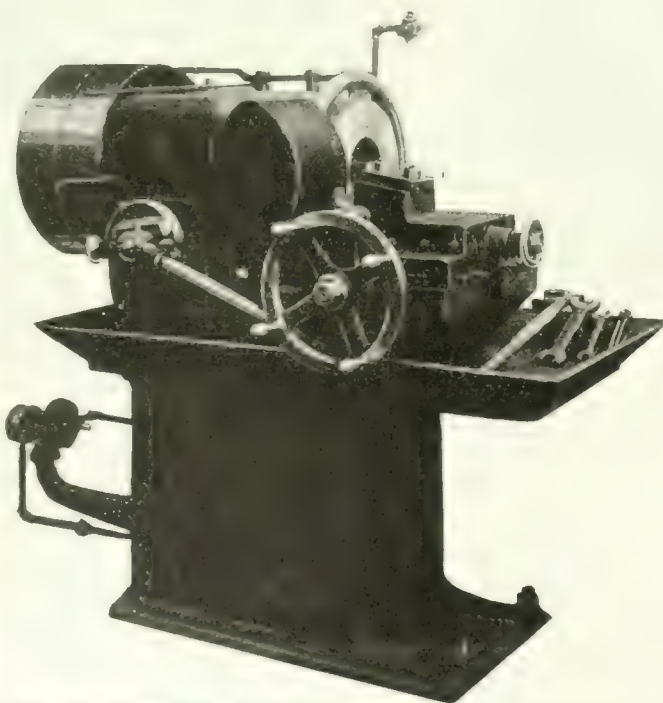
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A weekly newspaper devoted to the machinery and manufacturing interests.

Vol. XVIII.

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No. 24

EDITORIAL CONTENTS

NOTES ON MACHINING OPERATIONS ON 75-MM. U.S. H.E. SHELL	643-646
GENERAL	646-647
Man Power Biggest Factor in Industry... Washington Distributes War Orders... Twenty-First Annual Meeting of National Founders' Association... More Fuel Oil for Steamers... Recent Developments in Potash Production.	
HEAT TREATING AND ANNEALING FURNACE WITH OIL FUEL EQUIPMENT..	648-650
GENERAL	650
The Cost of Leaking Steam... Bronze Finished Buttons.	
PRODUCTION METHODS AND DEVICES	651-654
Special Grinding Attachment... Safety-Collar for Exposed Shaft Ends... Manufac- ture of Hardened Thread Gauges—IV.	
GENERAL	654
Effort to Conserve Fuel Supply... Board to Handle Export Steel Traffic in U.S... Electrically-Controlled Motor Boats... "Hush" Ships Described.	
PROGRESS IN NEW EQUIPMENT	655-656
Hydraulic Test Press for 75-mm. Shells... Excess Electric Power Converted Into Steam.	
EDITORIAL	657
Is Engineering Ability Appreciated at its True Worth?	
SELECTED MARKET QUOTATIONS	658-659
THE GENERAL MARKET CONDITION AND TENDENCY	659-664
Summary... Montreal Letter... Toronto Letter... Pittsburgh Letter.	
INDUSTRIAL AND CONSTRUCTION NEWS	665-666

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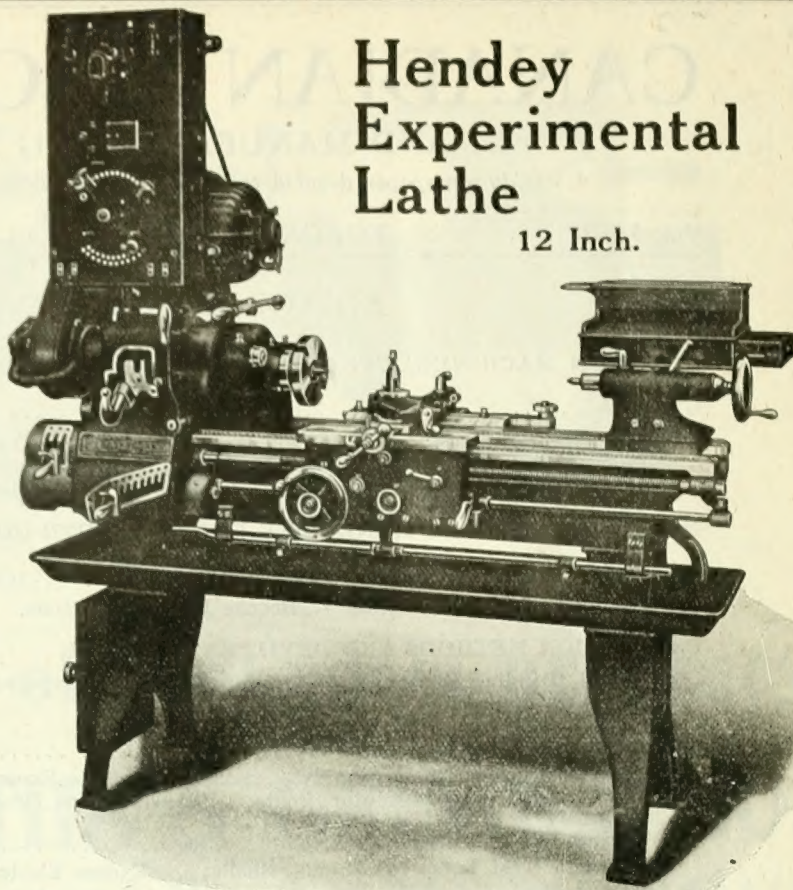
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INDEX TO ADVERTISERS

A	Diamond Saw & Stamping Works.. 33	K	Rockford Drilling Mach. Co. 23
Aikenhead Hardware, Ltd. 63	Dixon, C. L. 84	King Construction Co. 72	Roclofson Machine & Tool Co. 21
Allen Mfg. Co. 83	Dominion Central Drawing Office.. 84	L	Roper & Co., C. F. 77
Armstrong Bros. Tool Co. 83	Dominion Iron & Wrecking Co. 22	L'Air Liquide Society 24	S
Armstrong, Whitworth of Canada... 10	Dominion Machinery Co. 65	Lancashire Dynamo & Motor Co... 89	Shore Instrument & Mfg. Co. 83
Atkins & Co., Ltd., Wm. 15	Dominion Steel Foundry Co. 82	Landis Machine Co. 72	Shuster Co., F. B. 85
Aurora Tool Works 23	Drury Co., H. A. 6	Latrobe Electric Steel Co. 6	Silver Mfg. Co. 83
B	E	M	Skinner Chuck Co. 82
Baird Machine Co. 84	Eagle & Globe Steel Co. 10	MacNab Machy. Co., John 19	Sleeper & Hartley, Inc. 77
Banfield & Sons, W. H. 62	Eastern Machine Screw Corp. 79	Magnolia Metal Co. 86	Smith Mfg. Co., Philip 26
Banfield, Edwin J. 14	Elmes Engr. Works, Charles F. 16	Manitoba Bridge & Iron Works... 67	Standard Alloys Co. 9
Barnes Co., W. F., & John 23	Eric Foundry Co. 16	Manufacturers Equipment Co. 78	Standard Machy. & Supplies, Ltd. 91
Barnes Co., Wallace 71	Embree, Ira 84	Marion & Marion 71	Starrett Co., L. S. 25
Beaudry & Co., Inc. 84	F	Marsh & Henthorn, Ltd. 70	Steel Co. of Canada 3
Bertram, John, & Sons Co., Ltd. 1	Federal Engineering Co., Ltd. 59	McCabe, J. J., & Co., Inc. 68	Steeple, John, Co. 77
Bertrams, Ltd. 59	Fetherstonhaugh & Co. 71	McCoy-Brandt Machy. Co. 66	Sterling Engine Works 20
Bilton Mach. Tool Co. 18	Fitchburg Grinding & Mach. Co. 74	McDougall Co., R. Inside back cover	Stocker-Rumely-Wachs Co. 67
Blake & Johnson 74	Foss Machinery & Supply Co., The Geo. P. Inside back cover	McLaren, J. C., Belting Co. 85	St. Lawrence Welding Co. 78
Blashill Wire Mach. Co. 83	G	Mechanical Engineering Co. 97	Stow Mfg. Co. 74
Bliss Co., E. W. 17	Galt Machine Screw Co., Ltd. 73	Metalwood Mfg. Co. 17	Strelinger Co., Chas. A. 67
Blount & Co., J. G. 93	Gardner Machine Co. 33	Monarch Brass Mfg. Co. 72	Strong, Kennard & Nutt Co., The. 83
Brantford Oven & Rack Co. 59	Garlock-Walker Machy. Co. 19	Montreal General Tool Co. 28	Swedish Crucible Steel Co. 85
Bridgeford Mach. & Tool Works... 82	Garvin Machine Co. 18	Morton Mfg. Co. 71	Swedish Steel & Importing Co. 11
Bristol Company 83	General Supply Co. of Canada. 56	Murchey Machine & Tool Co. 80	T
Brownell Machy. Co. 64	Geometric Tool Co. 61	N	Tabor Mfg. Co. 85
Brown's Copper & Brass Rolling Mills 29	Gilbert & Barker Mfg. Co. 97	Napier Saw Works, Inc. 86	Tate-Jones & Co., Inc. 69
Brown & Sharpe Mfg. Co. 89	Gooley & Edlund, Inc. 26	Nicholson File 79	Taylor Instrument Co. 93
Budden, Hanbury A. 89	Grant Gear Works, Inc. 72	Niles-Bement-Pond, Inside front cover	Thwing Instrument Co. 99
C	Grant Mfg. & Machine Co. 27	Noble & Westbrook 84	Toledo Machine & Tool Co. 17
Canada Machinery Corporation Outside back cover	Greenfield Conduit Co. 70	Normac Machine Co. 71	Toronto Iron Works 82
Canada Metal Co. 78	Greenfield Machine Co. 86	Norton Crane Works 82	Toronto Testing Laboratory, Ltd. 86
Canada Wire & Iron Goods Co. 59	H	Norton, A. O. 84	Toomey, Inc., Frank 68
Canadian Barker Co. 72	Hamilton Gear & Machine Co. 76	Norton Co. 30	U
Can. B. K. Morton Co. 20	Hanna & Co., M. A. 10	Norton Grinding Co. 81	Union Drawn Steel Co. 83
Can. Fairbanks-Morse Co. 34	Hannifin Mfg. Co. 81	Nova Scotia Steel & Coal Co. 12	Union Tool Chest Works 83
Can. Drawn Steel Co. 86	Hawkridge Bros. 71	O	United Brass & Lead, Ltd. 83
Can. Inspection & Testing Laboratories, Ltd. 82	Hendey Machine Co. 104	Osborn (Canada), Ltd., Sam'l. 12	United States Electrical Tool Co. 32
Can. Laco-Philips Co., Ltd. 77	Henry & Wright Mfg. Co. 22	Oven Equipment & Mfg. Co. 101	V
Can. Steel Foundries, Ltd. 7	Heppburn, John T. 11	P	Vanadium-Alloys Steel 11
Can. S K F Co., Ltd. Front cover and page 4	Hinckley Mach. Works 85	Parmenter & Bulloch Co. 86	Victor Tool Co. 78
Carlyle Johnson Mach. Co. 8	Hoyle Metal Co. 86	Peerless Machine Co. 75	Victoria Foundry Co., Ltd. 78
Chapman Double Ball Bearing Co. 79	Hunter Saw & Machine Co. 59	Perrin, Wm. R. 17	Vulcan Crucible Steel Co. 6
Cincinnati Pulley Machy. Co. 91	Hurlbut-Rogers Machinery Co. 24	Petrie, H. W., Ltd. 65	W
Classified Advertising 64	Hyde Engineering Co. 7	Plessisville Foundry 27	Wells Bros. Co. of Canada 32
Clipper Belt Lacer Co. 79	I	Port Hope File Mfg. Co. 32	West Tire Setter Co. 75
Colonial Steel Co. 15	Independent Pneumatic Tool Co. 22	Positive Clutch & Pulley Works... 66	Whitcomb-Blaisdell Mach. Tool Co. 14
Curtis & Curtis Co. 26	Iron Works, The 71	Pratt & Letchwork Co. 7	Whiting Foundry Equipment Co. 54
Cushman Chuck Co. 82	J	Pratt & Whitney, Inside front cover	Wilkinson & Kompas 85
D	Jacobs Mfg. Co. 80	Preston Machinery Co. 73	Williams Machinery Co., A. R. 7, 59, 28
Davis-Bourmonville Co. 84	Jardine & Co., A. B. 68	Puro Sanitary Drink'g Fountain Co. 71	Williams Tool Co. 99
Davis Machine Tool Co., W. F. 69	Jenckes Mach. Co. 9, 67	R	Williams & Co., J. H. 84
Deloro Smelting & Refining Co. 5	Johnson Mach. Co., Carlyle 8	Racine Tool & Machine Co. 75	Willson & Co., T. A. 84
De-Mooy Machine Co. 93	Joyce Co., Geo. A. 84	Riverside Machy. Depot 66, 70	Wilmarth & Morman Co. 86
		Rivett Lathe & Grinder Co. 102	Winnipeg Gear & Engineering Co. 73
			Z
			Zenith Coal & Steel Products Co. 86

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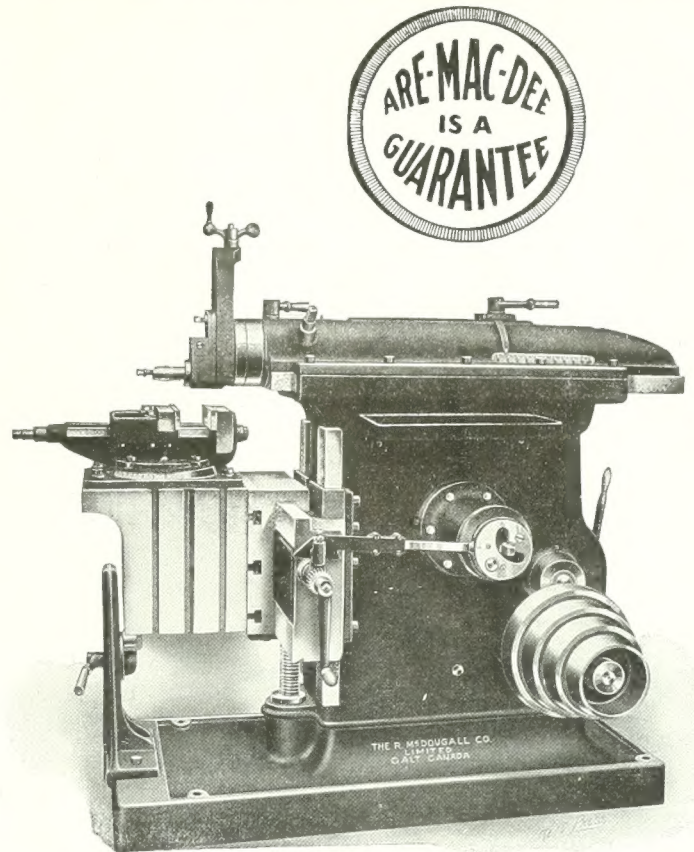
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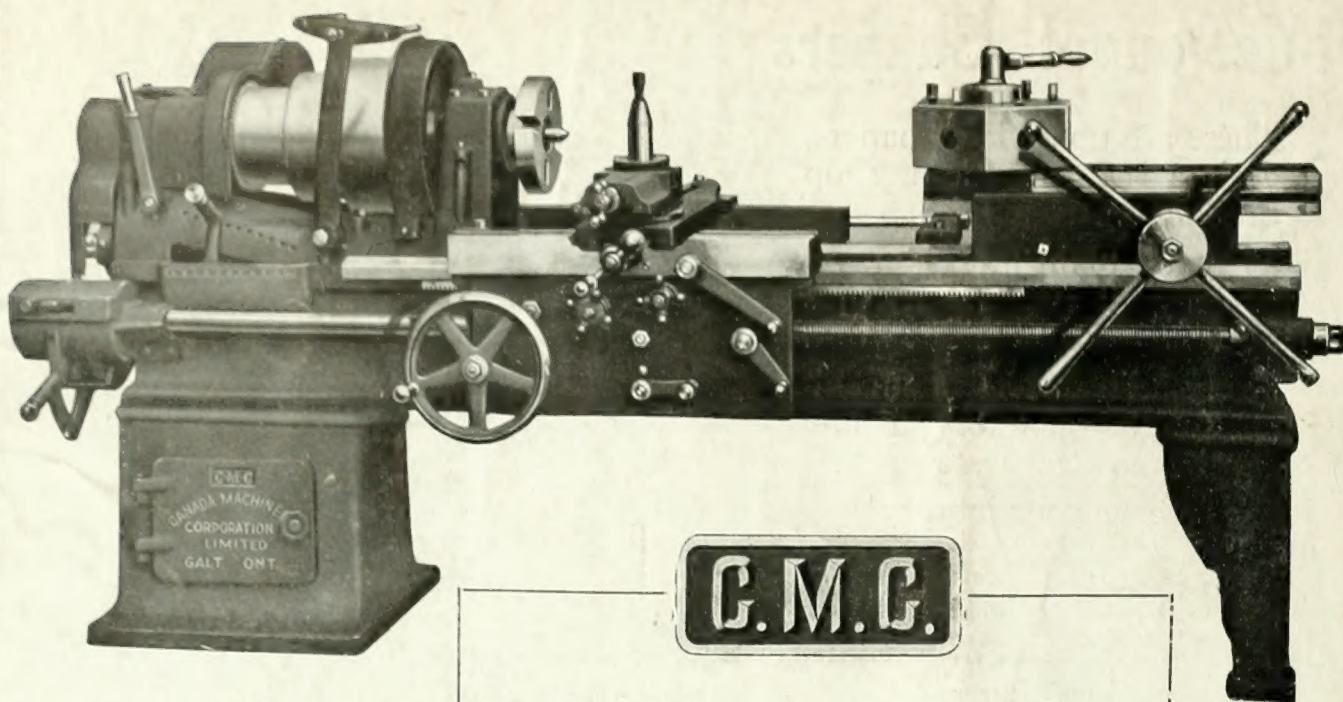
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