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WOMEN IN THE
PRODUCTION OF
MUNITIONS IN 
CANADA.

CANADIANA

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ISSUED BY THE
IMPERIAL MUNITIONS BOARD
CANADA
NOVEMBER, 1916

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Women in the Production of Munitions in Canada.

Presented with the Compliments of the
Imperial Munitions Board
through the
Minister of Education, Ontario

PICTURES HERE
REPRODUCED HAVE
BEEN TAKEN IN
CANADIAN MUNITION
PLANTS AND FAITH-
FULLY REPRESENT
ACTUAL CONDITIONS
AS OF THIS DATE.

Issued by the Imperial Munitions Board
Canada
November, 1916

mw

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We have been living in a sheltered valley for generations. We have been too comfortable and too indulgent many, perhaps, too selfish, and the stern hand of fate has scourged us to an elevation where we can see the everlasting things that matter for a nation, the great peaks we had forgotten of honour, duty, patriotism, and, clad in glittering white, the towering pinnacle of sacrifice pointing like a rugged finger to Heaven.

W. G. S. S.

Let us never forget the solemn truth that the nation is not constituted of the living alone. There are those who have passed away and those yet to be born. So this great responsibility comes to us as heirs of the past and trustees of the future. But with that responsibility there has come something greater still, the opportunity of proving ourselves worthy of it. And I pray that this may not be lost.

R. H. Baden.

: P R E F A C E :

THIS book has been prepared and issued by the Imperial Munitions Board with a view of emphasizing the practicability of woman labour in the production of munitions of war in this Country.

The photographs have been taken under the direction of the Board's Engineering Department and, to those associated with the manufacture of Munitions, will convey a technical meaning that we trust may be helpful. To others, it will broadly evidence the magnificent manner in which the womanhood of Canada, nobly backed by the workmen concerned, have rallied to the force behind the man behind the gun.

The imperative necessity for Munitions cannot be overstated. Canada will only do her share in this branch of the Empire's struggle by utilizing every human aid at her command. In this effort no one doubts the important part dilution of labour must play. We are confident of a response from employer and employee alike that will be as gratifying to our national pride as it is essential to our national existence.

The thanks of the Board is due and tendered to the manufacturers who kindly permitted access to their plants.

MARK H. IRISH,

Director, Department of Labour,
Imperial Munitions Board
Canada

November, 1916.

... NOTE ...

The material collected for the preparation of this book has been indexed and arranged under the trade and operation which they represent. They are at the service of firms considering the dilution of labour, and any information pertaining thereto can be obtained at the offices of the Imperial Munitions Board in Ottawa, Montreal and Toronto.

Foreword

THE photographs reproduced herein are selected from a large number taken in the various factories in the Dominion. No attempt has been made to place them in sequence of operation, the operation being described with each picture.

There are many and varied appliances which have been devised by engineers for convenient handling of small parts by women workers. Close views of some of these are shown.

While the photographs may be beneficial to manufacturers of munitions, inasmuch as they show novel and ingenious methods of tooling and general production, the main object of this publication is to emphasize the possibility of the Dilution of Labour, and hence this feature is kept constantly in view.

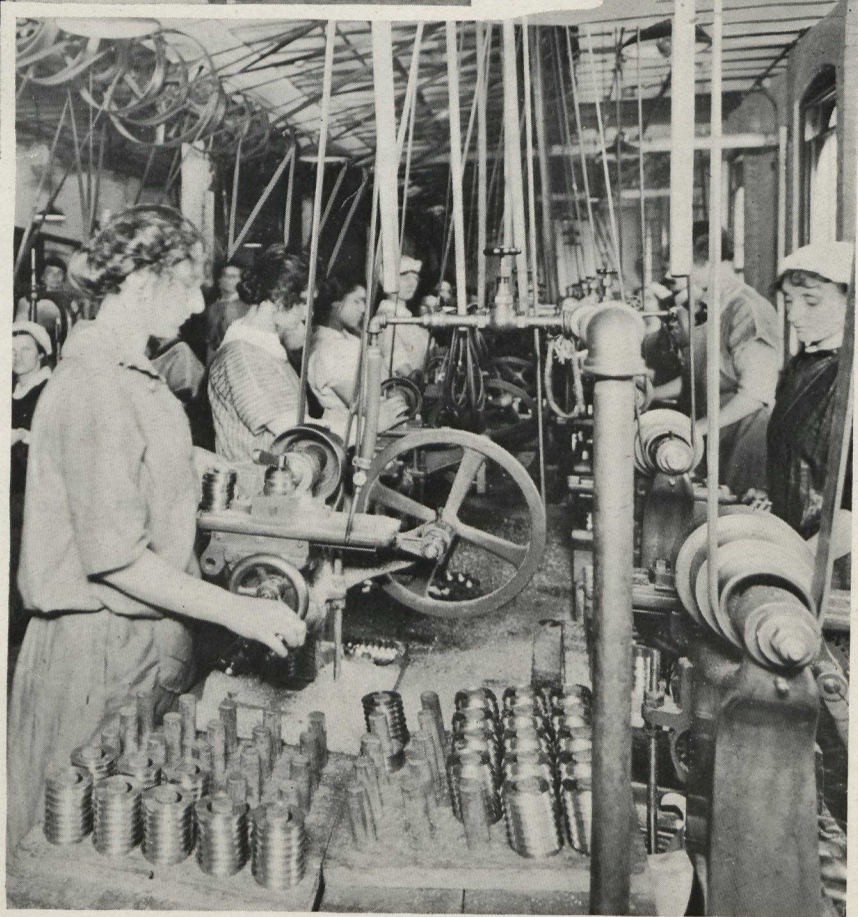
Shell Fuses

The photographs in this section are devoted to the manufacture of shell fuses.



Milling the Undercut of
Flash Hole in Stem No.
80 Fuse

Note the compressed air
nozzles handy to the oper-
ator for cleaning.



Milling Escape Hole.
Top and Bottom Rings
No. 80 Fuse

General View
of Ring
Turning
Department
No. 100 Fuse

The clean, dry floor, natural light and open windows for ventilation, are all conducive to good health. Good health is conducive to good output.



Detail of Above

Turning*and facing top and bottom rings; also inspecting.



Rough and Finish Turning
of Cap No. 80 Fuse

These operations need a fair amount of physical strain, but the operator was equal to it, and guarded the point where the strain was concentrated, viz. the wrist.



Women on Turret Lathes Executing
Five Operations of Top and Bottom
Rings on No. 80 Fuse as follows:

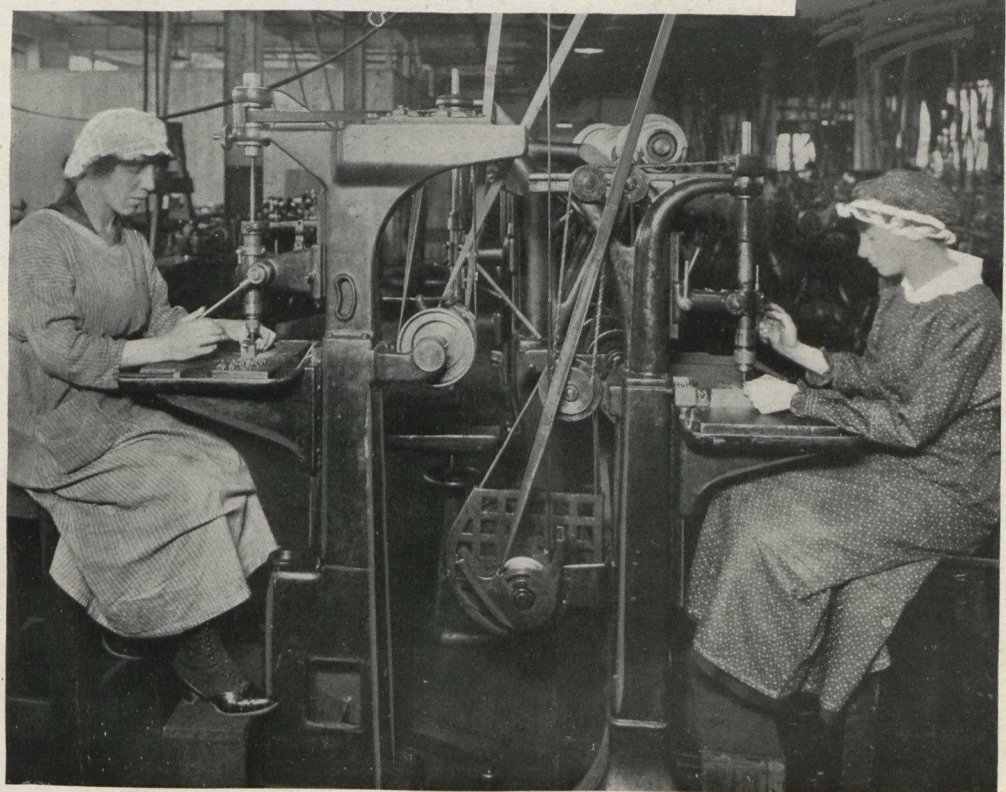
1. Chucking; 2. Boring; 3. Rough Reaming; 4. Finish Reaming; 5. Facing.



Various
Drilling
Operations of
Small Parts
No. 100 Fuse

Drilling
Needle Hole
of Detonator
Needle Plug
No. 100 Fuse

Two very ingenious jigs are in use on these drilling machines for holding the exceedingly small parts, the insertion of the part and the opening and closing of the jig was done with lightning-like action.





Assembling No 100 Fuses

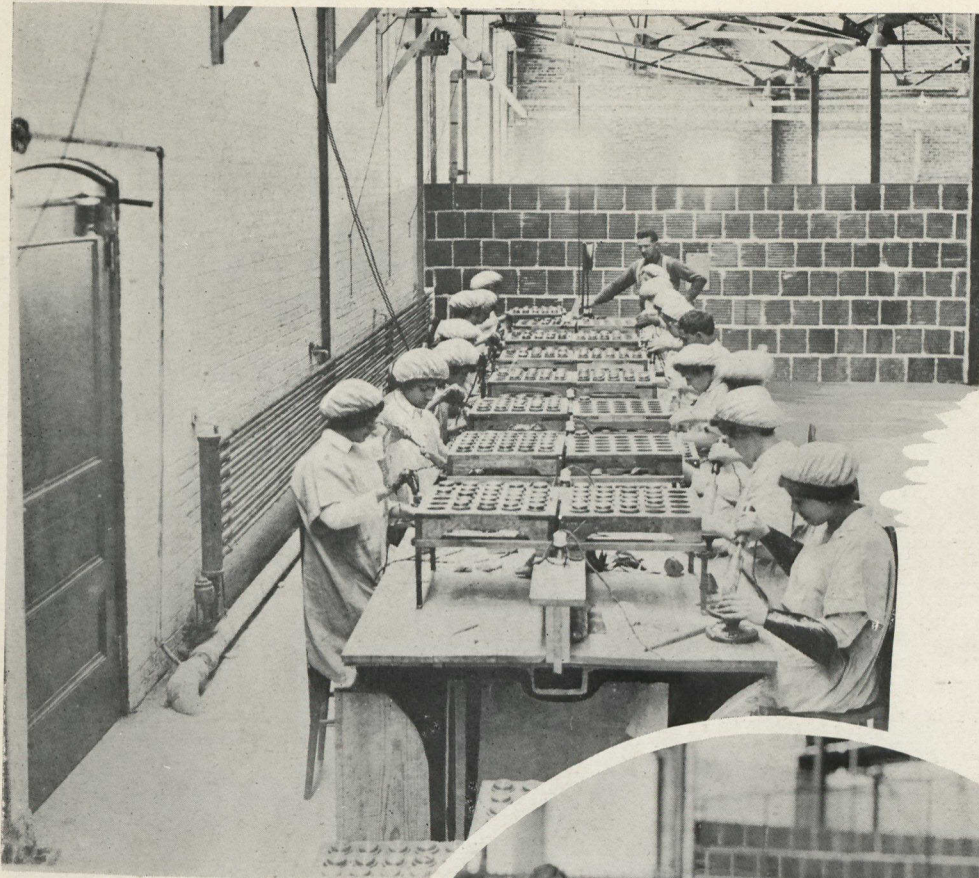
Putting in setting pins in bottom rings. (Front)

Hand reaming rings. (Back)

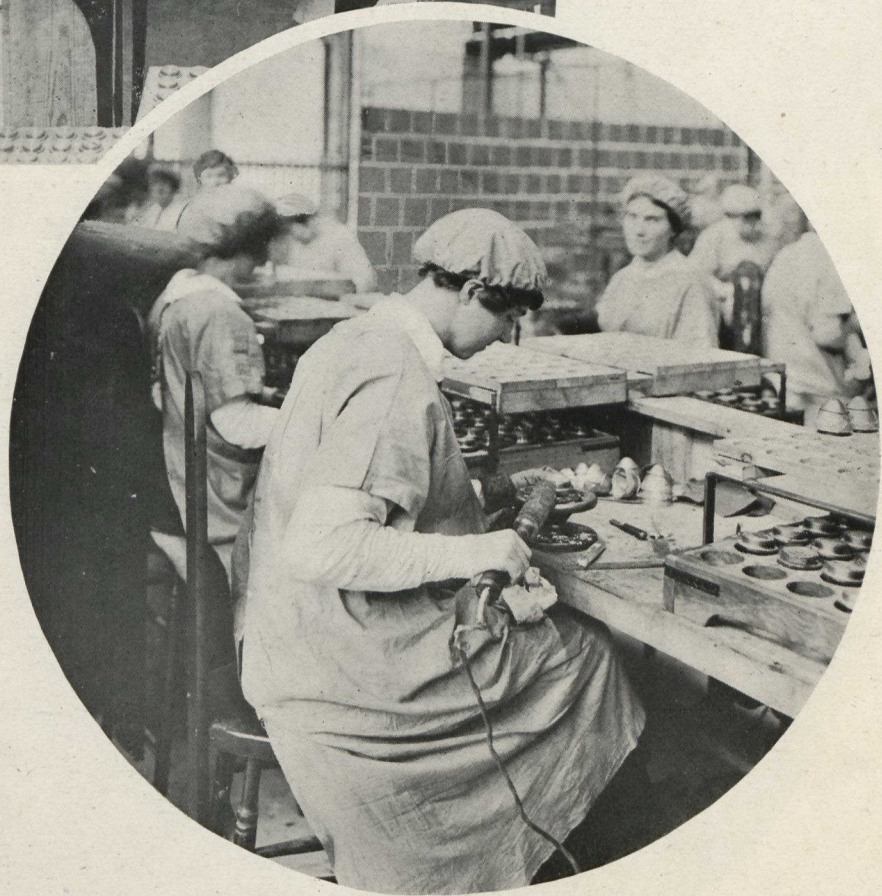


General View of Assembling Shop No. 100 Fuse

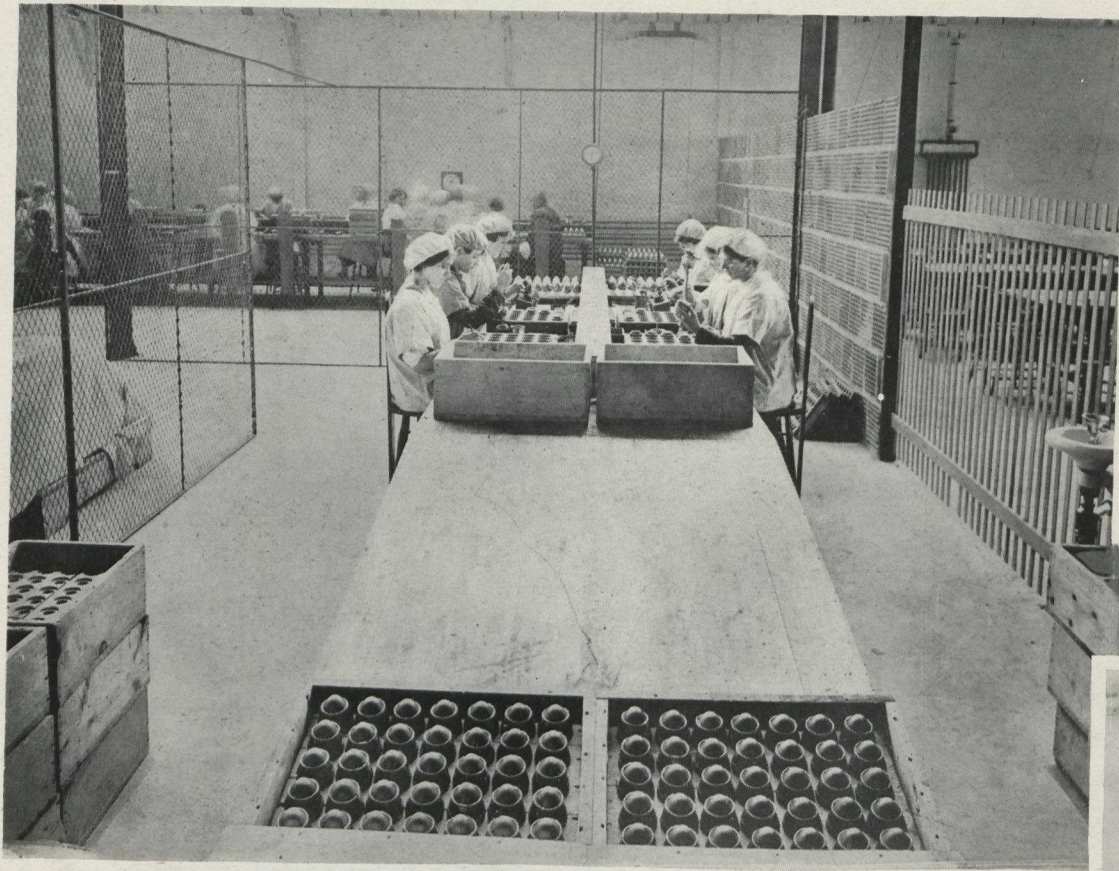
These are three excellent examples of clean, light and airy shops.



Soldering
the Cap of
No. 80 Fuse



Close Operation
of Above

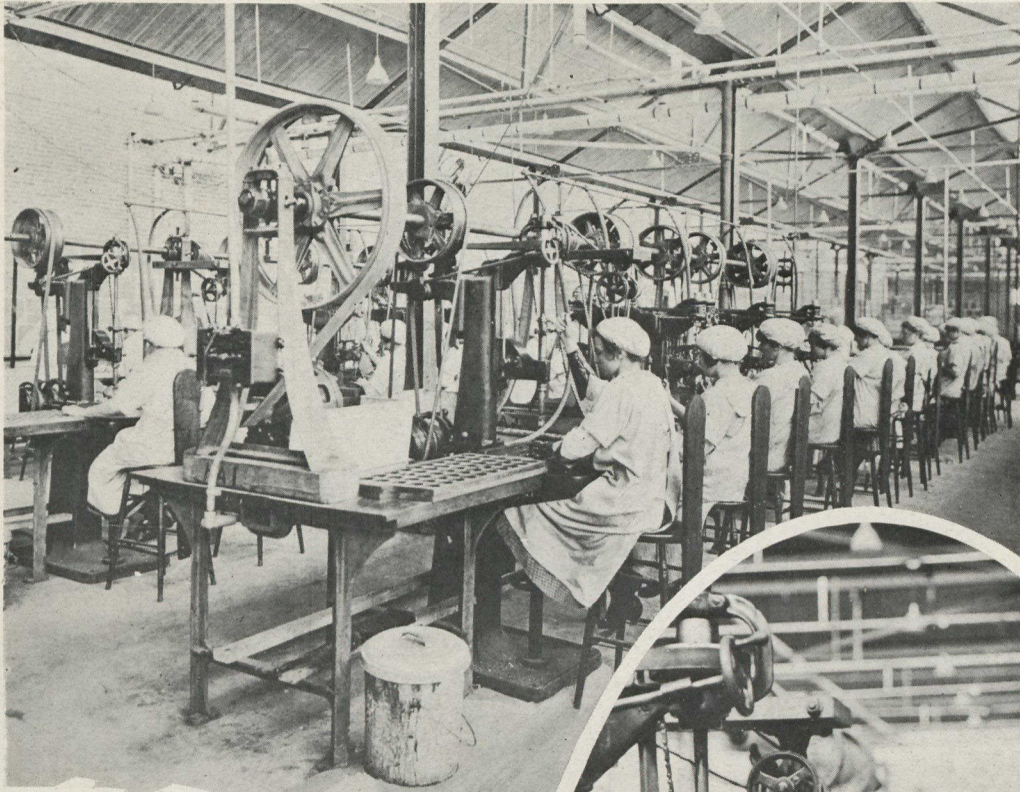


Filling the Base Charge and Packing No. 80 Fuse

Note the drinking fountain on right.

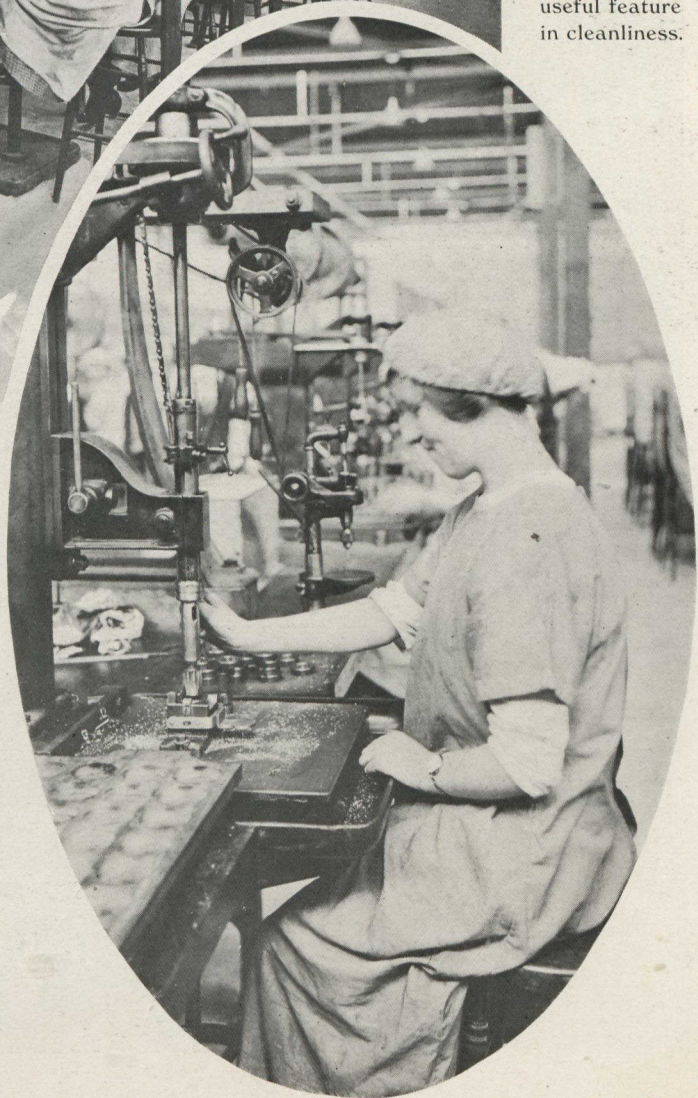


Close Operation of Filling the Base Charge No. 80 Fuse



Finishing
the Top
Ring of
No. 80 Fuse

The
"Highbacks"
attached to the
stools are a
great support to
the workers.
The refuse
cans are also a
useful feature
in cleanliness.

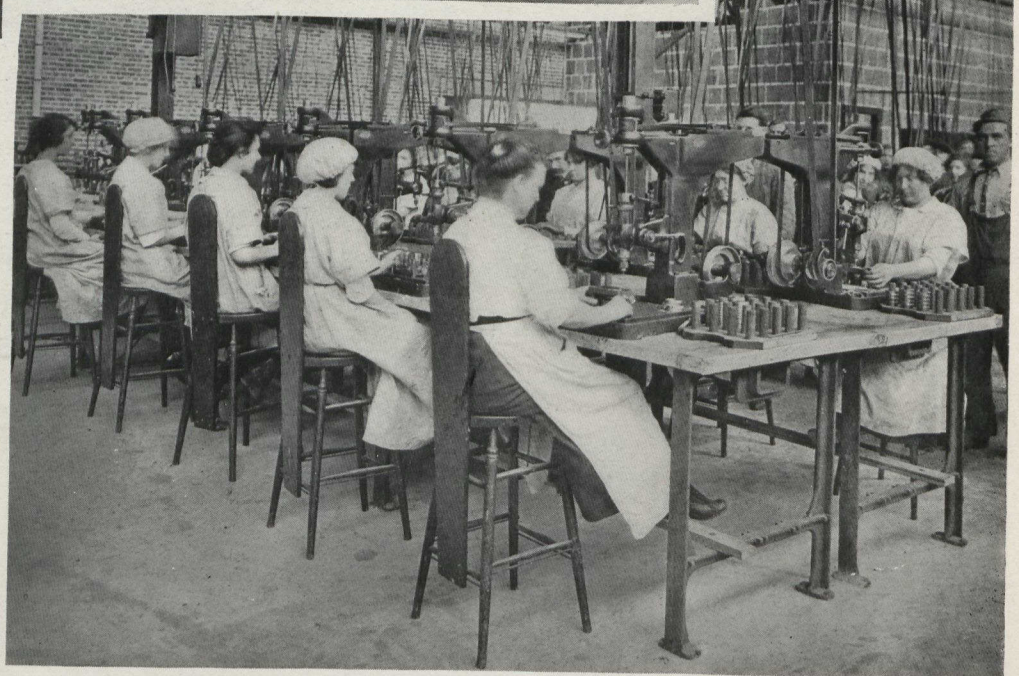


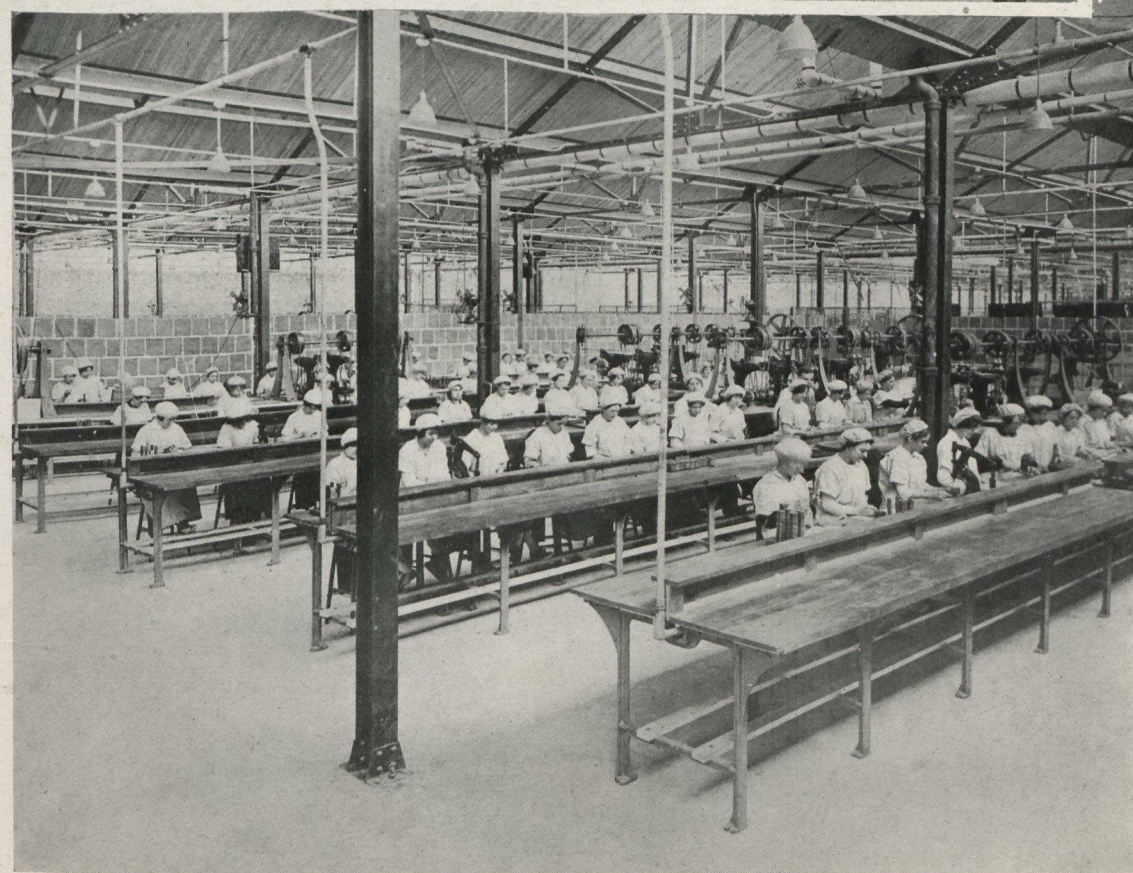
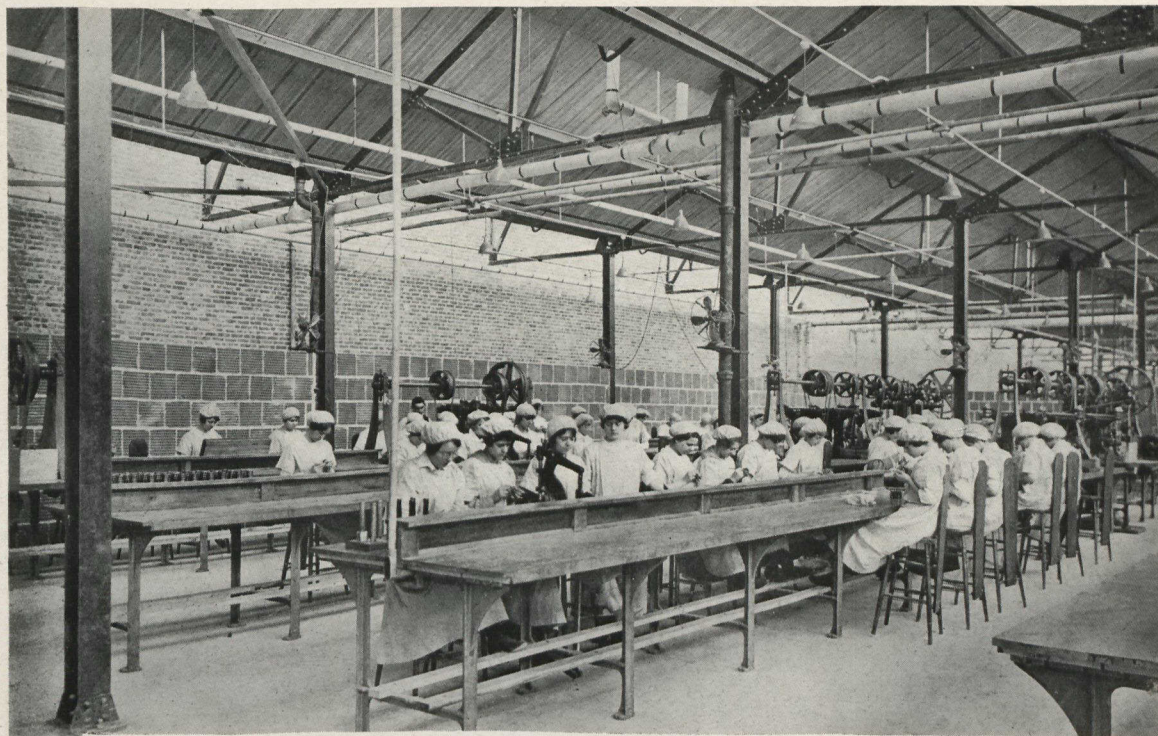
Close Operation of Above



Detail of Drilling
Operation, Clearly
Showing the Jig
and its Usefulness

Drilling Holes
Preparatory to
Routing the
Powder
Groove, No. 80
Fuse

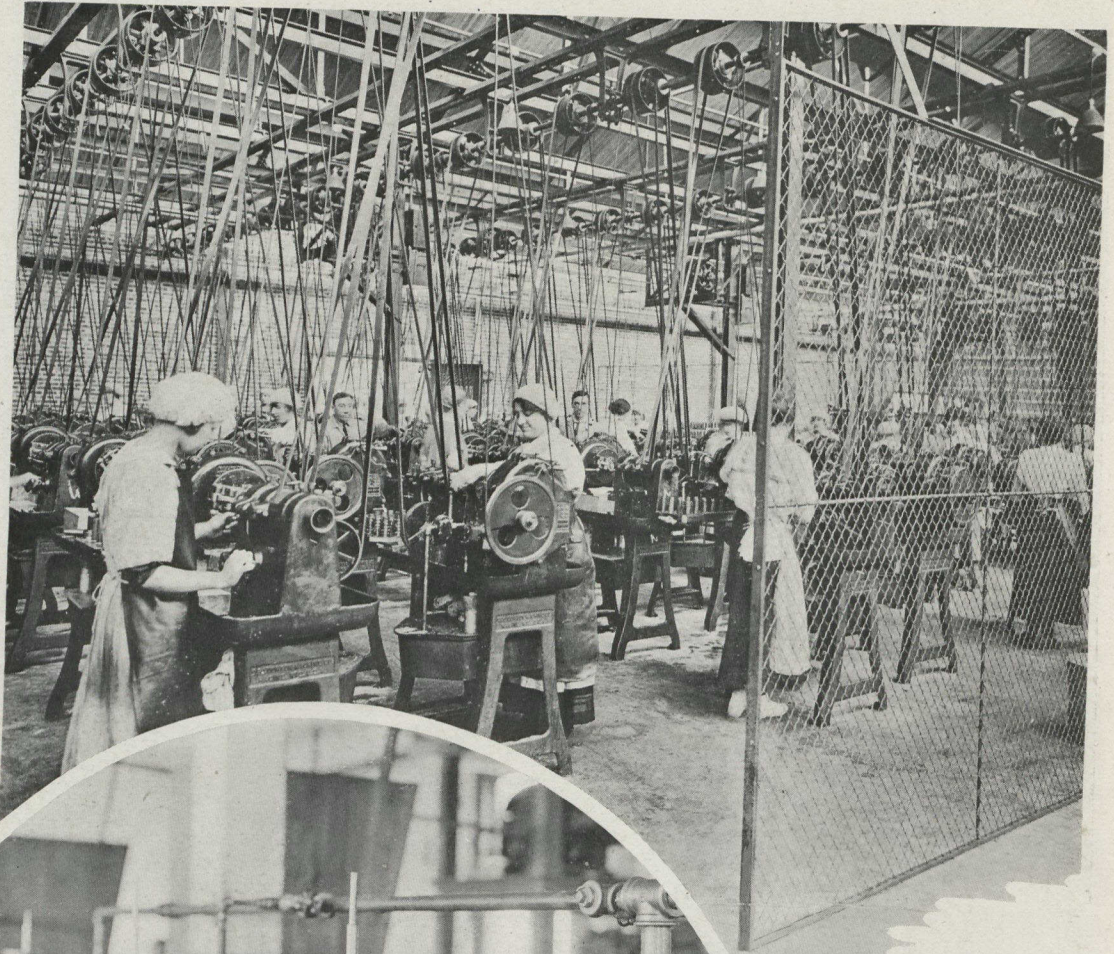




General Views of Assembly Room, No. 80 Fuse

Here are perfect examples of modern construction; in spite of the airy appearances there are plenty of fans for keeping the air moving, which incidentally keeps the workers moving. This factory was built and in operation in a very few months.

Routing
Powder
Groove
No. 80
Fuse



Drilling the Flash
Hole No. 80 Fuse



Finished
Assembly
No. 80
Fuse



Weather-
Proofing
No. 80
Fuse

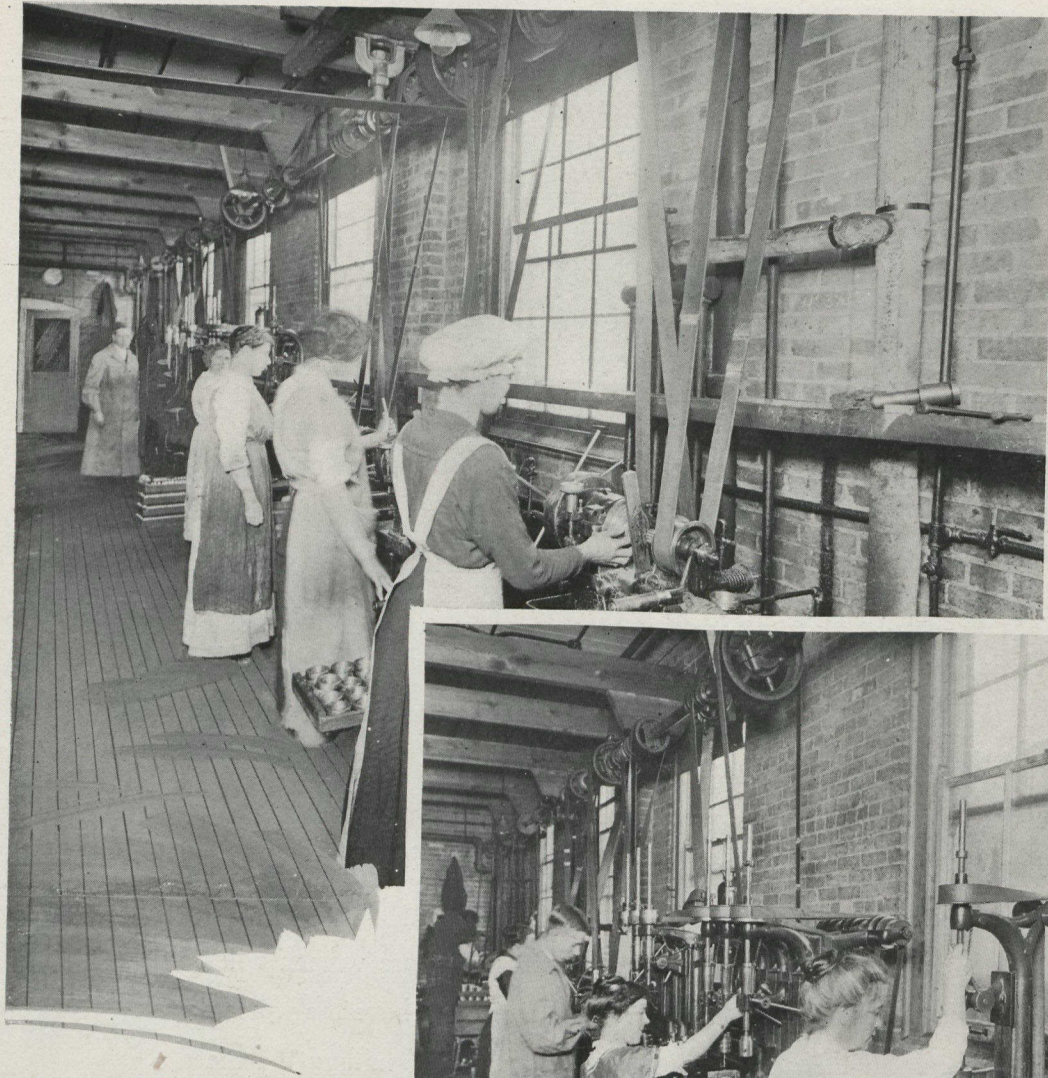
Foot Presses. Pressing
Needles in Needle Plug.



Various Milling
Operations on Top and
Bottom Rings
No. 80 Fuse

General Light Operations

THERE are many operations in the Machine Shop which can safely be assigned to women. This section illustrates such operations, from small drilling machines to heavy power presses, and yet may be fairly characterized as light operations. The tool room presents every advantage for female labour, in spite of the fact that engineering history tells us that it is the department for highly trained mechanics, but it has been clearly demonstrated that women, under the guidance of trained toolmakers, are efficient and useful. The grinding of milling taps, cutters, general cutting tools and other repetition work is particularly suitable for them. The making of jigs and dies is, and possibly always will be, a highly skilled mechanic's task, but we look forward to the time when many more women will be admitted to this branch of engineering work. Especially have the women astonished engineers in their aptitude for the handling of milling machines.



Milling
Inside
Thread of
Steel
Sockets for
18-Pounder
Shrapnel
Shells

Trained Mechanic Setting
Up Another Machine



Drilling and Tapping
Outside Thread of Steel
Sockets for 18-Pounder
Shrapnel Shells



Grinding Milling Tap

The independence of this woman is strikingly illustrated by the contempt she has for the stool.



Tool Grinding

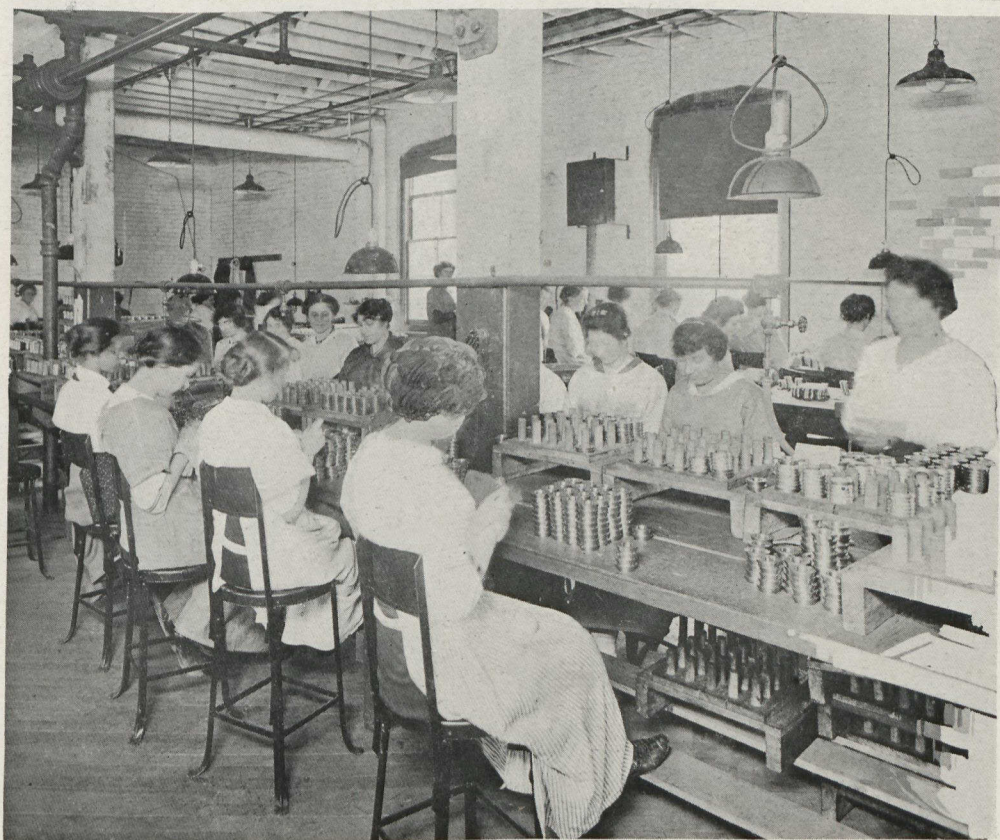
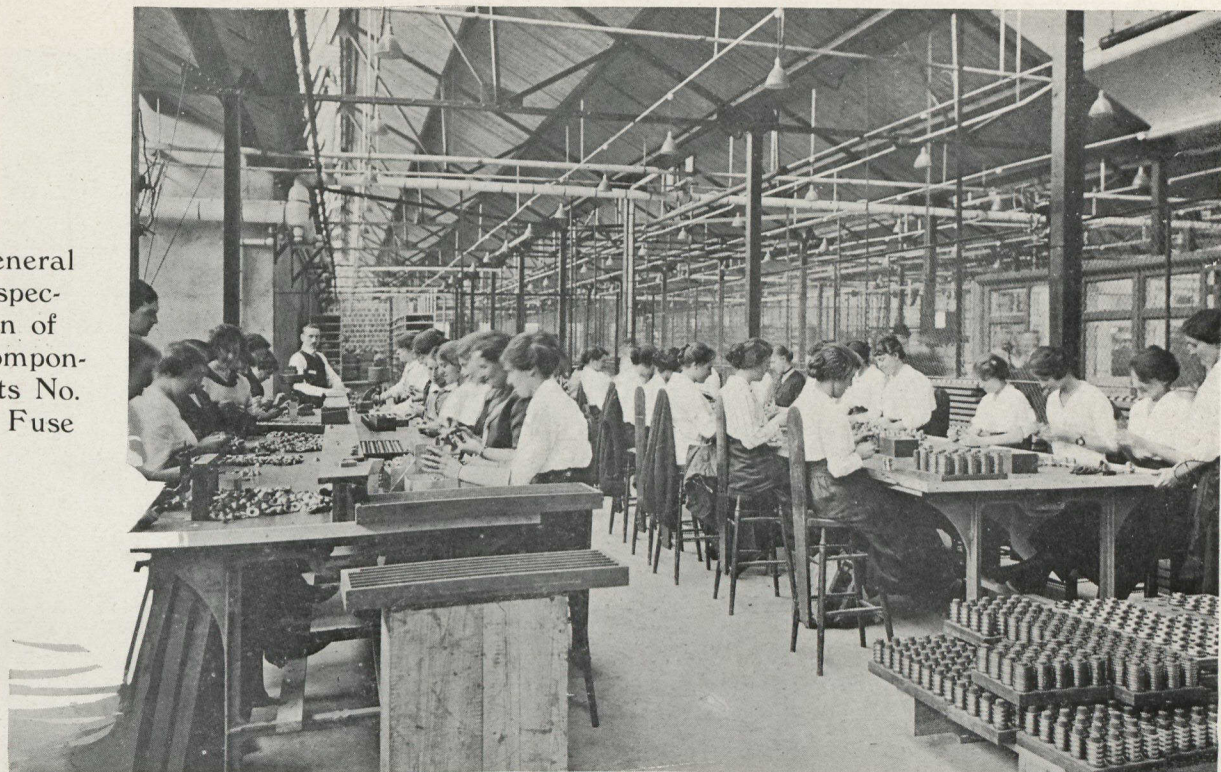


Painting Cartridge Case Clips



Tacking and Closing
Assembling
Strips for
Cartridge Case
Clips

General
Inspection of
Components No.
80 Fuse



Inspection of
Top and
Bottom Rings
No. 80 Fuse

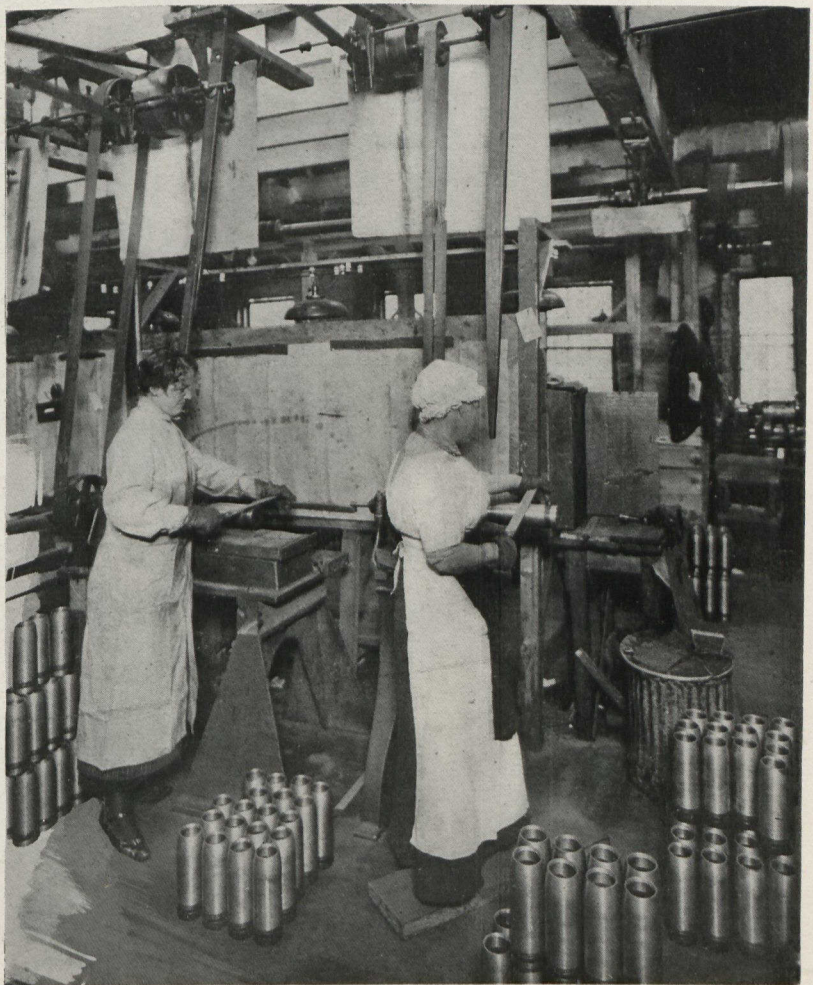
Inspection of Bodies No. 100 Fuse



Inspection 18-Pounder Shrapnel



Inspection



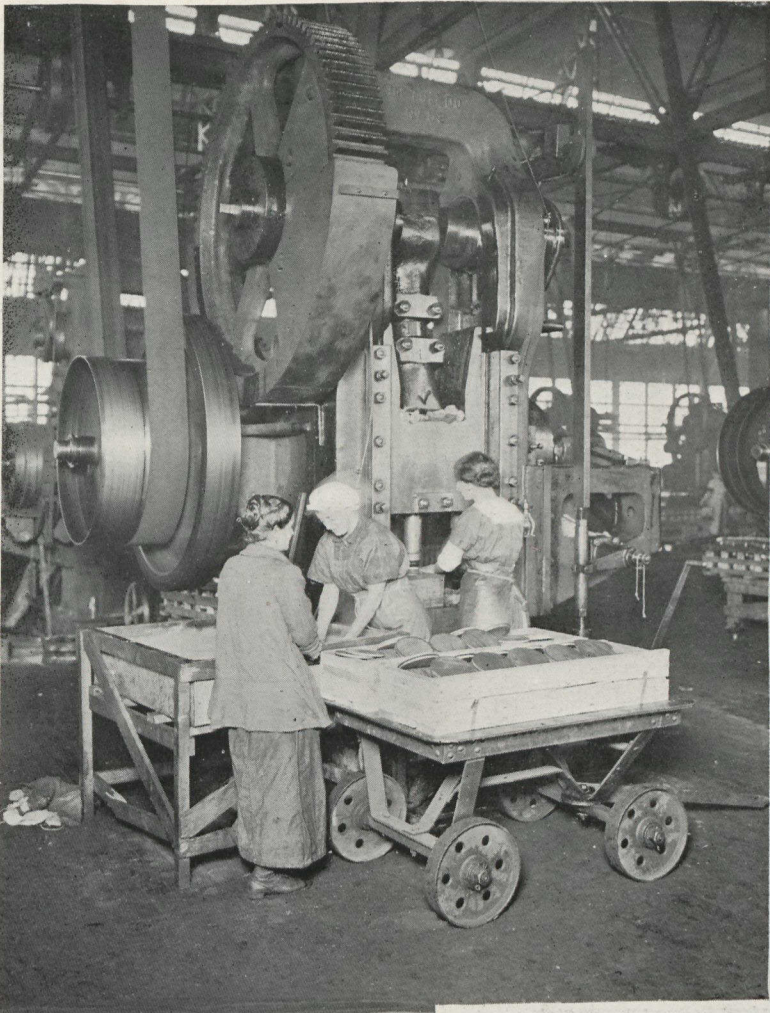
Finishing Oversize Shells with File

These women were able to rapidly run over shells with a file and pass them through the gauges which hitherto refused owing to the slight burrs.

Soldering
Powder
Cans for
18
Pounder
Shrapnel
Shells.

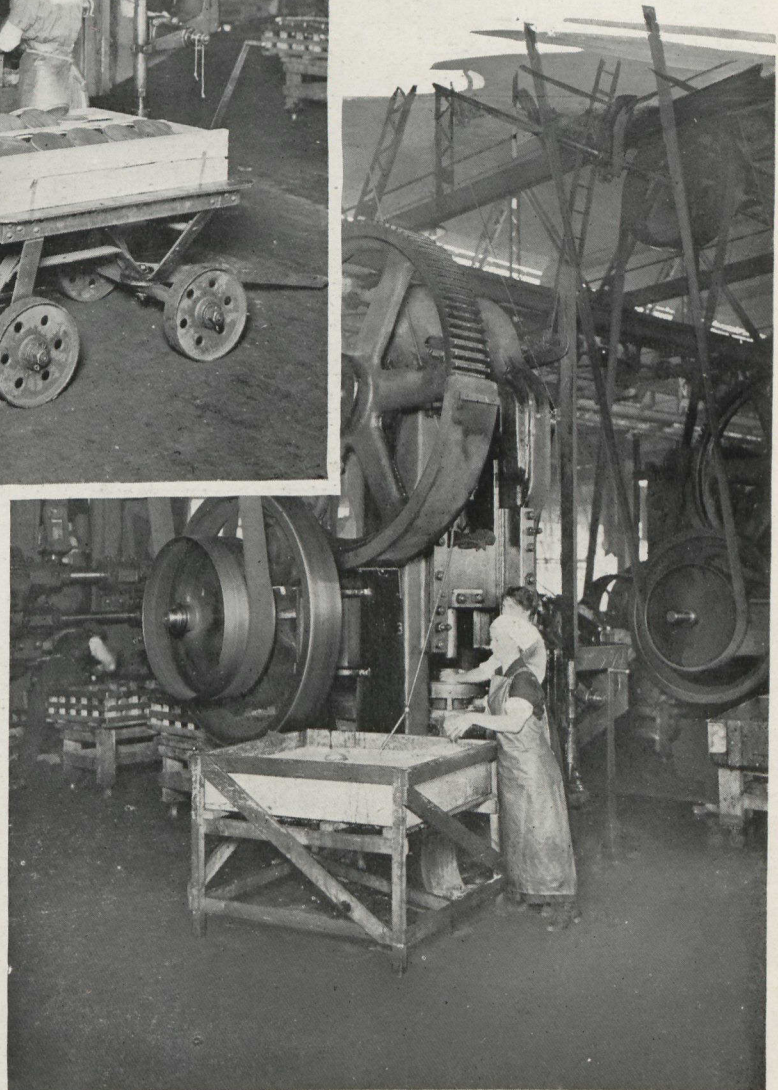


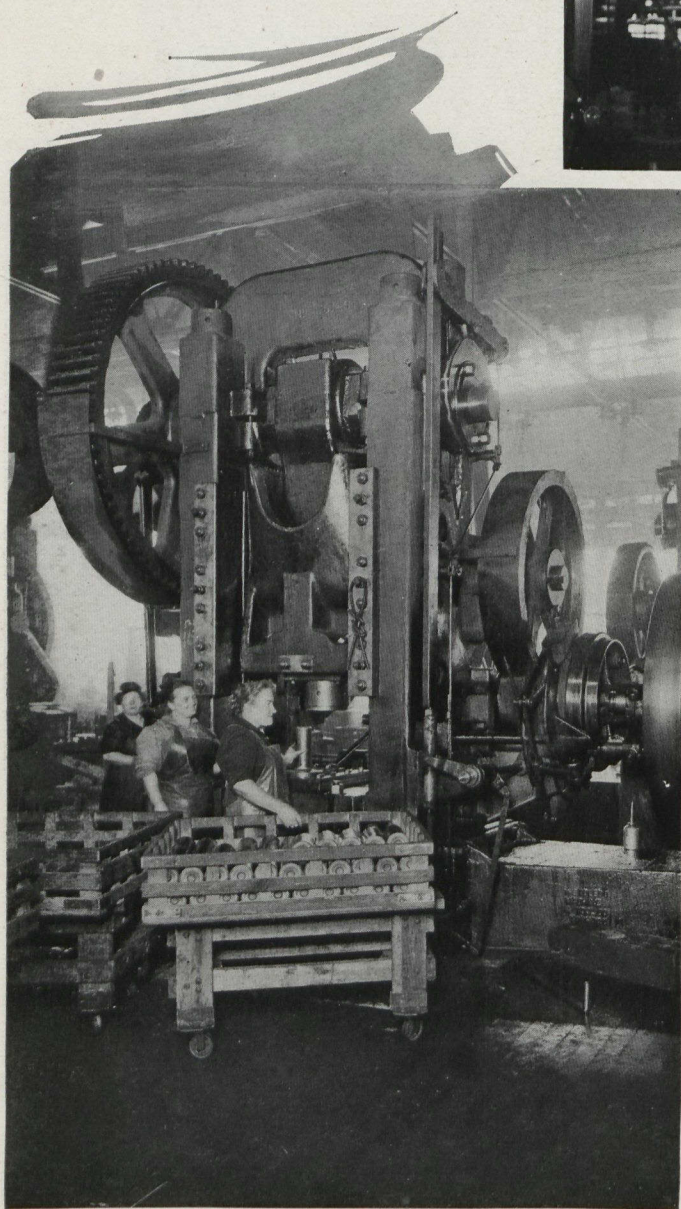
General View of Shop and Bank of Power Presses on Cartridge Cases for 18 Pounds.



Close View of the Two First Operations of Stamping Cartridge Cases for 18 Pounders

In the upper picture the third woman has just delivered the truck of blanks; after passing through the press the work is delivered at the back of the machine, collected on a truck and conveyed to the next machine for the next operator; trucking all done by women.





Further Operations on Presses for 18-Pounder Cartridge Cases.



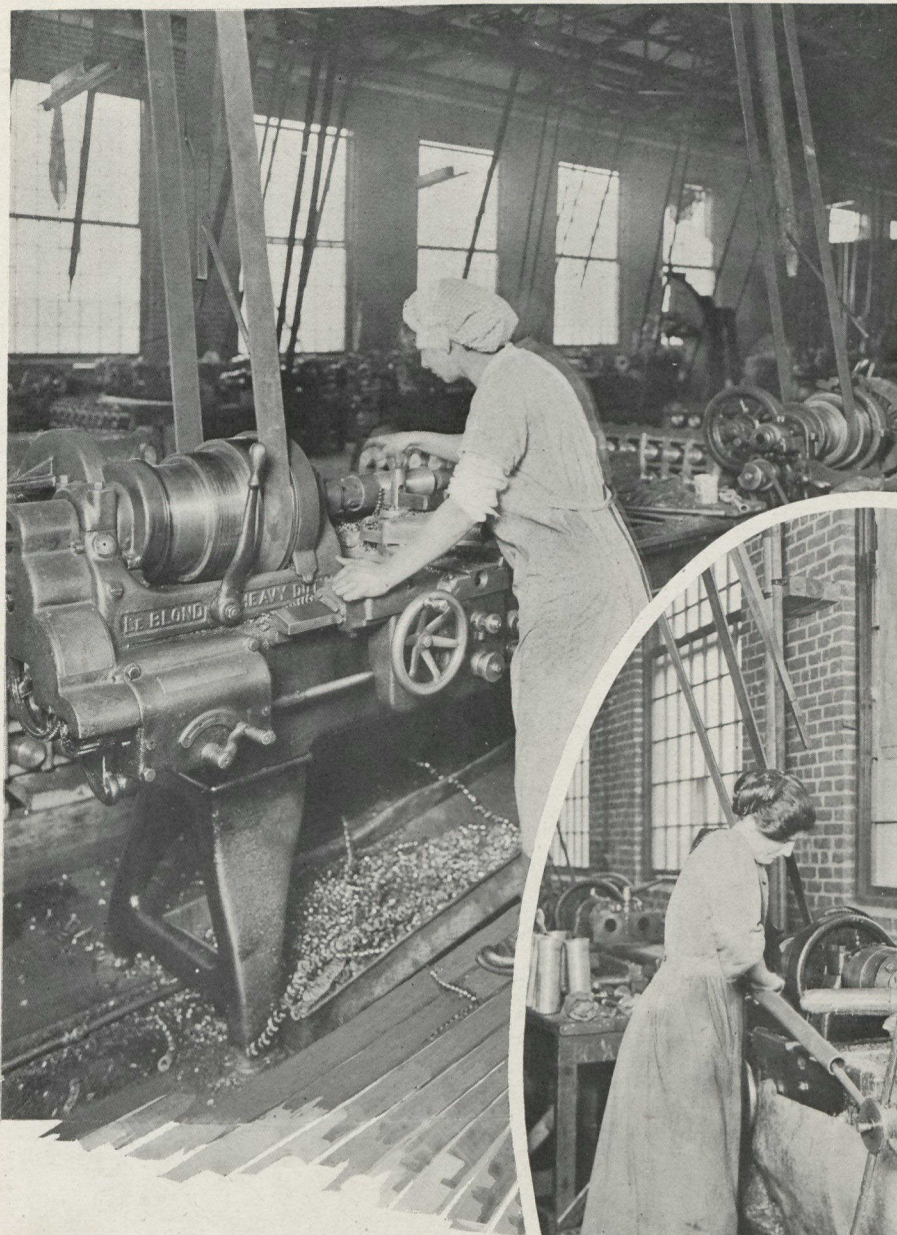
General Views of Shop, Women Workers on Percussion Primers

18-Pounder Shrapnel and High Explosive Shells

WE are now entering the heavy machine shop, where twelve months ago, in Canada, no thought of woman labour was in the mind of any manufacturer. Experience has proved that there is no operation on shell work that a woman cannot do, and, as a matter of fact, is not doing, even to the heavy operations which require great physical strain, but proper selection of the female labour makes this equally suitable for women.

Note the bath mat structure in front of the lathes. The generous use of lubricant which is necessary in the turning and boring operations, naturally produces a damp floor, which is particularly prejudicial to the continued efficiency of female labour. The adoption of the bath mat as here shown has proved a great aid in this direction.

We also desire to draw attention to the use of compressed air in eliminating the physical strain of tightening up chucks. A forging can be chucked or thrown out by the simple movement of a lever, operating two valves on an air piston, which open or close the chuck as the case may be. Examples of this are shown in the accompanying pictures.



Rough Turning
18-pounder Shrapnel

Note the forging is chucked on a taper mandrel and driven up by tail stock. A very easy method of chucking for women workers.

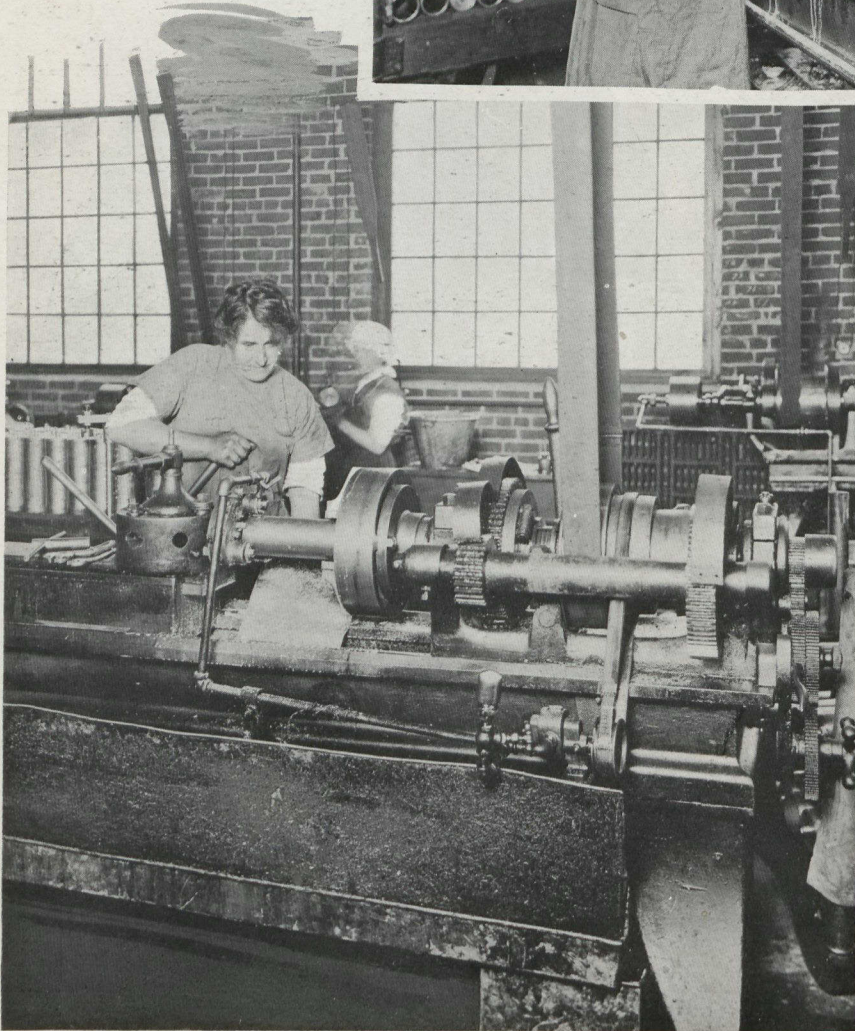


Chambering or Boring
18-pounder Shrapnel

This is one of the hardest operations on this type of shell.

Cutting Off the Base
18-pounder Shrapnel

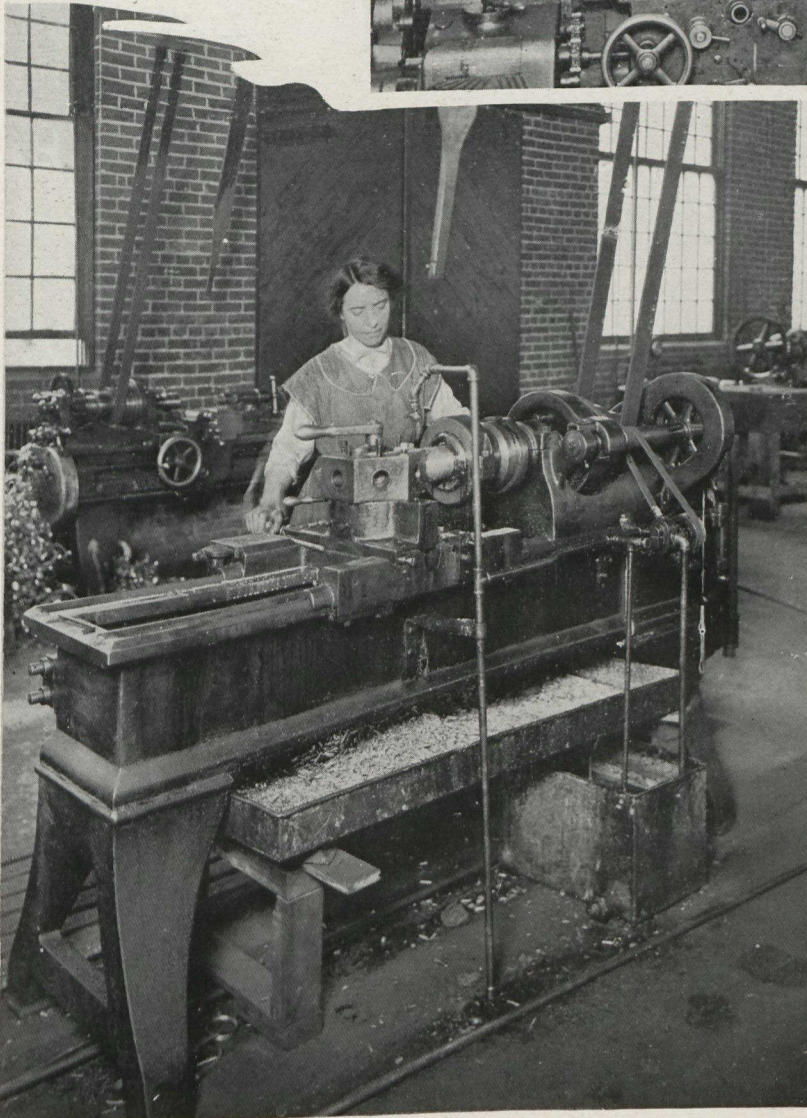
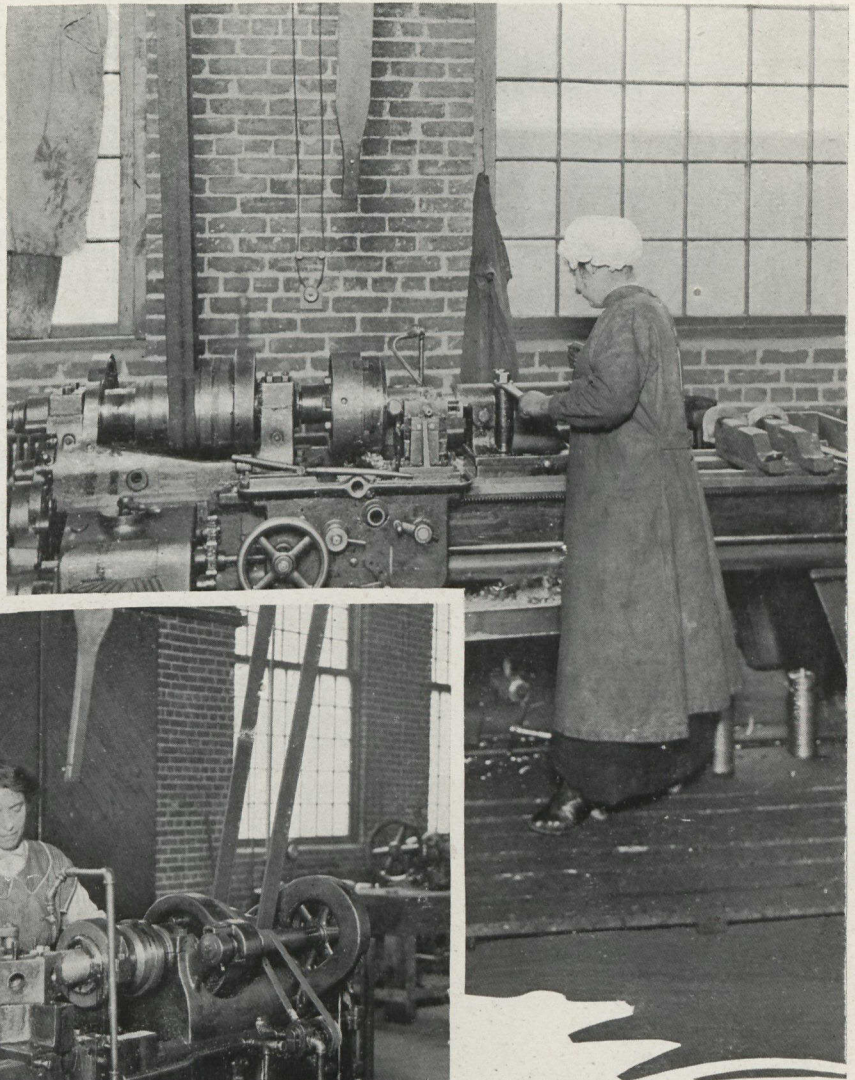
Front and back tools cutting
together.



Finish Facing,
18-pounder Shrapnel

Waving and
Undercutting for
Copper Band,
18-pounder Shrapnel

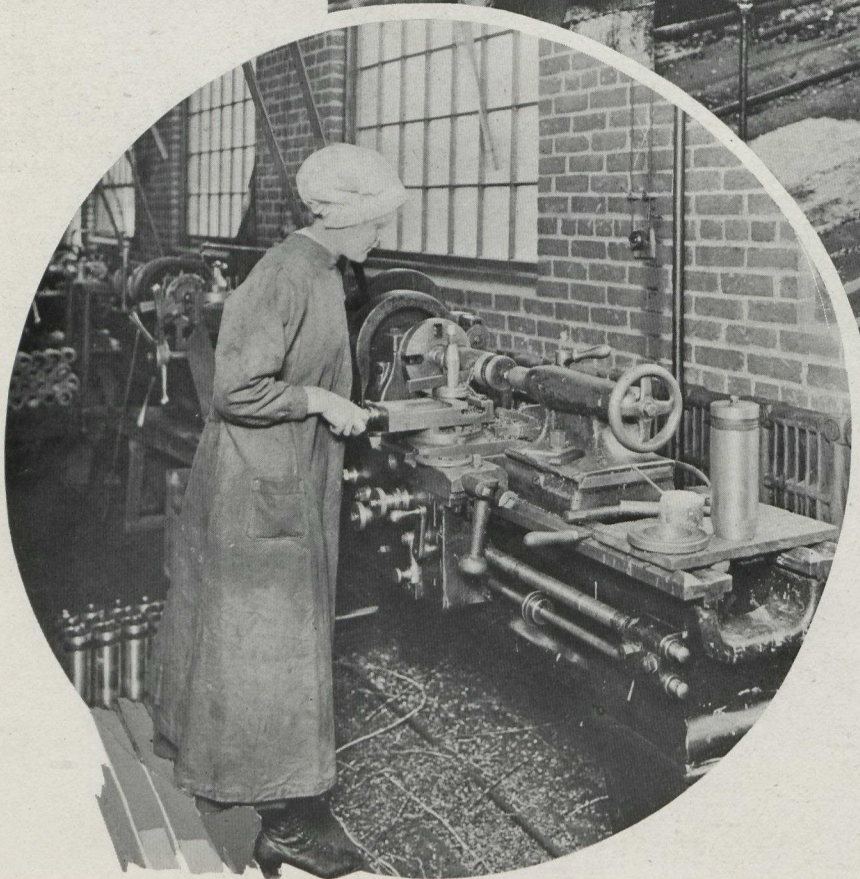
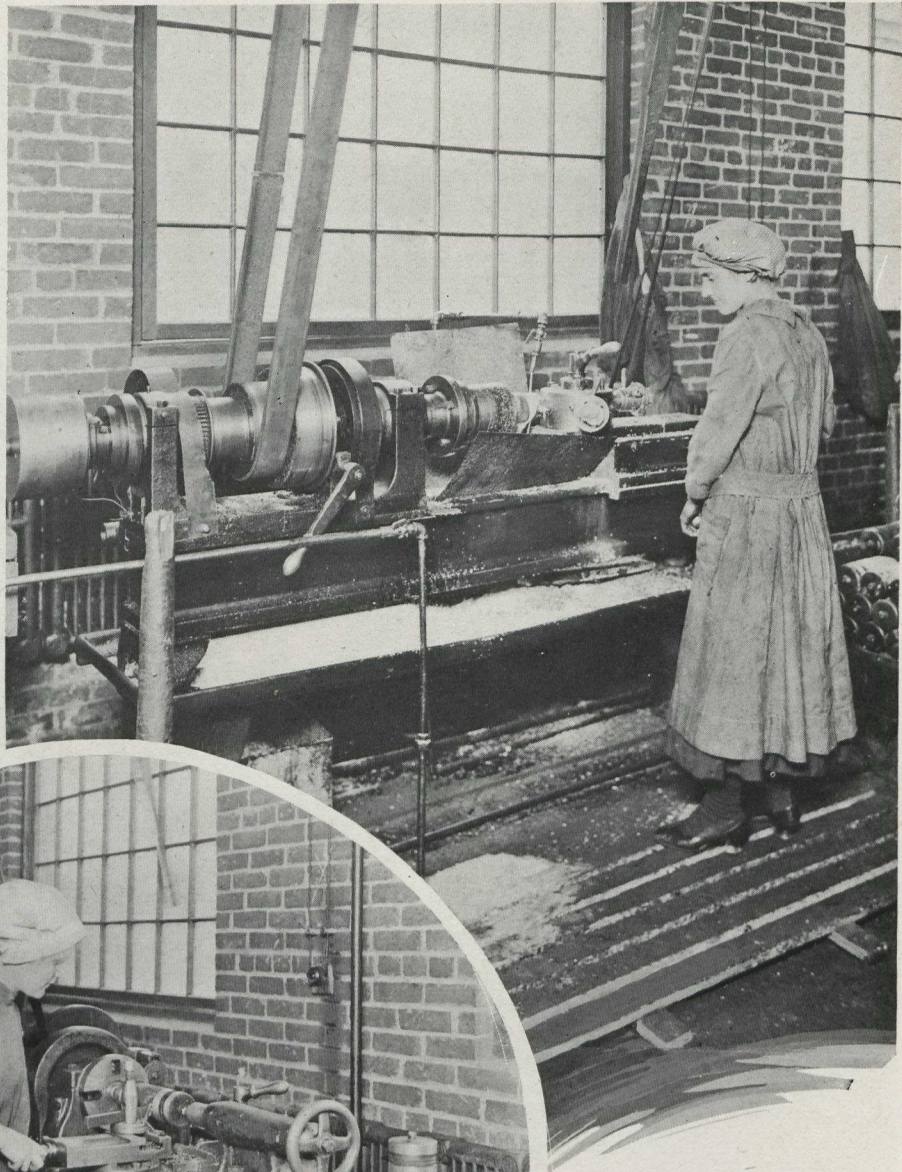
This operator working on an ordinary engine lathe had no automatic attachments, it was just a case of locking up the work with physical energy.



Undercutting the Nose
and Cutting Crimping
Groove, 18-pounder
Shrapnel

Threading the
Nose (Reaming
and Tapping)

Note the compressed air
chuck, air piston at ex-
treme end of headstock.
Automatic taps on turret.



Finish Turning and
Profile 18-pounder
Shrapnel.

Pressing on the Copper
Driving Band with
Hydraulic Press



Turning Copper Driving
Band, 18-pounder
Shrapnel



Turning
Copper
Driving
Band



Washing
and
Cleaning
Opera-
tions

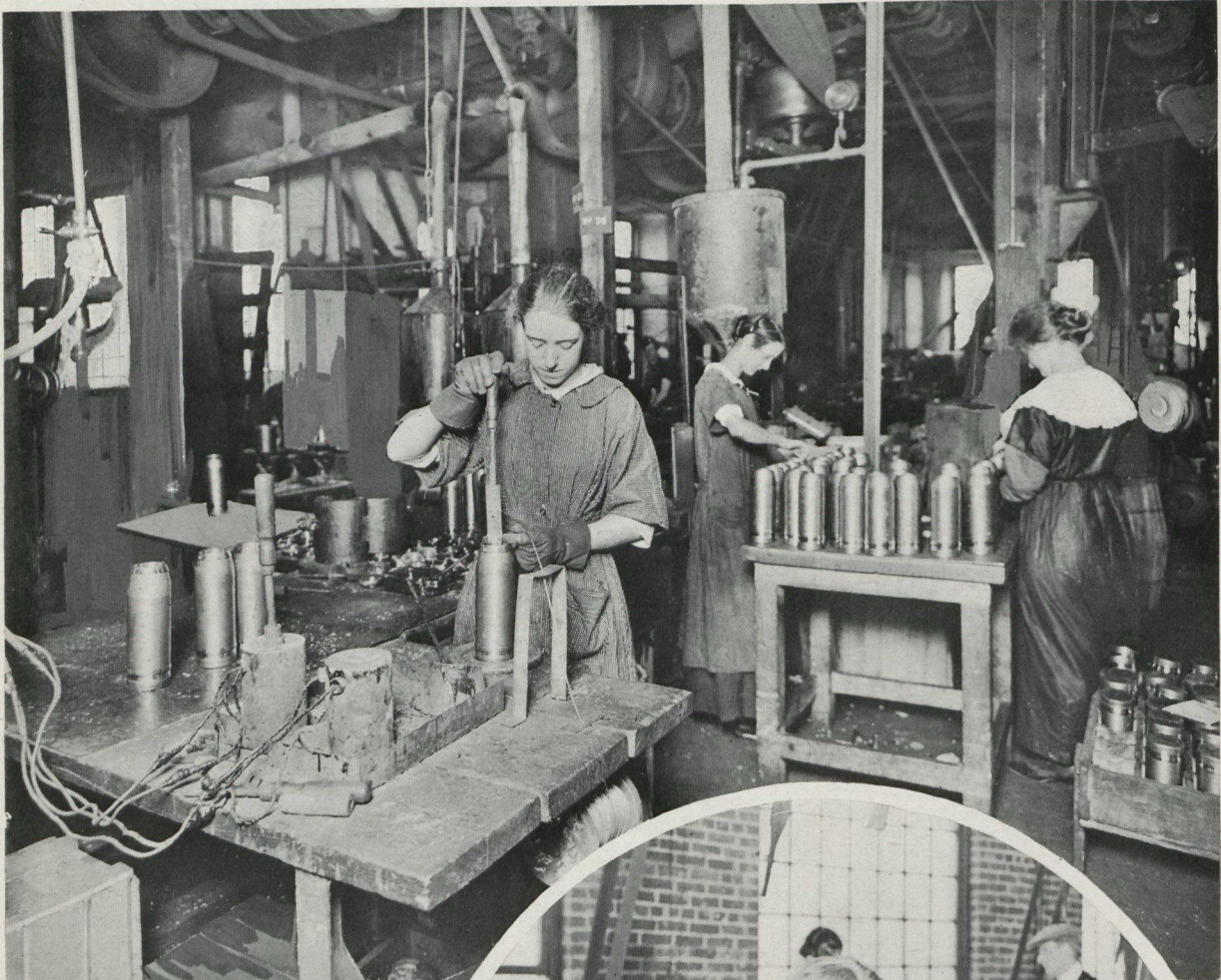


Loading and Weighing Operations.

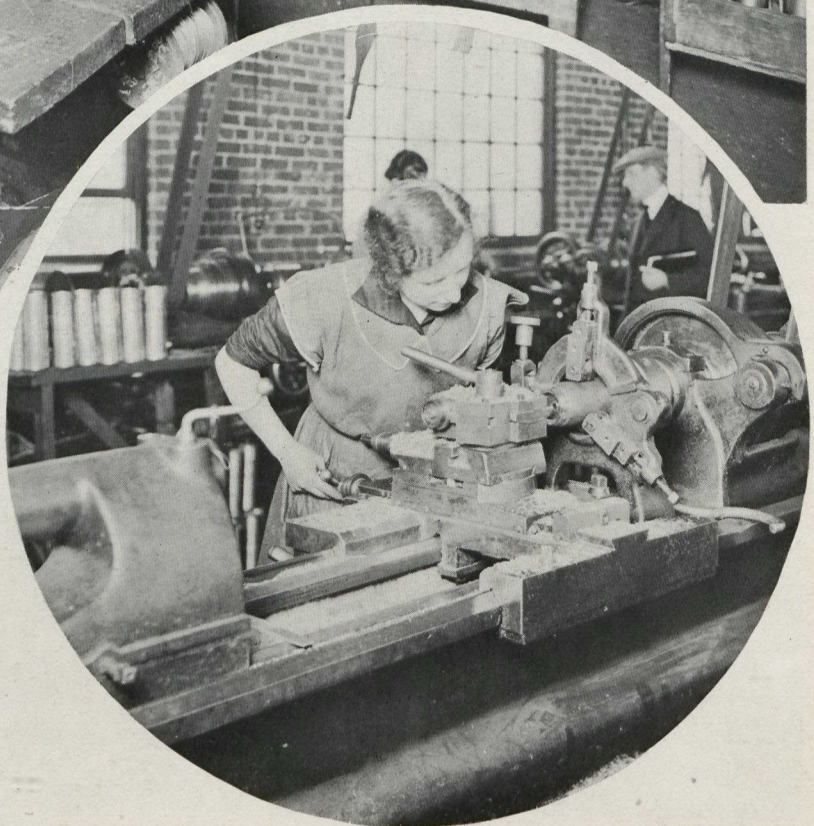


Screwing in and Rough Turning the Brass Socket.

The jig seen here is a very simple arrangement and requires no physical strain on the part of the worker.



A



B

(A) Soldering Sockets and
Tubes (front).

Loading (rear).

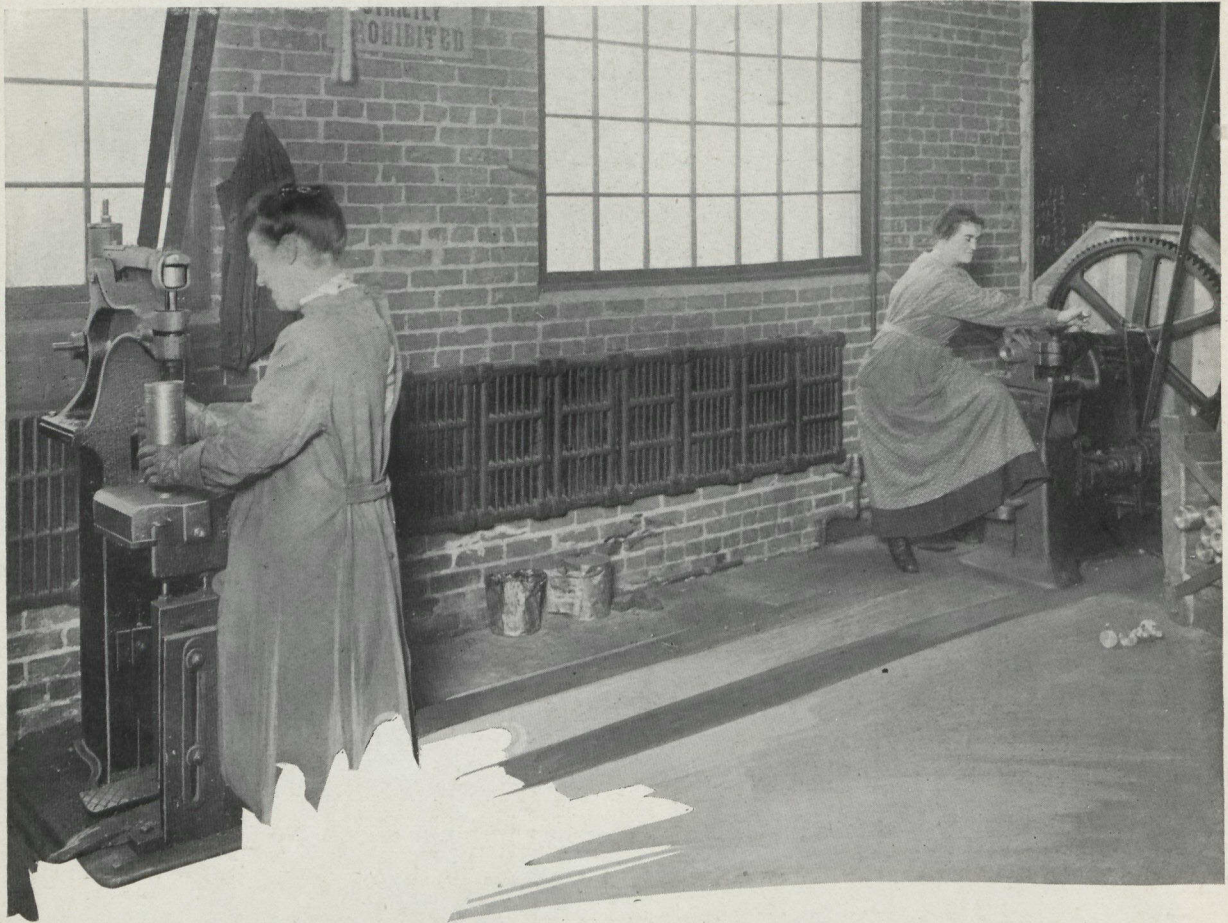
(B) Finish Turning the
Brass Socket
18-pounder Shrapnel



Swabbing Out Tubes and Weighing

Painting. Women are particularly adept at this operation.





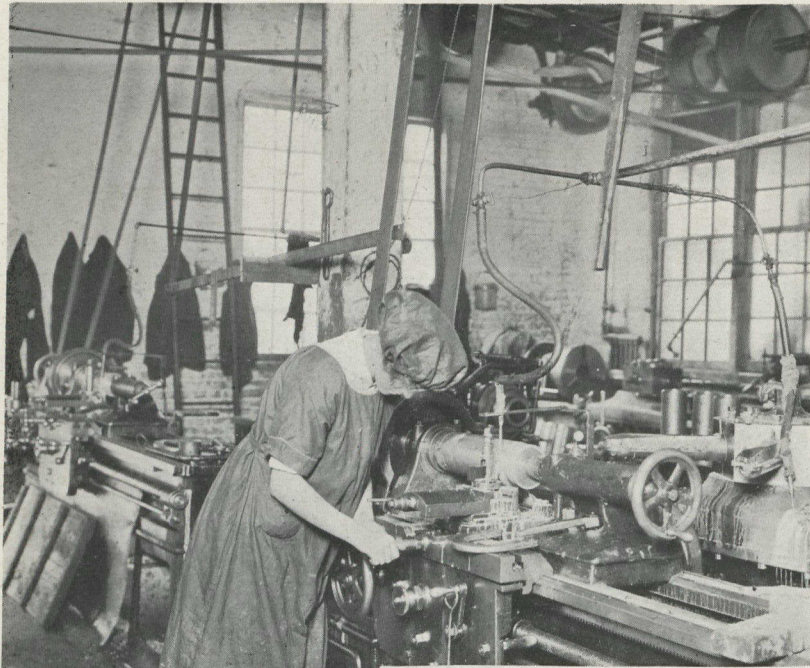
Screwing in the Base Plate and Rivetting ditto, 18-pounder High Explosive Shells

4.5-in. and 8-in. Shells

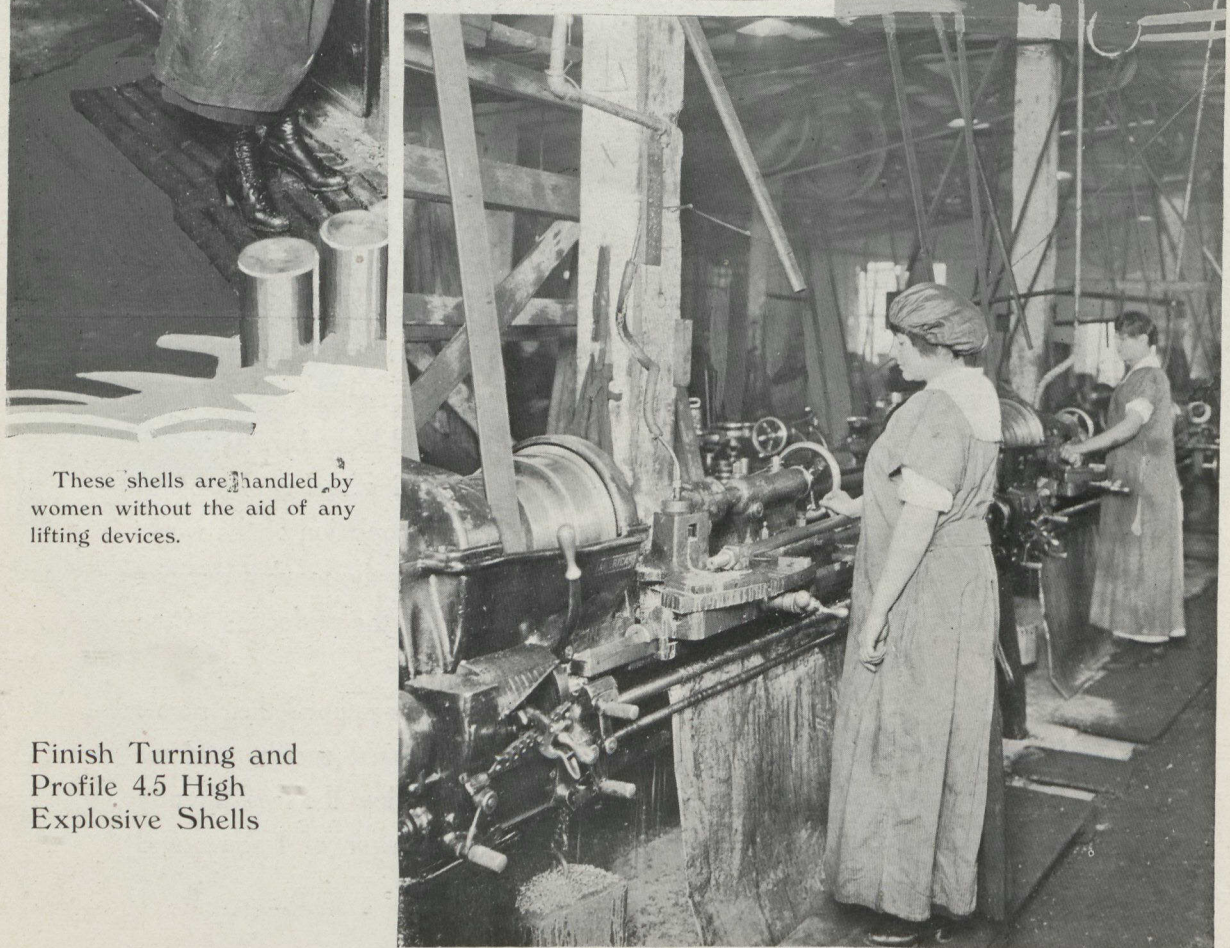
WHEN the Dilution of Labour became imperative, the manufacturer naturally thought that the heavier the shell the less adapted they were to female labour. The direct opposite has proved the case. The repetition in handling the smaller shell produced a physical strain that was not present in the slower and more deliberate moving about of the big projectile. In the smaller shell, men can conveniently, without mechanical assistance, handle them, whereas in the larger shell, men were obliged to use the assistance of machinery, and consequently men and women here became equal.

The devices for handling the larger shell, as shown in the pictures, will go to demonstrate the ease with which they are moved. Two distinct examples in the manufacture of eight-inch shells are reproduced. On pages forty-five to forty-nine are shown the block and tackle method of handling the shell bodies. On page forty-nine and thereafter a different method is seen. A roller track traverses the whole shop, and a shell from the first operation to the last is moved with the greatest of ease. At convenient places in the tracks indicators are installed which show on a dial the number of shells that have passed that point. Short sidings at right angles to the main track are provided where a shell is required for an operation, and here the shell is switched off the main track into the machine, where it is picked up and locked by hydraulic power. In the boring operation, the pressure on the boring tool is also maintained by hydraulic power, with safety cut-offs at the completion of the work. The factor of success in women's work on heavy shells is the moving devices, and the higher the perfection of these devices the higher the perfection of the output.

Great credit is due to the manufacturers who have equipped their plants with these modern devices for the conservation of physical energy, and we look forward confidently to the time when others will follow the lead already given, thereby opening a further possibility for the Dilution of Labour and the greater production of munitions.



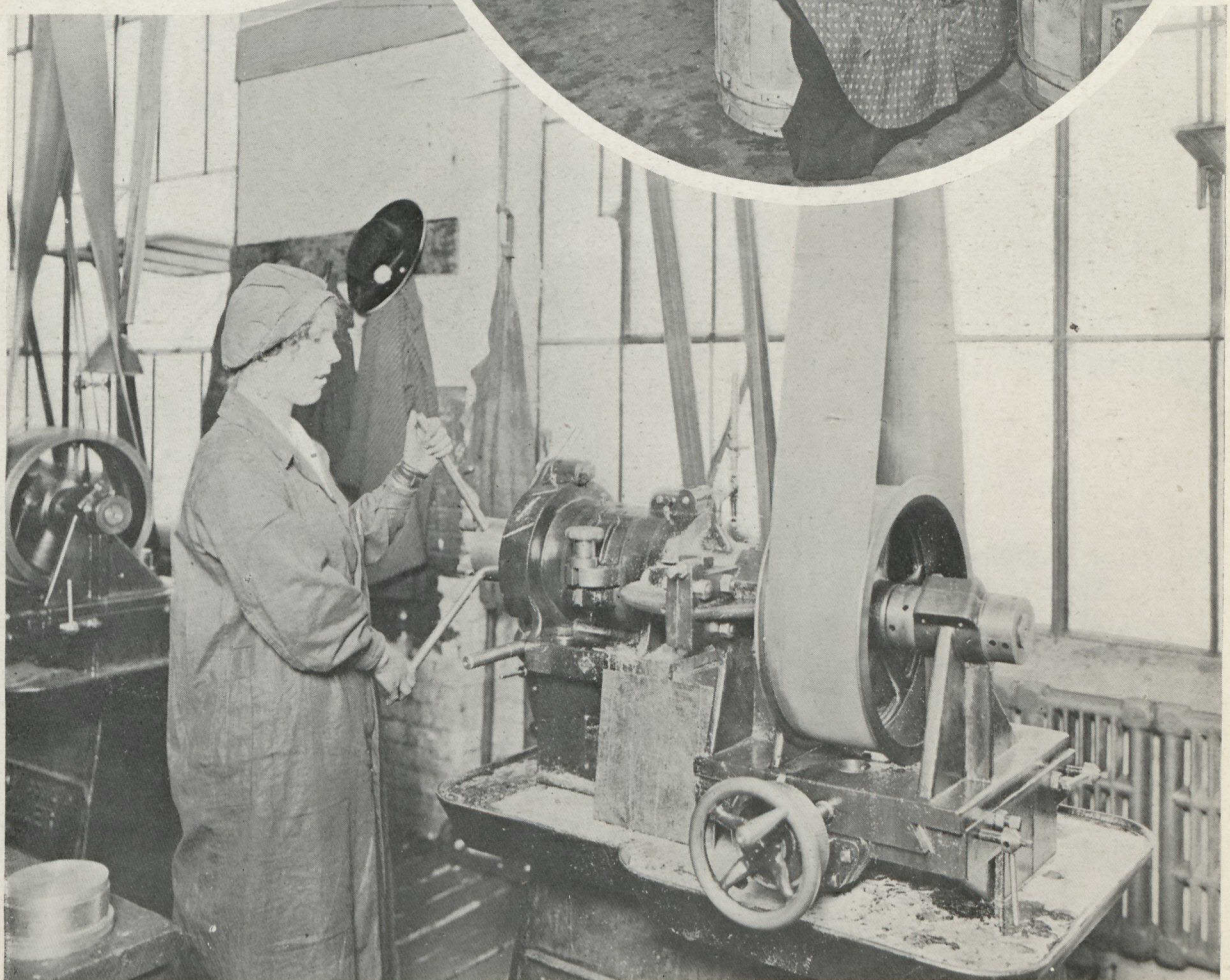
Second Rough Cut,
4.5 High Explosive



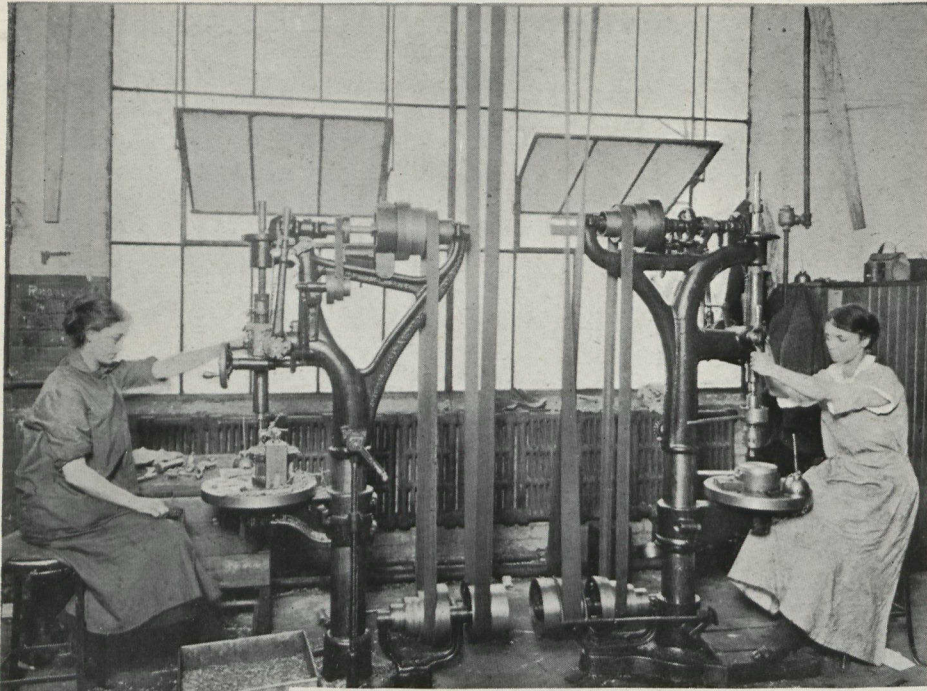
These shells are handled by
women without the aid of any
lifting devices.

Finish Turning and
Profile 4.5 High
Explosive Shells

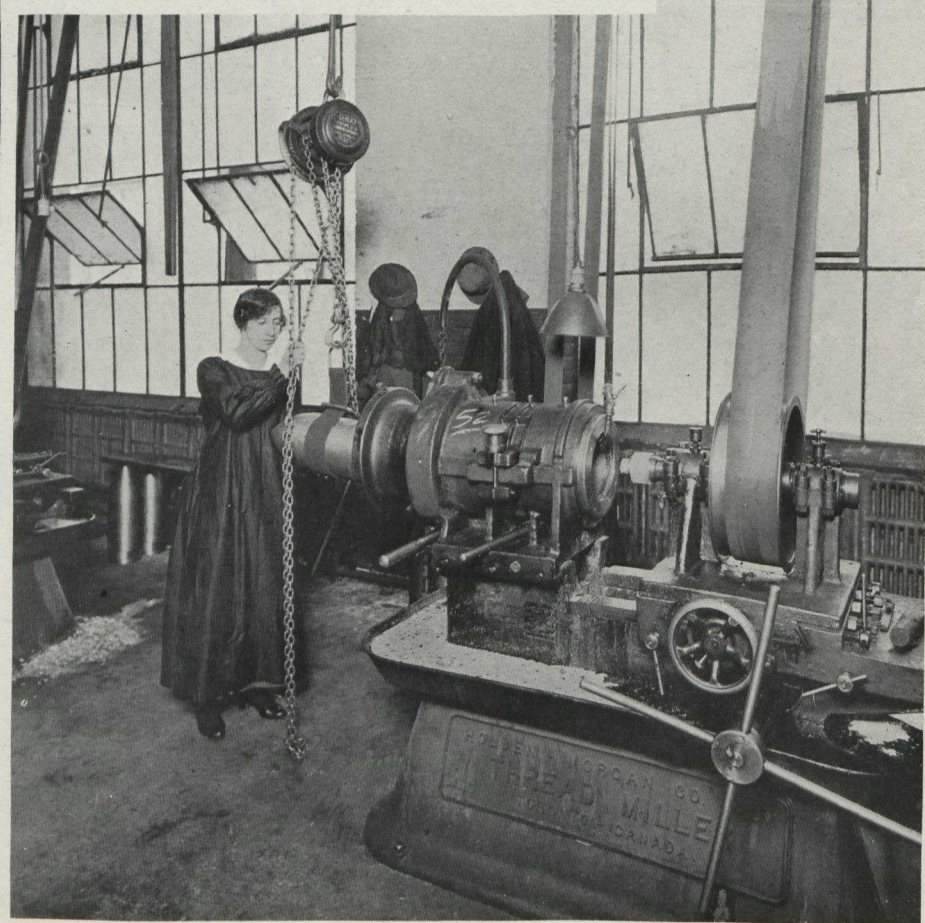
Varnishing 4.5 High Explosive



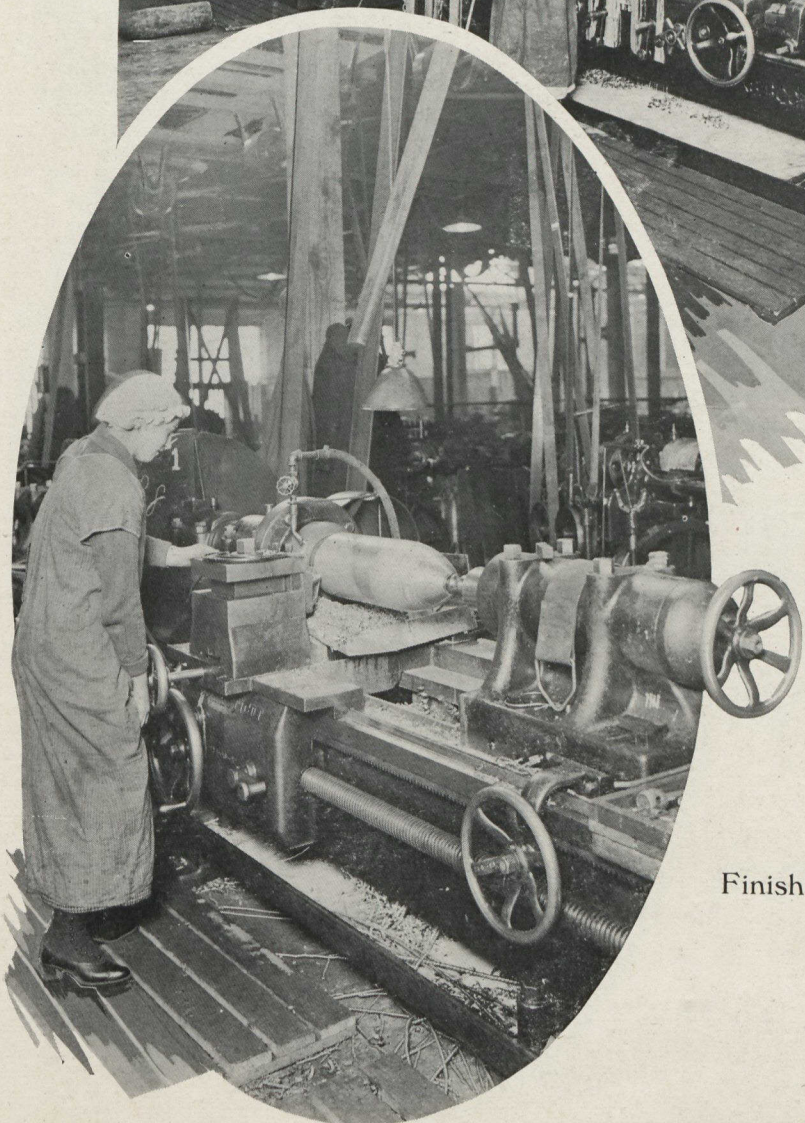
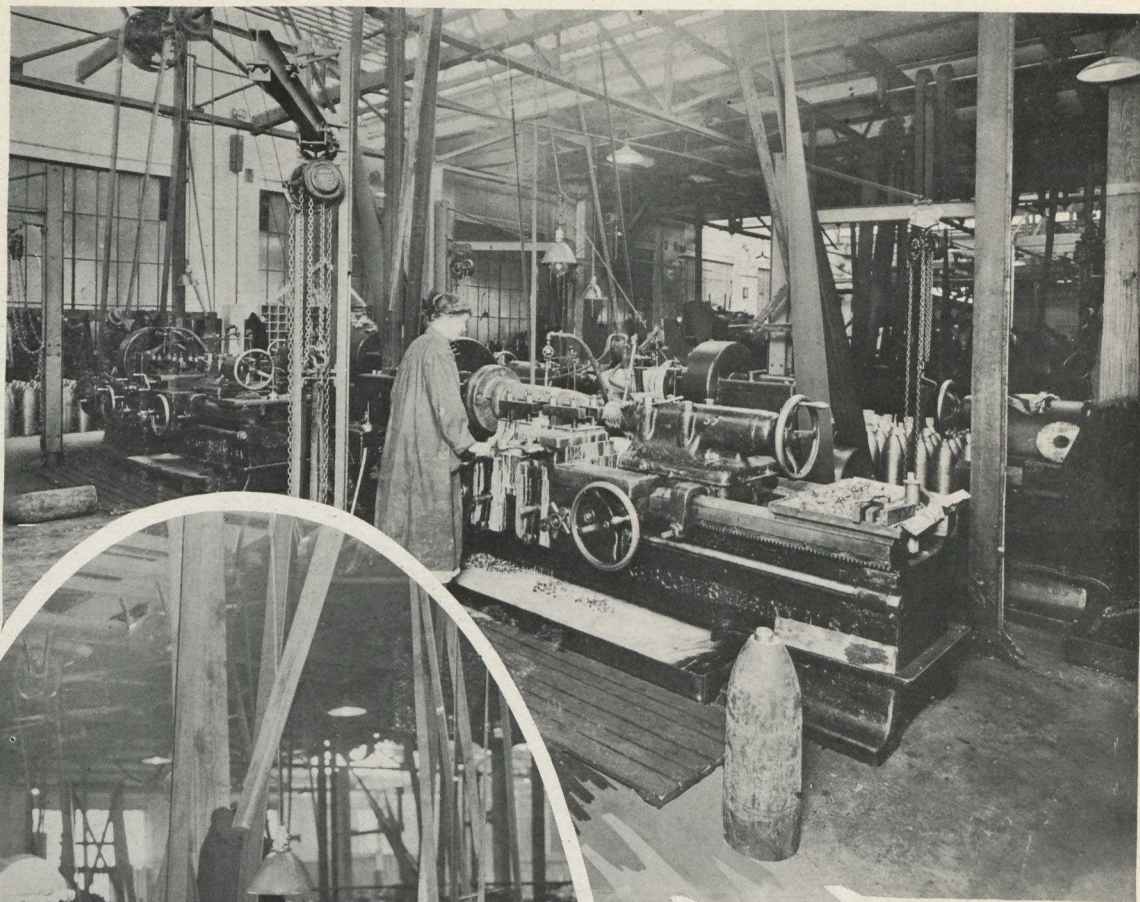
Milling Thread on Adaptor for 8 inch Shells



Drilling and
Tapping Wrench
Holes in Adaptor
8-inch Shell Work



Operator Feeding
8-Inch Shell Into
Milling Machine
for Milling Thread
in Base. The
small jib carries the
centering breech
of machine, and it
is easily replaced
after shell is
entered.

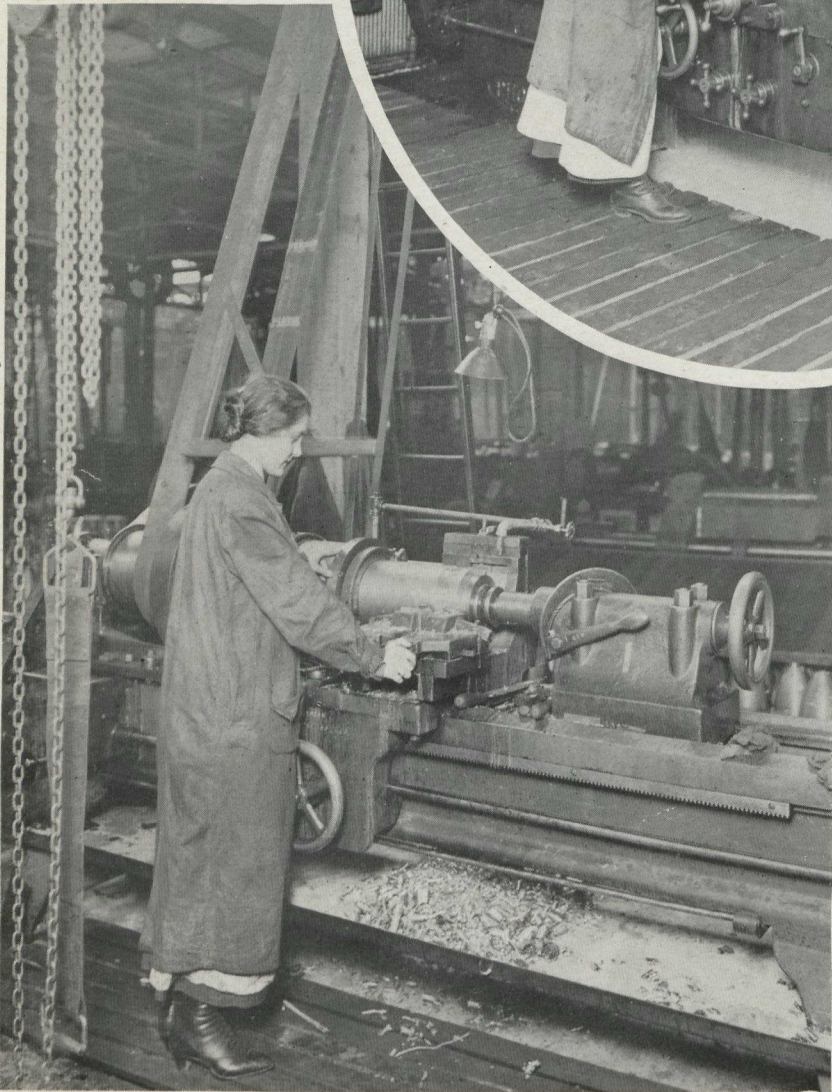
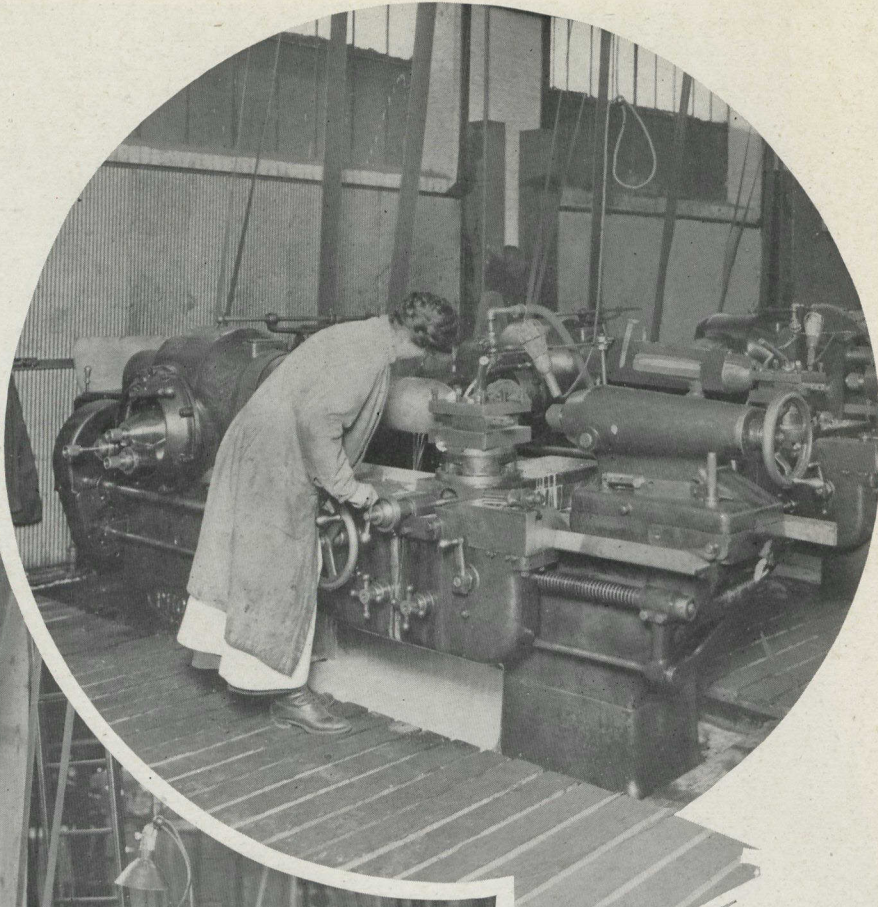


Rough Turning 8-inch Shell.

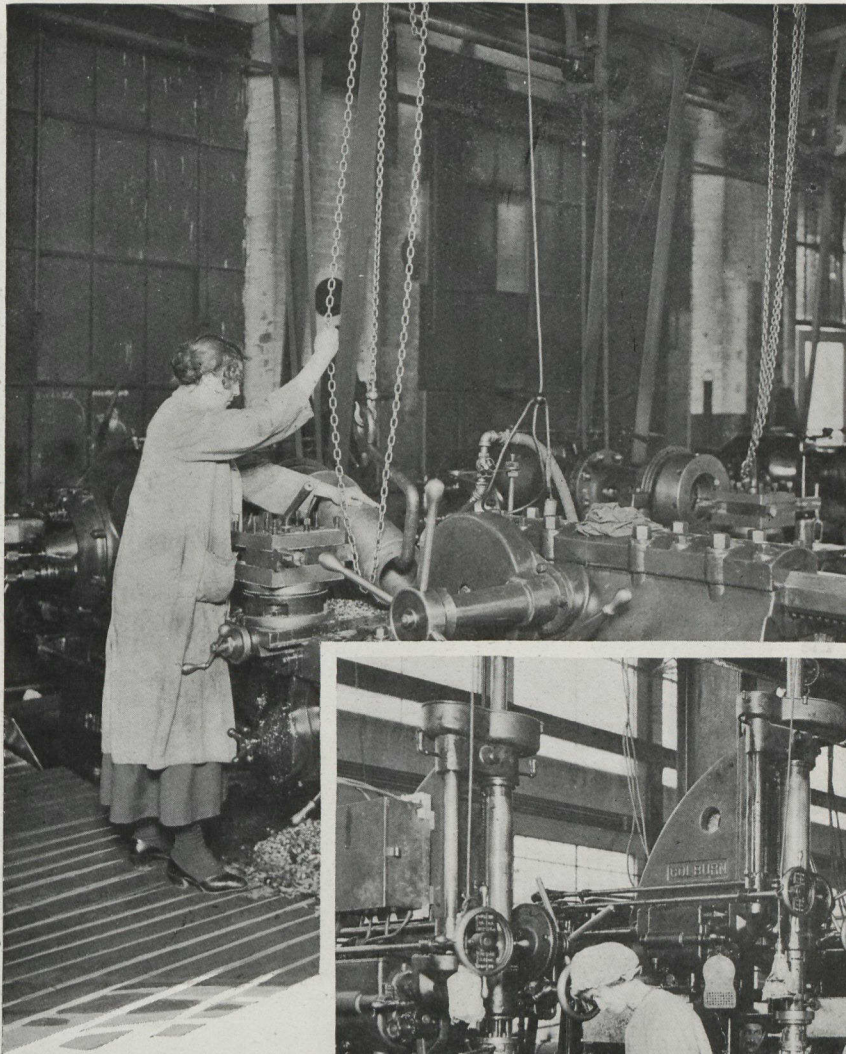
Note the lifting tackle on jib behind operator.

Finish Turning 8-inch Shells.

Boring the Fuse Hole
8-inch Shell



Undercutting and
Waving of 8 inch Shells



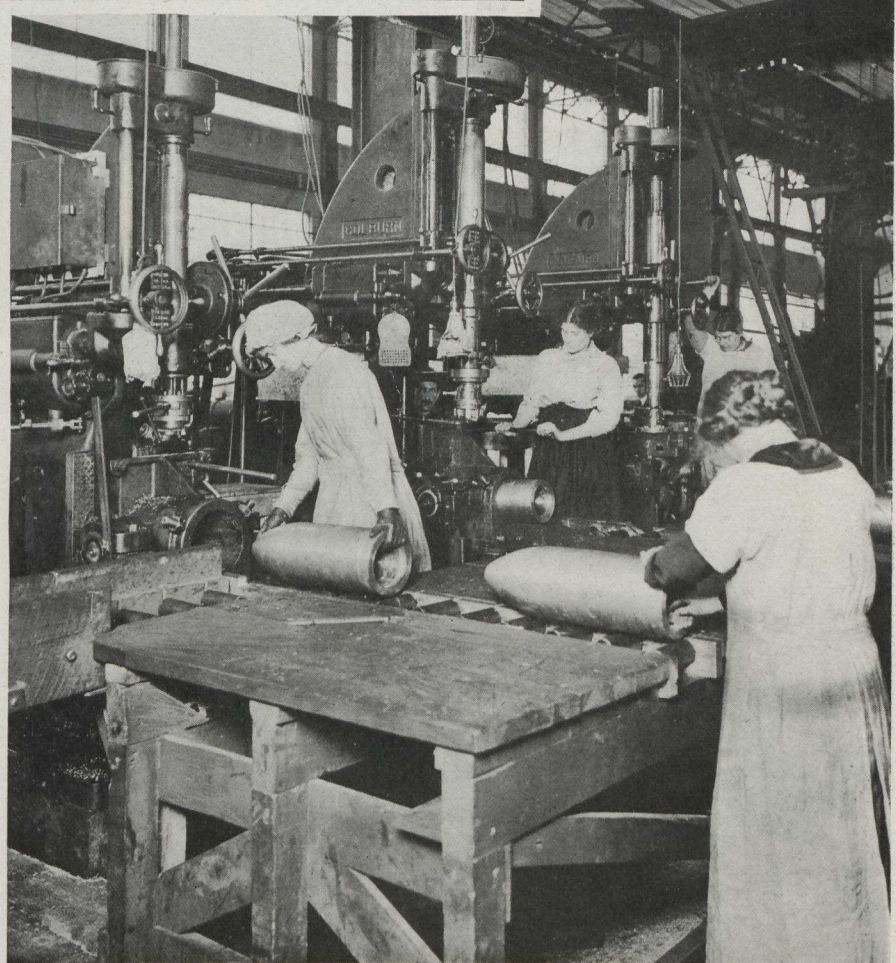
Handling an 8-inch Shell Body with Lifting Tackle Previous to an Operation

Recessing and Tapping Shell for Adaptor

1st machine, the shell is being entered in the jig.

2nd machine, the shell is nearly home.

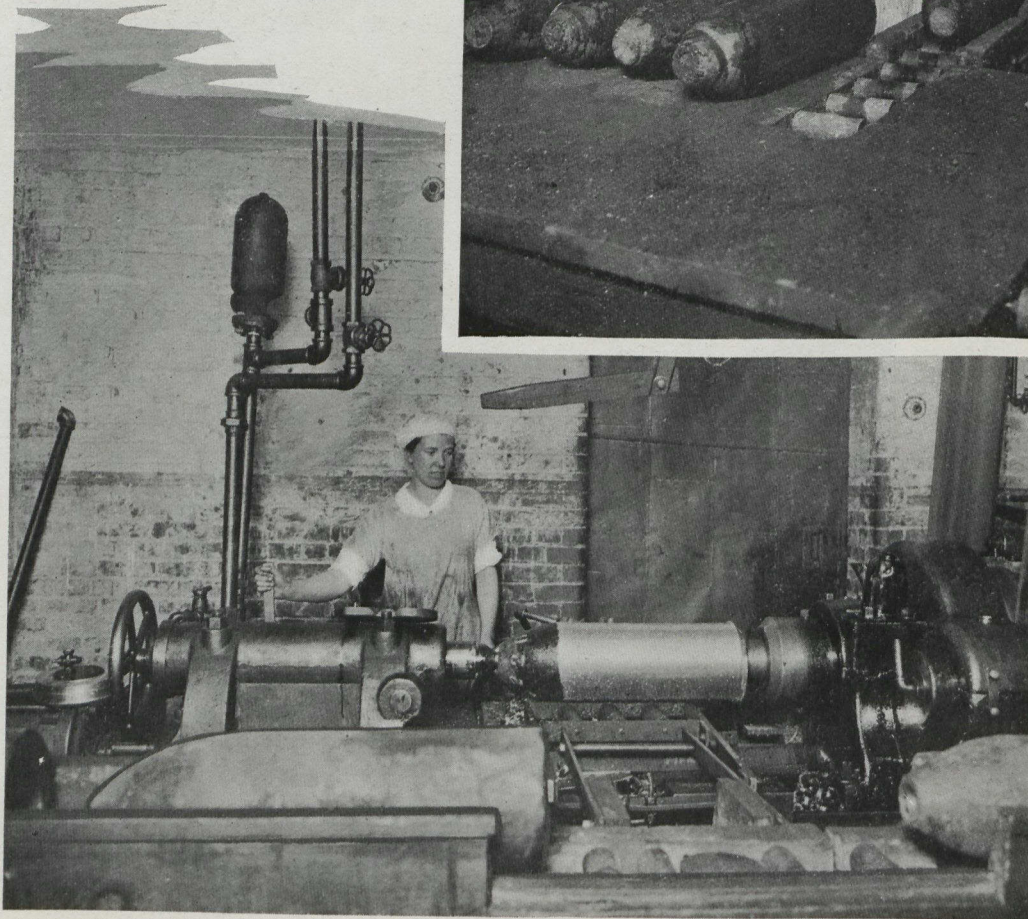
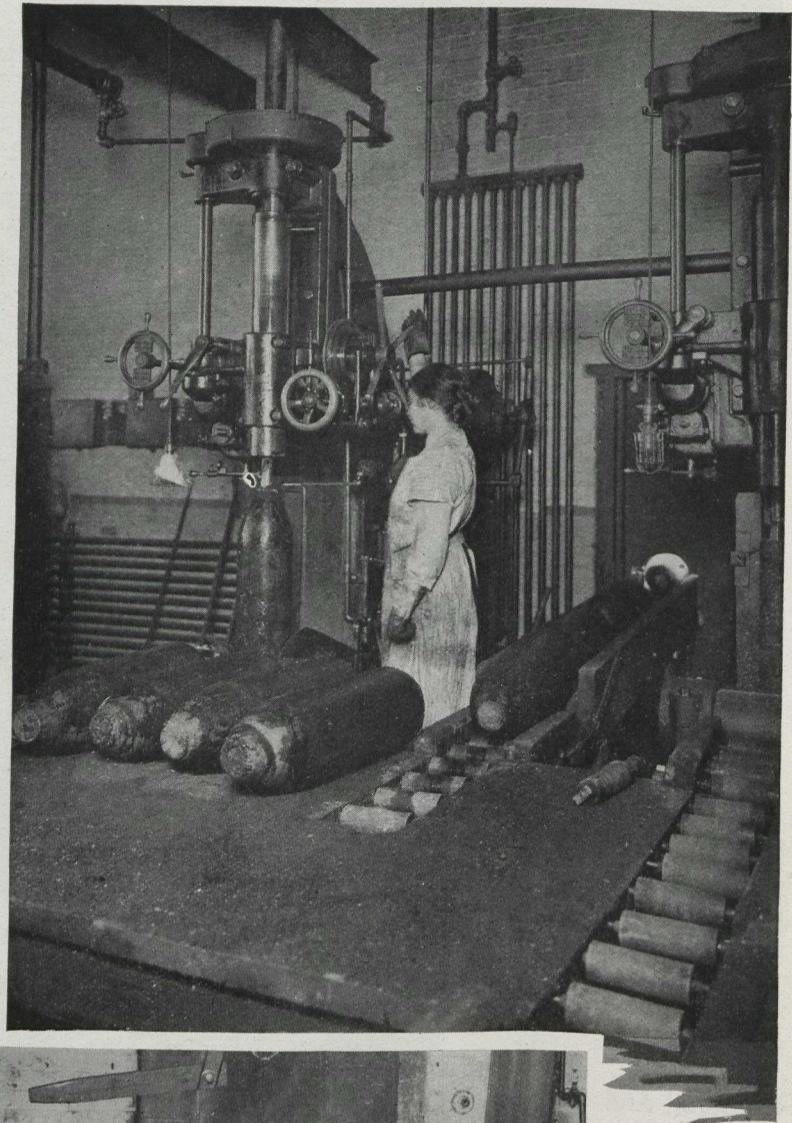
3rd machine, the jig by hydraulic power is upset, centered and closed ready for work.



The two photographs on this page strikingly illustrate the difference between two systems of handling 8-inch shells. In the upper picture the shells are transported from one machine to another by means of low trucks, from which they have to be lifted by chain blocks into the machine, and vice versa when the operation is completed. In the lower picture is seen the roller track previously described, also a good example of the short tracks at right angles to the main track, which, in this case, is for the purpose of inspecting. After inspection the shell is rolled on to the next track to go to the machine for the next operation.

Drilling the Nose.

This is the first operation. The forgings are being fed into the works through the central opening. The self centering jig is seen on the idle machine, after this operation the forgings are rolled along the roller track to the machines doing the rough turning.

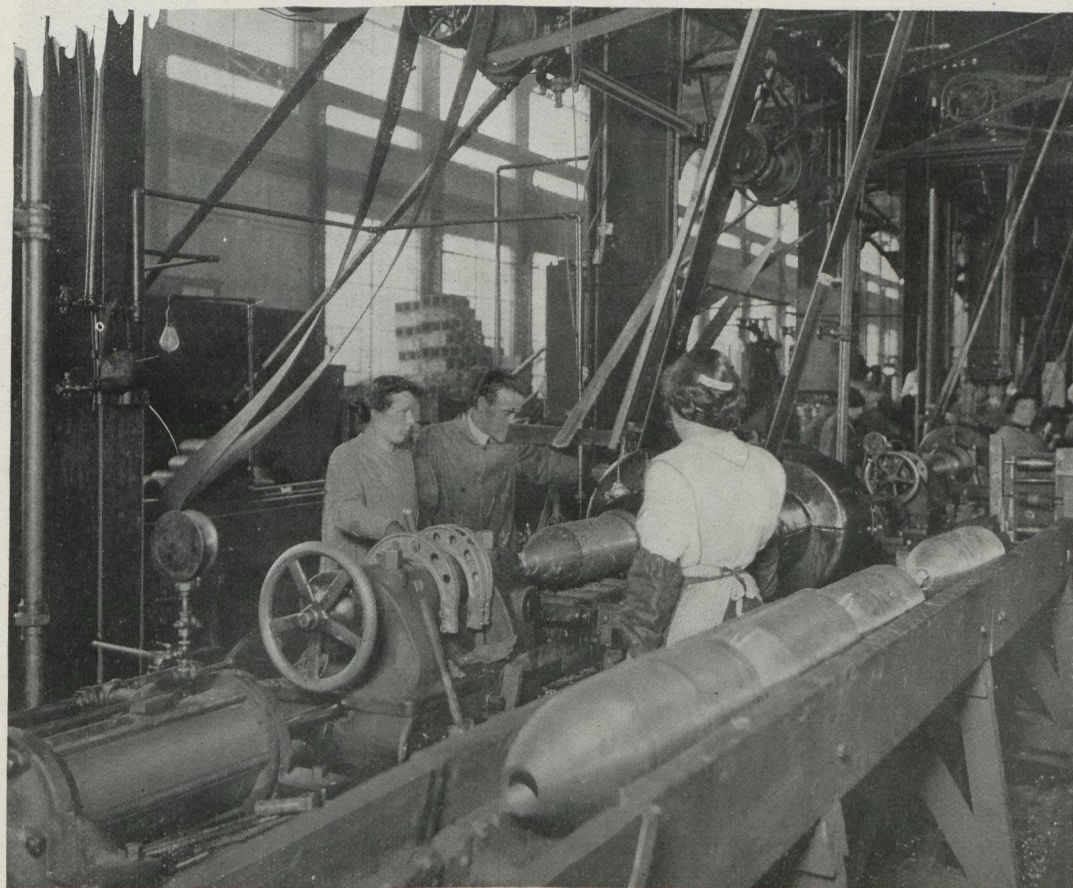
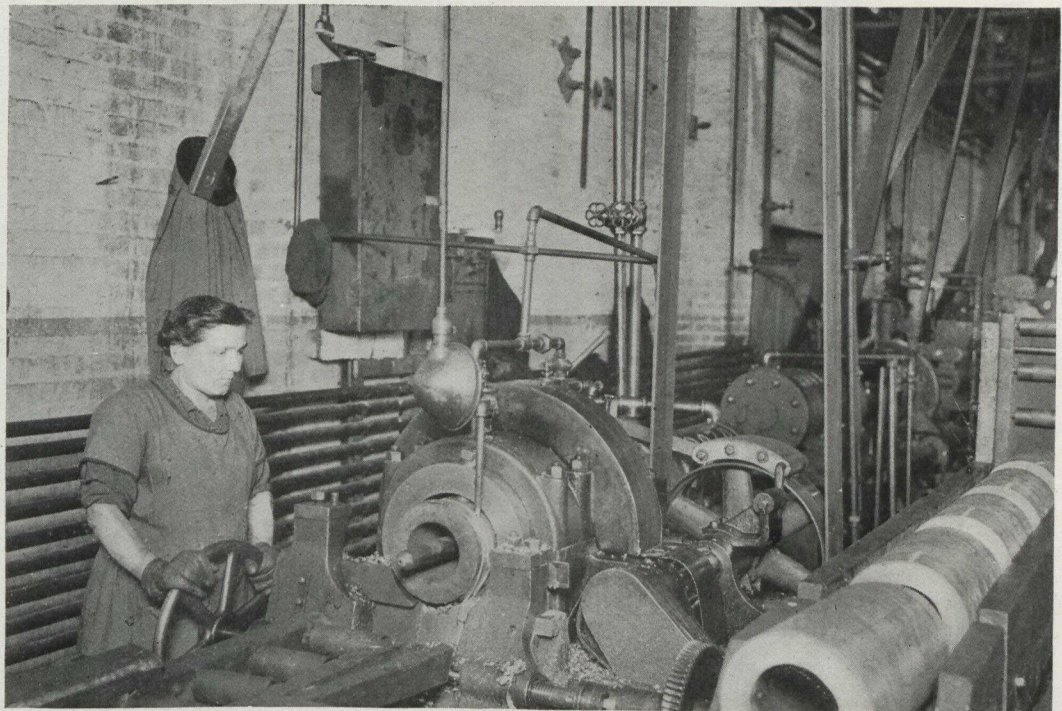


Machines Doing the Rough Turning

A clear view of the simple method of handling is shown here. Hydraulic power not only holds the forging during the operation but lifts it into place.

Dual
Operation

Cutting off the
nose and base.
Base end only is
seen.

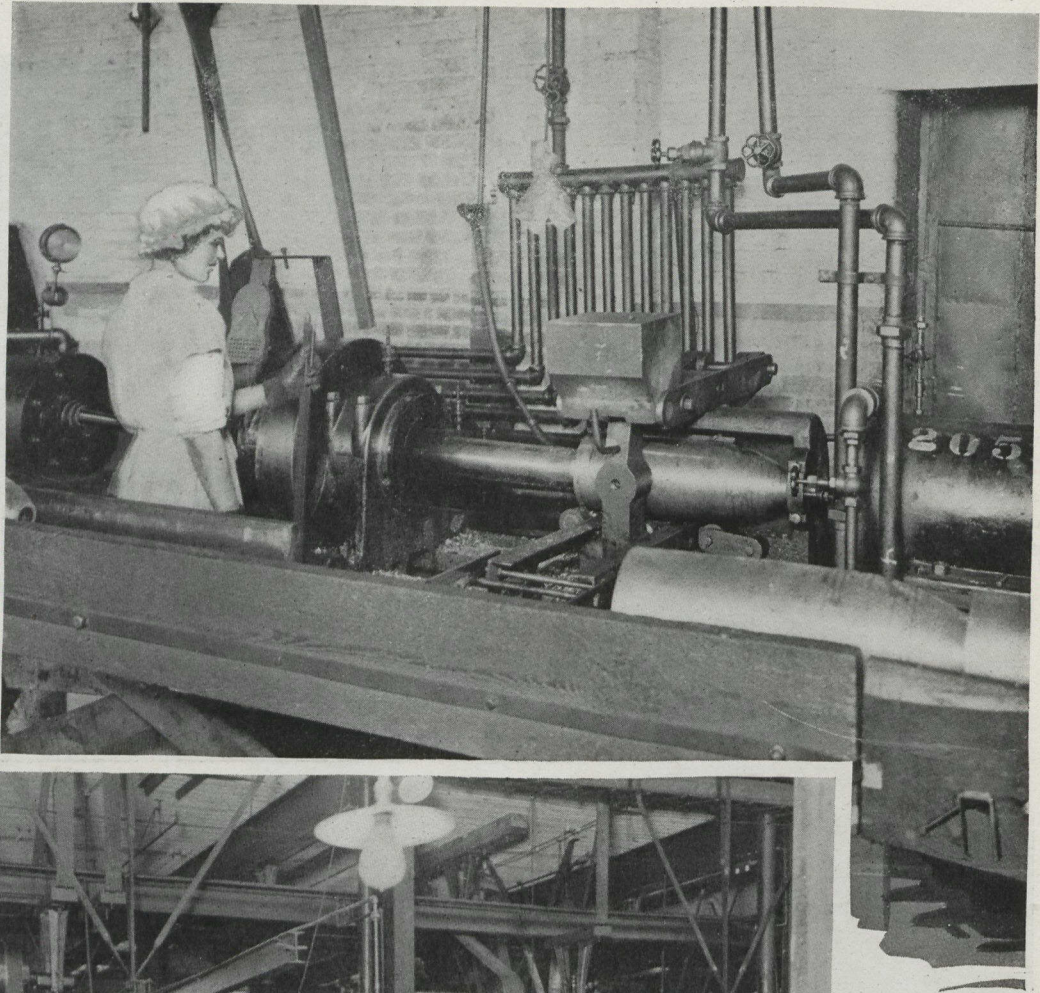


View of
Three
Machines
Finish
Turning
and Turn-
ing the
Profile.

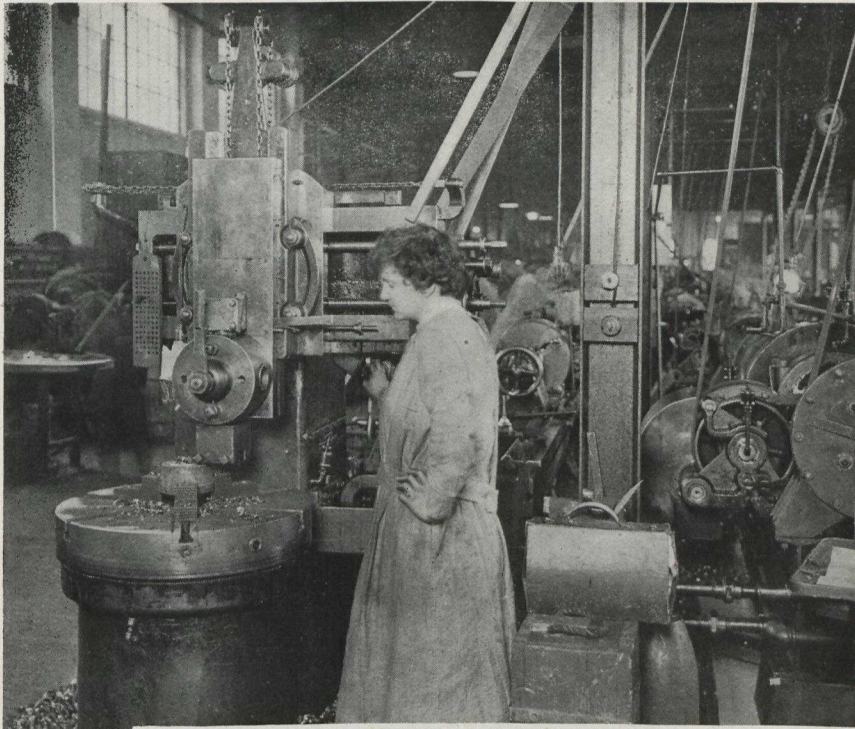
The opening
in the roller-
way track
seen to the
right of the
picture
is to facilitate
movement of
workers pass-
ing from place
to place, and
open and close
at will.

Rough Boring

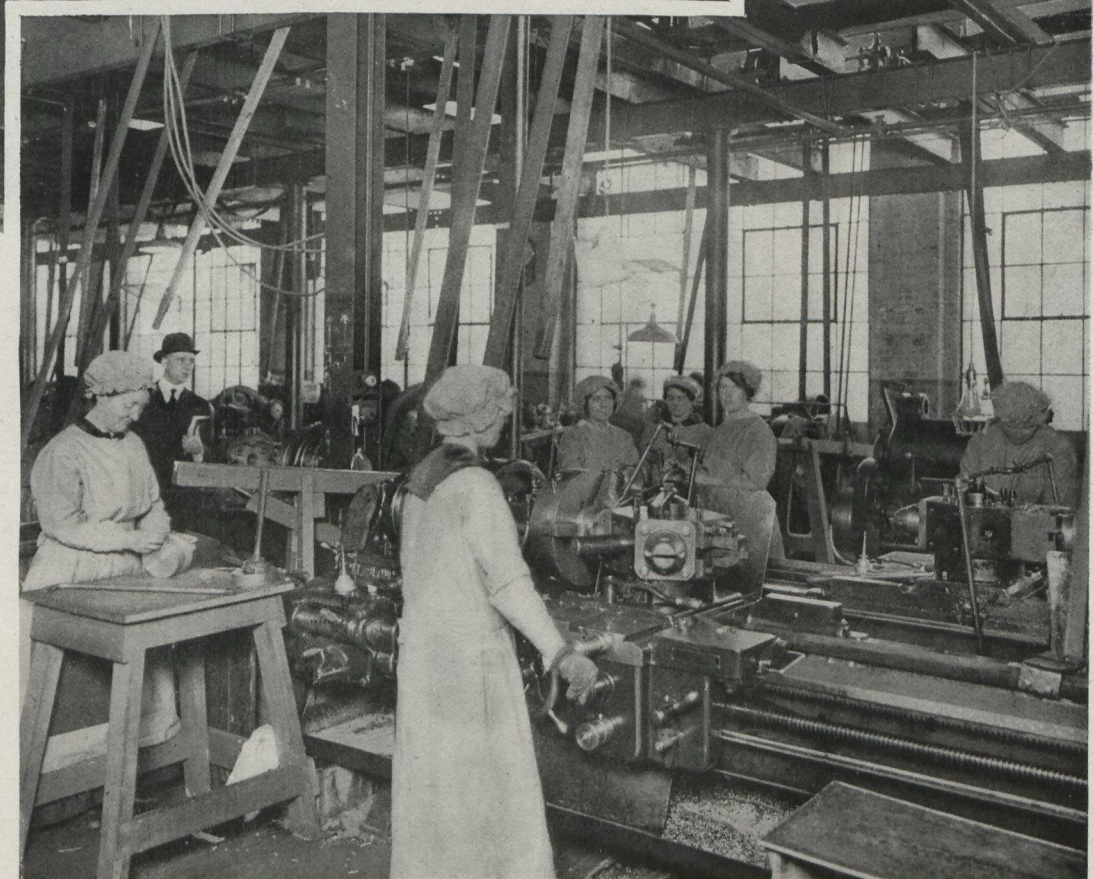
A good view of the Hydraulic cylinder and ram carrying boring tool is seen in this picture. As before mentioned a guide is attached to the ram which cuts off the pressure when the boring tool has reached its limit. The use of these automatic devices gives the women great confidence and they do their work with plenty of zest.



Inspection

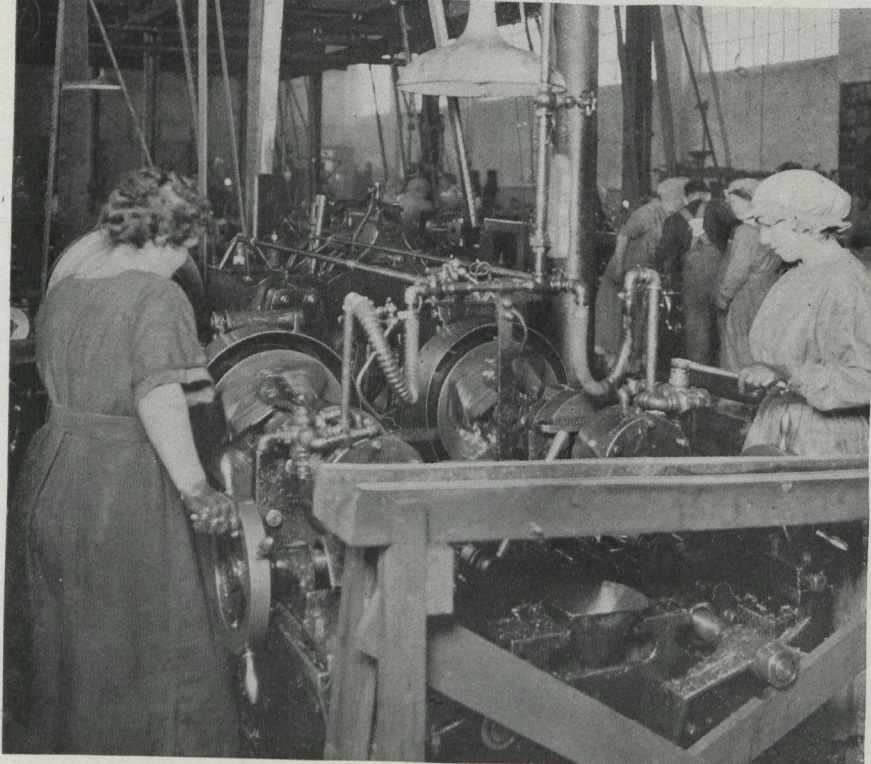
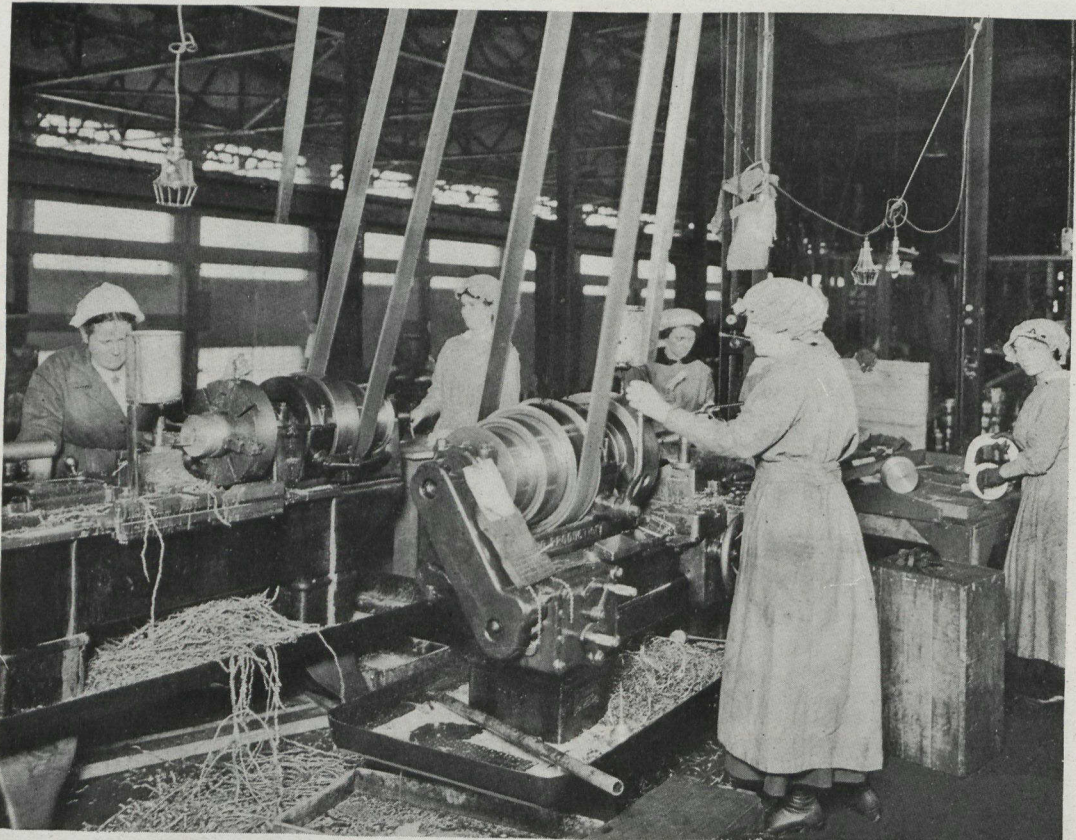


Rough turning the
Adaptor base for eight
inch shells
First operation

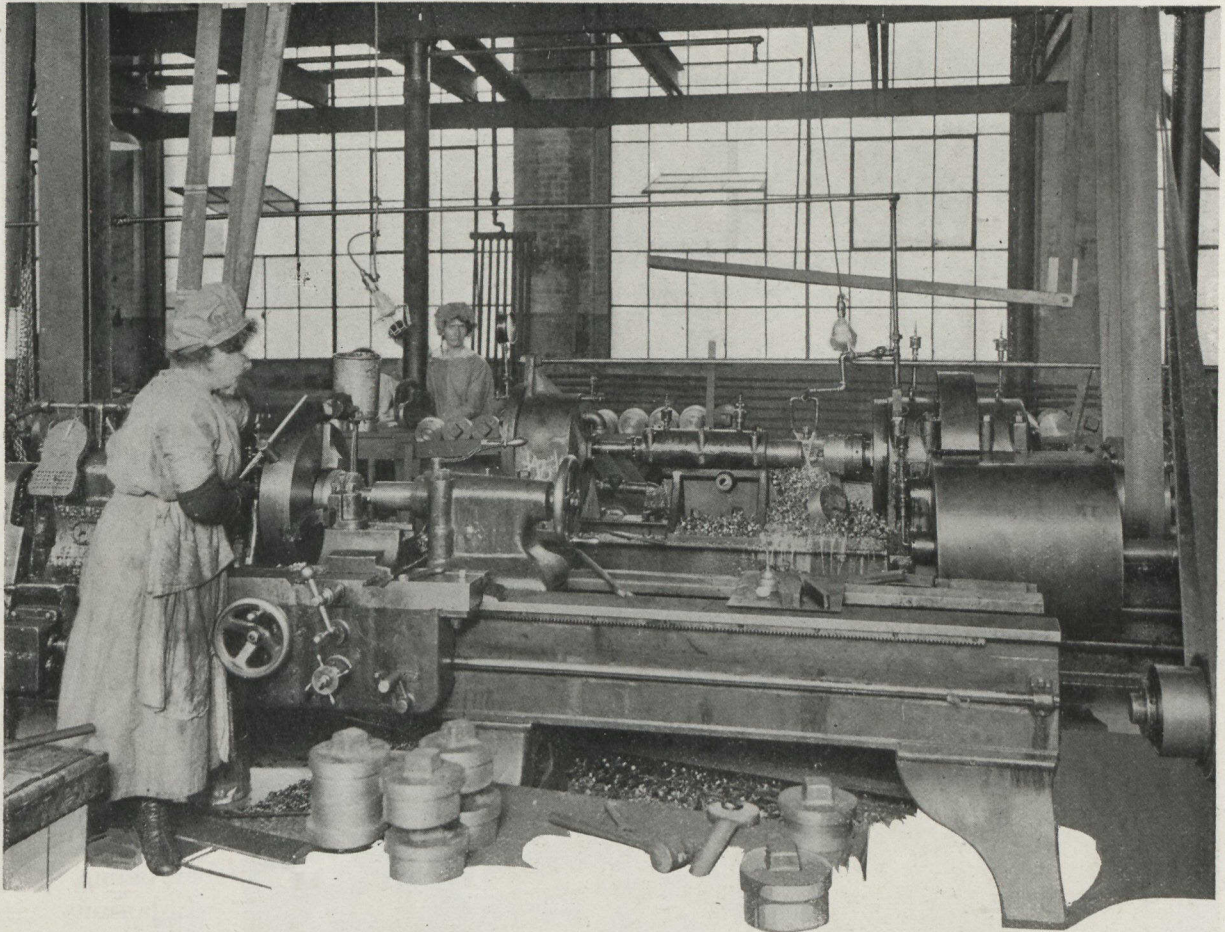


Rough
turning
the
Adaptor
Second
operation

Finish
Turning
the
Adaptor



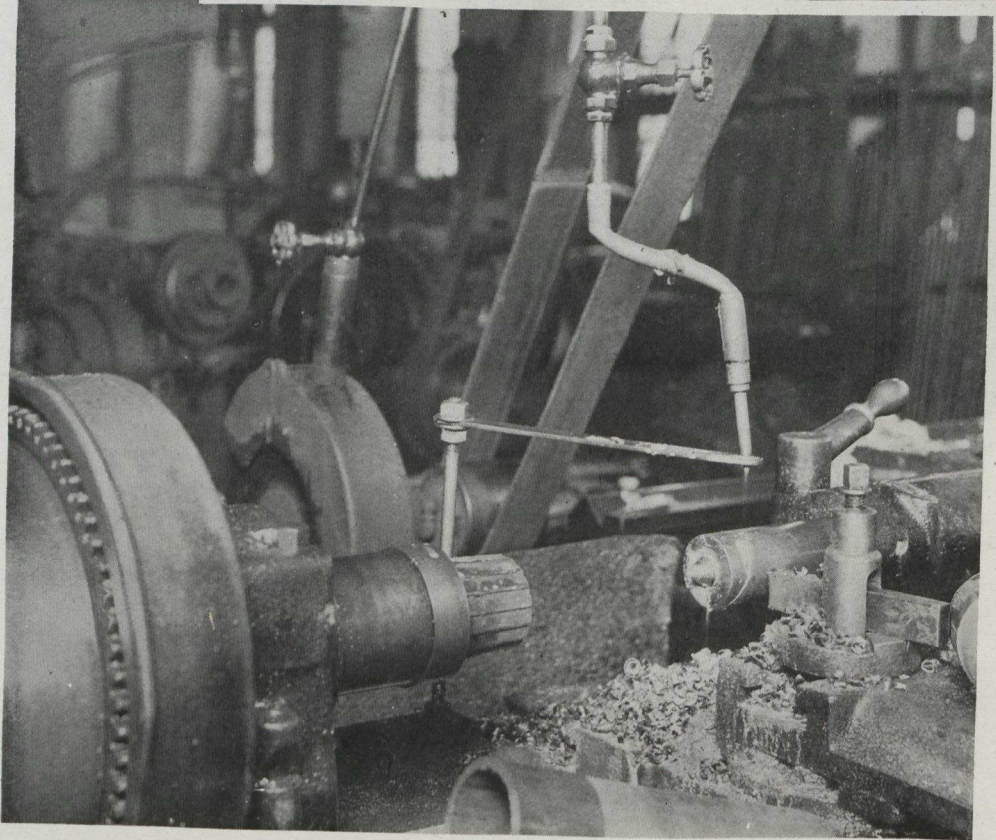
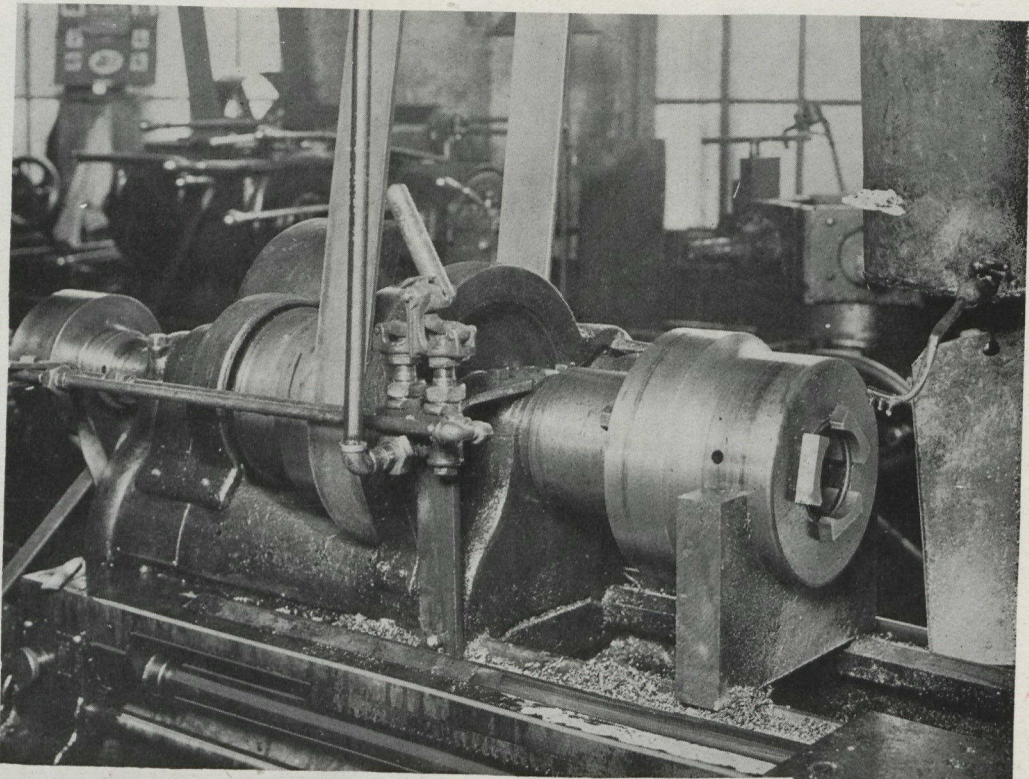
Threading and Chasing
Adaptor Thread



Finishing Base of Adaptor

General
View of
Compressed
Air Chuck

The adoption of this chuck for women workers is to be highly commended. The moving of the lever (in the centre of the picture) opening or closing the chuck at will. The air piston is clearly seen at the end of the headstock.



Driving Centre
Attachment,
Avoiding
Laborious
Chucking

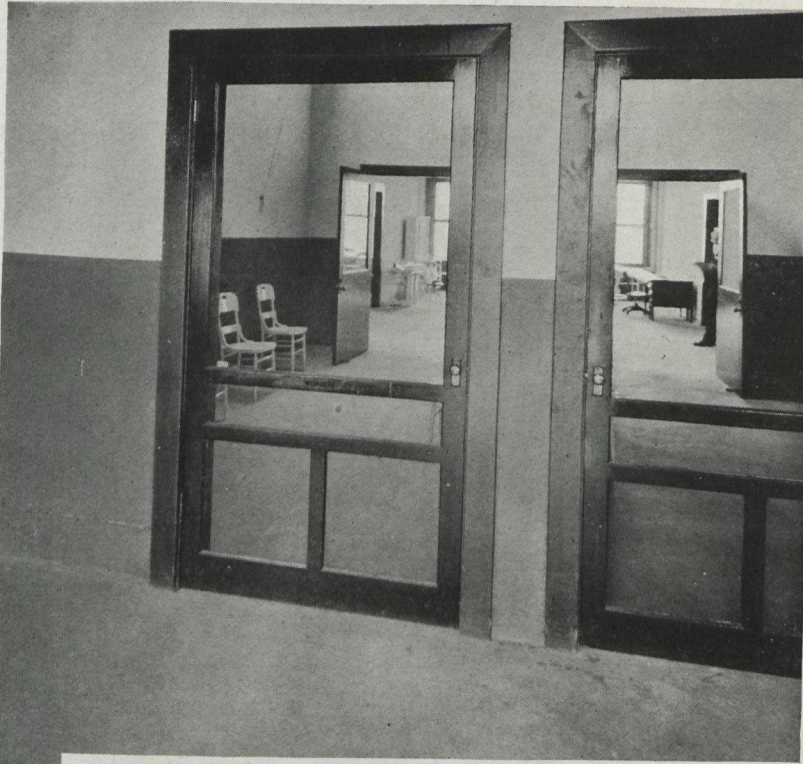
Forgings are quickly chucked in and out of the lathe by means of this taper mandrel, the forgings being driven tight on to the mandrel by the tailstock centre without unnecessary energy

Spacious Lunch Rooms

SPACIOUS Lunch Rooms, or Canteens, are provided in many plants where light refreshments can be purchased by the workers. The majority of the hands bring their own supplies, but tea, coffee, milk and sugar are nearly always provided by the manufacturer to the women, free of charge. Some employers, who use over a six-hour shift, allow ten minutes forenoon and afternoon for tea. In many cases these canteens are supervised and managed by the Young Women's Christian Association, as a patriotic contribution, those in charge being voluntary workers.

We cannot too highly commend the welfare feature of woman labour on the side of pure commercialism. It produces greater efficiency, greater output, and greater contentment where it is present than where it has not been introduced.

Matrons, where the number exceeds one hundred, are almost indispensable as a means of adjusting the many small irritations that are magnified in a woman's mind by neglect or inability to make them known to one of her own sex.



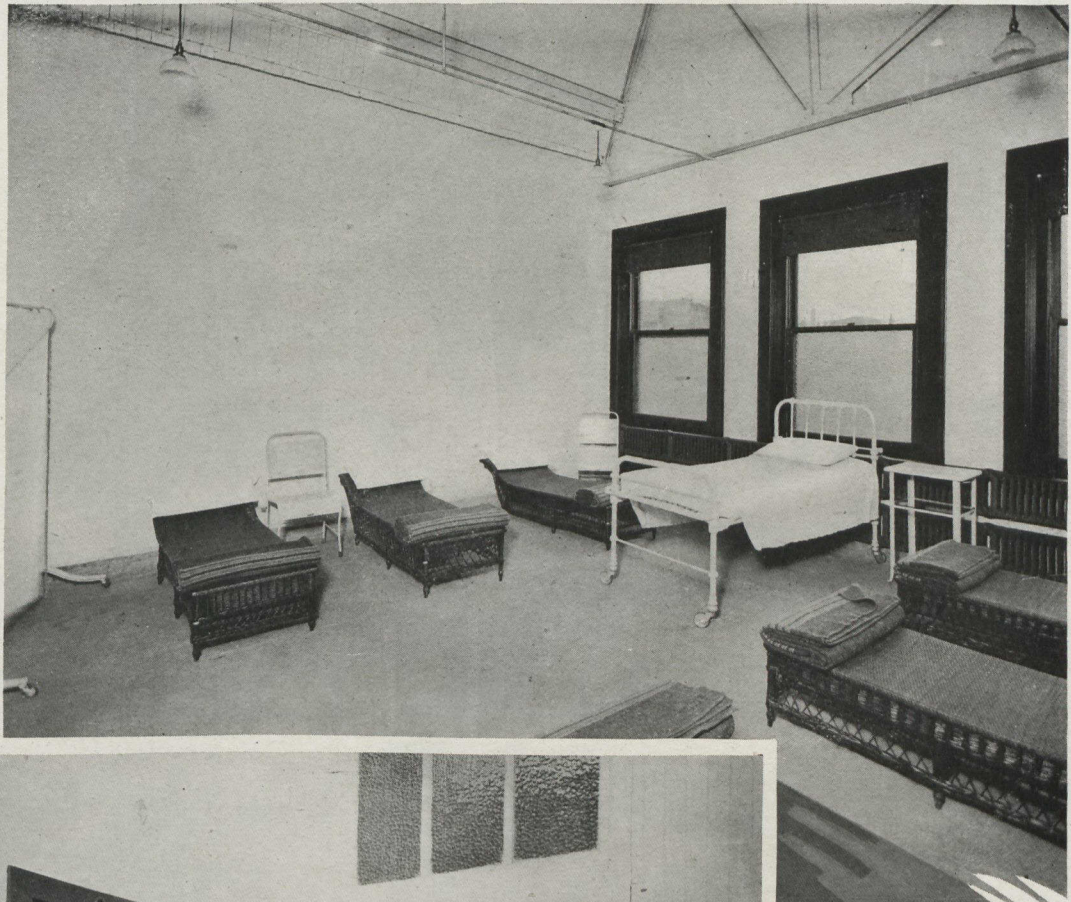
Entrance to Hospital
Department. Women (left)
Men (right)



General Operating Room

Operating table near right hand window. Sterilizing apparatus to left of picture.

Women's
Ward

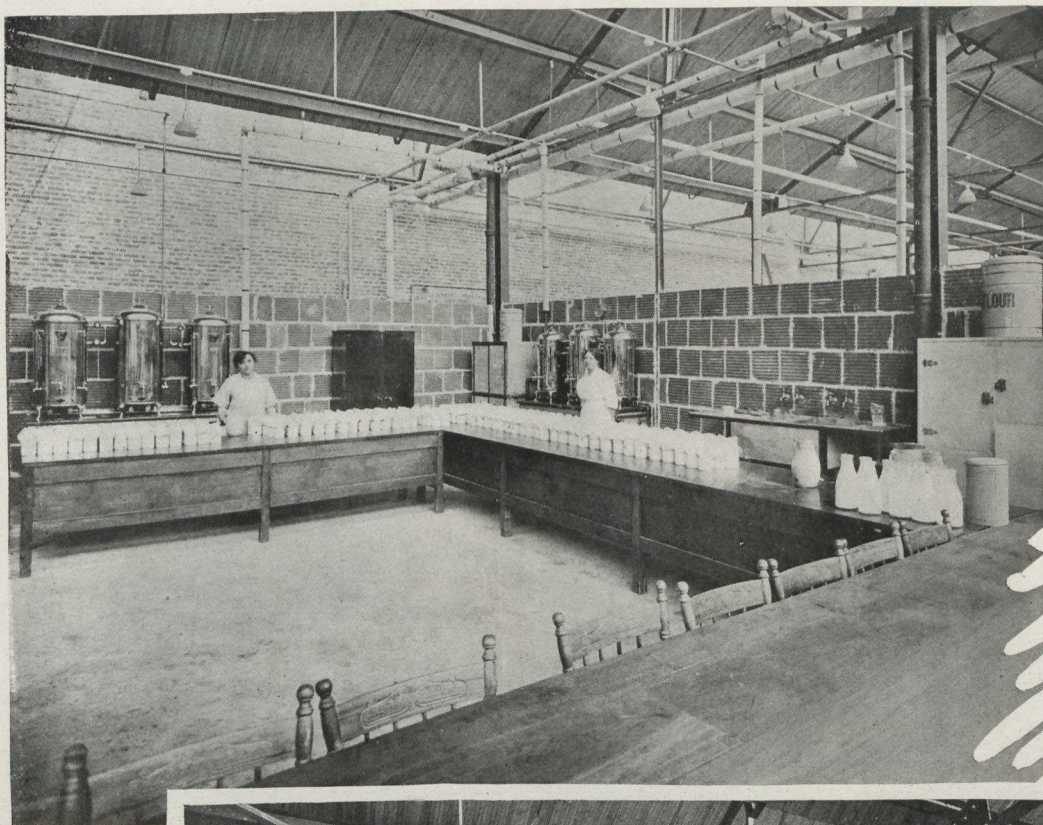


Looking Through
Men's Bathroom to
Men's Ward



Mid-day
Lunch, Enjoy-
ing their Well
Earned Meal
Cloak and
Hat Racks in
Background





The
Lunch
Counter

Almost ready for the 12 o'clock whistle. The tea and coffee mugs are ready to be filled, and are free to the women workers.

General
View of
Lunch
Room

24 tables.
Capacity of
each table,
30. Total,
720. Dimen-
sions of
room, 66 ft.
x 150 ft.



HOSPITAL, LUNCH ROOM
AND GENERAL ACCOMMODATION

Matron's Office
and Accident
Ward



Views of
Lunch
Counter
and
Lunch
Room



The official badge for women munition workers in Canada, issued by the Imperial Munitions Board. The badge is provided after 30 days' employment, and a service bar is added for each six months' continuous work at one plant.

I CAN'T! does nothing.
I'LL TRY! does wonders.
I WILL! does everything.