Women in the Production of Munitions in Canada.

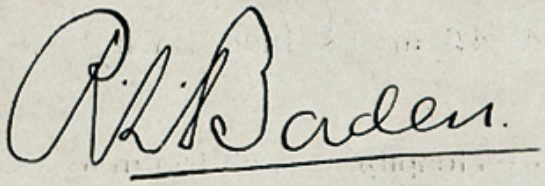
THE PICTURES HERE REPRODUCED HAVE ALL BEEN TAKEN IN CANADIAN MUNITION PLANTS AND FAITHFULLY REPRESENT ACTUAL CONDITIONS AS OF THIS DATE.

Issued by the Imperial Munitions Board
Canada
November, 1916

Sectional Index

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.

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.



: PREFACE :

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.

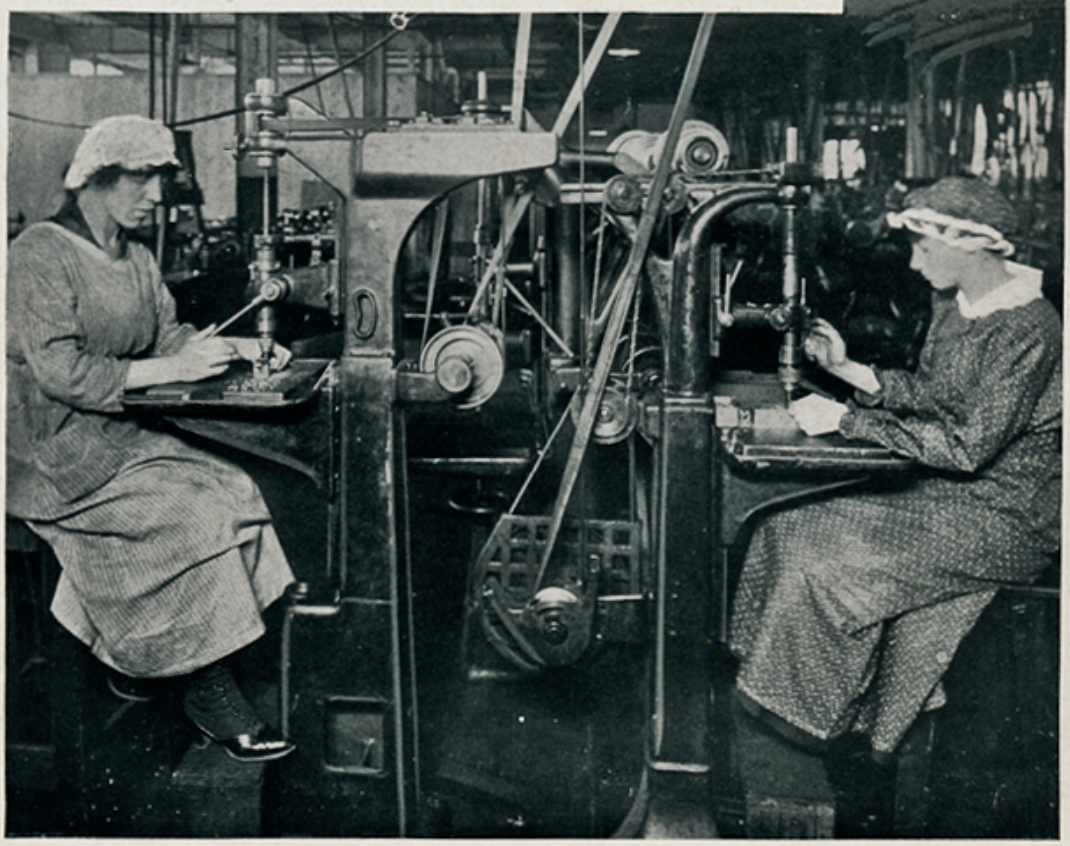
Rough and Finish Turning of Cap No. 80 Fuse

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.

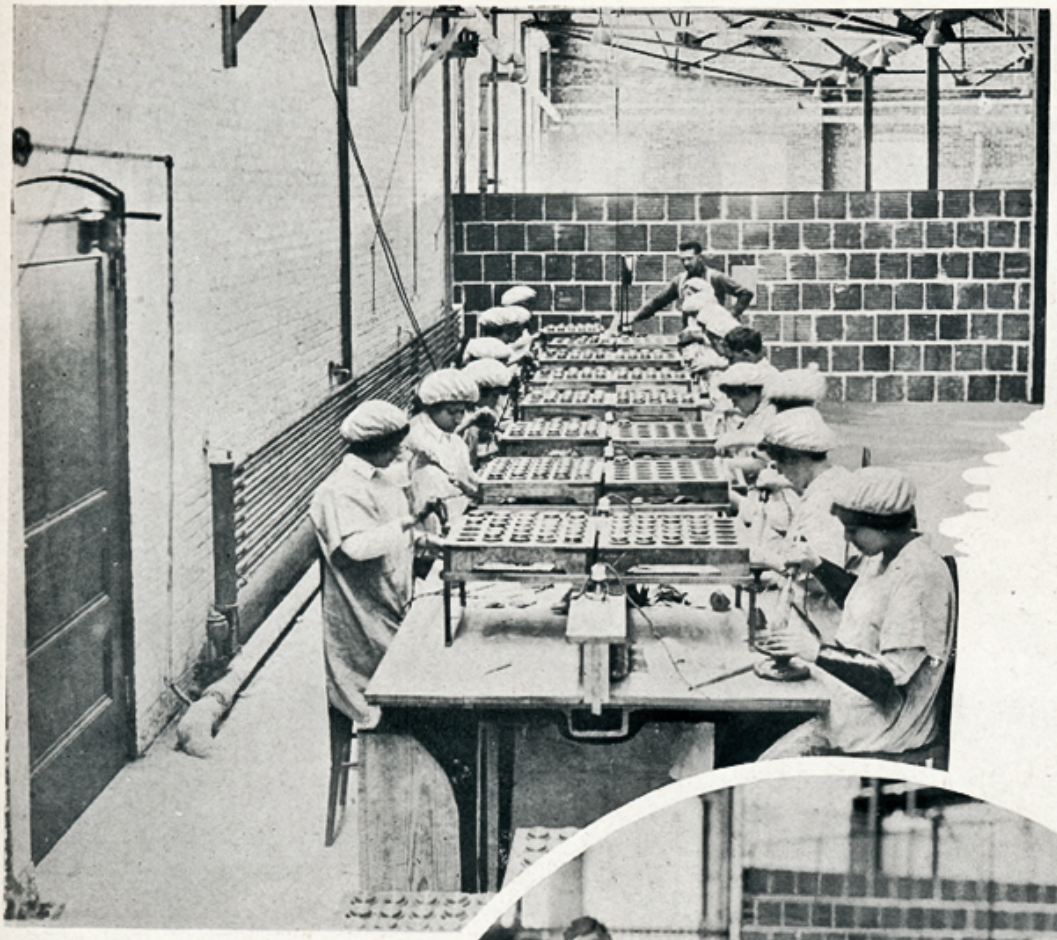
Assembling No 100 Fuses

Putting in setting pins in bottom rings. (Front)

Hand reaming rings. (Back)

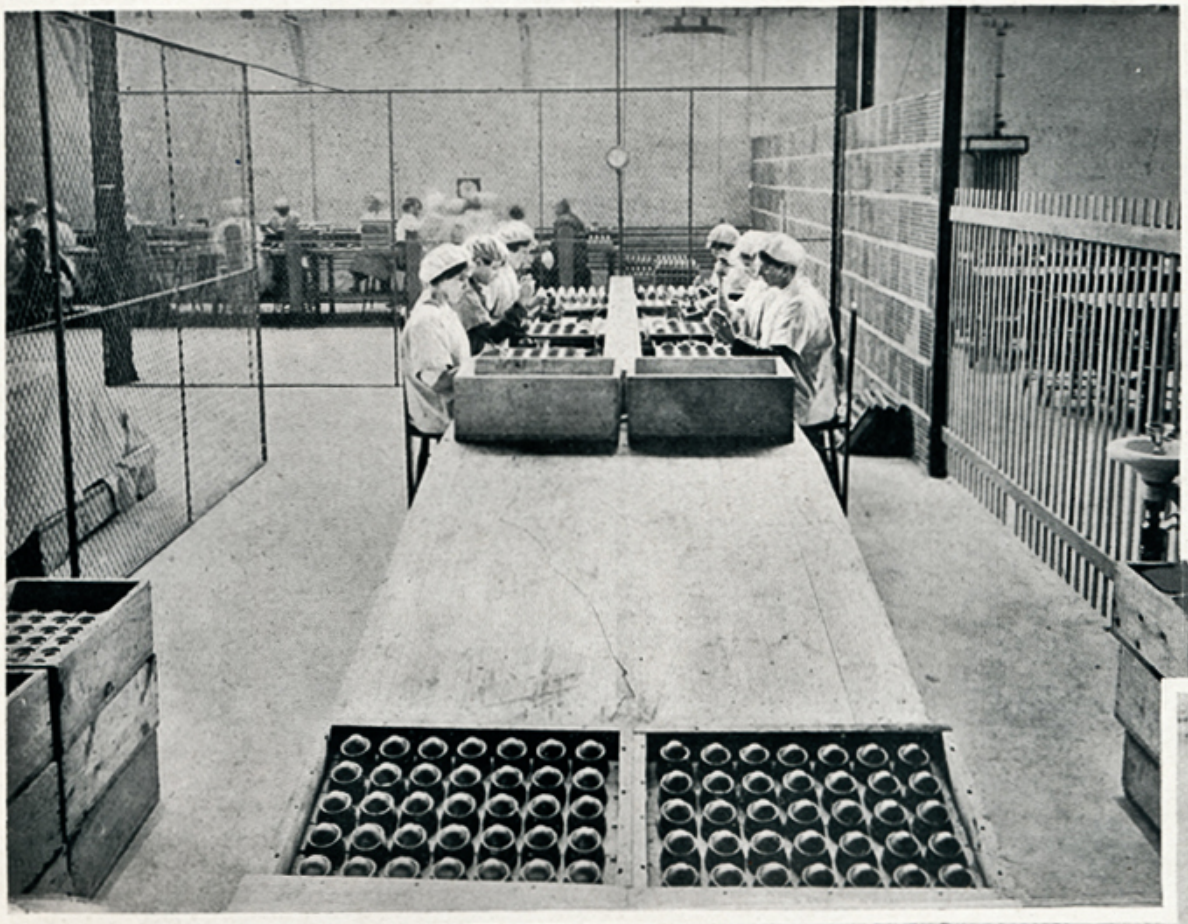
General View of Assembling Shop No. 100 Fuse

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



Soldering the Cap of No. 80 Fuse

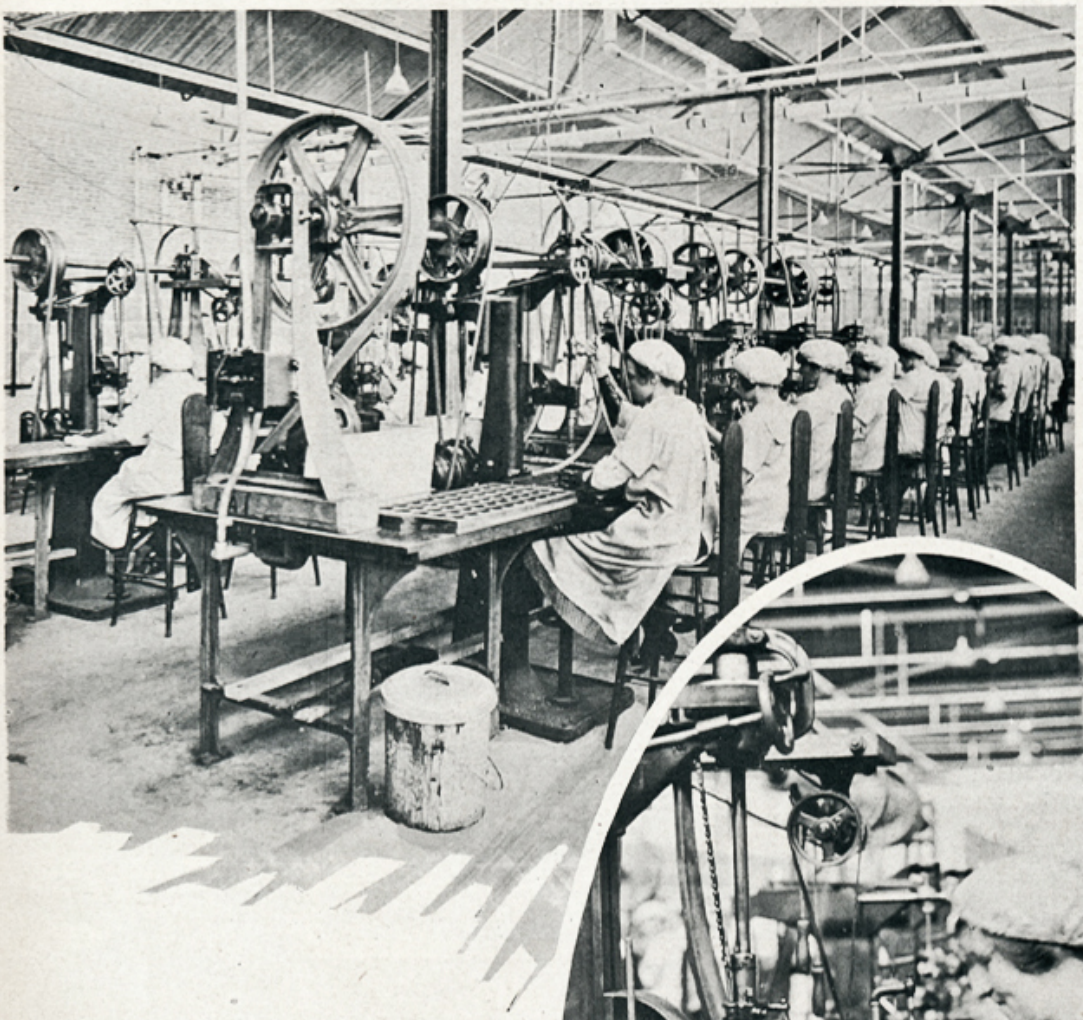
Close Operation of Above



Filling the Base Charge and Packing No. 80 Fuse

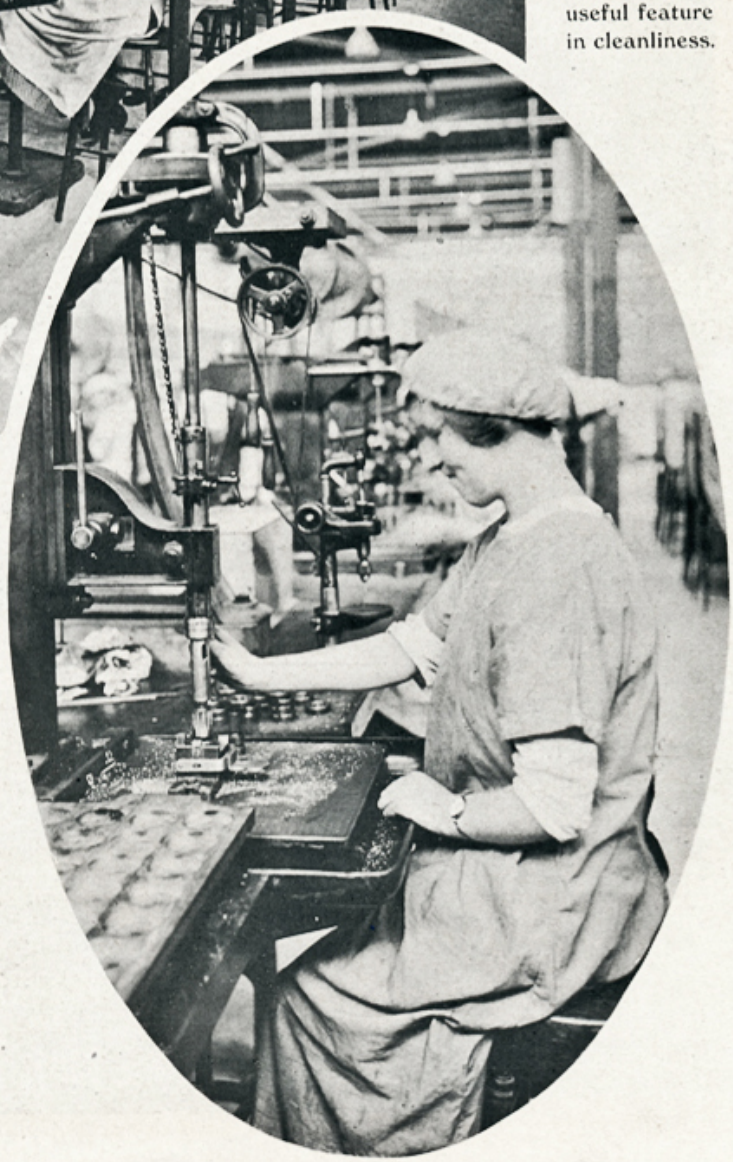
Note the drinking fountain on right.

Close Operation of Filling the Base Charge No. 80 Fuse

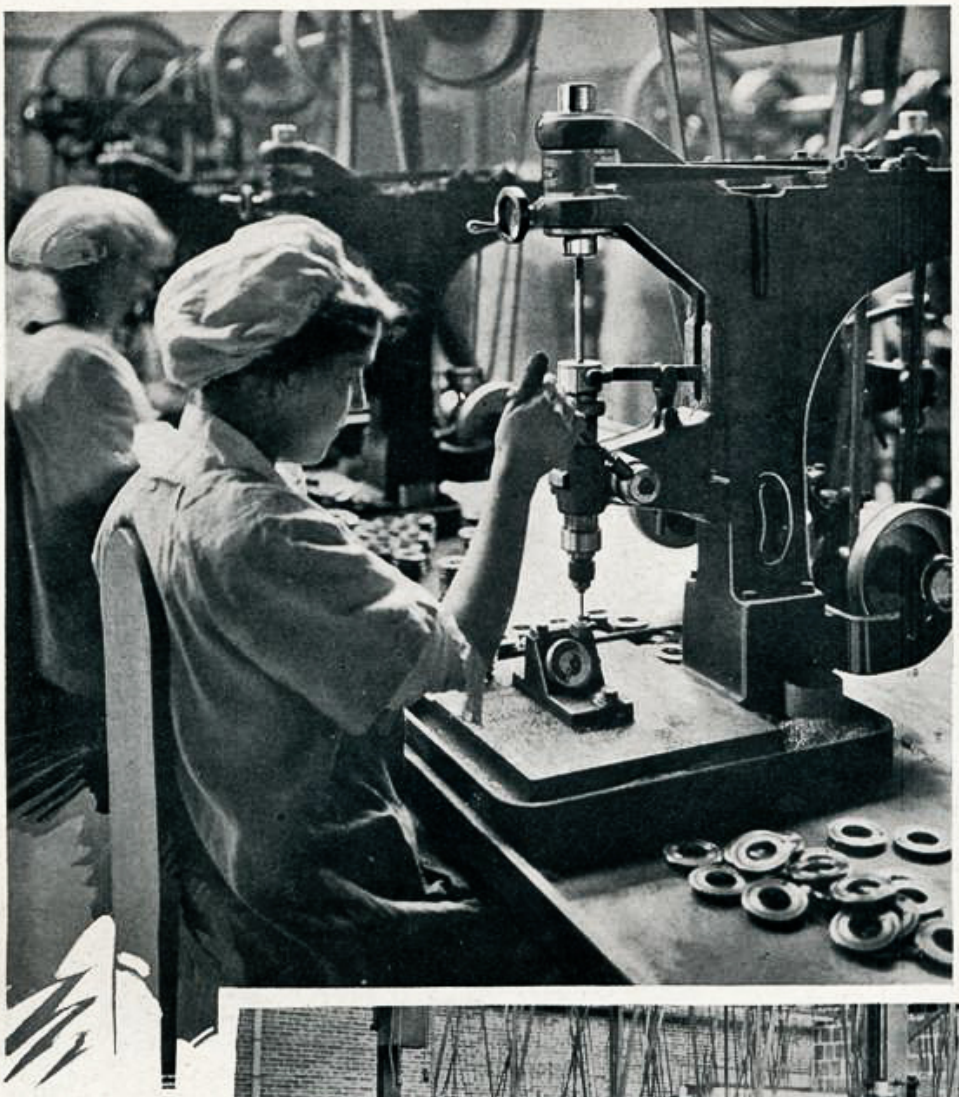


Finishing the Top Ring of No. 80 Fuse

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

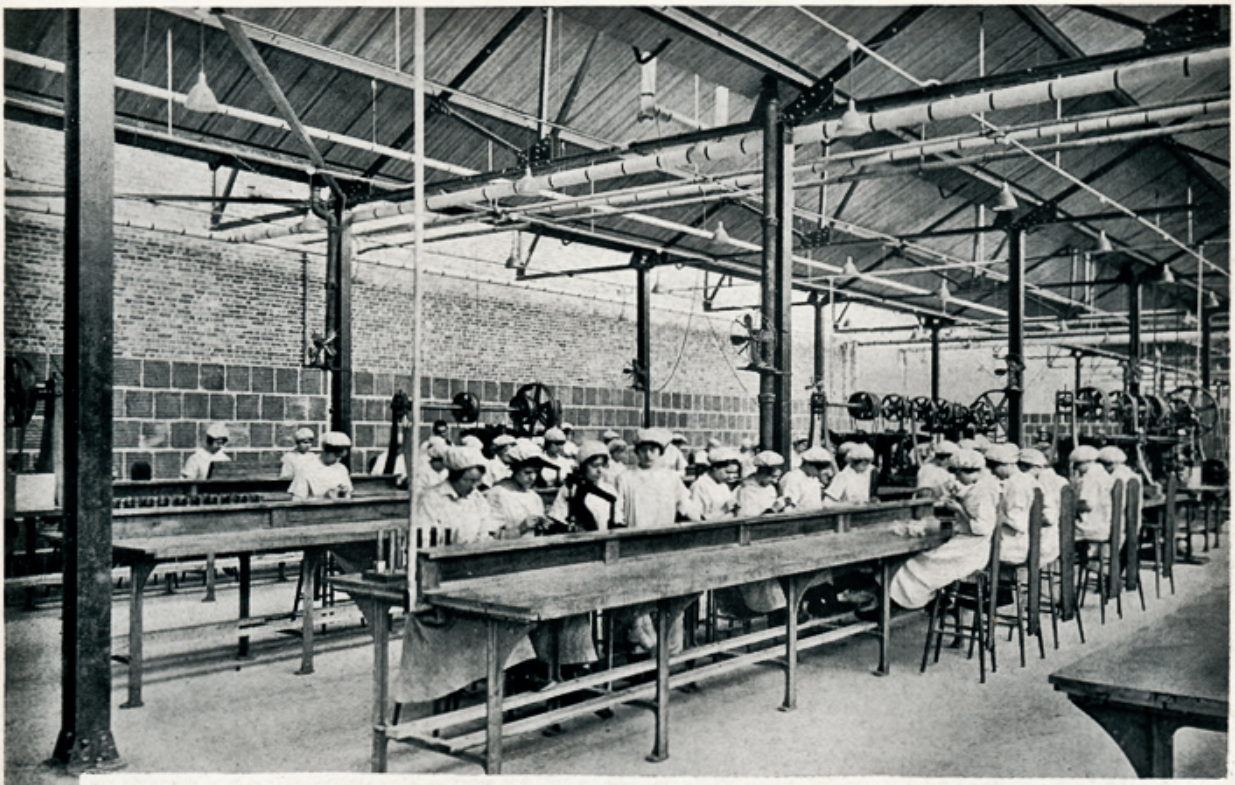


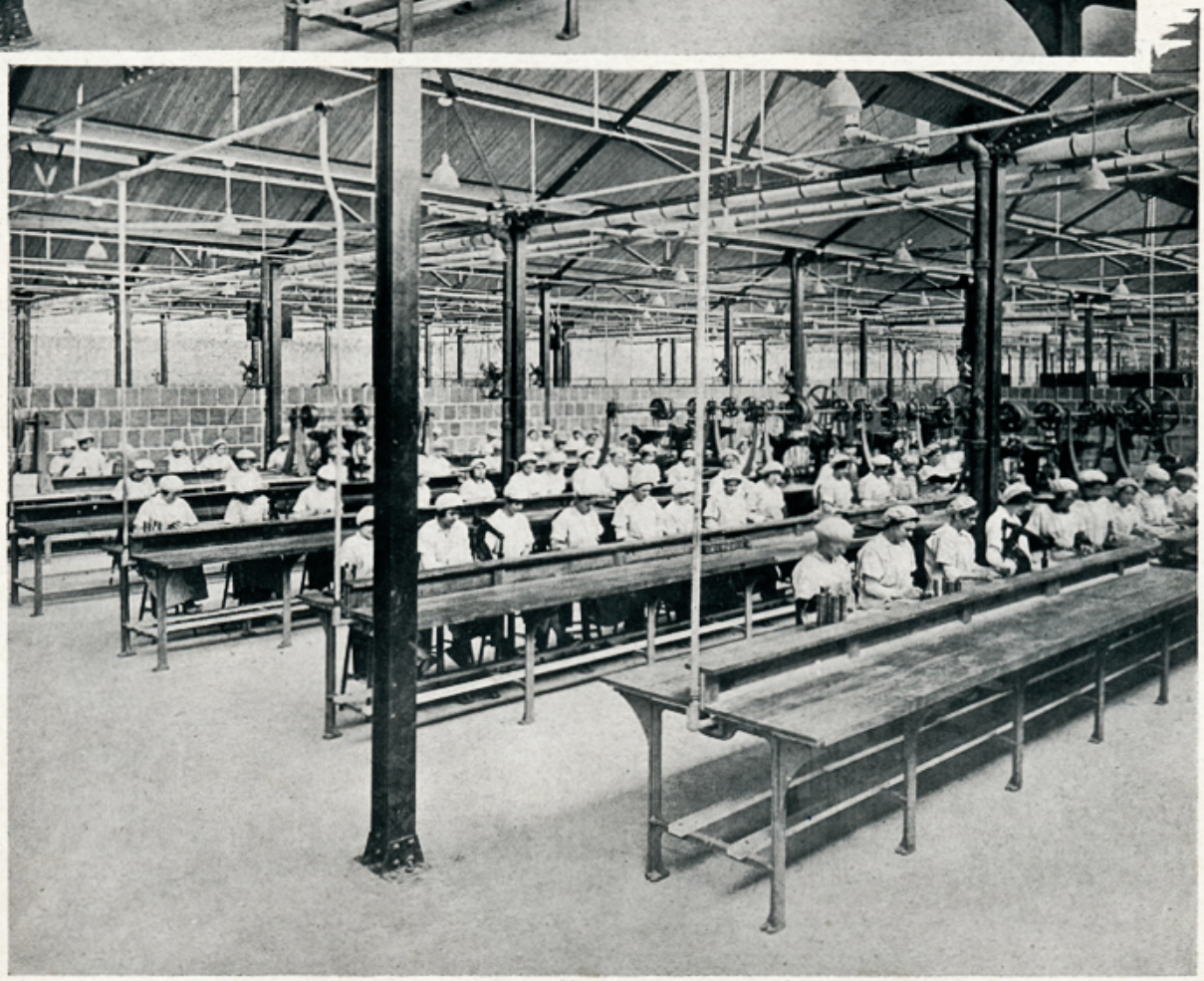
Close Operation of Above



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

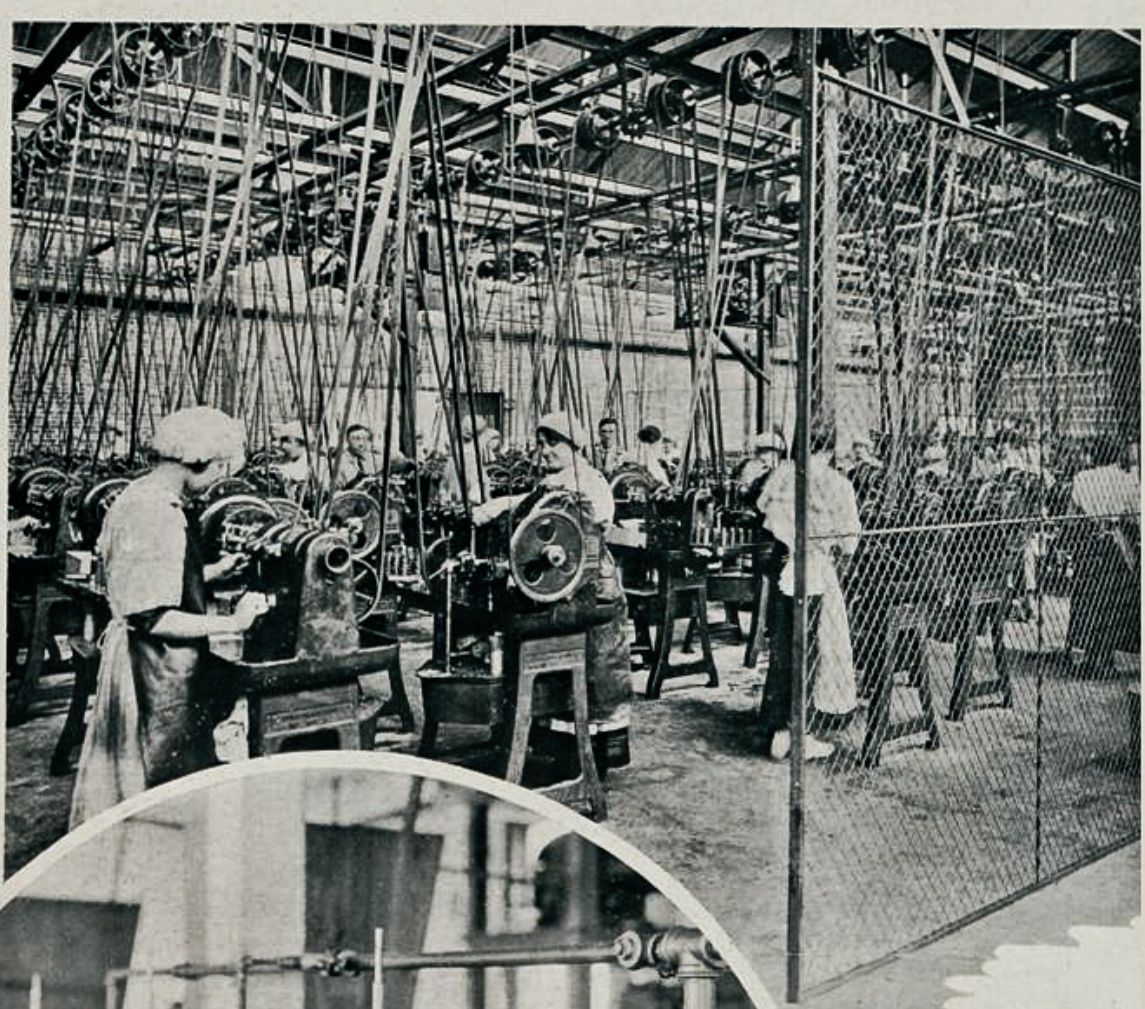
Drilling Holes Preparatory to Routing the Powder Groove, No. 80 Fuse





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.



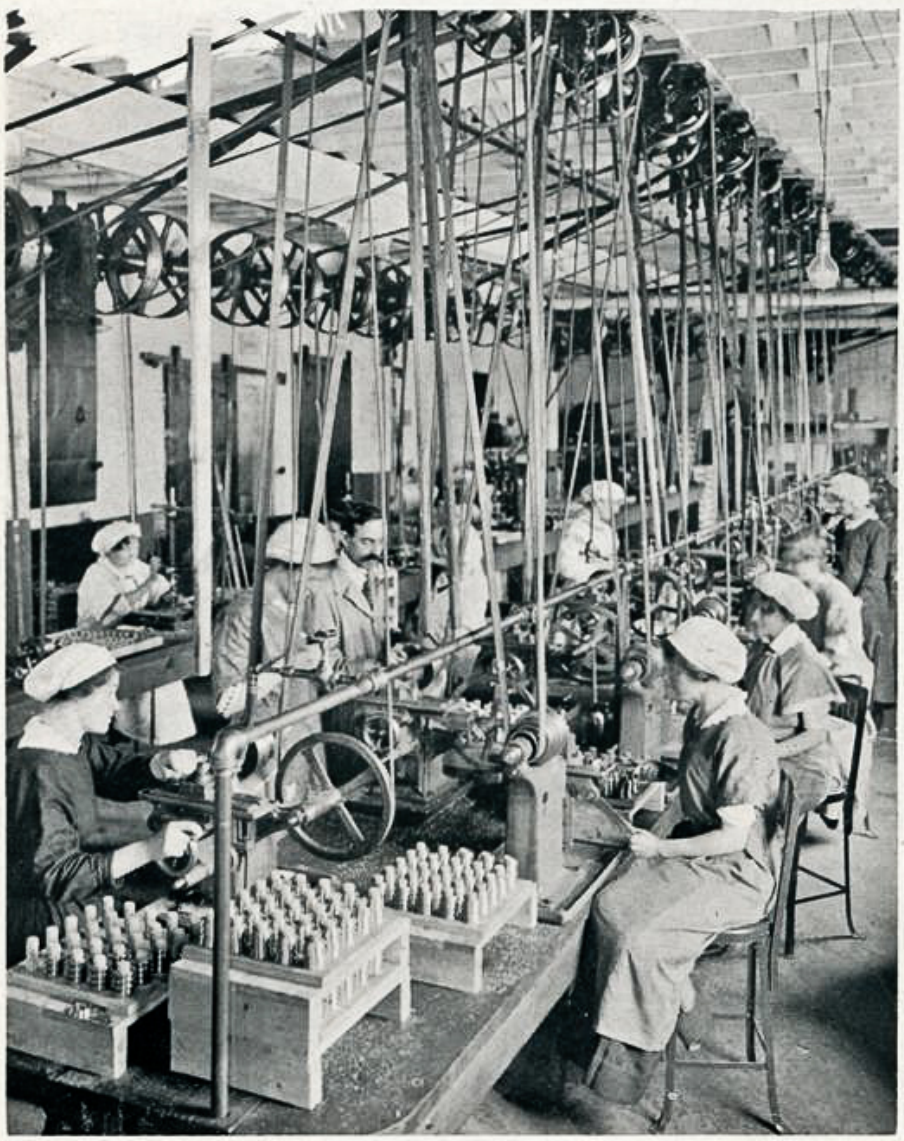
Routing Powder Groove No. 80 Fuse

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.

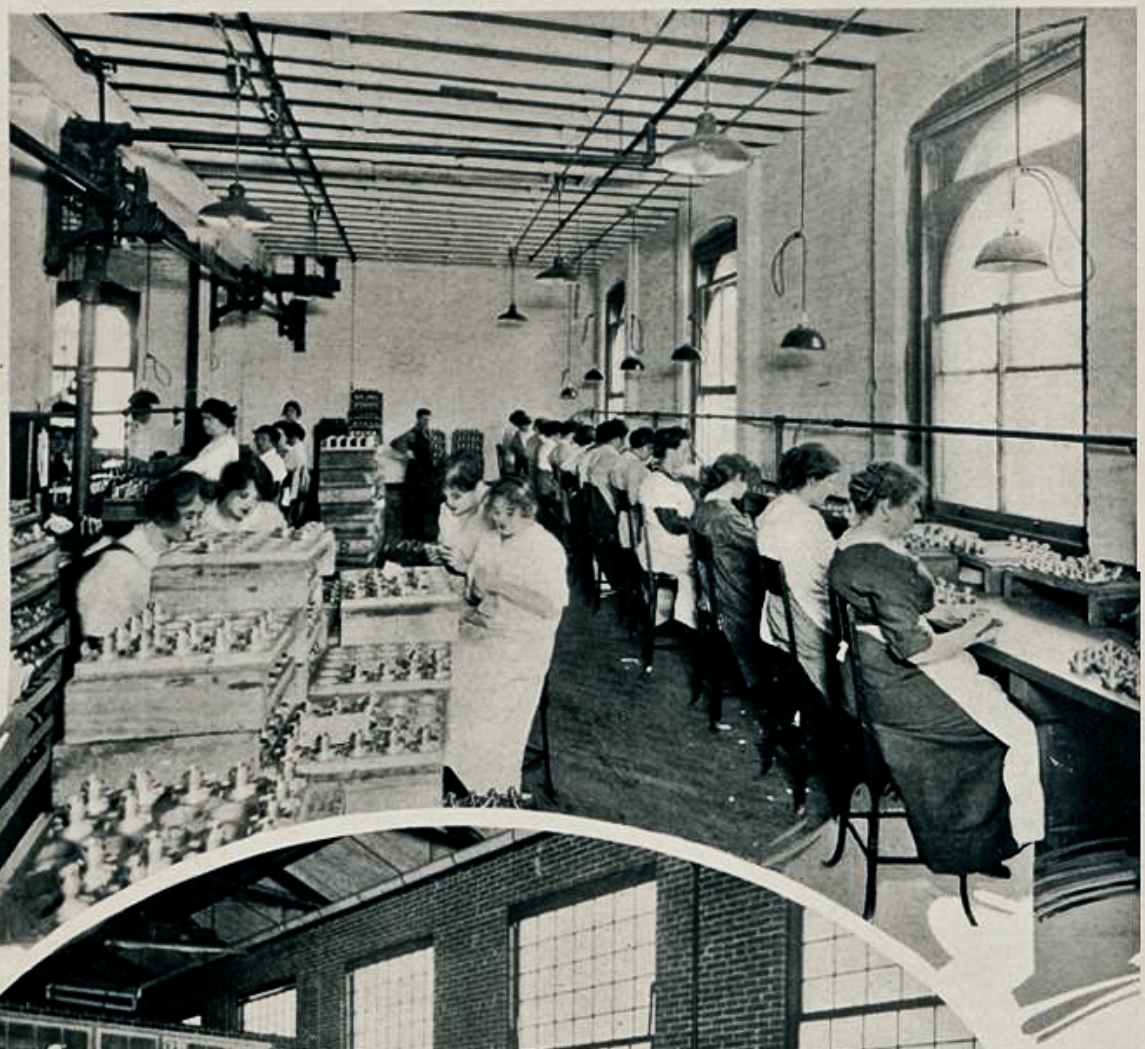
Tool Grinding

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



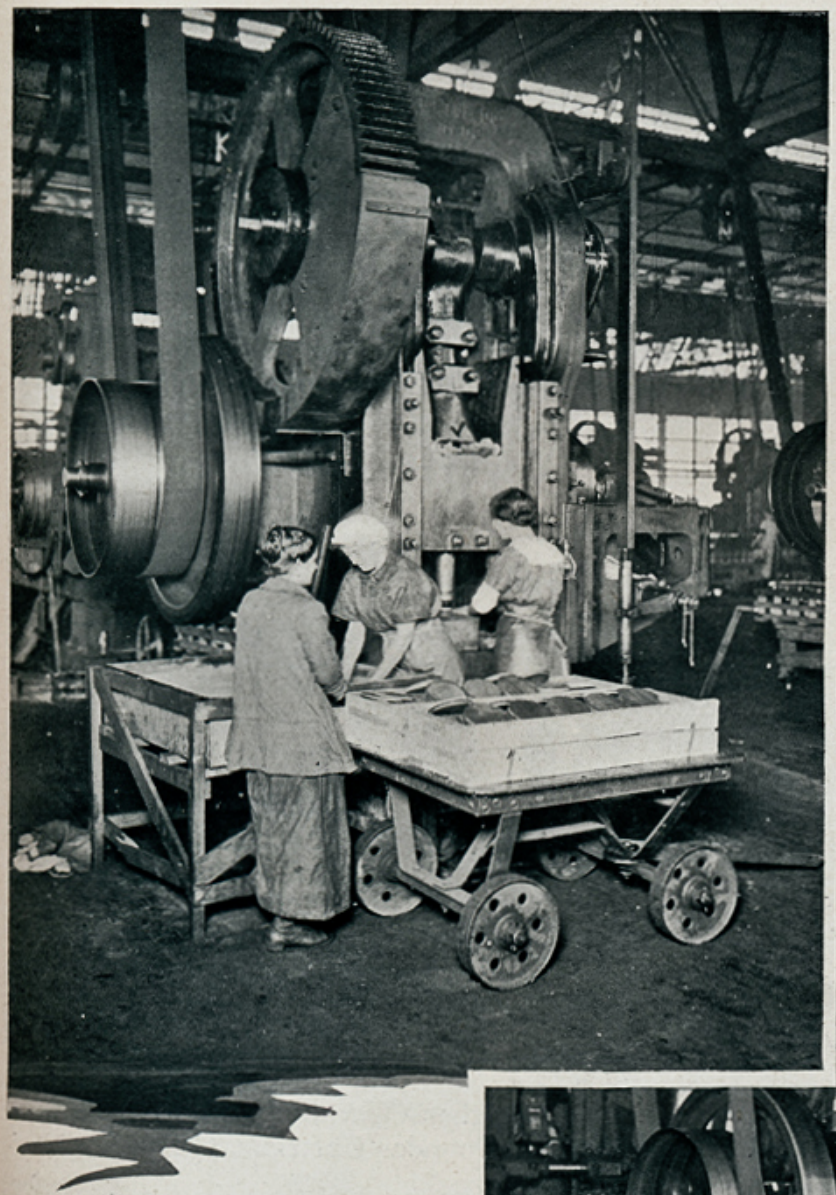
Inspection of Bodies No. 100 Fuse

Inspection 18-Pounder Shrapnel

Inspection

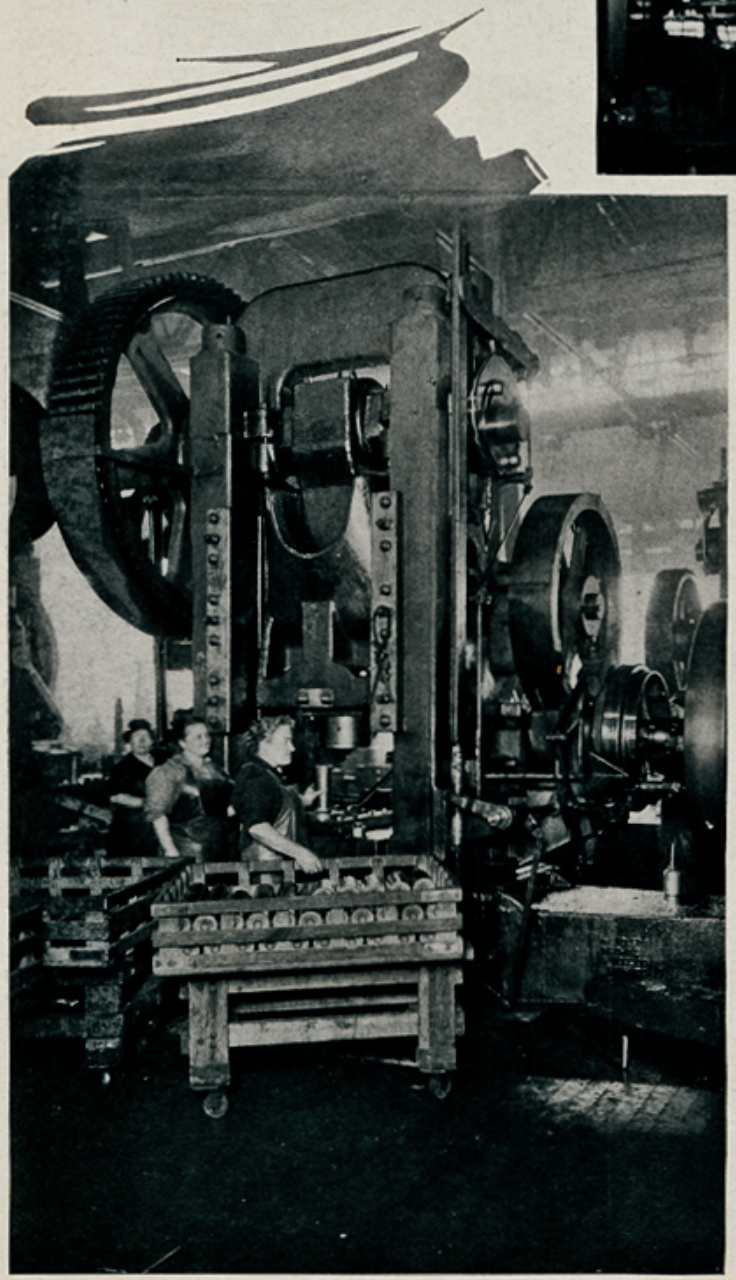
Finishing Oversize Shells with File

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.

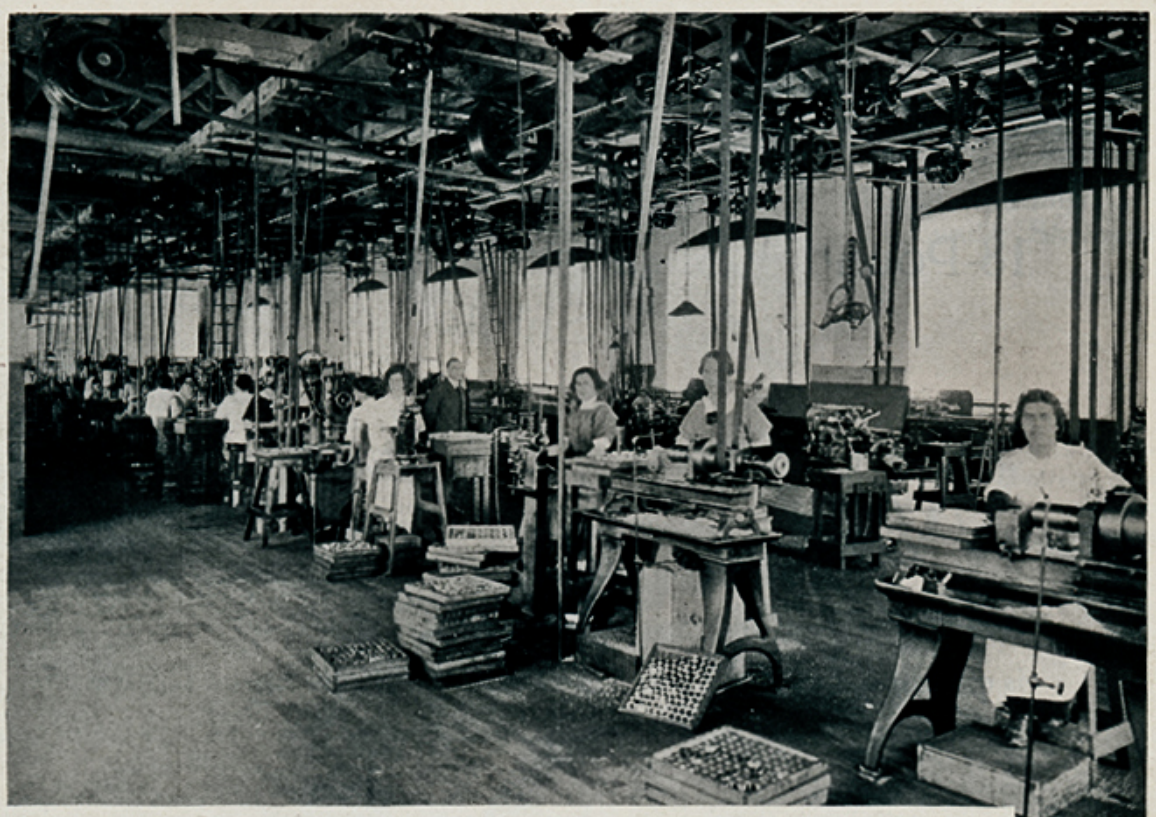


Close View of the Two First Operations of Stamping Cartridge Cases for 18 Pounders

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.



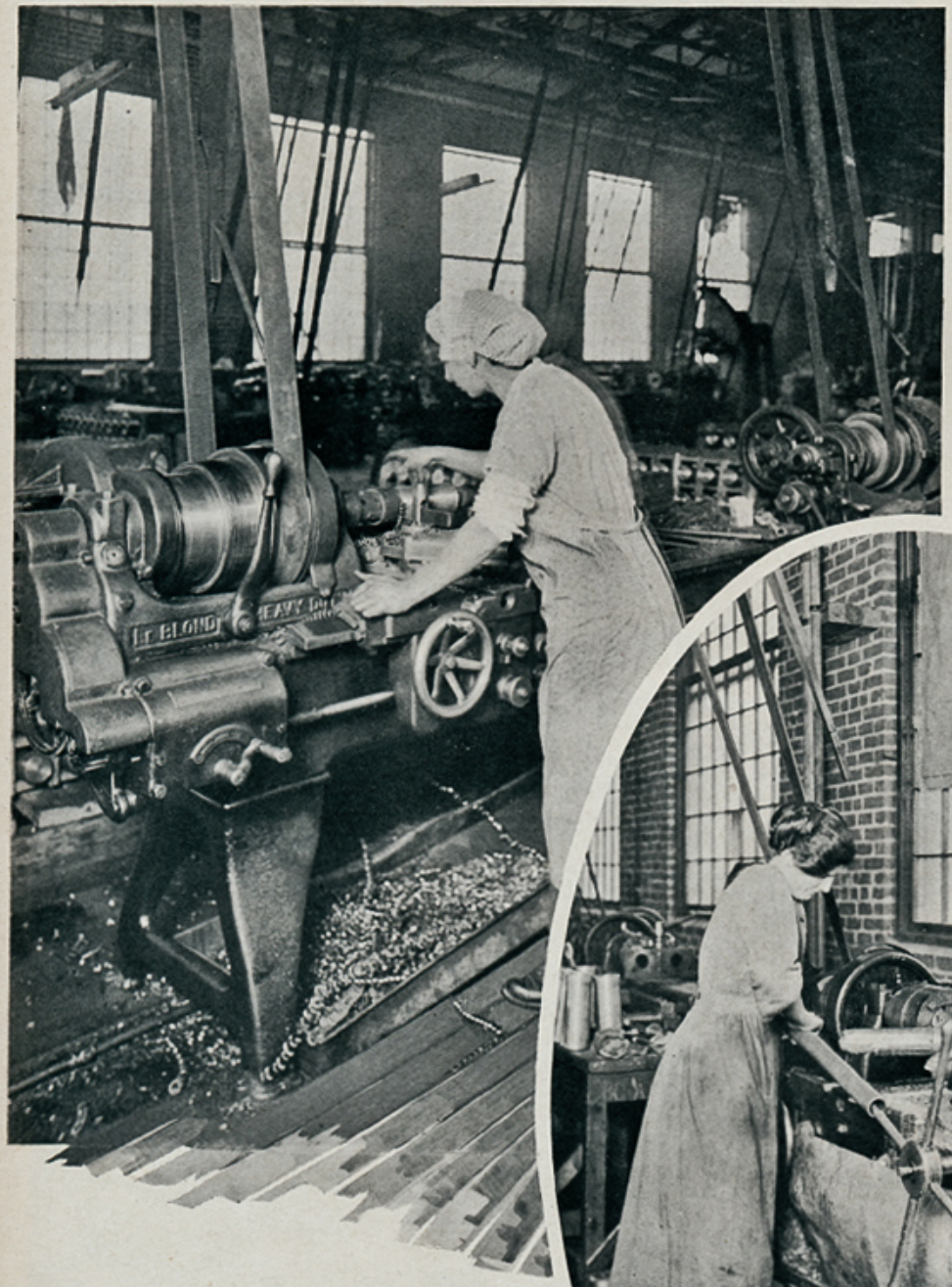
General Views of Shop, Women Workers on Percussion Primers

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

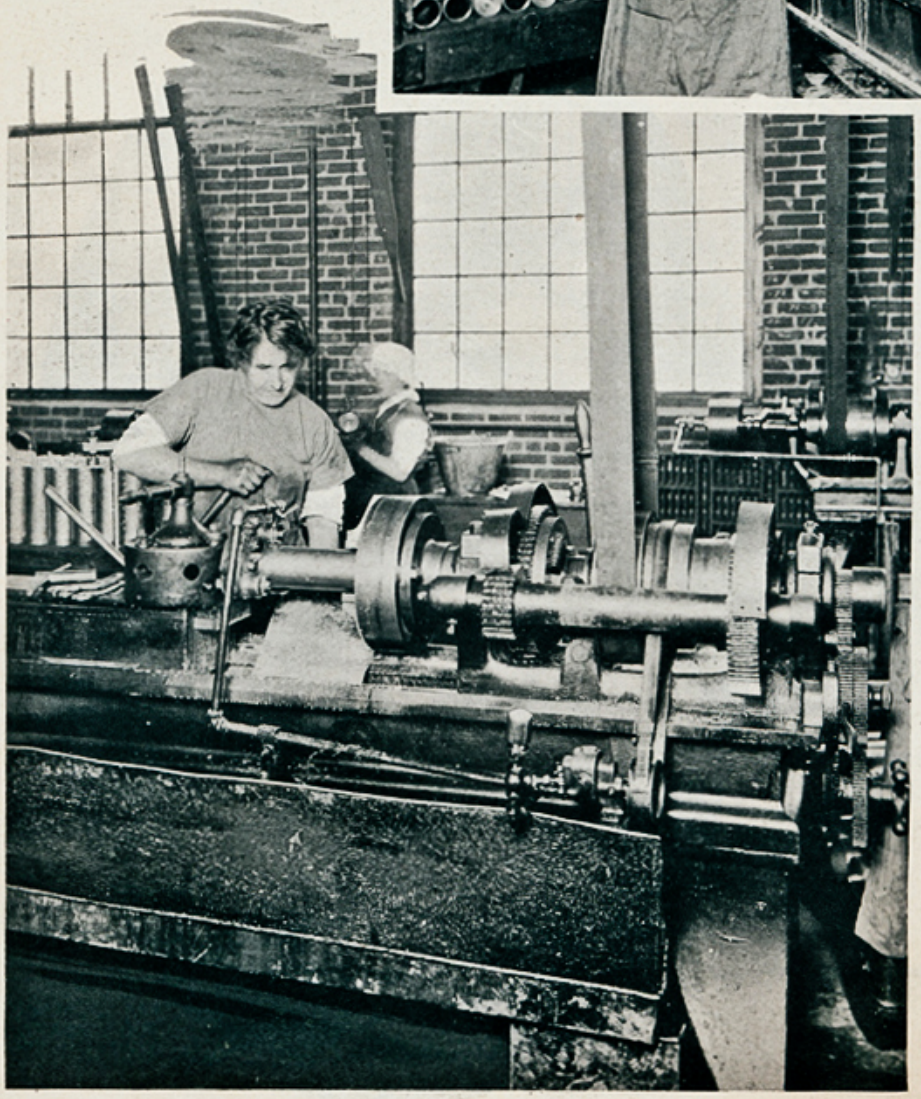
Note the forging is chucked on a taper mandrel and driven up by tail stock. A very easy method of chucking for women workers.

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

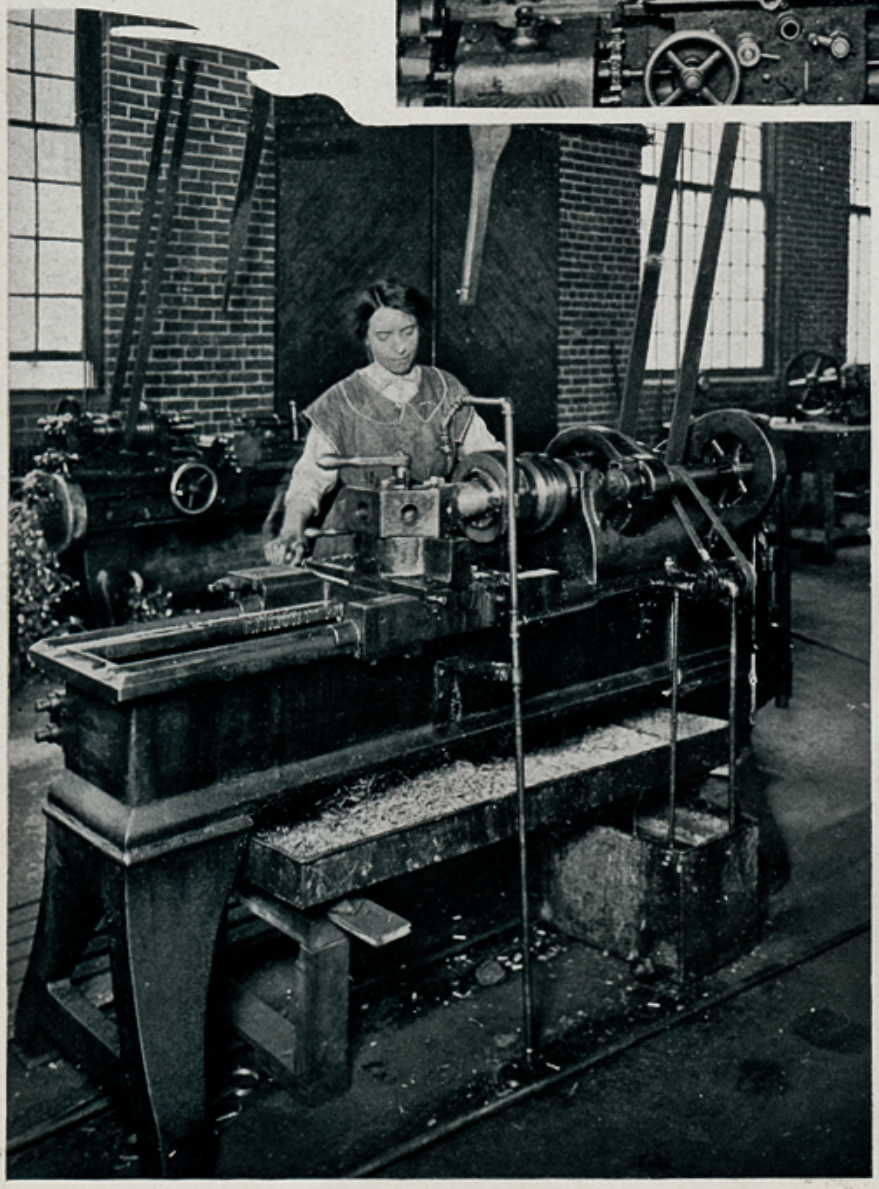
Front and back tools cutting together.



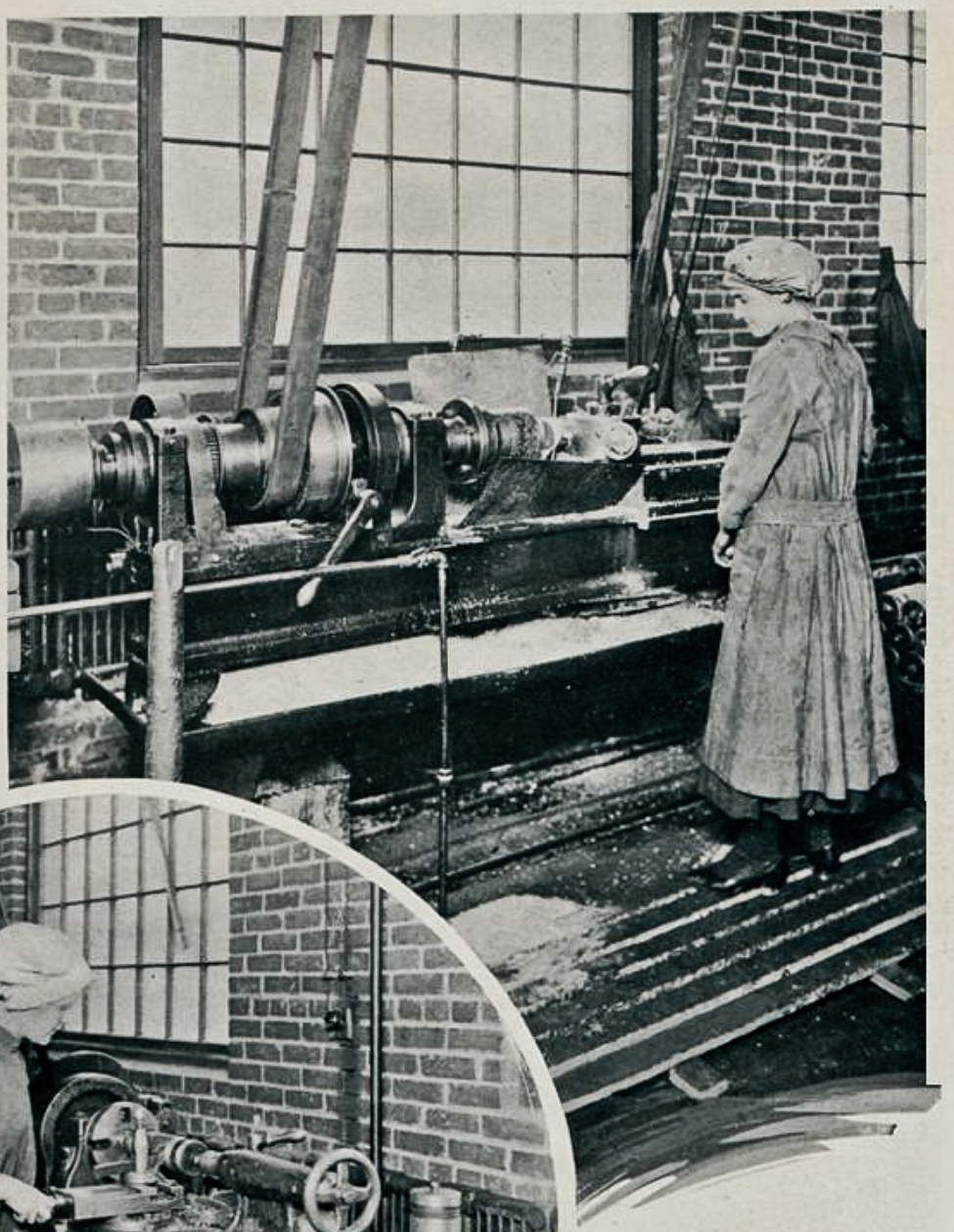
Finish Facing,
18-pounder Shrapnel

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.



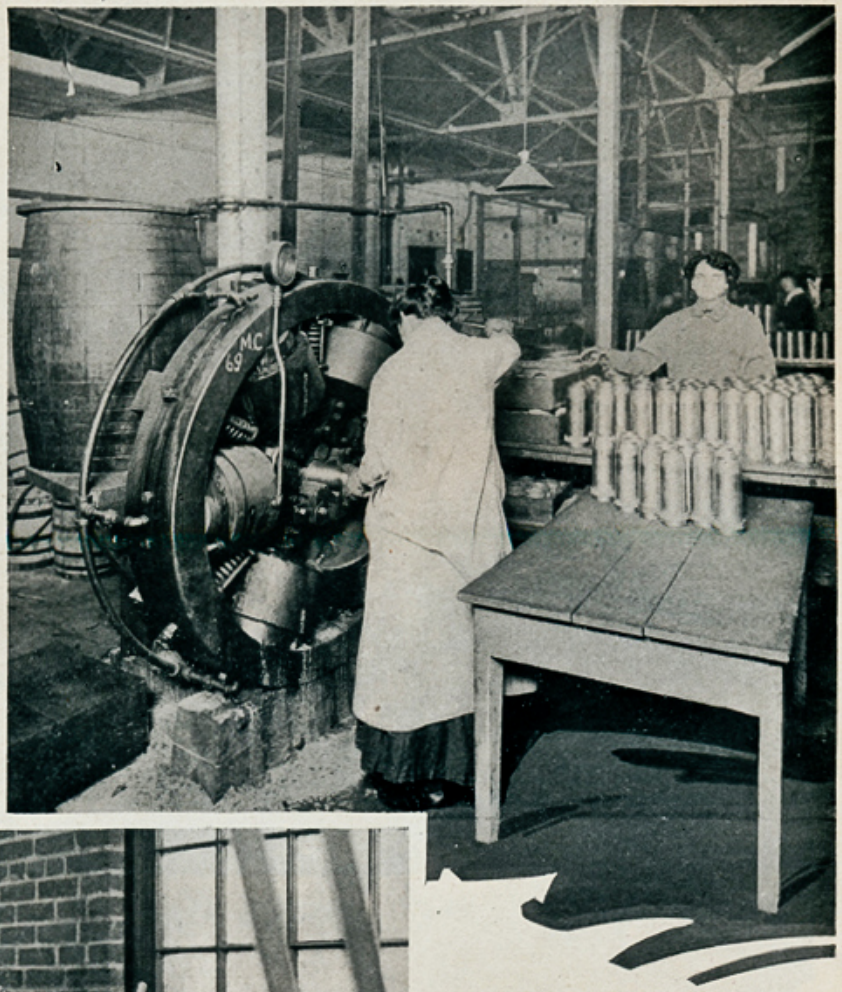
Undercutting the Nose and Cutting Crimping Groove, 18-pounder Shrapnel



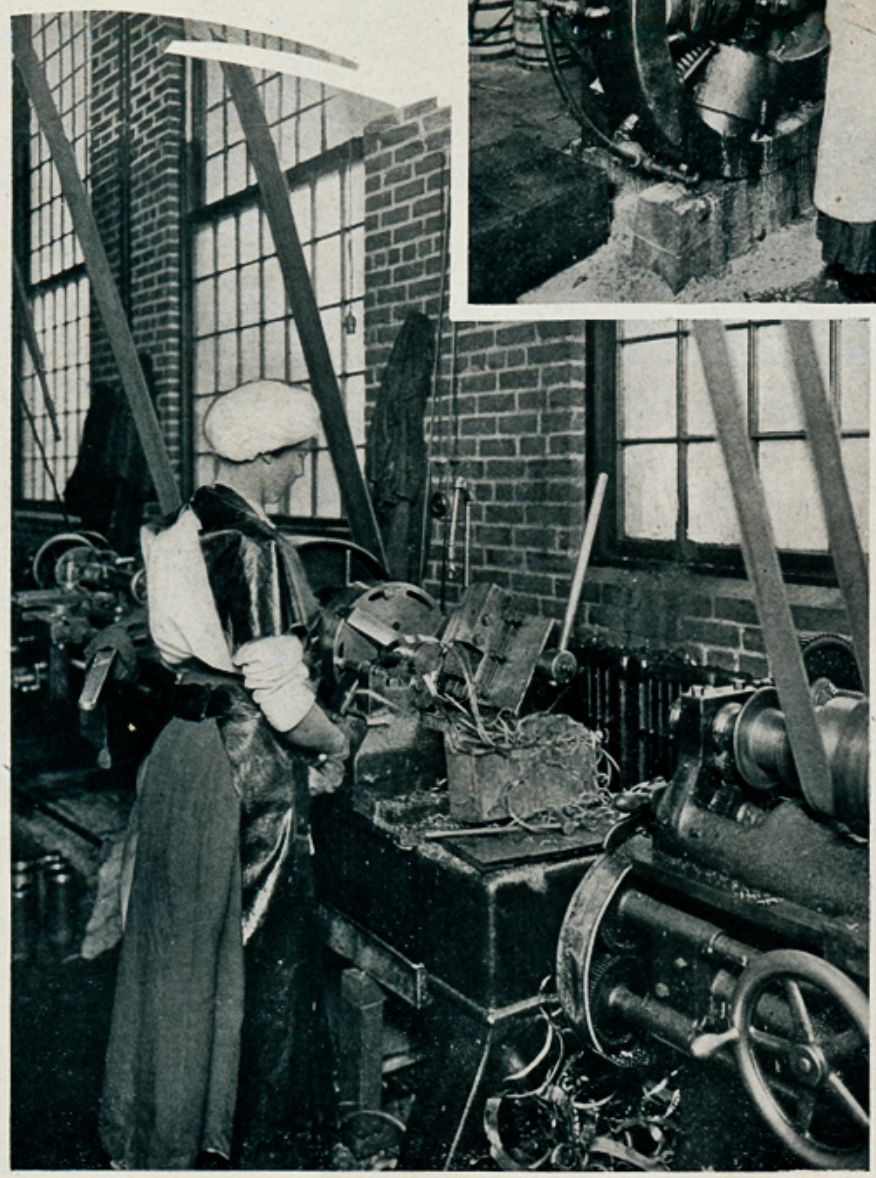
Threading the Nose (Reaming and Tapping)

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

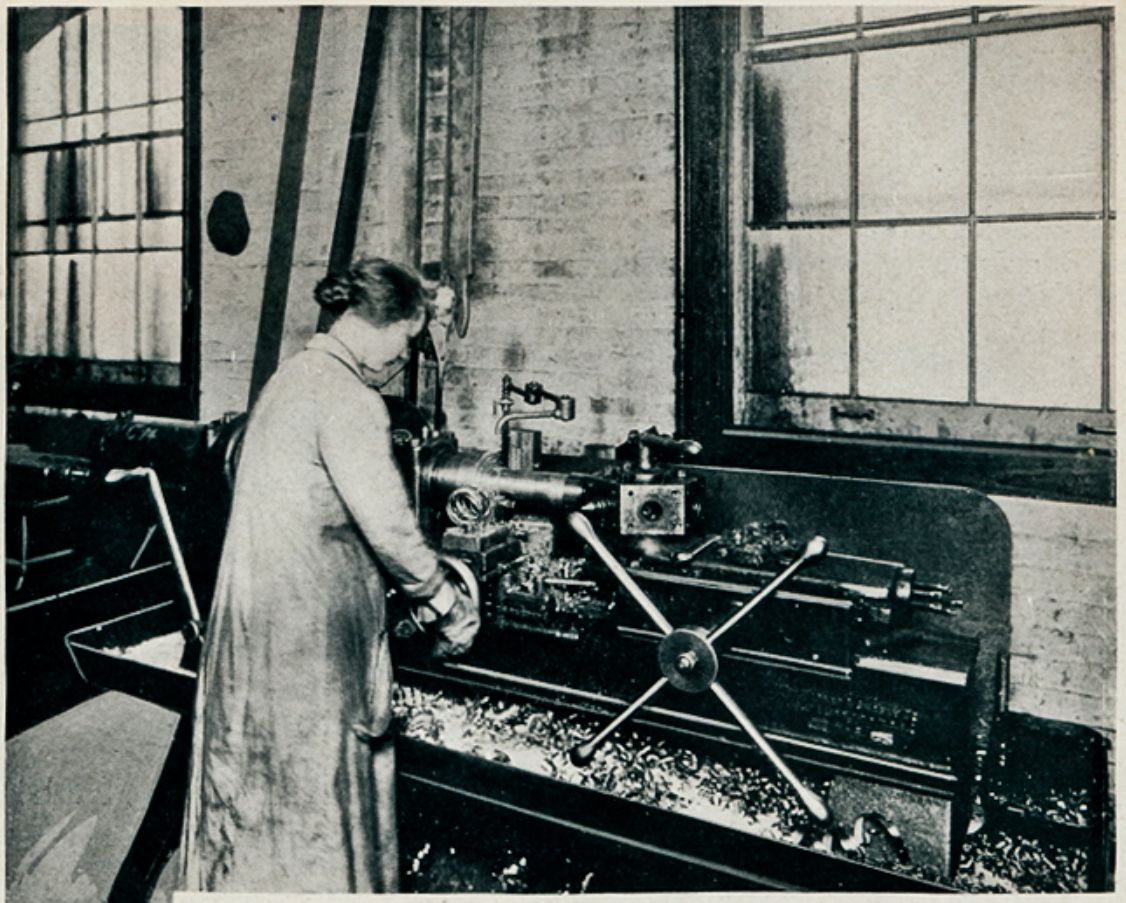
Finish Turning and Profile 18-pounder Shrapnel.



Pressing on the Copper Driving Band with Hydraulic Press

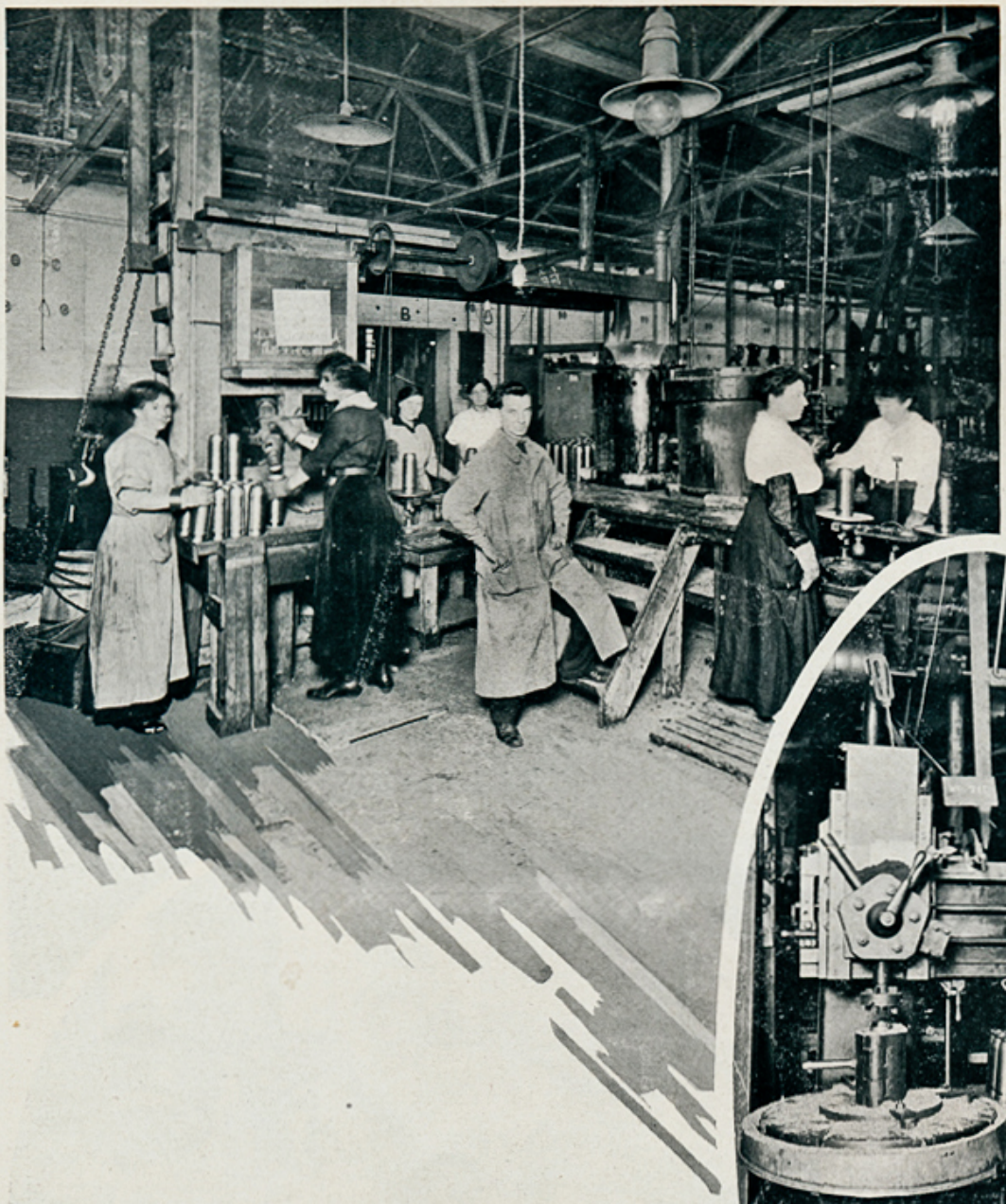


Turning Copper Driving Band, 18-pounder Shrapnel



Turning Copper Driving Band

Washing and Cleaning Operations

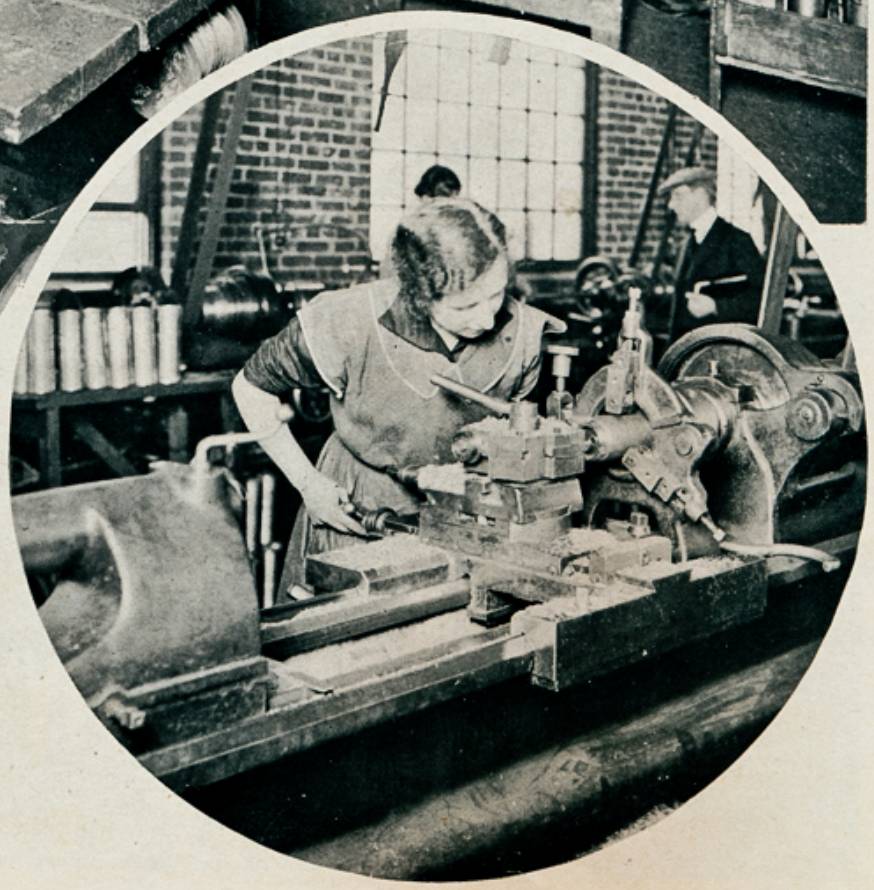


Loading and Weighing Operations.

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

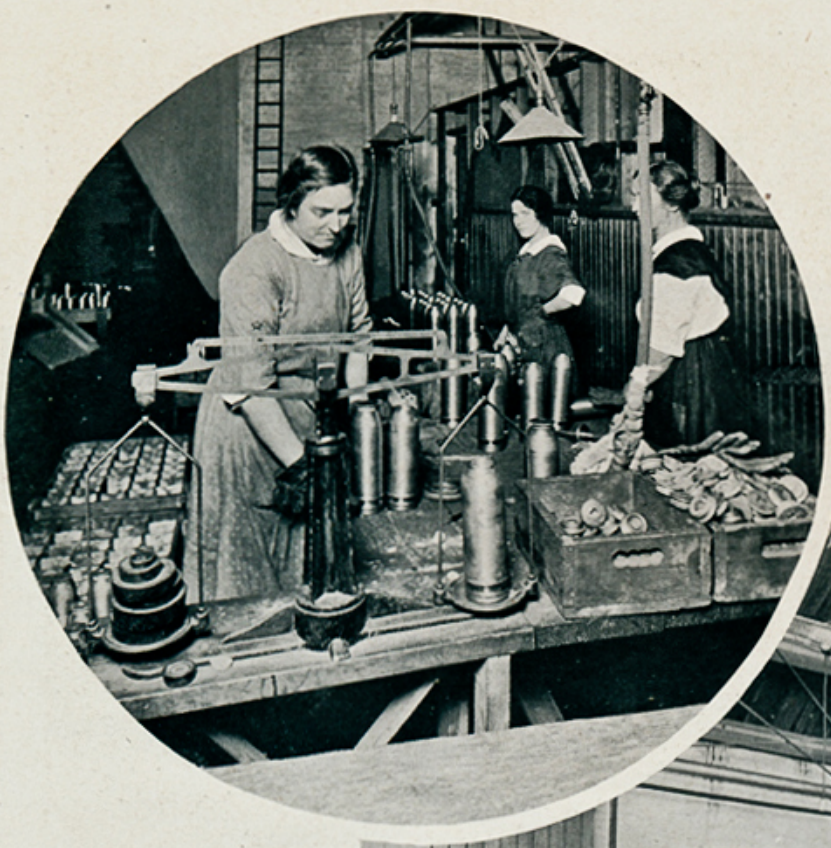


B

(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

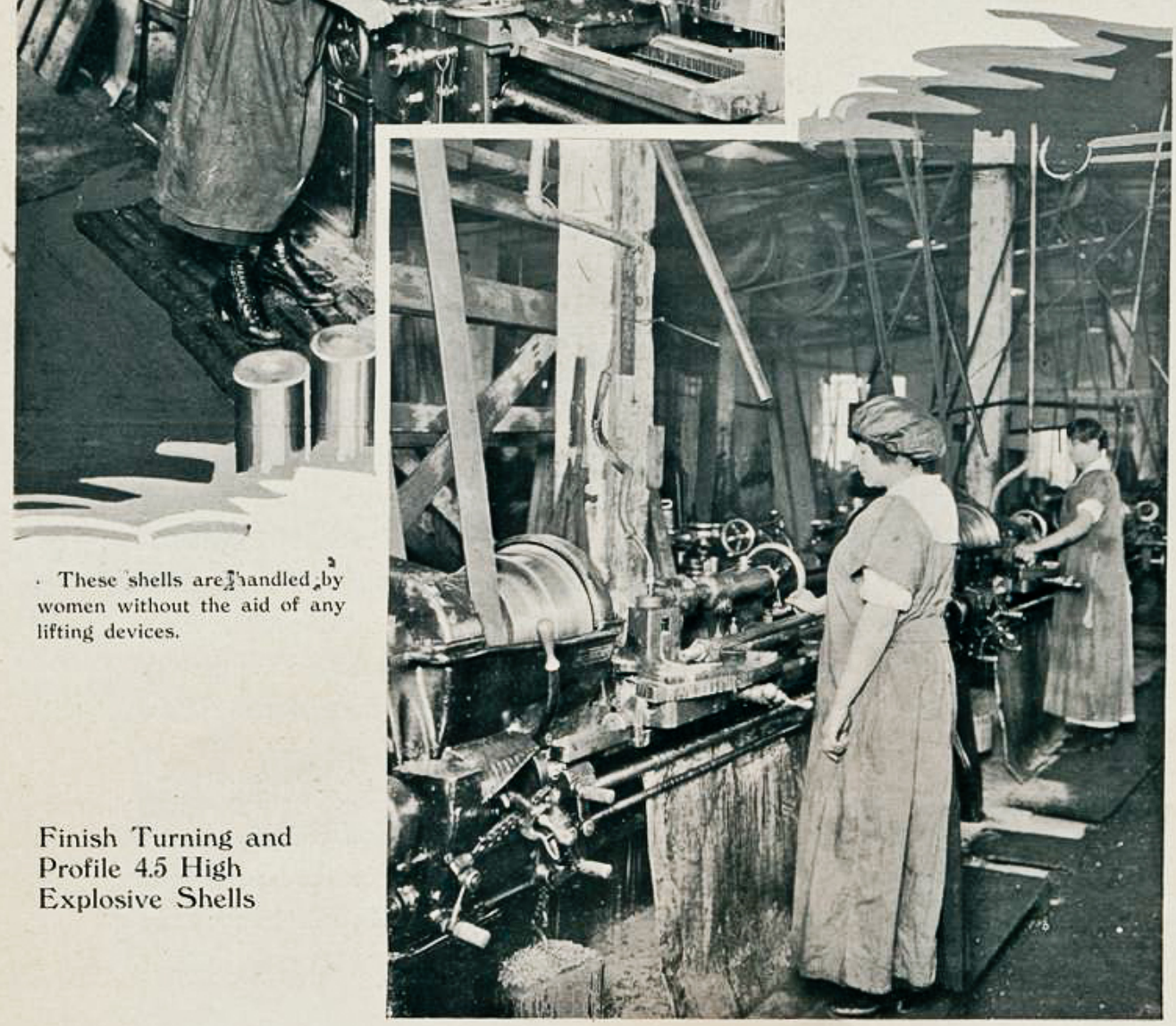
4.5-in. and 8-in. Shells

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.

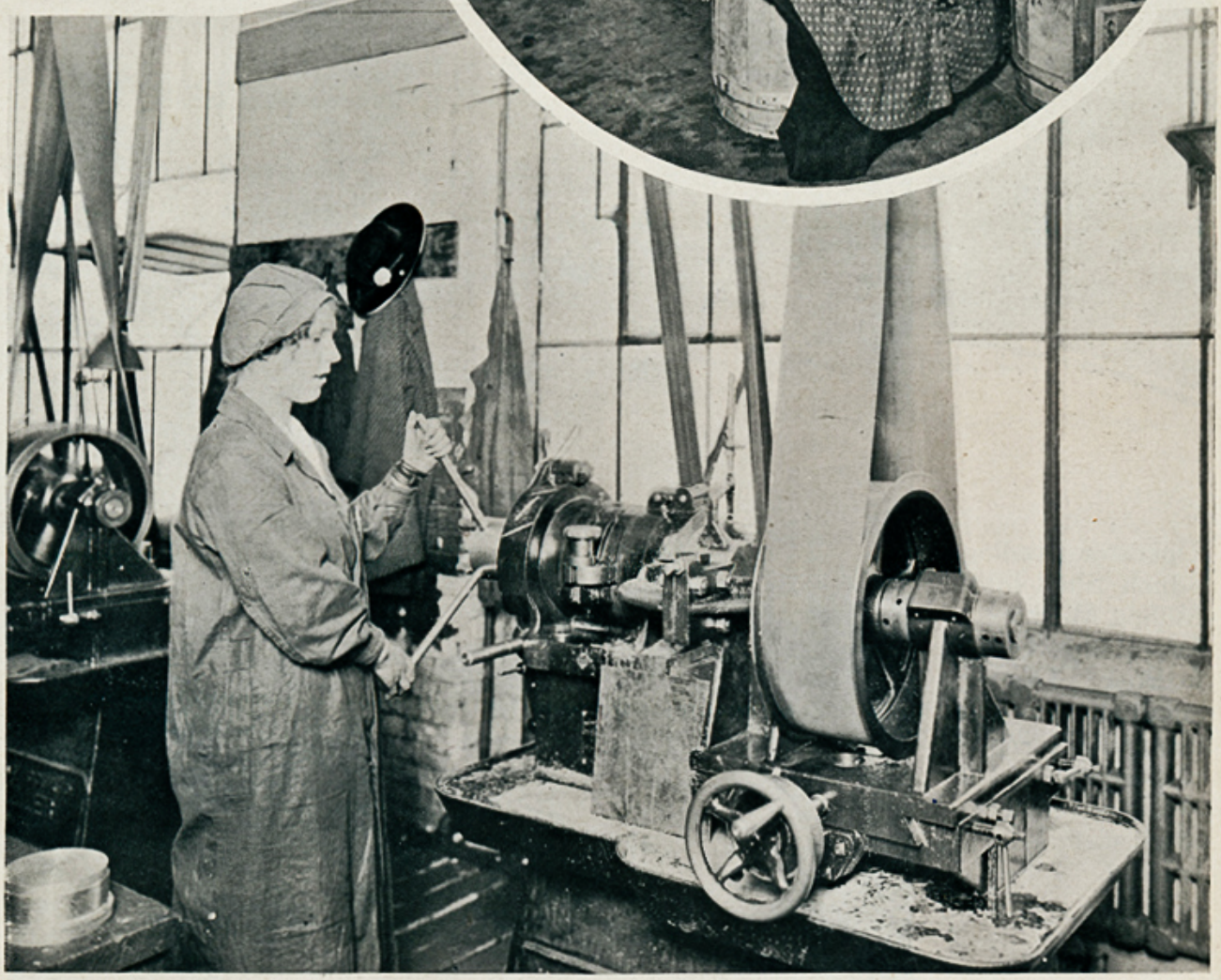
Second Rough Cut, 4.5 High Explosive



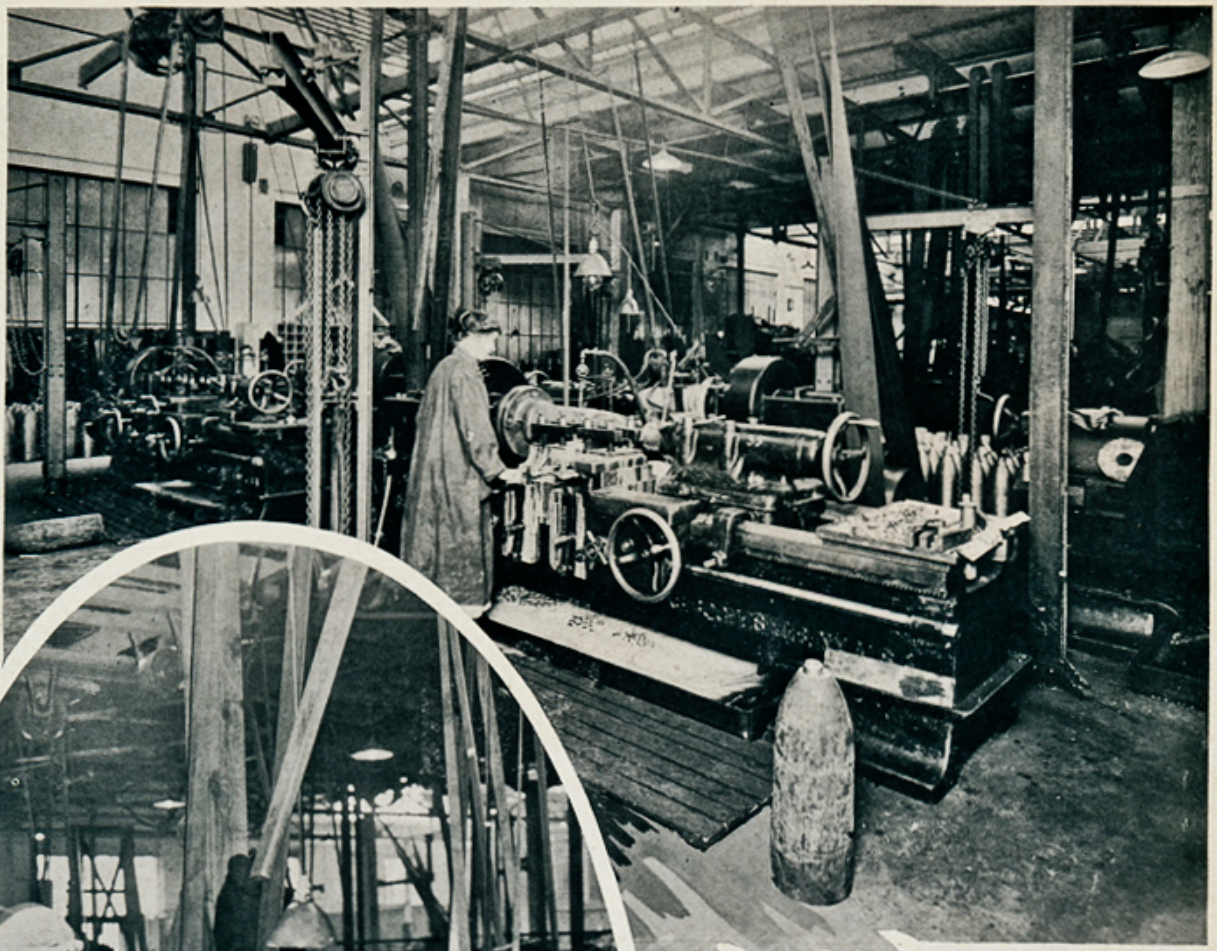
These shells are handled by women without the aid of any lifting devices.

Finish Turning and Profile 4.5 High Explosive Shells

Varnishing 4.5 High Explosive

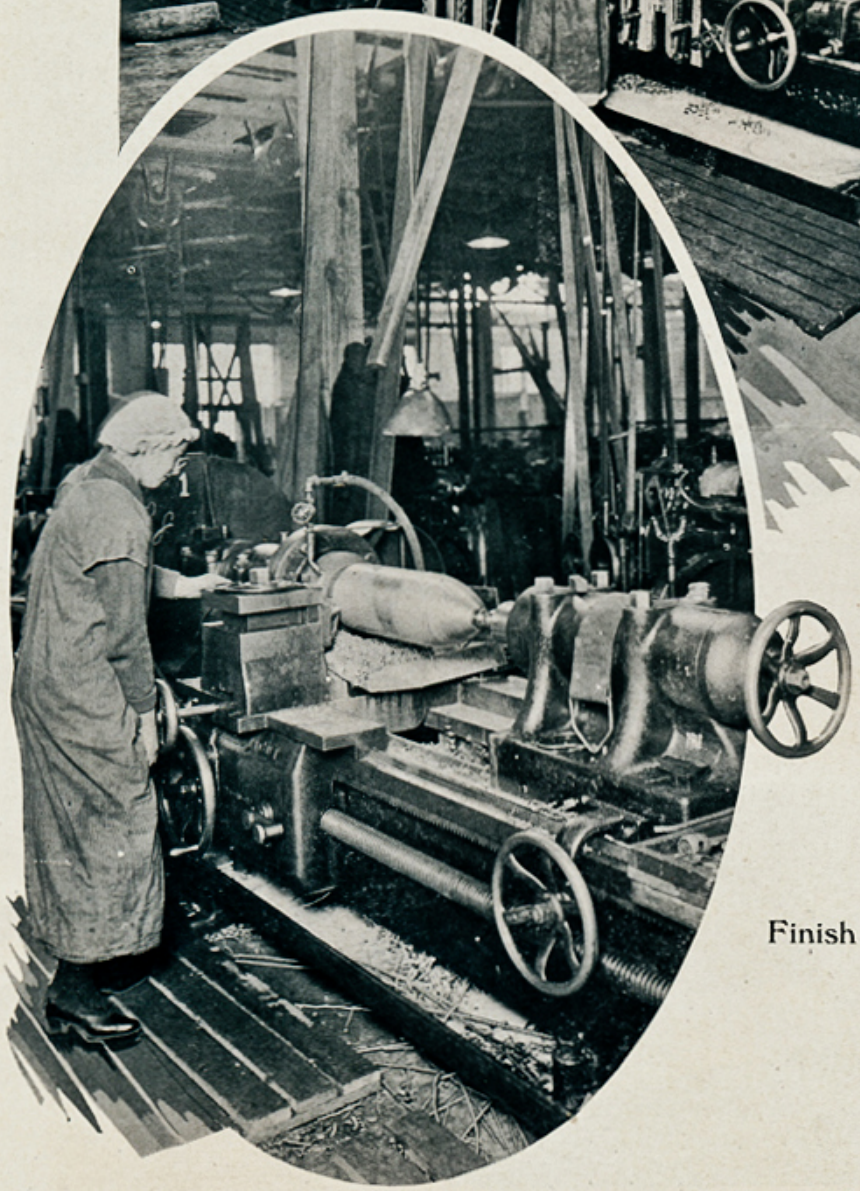


Milling Thread on Adaptor for 8 inch Shells

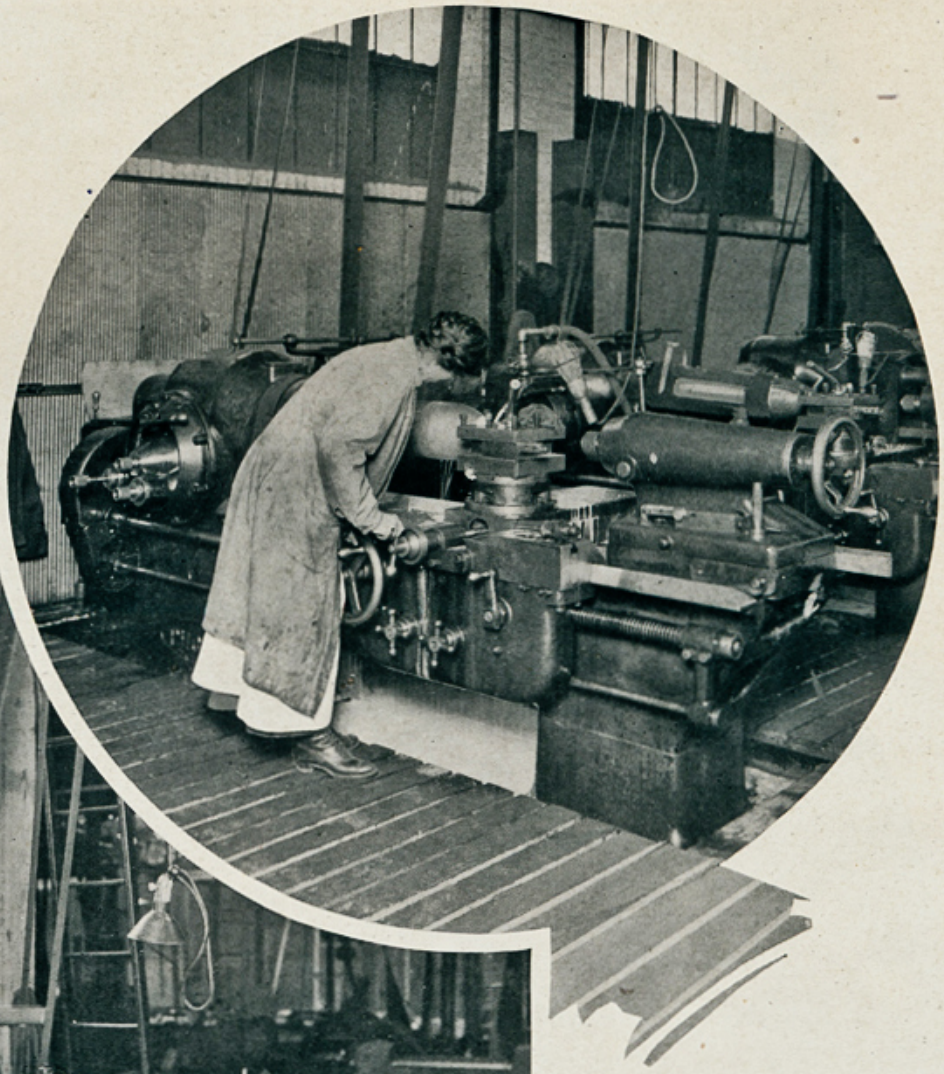


Rough Turning 8-inch Shell.

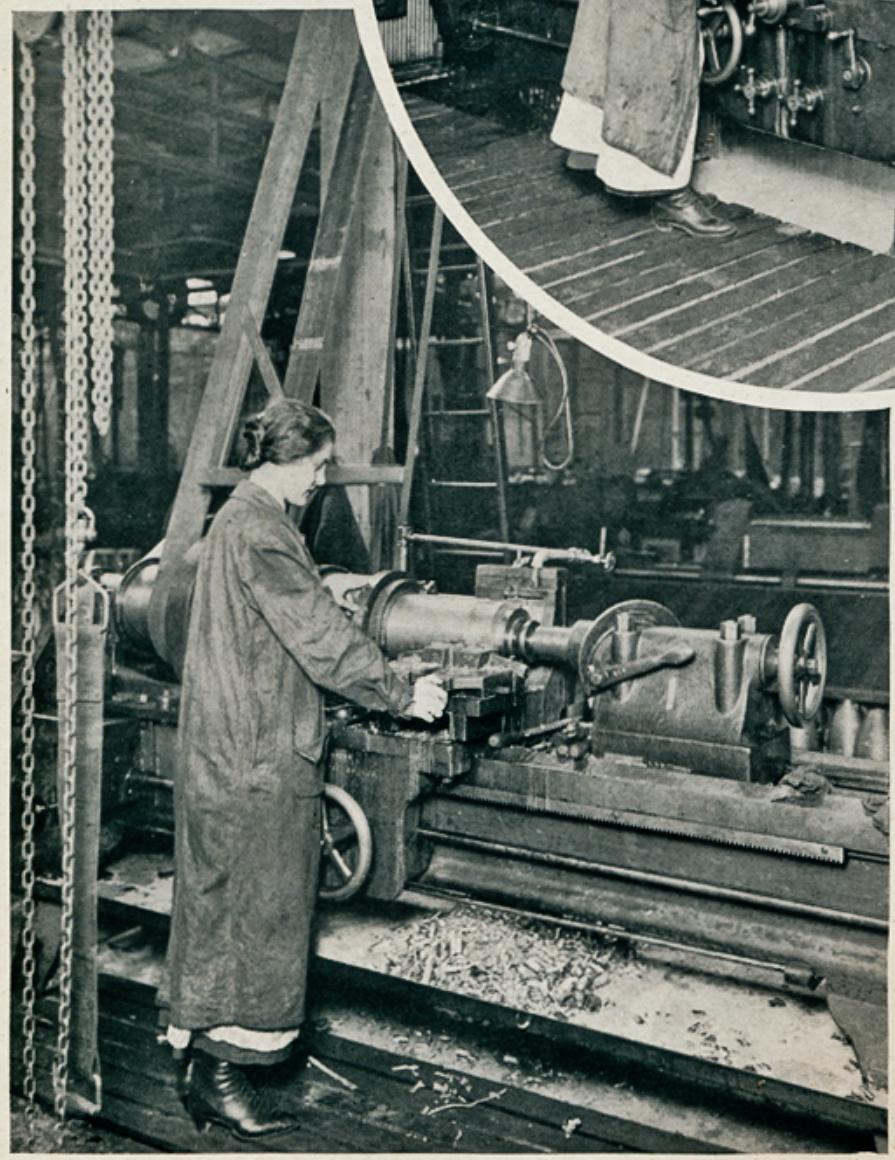
Note the lifting tackle on jib behind operator.



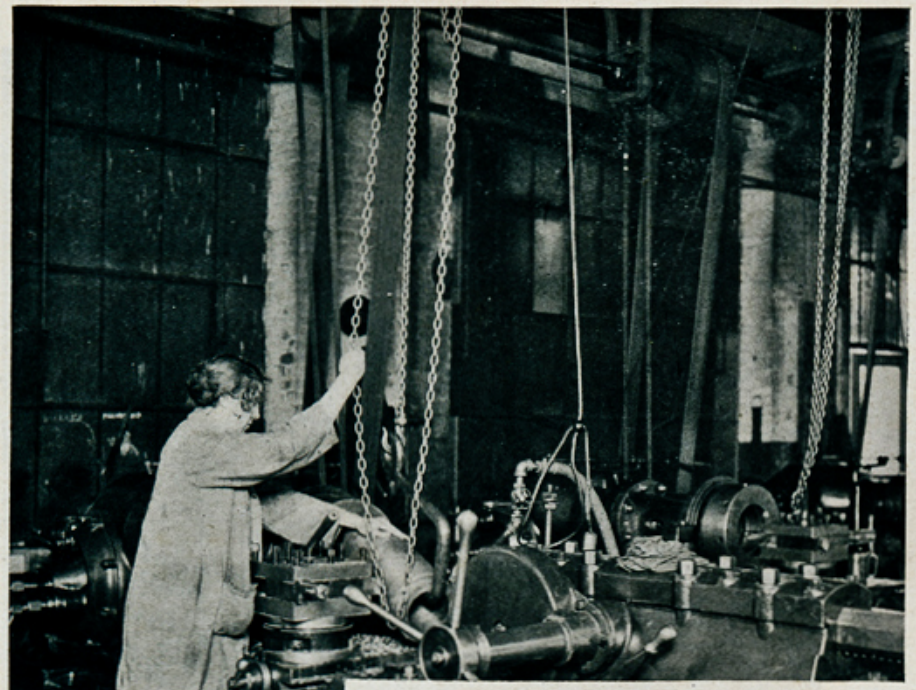
Finish Turning 8-inch Shells.



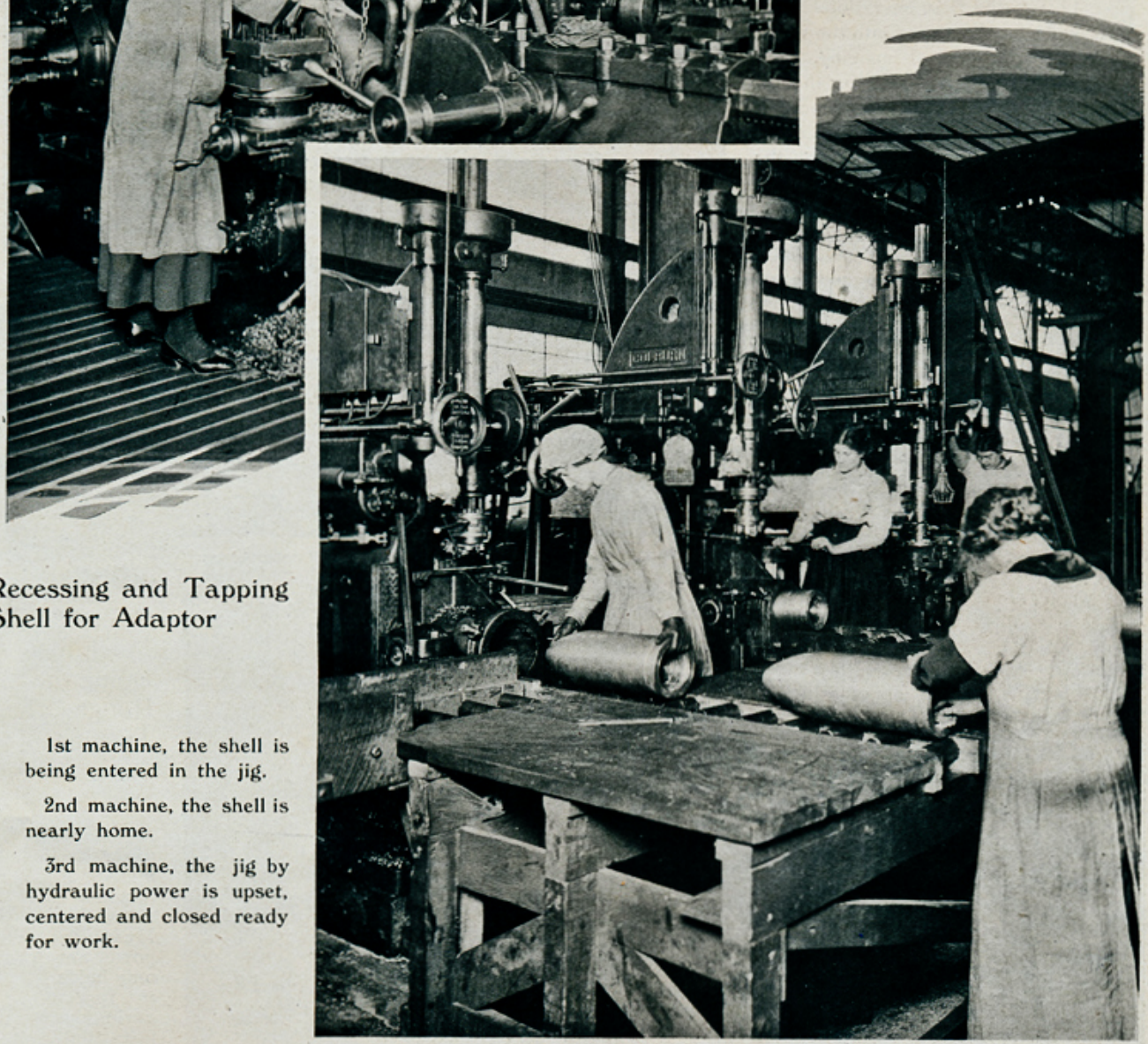
Boring the Fuse Hole
8-inch Shell



Undercutting and
Waving of 8 inch Shells



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



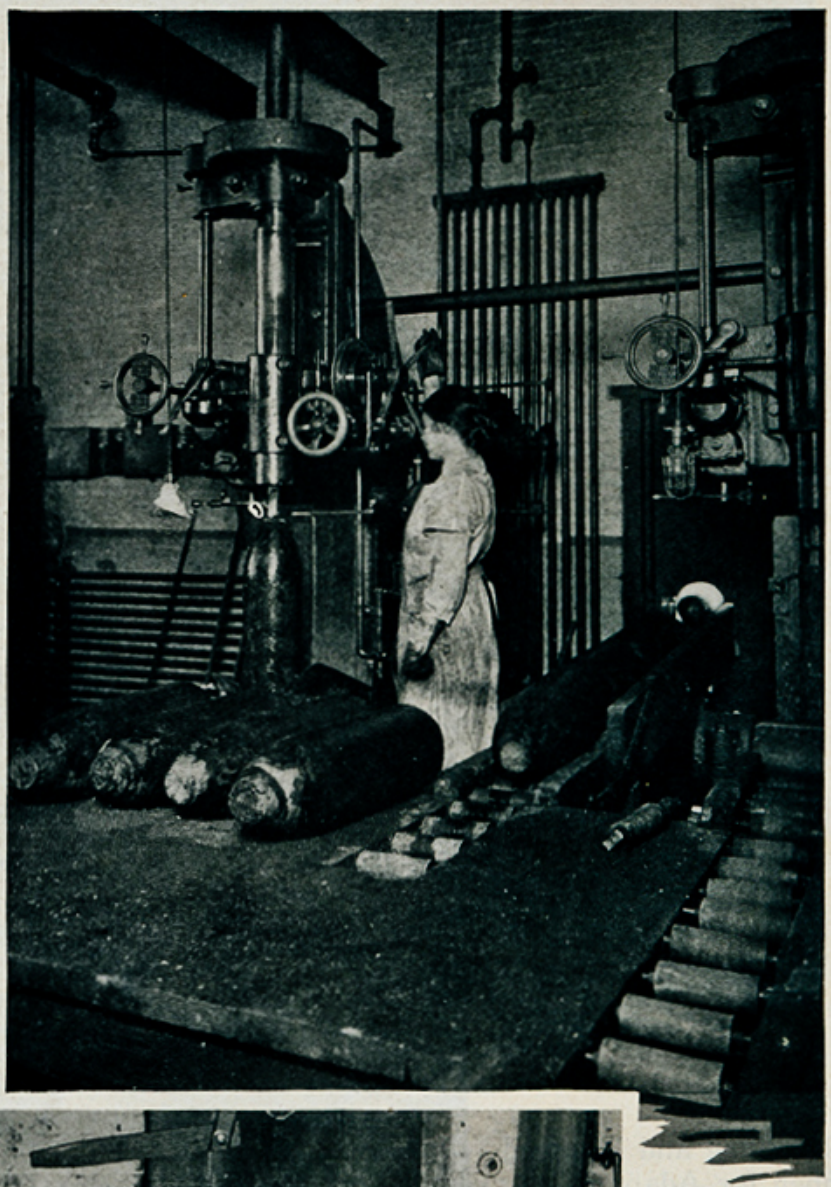
Recessing and Tapping Shell for Adaptor

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

2nd machine, the shell is nearly home.

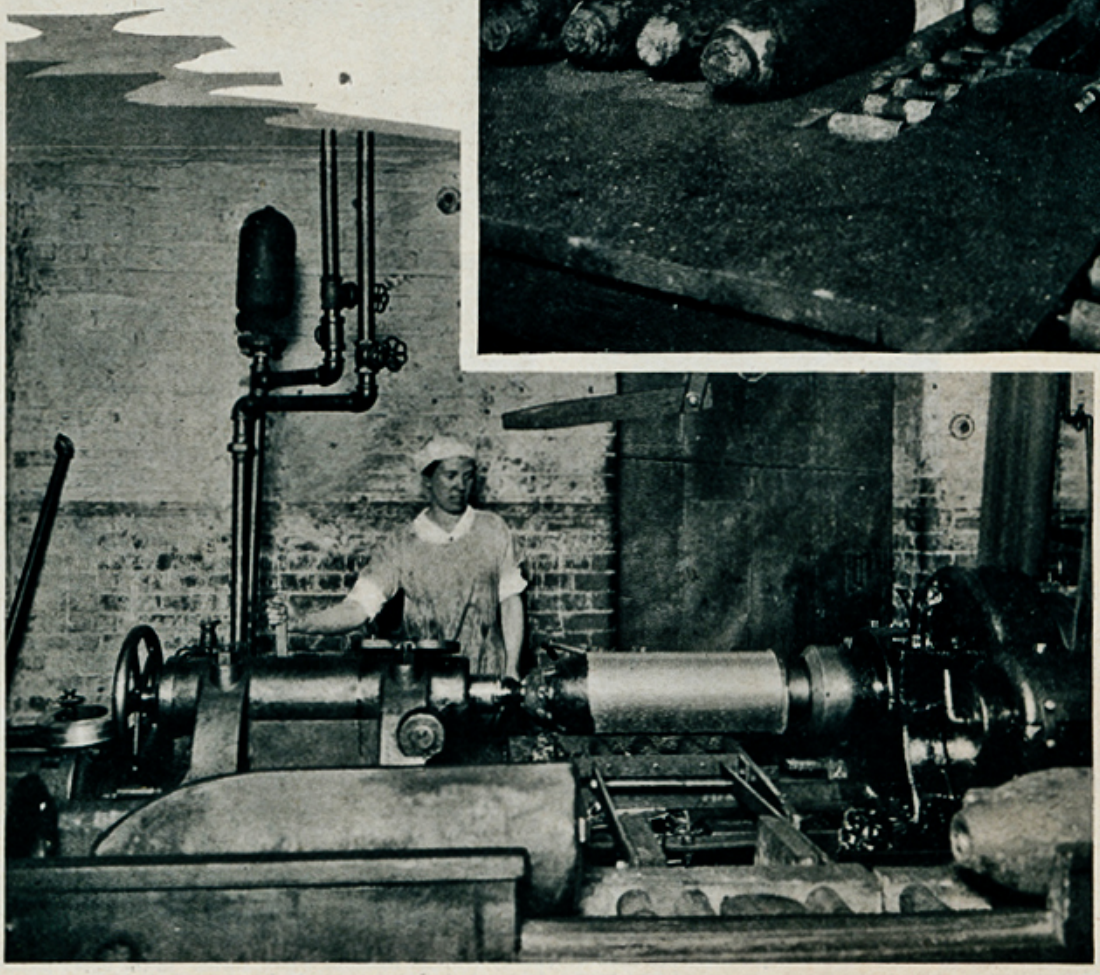
3rd machine, the jig by hydraulic power is upset, centered and closed ready for work.

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.



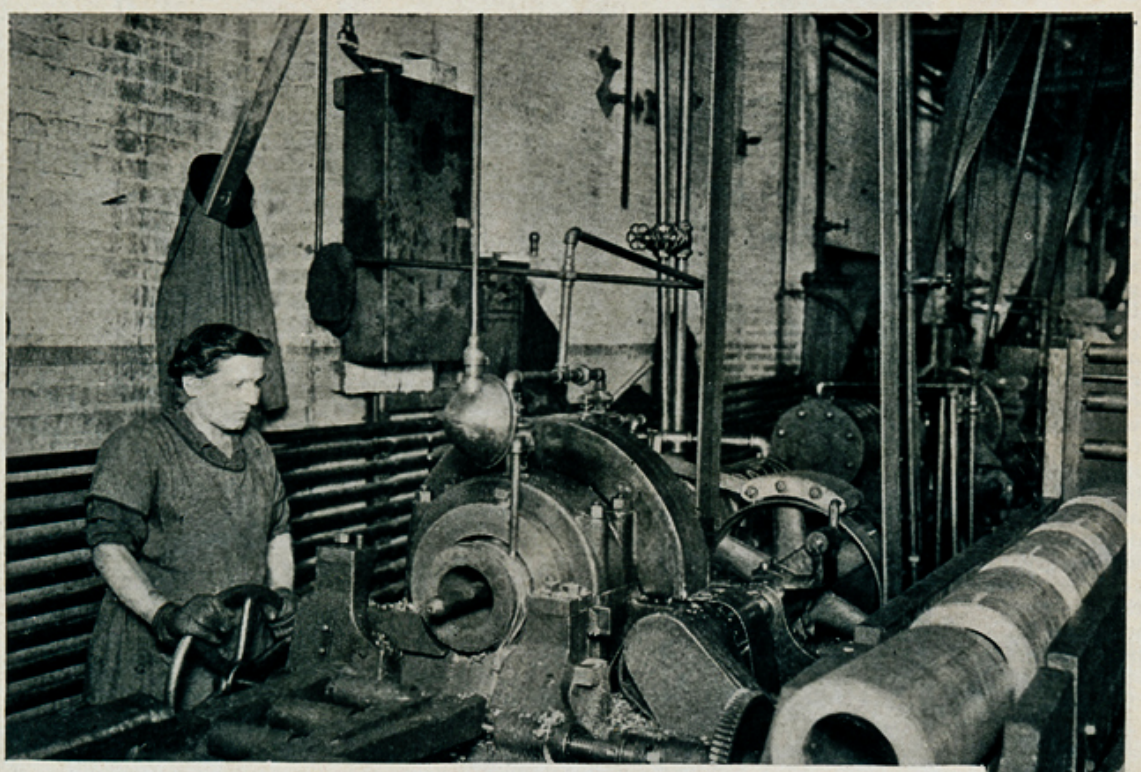
Drilling the Nose.

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.



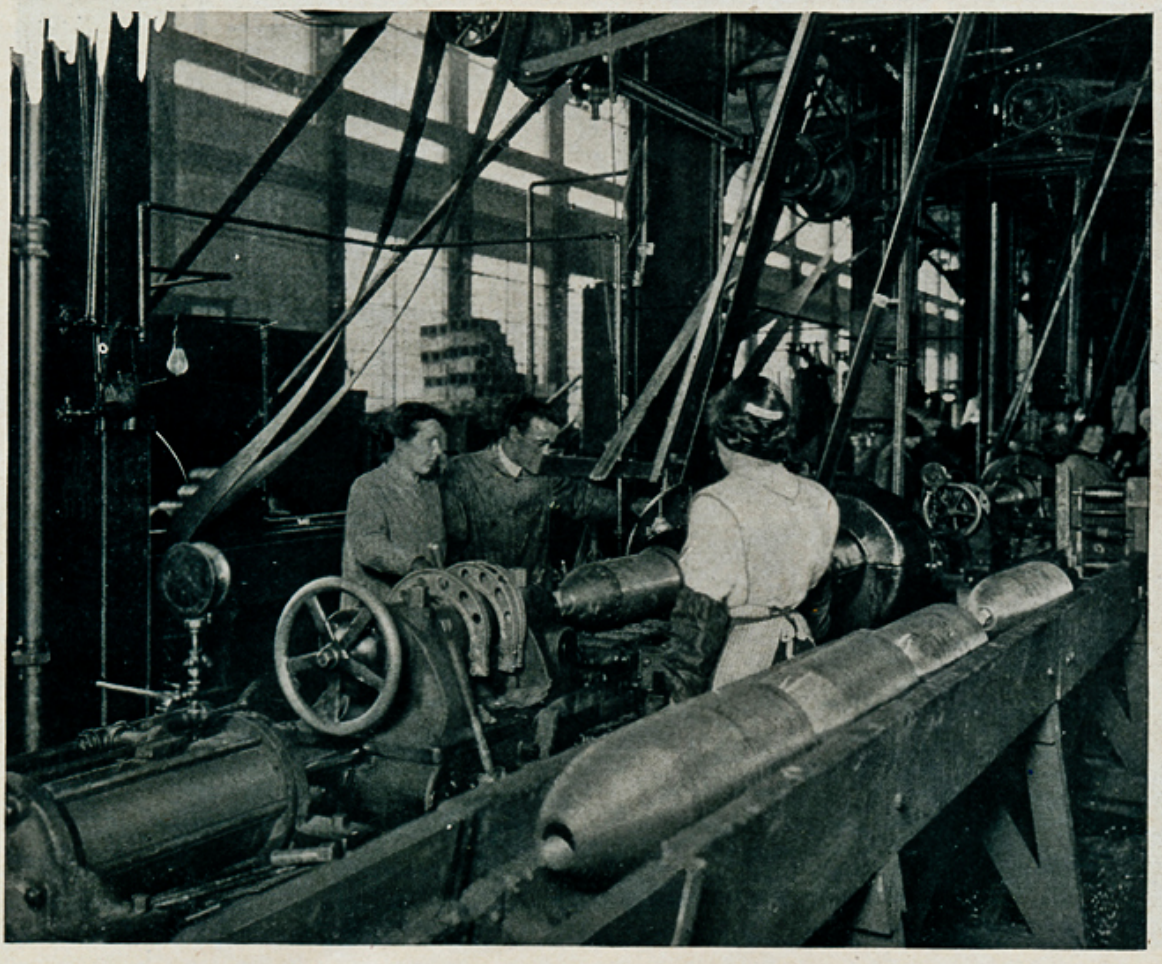
Machines Doing the Rough Turning

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.



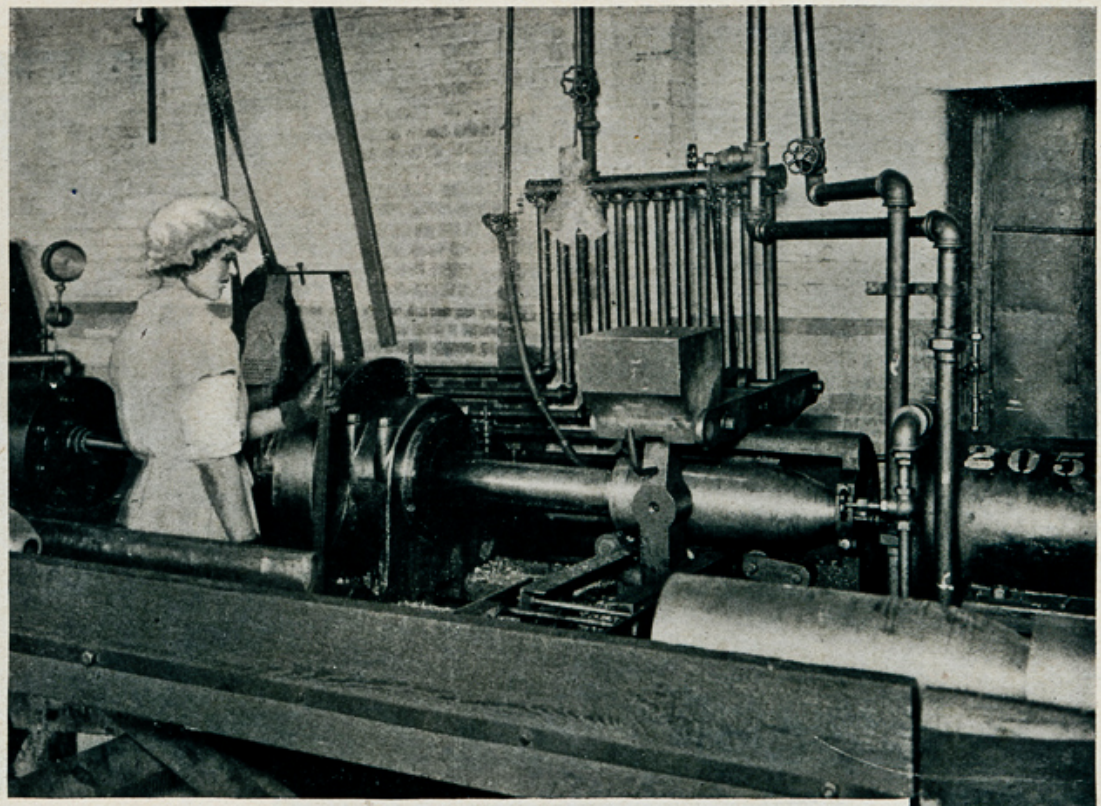
Dual Operation

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



View of Three Machines Finish Turning and Turning the Profile.

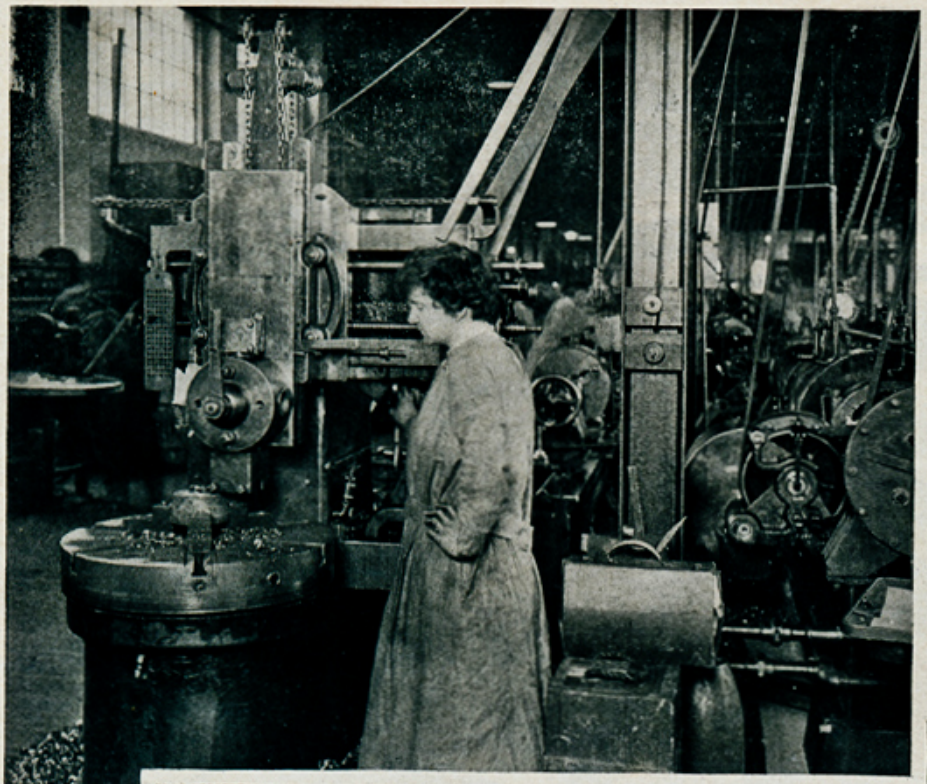
The opening in the roller-way track seen to the right of the picture is to facilitate movement of workers passing from place to place, and open and close at will.



Rough Boring

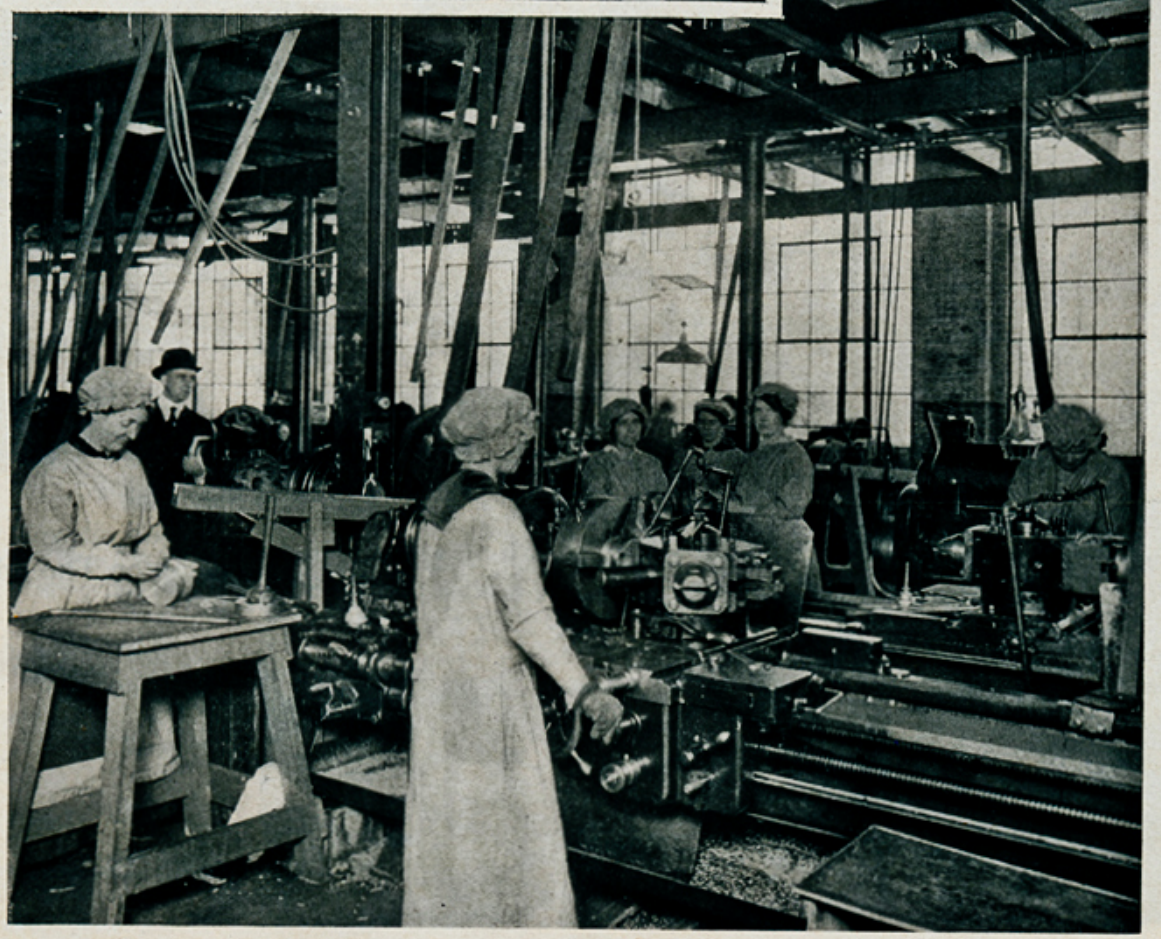
A good view of the Hydraulic cylinder and ram carrying boring tool is seen in this picture. As before mentioned a guide is attached to the ram which cuts off the pressure when the boring tool has reached its limit. The use of these automatic devices gives the women great confidence and they do their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

Inspection



Rough turning the Adaptor base for eight inch shells

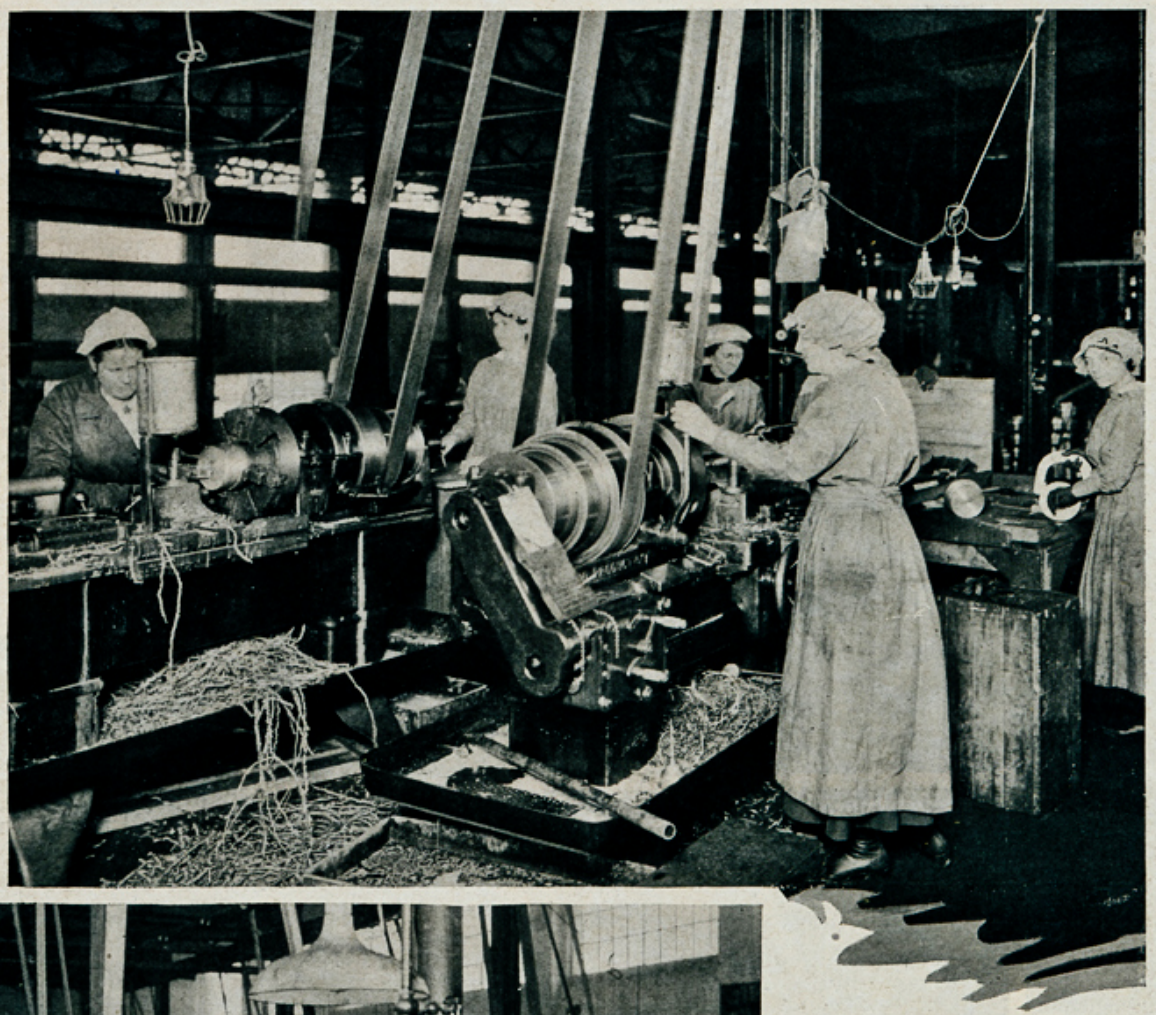
First operation

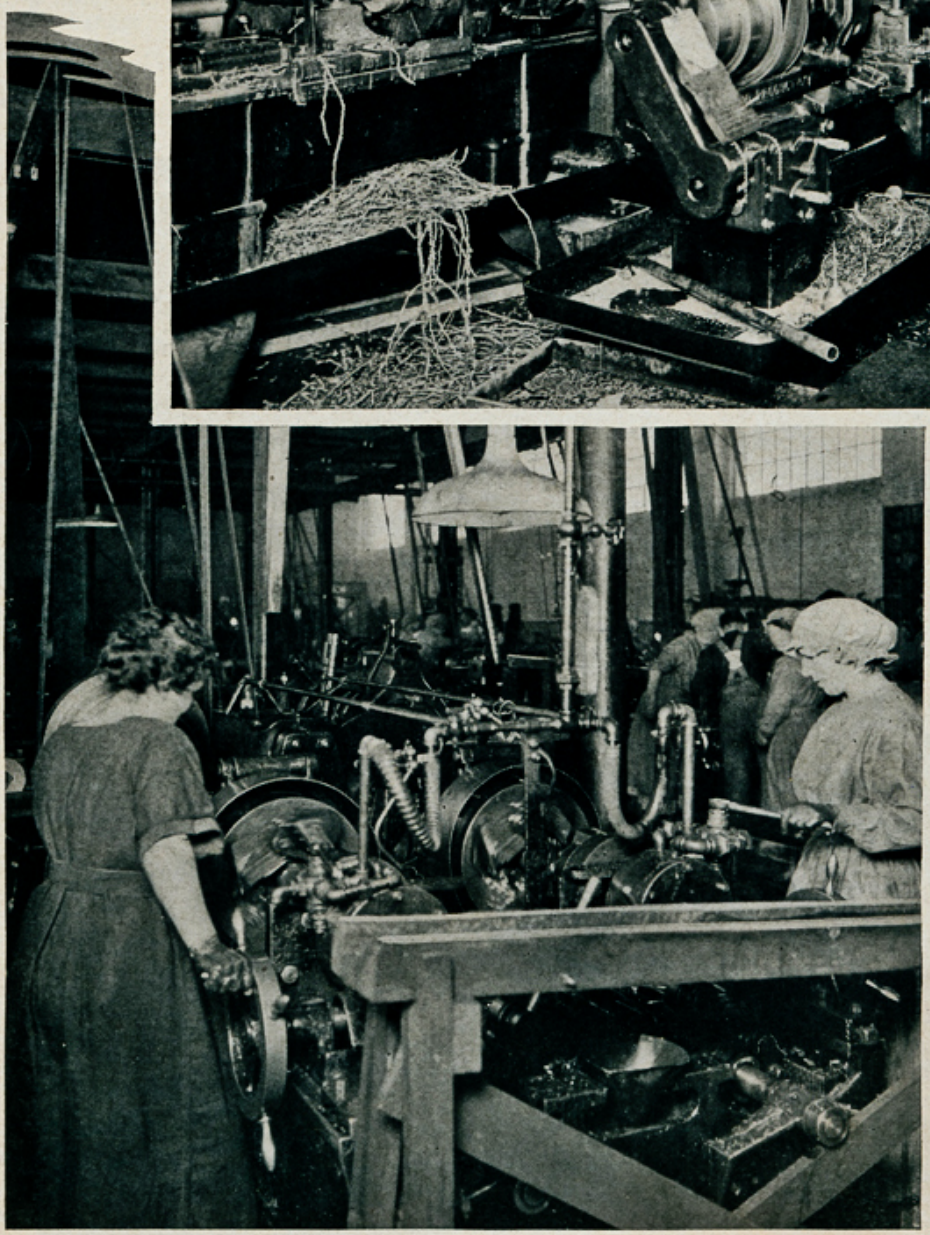


Rough turning the Adaptor

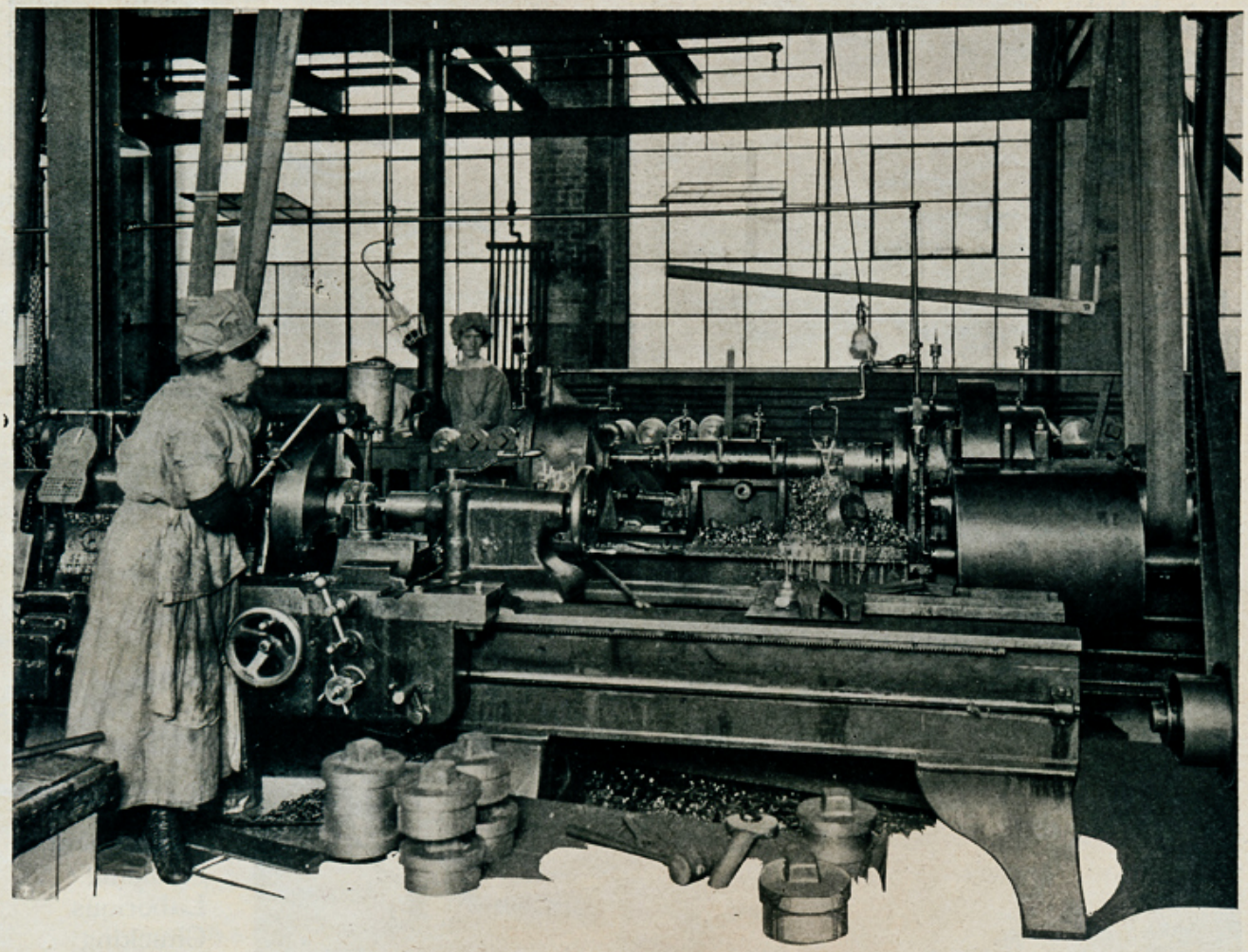
Second operation

Finish Turning the Adaptor

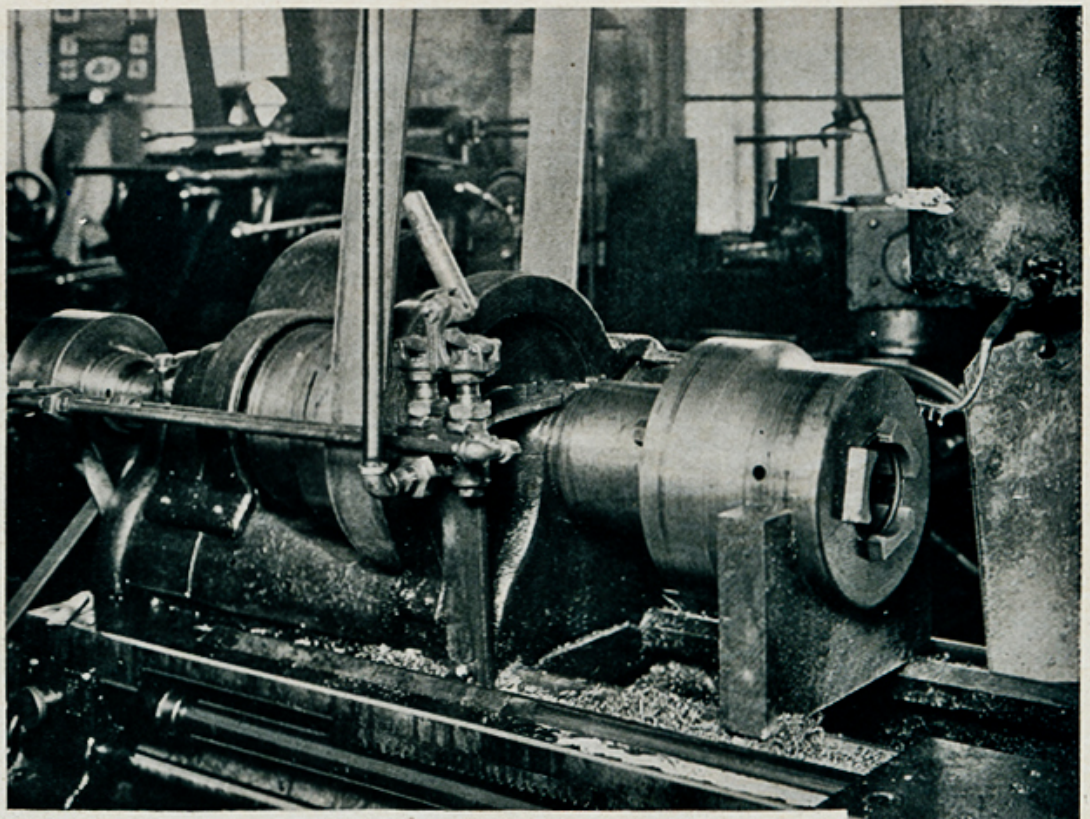




Threading and Chasing Adaptor Thread

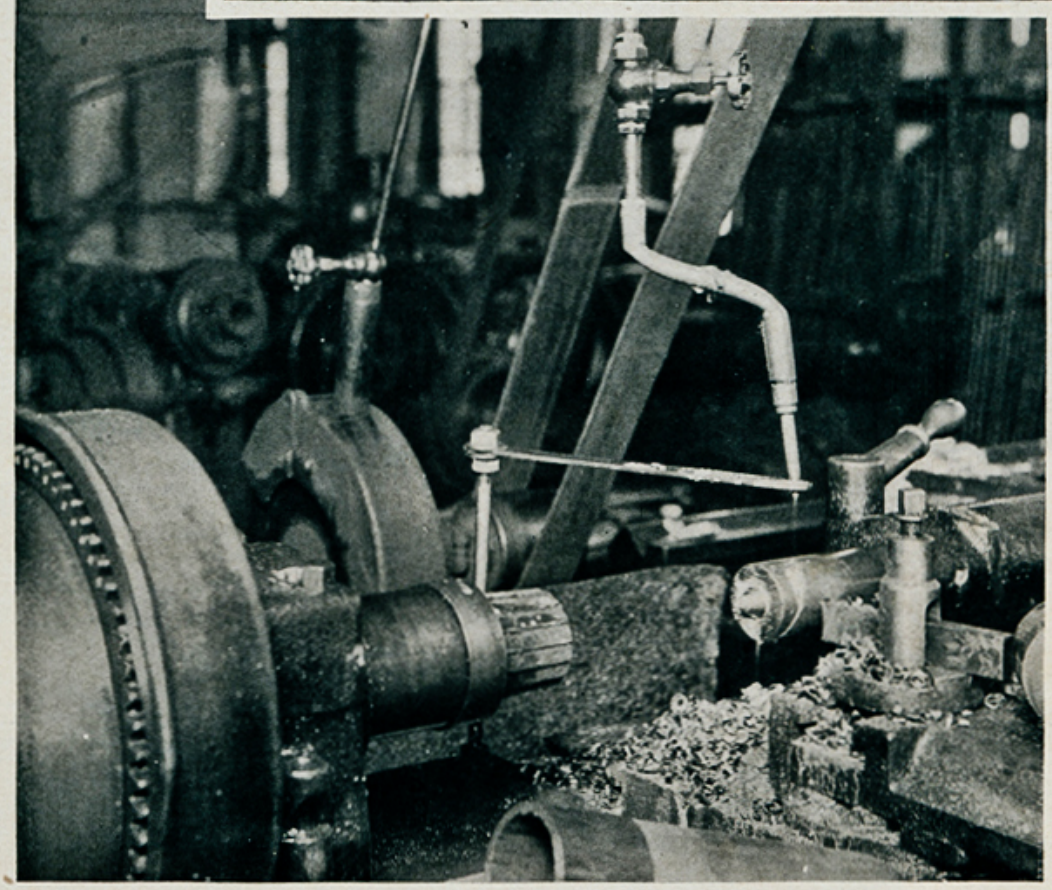


Finishing Base of Adaptor



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

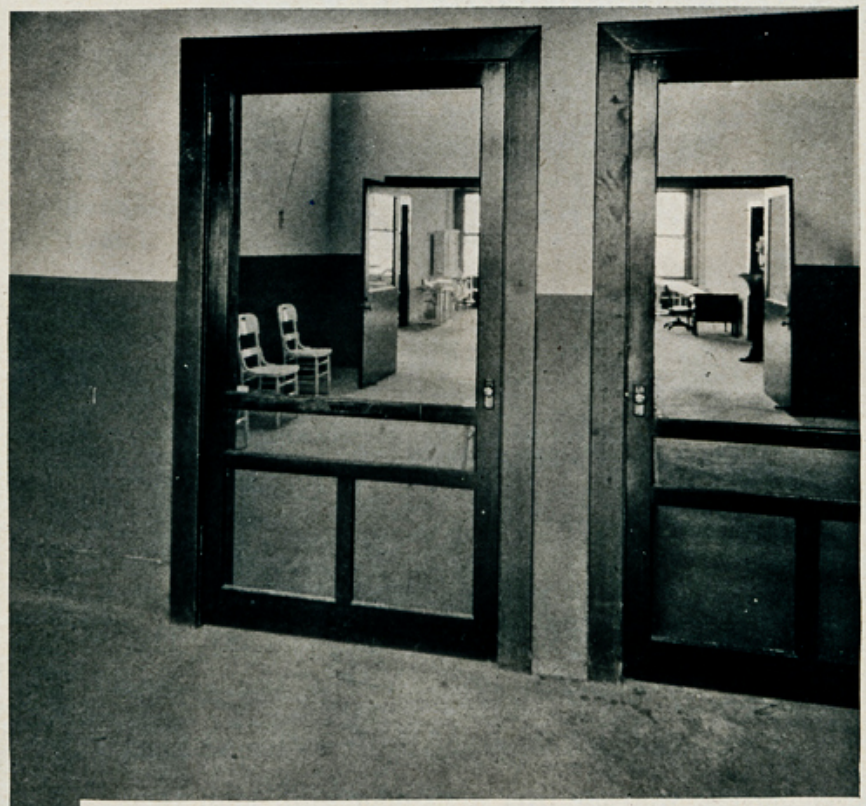
Forgings are quickly chucked in and out of the lathe by means of this taper mandrel, the forgings being driven tight on to the mandrel by the tailstock centre without unnecessary energy

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

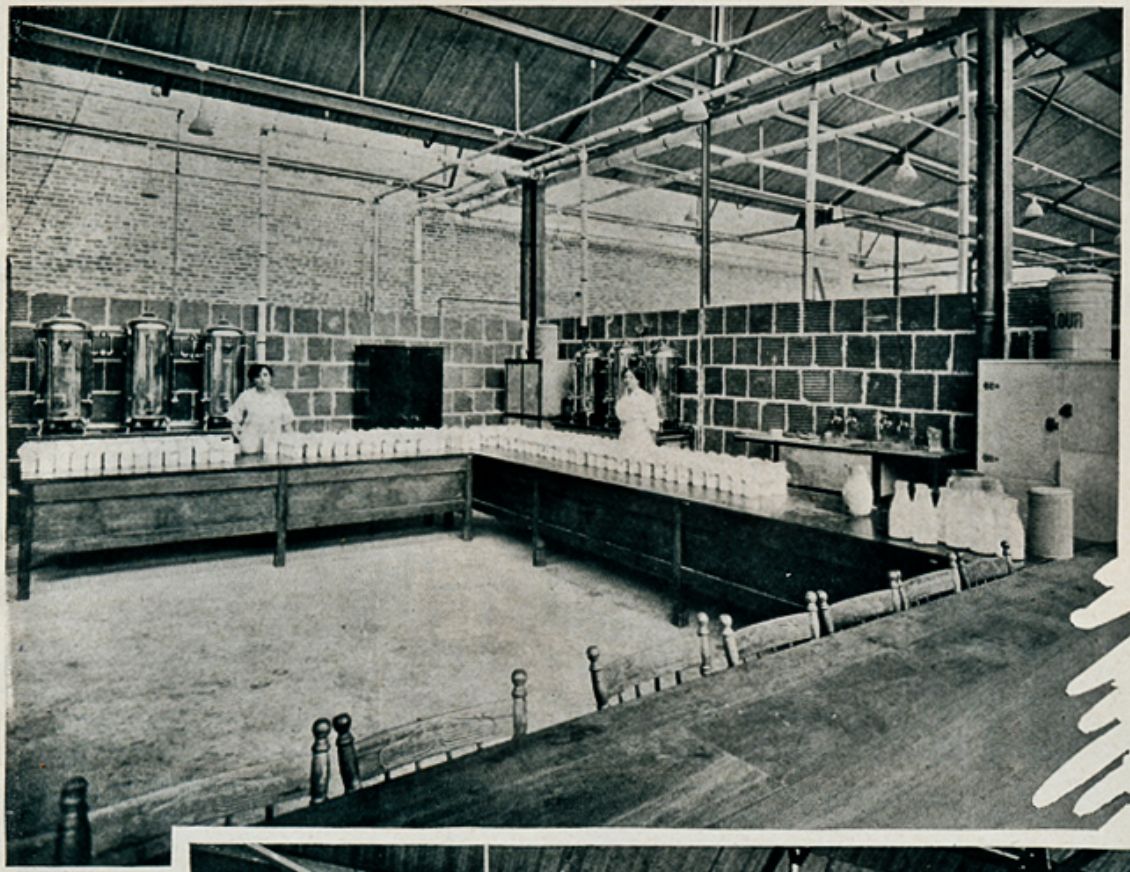
Operating table near right hand window. Sterilizing apparatus to left of picture.

Women's Ward

Looking Through Men's Bathroom to Men's Ward

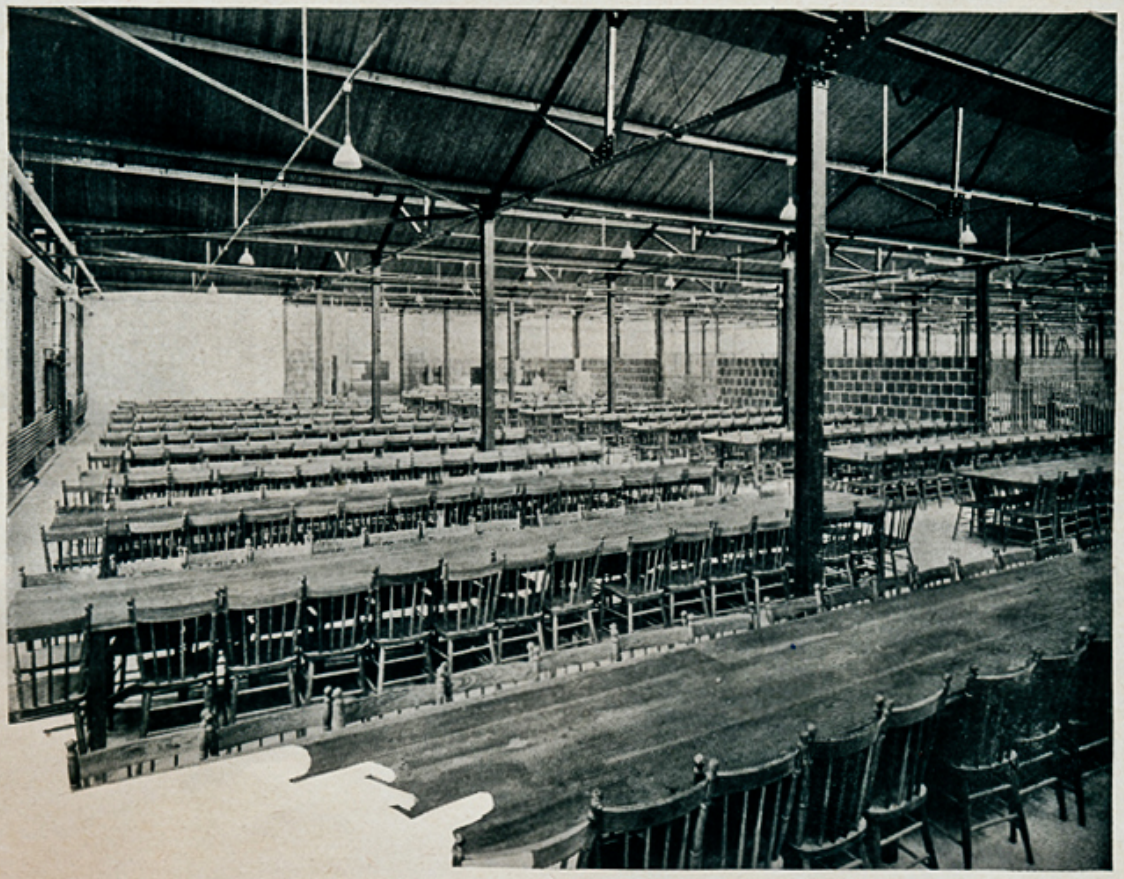
Mid-day Lunch, Enjoying their Well Earned Meal

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. Dimensions of room, 66 ft. x 150 ft.

Matron's Office and Accident Ward

Views of Lunch Counter and Lunch Room