

V. A. SALTER.
 ROLLING MILL.
 APPLICATION FILED JAN. 17, 1916.

1,206,381.

Patented Nov. 28, 1916.
 3 SHEETS—SHEET 1.

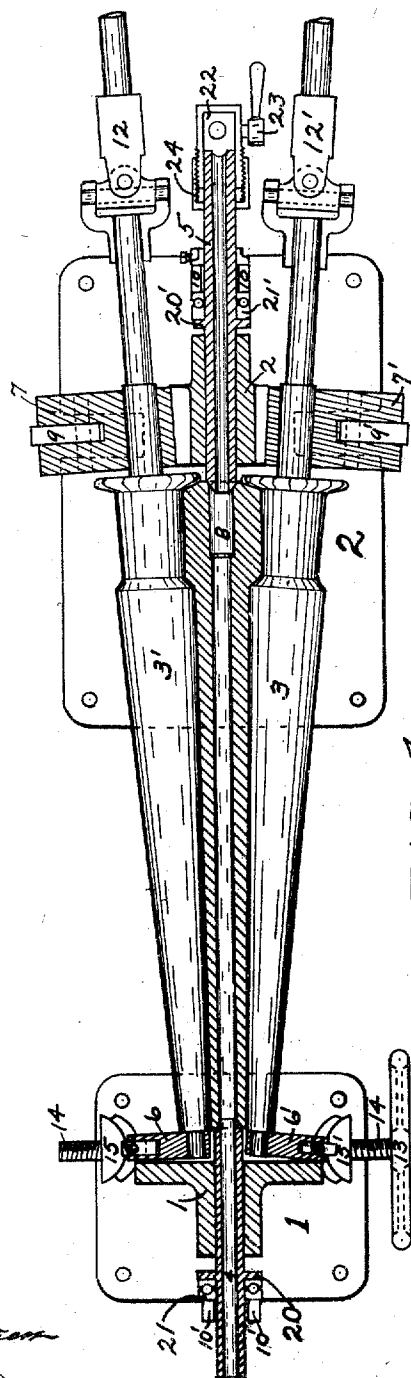


FIG. 1

WITNESSES:

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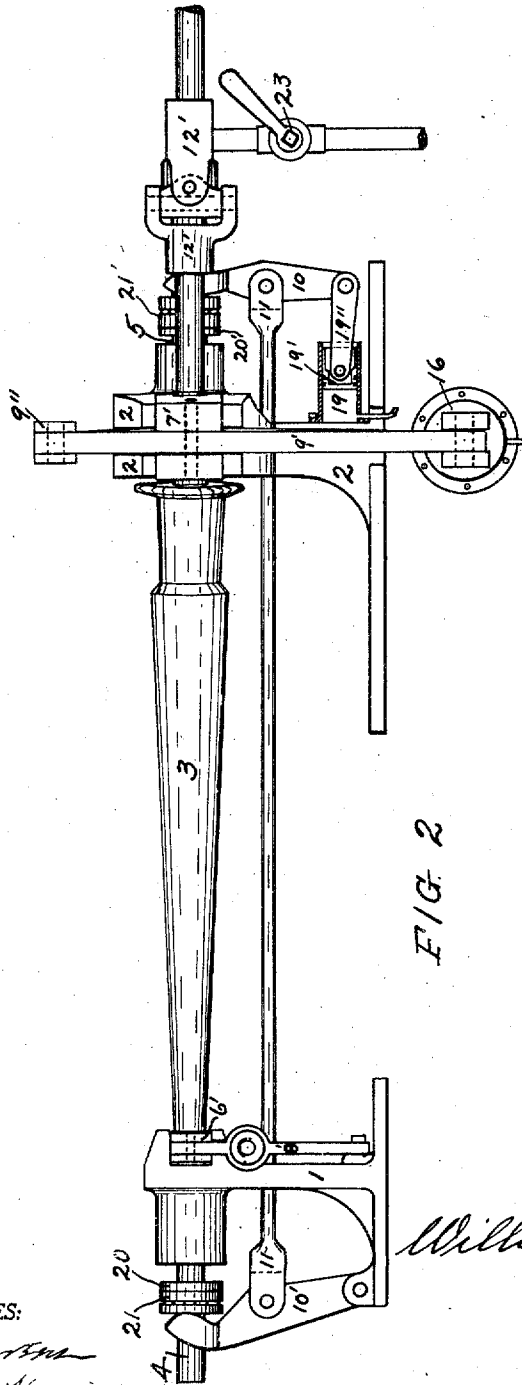


FIG. 2

WITNESSES:

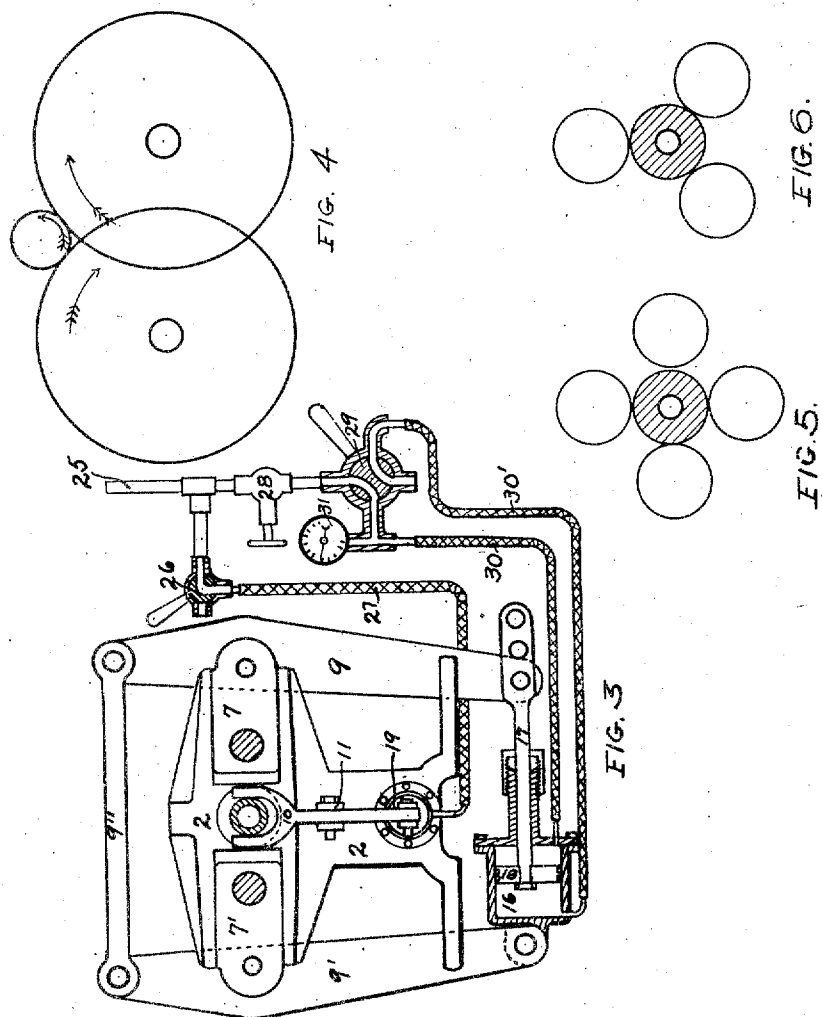
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 3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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ROLLING-MILL.

1,206,381.

Specification of Letters Patent.

Patented Nov. 29, 1916.

Application filed January 17, 1916. Serial No. 72,492.

To all whom it may concern:

Be it known that I, WILLIAM A. SALTER, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Rolling-Mills, of which the following is a specification.

My invention relates to a machine for the forming of gun and ordnance barrels, and has for its object the turning out of an improved product at a cheaper cost, and wherein all of the advantages of the wire wound or the hooped built up gun barrel, as to ballistic qualities are embodied in the single piece barrel with the cheapness of cost in manufacture of the latter.

To attain this end generally speaking, my invention consists of two supporting bases for mounting a number of rolls, with their adjustable bearings, hollow centering members, and connections between the hollow centers and a cooling element with means for controlling the flow of the cooling element.

As my invention contemplates the application of these improvements to the most highly organized mechanism for the forming of gun and ordnance barrels of the present day, it is obvious the details of construction and organization herein shown, may be varied when they include well known equivalents therefor without departing from the scope of my claims.

The subject matter claimed is hereinafter set forth in the claims at the end of this specification.

The accompanying drawings represent a rolling mill for the forming of steel gun and ordnance barrels, embodying all of my improvements, in the best way known to me, as is necessary to illustrate the subject matter herein claimed. Some of these improvements, however, may be used without the others, and in machines differing in its details of construction from the one herein shown.

Looking at the machine from a top view, I will call that end having the larger end of the rolls the front end, and the end having the smaller end of the rolls the rear end, the rolls lying in a horizontal plane.

Figure 1 is a top view of a rolling mill having two rolls with their integral bearing

shafts, universal joints, and short broken drive shafts shown in elevation and the other parts shown in sectional view through the axial line of the two rolls. Fig. 2 is a side view in elevation of the same machine but having the steam or air cylinder for applying thrust pressure to the two centering members shown in sectional detail. Fig. 3 is an end view in elevation from in front of the same machine, (but omitting the view of the connection to the cooling element) and having the pressure cylinder operating the pressure on the larger end of the rolls, shown in sectional detail. Also a view showing the steam or air line, and throttle valve and pressure gage, through which pressure is obtained to operate the various adjustments, and showing in section the four way valve leading to the pressure cylinder operating the rolls, and the three way valve leading to the cylinder operating the thrust on the centering members. Fig. 4 is a diagrammatic view of a power transmitting jack showing the lines of force that may be used to drive the rolls and from a single power member transmit the same direction of rotation to a series of rolls. Fig. 5 is a diagrammatic view of a rolling mill having four rolls, and showing the arrangements of the rolls, to which these improvements are adapted. Fig. 6 is a diagrammatic view of a rolling mill having three rolls, and showing the arrangement of the rolls to which these improvements are adapted.

In the practice of my invention, I provide the supporting bases 1 and 2 rigidly secured to the floor or other means, and each of which has large central bosses that are bored approximately in line for carrying the hollow centering members 4 and 5, and which also each have slots lying horizontally even with the centering bosses, and in which slide the adjustable bearing blocks 6 and 6' and 7 and 7' of the rolls 3 and 3'. Base 1 also has supports at the bottom for carrying the lower ends of the pressure levers 8 and 8' and the thrust levers 10'; while base 2 carries near its bottom the pressure cylinder 19 for operating the thrust on the centering members 4 and 5, through the levers 10 and 10' and the rod 11.

The rolls 3 and 3' are duplicates and larger at one end than the other, the out-

side shape of them conforming to the exterior profile lines of the gun or ordnance barrel being formed and they have at their larger end an integral flange that overlaps the end of the barrel, and prevents endwise drawing of the barrel during rolling operations. They also have extended integral shaft bearings, which are extended at the larger end to provide a driving means through the universal joints 12 and 12'. These rolls 3 and 3' are journaled in the bearings 6 and 6' and 7 and 7' and are operated through the pressure levers 8 and 8' at the rear end by means of the hand wheel 13, and the right and left hand threaded screw 14 and the nuts 15 and 15', and at the front end of the machine the rolls 3 and 3' are operated by means of the pressure levers 9 and 9' and the pressure cylinder 16.

The bearings 6 and 6' and 7 and 7' carry the ends of the rolls 3 and 3' and slide adjustably in the slots provided for them in the supporting bases 1 and 2 and the centers of the bearings are in line with the centers of the centering members 4 and 5.

The operating levers 8 and 8' are driven by means of the circular faced nuts 15 and 15' and the right and left hand threaded screw 14 by means of the hand wheel 13 for applying pressure on the smaller end of the rolls 3 and 3', these levers being hinged to pins in the base 1 at their lower ends, and their upper ends being connected with the bearings 6 and 6'.

The operating levers 9 and 9' are joined at their upper ends by means of the shackle bar 9'' and pivoted to the bearings 7 and 7', and between their lower ends is hung the pressure cylinder 16 and its connecting rod 17 and piston 18 through which pressure is applied to the larger ends of the rolls 3 and 3'.

The hollow centering members 4 and 5 are journaled in the bosses of the bases 1 and 2, and have endwise movement to conform to the length of barrel being rolled, and endwise pressure is applied upon them through the levers 10 and 10' connected together by the rod 11 by means of the pressure cylinder 19 and its piston 19' and connecting rod 19''. These hollow centers are tapered at their inner ends so as to fit in bevel edges of the bore of the barrel to receive them and make a close fit between them and the barrel, and they also have integral flanges 20 and 20' for transmitting the pressure exerted by the levers 10 and 10', through the medium of the ball bearings 21 and 21'.

The centering member 5 at the larger ends of the rolls 3 and 3' is hollow throughout its length, and at the outer end fits into the hollow elbow 22 in which it is free to turn and slide axially. This hollow elbow 22 is connected by a pipe to the cooling element, the flow of which is controlled by the valve

23, and the packing gland 24 prevents the escape of the cooling element around the joint of the centering member 5.

Compressed air or steam is obtained through the pipe 25 and is admitted through the valve 26 and tubing 27 to the cylinder 19 for giving endwise pressure on the centering members 4 and 5, and compressed air or steam is admitted through the throttle valve 28 and four way valve 29 and the flexible tubes 30 and 30' to the ends of the pressure cylinder 16, for operating and giving the required degree of pressure on the larger ends of the rolls 3 and 3' the operator in charge of the machine being guided by the pressure gage 31.

In operation, I take advantage of the fact that steel, when heated to a red or forging heat, expands considerably over what it was in a cold state, and shrinks in cooling to the same degree, and also while it is in a red or white stage of heat, steel adapts itself to forging operations by blows from hammers, rollers under pressure or constant heavy pressure. Also when a piece of steel is heated to a white or red heat to where it is in a forging state, and a strong cooling element is brought in contact with one side of it, that side will chill rapidly and the cooled portion travel slowly across the steel until the entire piece is cooled.

So in the operation of my invention I first machine and bore the gun or ordnance barrel to be treated to approximately its correct size, and this barrel "B" is then heated to a forging heat. The centering members 4 and 5 are then drawn back outward, and the rolls 3 and 3' spread, when the heated barrel is held between them, and compressed air or steam admitted to the cylinder 19, and the centering members 4 and 5 forced in and held tightly against and in the ends of the bore of the barrel "B" making a close tight connection, and because of the yielding compression connection through the medium of the cylinder 19, the members 4 and 5 automatically adapt themselves to expansions and contractions of the barrel while being worked. Bearings 6 and 6' are now tightened against the rear end of barrel "B" by turning the hand wheel 13, and a light pressure of compressed air or steam is admitted to the cylinder 16 through the throttle 28 bringing the front end of the rolls lightly against the barrel "B," and power is applied to the rolls 3 and 3' through any suitable means that will drive them in the same direction of rotation, thus turning the barrel "B" between them, and the centering members 4 and 5 rotate with the barrel, the ball bearings 21 and 21' allowing them thus to turn and at the same time maintaining the endwise pressure from the cylinder 19. With the rolls 3 and 3' now turning with the barrel "B," the valve 23 is now opened

admitting the cooling element to flow through the bore of the heated barrel, coming in through the centering member 5 and out through the centering member 4 to discharge, and as soon as the bore of the barrel commences to cool, forming a core of chilled steel in the center of the barrel, additional pressure is admitted through the valve 28 to the cylinder 16, thus increasing the pressure on the rolls 3 and 3' and forcing the hot outside parts of the barrel "B" down onto the chilled core interior, and as the cooled portion of the steel barrel travels slowly outward, in this cooling process each automatic part of the hot steel is rolled down against and shrinks on and compresses that part lying immediately next to it toward the bore. The result of the finished barrel being that each part of the barrel, is in a state of uniform tense compression against the bore to resist the forces of explosion, when in use.

Operation of the valves 26 and 29 releases the compression in cylinders 16 and 19, spreading the centering members and rolls apart, for disengaging the barrel "B".

I claim as my invention and desire to secure by Letters Patent:

1. In an ordnance rolling mill, the combination of a multiplicity of rolls, and hollow adjustable centers contiguous to the ends of the rolls.

2. In an ordnance rolling mill the combination of a multiplicity of rolls, hollow adjustable centers contiguous to the rolls and adapted to convey a cooling element, and yielding constant pressure connection between the centers.

3. In an ordnance rolling mill, the combination of a multiplicity of rolls, hollow adjustable centers contiguous to the rolls, a means to convey cooling element connected to one of the centers and means for controlling the flow of the cooling element.

4. In an ordnance rolling mill, the combination of a multiplicity of rolls, a hollow adjustable center adapted to convey a cooling element, and means for applying pressure endwise to the center.

5. In an ordnance rolling mill, the combination of a multiplicity of rolls, hollow

adjustable centers contiguous to the ends of the rolls, and means for applying variable pressure to the rolls.

6. In an ordnance rolling mill, the combination of a multiplicity of rolls, hollow adjustable centers, a means to convey cooling element connected with one of the centers, means for controlling the flow of the cooling element, and means for varying the pressure on the rolls.

7. In an ordnance rolling mill, the combination of a multiplicity of tapered rolls, a hollow center contiguous to the larger ends of the rolls, means for controlling the position of the center, and means for applying pressure to the rolls.

8. In an ordnance rolling mill, the combination of a multiplicity of tapered rolls having a flange at their larger ends a hollow adjustable center, means to convey a cooling element connected with the center, means for controlling the flow of the cooling element, and means for applying pressure to the rolls.

9. In an ordnance rolling mill, the combination of a multiplicity of tapered rolls having flanges at their larger ends, hollow adjustable centers contiguous to the ends of the rolls, means to convey a cooling element connected with one of the centers, means for applying endwise pressure to the centers, means for applying variable pressure to the rolls, and means for controlling the flow of the cooling element.

10. In an ordnance rolling mill, the combination of a multiplicity of tapered rolls having flanges at their larger ends, hollow centers contiguous to the ends of the rolls, means to convey a cooling element connected with one of the centers, and a yielding pressure connection between the centers, and means for applying variable pressure to the rolls.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM A. SALTER.

Witnesses:

C. SALTER,
M. A. SALTER.