No. 711,927. Patented Oct. 21, 1902.

R. MENGELBIER.

ROLLING MILL.

(Application filed Dec. 17, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

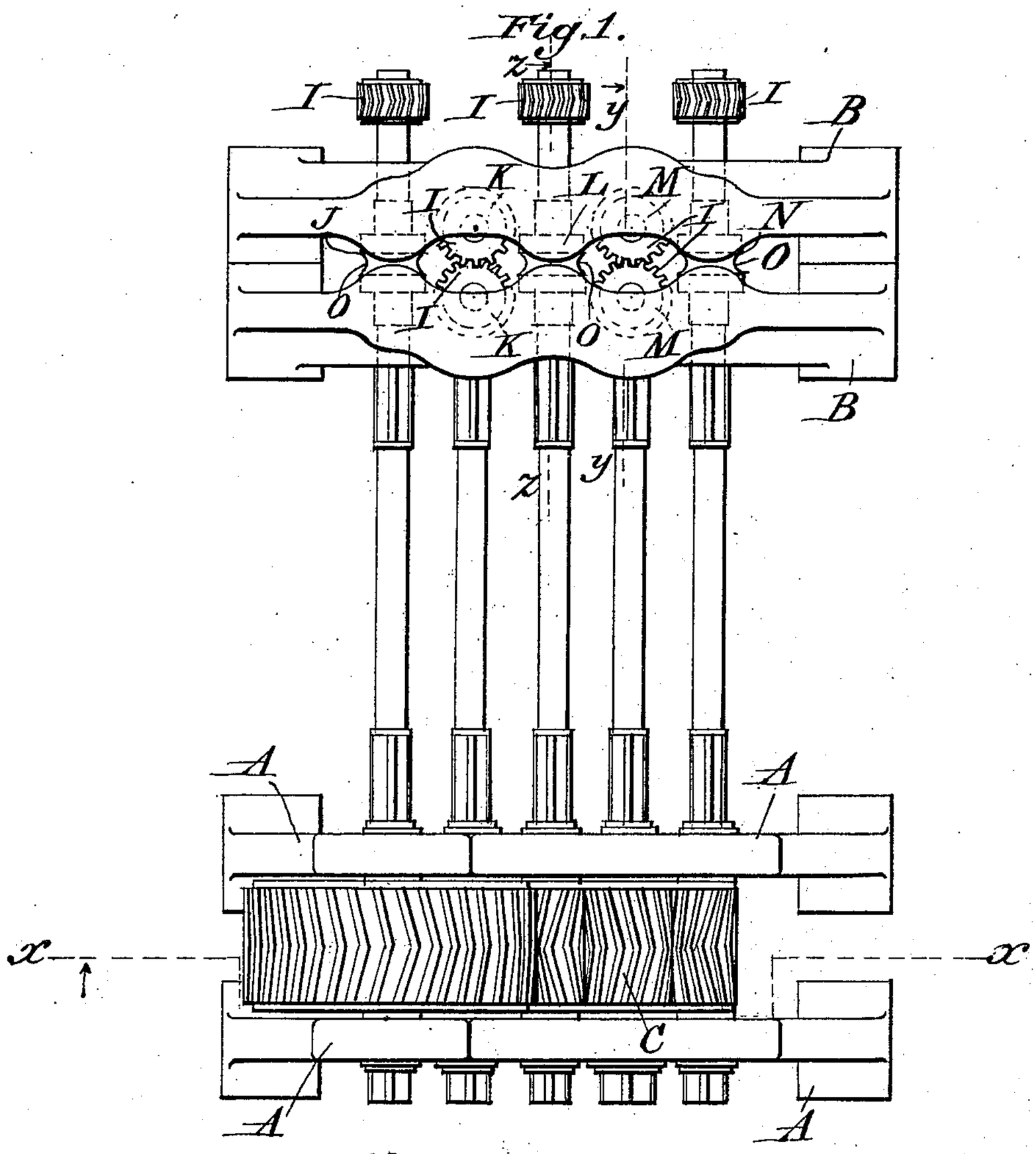
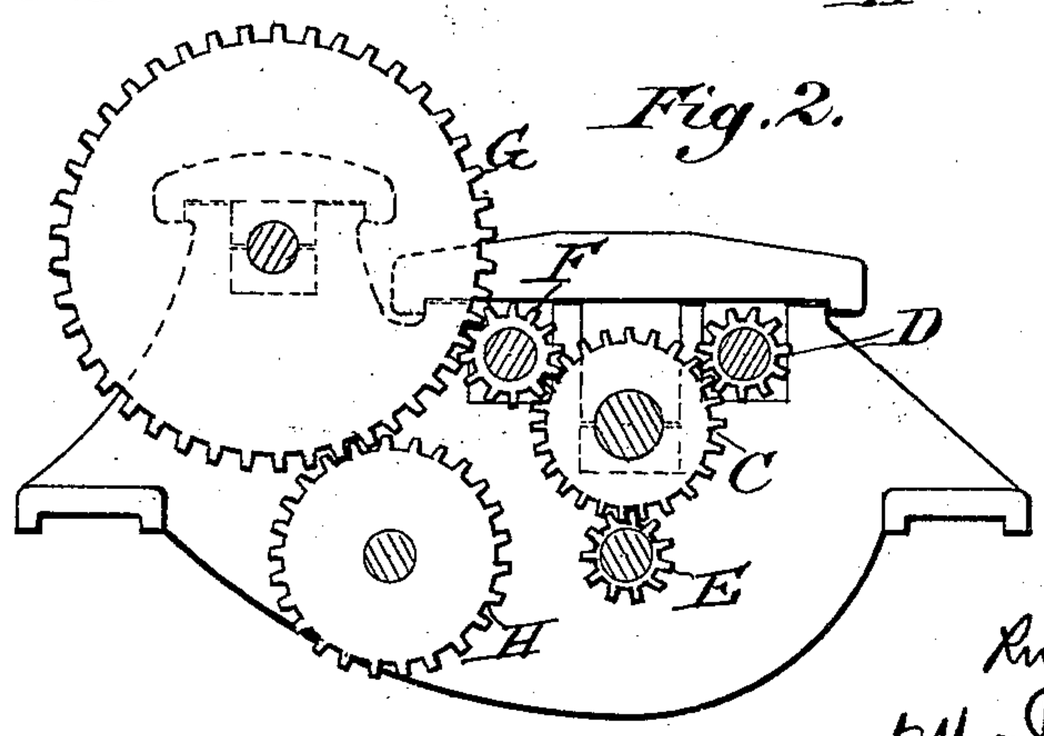


Fig. 2.



Witnesses

F. H. Schott

Anton Bloetzner.

Inventor:

Rudolf Mengelbier,

By Munn & Co.

His Attorney

No. 711,927. Patented Oct. 21, 1902.

R. MENGELBIER.

ROLLING MILL.

(Application filed Dec. 17, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

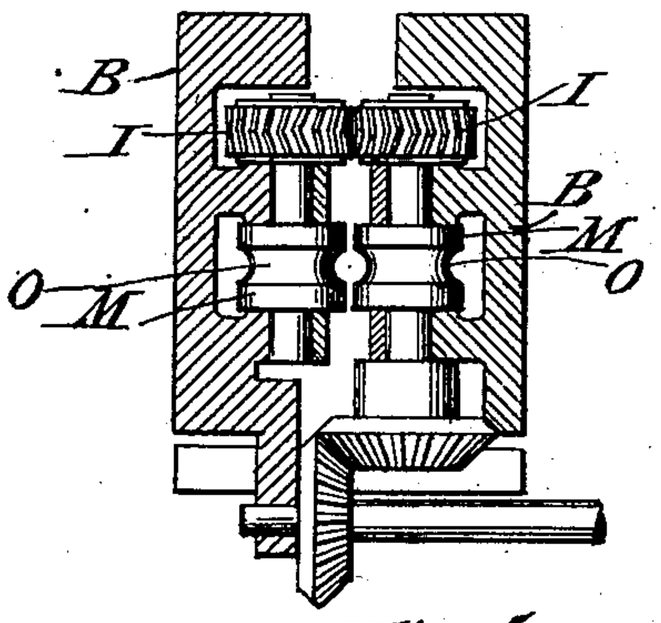


Fig. 4.

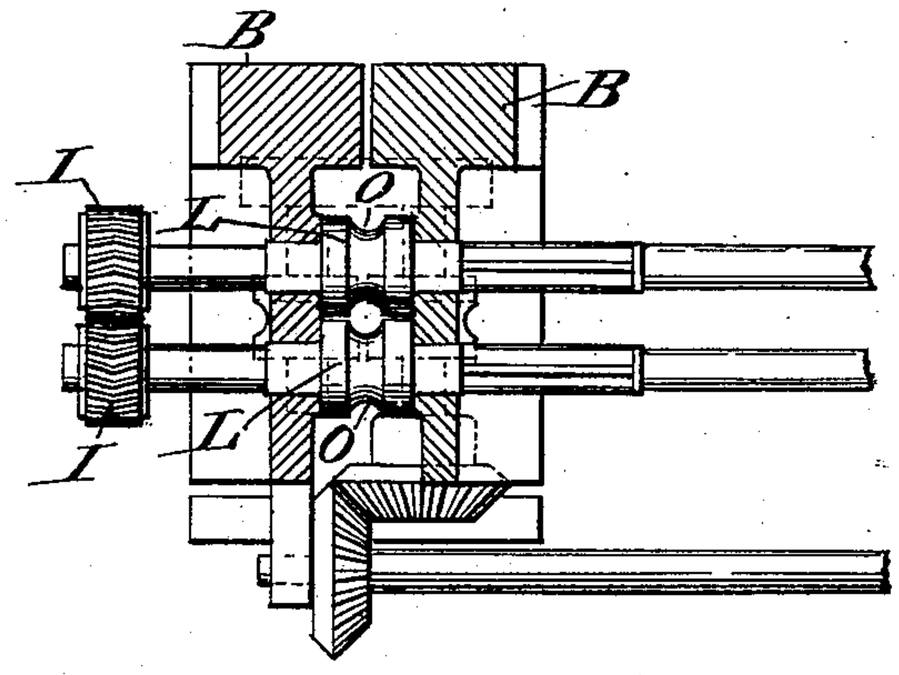


Fig. 5.

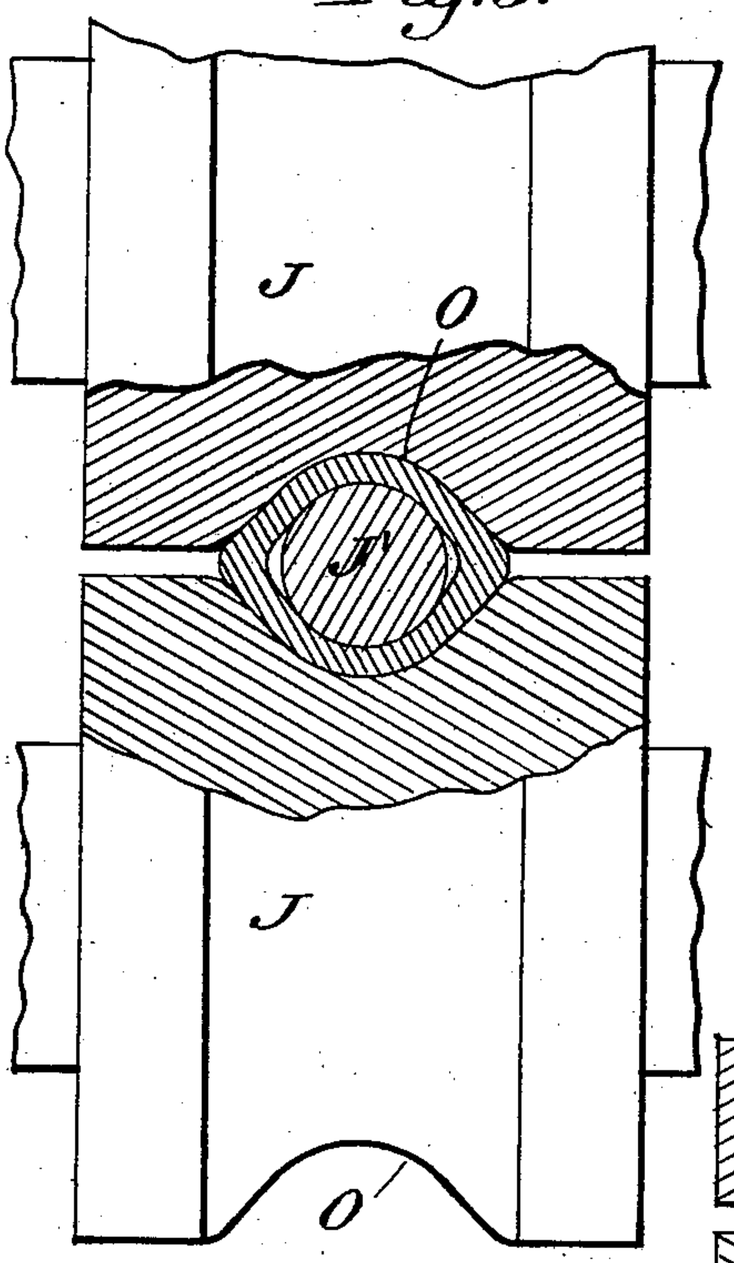


Fig. 6.

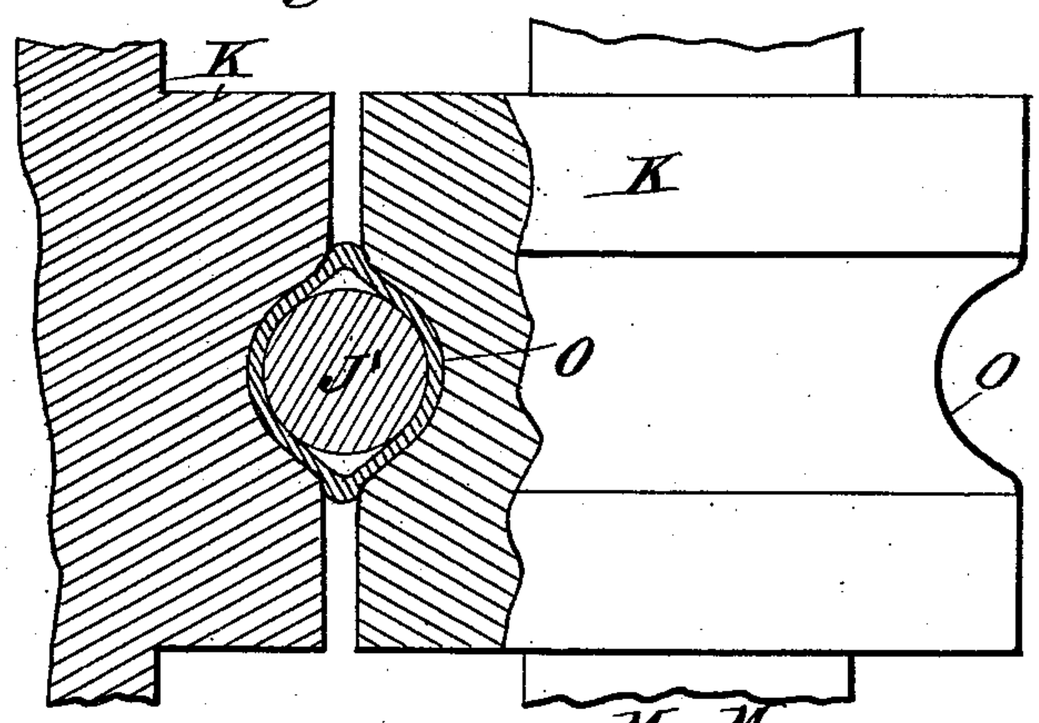


Fig. 7.

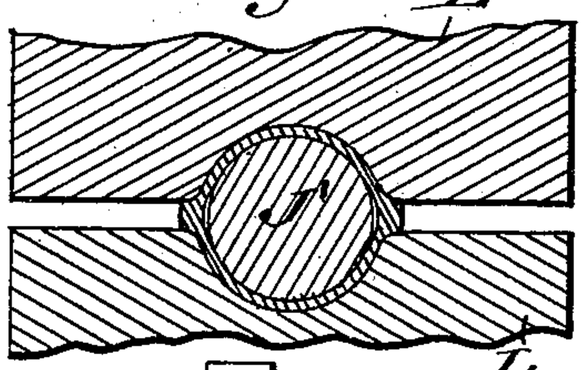


Fig. 8.

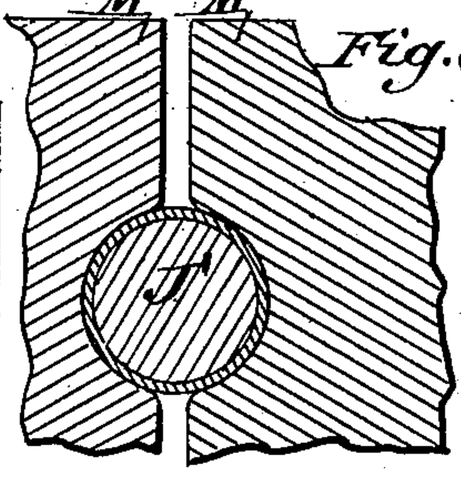
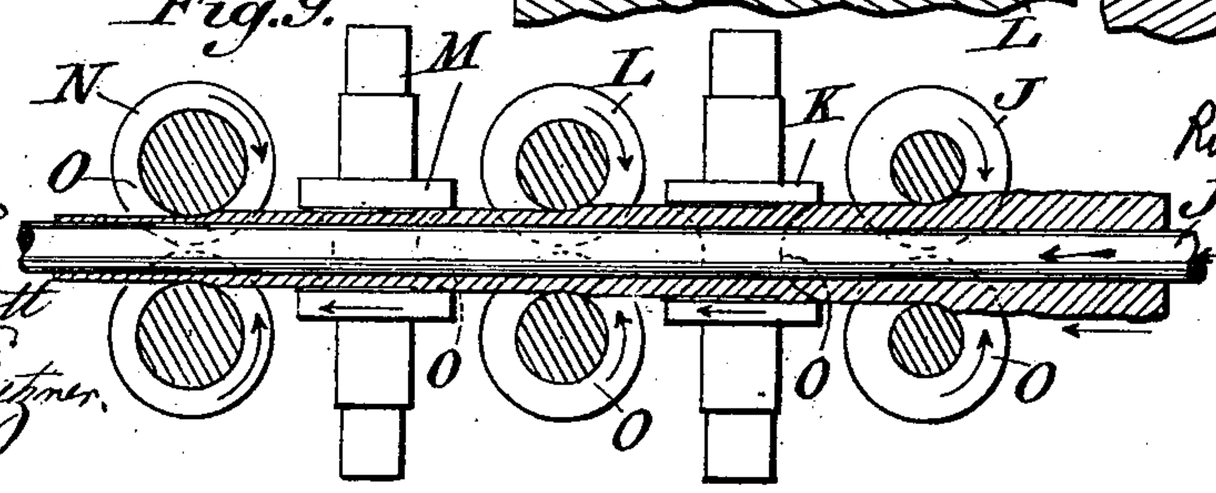


Fig. 9.



Witnesses
F. H. Schott
Anton Gleitzmer.

Inventor:
Rudolf Mengelbier,
by
Mayo & Mayo
his Attorneys.

UNITED STATES PATENT OFFICE.

RUDOLF MENGELBIER, OF ANDERNACH, GERMANY.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 711,927, dated October 21, 1902.

Application filed December 17, 1901. Serial No. 86,323. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF MENGELBIER, a subject of the King of Prussia, German Empire, and a resident of Andernach-on-the-Rhine, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Rolling-Mills, of which the following is a specification.

This invention relates to rolling-mills for drawing out hollow bars or tubes; and it consists in certain novel features hereinafter first fully described and then particularly pointed out in the claims.

In the annexed drawings, which fully illustrate my invention, Figure 1 is a plan view of a rolling-mill embodying my improvements. Fig. 2 is a vertical section on the line *x x* of Fig. 1. Fig. 3 is a vertical section on the line *y y* of Fig. 1. Fig. 4 is a vertical section on the line *z z* of Fig. 1. Figs. 5, 6, 7, and 8 are detail views showing the successive steps in the drawing out of the tube; and Fig. 9 is a diagrammatic longitudinal section through the system of rollers.

In carrying out my invention I employ a series of grooved rollers arranged in pairs, the adjacent pairs being arranged at right angles, and gearing for rotating said rollers. The grooves of the first pair of rollers are of such form that the space between the said rollers is non-circular or laterally expanded, while the grooves of the succeeding rollers gradually approach a semicircular form, so that the space between the finishing-rollers forms a true circle. The driving-gearing is so proportioned and arranged as to impart increasing speed to the successive rollers. By this arrangement the mandrel is drawn through the mill with a speed equal to the rotation of the last rollers, and the pressure of the several rollers is distributed, so that the shape of the mandrel is preserved.

Referring now to the drawings by letter, A B designate supporting-frames arranged in pairs, the driving-gearing being mounted between the frames A and the working rollers being mounted between frames B.

The driving mechanism consists of a train of gear wheels and pinions, one of which, C, is an idler rotated from the source of power and transmitting motion to the other members of the train. Meshing with this idler are a series of pinions D E F, which transfer the movement to some of the working rollers. The pinion F, furthermore, meshes with a large gear-wheel G, and this in turn meshes with a gear-wheel H of a diameter less than its own diameter, but greater than that of the pinion F. The pinions D and E may be of the same diameter as the pinion F, but I prefer to have them of less diameter. The gear-wheel G is located at the front of the mill, and its shaft is extended over to the frames B and carries the upper roller of the first pair of horizontal rollers. The shaft of the gear-wheel H is connected by bevel-pinions with one of the rollers of the first pair of vertical rollers. The shaft of the pinion F carries the lower roller of the second pair of horizontal rollers, and the remaining pinions alternately are geared to the vertical rollers and have a common shaft with the lower roller of a pair of horizontal rollers. The rollers of each pair of rollers are caused to rotate positively at the same speed by the pinions I on extensions of their shafts, as will be readily understood.

The working rollers J K L M N are arranged in alternately horizontal and vertical pairs, as shown and as before stated. The rollers are all provided with central annular grooves O, which receive the tube being acted upon, and the surfaces of which act on the metal to draw it out. By referring particularly to Figs. 5, 6, 7, and 8, it will be observed that the grooves in the first rollers are in the form of a non-circular curve, such as an ellipse with elongated ends—that is, they have wide openings—so that they do not completely surround the metal, but leave its sides untouched, so that under pressure the metal may expand laterally between the rollers, the extremities of the opposite sides of the ellipse being turned away from each other to accommodate this lateral expansion of the metal. The grooves of the next rollers are elliptical in form, but approach successively a semicircular form until the finishing-rollers are reached, when a true semicircular groove is found and the metal will be completely surrounded, so that the entire surface of the tube will be treated.

In operation a collar of hot metal is taken up on the end of a long mandrel J, which is then inserted between the front rollers and

pushed by any suitable means to the last rollers. The first pair of rollers will bear on the top and bottom of the metal, so that as the mandrel is moved backward between the rollers the metal will be drawn through in the shape shown in Fig. 5. The next pair of rollers will bear on the sides of the metal, giving it the shape shown in Fig. 6, and as the movement of the mandrel progresses the metal will be pressed closer against the mandrel and will be finally given a true circular cross-section, as will be readily understood on reference to Figs. 7 and 9.

It will be noted on reference to Figs. 5, 6, and 7 that the forming-rollers are out of contact and the ends of the grooves are turned away from each other, so that the metal may expand laterally into a rib which does not touch the sides of the mandrel, and consequently there is no overheating of the mandrel, and the sliding wear on the same is reduced to a minimum.

In rolling-mills heretofore known it was necessary to pass the tube several times between a single pair of grooved rollers or else the metal was forced over a stationary mandrel between several pairs of rollers, all of which had semicircular annular grooves. The former was unsatisfactory because the tube was cooled and the mandrel heated before the work was finished, the result being that the mandrel lost its shape and the product was imperfect. In mills employing several rollers all having semicircular grooves with a stationary mandrel there was so strong a frictional pressure exerted on the work between the rollers and the mandrel that the material adhered to the mandrel and its movement was stopped, the rollers and the mandrel quickly becoming worn or broken. Even if a movable mandrel should be employed in such a mill the friction on the mandrel would be so great that the finishing-rollers would be unable to draw the mandrel through with the work. As a result there would be either a straining or rubbing on the mandrel or a buckling of the material between the rollers. These objections are all overcome in a mill constructed in accordance with my invention, in which the mandrel, as will be readily seen from the foregoing description, is drawn through the mill with the tube at a speed equal to the speed of the last or finishing rollers and in which the slower preliminary roughening-rollers do not bear upon the entire surface of the tube, but permit the material to expand laterally. Consequently the entire surface of the mandrel is not subjected to pressure. The finishing-rollers have semicircular grooves, and therefore bear upon the entire surface of the tube and force the mandrel to travel at the same speed as they rotate, thereby preserving its shape and preventing adhesion of the tube thereto.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a rolling-mill, a continuous series of pairs of forming-rolls, the two members of each pair out of peripheral contact, the opposing faces of the groove on each member of a pair varying from a non-circular groove with elongated extremities in the case of the initial pair of rolls to a true circle in the case of the final pair of rolls, and a mandrel adapted to pass through the series of rolls.

2. In a continuous tube-rolling mill, a series of pairs of forming-rolls with each member out of peripheral contact, the opposing faces of the groove on each member of a pair varying from a non-circular curve in the case of the initial pair of rolls to a true circle in the case of the final pair of rolls, and a movable mandrel carrying the tube and adapted to pass through the several pairs of rolls whereby the tube will be compressed, shaped and elongated at a minimum of friction with the inclosed mandrel.

3. In a continuous rolling-mill, the combination with a plurality of pairs of grooved rolls arranged alternately in intersecting planes, and the openings between the several pairs of rolls graduating from a non-circular with elongated extremities to a circular cross-section, of a cylindrical mandrel adapted to move through the several pairs of rolls, and gearing adapted to rotate the successive rolls at increased speed, whereby a tube carried upon the mandrel will be compressed, shaped and elongated at a minimum of friction with the inclosed mandrel.

4. In a continuous tube-rolling mill, a plurality of pairs of grooved rolls arranged alternately in intersecting planes, a mandrel carrying a tube and adapted to move through the pairs of rolls, and gearing adapted to rotate the successive pairs of rolls at increasing speeds, the grooves of the initial pairs of rolls being in cross-section in the form of non-circular curves with progressively-receding extremities and spaced apart to permit the tube to expand laterally away from contact with the inclosed mandrel, and the grooves of the final rolls being in cross-section approximately a true circular curve.

5. In a continuous rolling-mill, the combination with a series of pairs of grooved rolls, having a graduated speed and openings ranging from an initial non-circular cross-section with elongated sides to a final circular cross-section, of a cylindrical mandrel adapted to receive a tube of heated metal and to pass longitudinally through the series of rolls whereby the metal tube thereon will be progressively compressed and elongated at a minimum of frictional resistance by alternately swelling the same from contact with the different sides of the mandrel and ultimately shaped and conformed to the size of the mandrel by the last pair of rolls.

6. In a continuous tube-rolling mill, a plurality of pairs of grooved rolls arranged alternately in intersecting planes, a mandrel carrying a tube and adapted to move through the

pairs of rolls, and gearing adapted to rotate the successive pairs of rolls at increasing speeds, the grooves of the initial pairs of rolls being in cross-section in the form of non-circular curves with progressively-receding extremities and spaced apart to permit the tube to expand laterally away from contact with the inclosed mandrel, the successive pairs of rolls having grooved faces progressively varying in contour from that of the initial rolls to an approximately circular curve in the final rolls, whereby in operation the tube will be compressed, elongated and shaped on the inclosed mandrel at a minimum of friction therewith.

In witness whereof I have hereunto set my hand in presence of two witnesses.

RUDOLF MENGELBIER.

Witnesses:
CHARLES LESIMPLE,
CARL SCHMITT.