(No Model.)

H. H. FORSYTH.

AXIAL ROLLING.

No. 379,386. Patented Mar. 13, 1888.

FIG. 1.

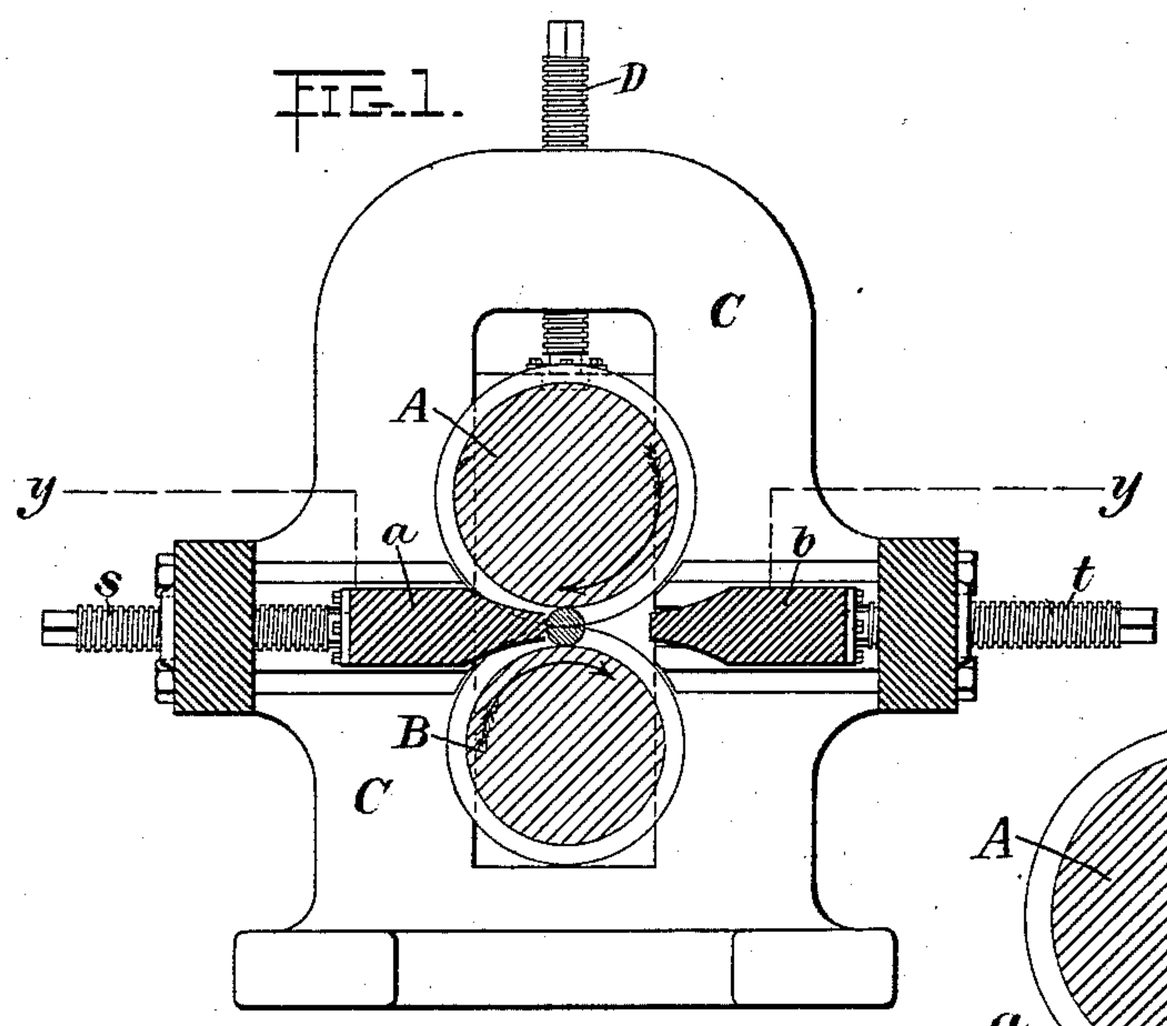


FIG. 2.

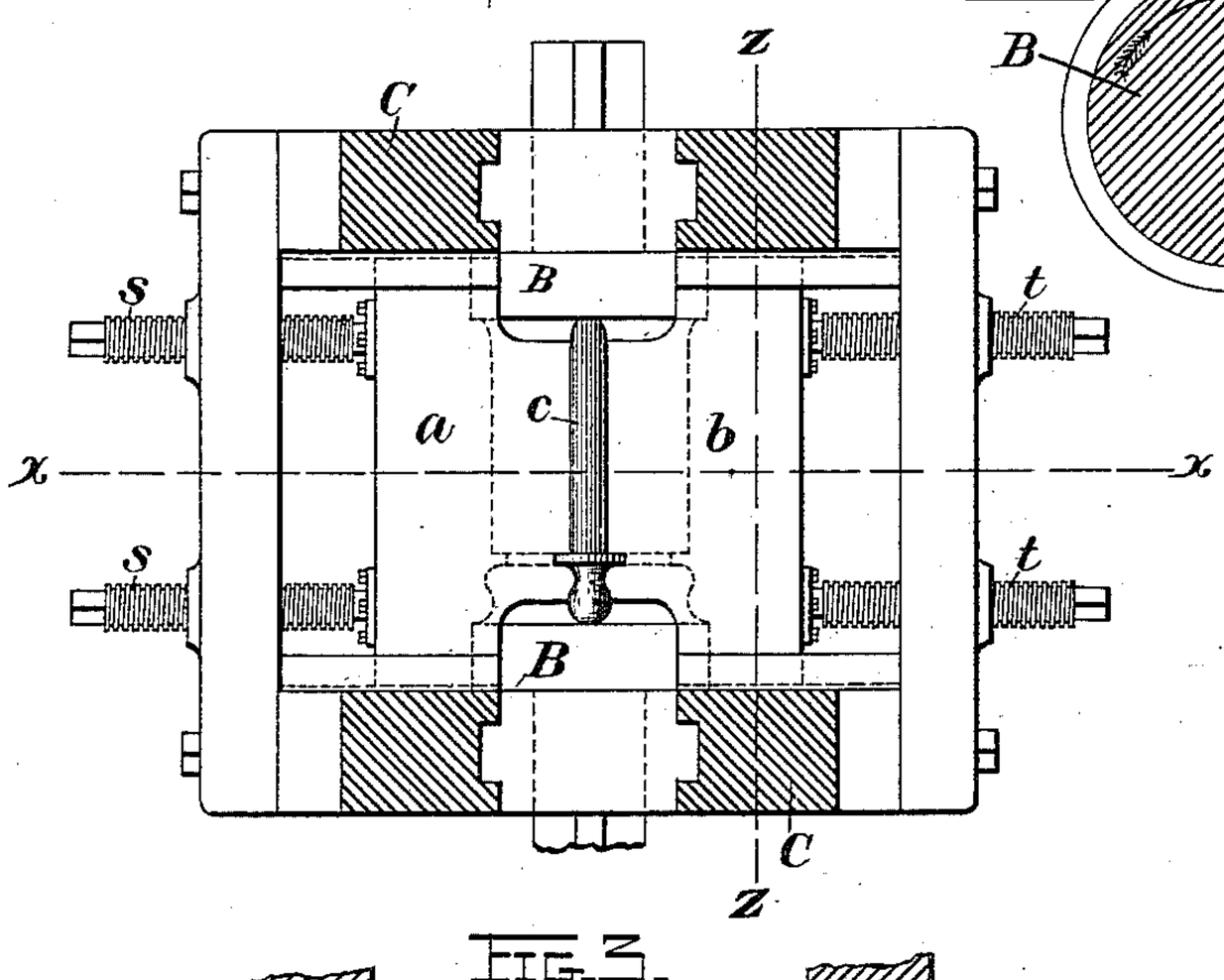


FIG. 4.

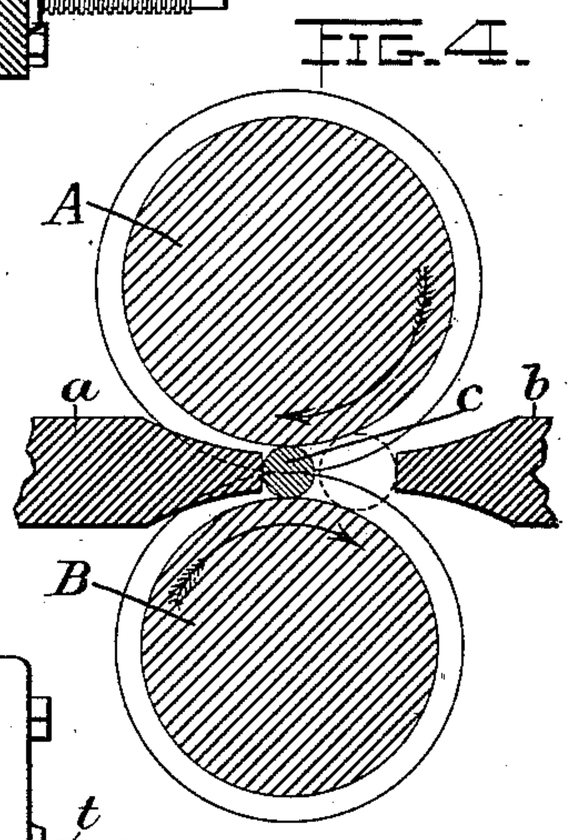
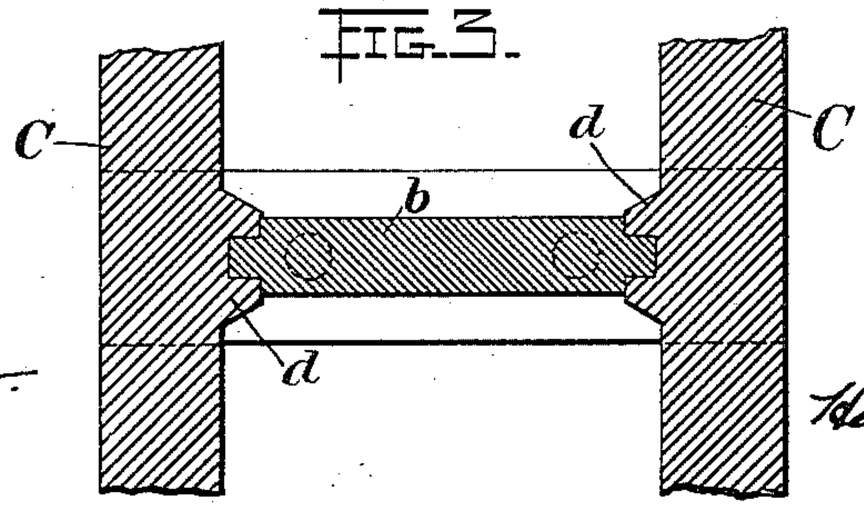


FIG. 3.



WITNESSES.

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AXIAL ROLLING.

SPECIFICATION forming part of Letters Patent No. 379,386, dated March 13, 1888.

Application filed January 30, 1888. Serial No. 262,385. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. FORSYTH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Axial Rolling; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of my machine for axial rolling on the line *x x* of Fig. 2. Fig. 2 is a horizontal section on the line *y y* of Fig. 1. Fig. 3 is a vertical cross-section on the line *z z* of Fig. 2, showing the mode of arranging the adjustable guide. Fig. 4 represents part of the roll and the back guide, illustrating the position of the blank before and after rolling.

Like symbols of reference indicate like parts in each.

The object of my invention is to roll articles of cylindrical shape in cross-section, but of irregular diameter, by placing the blank or rod in the bite of the rolls in a position parallel to the axis of the rolls. The difficulty in the successful accomplishment of this is to obtain sufficient pressure on the blank to be shaped without it slipping away from between the bite of the rolls, at which point alone the greatest pressure is exerted. Various plans have been suggested and attempted to accomplish this purpose with varying degrees of success. If one or both of the rolls are cut away at the point where the blank is fed in between them with gradually-increasing diameter, forming a snail-curve in cross section, it is obvious that the rolling must be completed at one rotation of the rolls on their axes; and if the rolls are at all points of true cylindrical shape in cross-section, although of varying diameter at various points in their length, and have the same surface speed, it is very difficult, if not impossible, to secure the requisite compressive action of the rolls on the blanks, because the blanks before rolling must necessarily be at certain points of larger diameter than the smallest surface distance between the rolls at their bite—*i. e.*, in the vertical plane of their axes—as otherwise there would no room for any alteration of shape of the blank, and it is therefore necessary either that the rolls should be brought gradually closer together as the rolling progresses, or that some means be provided for causing the blank to be forced or drawn between the bite of the rolls. Where reducing or shaping rolls revolve in opposite directions, the blank is drawn in with great force by the rolling action; but where the rolls revolve in the same direction no such tendency ordinarily exists, because while one roll tends to draw the blank in, the other tends to force it out, and it is this counteraction on opposite faces of the blank that effects its rotation on its axis.

The chief means employed by me to secure the desired end is to give one of the pair of rolls a greater surface speed than the other, and in connection therewith to use a guide placed horizontally in the plane of the bite of the rolls, which shall be adjustable, so as to suit blanks of different diameter, but shall be stationary during the operation of rolling. The effect of this construction is that the greater surface speed of one of the rolls produces a differential motion, the higher surface speed of one roll tending to draw the blank in between the bite of the rolls to a degree greater than the force exerted by the other roll to force the blank out from between the rolls, the stationary guide on the opposite side of the rolls preventing the blank from being forced past the axial line or bite of the rolls.

To enable others skilled in the art to construct and use my improvement, I will proceed to describe it with reference to the accompanying drawings.

Fig. 1 represents a pair of cylindrical rolls—A the upper one, and B the lower one—set in a suitable housing, C, and having the usual pressure-screw, D, to adjust the bite of the rolls. The shape of the rolls in cross-section is cylindrical, but the diameter will vary at different points, the longitudinal shape or contour of the surface (which will be the same in both rolls) being formed by grooves and straight or curved lines, or any of these, according to the shape of the article to be formed.

In the drawings the space between the bite of the rolls A and B, as shown in Fig. 2, is that of a coupling-pin.

The rolls A and B are rotated by power, and are so geared together (in any known way) as to move in the same direction, as indicated by arrows in Figs. 1 and 4, and so, also, that the

surface speed of one of the rolls shall be greater than that of the other, which is effected either by proper adjustment of the gearing or by making one of the rolls of greater diameter than the other, the latter being shown in Fig. 1, where the upper roll, A, is of the larger diameter. If preferred for any reason, this differential surface speed might be effected by making one roll of larger diameter than the other and also giving one a greater actual speed of rotation than the other. It is immaterial to which of the rolls (upper or lower) the greater surface speed is given. On each side of the rolls, in or near the horizontal plane of the pass between them, is placed a guide, *a*, (on one side) and *b* (on the other side.) These guides *a* and *b* are plates of metal of sufficient length to slide horizontally between ways *d d* (see Fig. 3) in the housing of the rolls, the edge of these plates toward the rolls being tapered sufficiently to enter the pass between the rolls far enough to come in contact with and support the blank *c* in its position parallel to the axes of the rolls and in the vertical plane of those axes, as shown in Fig. 1. One of these guide-plates, *a*, is capable of adjustment by set-screws *s s* or otherwise toward or from the vertical axial line of the rolls, but is intended to be stationary during the operation of rolling. The other guide-plate, *b*, is also furnished with set-screws *t t* or other suitable device, so as to be gradually moved forward during the operation of rolling, and to be moved backward, so as to admit of the feeding of the blank in front of the bite of the rolls, in a direction parallel to their axes. They are, however, entirely independent of each other.

The operation of my improved machine is as follows: The rolls A and B are adjusted by the pressure-screws D of the housing, so as to give the required bite and pressure. The rear guide-plate, *a*, is adjusted by the set-screws *s s*, so as to be firm and stationary during the operation of the machine, in the horizontal plane of the rolls and with its forward edge at a distance from the vertical plane of the axes of the rolls substantially equal to the semi-diameter of the article to be formed when finished, so that said article may, when finished, rest against the face or edge of said guide-plate parallel with the axes of the rolls, and the front guide-plate being drawn back, the blank is introduced in front of the rolls and parallel therewith. The first guide-plate is then moved forward until the blank is pressed up against the faces of the rolls in front of their bite, as represented by the dotted circle in Fig. 4. The rolls A and B, revolving in the same direction, as shown by the arrows in Fig. 1, then begin to act on the blank, causing its rotation on its axis, the direction of rotation of the smaller roll, B, tending to rotate the blank away from the bite of the rolls, while the direction of rotation of the larger roll, A, is such as to tend to draw the blank inward toward the bite of the rolls. The consequence is that, as the rolls continually act on the surface of the blank, causing its rotation on its own axis, it is made gradually to assume the contour the reverse of the rolls, while the greater surface speed of one of the rolls, (the acting-face of which moves in the direction toward the bite of the rolls,) being greater than that of the other roll, (the acting-face of which moves in the opposite direction,) causes the blank as it is gradually shaped to be drawn into the bite of the rolls until it assumes the position of the blank *c* in Fig. 2, with its axis in the vertical plane of the axis of the rolls and resting against the edge of the rear guide-plate, *a*. When in this position, the rotation of the rolls may, if desired, be continued long enough to give a smooth and finished surface to the blank, and then on the reversal of the rolls the finished article is delivered from the machine.

In the operation of the machine the front guide-plate, *b*, may be continually pressed forward by the set-screws *t t*, especially when there is considerable irregularity of diameter of the article to be made; but ordinarily it will not be found necessary to exert any pressure on the guide-plate *b* by the screws *t t* or to keep it pressed up against the blank.

It is hardly necessary to state that it is immaterial to which of the rolls the greater surface speed is communicated, nor whether this difference is produced by a difference in diameter of the rolls or by the adjustment of the gearing, or by a combination of both of these means, provided that the stationary guide *a* be placed on the side of the rolls toward which the operative face of the roll having the higher surface speed moves in its rotation.

I am aware that machines have been devised by others for the purpose of axial rolling having a pair of grooved or irregularly-shaped rolls of similar diameter and revolved at the same surface speed and in the same direction, and having an arm or arms for holding or retaining the blank or article to be operated upon in the bite of the rolls. I therefore disclaim such inventions; but

What I claim as my invention, and desire to secure by Letters Patent, is—

The apparatus for axial rolling hereinbefore described, consisting of a pair of rolls cylindrical in cross-section, power-driven at different surface speed, in combination with an adjustable stationary guide-plate placed in the horizontal plane of the bite of the rolls with its edge at a distance from the vertical plane of the axes of the rolls substantially equal to the semi-diameter of the finished article for the purpose of axial rolling of articles of cylindrical shape and irregular diameter, substantially as described.

In testimony whereof I have hereunto set my hand this 20th day of January, A. D. 1888.

HENRY H. FORSYTH.

Witnesses:
W. B. CORWIN,
JNO. K. SMITH.