

Feb. 20, 1940.

J. M. HOOPER

2,191,391

ROLLING ANGLES

Original Filed May 20, 1936

5 Sheets-Sheet 1

FIG. 1.

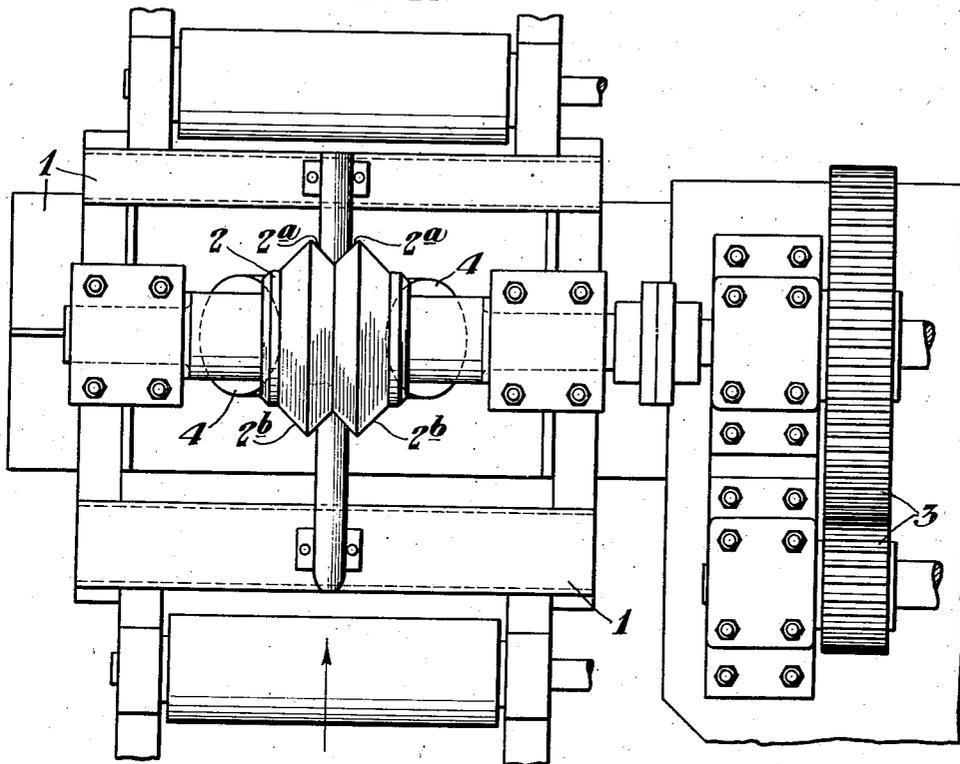
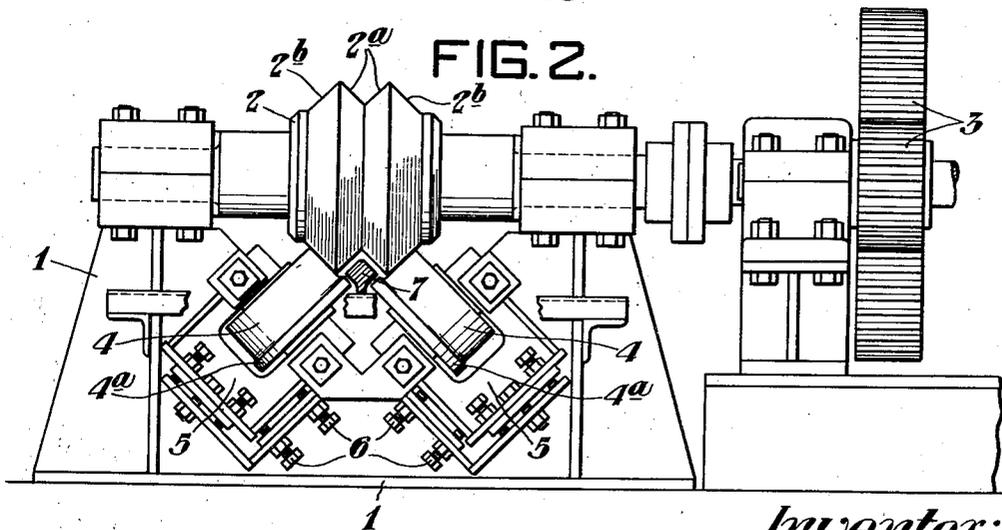


FIG. 2.



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FIG. 3.

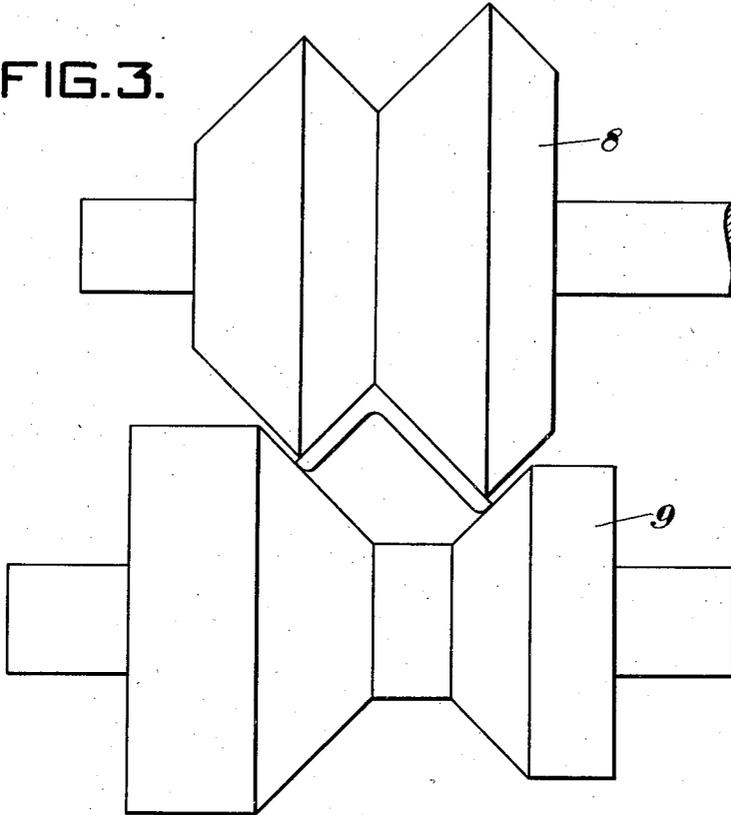
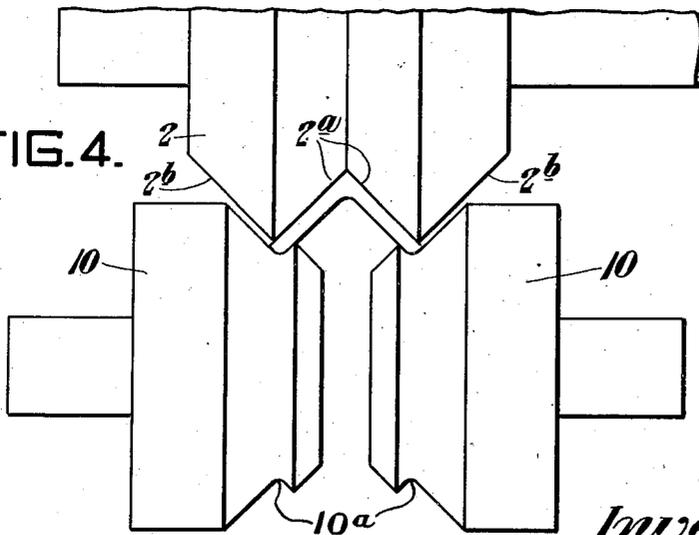


FIG. 4.



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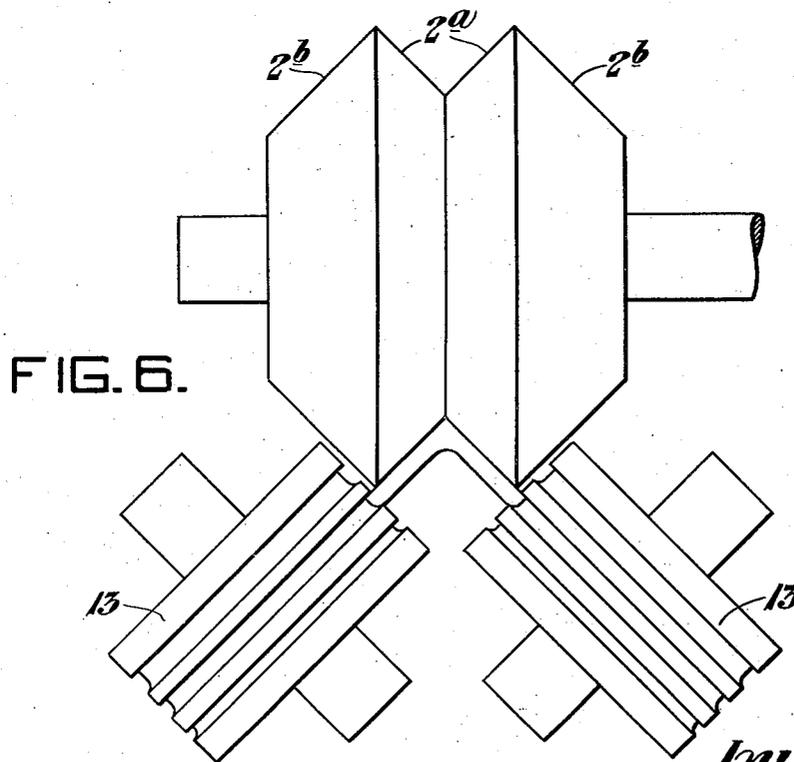
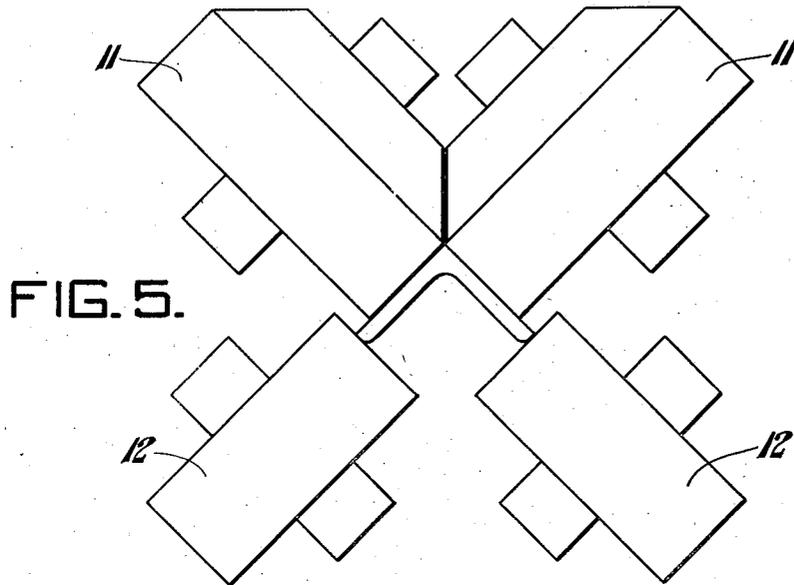
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FIG. 7.

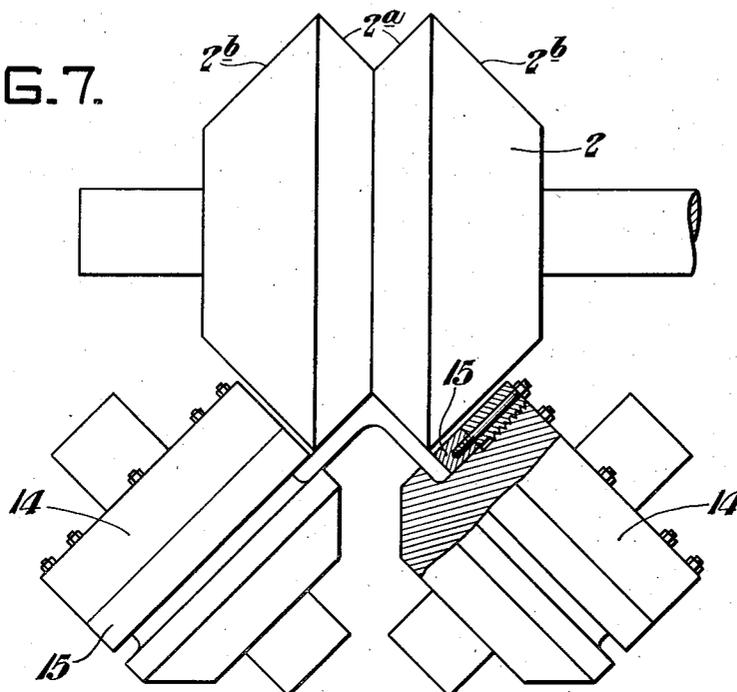
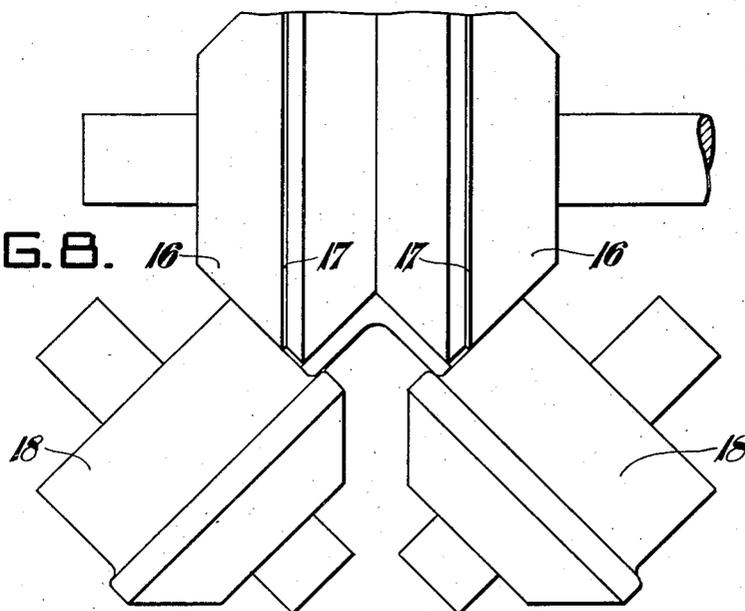


FIG. 8.



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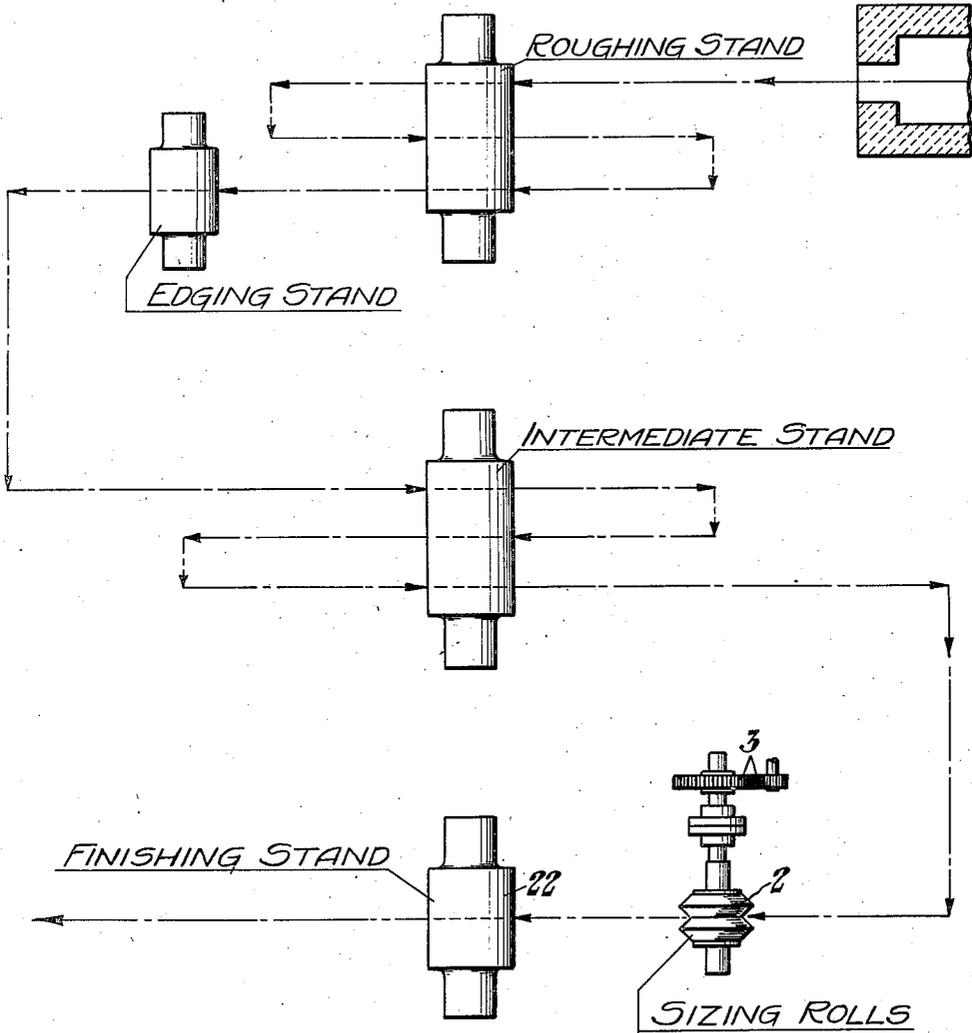
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FIG. 9.



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## UNITED STATES PATENT OFFICE

2,191,391

## ROLLING ANGLES

John M. Hooper, Torrance, Calif.

Original application May 20, 1936, Serial No. 80,856. Divided and this application September 13, 1937, Serial No. 163,685

## 1 Claim. (Cl. 80-66)

This invention is a division from my copending application entitled "Rolling angles", bearing Serial No. 80,856 and filed May 20, 1936. It relates to the rolling of angles, one of the objects being to reduce the number of roll changes heretofore necessary when angles of different leg lengths and thicknesses are required. Another object is to roll angles more accurately to the desired finished dimensions. Other objects may be inferred.

The present invention is characterized by rolling metal to an angle section, adjusting the thickness and leg lengths of this section by separate rolling operations and rolling this section to produce an angle of the desired finished dimensions. The metal may be rolled by conventional methods excepting that an open leader pass is used for the purpose of adjusting the angle's thickness no closed leader pass being used and the leg lengths being adjusted by rolling down the toes of the angle as a separate operation. The angle is then rolled through a finishing pass to bring it to its desired finished dimensions.

Since an open leader pass is used instead of the usual closed one, only the thickness of the angle is adjusted in this pass. This means that angles of various thicknesses and leg lengths may be produced without involving roll changes. Since the leg lengths are adjusted by rolling down the toes of the angle as a separate operation, accurately dimensioned legs are possible.

The accompanying drawings illustrate various means for accomplishing what has been described, the figures being as follows:

Figure 1 is a plan of a mill or machine for adjusting the leg lengths of angles.

Figure 2 is a partially sectioned end elevation of this apparatus.

Figures 3 through 8 illustrate a number of possible modifications which may be made in the roll elements of the apparatus illustrated by Figures 1 and 2.

Figure 9 schematically illustrates a mill with which the apparatus is combined.

More specifically, Figures 1 and 2 illustrate a mill or machine embodying a frame 1 which journals a horizontal roll 2 driven through gears 3 and which is grooved to fit the apex and outsides of the legs of an angle. Rolls 4 are journaled in mounts 5 which are themselves carried by the frame 1 in an adjustable manner. The axes of the rolls 4 are at right angles to the respective angle contacting surfaces of the groove in the roll 2 and are permanently guided in a vertical plane which intersects the axis of the

roll 2, adjustment of the rolls 4 being limited to movement toward and away from the roll 2 in right angular directions. These adjustments are obtained through a number of screws 6, the operation of which moves the mounts 5 in an obvious manner.

A guide 7 extends horizontally between the three rolls and presents a guiding surface that fits the insides of the angle sections whose leg lengths are to be adjusted. The rolls 4 have flanges 4<sup>a</sup> which function to provide surfaces which shape the toes of an angle passing through the rolls.

The roll 2 provides angular surfaces 2<sup>b</sup> against which the flat surfaces of the rolls 4 ride, the groove 2<sup>a</sup> of the roll 2, the guide 7 and the flanges 4<sup>a</sup> and adjacent portions of the rolls 4 providing what appears to be a closed pass. As a matter of fact, however, it has been found that angles passing through the apparatus very seldom contact the guide 7, this functioning primarily as a safety feature.

Figure 3 shows how somewhat the same result may be accomplished by two rolls, a grooved roll 8 being used in conjunction with a second grooved roll 9, the roll 8 supporting the outsides of an angle's legs and the roll 9 providing surfaces which bear against the toes of an angle. Figure 4 is the same excepting that two rolls 10 are substituted for the roll 9 and each of these rolls is grooved as at 10<sup>a</sup> to impart a predetermined shape to the toes of an angle. Figure 5 shows how two upper rolls 11 and two lower rolls 12 may be used to size the legs of an angle. It will be noted that the axes of the rolls in the embodiment shown by Figures 3 and 4 are parallel whereas the axes of the rolls in the embodiment shown by Figure 5 are each at right angles to one another.

Figure 6 shows the roll 2 which was illustrated by Figures 1 and 2, the rolls 4 being substituted by rolls 13 which each provide a series of grooves of differing thicknesses and which are shaped to encompass the complete toe portions of an angle. Figure 7 shows the rolls 4 substituted by rolls 14 which are each provided with a single groove like one of those shown by Figure 6 but which is adjustable by the insertion of rings 15 of varying thicknesses, these rings being retained in recesses formed in the rolls 14 and providing, in each instance, one side of the toe-shaping grooves.

Figure 8 shows an upper roll 16 that is grooved as is the roll 2 but which is further recessed as at 17 to provide clearance adjacent the outsides of

an angle adjacent its toes. The toes are worked by rolls 18 which are fundamentally the same as the rolls 4.

The rather large number of modifications are illustrated because of the newness of the present invention and the unfamiliarity of structural rollers with any design other than those embodying parallel or vertical rolls. The apparatus shown by Figures 1 and 2 is known to work successfully, but each of the various modifications has certain advantages which may appeal to different individuals.

A conventional structural mill for rolling angles is schematically illustrated by Figure 9. It consists of a roughing stand 19, an edging stand 20, an intermediate stand 21 and a finishing stand 22. The roughing, intermediate and finishing stands are in train while the edging stand is in tandem with the roughing stand. Broken lines and arrows show the passage of the work through the various stands.

Although the schematic illustration shows this mill as being conventional, in the mill of this invention no closed leader pass is used. As has been previously described, the leader pass is open.

In operation, a bloom or billet is roughed into a flat section in the roughing stand 19. It passes through the edging stand on edge and its width is roughly regulated. Entering the intermediate stand it is worked to an angle, the leader pass of this stand being such as to cause the work to leave with slightly larger dimensions than is ultimately desired.

The apparatus illustrated by Figures 1 and 2 is positioned so that the angle passes through it after it has left the leader pass and before it

enters the finishing stand 22. Its position is schematically illustrated as being close to the finishing pass, although its exact positioning is immaterial. At this point the toes of the angle are rolled down so as to adjust the leg length to that desired, the desired thickness then being obtained by passing through the finishing stand 22. Consideration of the lengthening effect of the finishing operation must be included in calculating the leg length adjustment.

The leader pass being an open one, it is possible to vary the thicknesses of different orders of angles through relatively large limits. The leg lengths are then obtained as an entirely separate operation, instead of simultaneously with the adjustment of the angles' thicknesses as is the case when the customary leader pass is used.

It is possible to shape the leader pass so that the angles leave it with outwardly curved legs. This may be an advantage in case the angles tend to buckle when being passed through the apparatus illustrated by Figures 1 and 2. It is not, however, necessary.

I claim:

A method of rolling angles, including rolling metal through a series of roll passes designed to permit production of angles having a range of leg thicknesses and adjusting the leg lengths of the resulting angles by rolling against their edges toward the apexes of the angles while anti-frictionally holding the apexes against the angle-edge rolling pressure, by means of angle-edge rolling means separate and independent from the angle-apex restraining means necessary to so hold the apexes of the angles.

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