No. 817,345. PATENTED APR. 10, 1906.

E. E. SLICK.

METHOD OF ROLLING ANGLES.

APPLICATION FILED JULY 22, 1903.

3 SHEETS—SHEET 1.

Fig. 1.

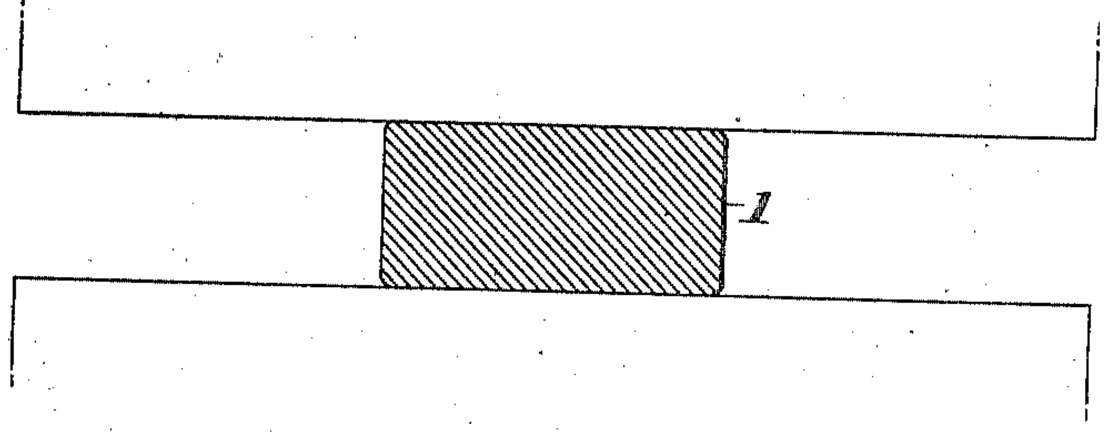


Fig. 2.

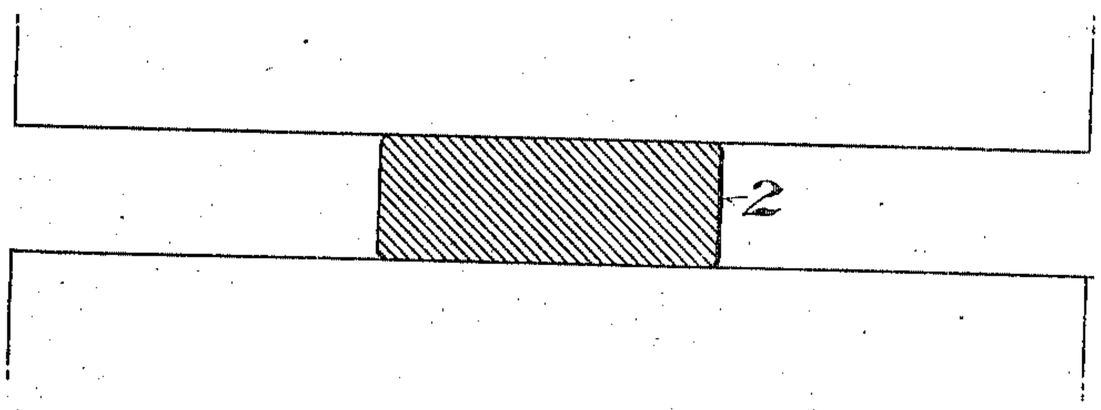
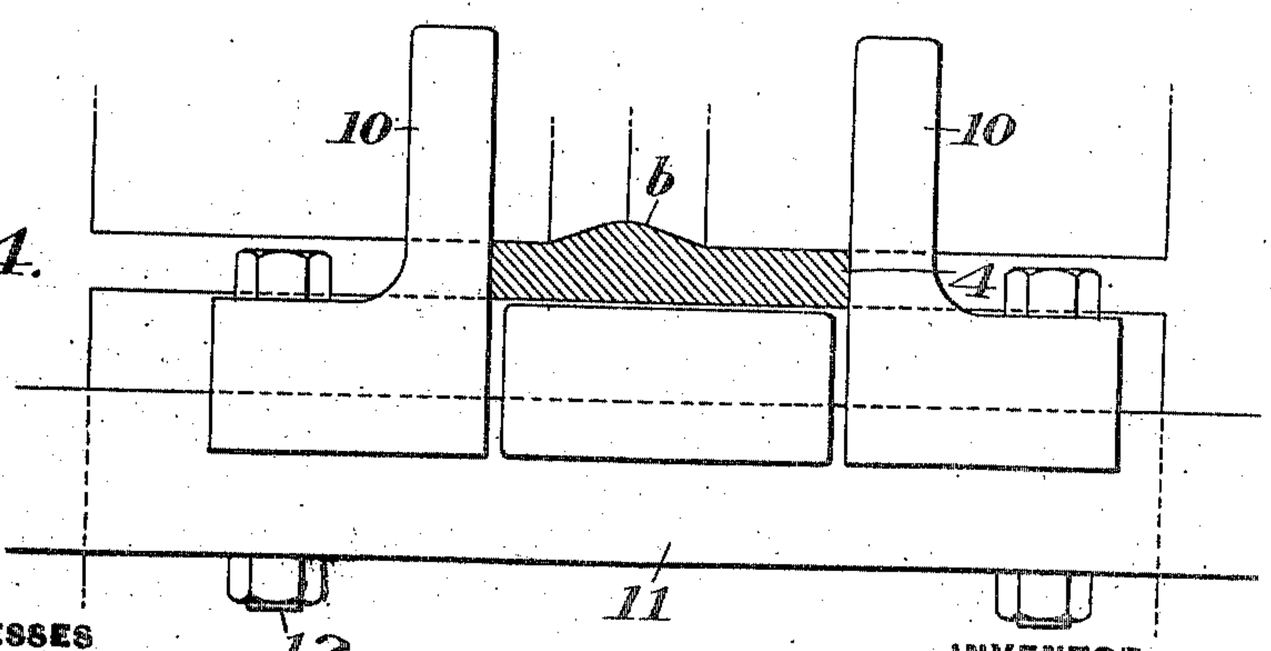


Fig. 3.

Fig. 4.



WITNESSES

Warren U. Swartz

H. M. Corwin

INVENTOR

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3 SHEETS—SHEET 2.

Fig. 5.

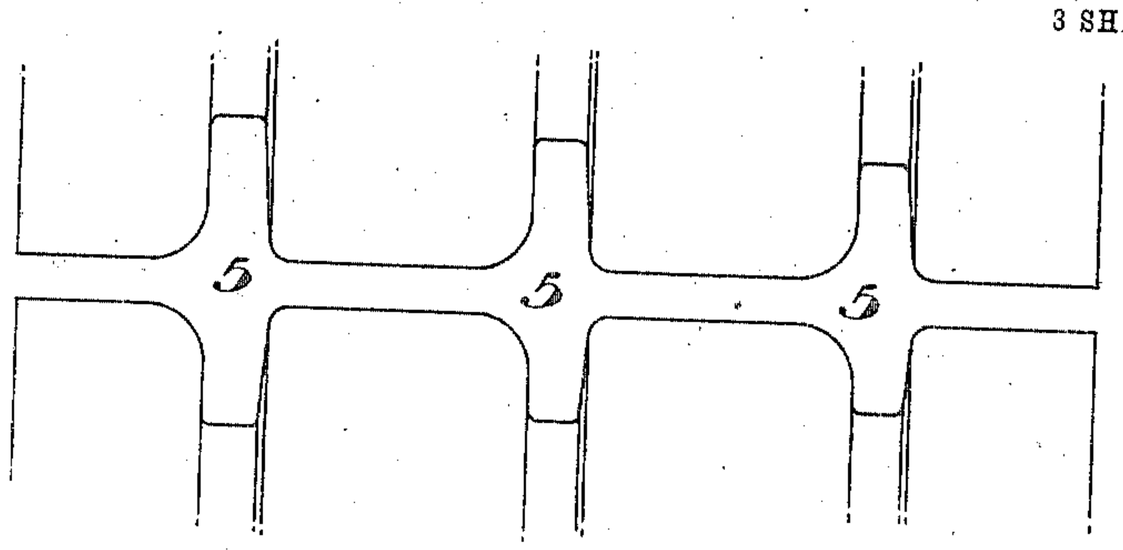


Fig. 6.

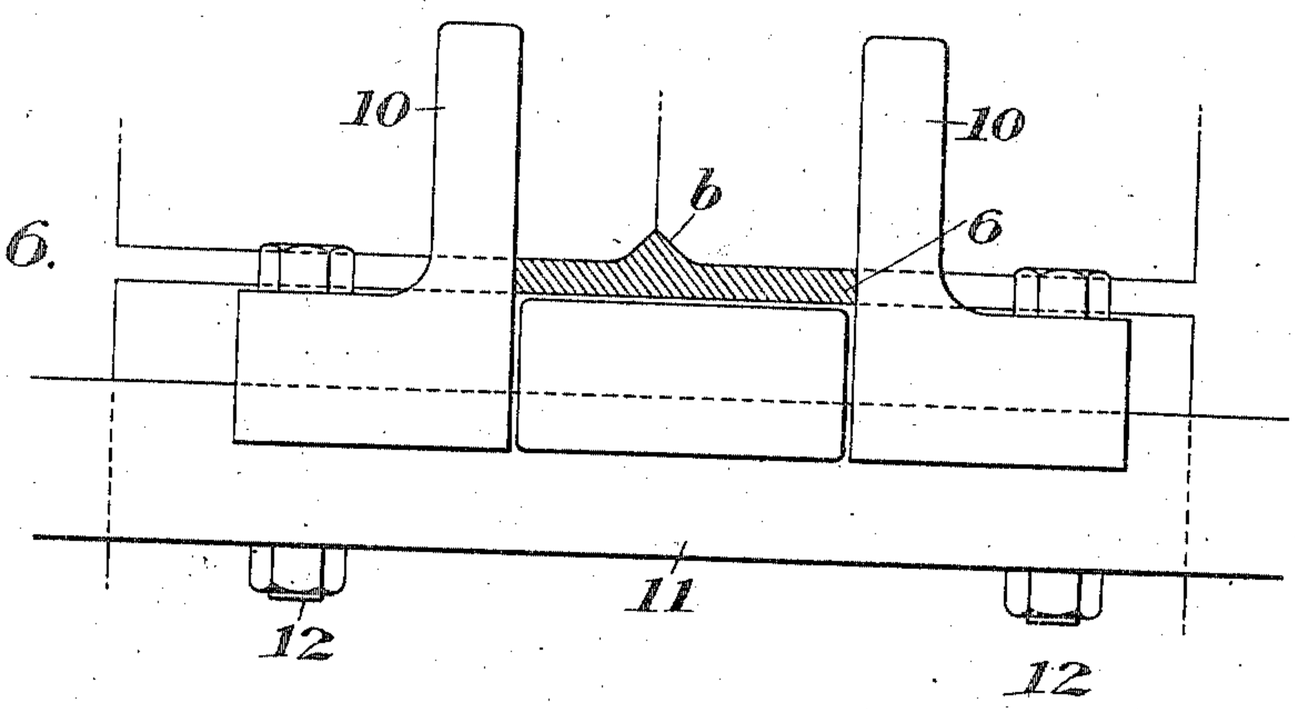


Fig. 7.

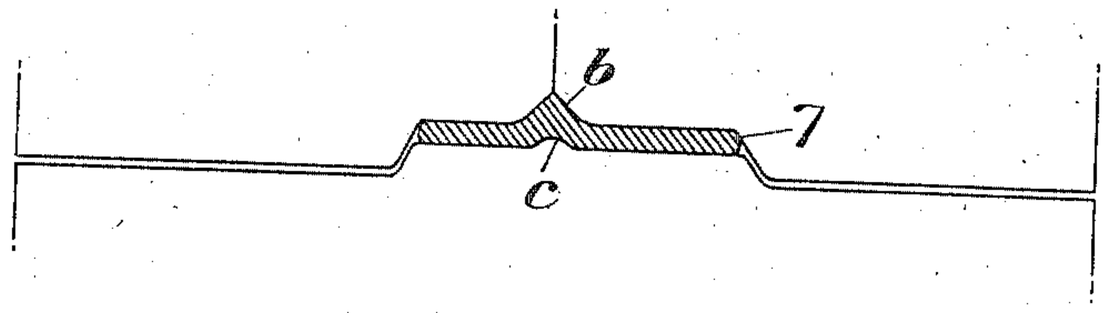


Fig. 8.

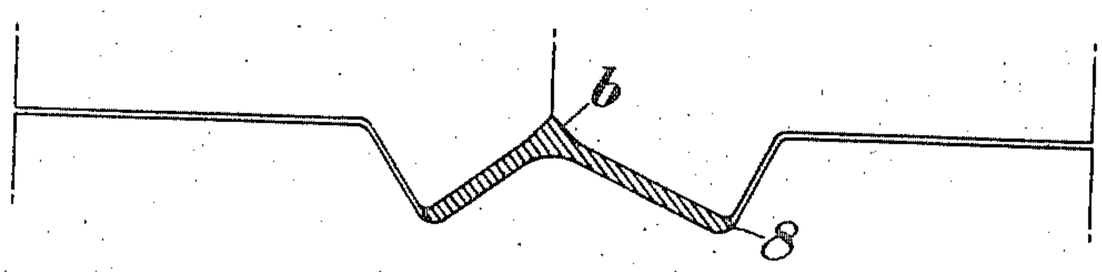
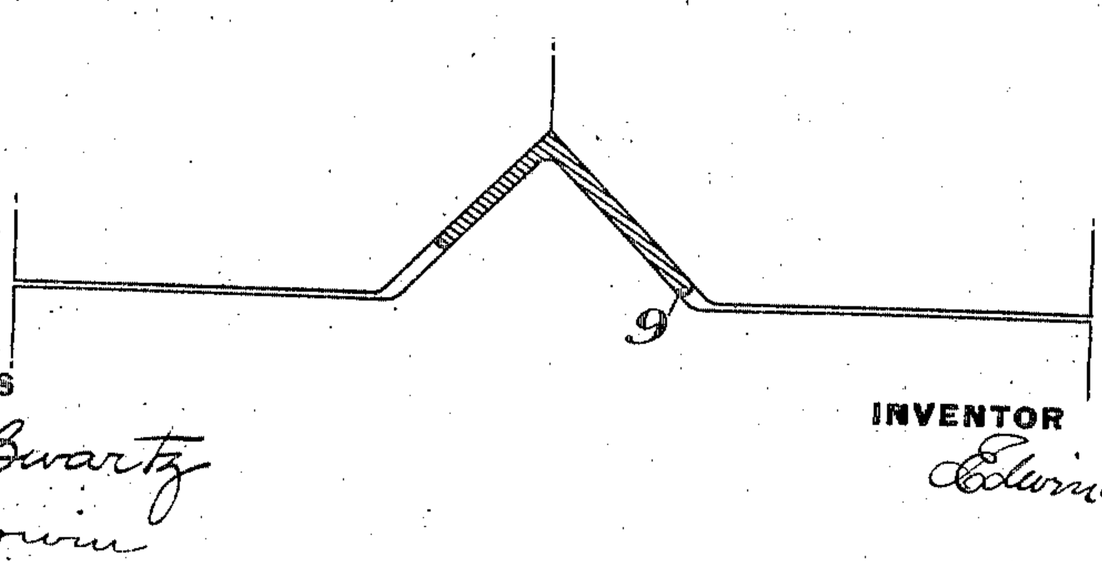


Fig. 9.



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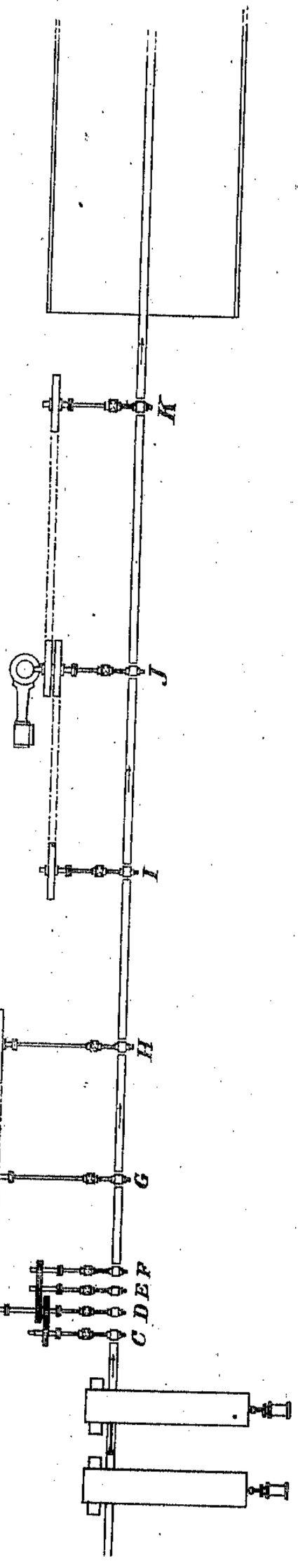
3 SHEETS—SHEET 3.

Fig. 10.



WITNESSES

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UNITED STATES PATENT OFFICE.

EDWIN E. SLICK, OF PITTSBURG, PENNSYLVANIA.

METHOD OF ROLLING ANGLES.

No. 817,345. Specification of Letters Patent. Patented April 10, 1906.

Application filed July 22, 1903. Serial No. 166,525.

To all whom it may concern:

Be it known that I, EDWIN E. SLICK, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Method of Rolling Angles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figures 1, 2, 3, 4, 5, 6, 7, 8, and 9 show the successive passes of a continuous mill arranged to carry out my process, and Fig. 10 is a diagrammatic plan view of the mill.

My invention relates to the rolling of angles and is designed to overcome the difficulties heretofore experienced in rolling angles due to the difficulty of adjusting the rolls to different thicknesses of product without making the angles uneven or straining the metal. It is also designed to fill the back or point of the angle and to provide for changing the respective widths of the legs.

Heretofore in the rolling of angles in a series of separate passes the legs have been formed in curved or dished shape or with angular bends before the final passes, which shaped the angle to the desired form. In adjusting the rolls of the different passes in such cases for different thicknesses of the angles the shifting of the roll will move some parts of the pass a greater distance than others, measured at right angles to the different parts of the blank, and cause a strain upon the angle-legs, which will injure and pull away the metal. This also prevents proper filling of the pass and gives irregular sections. It has also been proposed to roll such a section in a universal mill; but in this case the contour of the opposite sides of the pass in the opposing faces of the rolls is the same throughout the reduction, and the point or back of the angle will not fill out properly, as the metal cannot be proportioned correctly in the part which forms this back, owing to the fact that the movement of one roll toward the other reduces the cross-sectional area of the space occupied by the flange portions proportionately more than that of the space occupied by the ribbed portions, since the thickness of the flange portions is less than that of the rib portion. I overcome these difficulties by using rolls adjustable toward and from each other and having a succession of separate reducing-passes which are shaped to form the legs with all portions of each leg lying in the same flat plane and with a projection which is outside this plane to constitute the back of the angle, each successive pass having substantially the same width, but a lesser cross-sectional area, than the preceding, and the contour designed to preserve approximately the same proportional areas in the flange-forming and rib-forming sections of the passes throughout. By utilizing adjustable rolls having passes of this character before bending the legs to angle form the rolls may be adjusted to roll angle-blanks of different thicknesses because the changes in the amount of separation of the rolls changes the thickness of the metal the same amount for all parts of the legs, since these parts are in the same flat plane, and hence avoids the pulling and injuring of the metal and irregularity of shape.

The invention also consists in using a peculiar system of edging-passes and box-passes during the rolling, as hereinafter described.

In the drawings, Figs. 1 and 2 show the passes 1 and 2 for the billet from which the angle is formed. In Figs. 3 and 4, 3 and 4 are the next passes. In pass 3 a projection *b* is formed on one face of the billet to constitute the corner or back of the angle, the legs of the angle lying in the same plane. In pass 4 the cross-sectional area of both flanges or legs and the ridge or projection *b* are reduced, while the contour of the projection is developed, the width of the blank remaining substantially the same. The next pass 5 of Fig. 5 is an edging-pass, and I show several of these passes for forming angles of different widths. The edging-pass fixes the width of the blank and enables me to roll different-sized angles from the same-sized bloom. It further corrects variations in the bloom and gives an angle of uniform width. It is only necessary to give one edging-pass to the blank, and thus fix the width, although I may use more than one edging-pass, if desired. In the next pass 6 there is a further development of the corner *b* and reduction in area thereof, and a thinning of the flanges or legs, and in the next pass 7 a groove *c* is preferably rolled opposite to the projection in order to provide for easier bending of the legs. In the pass 8 the legs of the angle which were hitherto in the same flat plane are bent into angular form, and in the final pass 9 the legs are bent into final form and the angle finished. It will be noted that the passes 7, 8, and 9 are closed box-passes, whereas the

passes 1, 2, 3, and 4 are open passes. For a large variation in the thickness of the angle to be rolled I preferably replace the rolls forming passes 7 and 8 by other sets of rolls, but do not need to change the rolls of pass 9, as these can be adjusted for the different thicknesses. For small variations the rolls for the three passes 7, 8, and 9 may remain the same and be adjusted. For rolling different widths of angles the rolls forming passes 7, 8, and 9 will be changed.

As the legs of the angle lie in the same flat plane until the bending-passes are reached, the rolls may be adjusted to vary the thickness without causing distortion and pulling of the metal. The passes being separate and distinct from each other are each proportioned so that the metal will be properly distributed to fill the back or corner of the angle.

I have shown the angle as being formed of legs of different widths; but by using guides 10 10, which are adjustably secured to a transverse bar 11 by means of bolts 12, the position of the corner or back may be varied, so as to produce an angle having legs of the same width or any relative width desired. This adjusting of the guides will shift the point at which the corner or projection is made.

The passes may be formed in any desirable type of mill; but I prefer to use a continuous mill for this purpose. I show such a mill in Fig. 10 of the drawings, wherein C, D, E, F, G, H, I, J, and K are successive stands of rolls arranged in tandem and made adjustable to vary the thickness of the metal. The passes are all in line with each other, so that the billet travels forward continuously without shifting sidewise or handling.

In carrying out my process the metal travels through the successive passes, such as shown in the drawings, whereby I initially form the metal with a projection outside the plane of the legs and form these legs with the parts of each leg and preferably of both legs in the same flat plane. I then edge the metal and then pass it through the closed box-passes with the legs still in the same plane and then bend the legs in a plurality of passes to the final desired form. I change the relative widths of the legs by adjusting the guides and by shifting the point where the projection is made for the back of the angle.

The advantages of my invention result from the regular filling out of the shape, the absence of straining and pulling of the metal, and the rapidity of operation. A large output is obtained at low cost and different thicknesses and widths of angle-legs may be easily made.

By the words "substantially flat" or "in the same flat plane" I do not intend to restrict myself to form a face which is absolutely in the same horizontal plane, but to differentiate from the dishing or bending of the angle-leg heretofore used during the reducing rolling of the angle.

The apparatus may be widely varied, and the line of the lower face may vary somewhat so long as all parts of the same leg lie in the same general plane. The forming of the groove opposite the projection may or may not be done; but I prefer it, as it is an advantage in holding securely in place the angle during bending.

The apparatus corresponding to the method set forth in this case is claimed in my application filed August 21, 1902, Serial No. 120,588.

I claim—

1. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having separate passes shaped to substantially preserve the proportionate areas of the ridge and flange portions and maintain the flanges in substantially the same plane, then edging this flat blank to fix its width, and then bending the blank into angle form along the line opposite to the ridge, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

2. The method of rolling angles of different thicknesses, consisting in first forming a flat blank having a ridge on one side and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having passes shaped to preserve the proportionate areas of the ridge and flange portions and to maintain the flanges in substantially th same plane, adjusting the rolls and repeating the operation upon other blanks, and finally bending the blanks into angle form along the line opposite the ridge, whereby angles of different thickness may be produced by the same roughing-rolls; substantially as described.

3. The method of rolling angles of different thicknesses, consisting in first forming a flat blank having a ridge on one side, and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having passes shaped to preserve the proportionate areas of the ridge and flange portions and to maintain the flanges in substantially the same plane, adjusting the rolls and repeating the operation upon other blanks, edging the blank to fix its width, and finally bending the blanks into angle form along the line opposite the ridge, whereby angles of different thickness may be produced by the same roughing-rolls; substantially as described.

4. The method of rolling angles, consisting

in forming a flat blank having a ridge on one side, and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having separate passes shaped to substantially preserve the proportionate areas of the ridge and flange portions and maintain the flanges in substantially the same plane, then edging this blank to fix its width, forming a groove in the flat side of the blank opposite the ridge, and then bending the blank into angle form along the line opposite to the ridge, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

5. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having separate passes shaped to substantially preserve the proportionate areas of the ridges and flange portions and maintain the flanges in substantially the same plane, then edging this flat blank in an adjustable pass to fix its width, and then bending the blank in a separate set of rolls into angle form along the line opposite to the ridge, wherein angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

6. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having separate passes shaped to substantially preserve the proportionate areas of the ridge and flange portions and maintain the flanges in substantially the same plane, then edging this flat blank to fix its width, then reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions in at least one separate pass, and then bending the blank into angle form along the line opposite to the ridge, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

7. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and lateral legs or flanges, one of which is wider than the other, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having separate passes shaped to substantially preserve the proportionate areas of the ridge and flange portions and maintain the flanges in substantially the same plane, then edging the flat blank to fix its width, and then bending the blank into angle form along the line opposite to the ridge, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

8. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and flat legs or flanges, reducing the blank by passing it through separated successive passes in adjustable rolls, while substantially preserving the proportionate areas of the ridge and flange portions, then edging the flat blank to fix its width, and then bending the blank into angle form by passing it through a roll pass or passes, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

9. The method of rolling angles, consisting in forming a flat blank having a ridge with flat legs or flanges, edging the flat blank to fix its width, then reducing the blank, and then bending it into angle form; substantially as described.

10. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and lateral legs or flanges, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having open passes shaped to substantially preserve the proportionate areas of the ridge and flange portions and maintain the flanges in substantially the same plane, then edging this flat blank to fix its width, and then bending the blank into angle form along the line opposite to the ridge, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

11. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and lateral legs or flanges, one of which is wider than the other, reducing the thickness of the blank and the cross-sectional area of the ridge and flange portions by passing the blank between adjustable rolls having open passes shaped to substantially preserve the proportionate areas of the ridge and flange portions and maintain the flanges in substantially the same plane, then edging the flat blank to fix its width, and then bending the blank into angle form along the line opposite to the ridge, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

12. The method of rolling angles, consisting in forming a flat blank having a ridge on one side, and flat legs or flanges, reducing the blank by passing it through successive open passes in adjustable rolls, while substantially preserving the proportionate areas of the ridge and flange portions, then edging the flat blank to fix its width, and then bending the blank into angle form by passing it

through a roll pass or passes, whereby angles of different thicknesses and widths may be produced without changing the roughing-rolls; substantially as described.

13. The method of rolling angles, consisting in forming a flat blank having a ridge with flat legs or flanges in open passes, edging the flat blank to fix its width, then reducing the blank, and then bending it into angle form; substantially as described.

In testimony whereof I have hereunto set my hand.

E. E. SLICK.

Witnesses:
JOHN MILLER,
H. M. CORWIN.