D. MAXWELL.

METHOD OF ROLL FORGING METAL.

APPLICATION FILED JAN. 21, 1909.

984,283.

Patented Feb. 14, 1911.

Fig. 1.

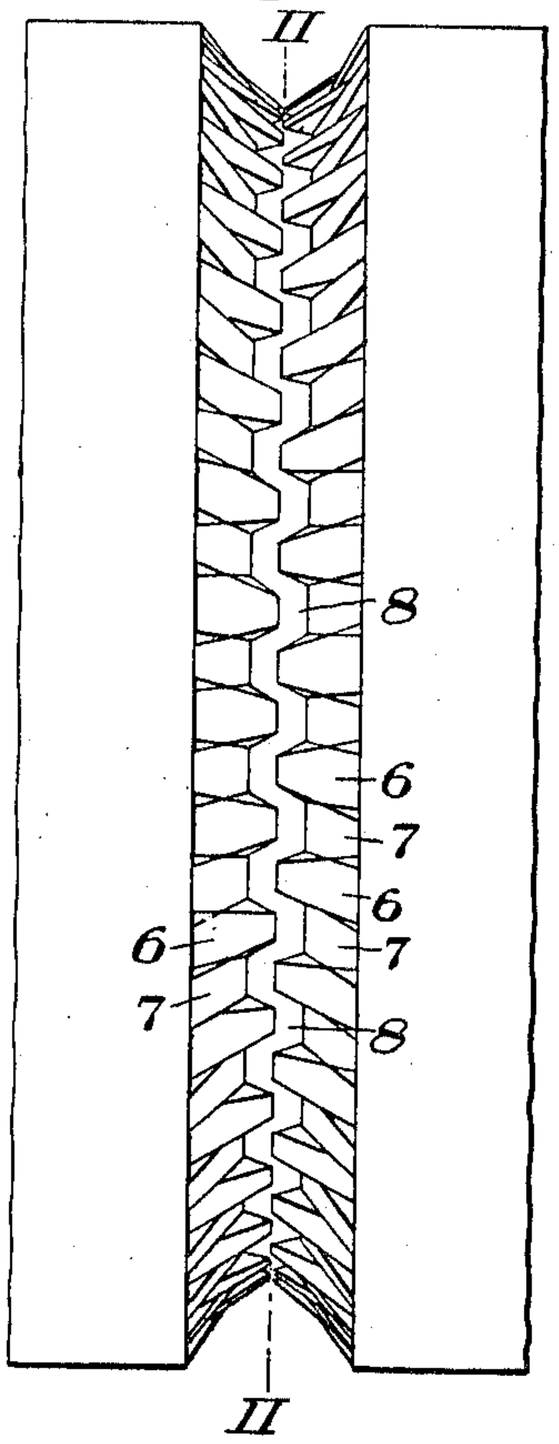


Fig. 2.

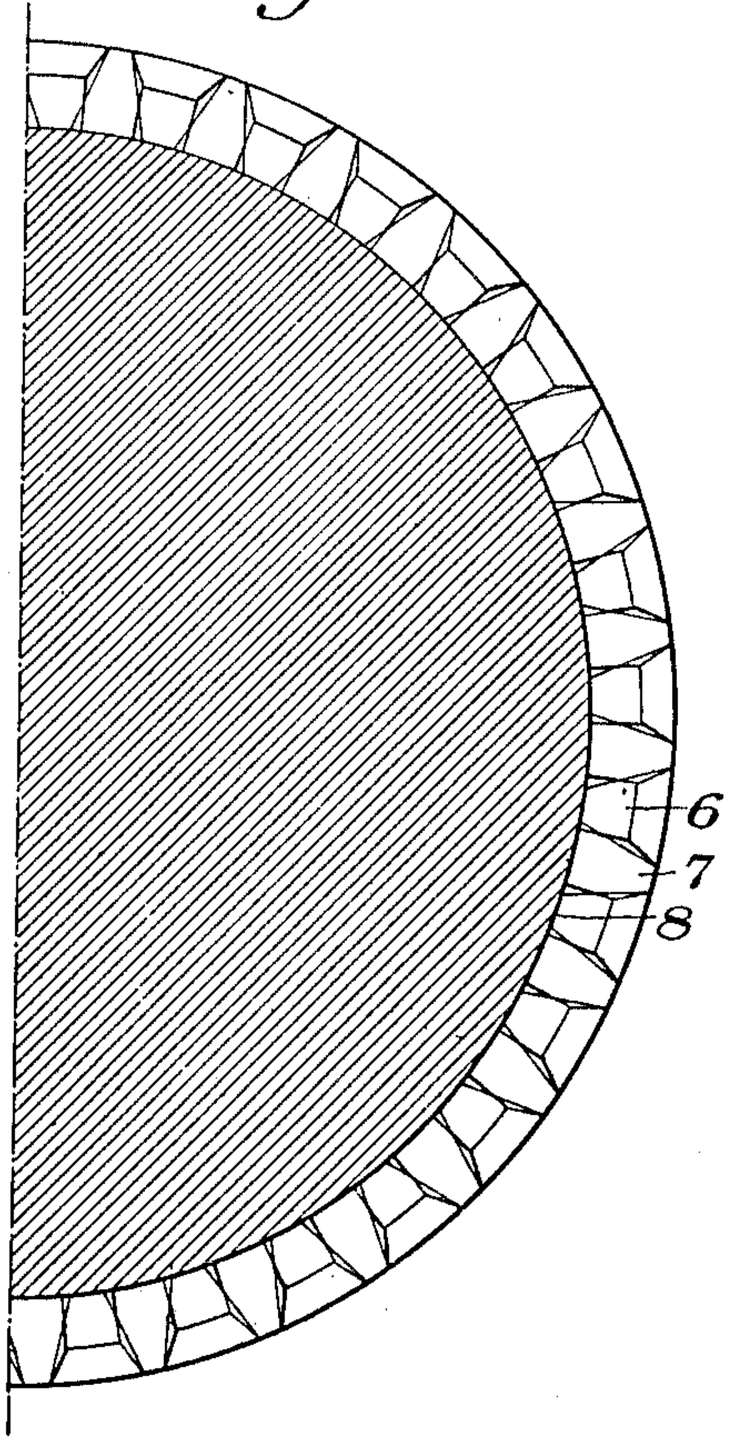


Fig. 3.

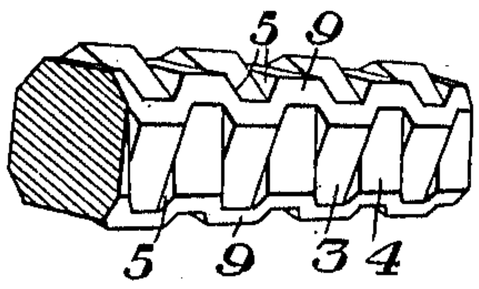


Fig. 4.

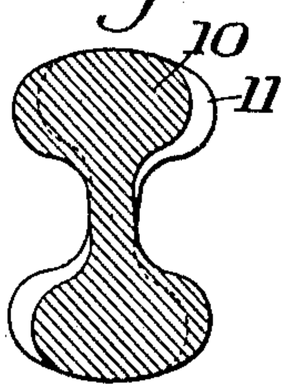


Fig. 6.

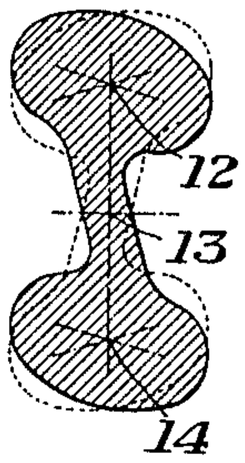
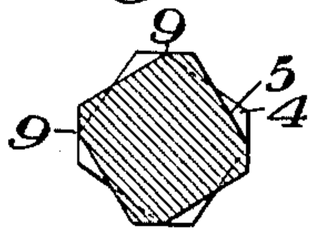


Fig. 5



WITNESSES

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METHOD OF ROLL-FORGING METAL.

984,283. Specification of Letters Patent. **Patented Feb. 14, 1911.**

Application filed January 21, 1909. Serial No. 473,511.

To all whom it may concern:

Be it known that I, DAVID MAXWELL, of Detroit, Wayne county, Michigan, have invented a new and useful Method of Roll-Forging Metal, 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—

Figure 1 is a plan view of a portion of one form of roll for carrying out my invention; Fig. 2 is a section on the line II—II of Fig. 1; Fig. 3 is a perspective view of one form of bar rolled in accordance with my invention; Fig. 4 is an end view illustrating the invention as applied to the rolling of T-rails; Fig. 5 is an end view of the bar shown in Fig. 3, and Fig. 6 is a sectional view showing a modified method of rolling a T-rail.

My invention has relation to rolling or roll-forging metal, and is designed to provide a novel method of rolling or roll-forging whereby the elastic limit of the metal is greatly increased.

In accordance with my invention, the blank being rolled is subjected to a rapid succession of displacing actions alternately exerted in opposite directions, and each tending to rotate a relatively short section of the blank about a longitudinal axis thereof, the effect of this being to so change the position and relation of the fibers of the metal as to greatly increase its toughness and elastic limit. The action is, in effect, a kneading one, which effects a more thorough amalgamation of the metal.

My invention is applicable to rolling various objects, such as reinforcing bars for concrete construction, rails and bars of various characters where high tensile strength is desirable with a minimum amount of metal, since it enables the area of the bar or rail to be materially reduced for a given tensile strength.

My improved method may be applied in the rolling operation, either in the finishing pass or passes, or in one or more of the intermediate passes, according to the nature of the bar being rolled.

My invention will be best understood by reference to the accompanying drawings, which will now be described, and in which I have shown a suitable roll for carrying out the method in connection with the rolling of reinforcing bars for concrete construction. Fig. 3 shows in perspective a section of such a bar. This bar is of angular cross-section, and has each of its faces formed with two series of transversely extending wedge-shaped deformations 3 and 4. The deformations 3 and 4 alternate with each other upon each face of the bar, their outer faces being inclined planes, approximately one-half of each deformation being above the normal plane of the face of the bar, while the other half of each deformation is below the normal plane of the face of the bar, each deformation bounded by the inclined surfaces or fillets 5.

By reference to the end view of the bar shown in Fig. 5, it will be seen that the deformations described are, in fact formed by a rotary displacement in opposite directions of adjacent relatively short sections of the bar, the metal constituting each of such displacements having been actually rotated about the longitudinal axis of the bar through an angle less than ninety degrees, this rotary displacement constituting the novel feature of my improved method of rolling. This bar is rolled by a pair of rolls, a portion of one of which is shown in Fig. 1, two similar rolls being provided to form the complete pass. By reference to this figure it will be seen that the pass is in general of V-form, having each of its inclined side walls formed with a series of alternating wedge-shaped projections 6 and depressions 7, each projection 6 on one face being opposite a corresponding depression 7 of the other face of the pass, and the two faces being separated from each other at the bottom by an irregular space 8, which corresponds to the irregular longitudinal rib 9 at each corner of the completed bar. As the bar is forced through this pass, it will be seen that each of the projections 6 exerts a rotary displacing action upon a corresponding section of metal, forcing this laterally into one of the recesses 7 on the opposite wall of the pass, the combined effect of the projections and recesses on all four of the walls of the pass being to effect the rotation in opposite directions of adjacent short sections of metal in the manner most clearly seen in Fig. 5. Where the invention is applied to the bar being rolled in the finishing pass, the high speed employed causes the method to have practically the same effect upon the metal as a hammer forging, the bar being struck into form by the rapid successive applications of the pressure of the corrugating projections

of the rolls. In rolling the bar shown in Fig. 3, this deforming pass preferably constitutes the finishing pass, and in connection with the displacing action described there also preferably takes place a reduction in the area of the bar or blank.

Fig. 4 illustrates the application of my invention to the rolling of T-rails. In this case, the displacing operation preferably takes place in one of the intermediate passes, which is so shaped as to effect alternate displacement of relatively short sections of the blank, as indicated at 10 and 11 in this figure, these opposite displacements alternating with each other throughout the length of the blank. In the subsequent passes, the blank is brought back to true section, but this does not destroy the effect upon the fibers of the metal produced by the displacements at the intermediate pass.

Fig. 6 shows a modified method of producing the same effect in rolling a T-rail or I-beam section in which the different portions of the section of the blank are rotated or displaced by the action of the projections on the rolls about the three different centers 12, 13 and 14.

It will be obvious that the exact form of the roll passes will necessarily vary with the particular section of the bar being rolled in any particular case; but that in order to obtain the benefits of my invention the passes are in all cases provided with supplementary projections and recesses, the effect of which upon the blank is to cause displacements thereof of the general character above described.

By means of my invention the elastic limit, as well as the ultimate tensile strength of the metal is very greatly increased, thereby enabling the use of a materially smaller section of bar for a given tensile strength.

What I claim is:—

1. The method of roll-forging metal shapes, which consists in passing a blank through a pair of rolls having their passes provided with deforming projections and cavities which effect successive rotary opposite displacements of the metal; substantially as described.

2. The method of roll-forging metal shapes, which consists in subjecting the blank to a rapid succession of displacing actions alternately exerted in opposite directions, and each tending to rotate the metal about a longitudinal axis thereof; substantially as described.

3. The method of roll-forging metal shapes, which consists in subjecting adjacent relatively short sections of the blank to opposite rotary displacements of a character to rotate the metal of such adjacent sections in opposite directions about a longitudinal axis of the blank; substantially as described.

4. The method of roll-forging metal shapes, which consists in passing the blank through a roll pass which effects successive opposite rotary displacements of relatively short adjacent sections of the blank; substantially as described.

5. The method of roll-forging metal shapes, which consists in passing the blank through a roll pass which effects successive opposite rotary displacements of relatively short adjacent sections of the blank, and simultaneously reducing the cross sectional area of the blank; substantially as described.

6. The method of roll-forging metal shapes, which consists in passing a blank through a pair of rolls having their passes provided with deforming projections and cavities which effect successive rotary opposite displacements of the metal about at least one longitudinal axis of the blank; substantially as described.

7. The method of roll-forging metal shapes, which consists in passing a blank through a pair of rolls having their passes provided with deforming projections and cavities which effect successive rotary opposite displacements of the metal about a plurality of different longitudinal axes of the blank; substantially as described.

8. The method of roll-forging metal shapes, which consists in passing the blank through a roll pass which effects successive opposite rotary displacements of relatively short sections of the blank; substantially as described.

9. The herein described method of roll-forging metal shapes to increase the elastic limit of the metal, which consists in subjecting a blank to a rapid succession of roll actions which rotate successive units or sections of the metal bodily in opposite directions about a longitudinal axis of the blank, whereby an elongated shape is produced composed of relatively short sections each of which is bodily twisted about its axis in an opposite direction to the adjacent sections; substantially as described.

In testimony whereof, I have hereunto set my hand.

DAVID MAXWELL.

Witnesses:
E. K. WOODWARD,
WALTER S. WHEELER.