No. 765,986. PATENTED JULY 26, 1904.

J. H. NICHOLSON.

CONICAL ROLLS FOR PIERCING, EXPANDING, OR CROSS ROLLING METAL BILLETS OR TUBULAR BLANKS.

APPLICATION FILED JUNE 7, 1902.

NO MODEL.

Fig. 1.

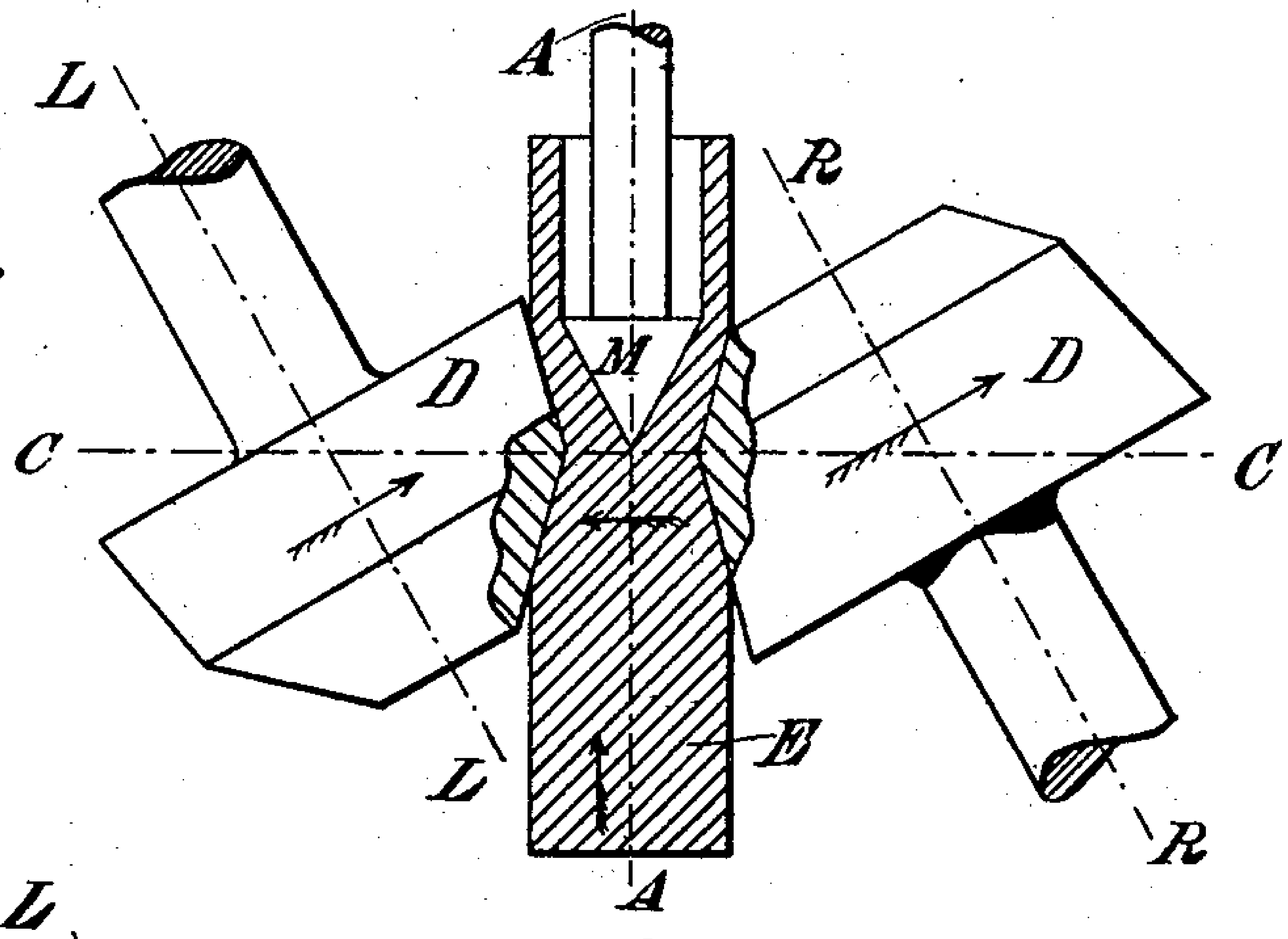


Fig. 2.

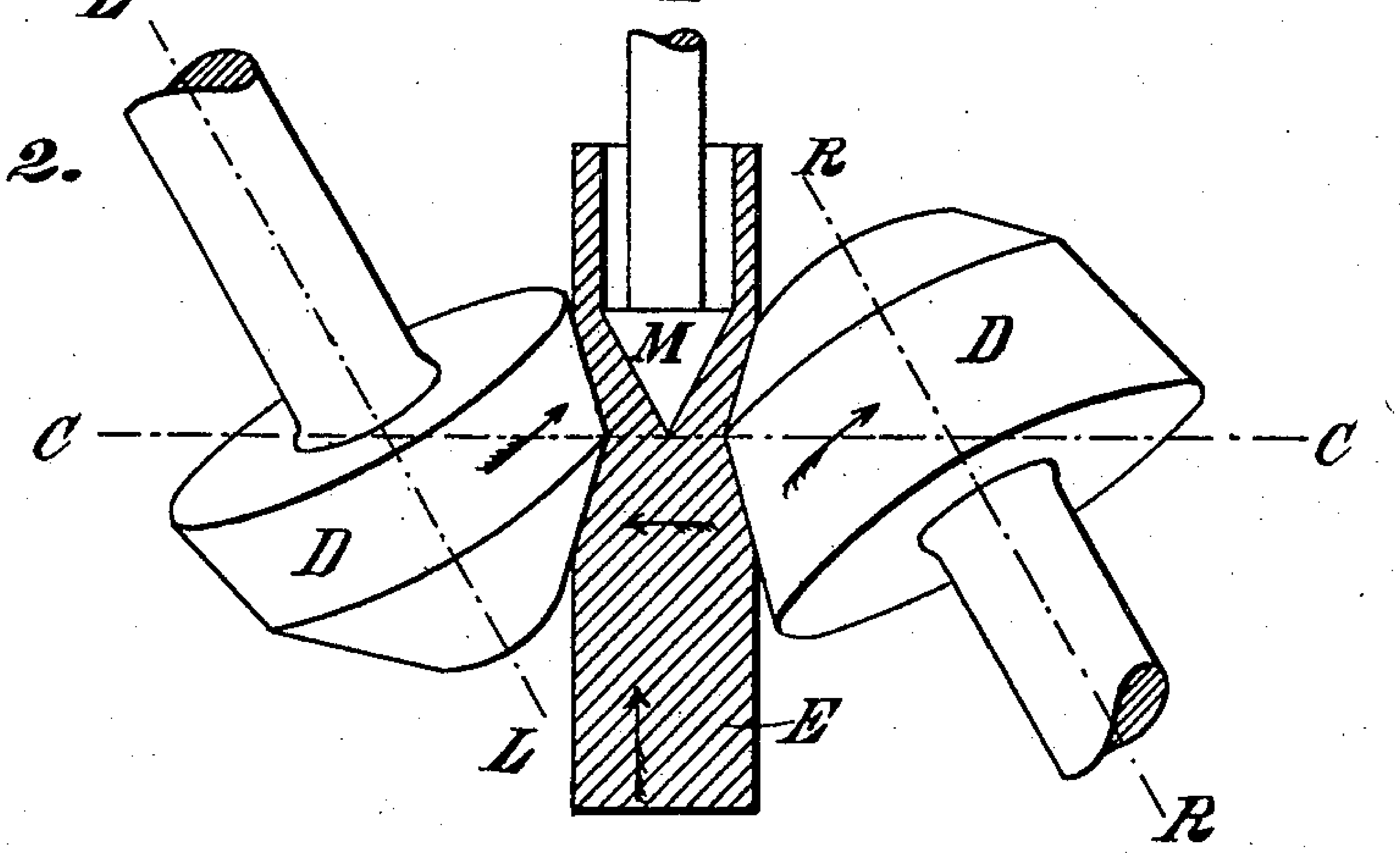


Fig. 3.

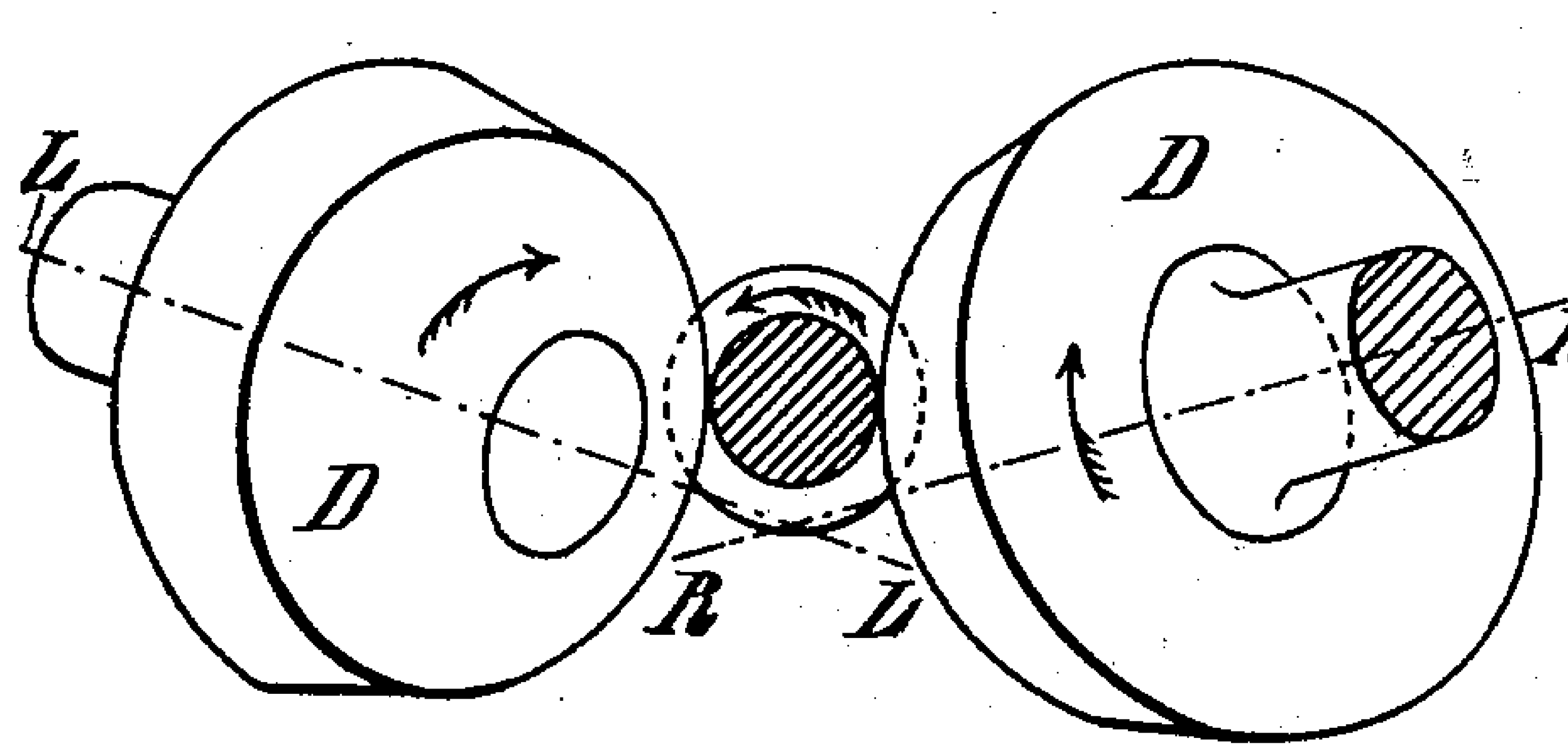
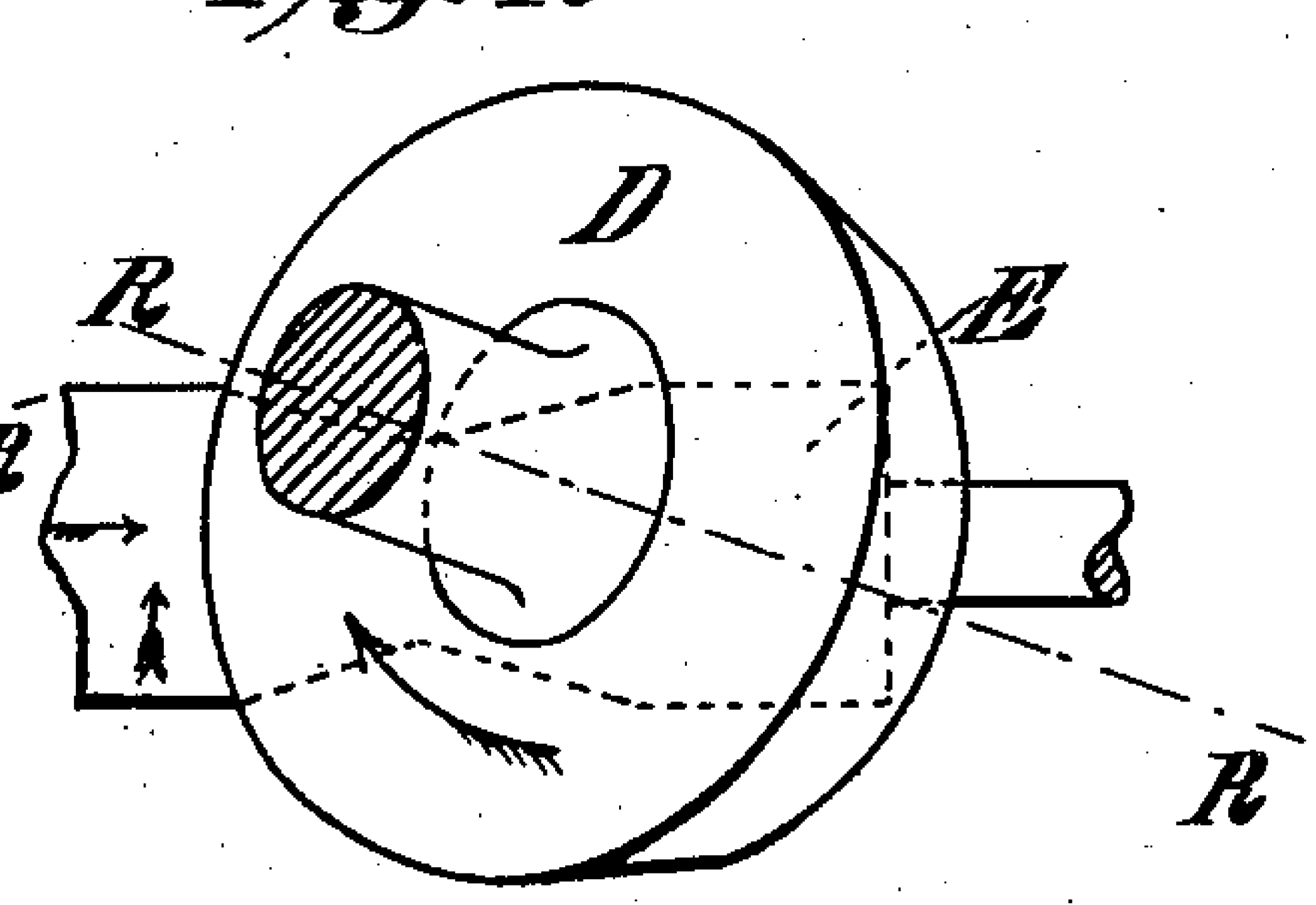


Fig. 4.



Witnesses
E. A. Mitchell.
Wm. Tillman Jr.

Inventor
John H. Nicholson
By his Attorneys
Foster Freeman

No. 765,986. Patented July 26, 1904.

UNITED STATES PATENT OFFICE.

JOHN H. NICHOLSON, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO NATIONAL TUBE COMPANY, A CORPORATION OF NEW JERSEY.

CONICAL ROLLS FOR PIERCING, EXPANDING, OR CROSS-ROLLING METAL BILLETS OR TUBULAR BLANKS.

SPECIFICATION forming part of Letters Patent No. 765,986, dated July 26, 1904.

Application filed June 7, 1902. Serial No. 110,673. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. NICHOLSON, a citizen of the United States, residing in Pittsburg, Pennsylvania, have invented certain new and useful Improvements in Conical Rolls for Piercing, Expanding, or Cross-Rolling Metal Billets or Tubular Blanks, of which the following is a specification illustrated by drawings.

This invention relates to rolling-mills suited to the cross-rolling of billets, tubular blanks, &c., for the purpose of either piercing them over a mandrel or expanding them upon a mandrel or treating them for reduction or other purposes while in the hot state. In the usual construction of such mills the billet first enters a converging portion of the pass between the rolls, where it is gripped and strongly compressed by the rolls until it reaches a diverging or expanding portion of the pass.

In United States Patent to Stiefel, No. 551,340, of December 10, 1895, there is shown and described a disk mill for making tubes from metallic ingots, in which the axes of the disks are substantially parallel with each other and in which the largest diameter of one disk is opposed to the smallest diameter of the opposing disk, and vice versa, in such a way that the sum of the two speeds which the respective disks tends to give to the billet at each point is approximately equal throughout the length of the pass, although the difference between the surface speeds of the two rolls at each point in the pass varies very greatly throughout the length of the pass, producing consequent slip and lost work between the disks and the billet. In order to obviate such slipping between the disks and the billets, as well as to entirely eliminate twist in either the converging or the diverging portions of the pass, as preferred, conical rolls, both converging toward the same end of the pass, have been devised and used. Such mills are illustrated, for example, in the following patents: R. C. Stiefel, No. 605,027, patented May 31, 1898; Nicholson, No. 628,024, dated July 4, 1899, and Nicholson, No. 718,723, dated January 20, 1903. Such constructions, while greatly reducing the slip and twist upon the portion of the pass that converges in the same direction as the conical rolls, necessarily produces a twisting or slipping between both the rolls and that portion of the billet in the other part of the pass that converges in the reverse direction to that of the rolls.

The object of the present invention is to produce an improved mill of this class in which conical or conoidal rolls which taper in opposite directions may be so employed that the smaller diameters of one roll are opposed to the larger diameters of the opposite roll, so as not to produce excessive twisting effect upon any one point of the billet in its passage through the pass, such as would occur with the opposed surfaces of the two rolls tapering both in the same direction, but oppositely to the taper of the billet at any one point in the pass.

The preferred form of the invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a diagrammatic illustration of one form of rolls in position to produce rolling of the billet without forward feeding effect. Figs 2, 3, and 4 are plan view, end view, and side view, respectively, of such rolls as utilized to produce both rolling effect and equal forward feeding effect upon the billet.

In the drawings the mountings for the rolls and the guides for the billet in the pass and the means for actuating the rolls are all omitted, as these are not of the essence of the invention and would confuse the illustration of the relationships existing between the rolls and the billet.

In Figs. 1 and 2 the billet is shown in central longitudinal section, and in Fig. 3 it is shown in transverse section at the narrowest point of the pass.

For clearness of illustration and comparison the converging and the diverging portions of the pass have been made substantially equal. Each of the rolls has two conical surfaces, though manifestly one, at least, of these four surfaces might be made cylindrical—for in-

stance, the one of largest area—as is well understood in the art, without sacrificing some of the features of this invention.

In Fig. 1 the rolls D D are shown with their respective axes L L and R R lying in the same plane with and intersecting the axis A A of the pass. As a consequence, the rolls produce rotation without feeding, and the application of a feeding force is necessary to effect the forward moving of the billet. Each roll is shown with two conical rolling-surfaces, the larger of each being less beveled or tapered than the smaller. The smaller diameters of one roll are placed opposite the larger diameters of the opposing one. If, therefore, the surface speeds of both rolls at the point where they meet the narrowest portion of the billet are equal, it follows that as we go in either direction from this portion of the pass the surface speed of the roll on one side of the pass increases, while that on the other side of the pass decreases. The mean speed, or, in other words, the sum of the two speeds at any point in the length of the pass, is approximately constant, neglecting the variation due to the varying diameter of the billet at different points in the length of the pass. It must be understood that, if desired, either roll may be displaced, preferably in an upward direction, slightly, so that the two rolls do not act upon exactly opposite sides of the billet, and therefore tend to force the billet laterally from between them against the guides, thereby permitting the omission of a guide on one side, preferably the upper side of the billet, as well understood in the art. This feature is omitted from all the drawings because it tends to confuse the otherwise simple relationship between the rolls and the billet.

In Figs. 2, 3, and 4 the rolls are skewed to produce substantially equal feeding effect. Preferably they are skewed about a transverse axis C C. Such an axis is shown in Fig. 1, where it lies in the same plane with the axis of the pass and the axes of the rolls. In Figs. 2, 3, and 4 the rolls may be regarded as skewed about such an axis, both rolls having their smaller ends inclined downward, so that the axes as seen in end view appear to cross on the same side of the pass, while as seen in side view, Fig. 4, their opposite inclination in respect to the axis of the pass is apparent.

While for clearness of illustration I have shown truly conical surfaces throughout, it will be understood by those well skilled in the art that conoidal surfaces may be employed and that there need be no sharp line of demarcation in such case between the more tapered and the less tapered portions of each roll. In any event the billet in the first or converging portion of the pass is acted upon by conical rolls, only one of which tapers in the opposite direction to the taper of the billet. In the expanding or diverging portion of the pass the same relationship holds—that is to say, on only one side does the conical surface of the roll taper in the opposite or reverse direction to the taper of the billet.

Obviously some features of the invention may be used without other features and the invention may be embodied in widely-varying forms without departing from the principles of the invention. For this reason I claim the following:

1. The combination of two conoidal rolls forming a converging and then diverging pass between them, the convergence or taper of the two rolls throughout their entire rolling-surfaces being in opposite directions in respect to the length of the pass, and the rolls being skewed, the smaller ends of both rolls being inclined in the same direction and the smaller diameters of one roll being opposed to the larger diameters of the other, for substantially the purposes set forth.

2. The combination of two conoidal rolls each having two rolling-surfaces of differing degree of convergence or taper, forming a converging and then diverging pass between them, the convergence or taper of the two rolls being in opposite directions in respect to the length of the pass, and the larger diameters of one roll being opposed to the smaller diameters of the other, substantially for the purposes set forth.

Signed this 31st day of May, 1902.

JOHN H. NICHOLSON.

Witnesses:

W. T. BENTZ,

JOHN FRITZ.