

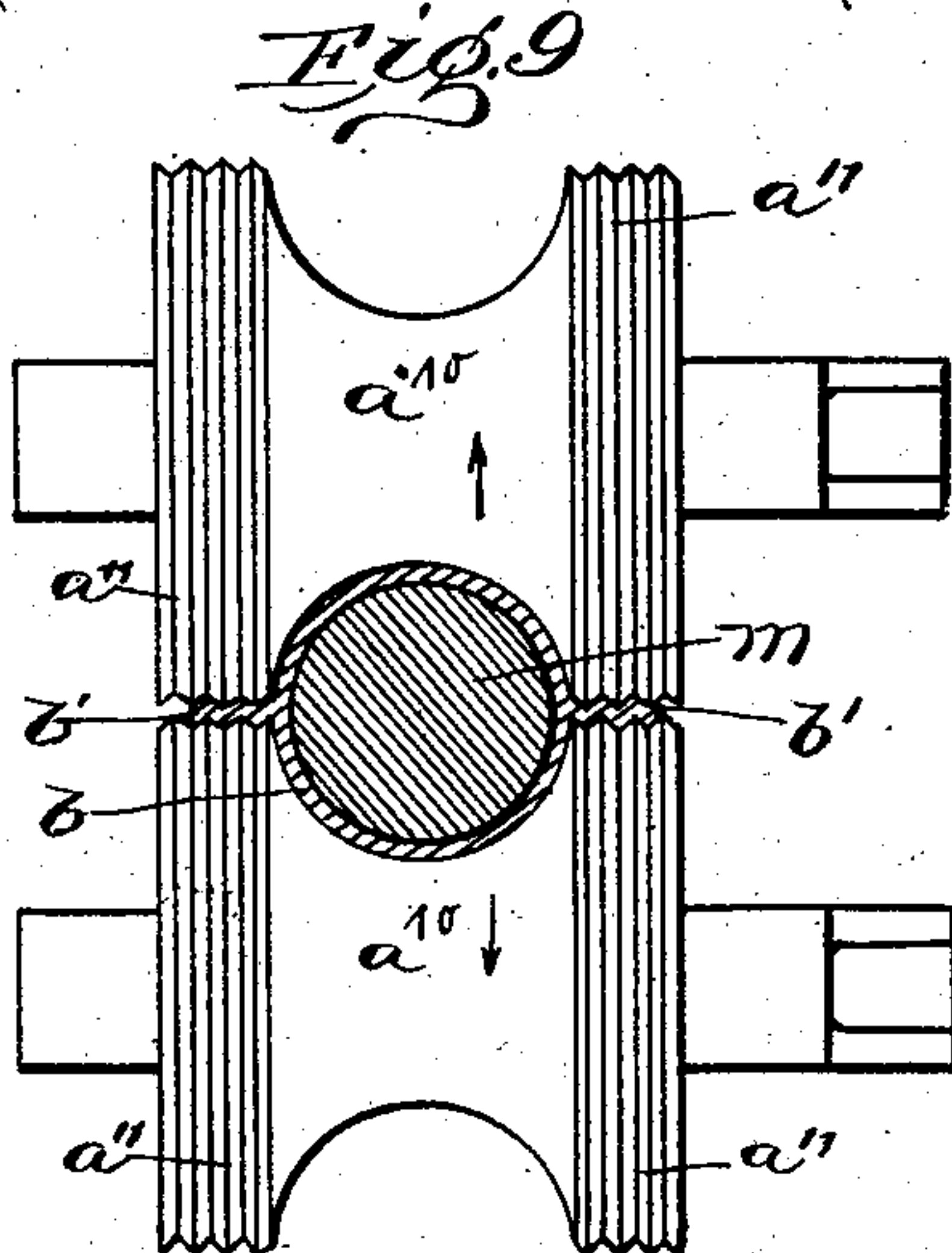
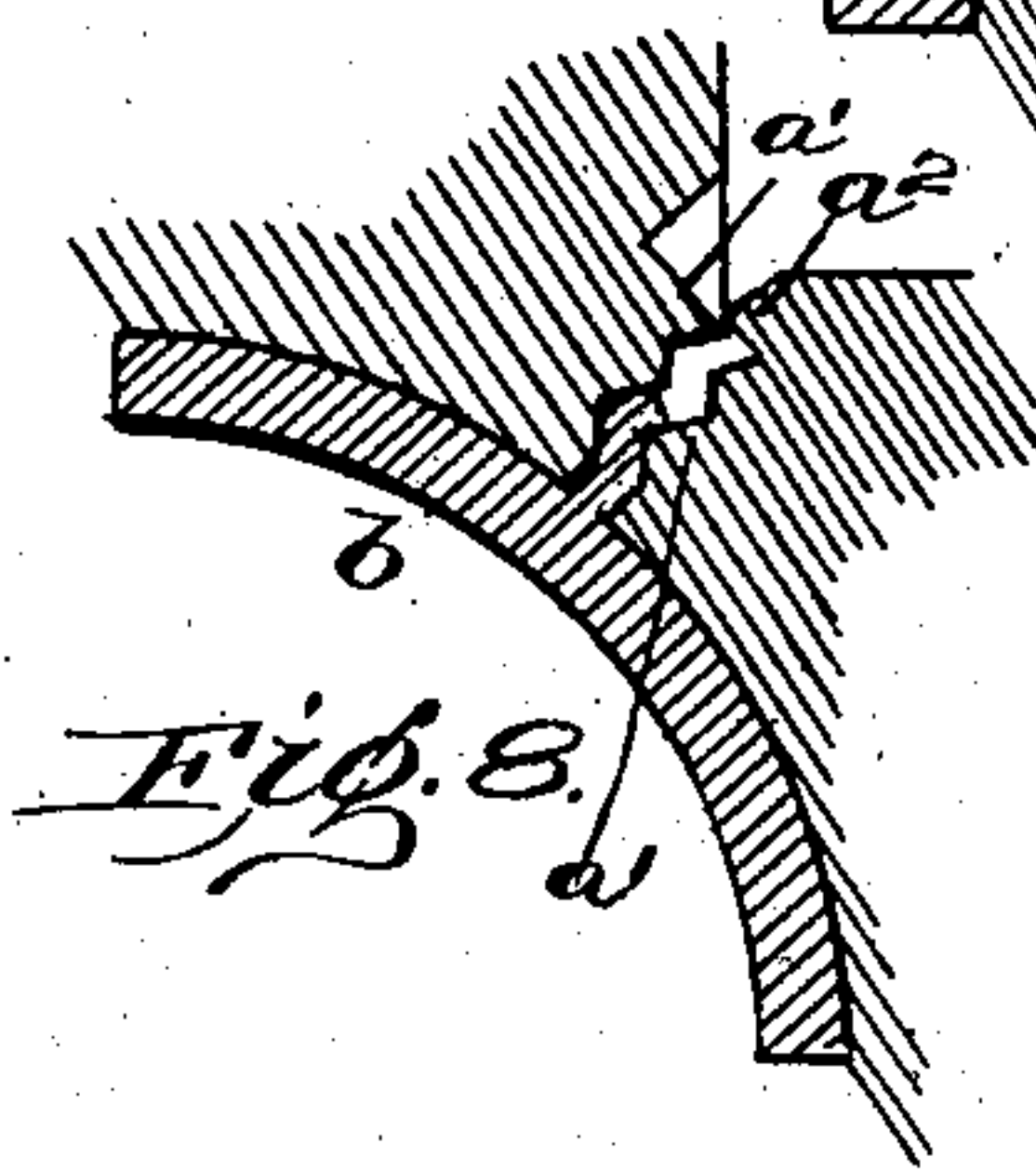
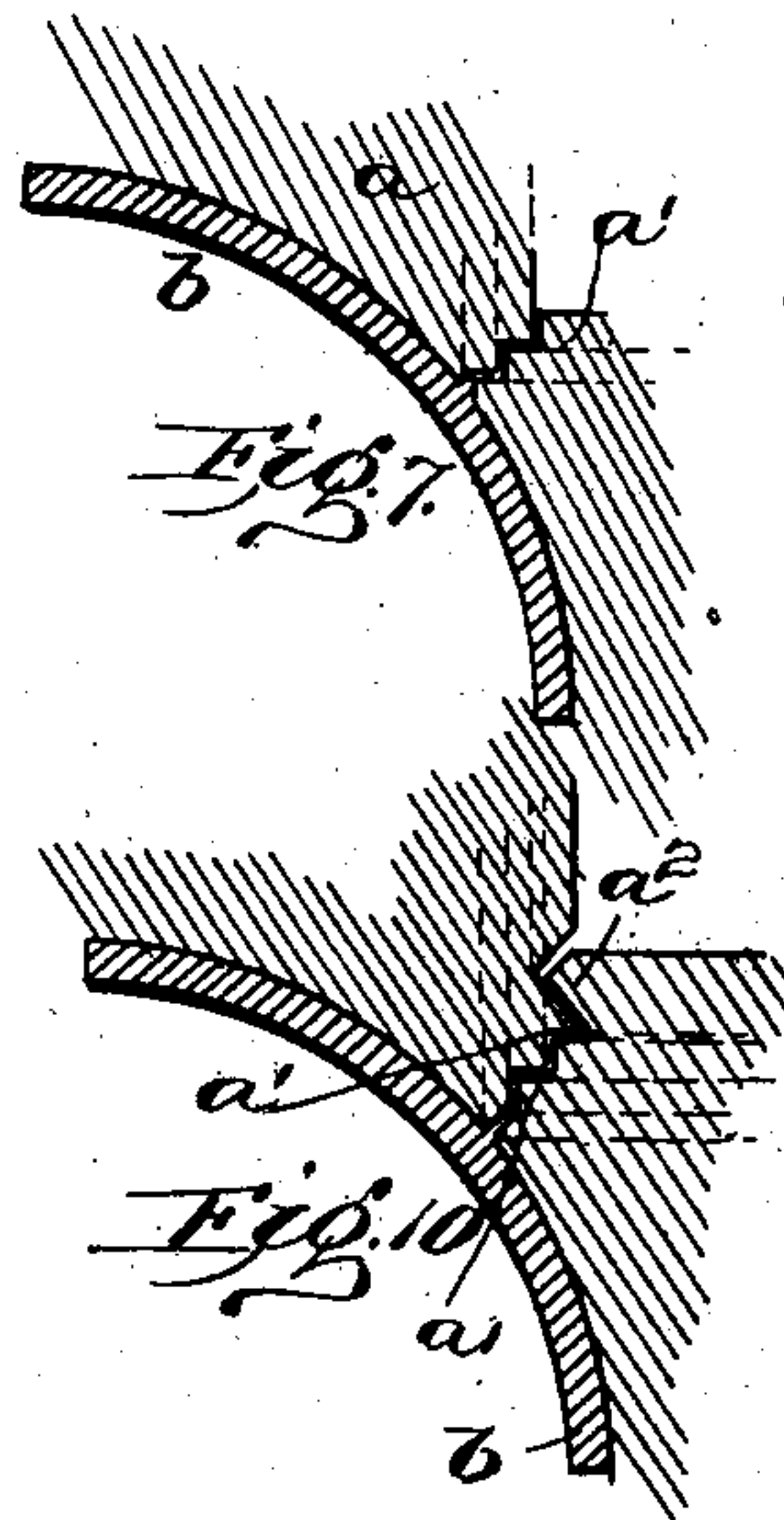
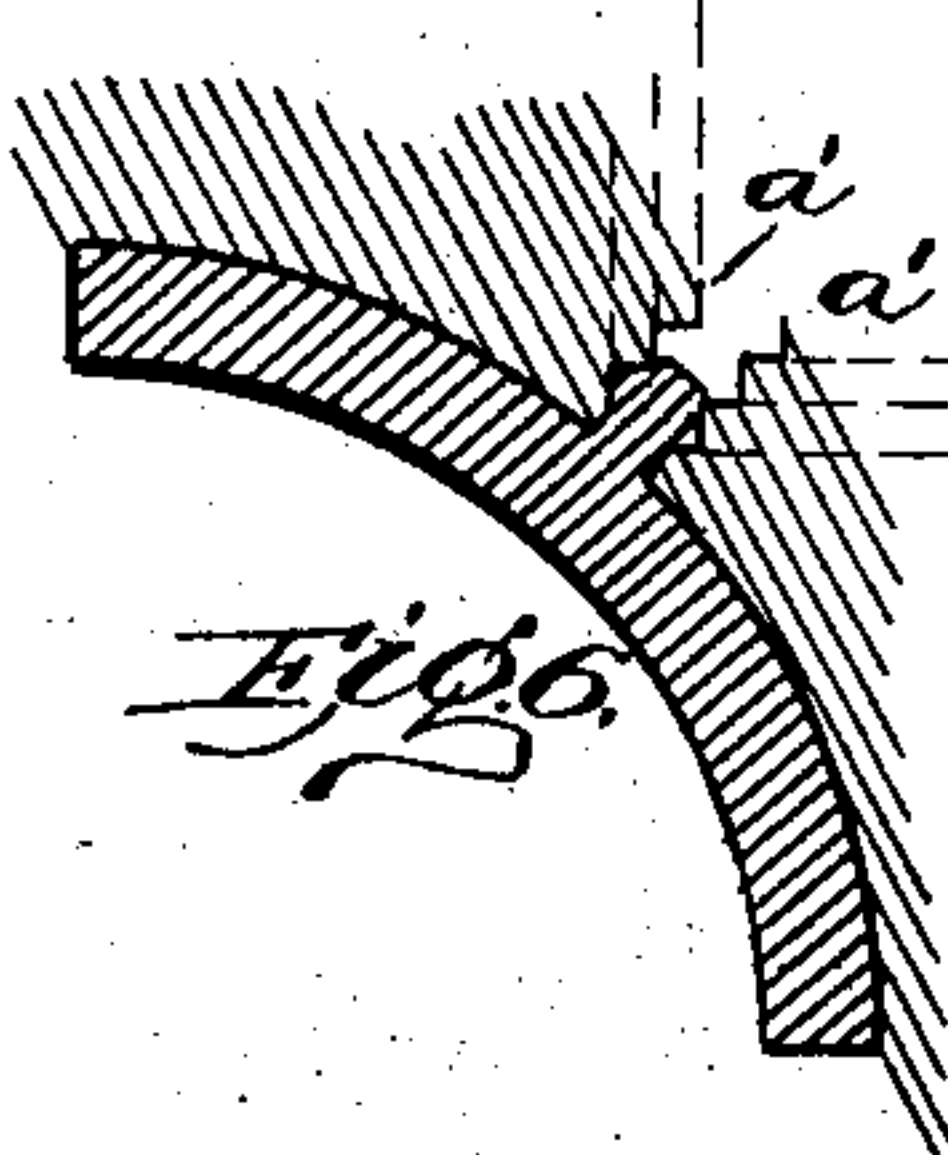
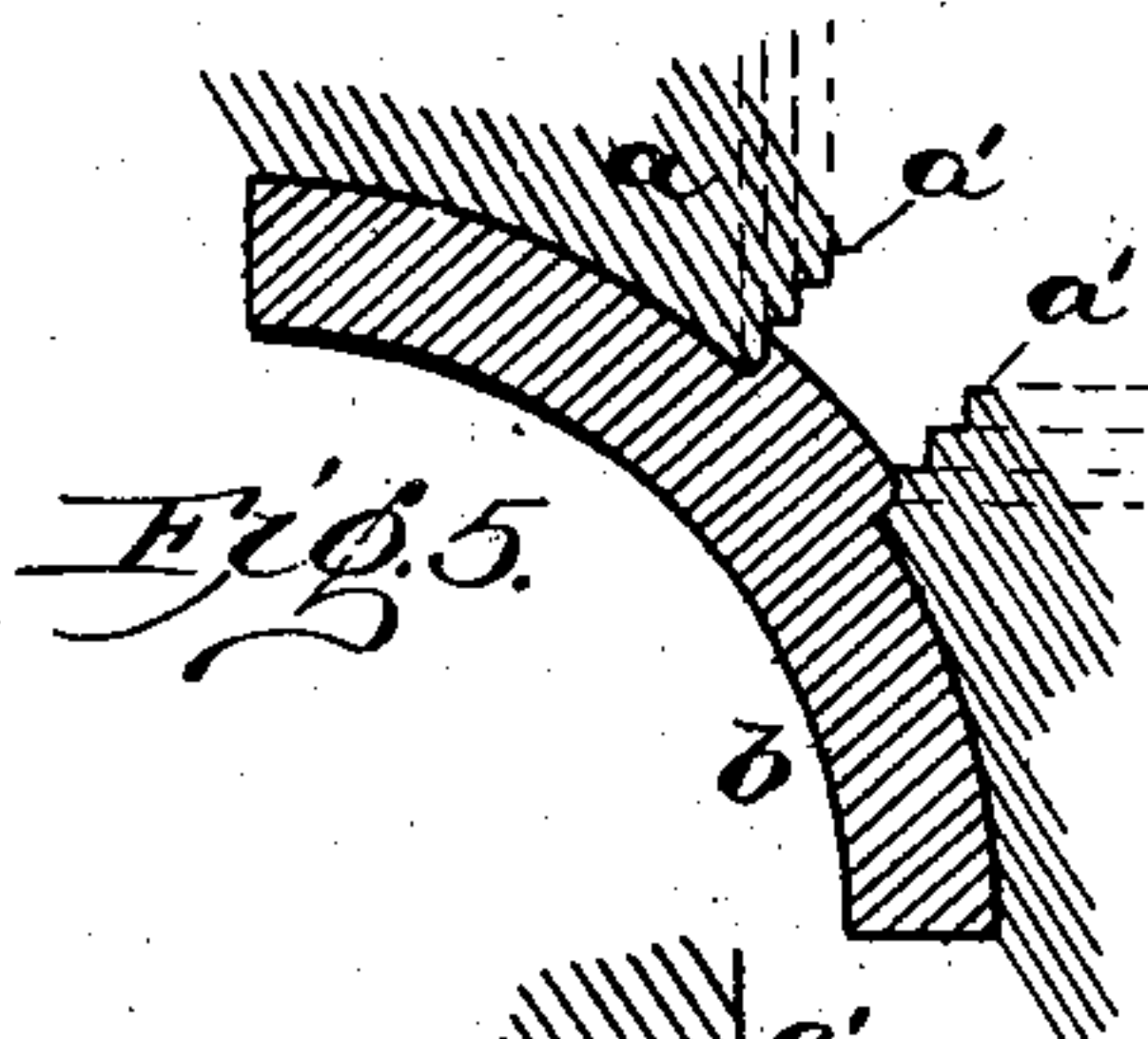
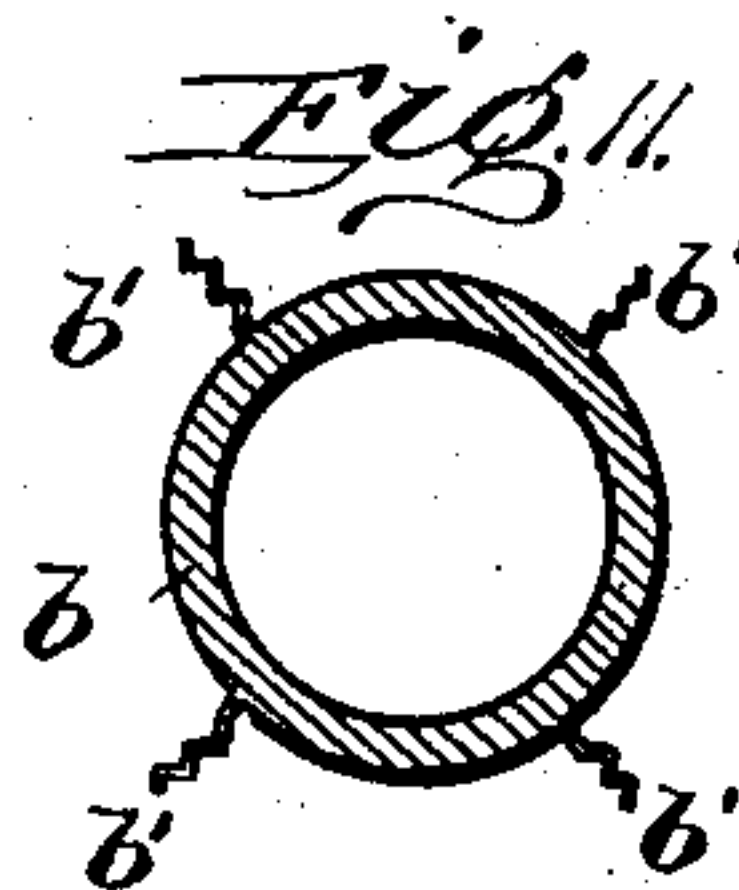
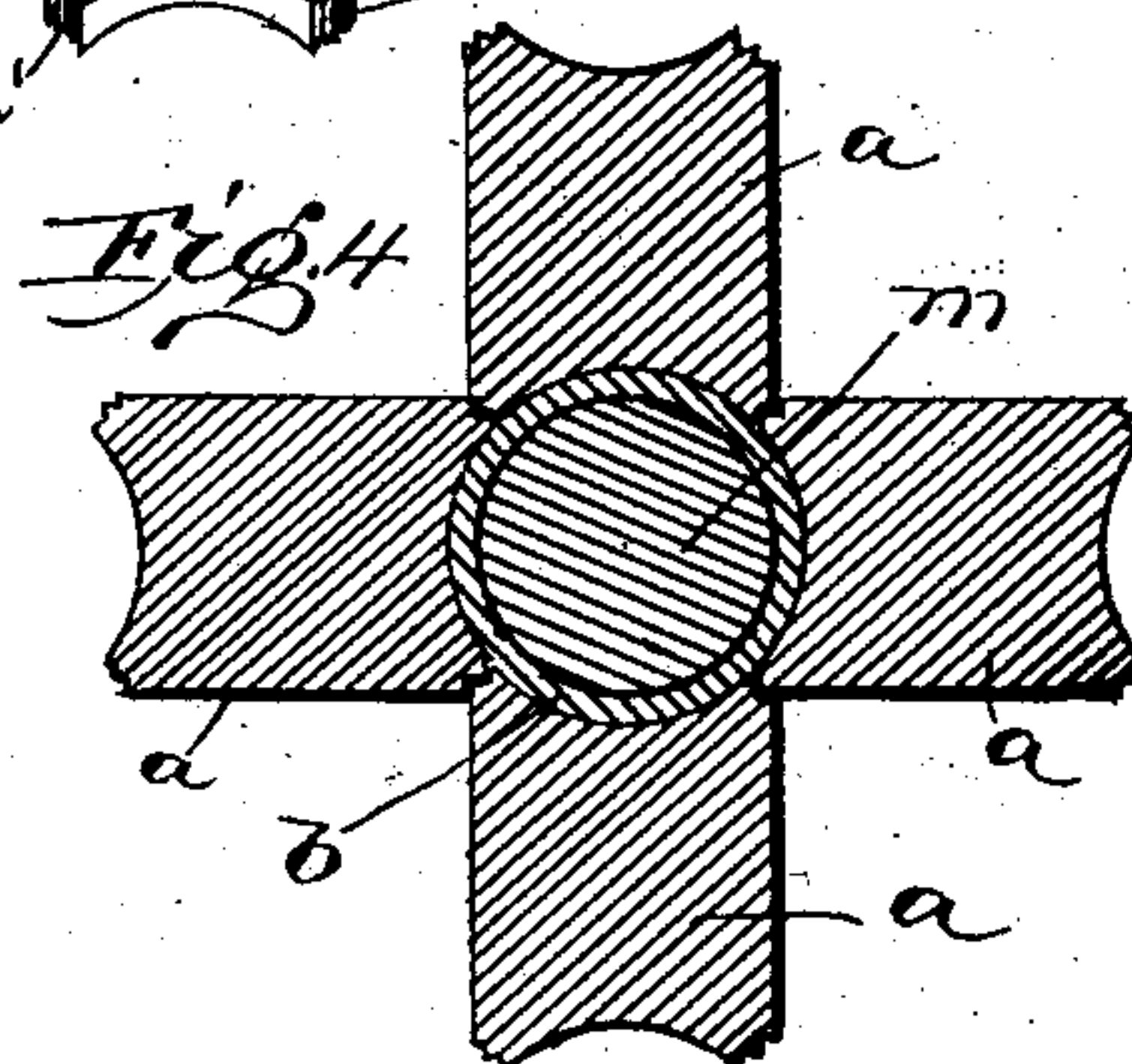
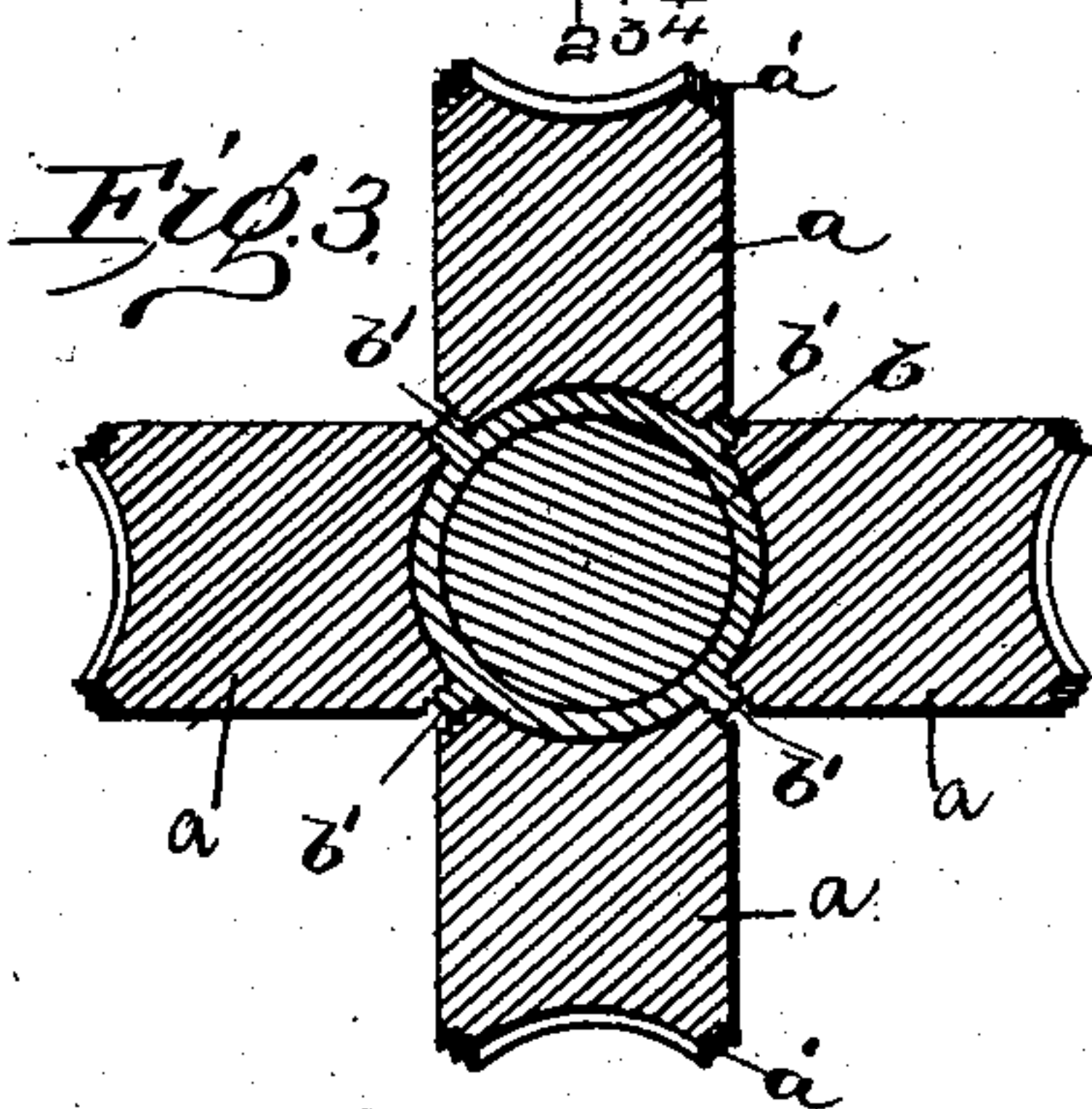
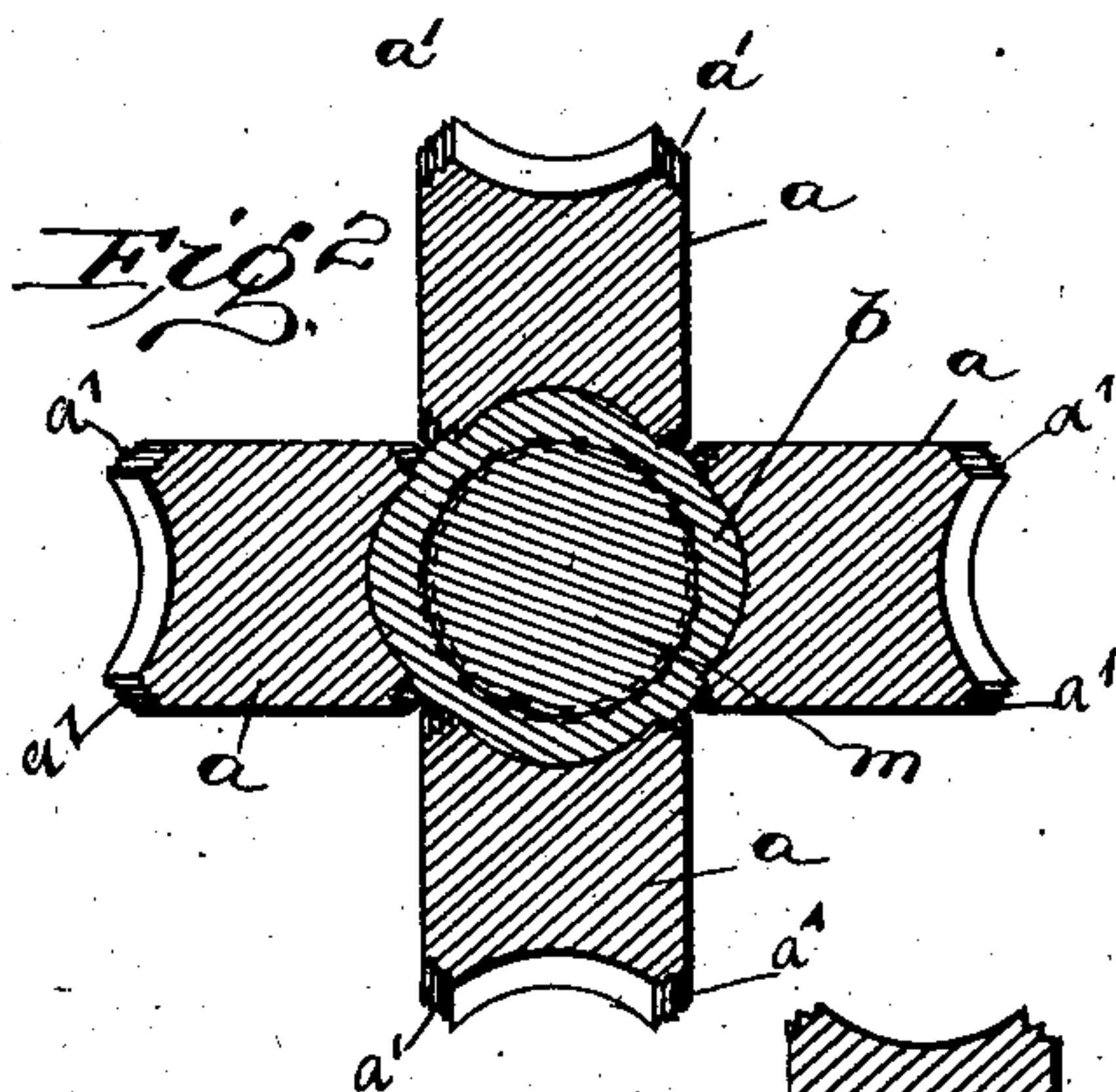
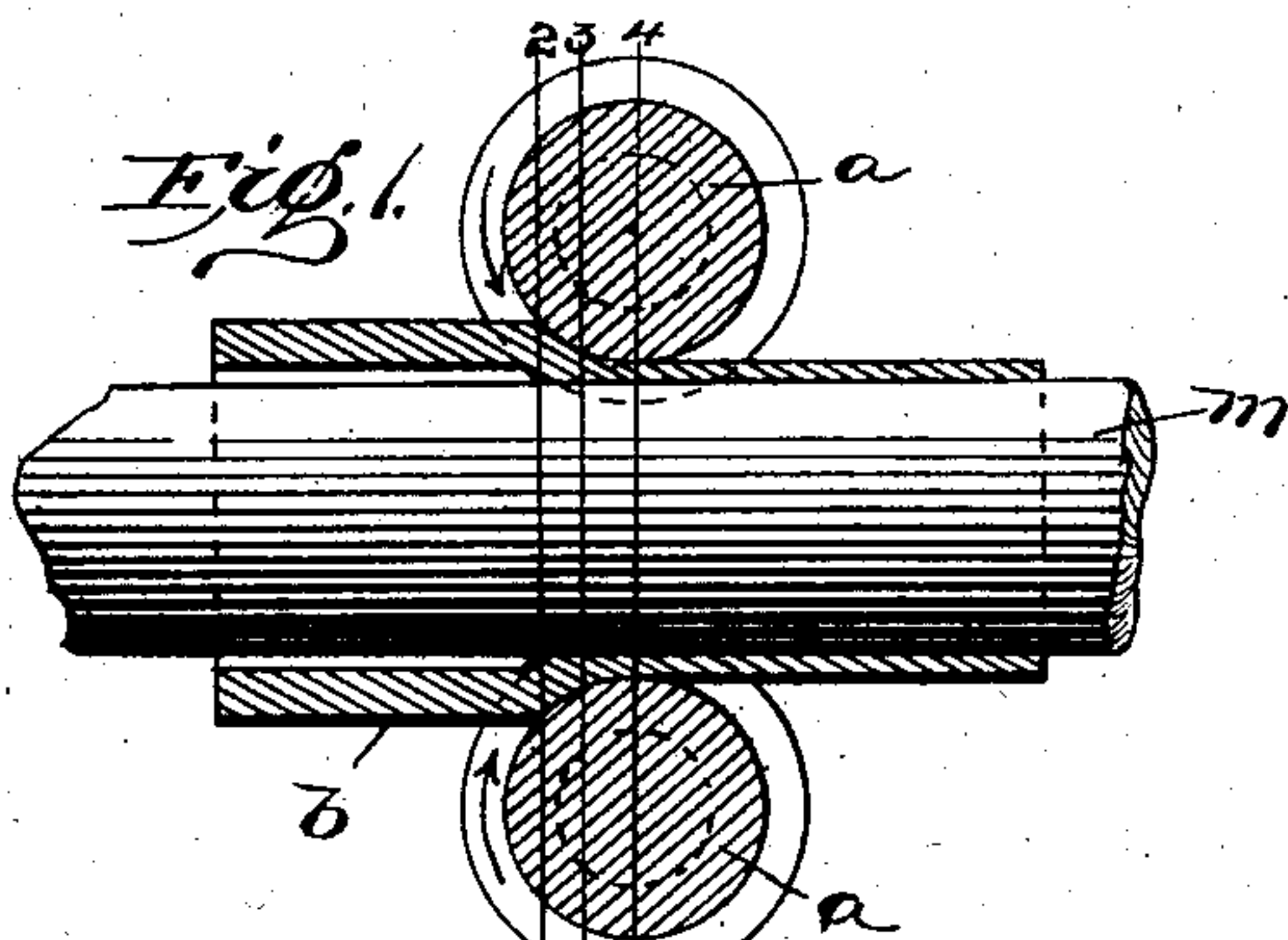
No. 721,211.

PATENTED FEB. 24, 1903.

M. MANNESMANN.  
ART OF ROLLING TUBES.

APPLICATION FILED OCT. 3, 1901. RENEWED SEPT. 17, 1902.

NO MODEL.



witnesses:

J. M. Fowler  
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Inventor

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# UNITED STATES PATENT OFFICE.

MAX MANNESMANN, OF REMSCHEID-BLIEDINGHAUSEN, GERMANY.

## ART OF ROLLING TUBES.

SPECIFICATION forming part of Letters Patent No. 721,211, dated February 24, 1903.

Application filed October 3, 1901. Renewed September 17, 1902. Serial No. 124,810. (No model.)

*To all whom it may concern:*

Be it known that I, MAX MANNESMANN, a citizen of the Empire of Germany, residing at Remscheid-Bliedinghausen, Germany, have  
5 invented new and useful Improvements in the Art of Rolling Tubes, of which the following is a specification.

My invention relates to the rolling of hollow billets or blanks into tubes between  
10 grooved rolls and a mandrel, as described in my pending applications, Serial Nos. 77,926, 77,441, 71,564, and 77,440, whereby on the tube longitudinal ribs, fins, or feathers are produced by the edges of the rolls, which ribs,  
15 fins, or feathers may be compressed by circumferential rims at the sides of the edges and grooved parts of the rolls.

My invention consists in providing corrugations on such circumferential rims of the  
20 rolls, whereby corrugated ribs, fins, or feathers are produced on the rolled-out tube. The corrugated rims take a firm hold of the material of the blank squeezed down between the edges of the rolls, so that it cannot slide  
25 along the rims in outward direction while being compressed by the rims. The effect is that the height of the ribs, fins, or feathers on the rolled-out tube is less than if smooth circumferential rims would be employed.

30 When the corrugations run in circumferential direction around the rolls, the material of the blank which tends to escape from the pressure between the rolls and the mandrel would have to move in the space between the  
35 rolls and to slide along corrugated surfaces of the rims, whereby a great resistance is offered to the escaping material of the blank and the quantity of escaping material reduced. On the other hand, the corrugated  
40 rims take hold of the material between the edges of the rolls, approach each other, and move simultaneously toward the axis of the hollow blank, thereby pressing down in some way toward the center the material in contact with the corrugated surface. By this  
45 means the height of the fins or feathers is reduced. The corrugated surfaces of some of the circumferential rims may have at their outer ends overlapping rims or edges which  
50 overlap the corrugated rims of the other rolls, thus forming a somewhat-closed caliber in which the tube and the feathers are com-

pressed and by which the escape of the material of the blank at the spaces between the rolls may be diminished.

55 Tubes with corrugated ribs, fins, or feathers may form in themselves a useful new article of production for heating and other purposes.

Figure 1 is a longitudinal section through  
60 a hollow blank, partly rolled out, and a cross-section through the rolls. Figs. 2, 3, and 4 are cross-sections on lines 2 2, 3 3, and 4 4, Fig. 1, and show four rolls surrounding the blank and the mandrel without the axes of the rolls.  
65 Figs. 5, 6, and 7 show the spaces between the corrugated rims of the rolls in Figs. 2, 3, and 4, respectively, on a larger scale. Figs. 8 and 10 show different stages of two opposite rims of the rolls in progress of the rolling out of the  
70 tube, whereby overlapping rims or edges form a somewhat closed caliber, in which the fins or ribs formed on the blank are compressed and stretched out in longitudinal direction. Fig. 9 is an end elevation, seen from the out-  
75 going end, of a rolling-mill with two rolls, the tube and the mandrel in cross-section. Fig. 11 is a cross-section through a rolled-out tube.

Similar letters of reference indicate corresponding parts.

80  $a$   $a$  and  $a^{10}$   $a^{10}$  are the rolls,  $b$  the hollow blank, and  $m$  the mandrel. The rolls are provided with corrugated rims  $a'$   $a'$  and  $a^{11}$   $a^{11}$ .

$a^2$  represents overlapping edges or rims, which overlap the corrugated rim of the ad-  
85 jacent roll in order to form a somewhat-closed caliber at a certain position of the rolls.

$b'$   $b'$  are corrugated longitudinal ribs, fins, or feathers on the tube  $b$ .

The operation is as follows: A hollow billet  
90 or blank on a mandrel is rolled out by positively-driven rolls, whereby the edges of the rolls impinge upon the hollow blank and a portion of its material is squeezed down by the edges and compressed by the corrugated  
95 rims of the rolls. The corrugated rims take a firm hold of the material between them and as they approach each other roll it out into corrugated ribs, fins, or feathers, which may be connected with the rolled-out tube. In  
100 case of three or four rolls, and to some extent even with two rolls, the corrugated edges of the rolls approach each other and simultaneously to the center of the blank, thereby press-



ing down the material of the blank and reducing the height of the rolled-out feathers or fins.

The rims may be corrugated in any suitable way and be made with sharp or rounded-off edges, or wave-like, and two, three, or more rolls may be employed. The rolls are positively driven. The mandrel may be stationary or loose in order to go with the blank through the rolls; but in case a strong elongation of the blank is wanted it is best to give positive revolving motion to the rolls and a positive endwise movement to the mandrel, as described in my pending applications, Serial Nos. 68,993, 77,441, and 70,497. The corrugated ribs, fins, or feathers may be cut off the tube in the same pass with the rolling operation or in a separate pass, or the corrugated ribs, fins, or feathers remain on the tube. They can be used for heating and other purposes. The corrugations shown in the drawings are corrugated in radial direction—*i. e.*, a plane laid through the axis of a roll will cut the rim in a corrugated line, while a plane laid vertically to the axis and through the rim will cut the rim in a circular line. In this case the corrugations run around the axis of the rolls; but the corrugations may run obliquely to a plane laid at right angles to the axis of the roll, or even the corrugations may run parallel or convergent to the axis of the roll, so that the rims are corrugated in circumferential direction—*i. e.*, a plane laid at right angles to the axis of the roll through the rim will cut the same in a corrugated line. In this case tubes with longitudinal ribs or feathers corrugated in longitudinal direction may be produced.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The improvement in the art of rolling tubes and other hollow bodies between two or more rolls which consists in subjecting a hollow billet or blank on a mandrel to the action

of positively-driven rolls which have corrugated rims at the sides of the grooves whereby tubes or other hollow bodies with corrugated longitudinal ribs, fins or feathers are produced substantially as described.

2. The improvement in the art of rolling tubes between two or more rolls, which consists in rolling a hollow billet or blank on a mandrel between positively-driven rolls, the working faces of which consist of a grooved center portion and corrugated rims at the sides thereof, whereby the blank is rolled out and a portion of its material is compressed between the corrugated rims, substantially as described.

3. The improvement in the art of rolling tubes between two or more rolls, which consists in rolling a hollow billet or blank on a mandrel between positively-driven rolls, the working faces of which have grooved center portions and corrugated rims at the sides thereof, some of the corrugated rims having additional ribs or edges which overlap the corrugated approaching rims, thus forming a somewhat-closed caliber, in which the tube and the ribs, fins or feathers are compressed and elongated, substantially as described.

4. The improvement in the art of rolling tubes between two or more rolls, which consists in rolling a hollow billet or blank on a mandrel between positively-driven rolls, the working faces of which consist of a grooved center portion and corrugated rims at the sides thereof, the corrugations running obliquely to the plane laid vertically through the axis of the roll, whereby the blank is rolled out and a portion of its material is compressed between the corrugated rims, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

MAX MANNESMANN.

Witnesses:

JOHN G. PARKER,  
EMORY H. BOGLEY.