

No. 698,179.

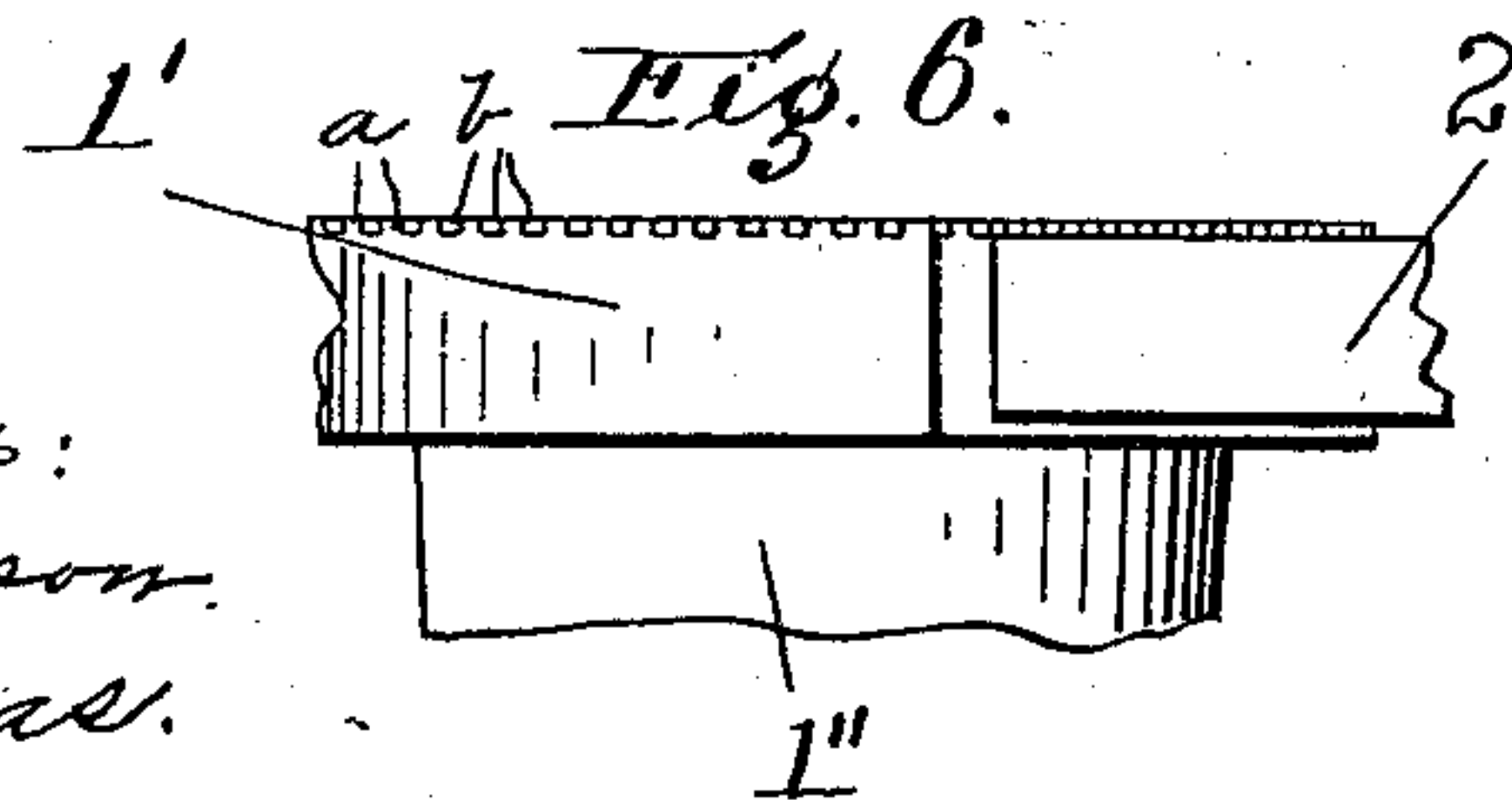
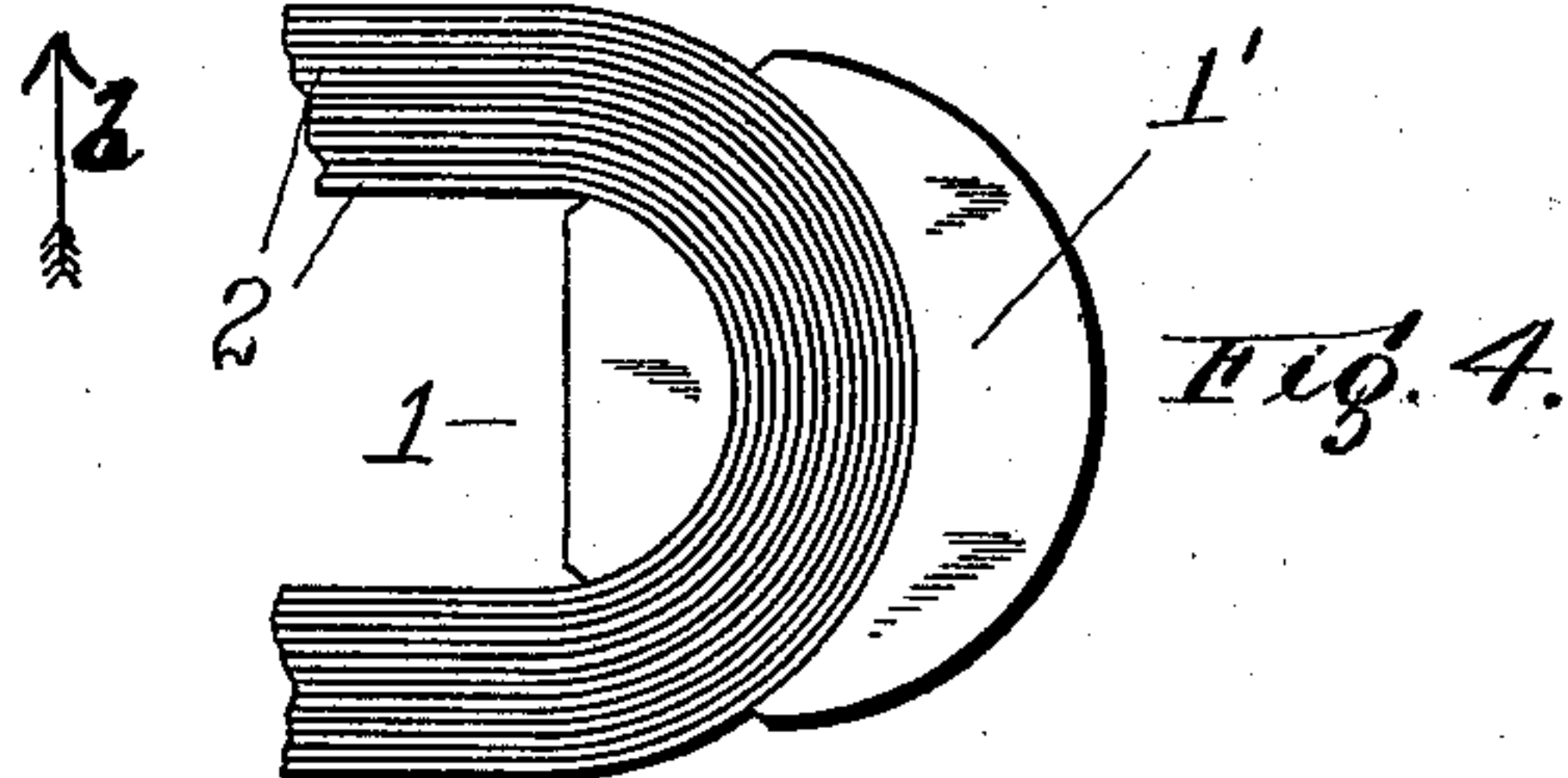
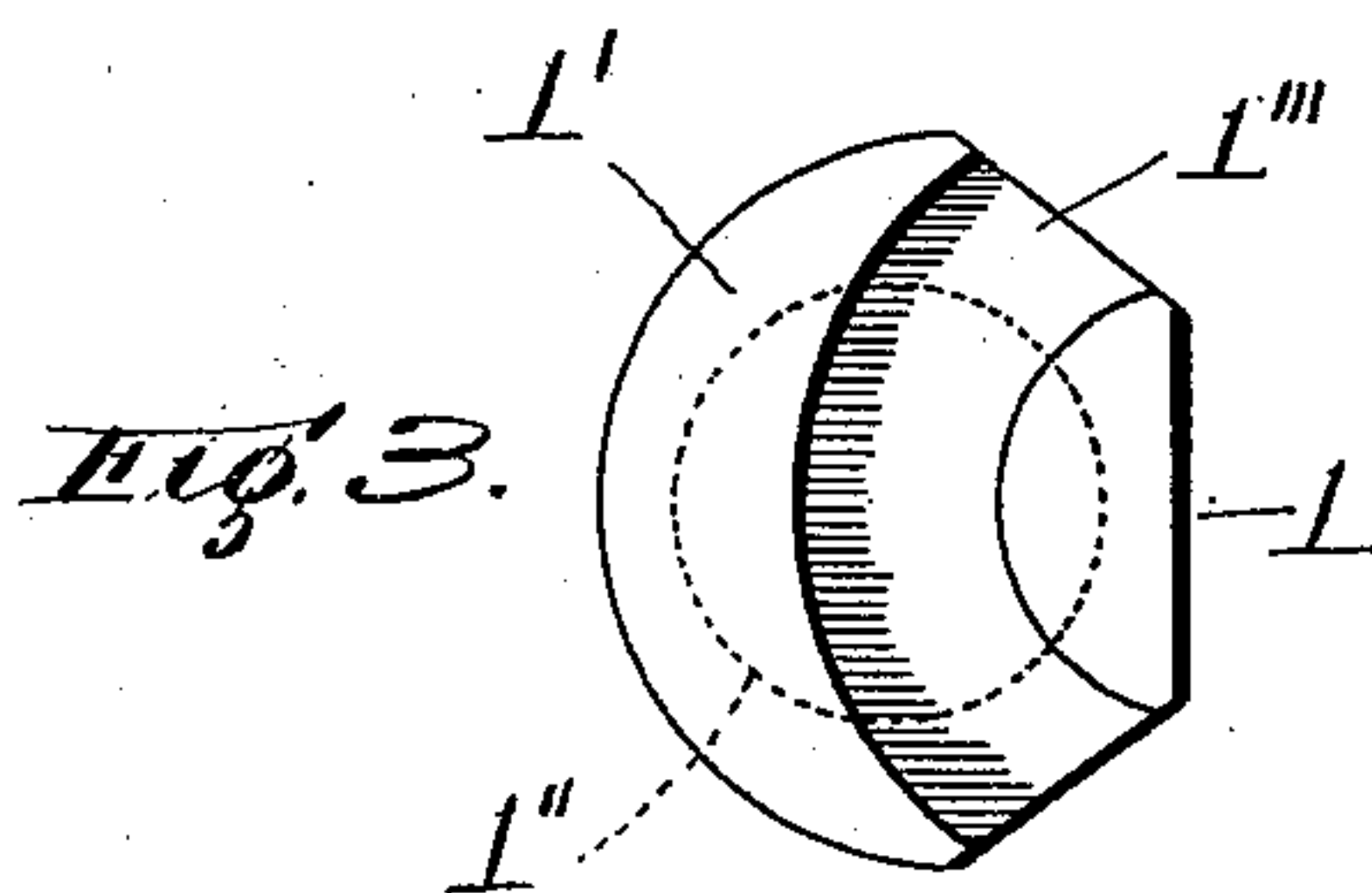
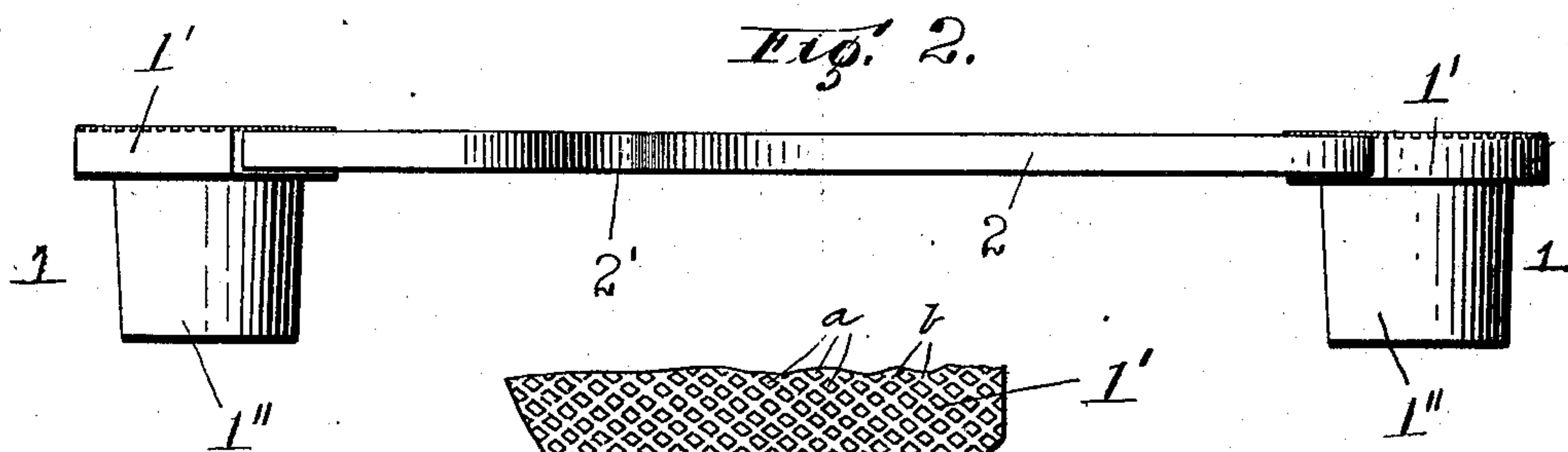
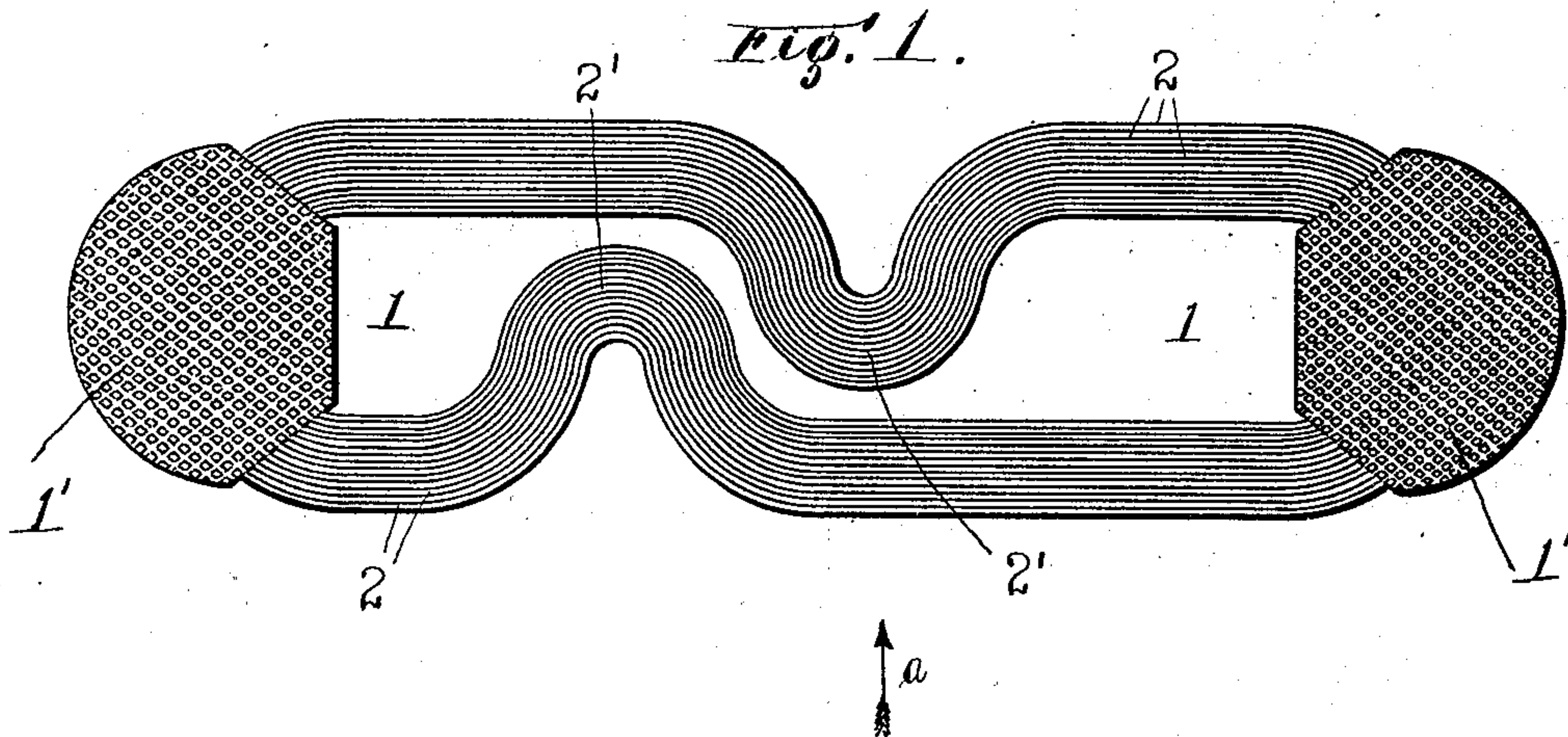
Patented Apr. 22, 1902.

F. H. DANIELS & H. W. WYMAN.

RAIL BOND.

(Application filed Dec. 28, 1901.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## RAIL-BOND.

SPECIFICATION forming part of Letters Patent No. 698,179, dated April 22, 1902.

Application filed December 28, 1901. Serial No. 87,519. (No model.)

*To all whom it may concern:*

Be it known that we, FRED H. DANIELS and HORACE W. WYMAN, citizens of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have jointly invented certain new and useful Improvements in Rail-Bonds, of which the following is a specification.

Our invention relates to rail-bonds for electric railways; and the object of our invention is to make an improved rail-bond comprising two terminals or ends and wire strands, preferably in two sets, forming the body portion and extending between the terminals and secured thereto in the manner to be hereinafter described.

In our improved rail-bond we make the head of the terminal with a depression or recess in its upper surface, which is open through the upper surface of the head and is of substantially the same depth as the diameter or thickness of the wire strands which extend in said recess. The wire strands are placed in the recesses in the heads of the terminals from the upper sides of the heads and are secured therein and to the terminals by pressure or drop-forging between dies. The die which engages the top or outer surface of the head of the terminal has a series of projections or extensions thereon having sharp edges and recesses or depressions formed by the projections or extensions and making a roughened surface for the purpose to be hereinafter described. The completed terminal will have on its head or outer surface a series of projections or extensions and recesses or depressions, making a roughened surface.

We have found in practice that when the head of the terminal and the wire strands extending in the recess therein, as above described, are subject to pressure or drop-forging between smooth-faced dies that the strands are elongated where they extend between the dies, thus reducing their diameter at their point of connection with the terminal, and consequently reducing the conducting area of the strands at this point. We have also found in addition to the elongation of the strands and the reducing of their conducting

area, as above described, that the spaces between the strands, where they extend side by side in the recess in the head of the terminal, are not entirely closed and the strands made substantially integral by an absolute union. The spaces left between the individual strands, though they may be scarcely visible, are sufficient to allow of the entrance of moisture, gases, &c., to cause electrolytic action on the strands and seriously affect the conductivity of the strands at this point. We have also found that we can prevent the elongation of the strands and the spaces between them, above described, by making the die which engages the outer surface of the head of the terminal and the wire strands which extend in a depression therein with a roughened face or surface, comprising a series of projections or extensions with sharp edges thereon, as above described.

The action of the roughened surface of the die and the projections or extensions thereon on the wire strands is that the sharp edges on the projections on the die which form the roughened surface enter into and break up or spread the exposed surface of the wire strands and cause the metal therein to be forced into the recesses or depressions in the face of the die between the projections thereon instead of flattening or pressing out the strands to elongate them. At the same time the roughened surface of the die acts to close entirely the spaces between the strands, where they extend in the recess in the head of the terminal and to make the strands substantially integral by an absolute union.

Referring to the drawings, Figure 1 is a plan view of a rail-bond embodying our improvements. Fig. 2 is an edge view of the bond shown in Fig. 1 looking in the direction of arrow *a*, same figure. Fig. 3 shows the head of one terminal with the recess therein before the strands of wire are placed therein. Fig. 4 shows the head of one terminal with the strands of wire in the recess before they are united to the terminal by pressure. Fig. 5 is, on an enlarged scale, a detached section of the terminal and the wire strands, shown at the left in Fig. 1; and Fig. 6 is an edge



view of the parts shown in Fig. 5 looking in the direction of arrow *b*, same figure.

In the accompanying drawings, 1 represents the terminals or ends of the rail-bond, preferably made in the shape shown, with the enlarged flat heads 1' and cylindrical attaching-lugs 1'', as is customary. The head 1' of each terminal 1 has a depression or recess 1''' in its top or outer surface, (see Fig. 3,) the shape and depth of which correspond to the shape and thickness of the wire strands 2 at their curved ends.

The wire strands 2 form the body portion of the bond and are preferably flattened in cross-section and arranged in two parallel sets, as shown. Each set of strands 2 may be made with a curve or bend 2' therein, if preferred, to allow for any expansion of the bond.

The wire strands 2, forming the body portion of the bond, are preferably made from a length of wire by coiling or bending the wire around two pins or forms on the head of a lathe until there is a sufficient conducting area to carry the current of electricity. The free ends of the wire (not shown) may extend, one upon the inside and one upon the outside of the series of strands, at the point where the curved ends of the strands extend in the recess 1''' in the head 1' of the terminal 1.

In making our bond the curved ends of the strands 2 are placed in the recess 1''' in the head 1' of the terminal 1 from the upper side of the head (see Fig. 4) and then the head and the strands extending in the recess are subject to great pressure between dies, one of which, the one which engages the top or outer surface of the head, has its surface roughened or provided with a series of projections or extensions, preferably of square or diamond shape, with flat tops and sharp straight edges around the tops and recesses or depressions between the projections to produce a roughened surface on the top or head of the terminal, consisting of a series of projections or extensions *a*, preferably of uni-

form size and shape, and a series of depressions or recesses *b* between the projections, as shown in Figs. 5 and 6. In making the union between the heads of the terminals and the strands the union may be made with or without a flux when the pressure is applied.

It will be understood that the details of construction of our rail-bond shown in the drawings and above described may be varied, if desired. The shape of the terminals and of the body of the bond may be varied, if desired.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A rail-bond, comprising two copper terminals or ends, each having a recess in its top or outer surface, and wire strands forming the body portion and extending in said recess, and secured therein by pressure, substantially as shown and described.

2. A rail-bond, comprising a body portion, and terminals or ends having their heads roughened, or provided with a series of projections or extensions, and recesses or depressions, substantially as shown and described.

3. A rail-bond, comprising a body portion, and terminals or ends having their heads studded with projections, substantially as shown and described.

4. A rail-bond, comprising two terminals or ends, each having a recess in its head or outer surface, and wire strands forming the body portion and extending in said recess, and the head or exposed surface of the terminals and of the wire strands, where they extend in the recess in the terminals, roughened, or studded with projections, substantially as shown and described.

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