

H. JAPP.
SEGMENT FOR TUNNEL LININGS.

APPLICATION FILED AUG. 2, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

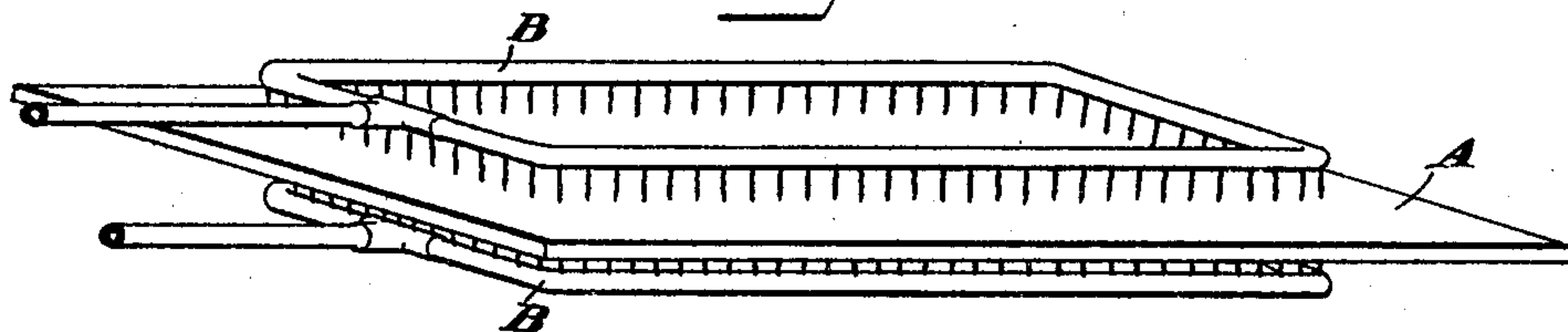


Fig. 2.

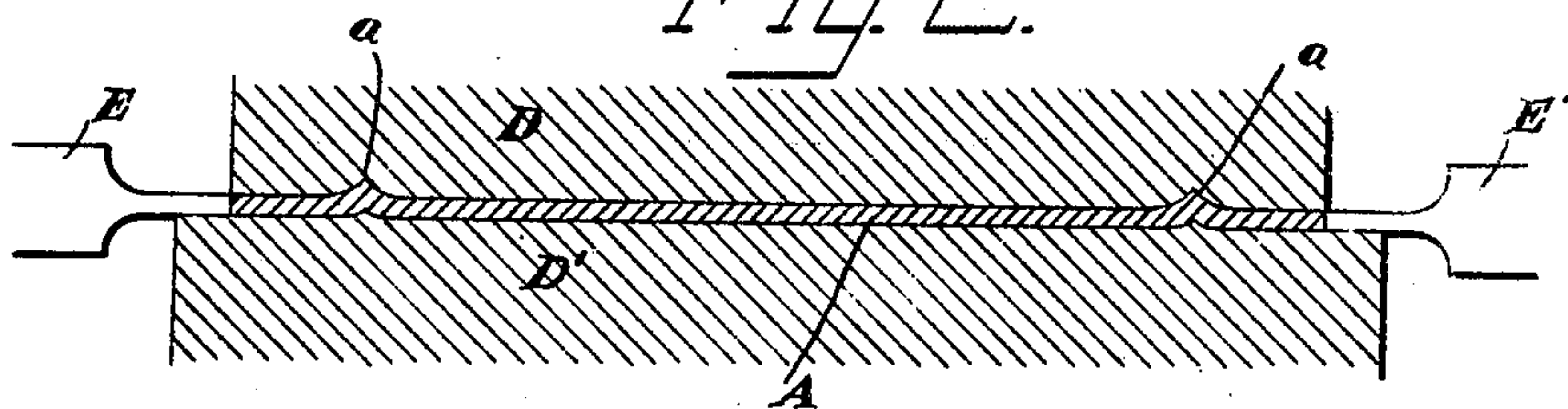


Fig. 3.

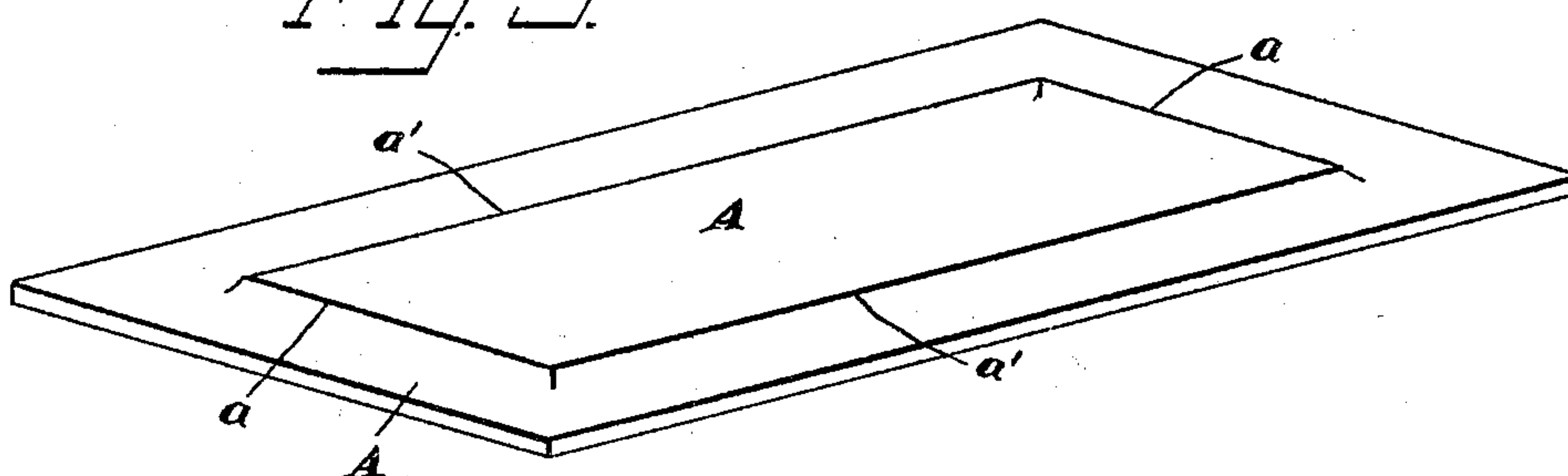
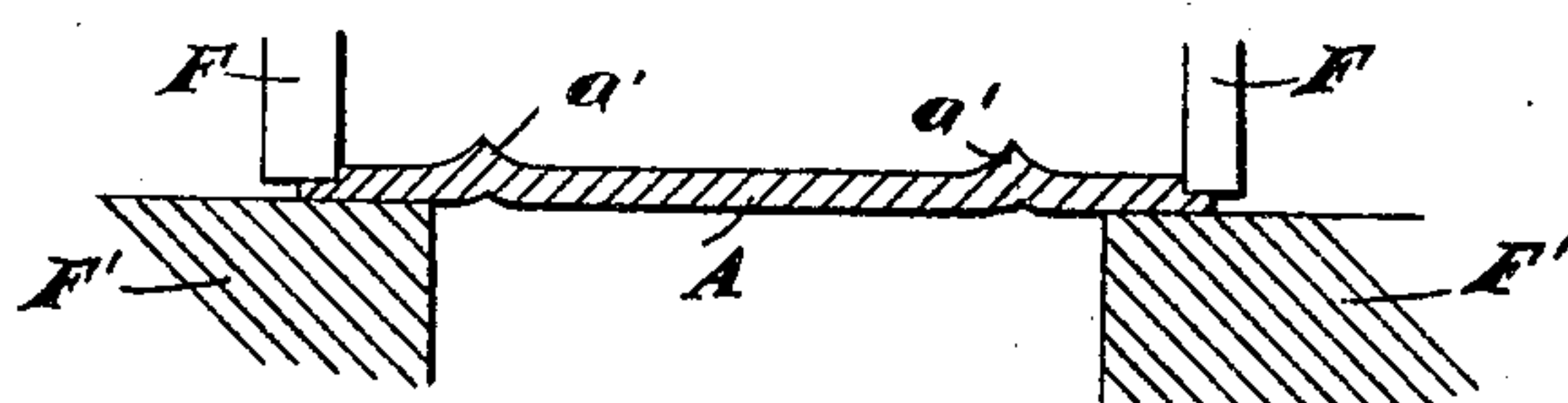


Fig. 4.



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2 SHEETS—SHEET 2.

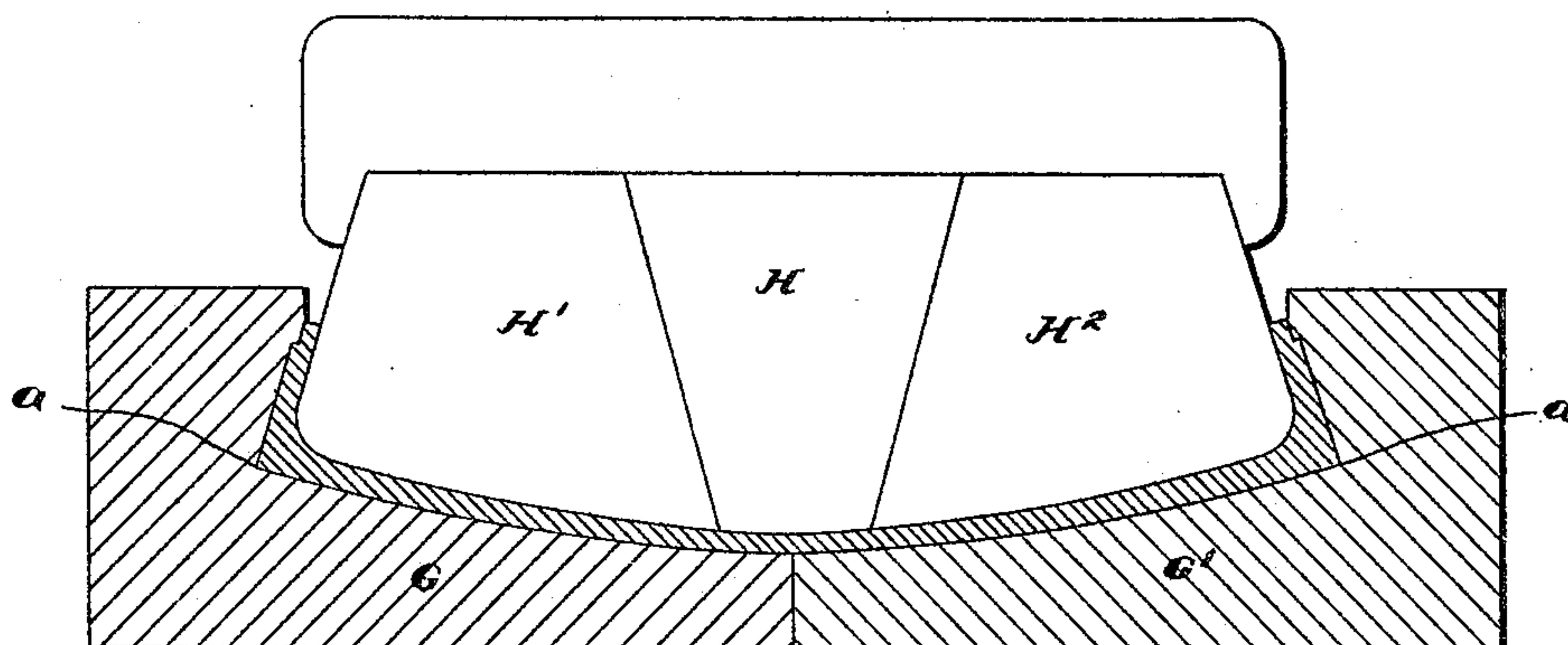


Fig. 5.

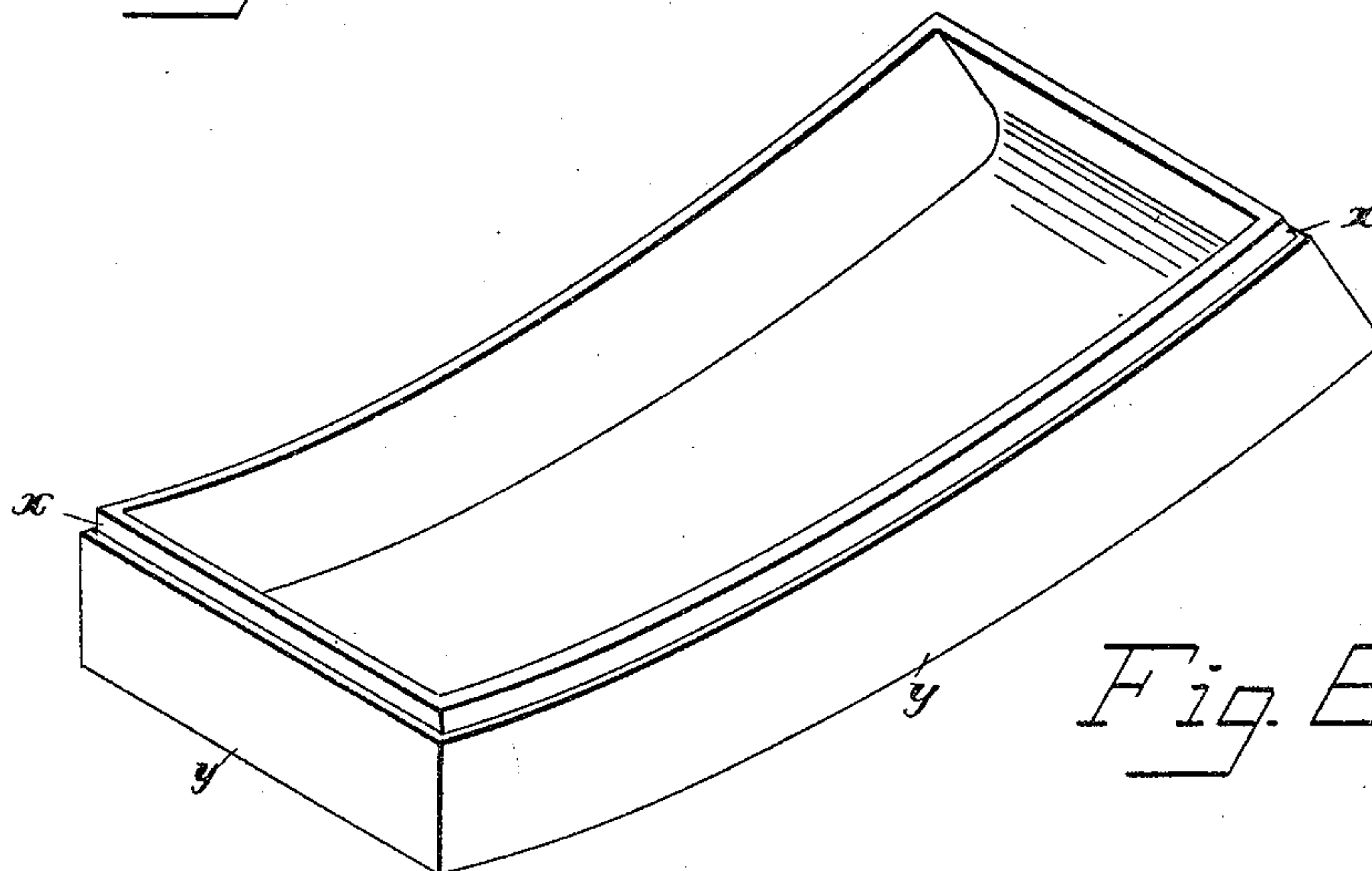


Fig. 6.

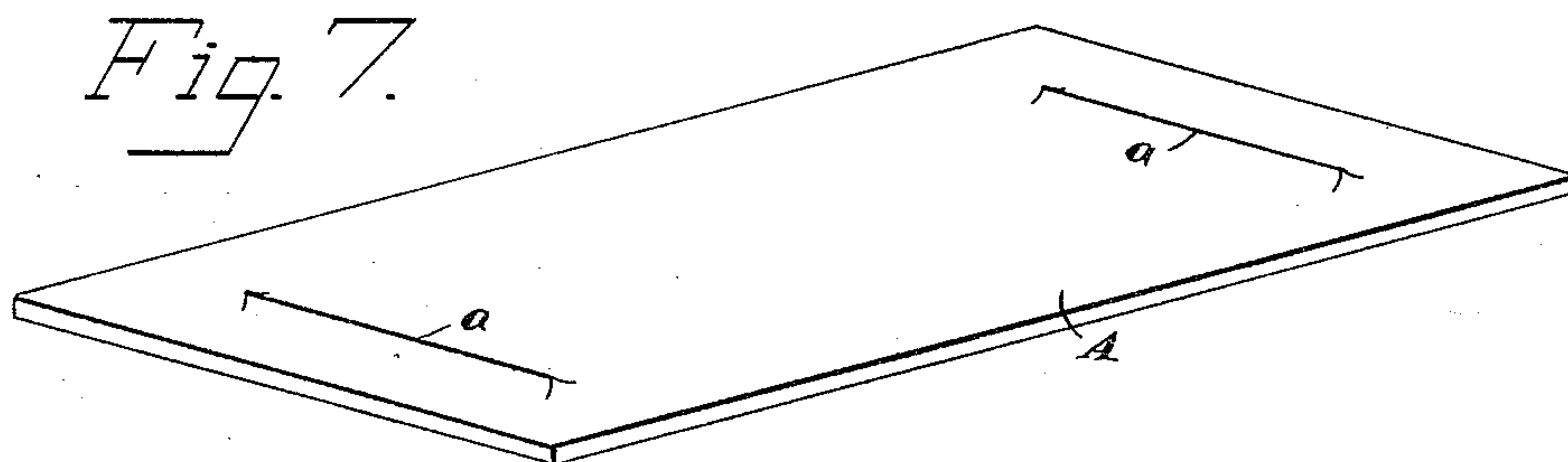


Fig. 7.

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UNITED STATES PATENT OFFICE.

HENRY JAPP, OF NEW YORK, N. Y.

SEGMENT FOR TUNNEL-LININGS.

No. 806,673.

Specification of Letters Patent.

Patented Dec. 5, 1905.

Application filed August 2, 1905. Serial No. 272,360.

To all whom it may concern:

Be it known that I, HENRY JAPP, a subject of the King of Great Britain, residing in the borough of Manhattan, in the city, county, and State of New York, have invented an Improved Segment for Tunnel-Linings, of which the following is a specification.

The object of my invention is to economize the construction of the metal linings of tubular tunnels, which are built up of curved segments flanged on their four edges and bolted together. These curved and flanged segments have always been made of cast-iron or cast-steel at considerable expense. With a view to economy of manufacture it has been proposed to make these segments of pressed or rolled steel; but that proposition failed of success because the segments made in that way had rounded outer corners and were found to be lacking in strength and liable to buckle, and so unable to resist the strain at those points. I have discovered how these segments can be economically made of pressed or rolled steel to successfully withstand all strains on the completed tube as well as if that tube were built up of the more expensive and heavier castings.

In the accompanying drawings, Figure 1 is a perspective view illustrating how the steel plate of which the flanged segment is to be formed is heated locally. Fig. 2 is a sectional view illustrating another step in the formation of the segment. Fig. 3 is a perspective view of the plate formed with rib. Fig. 4 is a sectional view illustrating another step. Fig. 5 is a sectional view illustrating the final pressing operation, and Fig. 6 is a perspective view of a finished segment, and Fig. 7 is a perspective view of a modification.

The preferred form of the flanged segment to be produced is illustrated in Fig. 6. To make this segment, I first produce upon a sheet of iron or steel of the requisite size a thickening rib or bead a and a' , Fig. 3, of a rectangular outline, the rectangle being of a size the same as the outline and the size of the outer face of the segment after the flanges have been formed thereon. Preferably this rib or enlargement is formed only on one face of the plate—viz., that plate which is to form the outer face of the segment—and the rib is preferably made obtusely wedge-shaped in cross-section—that is, with a sharp angle or edge, as indicated in Figs. 2 and 4. This sharp-edged rib may be produced in different ways and by different means—as, for example, by

upsetting or by rolling or in part by upsetting and in part by rolling. By way of illustration I have shown in Figs. 1 and 2 how the rectangular rib may be produced by the upsetting process. In Fig. 1, A indicates a plain wrought iron or steel plate which is being subjected to local heat in that portion of the plate where the rib is to be formed. This local application of heat is shown as being effected by means of two corresponding gas-burners B B on opposite faces of the plate, these burners being of the desired rectangular outline and adapted to project jets of flame directly upon the plate at the points to be heated. The plate thus locally heated is then put into upsetting-dies (indicated in Fig. 2 and consisting of top and bottom dies D and D' and side dies E E') to force the heated portion of the metal plate from all four edges into the recesses shown as formed in the upper die D to produce the sharpened rib a , before spoken of and as indicated in the perspective view, Fig. 3. In Fig. 4 I have indicated another step in the formation of the plate—namely, the formation around the margin of the calking-cheek a , Fig. 6, commonly employed in tunnel-lining segments to aid in forming tight joints between the adjacent segments. In Fig. 4 I have shown this process of formation by rolls or dies F F'. The ribbed plate has to be flanged, and this may be either before or after the calking-cheek is formed. The flanging of the plate may be effected in various well-known ways and by various means. It may be produced by forging or partly by means of rolls and partly by means of forging. In Fig. 5 I have indicated means whereby all four flanges on the four margins of the plate may be formed at once and the segment curved by a pressing operation; but the curving of the segment may be a separate step from the flanging. In this Fig. 5 G G' are the two parts of the lower female die; and H H' H² are the three parts of the upper male die, the central part H' being wedge-shaped to force the parts H H² laterally. It will be understood that different parts of the rib a a' on the plate become in this operation the outer angles of the flanges, Fig. 5, providing at those points sufficient metal to give a full and sharp corner, such as is required to give the necessary strength in the finished tube built up of these segments.

In some cases it may suffice to construct the tunnel-segments with sharp corners at the ends only where the radial joints occur in the

construction of the tunnel-tube, while the sides where the circumferential joints occur are left more or less rounded, since less strength is required there. In such case I form the iron or steel plate with beads *a a*, as shown in Fig. 7, to form sharp corners at the flanged ends when the plate is subjected to the further manipulation, such as already described with reference to the plate shown in Fig. 3.

10 The rivet and other holes can be formed in the segments by punching by any convenient means.

I claim as my invention—

1. As a new article of manufacture, a tunnel-lining segment of wrought steel or iron, 15 with four flanged edges, the outer corners of the flanged ends being sharp, as and for the purpose described.

2. As a new article of manufacture, a tunnel-lining segment of wrought steel or iron, 20 with four flanged edges, the outer corners of the flanged edges being sharp, as and for the purposes described.

3. As a new article of manufacture, a tunnel-lining segment of wrought-steel, with 25 four flanged edges having calking-cheeks, the outer corners of the flanged edges being sharp, as and for the purposes described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses. 30

HENRY JAPP.

Witnesses:

L. I. SEIG,

CHAS. BRESLOFF.