

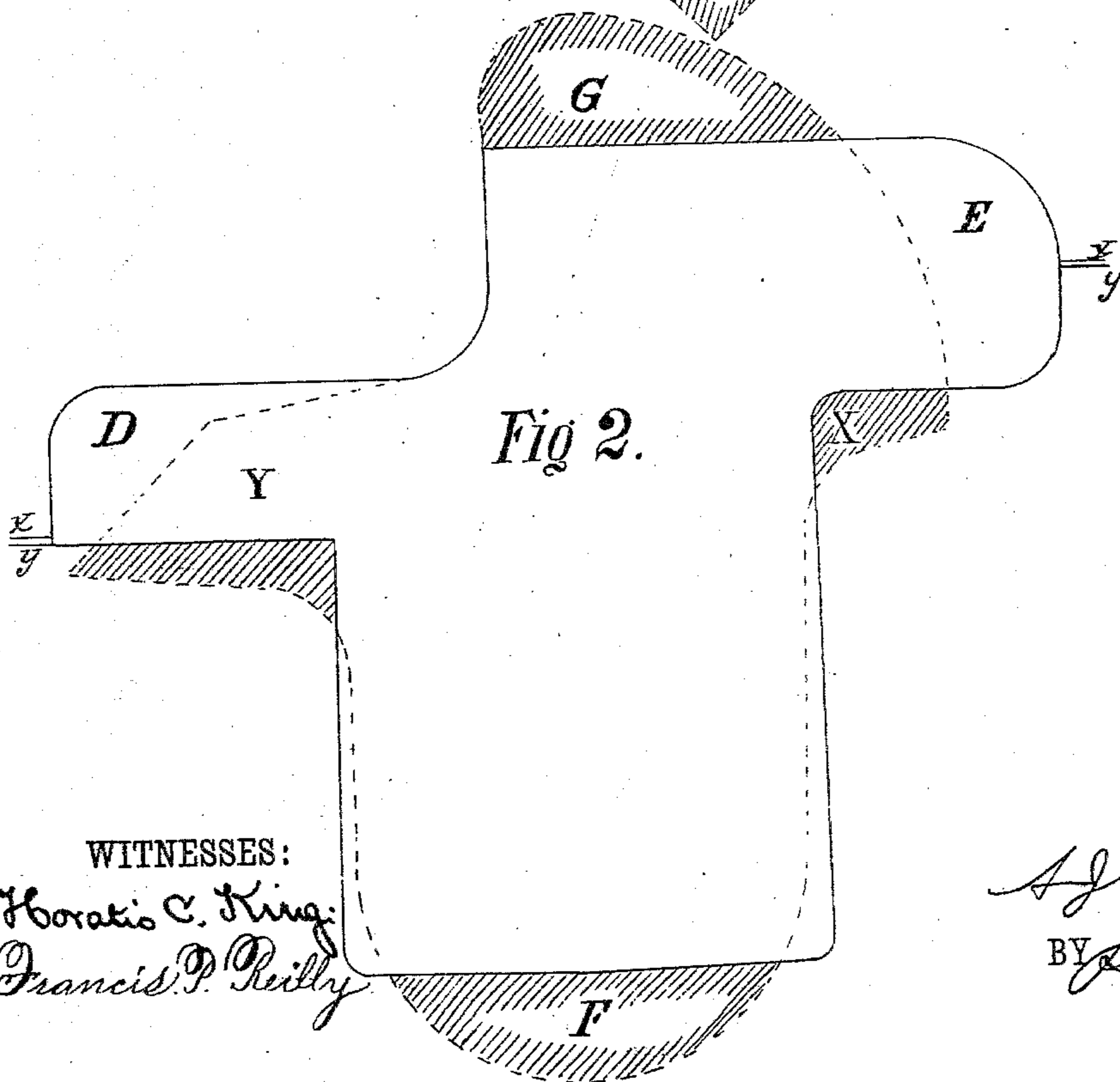
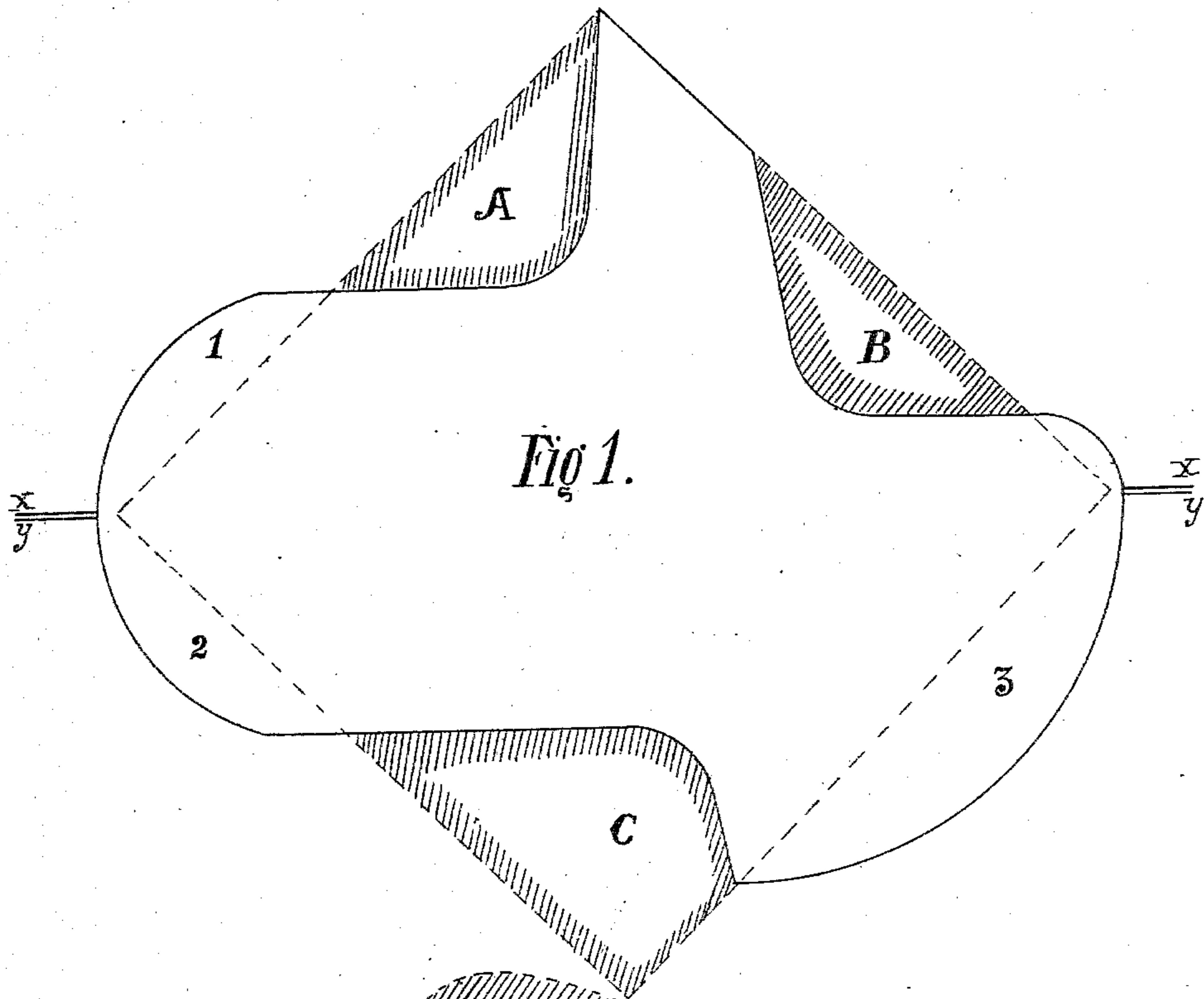
(No Model.)

3 Sheets—Sheet 1.

A. J. MOXHAM  
ROLLING MILL.

No. 303,036.

Patented Aug. 5, 1884.



WITNESSES:  
Horatio C. King  
Francis P. Reilly

INVENTOR  
A. J. Moxham  
BY *E. P. Voorhes*  
ATTORNEY

(No Model.)

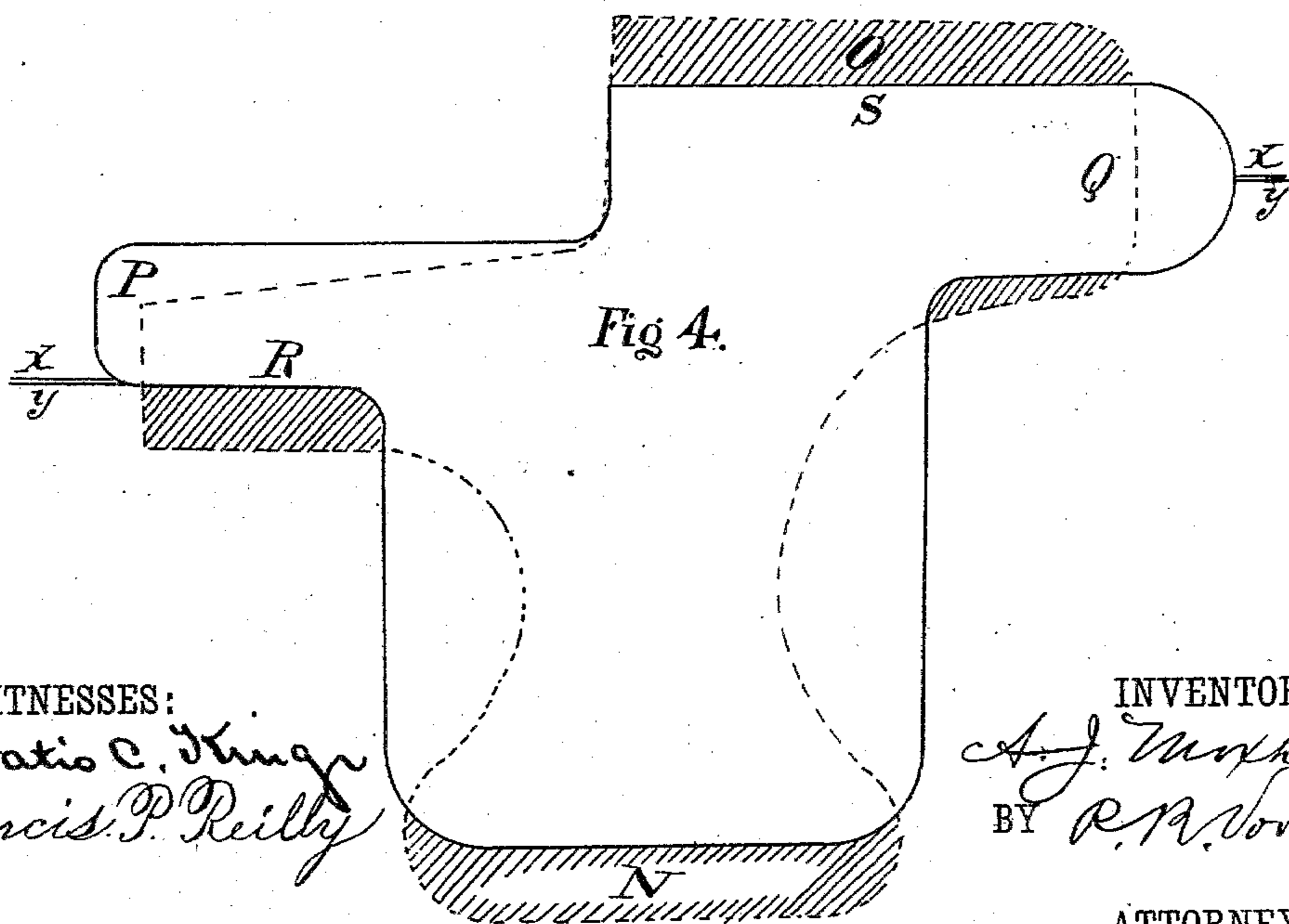
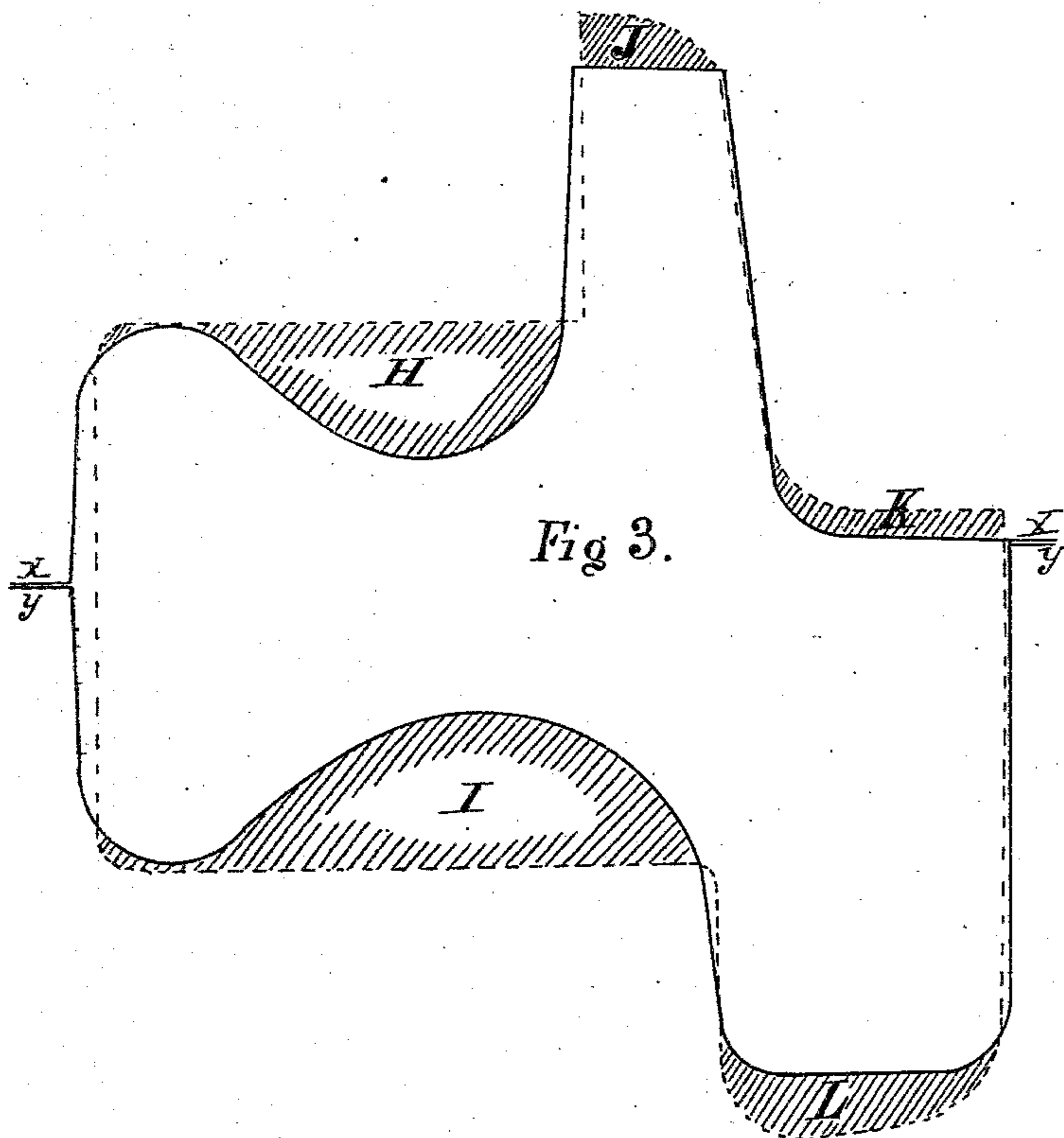
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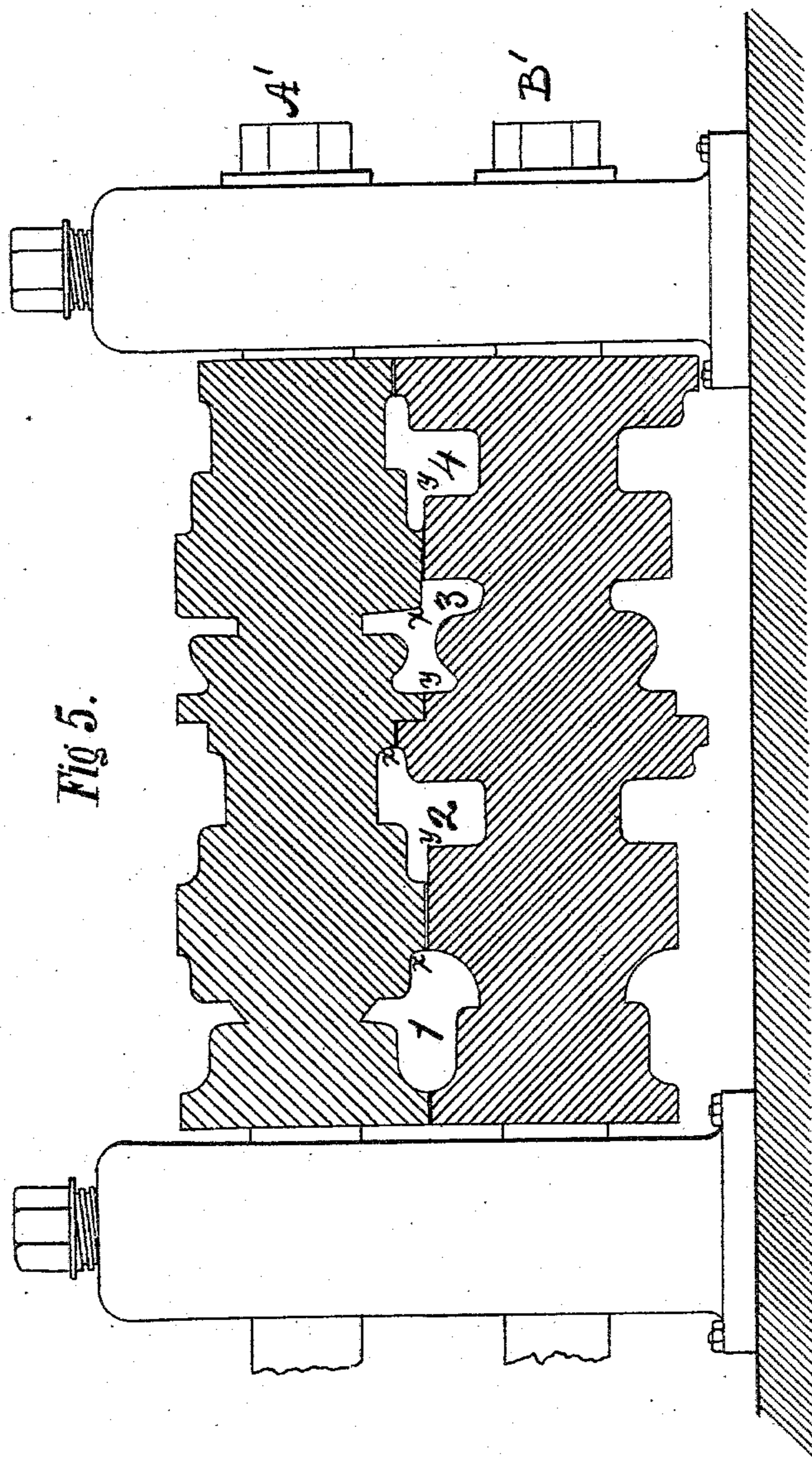


Fig 5.

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# UNITED STATES PATENT OFFICE.

ARTHUR J. MOXHAM, OF LOUISVILLE, KENTUCKY.

## ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 303,036, dated August 5, 1884.

Application filed November 26, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, ARTHUR J. MOXHAM, of Louisville, in the county of Jefferson and State of Kentucky, have invented a new and useful improvement in rolling-mills for rolling steel or iron blooms or piles into irregular girder shapes or rails, which improvement or invention is fully set forth and illustrated in the following specification and accompanying drawings.

The object of this invention is to quickly rough-roll or "rough-out" steel and iron blooms or piles into irregular forms, which can be subsequently further reduced or finished, as may be desired.

The invention consists of a pair of rolls having grooves or "passes" of the shapes and conformations hereinafter described.

In the drawings, Figure 5 represents a pair of rolls having the necessary grooves to carry out the invention. Figs. 1, 2, 3, and 4 represent, respectively, the several passes 1, 2, 3, 4 (enlarged) of the rolls shown in Fig. 5. Said figures also represent the said passes drawn to a scale of half size.

In said figures, it will be observed, that the full lines in Fig. 1 are reproduced as dotted lines in Fig. 2, the full lines in Fig. 2 as dotted lines in Fig. 3, and the full lines in Fig. 3 as dotted lines in Fig. 4, the full lines in Fig. 4 indicating the last pass of the series.

The dotted lines in Fig. 1 represent a bar or bloom rectangular or square in cross-section, and the rolling operation is performed throughout the respective passes by first entering the bloom, as shown in Fig. 1, diagonally—that is, with its diagonal lines vertical and horizontal. Rolled down in this pass to the shape shown by the full lines in Fig. 1, the bloom is then inserted into pass No. 2, as shown by the dotted lines, but turned one-fourth around to the left, so that the former vertical becomes the horizontal. Rolled down in this pass to the shape shown in full lines in Fig. 2, the bloom is then inserted into pass No. 3, as shown by the dotted lines, but turned one-fourth around to the right, so that the former horizontal becomes the vertical. Rolled down in this pass to the shape shown in full lines in Fig. 3, the bloom is then inserted into pass No. 4, as shown by the dotted lines, but turned

one-fourth around to the left, so that the former vertical becomes the horizontal. This completes the operation. The passes Nos. 2 and 4 are flattened or "dummy" passes.

The several grooves will now be more particularly described.

The letter A' indicates the upper roll, and B' the lower roll, their parting lines being indicated in the several figures by the letters  $x$  and  $y$ , respectively.

It will be observed that in pass No. 1, Fig. 1, are three tongues, A and B, in the top groove, and C in the bottom groove. These tongues bite the bloom as it is drawn into the pass, and the metal is caused to flow into the three spaces 1 2 3. The metal being thus free to flow into said spaces, the work done by said tongues is expended partly in this displacement of the metal or change of form, and partly, but to a less extent, in elongation of the metal. The bloom, as has been stated, is inserted on the diagonal, which of itself is no new thing to do. Such is the general practice in ordinary Gothic roughing grooves, and also in rolls for rolling bars square in cross-section; but in all these cases the work is regularly distributed over the sides of the square or Gothic and elongation, not displacement, effected. In other words, the pass has no spaces at all, said pass and the entering-bar having the same shaped cross-section. In this pass No. 1 such is not the case, as is evident from the description just given of the shape of the grooves constituting the pass, and of the character of the work performed therein; but in effecting the work, as is herein done, the great tendency of the bloom to turn or twist in the pass, being inserted on the diagonal, must be overcome, for a very slight difference in the work on one side compared with that on the other side will cause such twisting.

It will be seen from the drawing that the tongues A, B, and C are not equidistant from the center; hence provision must be made to prevent such conformation from causing a twist, which if begun cannot practically be undone or corrected in the pass. This twisting is entirely prevented and avoided in pass No. 1 by the spaces 1 2 3, above mentioned. Into these spaces the metal is free to flow, and with a given area or section of bite on the

part of the tongues A, B, and C, the tendency of the metal to flow into said spaces will be fixed and certain. If this bite be varied, the flow of the metal will vary. The parts of the grooves adjacent to the spaces 1 2 3 are therefore turned to such curves as will properly and neatly effect or accommodate this flow into said spaces. The whole pass therefore, or rather each part of each groove constituting the pass, properly grips the bloom, and subsequent turning or twisting in the pass is rendered impossible when once the bloom or bar is fully entered. Care must be taken, however, not to have said spaces too large, or twisting will be inevitable. In practice it is even preferable to have said spaces of a little less capacity than would be demanded for the flow naturally imparted to the metal in order to insure positive action on the part of the rolls upon the metal. By the means just described twist is not only prevented, but the desired shape of the mass of metal for the next pass is also effected. It is evident, therefore, that as long as the relation between the tongues and the spaces in pass No. 1 is preserved, as above described, that the proportions of a girder may be varied, and yet be rolled in a pass of proper configuration therefor without departing from the invention illustrated in said pass No. 1.

The grooves in pass No. 2 are dummy-grooves. In this pass, it will be observed, that the protrusion Y (shown in dotted outlines) is thrown upward to fill out the space D, while the protrusion G X (shown in dotted outlines) is subjected to the ordinary action of a dummy-groove to fill out the space E, the work of elongation or draft proper being done at the points F and G X. Ordinarily a dummy-pass is only used for purposes of reduction of sectional area simultaneously with the horizontal spreading of some particular point, as described at G X; but in this case, while said pass effects such action at G X, its action upon the protrusion Y is principally exerted to change the location of the mass protruding at Y, as above stated, rather than to spread said mass by draft exerted thereupon. In pass No. 3, Fig. 3, there is nothing notable but its shape, (shown in full lines,) to which the metal is reduced from the shape (shown in dotted lines) in which it left pass No. 2. Pass No. 4, Fig. 4, is (like pass No. 2) a dummy-pass, in which the metal is reduced to the desired shape (shown in full lines) from the shape (shown in dotted lines) received in pass No. 3.

There is a twofold advantage gained in rolling in such rolls as are herein described by entering the blooms or bars upon the "diagonal," for, in the first place, the diagonal being longer than any one side, the bloom is entered with one of its diagonals vertical. Thus the maximum depth of metal is secured (where greatest depth is needed) for first-class girders. If, however, shallow girders only are needed, the excess of depth after leaving the

first pass is still available for use (being therein easily flattened) in the succeeding dummy-passes, Nos. 2 and 4, Figs. 2 and 4. There is great latitude permissible in the use of a dummy or spreading pass, for, by putting a maximum of work or "draft" on the dummy-passes, any excess of depth can be quickly rolled down or removed. It is easier in all rolling to reduce vertically than to increase horizontally; hence we have in this case, from the use of the diagonal entry, a maximum of benefit derived from the original dimensions of the bloom or other mass subjected to the rolling operation.

The rolls herein described are adapted to the manufacture of girder tram-rails.

It is obvious that if a form of girder be desired, either plain or of any shape having a flange unaccompanied by an offset, the necessary changes for such purpose may be made in the grooves or passes without departing from this invention in any substantial particular.

Having thus fully described my said improvements as of my invention, I claim—

1. A set of rolls for rolling blooms or piles of rectangular cross-section into girder-rails or beams, provided with a pass or grooves, having shaping or forming tongues, as A B C, therein, and spaces, as at 1 2 3, the absolute volume of space thus provided for the flow of the metal being only equal to or slightly less than the volume of metal displaced under the shaping action of said tongues thereon, whereby the bloom or pile, being entered into said pass with one of its diagonal lines vertical and the other horizontal, is supported by all portions of the pass, twisting of the same being thereby prevented and straight delivery of the metal from the pass secured, all substantially as described, for the purposes set forth.

2. A set of rolls for rolling metal blooms or piles into girder shapes, provided with a dummy pass or grooves, having spaces, as at E and D, substantially of the contour indicated in Fig. 2, the desired shape of metal in the space E being imparted by elongation, but in the space D mainly by displacement independently of elongation, all substantially as described, for the purposes set forth.

3. A set of rolls for rolling metal blooms or piles, provided with two passes substantially of the conformation indicated in Figs. 1 and 2, for the purposes set forth.

4. A set of rolls for rolling metal blooms or piles, provided with two passes substantially of the conformation indicated in Figs. 3 and 4, for the purposes set forth.

5. A set of rolls for rolling metal blooms or piles, provided with passes substantially of the conformation indicated in Figs. 1, 2, 3, and 4, for the purposes set forth.

A. J. MOXHAM.

Witnesses:

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J. E. SEDLMEYER.