

No. 706,310.

Patented Aug. 5, 1902.

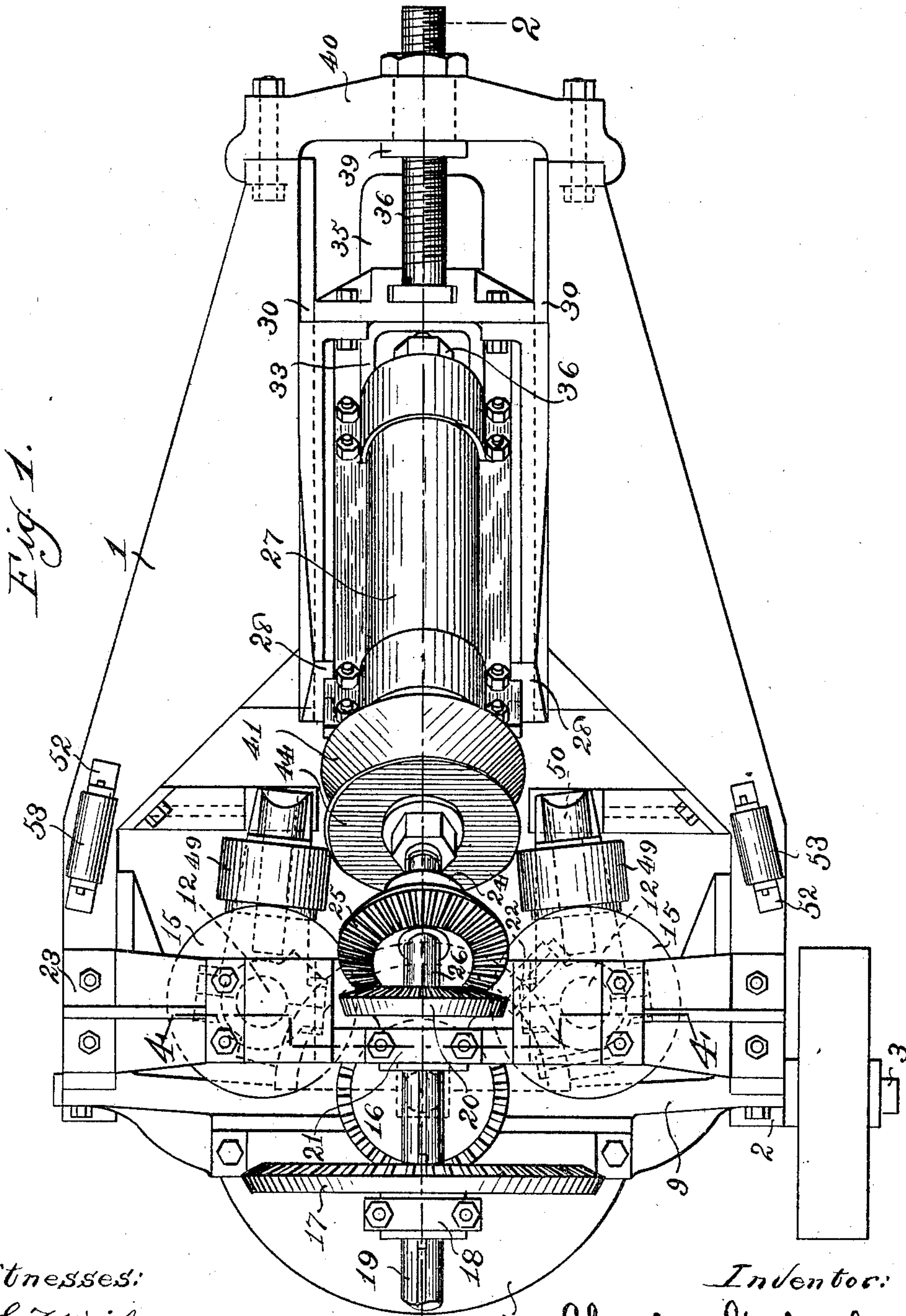
C. GABRIEL.

MACHINE FOR BENDING ANGLE IRONS, CHANNEL IRONS, &c.

(Application filed July 12, 1901.)

(No Model.)

4 Sheets—Sheet 1.



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*John Snowhook*

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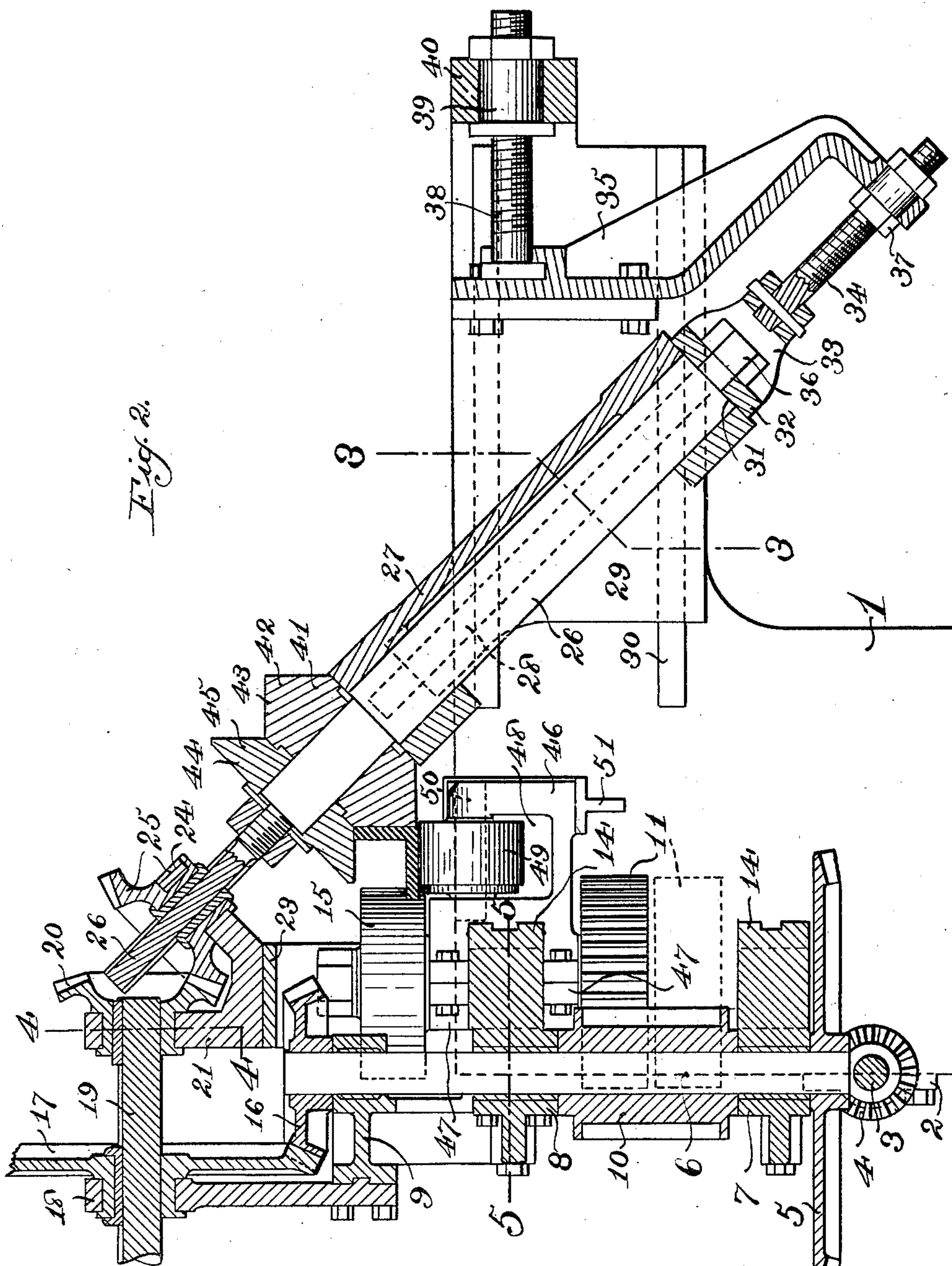
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4 Sheets—Sheet 2.



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Fig. 3.

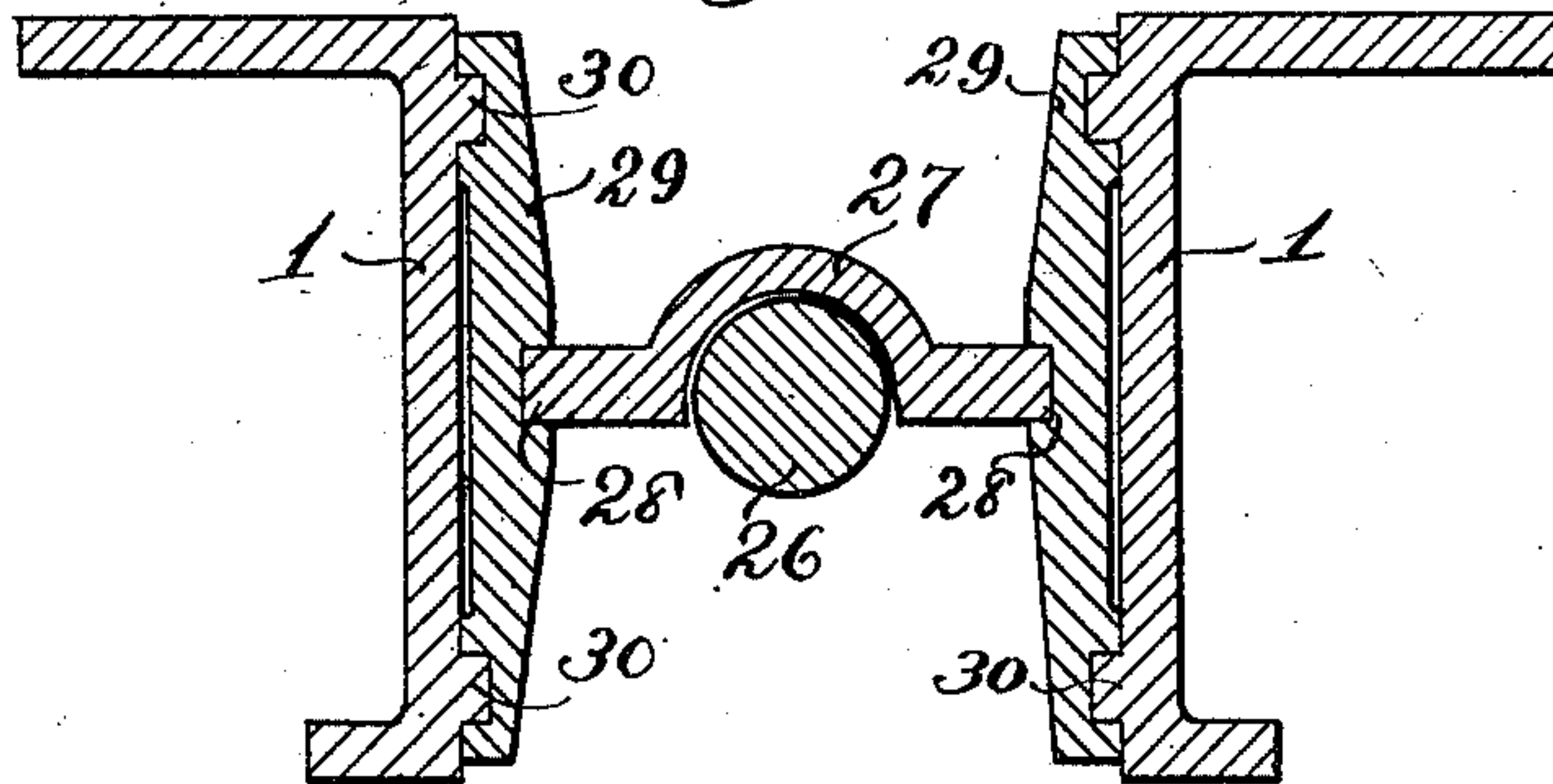


Fig. 4.

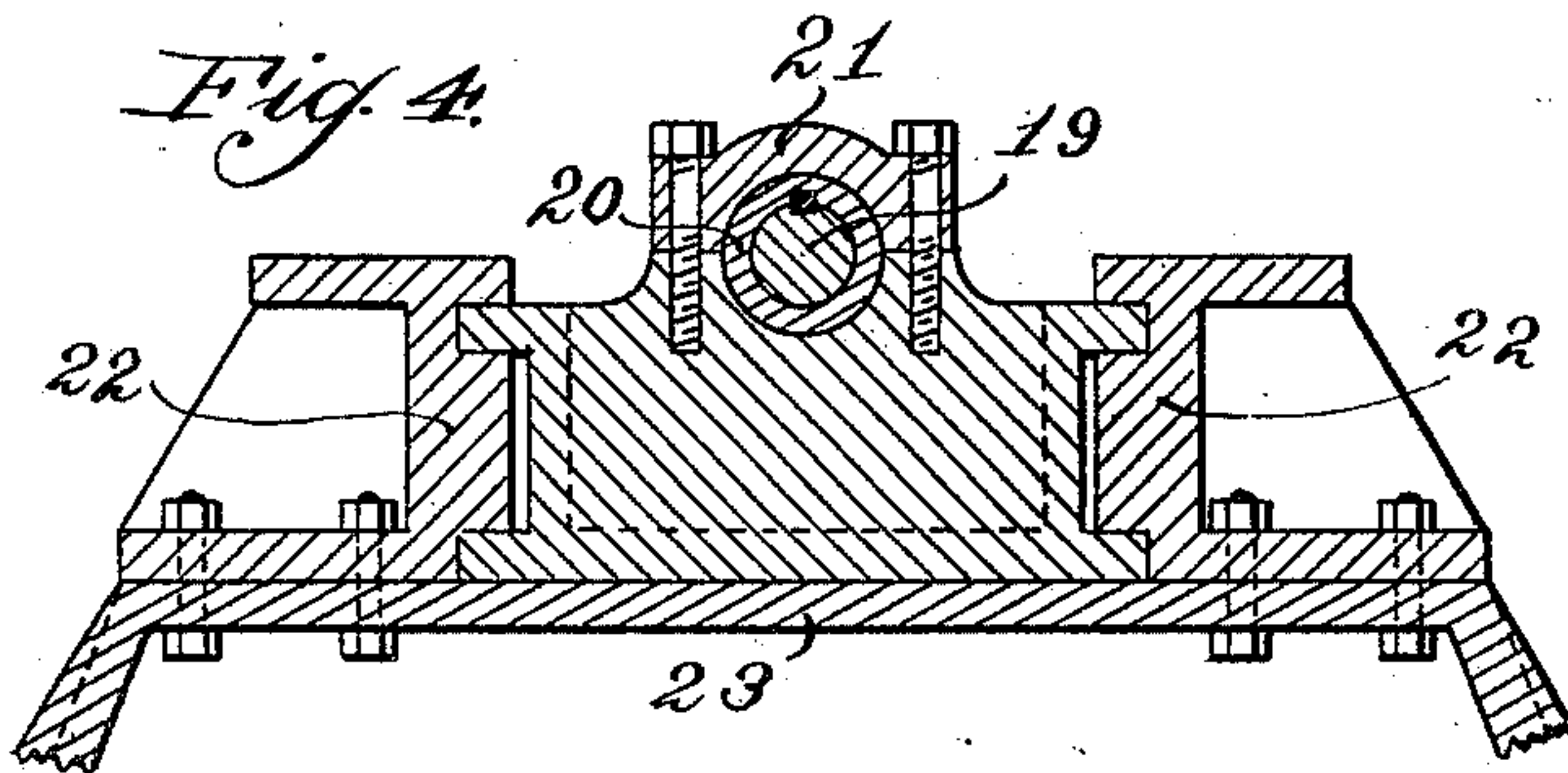
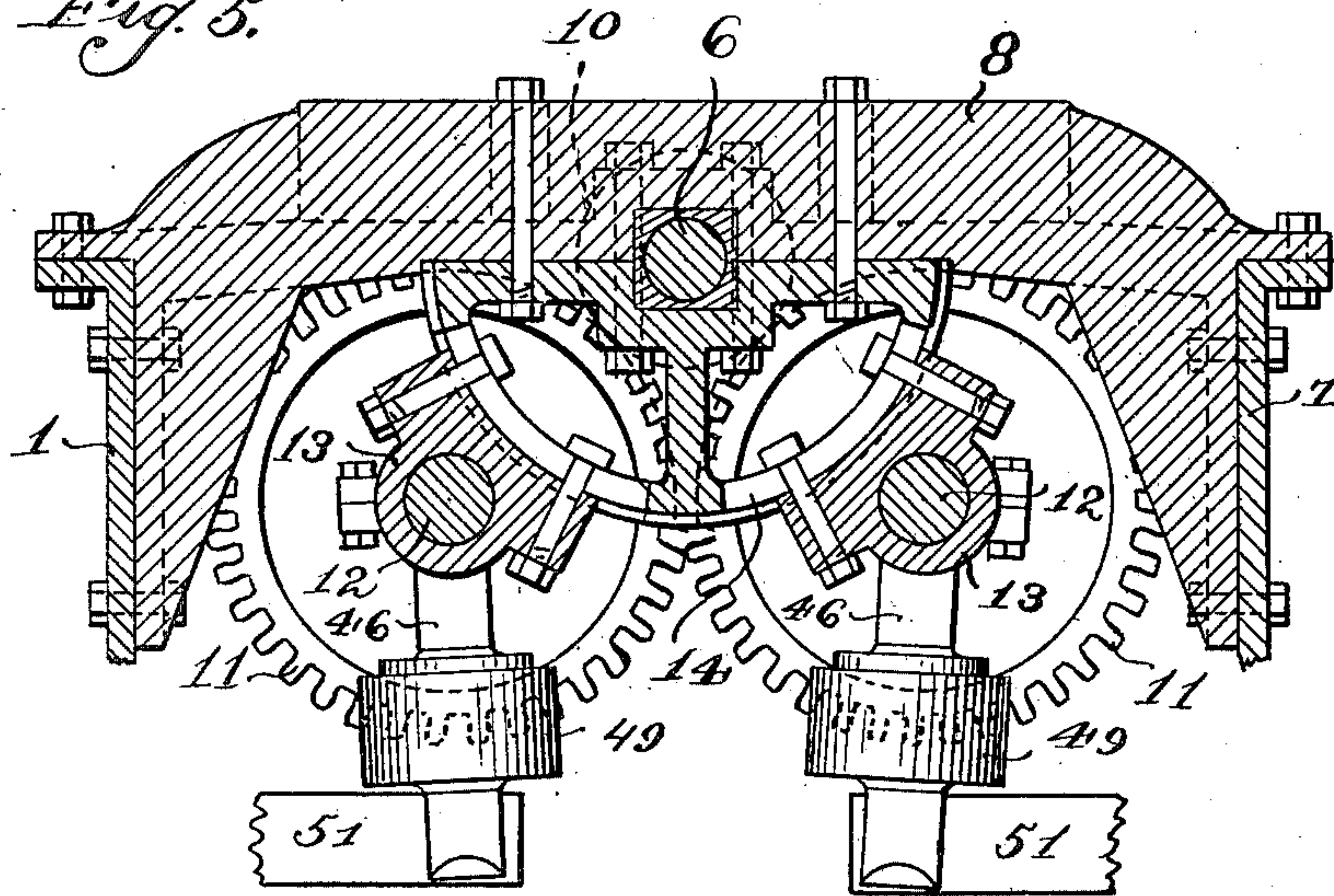


Fig. 5.



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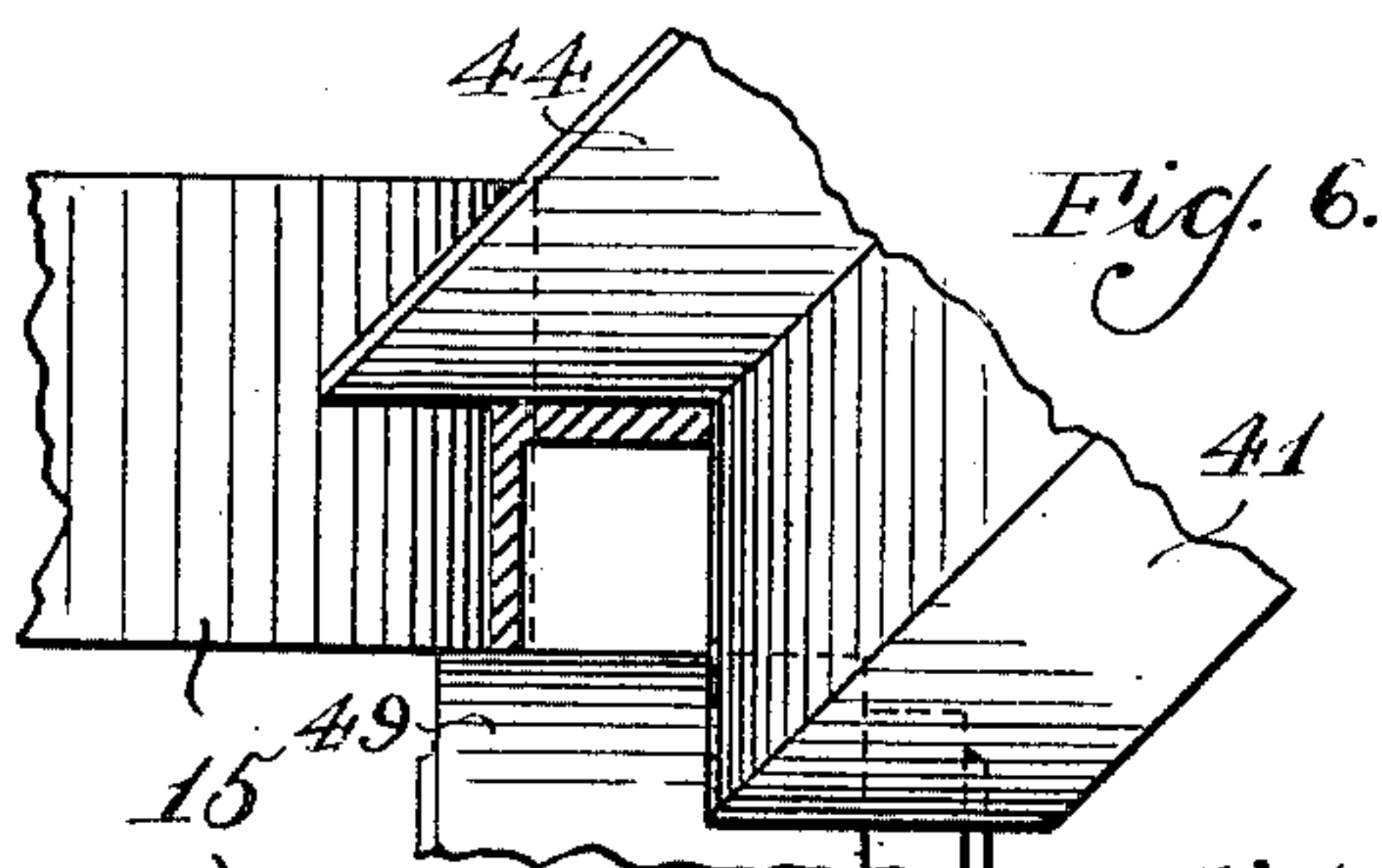


Fig. 6.

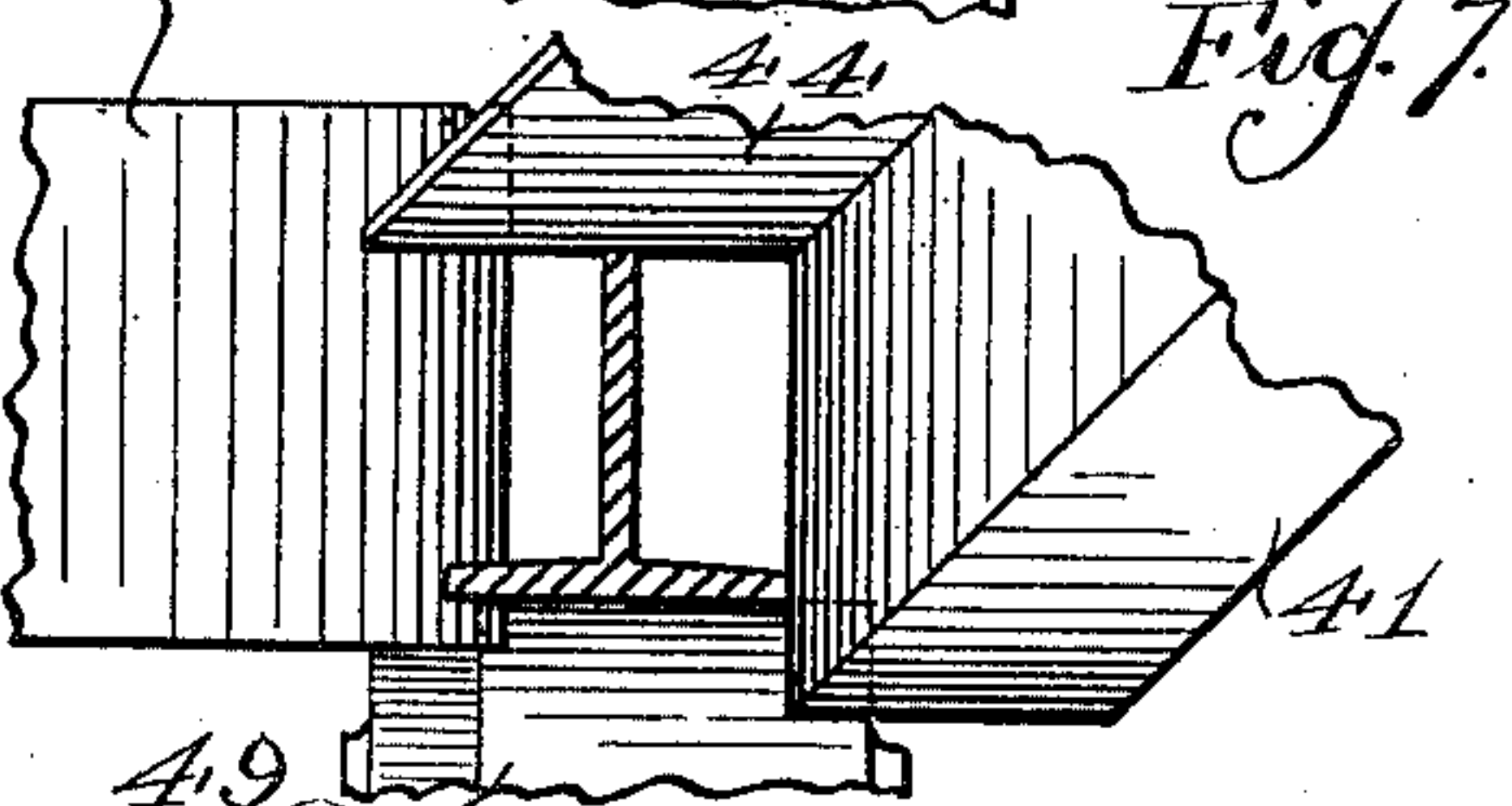


Fig. 7.

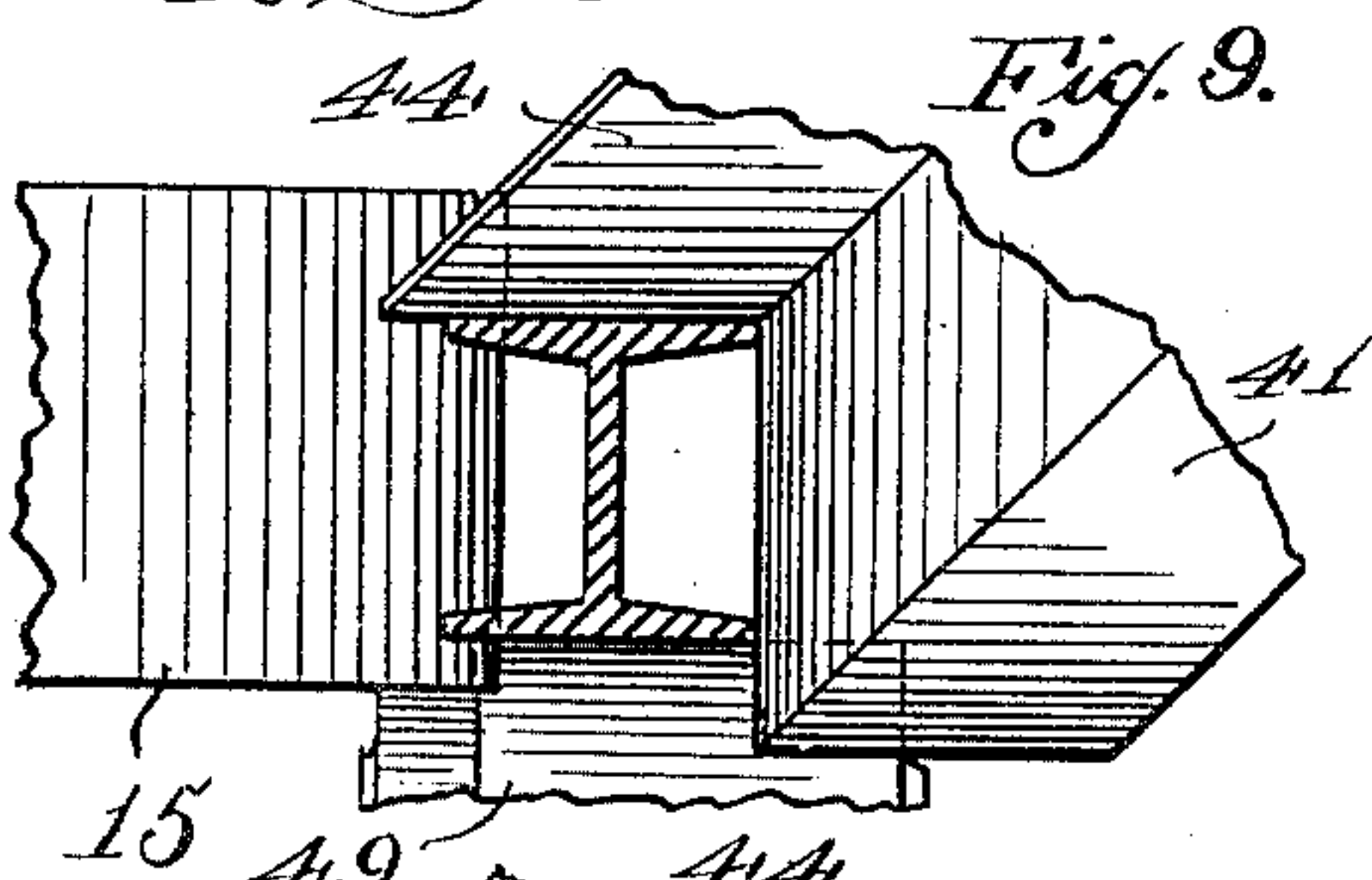


Fig. 9.

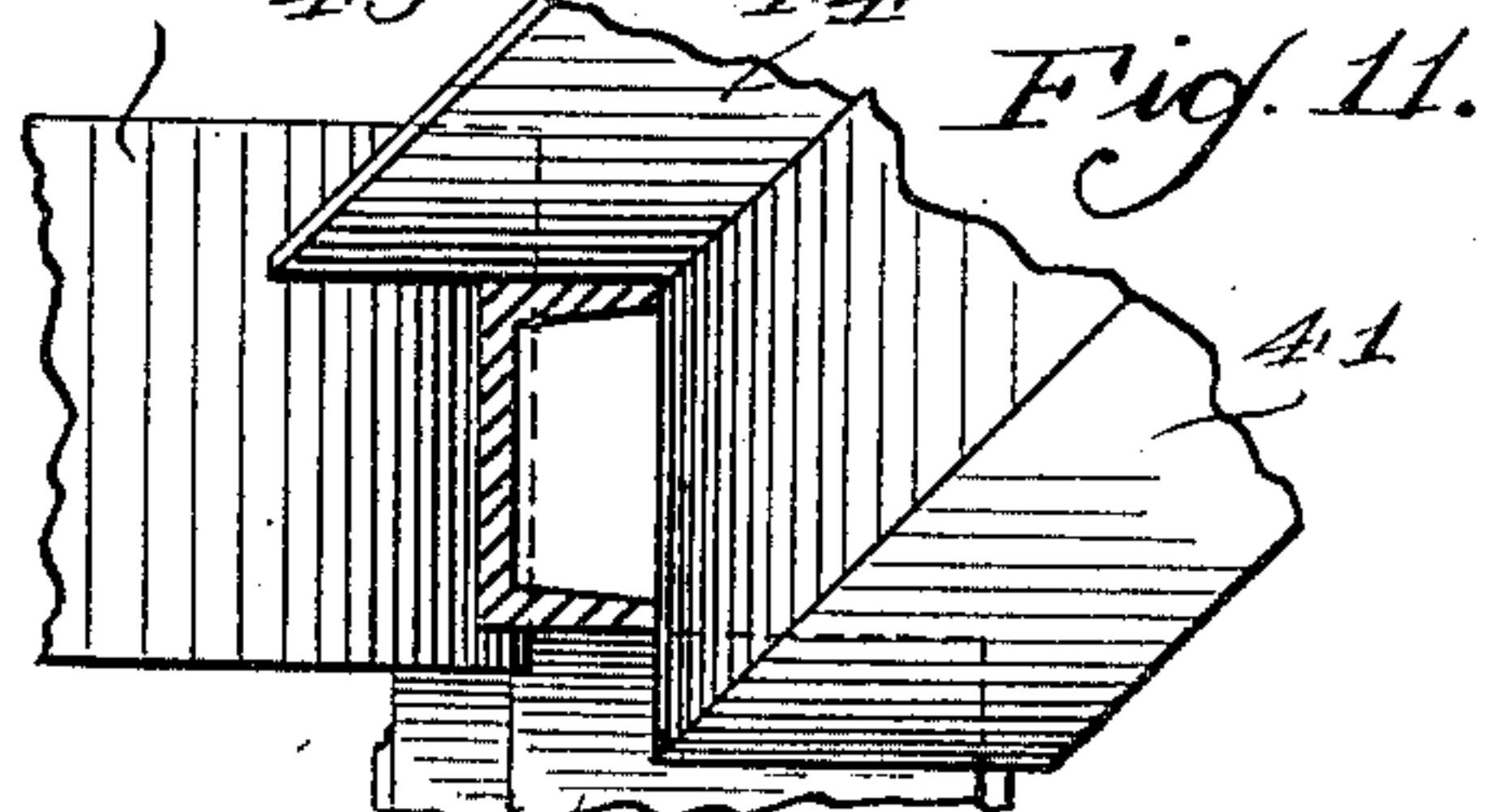


Fig. 11.

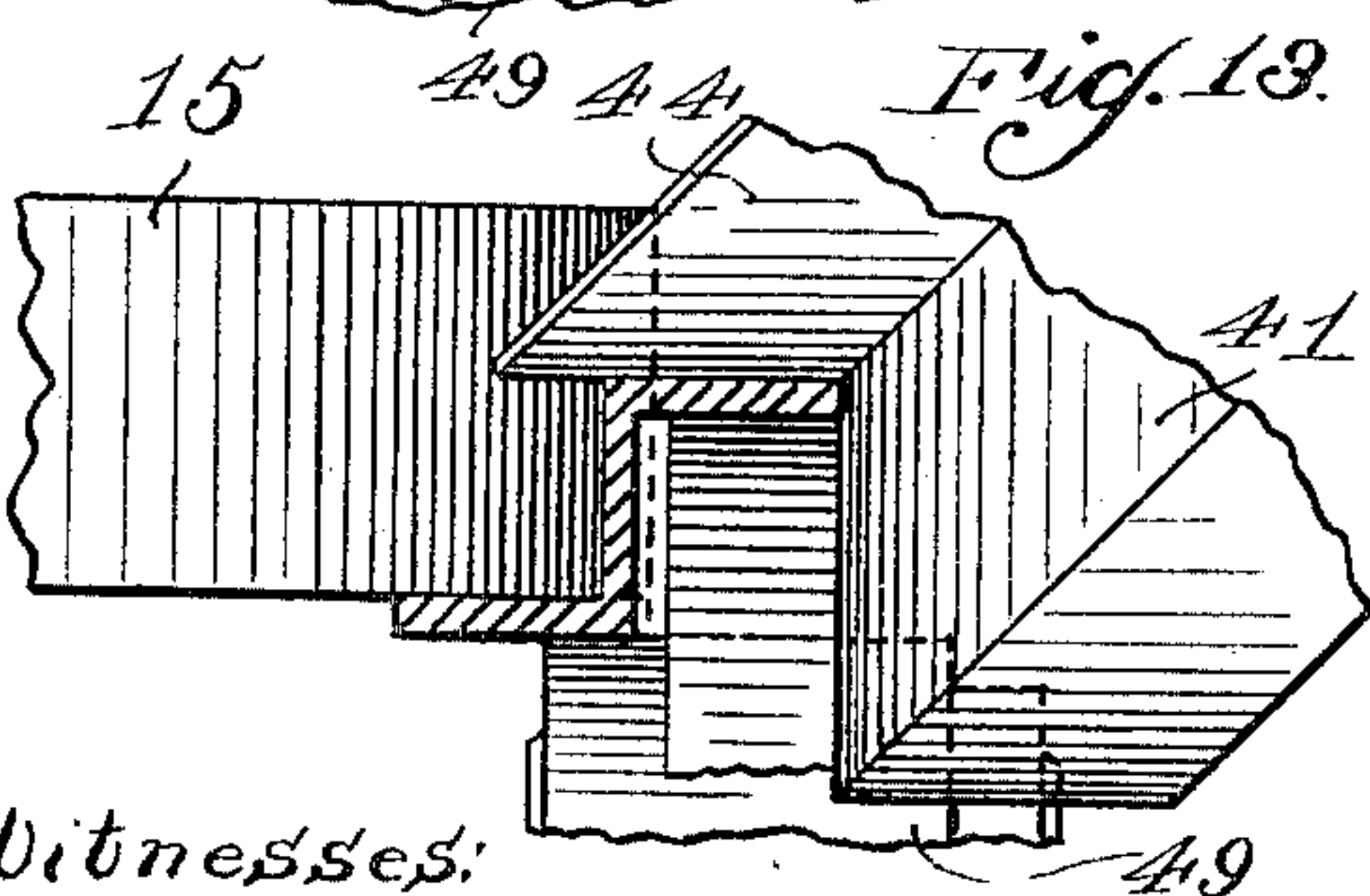


Fig. 13.

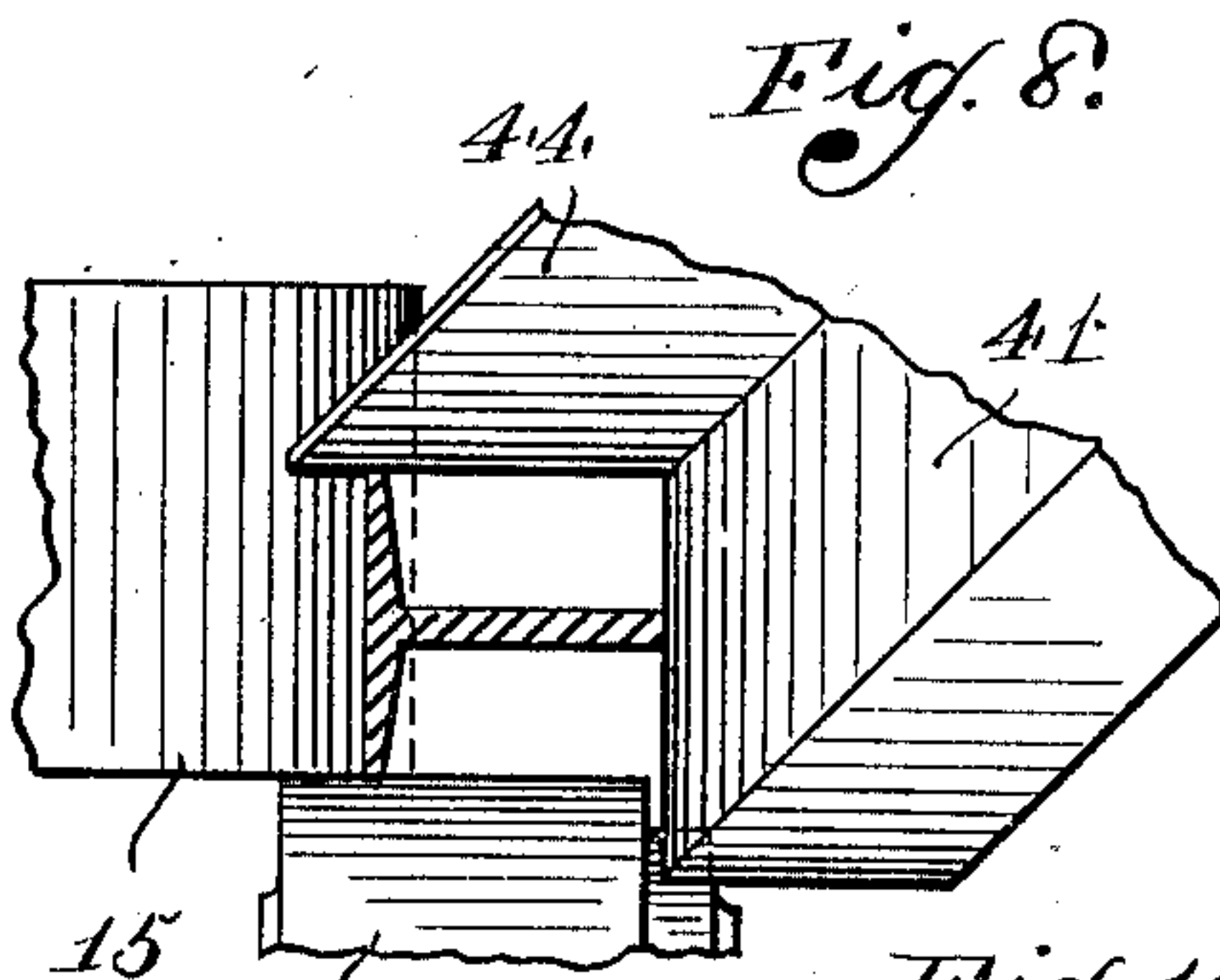


Fig. 8.

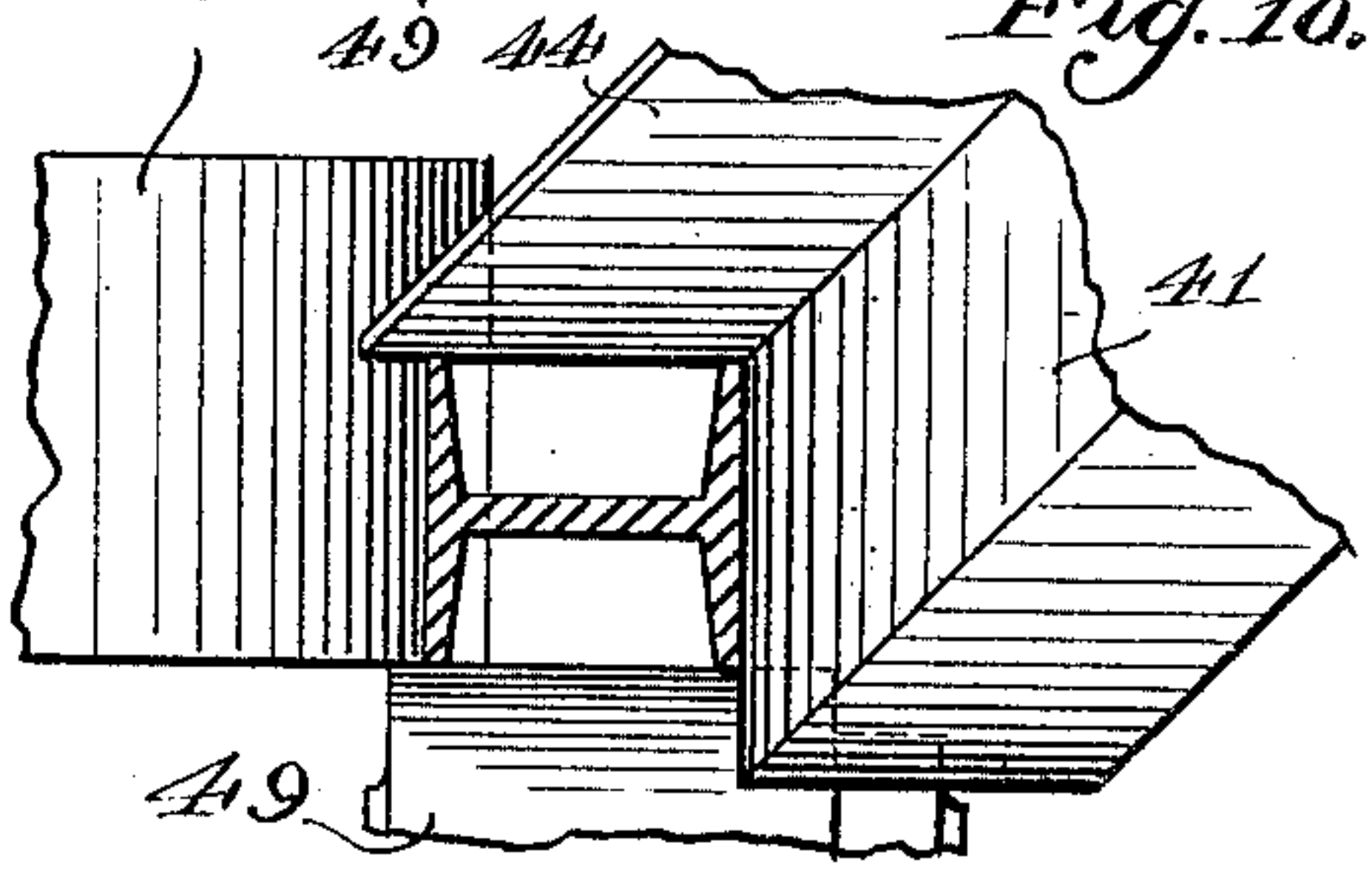


Fig. 10.

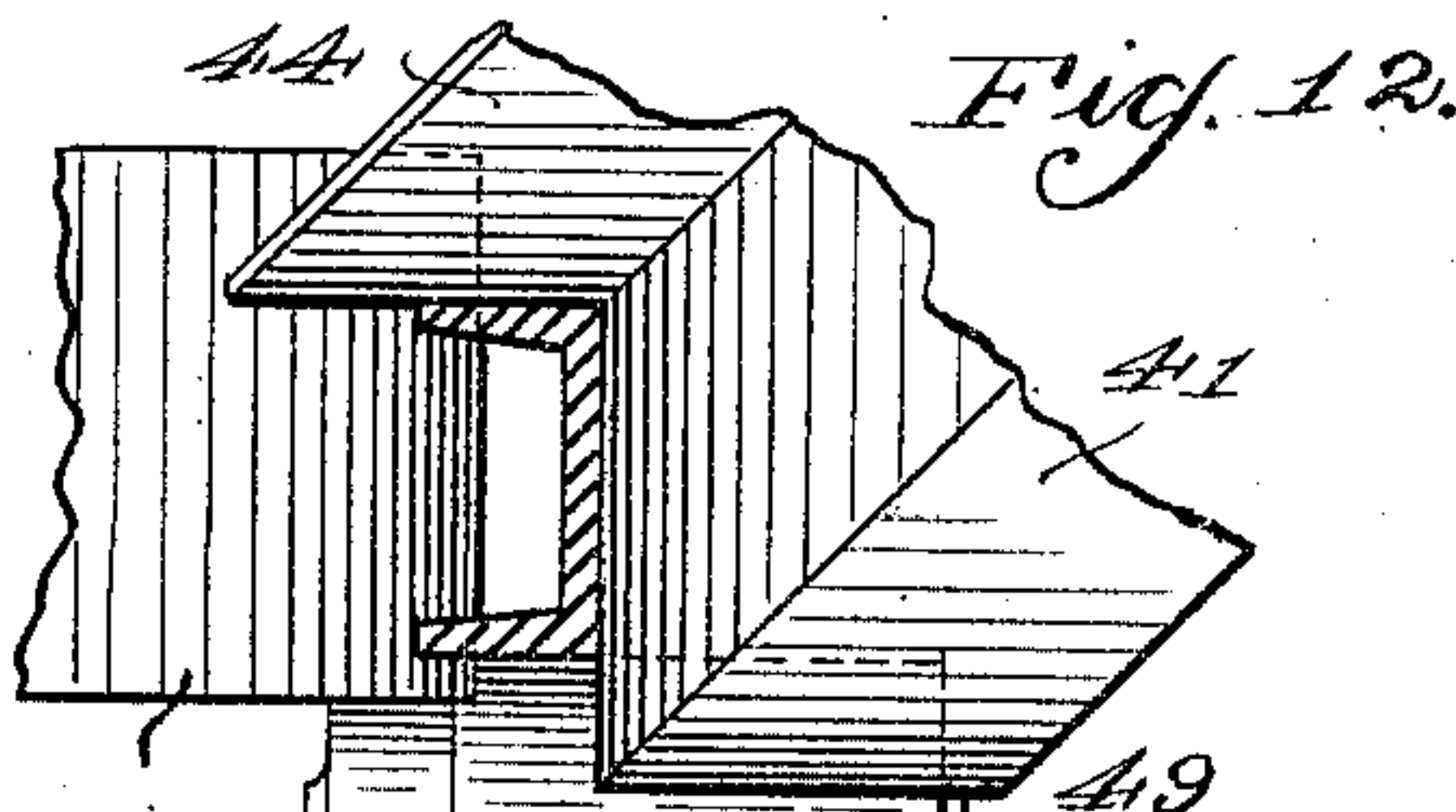


Fig. 12.

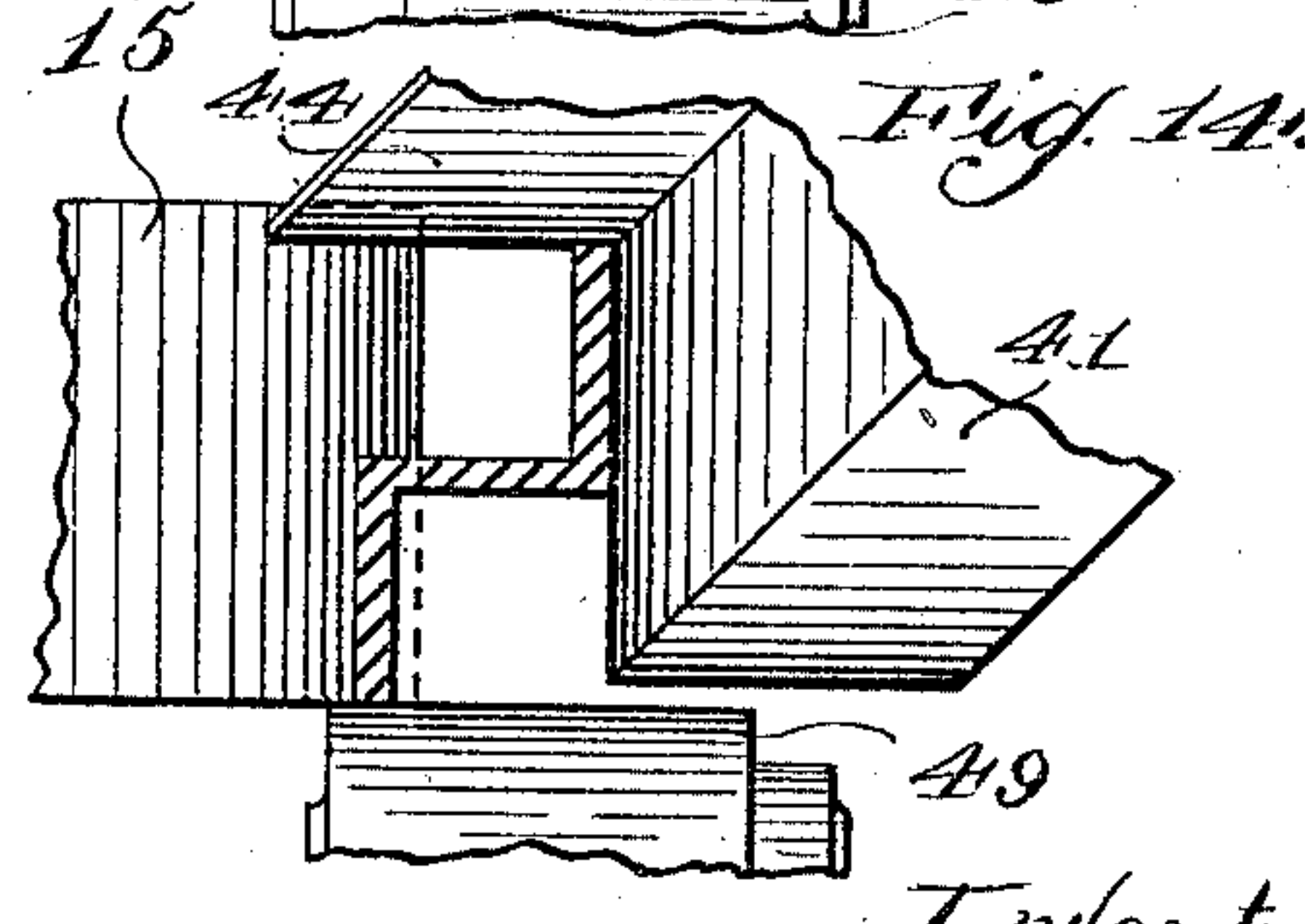


Fig. 14.

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# UNITED STATES PATENT OFFICE.

CHARLES GABRIEL, OF CHICAGO, ILLINOIS.

## MACHINE FOR BENDING ANGLE-IRONS, CHANNEL-IRONS, &c.

SPECIFICATION forming part of Letters Patent No. 706,310, dated August 5, 1902.

Application filed July 12, 1901. Serial No. 68,039. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES GABRIEL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Machines for Bending Angle-Irons, Channel-Irons, &c.; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a novel construction in a machine for bending angle-irons, Z-bars, channel-bars, I-beams, &c., the object being to provide a machine adapted to receive any desired standard form of rolled iron or steel and bend the same cold to any desired curvature; and it consists in the features of construction and combinations of parts herein-  
after fully described and claimed.

In the accompanying drawings, illustrating my invention, Figure 1 is a top plan view of a machine constructed in accordance with my invention. Fig. 2 is a central longitudinal section of the same on the line 2 2 of Fig. 1. Fig. 3 is a detail transverse section on the line 3 3 of Fig. 2. Fig. 4 is a detail transverse section on the lines 4 4 of Figs. 1 and 2. Fig. 5 is a horizontal section on the line 5 5 of Fig. 2. Figs. 6 to 14, inclusive, are detail views in elevation, showing the relative positions of the bending members for bending various shapes of bars.

To bend rolled iron and steel bars of various shapes cold requires considerable power, but more particularly it requires that the piece to be bent shall be so held in place between the bending devices as to positively prevent the buckling of any flange or any change in the cross-sectional form of the bar. It is particularly desirable that the machine be as simple as possible in construction and every part thereof very strong, strength being obviously requisite and simplicity of adjustment for bending various shapes and sizes of bars essential, as complication in this direction leads to confusion and delicacy in certain parts, which is positively fatal to successful operation.

In order to successfully bend an angle or channel bar, the same must be held so that

when bent it will lie in a given plane. This necessitates six bearing-points on the bar, three of which serve to accomplish the bending operation and the other three of which serve to prevent bending in a transverse direction. Should it be desired to bend such bar in two directions—as, for instance, to bend a channel-bar so that the web becomes conical—then the last three bearing-points are set to accomplish the bend in the transverse direction.

My machine consists of a frame 1, comprising two side plates connected together by means of a plurality of cross-bars carrying bearings in which shafts carrying the working parts of the machine are journaled. Said frame 1 carries bearings 2 at one end, in which the drive-shaft 3 is journaled. The latter carries a bevel-pinion 4, meshing with the bevel-gear 5 on the lower end of a vertical shaft 6, journaled in cross-bars 7, 8, and 9. Said shaft 6 carries a spur-pinion 10 between its ends, which meshes with a spur-gear 11 on each of two counter-shafts 12, journaled in bearings 13, movably mounted on semicircular guides 14 on said cross-bars 7 and 8 and concentric with said shaft 6. The said pinion 10 is more than double the width of both the spur-gears 11, and the latter are relatively so mounted as to permit them to overlap each other. Said counter-shafts 12 carry rollers 15 at their upper ends, which are rigid therewith and form one of the main parts of the bending devices. At its upper end said shaft 6 carries a bevel-gear 16, meshing with a bevel-gear 17, journaled in a bearing 18 on the cross-bar 9 and held against longitudinal movement in said bearing 18. A shaft 19 is longitudinally movable in said bevel-gear 17 and at its other end carries a miter-gear 20, the hub of which is journaled in and is longitudinally rigid with a frame 21, movable in guides 22 on a cross-bar 23. Said frame 21 carries a bearing 24, in which the hub of a miter-gear 25 is journaled and meshes with the miter-gear 20. A shaft 26 is keyed to and longitudinally movable in said miter-gear 25 and stands at an angle of forty-five degrees to the shaft 6. Said shaft 26 is enlarged at its middle portion, and at such enlarged portion is jour-



naled in a sleeve-bearing 27, which is longitudinally movable in guides 28 in a frame 29, which in turn is horizontally movable in guides 30 on the side plates of the frame 1.

5 The lower end of said shaft 26 is reduced to form a shoulder 31, and said reduced end passes through a plate 32 of a frame 33, rigidly mounted upon the said sleeve-bearing 27 and having rigid connection with the upper

10 end of a screw-shaft 34, journaled in a downwardly-extending arm 35 of said frame 29. Said reduced end of said shaft 26 is threaded to receive a nut 36, which serves as a collar to prevent said shaft 26 from longitudinal

15 movement relatively to said frame 33. Said screw-shaft 34 passes through a threaded sleeve-nut 37, which is journaled in said arm 35 of said frame 29 and is longitudinally rigid. By turning said nut said screw-shaft 34 is

20 moved longitudinally. Said frame 29 is moved in its guides and held in any desired position by means of a screw-shaft 38, which is rigid therewith and passes through a sleeve-nut 39, journaled in a bearing 40 in the end of the

25 frame 1. Said shaft 26 carries a roller 41, which is turned off to form two conical faces 42 and 43, extending at an angle of forty-five degrees to the axis of said shaft and ninety degrees to each other. Above said roller 41

30 is a second roller 44, having one tapered face 45, extending at an angle of ninety degrees to the face 43 of said roller 41. Said face 43 of said roller 41 when revolving is always parallel with the faces of the rollers 15 at one

35 point, as will be obvious, while the faces 42 and 45 are always perpendicular thereto at a corresponding point. Thus a bar passing between the rollers 15 on one side and said roller 41 on the other side will be compressed on

40 parallel lines. On each of said shafts 12 a frame 46 is pivotally mounted, said frame having two journals 47, engaging same above and below the upper movable bearing 13. At the free end of said frame is a recess 48, into

45 which an idler 49, carried by a shaft 50, extends, said shaft 50 being journaled in said frame. The free end of each of said frames 46 rests upon and is supported by a bracket 51, secured to one of the side plates of the

50 frame 1, and when swung to the desired position is held in place by means of pins entering openings in the said brackets. Said idlers 49 are adapted to support the bar to be bent.

The manner of mounting the shaft 26 obviously permits same ample adjustment to bring the rollers 41 and 44 in proper position relatively to the rollers 15 to receive the bar to be bent, and the curve to which such bar is to be bent having been determined said

55 rollers 15 and shaft 26 are adjusted to the proper position, so as to bear upon such bar at three points, one of which is midway between the two others. The face 43 of roller 41 coacts with the rollers 15 to bend the bar,

60 while the idlers 49 and face 45 of roller 44 coact to hold said bar in position during the

bending operation. The last-named parts may obviously also be set to bend the bar vertically at the same time that it is bent horizontally by the other parts. Should it be

70 desired to bend the bar to spiral form, I mount a small frame 52, carrying an idler 53 on one of the side pieces of said frame 1, the uppermost portion of said idler 53 being higher than the uppermost portions of the idlers 49.

75 The end of the bar first leaving the bending-rolls will be forced upward by said idler 53, thereby bending same vertically and making it spiral. The end portions of the bar will remain straight for a distance equal to the dis-

80 tance between the point on one of the rollers 15 and point on roller 41, bearing against the bar, as will be obvious.

I can so manipulate my machine as to enable me to bend bars to numerous shapes, 85 such as irregular and ogee curves, spiral, and so that one flange or the web lies in a cone, &c. To accomplish the last operation, the shaft 26 is lowered vertically, thereby causing the bar to be bent simultaneously in two

90 directions and producing a conical ring. By means of the single shaft 26 set at an angle and carrying the bevel-faced rollers I am enabled to accomplish what otherwise would require two or more shafts or would require two

95 or more operations, and besides this I am enabled to bend bars with greater accuracy than is possible with a greater number of operations.

I claim as my invention—

1. In a machine of the kind specified, the combination with a driven shaft mounted in a bearing movable in two directions and carrying a roller, of two driven rollers mounted on shafts journaled in bearings movable rela-

105 tively to each other and to said first-named shaft, said rollers on said shafts being adapted to bear on the bar to be bent at three different points to bend the same.

2. In a machine of the kind specified, the combination with a shaft standing at an angle of forty-five degrees to a vertical line and carrying bevel-faced rollers, of two pairs of rollers turning on vertical and horizontal axes respectively and journaled in movable bear-

115 ings, said rollers being adjusted relatively to each other and to said bevel-faced roller to coact with the latter to bear upon and bend a bar to any desired single or compound curvature.

3. In a machine of the kind specified, the combination with two pairs of rollers revolvable on horizontal and vertical axes respectively, of a shaft standing at an angle of forty-five degrees to the axes of rotation of each of

125 said pairs of rollers, a sleeve-bearing carrying said shaft, a frame in which said sleeve-bearing is longitudinally movable, guides in the frame of the machine in which said frame carrying said bearing is movable in a direc-

130 tion at an angle to the direction of movement of said sleeve-bearing, and bevel-faced roll-



ers carried by said shaft and coacting with said pairs of rollers respectively to bear upon the bar to be bent to bend the latter.

4. In a machine of the kind specified, the combination with a frame, a drive-shaft journaled therein, a curved guide on said frame concentric with said shaft, bearings movably mounted on said guide, shafts journaled in said bearings and carrying spur-gears, a pinion on said drive-shaft intermeshing with each of said spur-gears, and rollers carried by said shafts, of a shaft journaled in a bearing on said frame and carrying a roller coacting with said first-named rollers to bear upon and bend a bar.

5. In a machine of the kind specified, the combination with a frame, a drive-shaft journaled therein, a curved guide on said frame concentric with said shaft, bearings movably mounted on said guide, shafts journaled in said bearings and carrying spur-gears, a pinion on said drive-shaft intermeshing with each of said spur-gears, and rollers carried by said shafts, of a shaft journaled in a bearing on said frame and carrying a roller coacting with said first-named rollers to bear upon and bend a bar, and gearing between said last-named shaft and said drive-shaft.

6. In a machine of the kind specified, the combination with a frame, a drive-shaft journaled therein, a curved guide on said frame concentric with said drive-shaft, bearings movably mounted on said guide, counter-shafts journaled in said bearings, gearing between said drive-shaft and said counter-shafts, rollers carried by said counter-shafts, bearings pivotally secured to said counter-shafts, shafts journaled in said pivoted bearings extending transversely to said counter-shafts, and rollers on said transverse shafts, of a shaft carrying rollers coacting with the rollers on said counter-shafts and said transverse shafts to bear upon and bend a bar.

7. In a machine of the kind specified, the combination with a frame, a drive-shaft journaled therein, a curved guide on said frame concentric with said drive-shaft, bearings movably mounted on said guide, counter-shafts journaled in said bearings, gearing between said drive-shaft and said counter-shafts, rollers carried by said counter-shafts, bearings pivotally secured to said counter-shafts, shafts journaled in said pivoted bearings extending transversely to said counter-shafts, and rollers on said transverse shafts, of a shaft carrying rollers coacting with the rollers on said counter-shafts and said transverse shafts to bear upon and bend a bar, and means for adjusting said last-named shaft relatively to said counter-shafts and trans-

verse shafts to bring said rollers thereon into the desired position relatively to said rollers on said counter and transverse shafts.

8. In a machine of the kind specified, the combination with a frame, a drive-shaft journaled therein, a curved guide on said frame concentric with said drive-shaft, bearings movably mounted on said guide, counter-shafts journaled in said bearings, gearing between said drive-shaft and said counter-shafts, rollers carried by said counter-shafts, bearings pivotally secured to said counter-shafts, shafts journaled in said pivoted bearings extending transversely to said counter-shafts, and rollers on said transverse shafts, of a frame movable in guides in the frame of the machine transversely to said drive-shaft, a sleeve-bearing mounted in guides in said movable frame movable longitudinally in said guides and extending at an angle of forty-five degrees to said drive-shaft, a shaft journaled in said bearing, gearing between said shaft and the drive-shaft, and beveled rollers mounted on said shaft and adapted to coact with said rollers on said counter-shafts, and drive-shafts to bend a bar in one or more directions.

9. In a machine of the kind specified, the combination with a pair of rollers revoluble on vertical axes and adapted to bear upon the bar to be bent on one face, and a pair of rollers revoluble on horizontal axes and adapted to bear upon the bar to be bent on a face transverse to the face engaged by said first-named rollers, of a shaft extending at an angle of forty-five degrees to the vertical axes of said first-named rollers, an adjustable sleeve-bearing carrying said shaft and movable horizontally and longitudinally, and a grooved roller carried by said shaft and having one face overhanging and adapted to coact with said horizontal rollers and engage the face of the bar opposite to that engaged by said horizontal rollers, and having a beveled face in horizontal alinement with said vertical rollers and adapted to engage the face of the bar opposite that engaged by said vertical rollers, said beveled faces being adapted to bear upon the bar at points practically midway between the points of engagement of said vertical, and horizontal rollers respectively, and forming a third bearing-point relatively to each of said pairs.

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

CHARLES GABRIEL.

Witnesses:

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JOHN SNOWHOOK.