

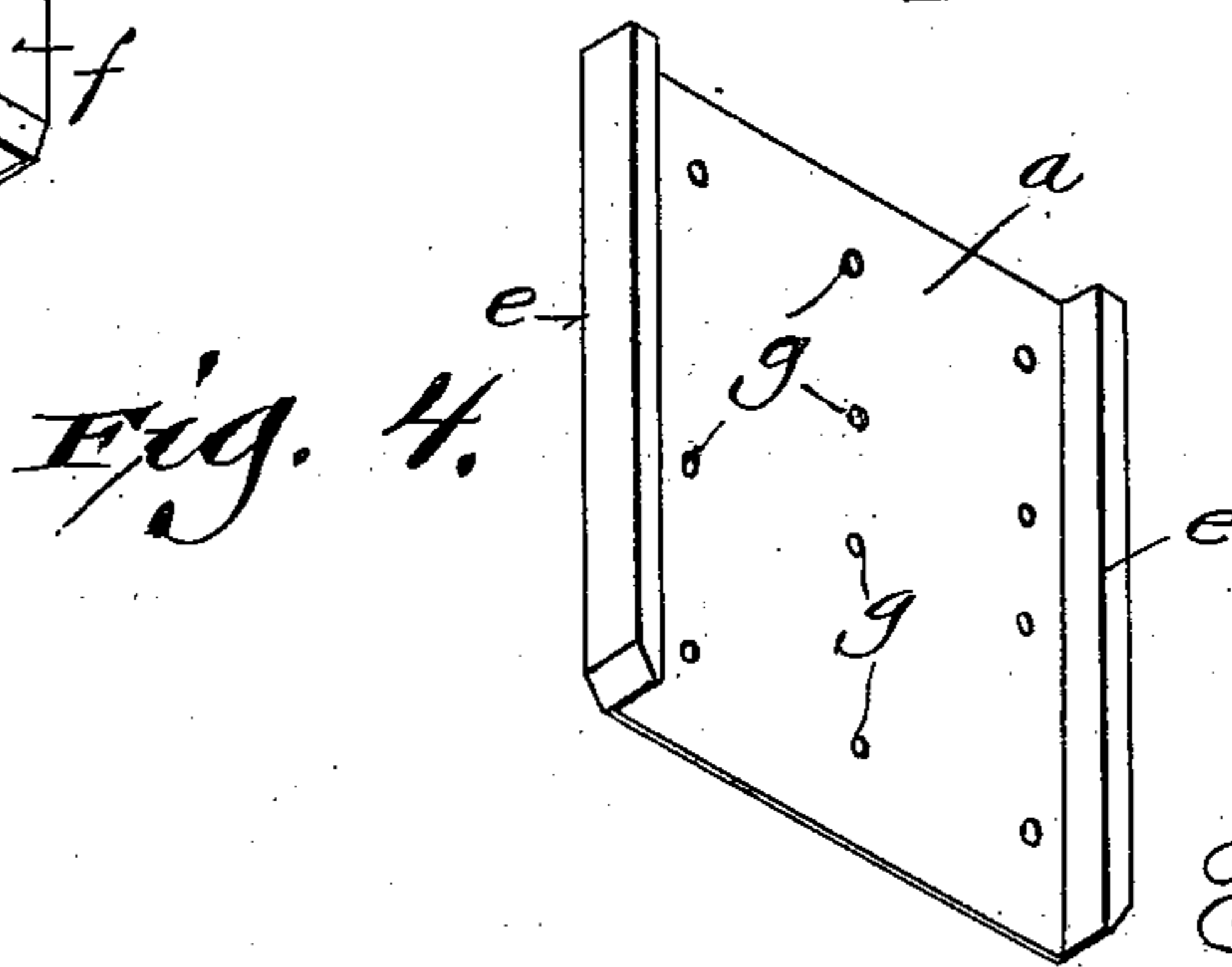
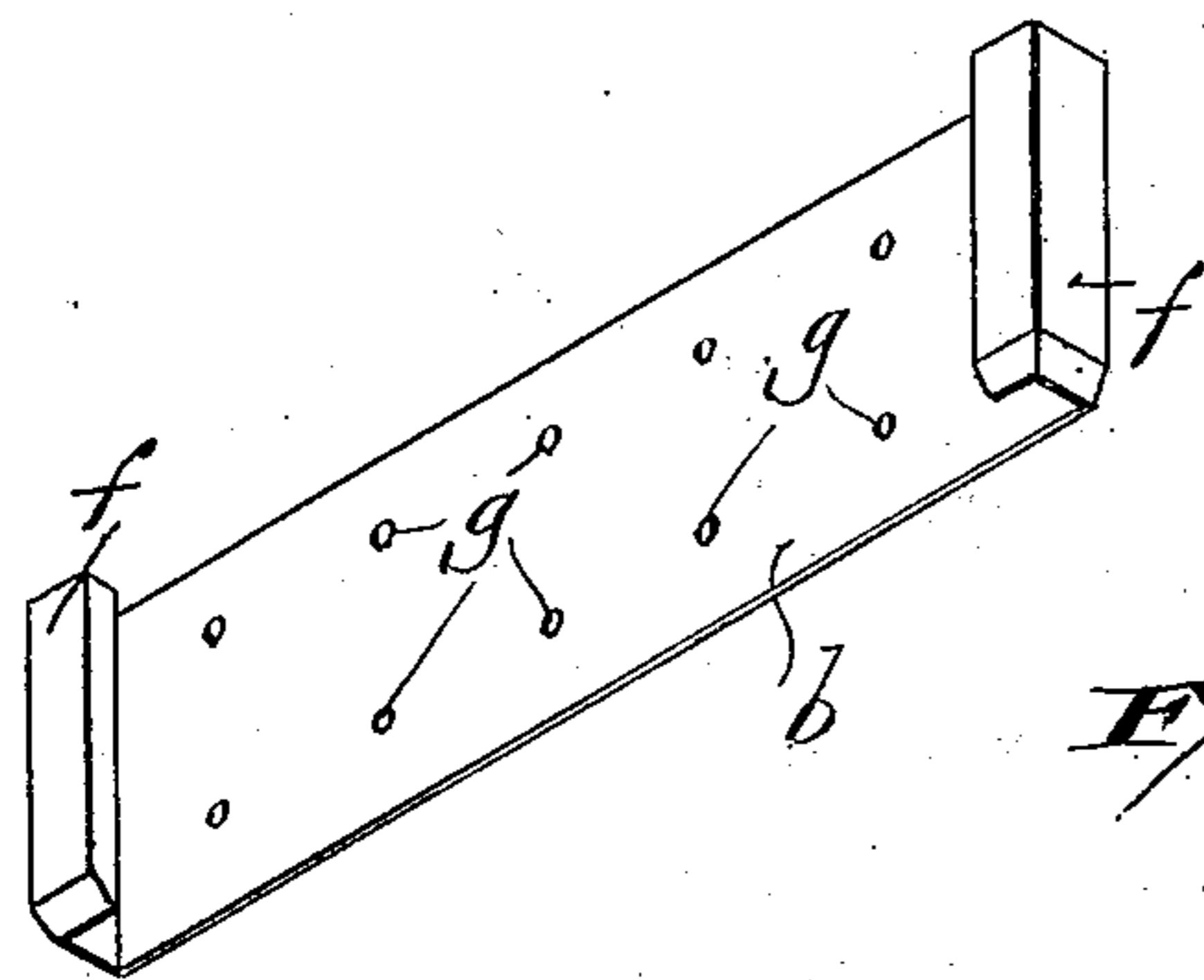
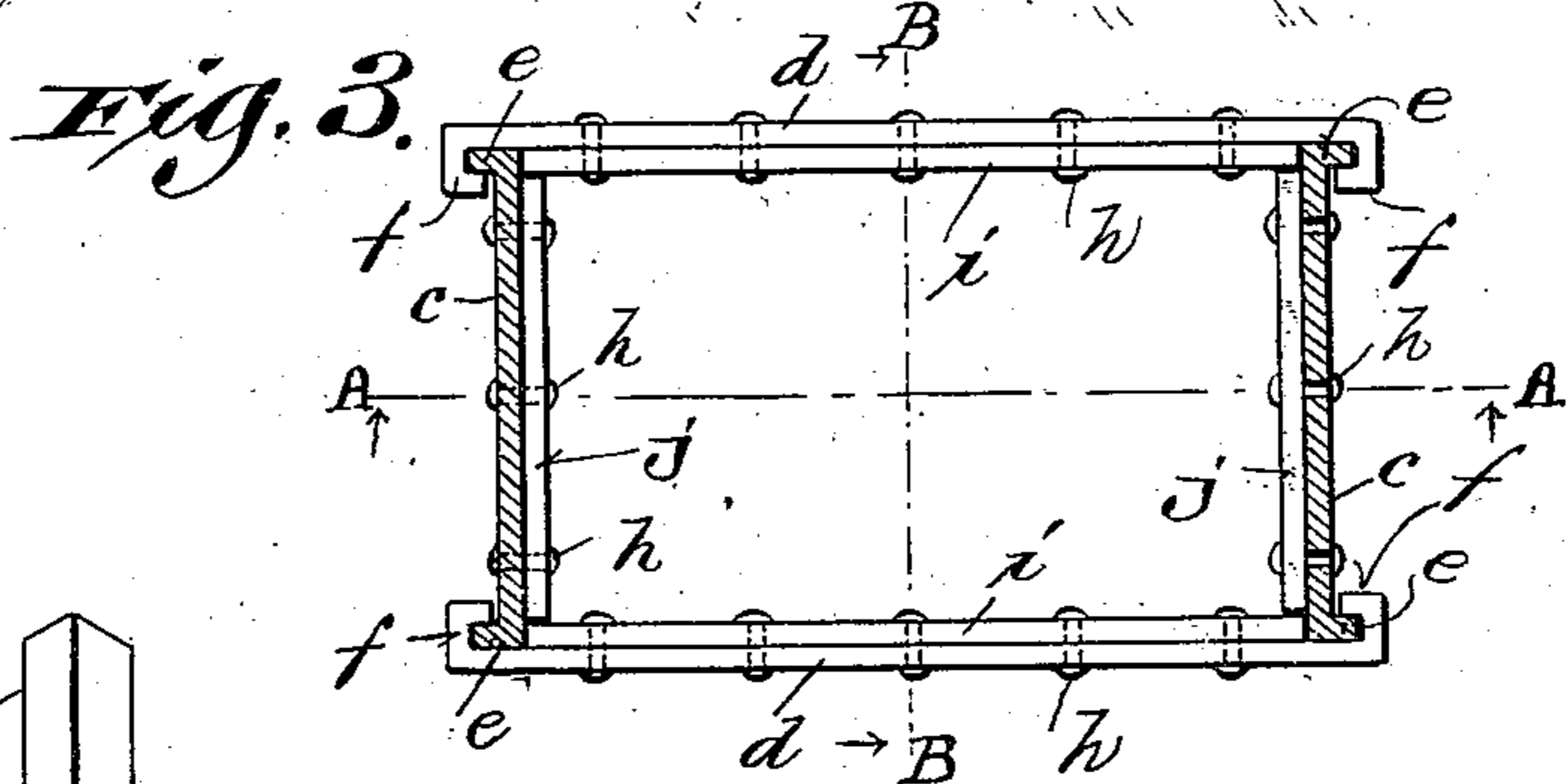
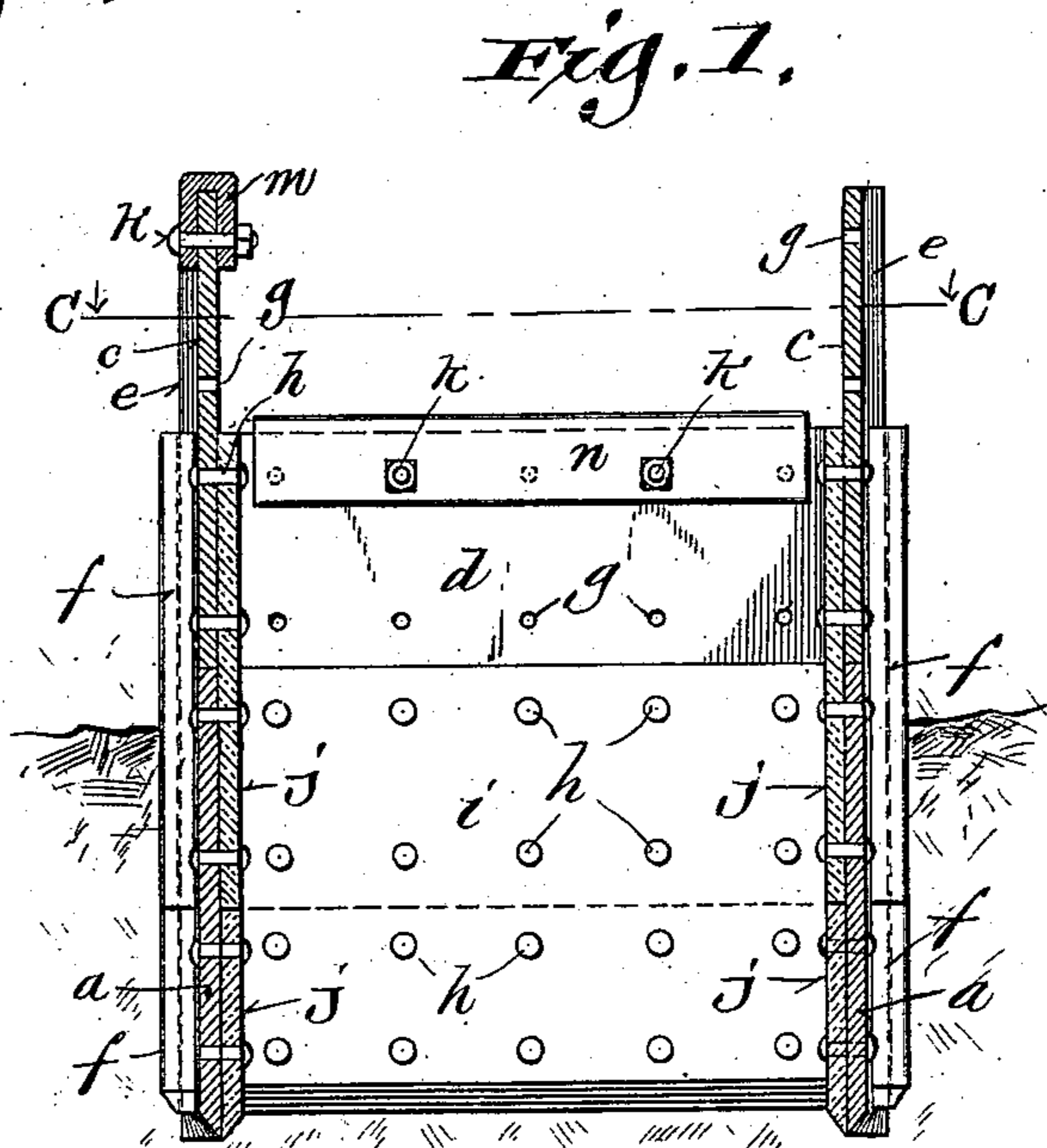
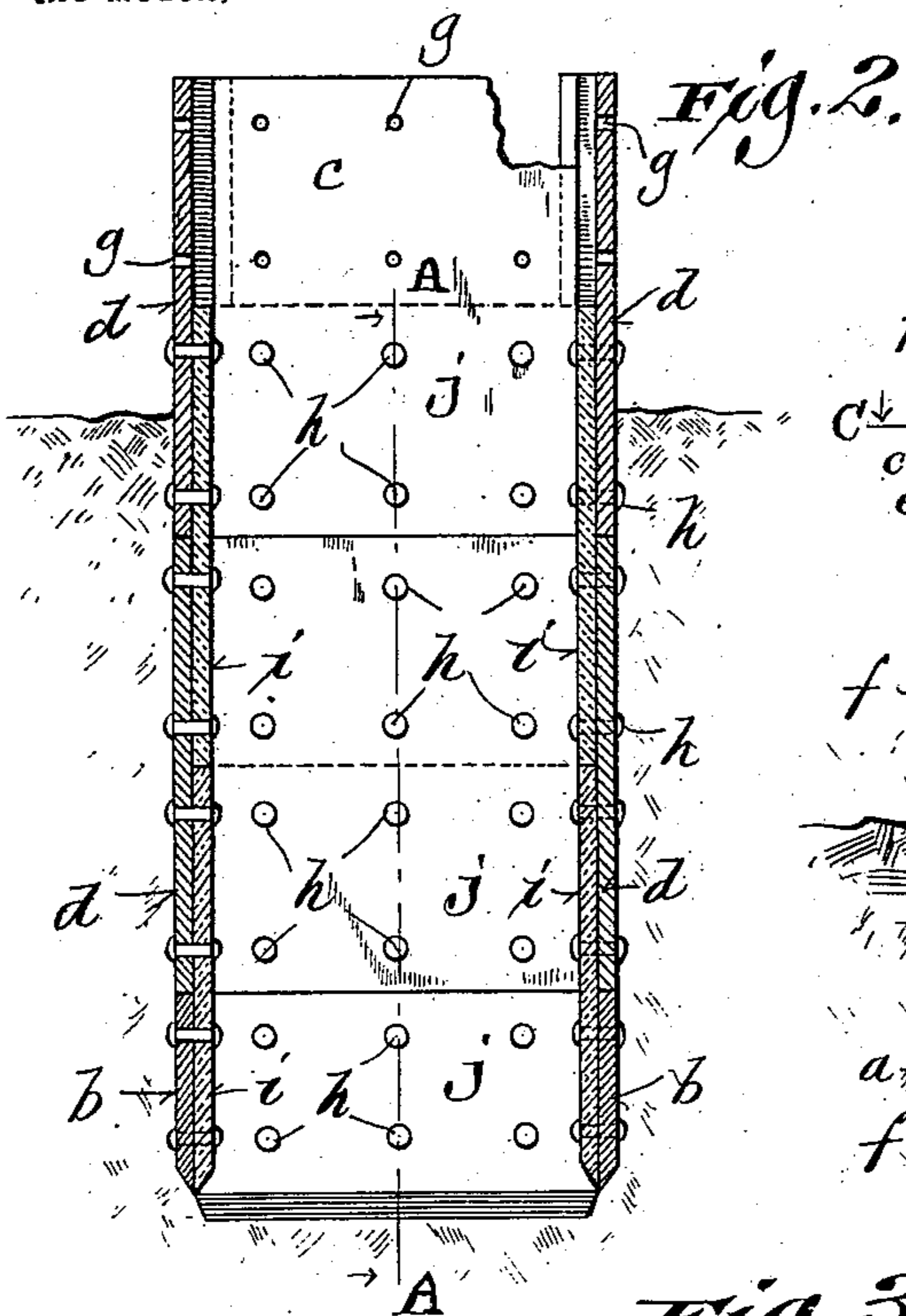
No. 694,398.

Patented Mar. 4, 1902.

G. J. MAAS.  
CONSTRUCTION OF SHAFTS.

(Application filed July 25, 1901.)

(No Model.)



Witnesses:  
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# UNITED STATES PATENT OFFICE.

GEORGE J. MAAS, OF NEGAUNEE, MICHIGAN.

## CONSTRUCTION OF SHAFTS.

SPECIFICATION forming part of Letters Patent No. 694,398, dated March 4, 1902.

Application filed July 25, 1901. Serial No. 69,633. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE J. MAAS, a citizen of the United States, and a resident of Negaunee, in the county of Marquette and State of Michigan, have invented certain new and useful Improvements in the Construction of Shafts; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to the construction of a shaft for use in mining, particularly in places where a quicksand is found to exist; and it consists in certain peculiarities of construction and combination of parts in said shaft, all as will be fully set forth hereinafter in connection with the accompanying drawings and subsequently claimed.

In the said drawings, Figure 1 is a vertical sectional view, taken on the line A A of Figs. 2 and 3, of the preferred form of my said shaft. Fig. 2 is a like view taken on the line B B of Fig. 3. Fig. 3 is a horizontal sectional view taken on the line C C of Fig. 1 and looking downward, the cap on the side piece shown in Fig. 1 being removed in Fig. 3. Figs. 4 and 5 are detail perspective views of one of the bottom end plates and one of the bottom side plates, respectively.

Referring to the drawings, *a a* represent the outer bottom end plates, and *b b* the outer bottom side plates, forming when put together the shoe of the shaft, while *c c* represent the other outer end plates, and *d d* the other outer side plates, of the shaft. The bottom or shoe plates are beveled on their lower edges for the more ready penetration of the earth, and all of my plates are preferably made of steel, (although iron plates may answer in some cases,) all of the outer end plates *a* and *c* being shown with outwardly-turned side or edge flanges *e e* and all of the outer side plates *b* and *d* with angle-flanges *f f* to inclose the said flanges *e e* of the end plates. The bottom or shoe outer side plates *b* are shown of only one-half the height of the bottom or shoe outer end plates *a*; but all the other side and end plates are preferably of equal height, except at the top of the completed shaft, where the relative height of the end and side plates is reversed from the relative heights of the shoe-plates, so as to bring all plates forming the

collar of the shaft to the same upper horizontal line.

All of the described outer plates are formed with series of bolt-holes *g g* therethrough, whereby they may be secured to the similarly-perforated inner or lining plates by bolts or rivets *h h*. The inner side plates *i i* are shown thus bolted or riveted to the outer side plates *b d* and with their end edges closely adjacent to the outer end plates *a c*, while the inner end plates *j j* are bolted or riveted to the said outer end plates and with their end edges closely adjacent to the inner surfaces of the said inner side plates *i i*, all as best shown in Fig. 3. Hence although the outer and inner end plates at each end are vertically united together and the outer and inner side plates at each side are likewise vertically united together there is no rigid union of any of the end and side plates nor of any of the opposing plates of any pairs of either end or side plates, but all have free vertical motion or play independent of the motion or play of the opposite vertical row. It will be observed that the outer and inner plates of each vertical row break joints with each other, and therefore the lower inner end plates *j* are of only half the height of the lower outer end plates *a* and the lower inner side plates *i* are double the height of the lower outer side plates *b*, all the intermediate inner plates being of equal height, while the top layer has half and full height inner plates to complete the lining of the collar of the shaft on the same single upper horizontal line of the outer plates of said collar.

In starting the sinking of a shaft as many sets of plates are secured together as deemed practical, building up from the shoe of the shaft, and then the thus-commenced structure is elevated by a derrick over the point at which the shaft is to be sunk and lowered until the shoe of the shaft rests on the surface, or, if preferred, the plates may be originally put together, starting with the shoe-plates, at the desired point. It then becomes necessary to drive the plates forming the lower part of the shaft into the ground, and to avoid injury to the upper edges of the plates I employ the caps *m n*, which are shown in Fig. 1, said caps having one horizontal surface with two par-

allel vertical flanges, so as to slip upon the upper exposed portions of the plates, to which they are temporarily secured by bolts *k* and nuts, (the outer plates *c d* being thus represented in Fig. 1,) said bolts passing through the holes *g g* in the said plates *c d* and through registering holes in the said caps *m n*. These caps *m n* receive the impact of any suitable weight or hammer, such as the hammer of a pile-driver, and preferably each vertical series of plates is driven separately, first the end plates and then the side plates, the end plates and side plates extending originally to different heights by reason of the original differences in height between the end and side bottom or shoe plates. When the two vertical series of the thus-united outer and inner side plates have been driven down into the earth until the top lines of the lower inner side plates *i* are just above the surface of the earth, as indicated in Fig. 1, where one of such series is shown, the side caps *n*, which were secured to the outer side plates *d*, as indicated in said Fig. 1, are removed and the next pair of inner side plates *i* slipped to place and secured to the said outer side plates from which the caps have just been removed by bolts or rivets *h*, (the inner side plates now extending above the plane of the outer side plates,) and then the end caps *m* are secured to the outer end plates *c*, as also indicated in said Fig. 1, and power applied to drive the two vertical series of the united outer and inner end plates downward until the top lines of the inner end plates *j* are in turn just above the surface of the earth, and then the said end caps *m* are removed and the next pair of inner end plates *j* slipped to place and secured to the said outer end plates *d* by bolts or rivets and the side caps *n* placed on the upper ends of the projecting side plates, (which are now the inner side plates *i*,) and this process of alternately driving down the vertical series of connected side plates and connected end plates continued, the caps being always secured to the upper projecting plates of the series to be driven, whether the same are outer or inner plates, and the new plates added and bolted or riveted, as required, until the shaft has been thus built and driven to the required depth, (as, for example, through and past a quicksand down to the hard-pan, clay, or solid ledge, thereby cutting off the inflow of the quicksand,) and then the collar of the shaft comprising the described half-height and full-height plates is added, and the sand and earth and other "dirt" within the shaft is excavated and hoisted out, and the shaft is in place and complete, without any further change, ready for all necessary subsequent mining operations.

In very large shafts it may sometimes be more convenient to make the described outer and lining plates each of more than one piece of metal; but in such cases the several pieces are rigidly united so as to form, when completed, entire plates, and the method of unit-

ing and driving such plates is exactly the same as with the integral plates herein described and illustrated.

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

1. A shaft, comprising vertical series of end plates, and vertical series of side plates, having interlocking side edges, the adjacent plates of each vertical row of both end and side plates being united by vertical inner or lining plates, whereby each vertical row of plates has independent vertical movement, while incapable of lateral separation from its adjacent vertical rows.

2. A shaft, comprising a shoe formed of two opposed pairs of vertically-disposed end and side plates, having interlocking side edges, and beveled on their bottom edges, with a second series of similarly-interlocked end and side plates, separately united by vertical inner or lining plates to the corresponding plates of said shoe, and additional series of similarly-interlocked end and side plates, separately united to the corresponding adjacent plates, each united vertical row of plates having independent vertical movement, but incapable of lateral separation from its adjacent vertical rows.

3. A shaft, comprising a shoe formed of two opposed pairs of vertically-disposed end and side plates having interlocking side edges, and beveled on their bottom edges, the pair of end shoe-plates being of different height from the pair of side shoe-plates, with additional series of similarly-interlocked end and side plates of equal height, and a top series of plates, forming the collar of the shaft, wherein the relative height of the pair of end plates and the pair of side plates is different, and in reversed order to the relative height of the pair of end plates and pair of side plates forming the shoe of the shaft, together with series of vertical inner or lining end and side shoe-plates of different height, having beveled bottom edges, and bolted or riveted to the first-named end and side shoe-plates, the shorter inner shoe-plates being secured to the taller outer shoe-plates, and the taller inner shoe-plates being secured to the shorter outer shoe-plates; top or collar inner or lining plates of different height bolted or riveted to the outer top or collar plates, in relatively reversed order to the relative height of the latter, and intermediate inner or lining plates of equal height to the intermediate outer plates and bolted or riveted thereto, so as to break joints therewith; whereby each vertical row of united end or side plates is continuous on both the outer and inner surfaces from top to bottom, and capable of independent vertical movement, but incapable of lateral separation from its adjacent vertical rows.

4. In a shaft, the combination of a series of pairs of outer end plates having outwardly-turned side flanges; a series of pairs of outer

side plates having inwardly-turned side flanges interlocking with the side flanges of the outer end plates; a series of pairs of inner side plates bolted or riveted to the outer side plates and having straight end edges closely adjacent to but free from union with the inner surfaces of the ends of the outer end plates; and series of pairs of inner end plates bolted or riveted to the outer end plates, and having straight end edges closely adjacent to but free from union with the inner surfaces of the ends of the inner side plates.

5. In a shaft, the combination of a series of pairs of outer end plates and series of pairs of outer side plates having vertical interlocking end edges; with series of pairs of inner or lining end and side plates, respectively

bolted to the corresponding outer end and side plates, the end edges of one pair of said inner plates bearing against but being free from union with the inner surfaces of one pair of the outer plates, and the end edges of the other pair of said inner plates bearing against but being free from union with the inner surfaces of the ends of the first-named pair of inner plates.

In testimony that I claim the foregoing I have hereunto set my hand, at Negaunee, in the county of Marquette and State of Michigan, in the presence of two witnesses.

GEORGE J. MAAS.

Witnesses:

FRANK M. BENEY,  
JOHN T. MCCALL.