

(No Model.)

H. B. TITUS & H. J. KNAPP.  
HINGE.

No. 563,432.

Patented July 7, 1896.

FIG. 1.

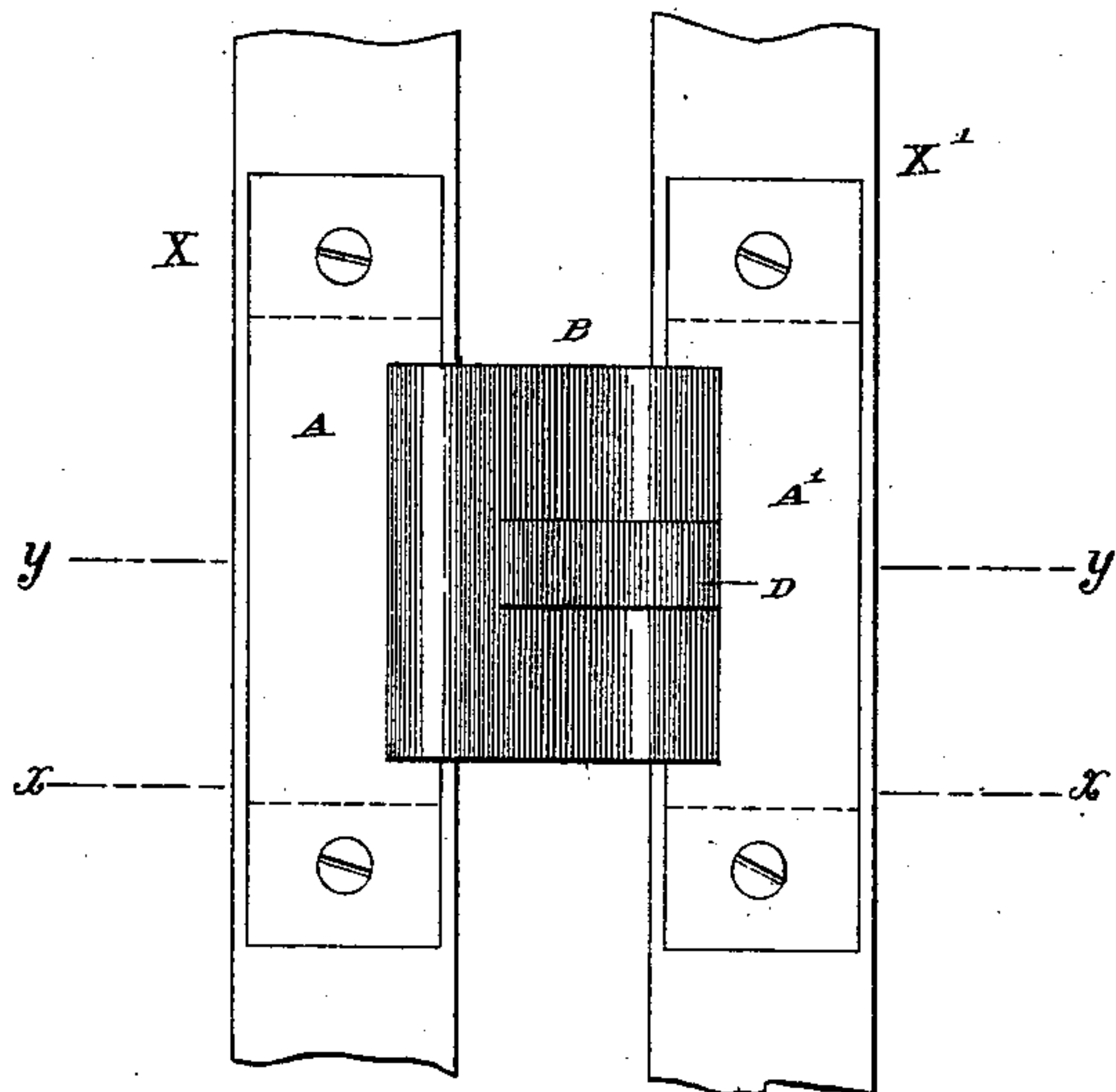


FIG. 2.

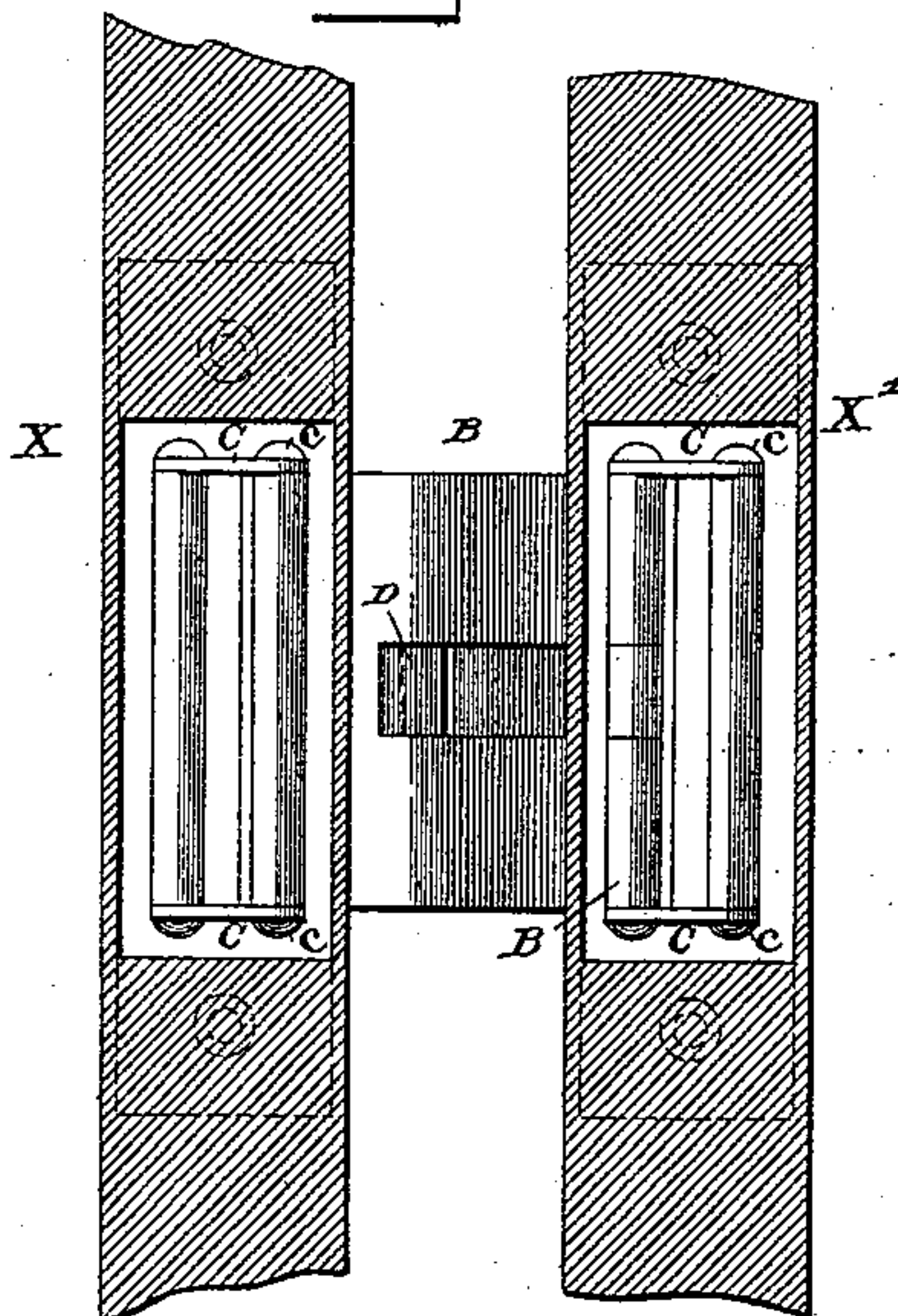


FIG. 3.

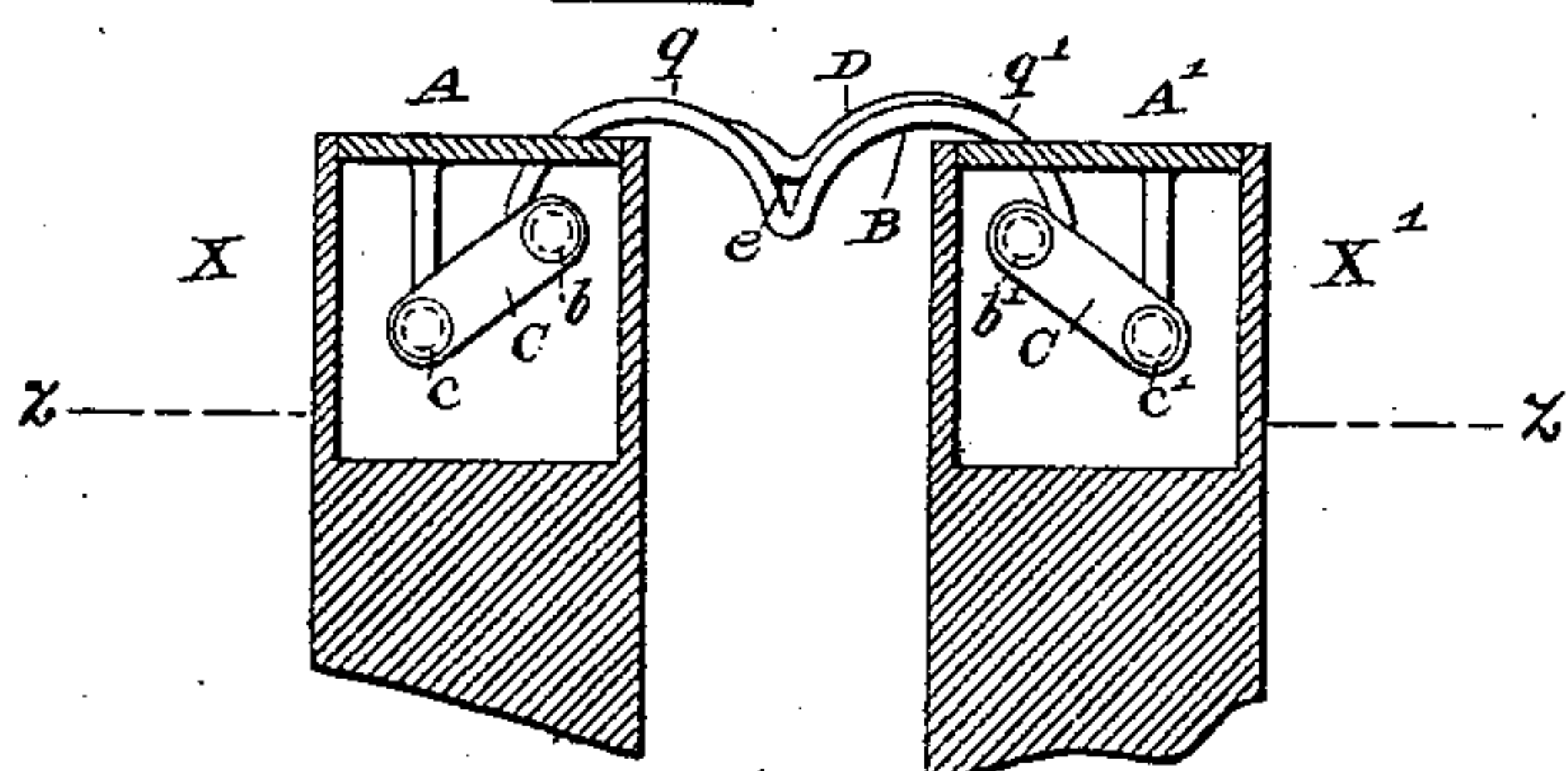


FIG. 4.

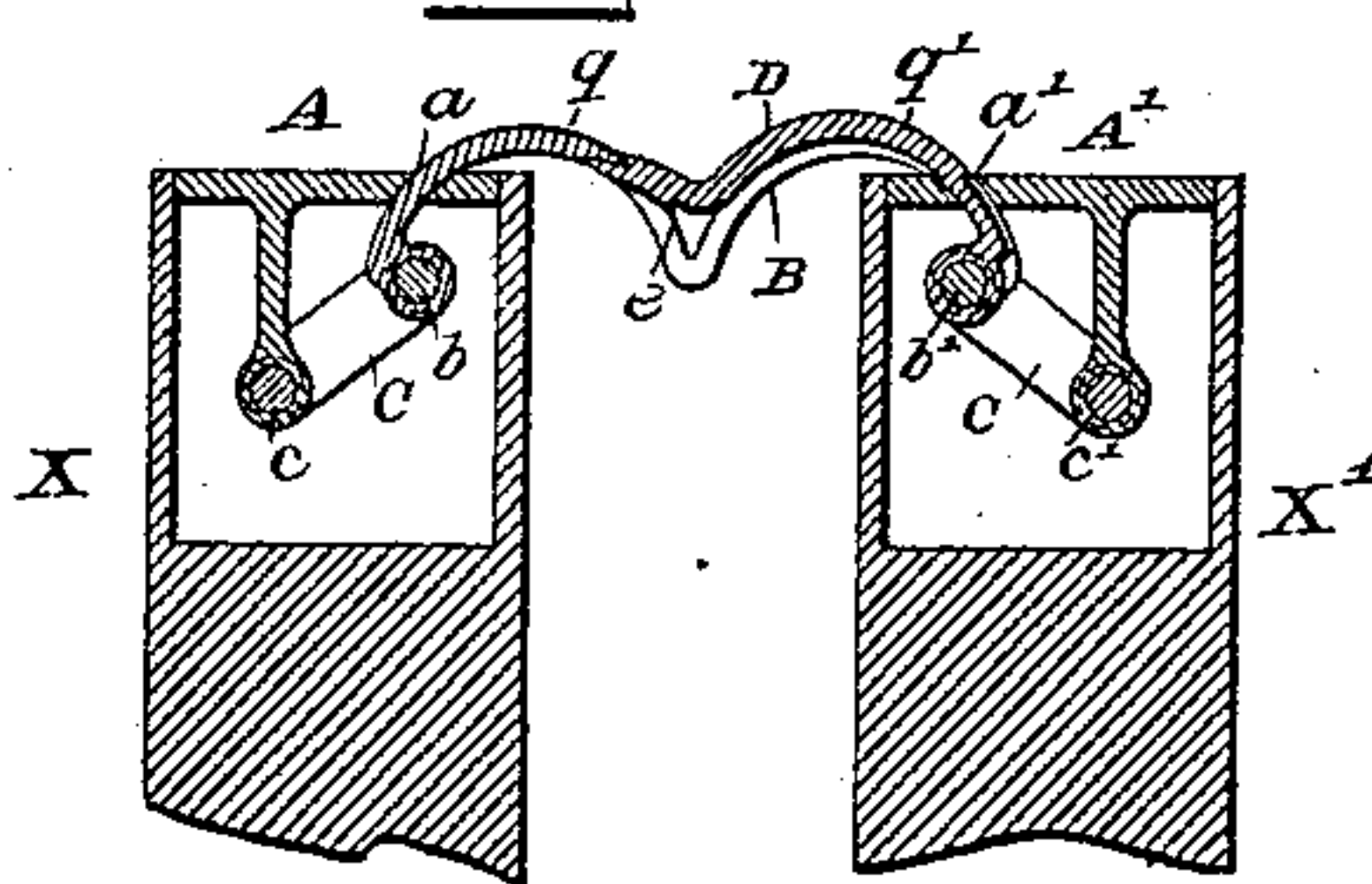


FIG. 5.

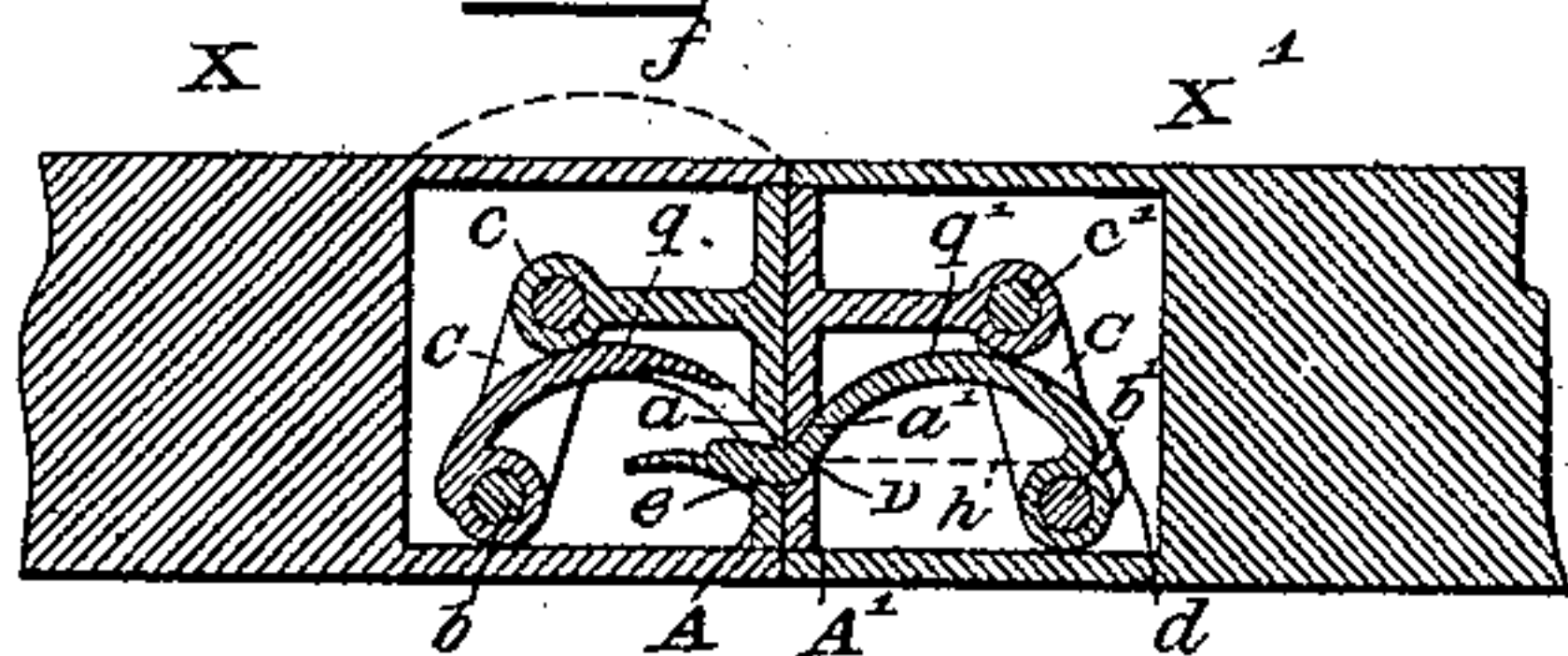


FIG. 6.

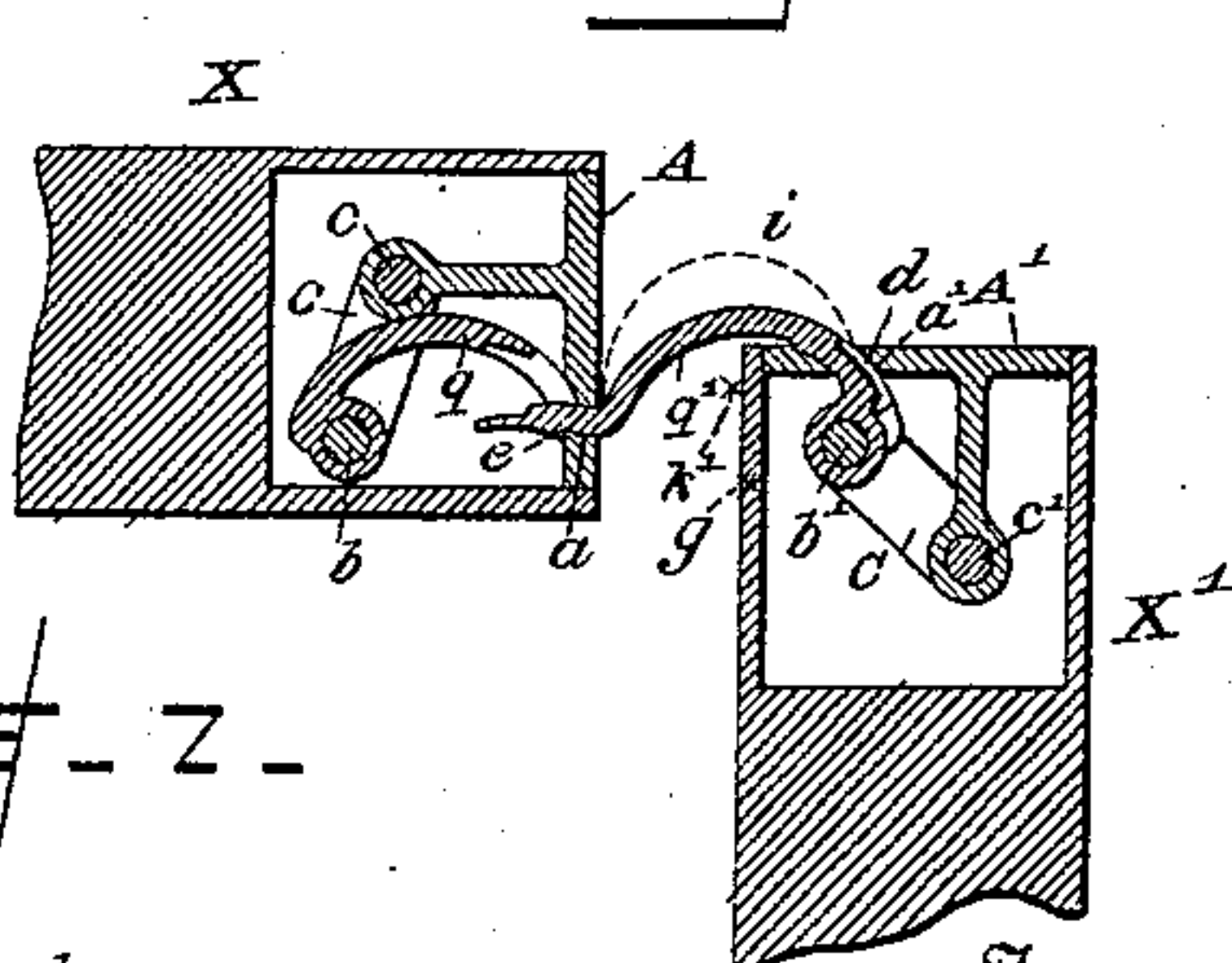
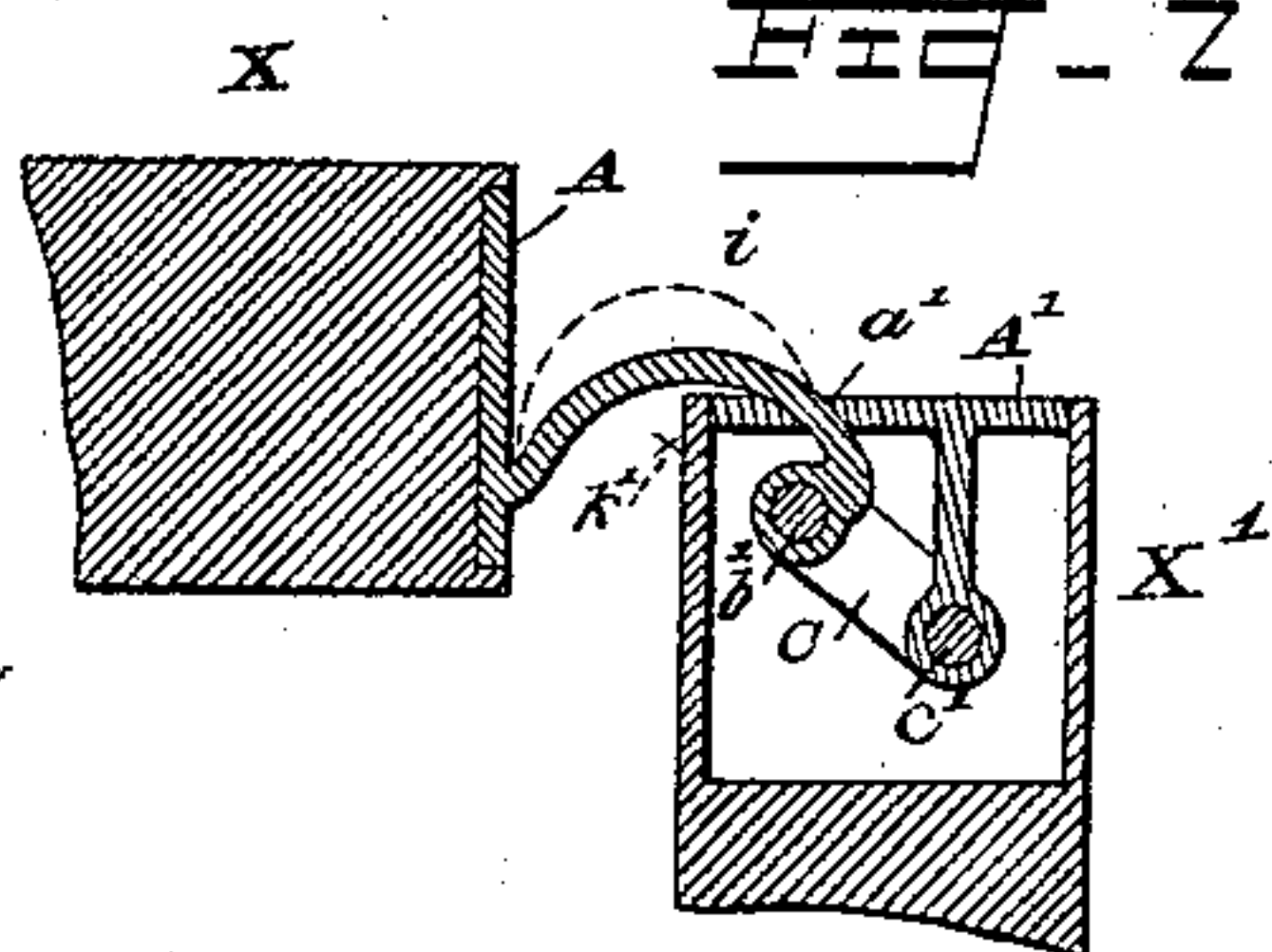


FIG. 7.



Witnesses  
Edw. S. Durrall Jr.  
Wm. L. Boyden

Inventors  
Herbert B. Titus  
Henry J. Knapp  
per Fred. W. Wacker  
Attorney



# UNITED STATES PATENT OFFICE.

HERBERT B. TITUS, OF NEW YORK, N. Y., AND HENRY J. KNAPP, OF EAST DOVER, VERMONT.

## HINGE.

SPECIFICATION forming part of Letters Patent No. 563,432, dated July 7, 1896.

Application filed March 31, 1893. Serial No. 468,447. (No model.)

*To all whom it may concern:*

Be it known that we, HERBERT B. TITUS, residing at New York, in the county and State of New York, and HENRY J. KNAPP, residing at East Dover, in the county of Windham and State of Vermont, citizens of the United States, have invented certain new and useful Improvements in Hinges; and we 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.

Our invention relates to an improvement in non-projecting and hidden or concealed hinges, that is to say, hinges that are concealed within the hinge-connected parts of a structure, or between their opposite and contiguous edges, the object of the invention being to provide a hinge which shall connect the door, lid, or hinged part of a structure to the immovable part by square and abutting edges, permit the hinged part to be opened and closed in the ordinary manner, and be entirely concealed when it is closed. Such a hinge is particularly useful for pianos, desktops, tables, chests, and other articles or structures in which it is desirable that their upper or exterior surfaces, when the lids or doors are closed, should be smooth and free from the unsightly or troublesome projections of the ordinary form of hinge.

The invention consists, essentially, in the construction, arrangement, and combination of the several parts constituting the device, as hereinafter described and claimed.

Figure 1 is a view in elevation of an example of our improved hinge when open to its fullest extent, the same being shown as applied to the adjacent edges of two parts of a structure which it is desired to hinge together. Fig. 2 is a vertical sectional elevation of the same on the line  $z z$  of Fig. 3 and illustrates a form of the pivotal mechanism of the hinge behind its leaves. Fig. 3 is a transverse section on the line  $x x$  of Fig. 1. Fig. 4 is a transverse section on the line  $y y$  of Fig. 1. Fig. 5 is a similar sectional view to Fig. 4, but showing the hinge only partly open. Fig. 6 is a sectional view taken on the same line as Fig. 4, but showing the hinge

closed. Fig. 7 is a transverse sectional view of a modified form of the hinge having pivotal mechanism attached to only one of the leaves.

Similar letters of reference designate corresponding parts throughout all the different figures of the drawings.

What we herein illustrate and describe is given, by way of example, to explain the principle and a practical construction and operation of the device; but we do not intend to be limited to the form, location, or relative structure of parts as here presented, for they can be varied as required to put the invention into practical use in the various places where it may be found useful and desirable.

In the present example of our invention,  $A$   $A'$  represent the leaves or securing-plates, which are of any suitable size and shape, and adapted to be fastened by screws or other device to the adjoining edges of the parts to be hinged together, as  $X$  and  $X'$ ,  $X$  representing a door or lid, and  $X'$  a door-jamb, or immovable part of the structure. The edges of the parts  $X$   $X'$ , at the back of the leaves  $A$   $A'$ , are recessed or mortised to provide suitable cavities to contain the mechanism, whereby the two leaves may be pivotally connected at concealed points by means of a curved plate  $B$ . The ends or opposite straight edges of this plate preferably pass through slots  $a$   $a'$  in the leaves  $A$   $A'$ , respectively, so that the said edges may lie behind the leaves and the plate be thereby attached to said leaves by means of suitable pivotal connections. As here illustrated and described, this connection is made by two or more short links or arms  $C$   $C$ . These links are pivoted at one end to the edges or ends of the plate  $B$  by means of the transverse pivot-pins or pintles  $b$   $b'$ , carried in bearings formed on said edges, and at the other end are pivoted to the leaves  $A$   $A'$ , or preferably, to give proper position and direction to the plate  $B$ , to inwardly-projecting spurs or flanges integral with said leaves, as shown, by means of the pintles  $c$   $c'$ , carried in suitable bearings. (These pintles are hereinafter also termed "pivots," for convenient designation.)

The form of the plate  $B$  may be a single



curve; but in order that the leaf A may revolve through a half-circle or its equivalent, and upon pivots occupying so little space as to be concealed within an ordinary piano-lid, two curves are necessary in this form of construction, each curve preferably a quadrant, and extending from the center of the plate to the points of its pivotal connections, as  $q$  and  $q'$  in Figs. 4, 5, and 6. When the hinged part X of the structure swings open or shut, these curved sections or quadrants  $q$   $q'$  of the connecting-plate B are carried through the slots  $a$   $a'$  in their respective leaves, so that when the door or lid is shut the plain square edges of the hinge-connected parts are in close apposition, and the quadrants  $q$   $q'$  are within the cavities behind the leaves A A', through which they respectively have passed, as in Fig. 6; and when the door or lid is open these quadrants are projected outward through the slots  $a$   $a'$  in the leaves A A', as in Figs. 3 and 4.

In bringing the hinged part X from its position in Fig. 4 there is a tendency, especially from the weight of a lid when closing or swinging to its horizontal position in Fig. 6, for the pivotal mechanism of the immovable part X' to be first acted upon, and for the plate B to come to its final position before the lid is closed, and consequently for the final movement of the lid to be upon its own pivotal mechanism, and therefore for its lower or inner edge to describe an arc below the plane  $p$   $p$ , as indicated by the dotted line  $f$  in Fig. 6. This tendency and consequent friction of the lid upon its support may be prevented by controlling the movement of the plate B so that it shall be held in position relatively to first one leaf and then the other during both the opening and closing movements of the hinge. For this purpose a spring may be used, or, perhaps, preferably a tongue, pawl, or detent D, being a narrow piece of metal, a little shorter than the plate B and curved to conform thereto. It is pivoted at one end behind the leaf A' on the pivot-pin  $b'$  along with the plate B, and is preferably of the same thickness as the plate and inserted in a transverse slot therein, with its free end, which is brought to a thin edge at the point, extending a little beyond the end of the slot and fitting into a groove at the back of the plate. This detent is provided on its outer or face side near the pivoted end with a notch or indentation  $d$ , which is adapted to engage the edge of the slot  $a'$  in the leaf A' when the detent is projected with the quadrant  $q'$  of plate B outward through the slot  $a'$  or in front of said leaf A', as in Fig. 4; and it is also provided on its opposite side near the other end with a notch  $e$ , which is adapted to engage with the edge of the slot  $a$  in the leaf A when its free end with the quadrant  $q$  of said plate is behind said leaf A, as in Fig. 5. These notches or indents  $d$  and  $e$  are engaged with and disengaged from the leaves A' and

A, respectively, by a slight vibratory movement of the detent, which is so shaped and so adjusted that when it is in position flush with the quadrant  $q'$  of plate B its free end is raised from the rear side or interior of the quadrant  $q$ , as in Figs. 5 and 6; and when its free end is depressed flush with the interior of quadrant  $q$  the detent is slightly raised from its position flush with the face or exterior of quadrant  $q'$ , as in Fig. 4. The practical operation of this detent is as follows: The lid being closed, as in Fig. 6, and the detent in position flush with the quadrant  $q'$  of plate B, with its free end raised from the quadrant  $q$ , the notch  $e$  is then in engagement with the leaf A, and the detent being firmly held in this position by the edges of the slot  $a'$  in the leaf A', the plate B is held locked with the leaf A. Therefore, in opening the lid X or raising it from its position in Fig. 6, the plate B is held rigid therewith and can revolve only upon the pivot  $b'$  behind the leaf A', which revolves simultaneously upon the pivot  $c'$  until a quarter-turn is made to the position in Fig. 5, when the notch  $d$ , having reached the point of engagement with the leaf A', the detent is swung slightly outward by the pressure upon its free end of the edge of the slot  $a$  in the leaf A, which thereby becomes disengaged from the notch  $e$  simultaneously with the engagement of the leaf A' with the notch  $d$  as the lid commences to make another quarter-turn upon the pivotal mechanism behind the leaf A to its final position in Fig. 4. In closing the lid these movements are reversed; that is, the notch  $d$ , being in engagement with the leaf A' by reason of the free end of the detent being held by the leaf A flush with the quadrant  $q$  of plate B, as in Fig. 4, said plate is thereby held locked and rigid with the leaf A' until a quarter-turn of the lid is made to its position in Fig. 5, when by the pressure of the edge of the slot  $a$  in the leaf A upon the face of the detent it is pressed back to its position flush with the quadrant  $q$  of plate B. By this movement of the detent the notch  $e$  is engaged with the leaf A simultaneously with the disengagement of the notch  $d$  from the leaf A', and the last quarter-turn of the lid to its position in Fig. 6 is made upon the pivots behind the leaf A', so that in opening the lid the pivotal mechanism within the fixed part of the structure operates first and that within the lid or revolving part last, while in the closing movement the pivotal mechanism within the revolving part operates first and that within the fixed part last; and as thus controlled the movement of the lid, both in opening and closing, is firm, steady, and uniform through each quarter-turn.

We are aware that a hinge having a single pivot attached to the upper or outer edge of one of its leaves and at the back thereof, so as to be concealed within a cavity in the immovable part of the structure, and provided



with a rigid bent arm which connects this pivot with the revolving leaf through an opening in the pivot-bearing leaf, so that it can revolve to about a right angle, has heretofore been constructed; but neither the form of the connecting-arm, nor the opening through which it passes, affects in any way the movement or direction of the revolving leaf, which simply revolves concentrically with the pivot with which it is thus connected; and therefore the lid or door to which it is attached cannot revolve from a close-fitting square joint, and the uses to which it is adapted are few; but we do not think that it in any way exemplifies our invention, or anticipates the ideas embodied in the device here presented.

In our invention the revolving leaf of the hinge does not revolve concentrically with nor in the corresponding movement immediately upon a fixed pivot; but during the first quarter-turn it revolves directly upon an intermediate pivot, which is itself simultaneously revolving upon and concentrically with a fixed pivot attached to the back of the immovable leaf. Furthermore, the direction of the revolving leaf is substantially controlled by the form of the connecting-plate and by the opening or guiding-slot through which it passes, though modified to some extent by the movement of the pivot with which it is immediately connected. The operation of this intermediate and simultaneously-revolving pivot *b'* is to give to the revolving leaf and lid, when opened, a slight outward movement, thereby so modifying the curvilinear movement given to them by the quadrant *q'* of the connecting-plate passing through the guiding-slot *a'* that they are immediately separated from the fixed part of the structure and so revolve without contact therewith. The position of the quadrant *q'*, the leaf *A*, and the lid *X* in Fig. 5 is substantially the same as if the quarter-turn from their respective positions in Fig. 6 were made through a true arc described from a fixed pivotal center, as *g*; but such a movement is impossible, for the reason that this center is below the plane of the exterior surface of the immovable part of the structure *X'*. The actual movement is that the inner end of the quadrant *q'* is carried by its connecting-pivot *b'* and its revolution thereon not through the arc of said quadrant, but through the chord of said arc, as indicated by the dotted line *h* in Fig. 6, and the outer end, along with the point of the leaf *A*, to which, during this movement, it is rigidly attached, is correspondingly thrust outward and by the operation of the guiding-slot *a'* is carried to its final position in Fig. 5, and also in Fig. 7, through the space indicated by the dotted line *i*. This line is substantially an arc as described from the pivotal center *k*. This movement of the lid, when opened, is therefore practically and substantially the same as when revolved upon a fixed

pivot projecting above the abutting parts. By duplicating this pivotal mechanism behind the movable leaf and also the curved connection, so that the two curved parts or quadrants are in form as here shown, another quarter-turn may be made in the same direction. In this movement, however, the plate *B* being held rigid with the leaf *A'*, the pivot *b* becomes the fixed pivot, and the pivot *c* revolving concentrically therewith, the guiding-slot *a* moves along the quadrant *q* as the leaf *A* with the lid *X* is carried from its position in Fig. 5 to that in Fig. 4, thus completing the revolution through the equivalent of a half-circle. In closing the lid and hinge these movements are simply reversed, the several parts passing through the same arcs and spaces as in opening.

The plate *B* should be attached to the link *C* at such points on the under side of the connecting-pivots that by its partial revolution thereon, in opening the hinge, the extreme end of each quadrant curve will reach its guiding-slot simultaneously with the contact of its pivotal bearings with their respective hinge-leaves.

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

1. In a hinge, the combination of the slotted leaves, the curved connecting-plate having a transverse slot and with its edges passed through the slots in the leaves, the links pivoted to said edges and to the rear sides of the leaves, and the detent likewise pivoted and situated in the slot in the connecting-plate, said detent having indents.

2. In a hinge, the combination of the hinge-leaves having guiding-slots, the curved connecting-plate passing through said slots and having its opposite ends or edges attached to the rear side of said leaves by double pivots, and the links forming said double pivots, one of which is fixed and the other revolves concentric therewith.

3. In a hinge, the combination with slotted leaves, of a connecting-plate, said plate having two curves and each curved section passing through a guiding-slot in its respective leaf to the concealed side of which it is attached double pivotal devices for attaching the connecting-plate to the leaves so that when in opening the hinge it is moved outward through the guiding-slot in said leaf to a position substantially at right angles thereto, the inner end of said curved section is carried in nearly a direct line to the guiding-slot and its outer end describes a curve eccentric to the curve described by its final position.

4. In a hinge, the combination with leaves of a connecting-plate each of whose opposite edges is attached to one of said leaves by a double pivot, one pivot being fixed and the other revolving concentric therewith; said plate having two curves, and each curve,



in opening and closing the hinge, passing through a guiding-slot in the leaf to which it is immediately attached.

- 5 In a hinge, the combination with leaves  
and a connecting-plate inserted in guiding-  
slots in said leaves and pivotally attached to  
the rear side thereof, of a detent pivoted at one  
end along with said plate and inserted with  
it in said slots, and provided with notches  
10 adapted to engage with said leaves so as to  
hold said plate locked first with one leaf and  
then the other, during the opening and clos-  
ing movements of the hinge.

In testimony whereof we affix our signatures in presence of two witnesses.

HERBERT B. TITUS.  
HENRY J. KNAPP.

Witnesses to the signature of Herbert B. Titus:

C. W. WILCOE,  
A. T. DAVIS.

Witnesses to the signature of Henry J. Knapp:

W. F. MAY,  
E. A. RYTHER.