

J.L. Hall,  
Lock,  
No 30,140, Patented Sept. 25, 1860.

Fig: 1.

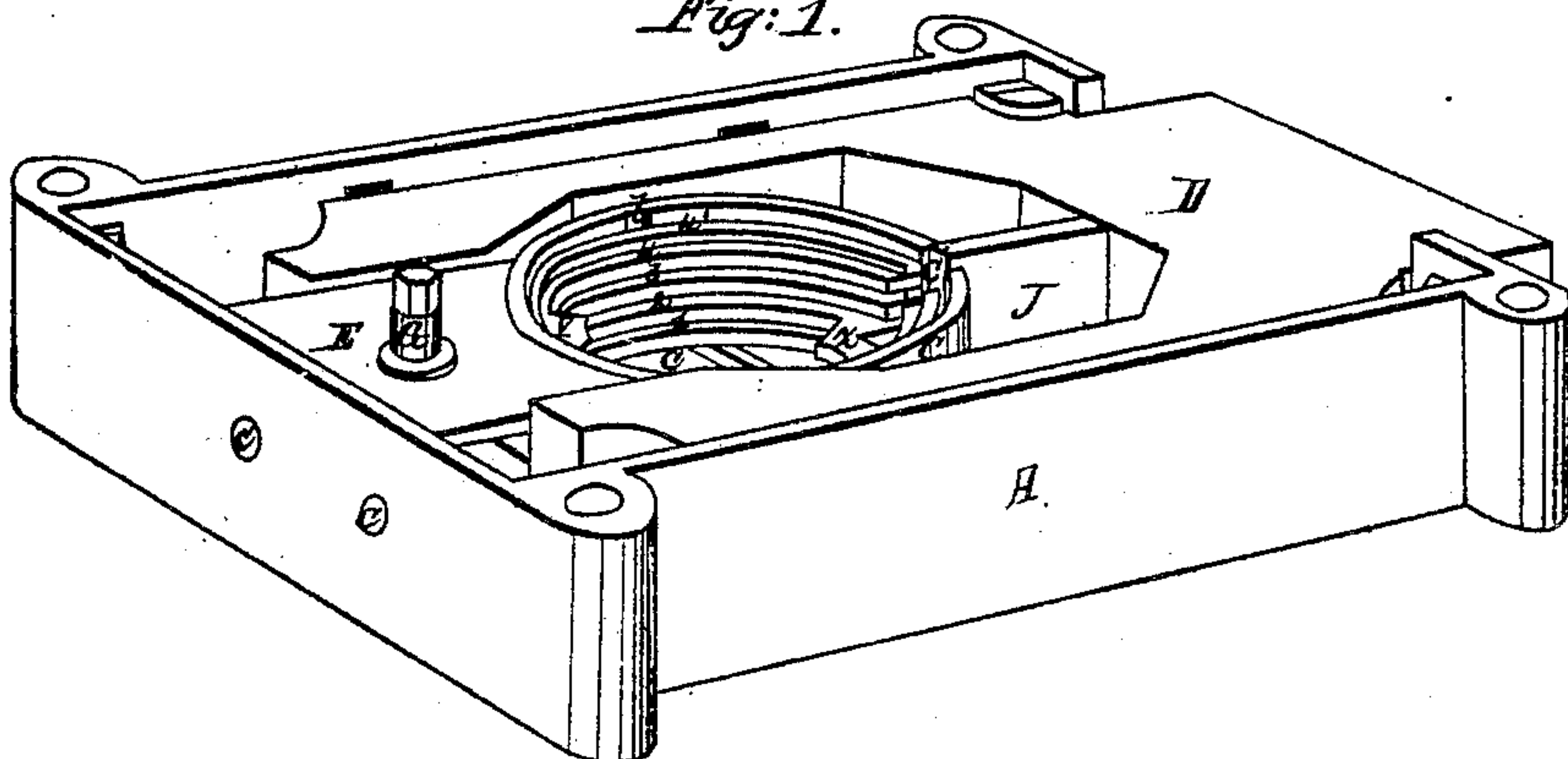


Fig: 13.

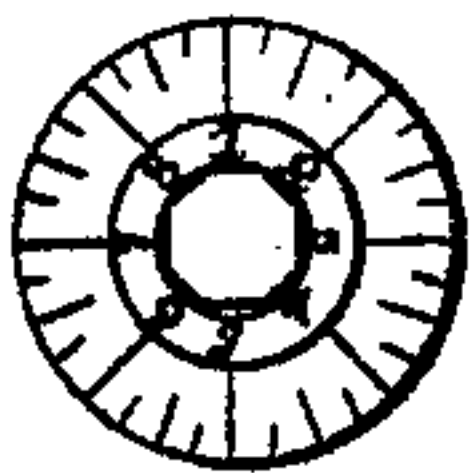


Fig: 11.

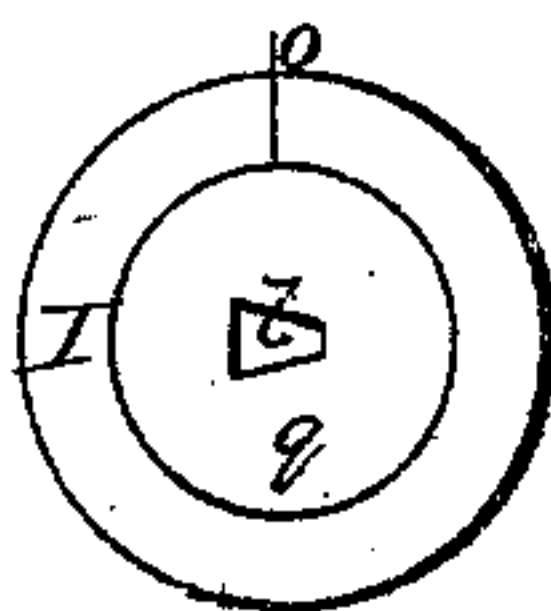


Fig: 12.

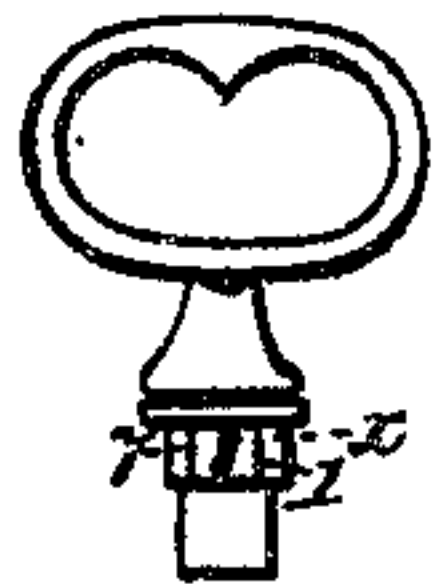
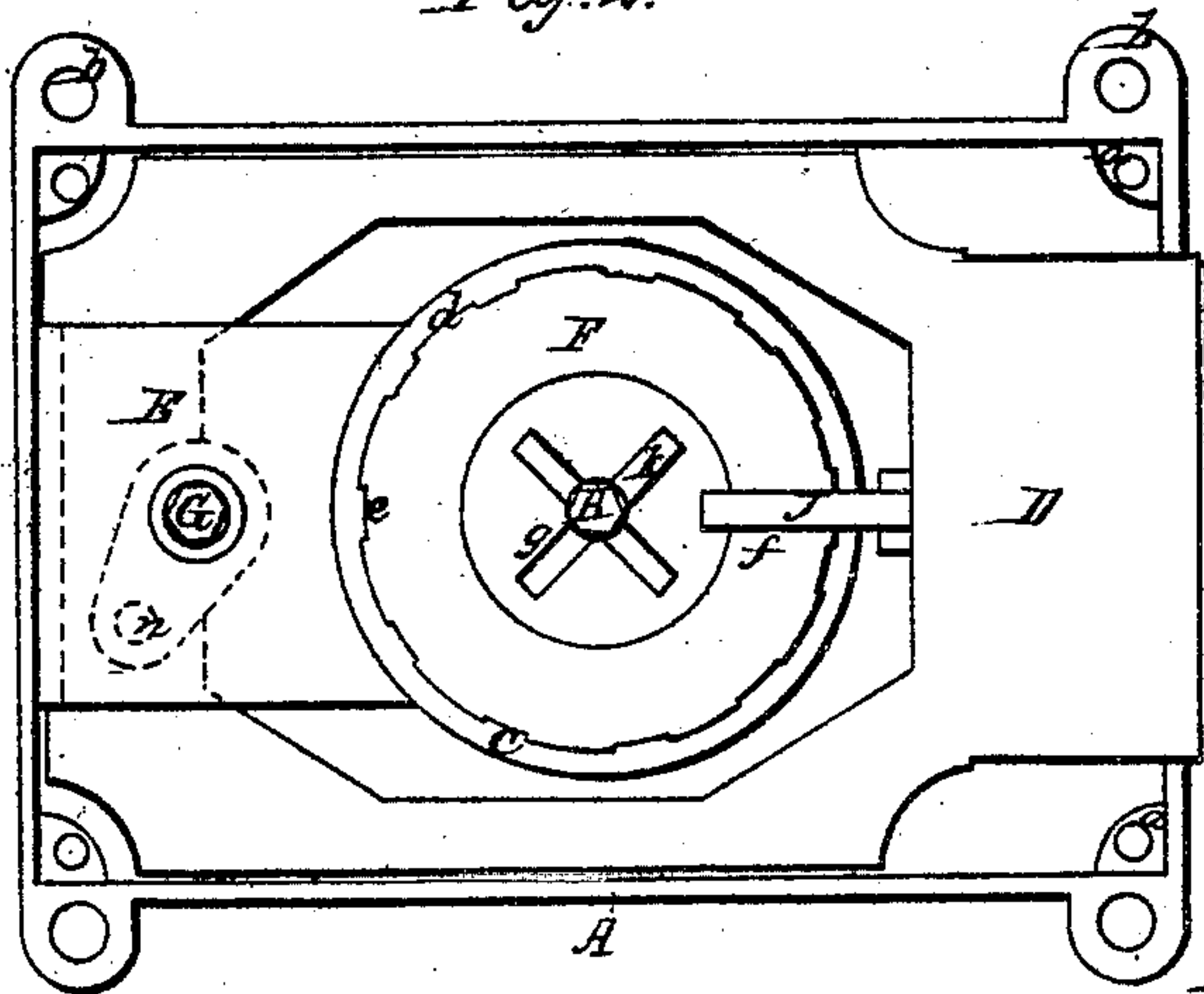


Fig: 2.



Witnesses:

*Wm. C. Hughes*  
*Charles Fisher*

Inventor:

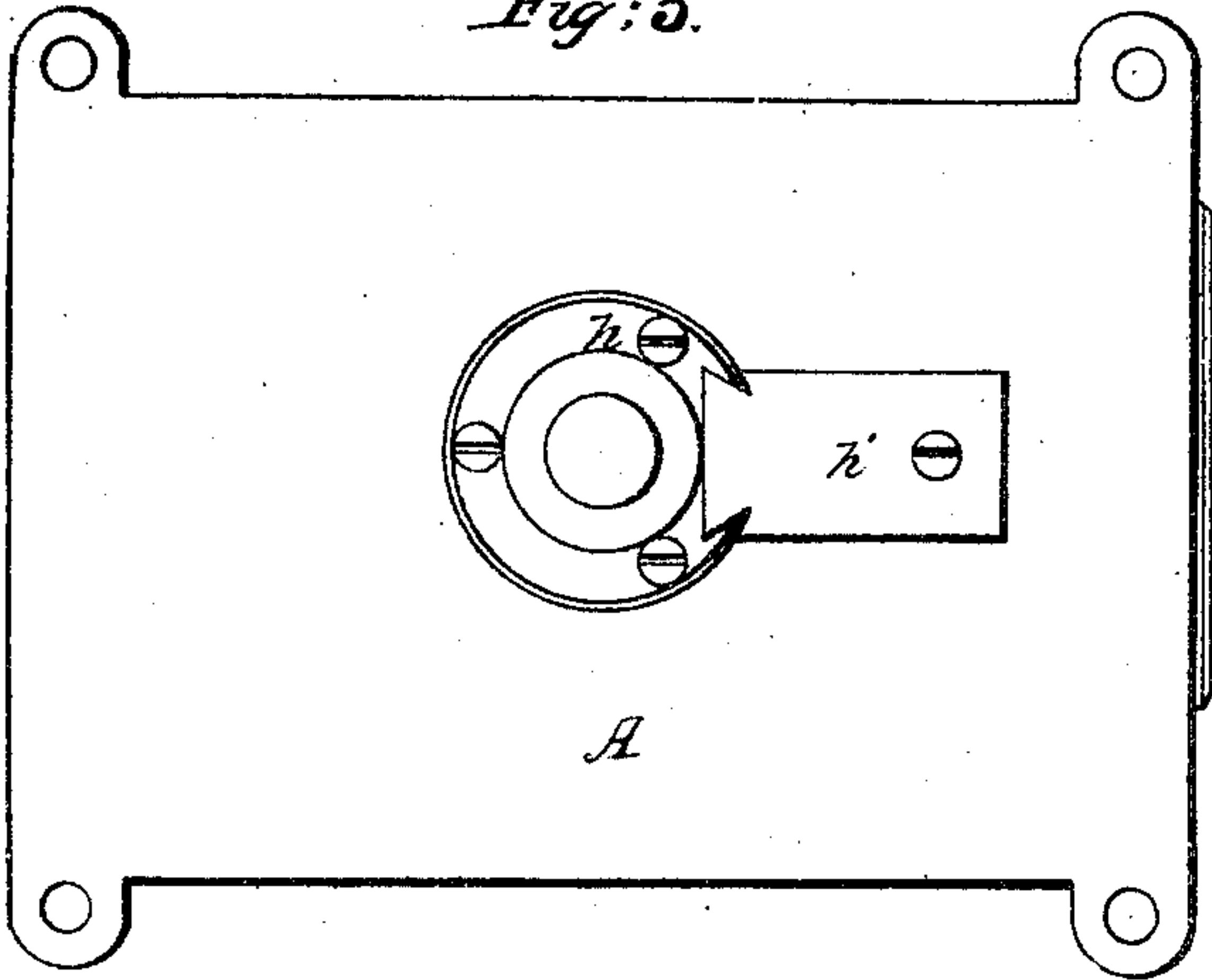
*Joseph L. Hall*

J. L. Hall,  
Lock,

No. 30,140,

Patented Sept. 23, 1860.

Fig: 3.



A

Fig: 6.

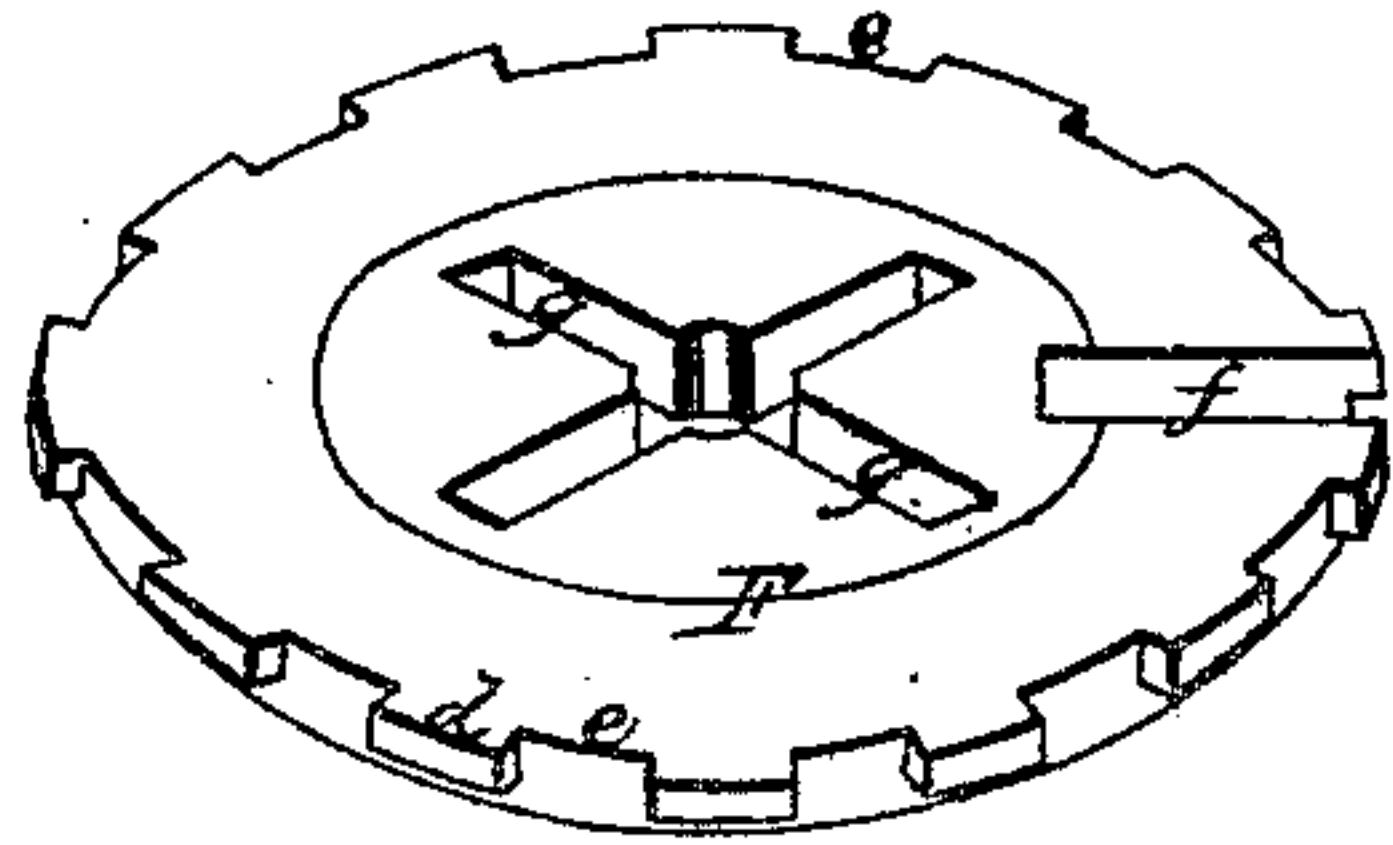


Fig: 10.

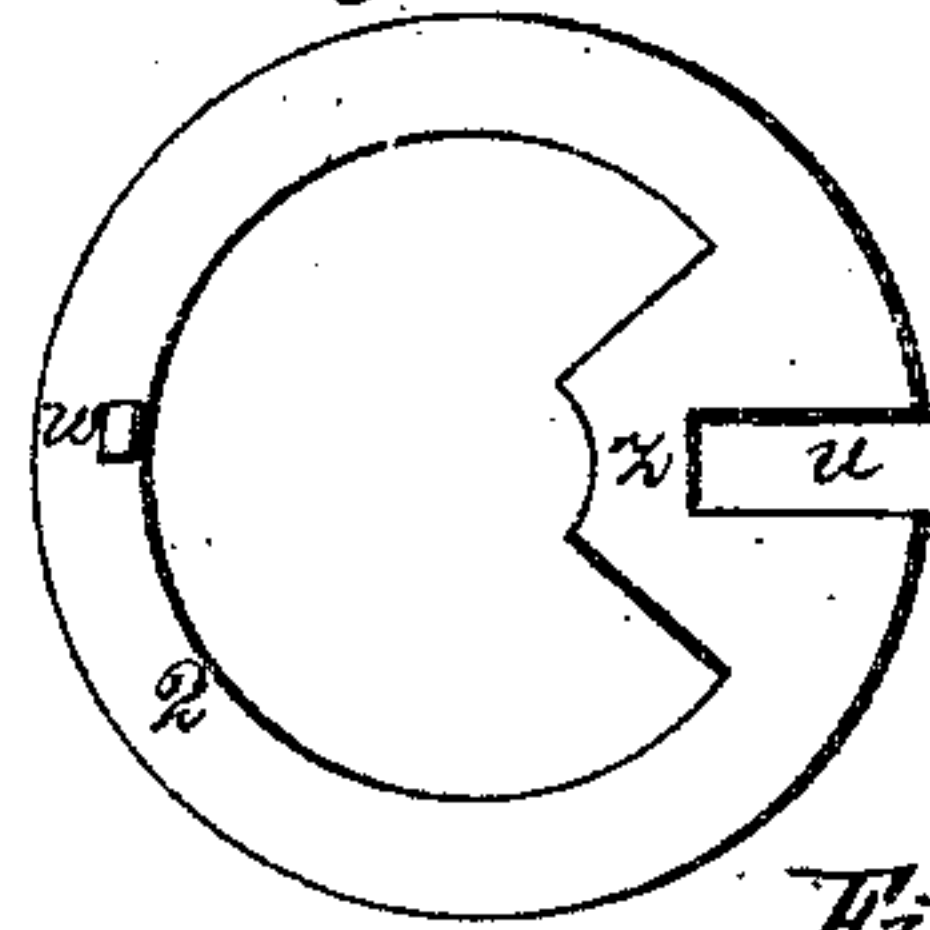


Fig: 4.

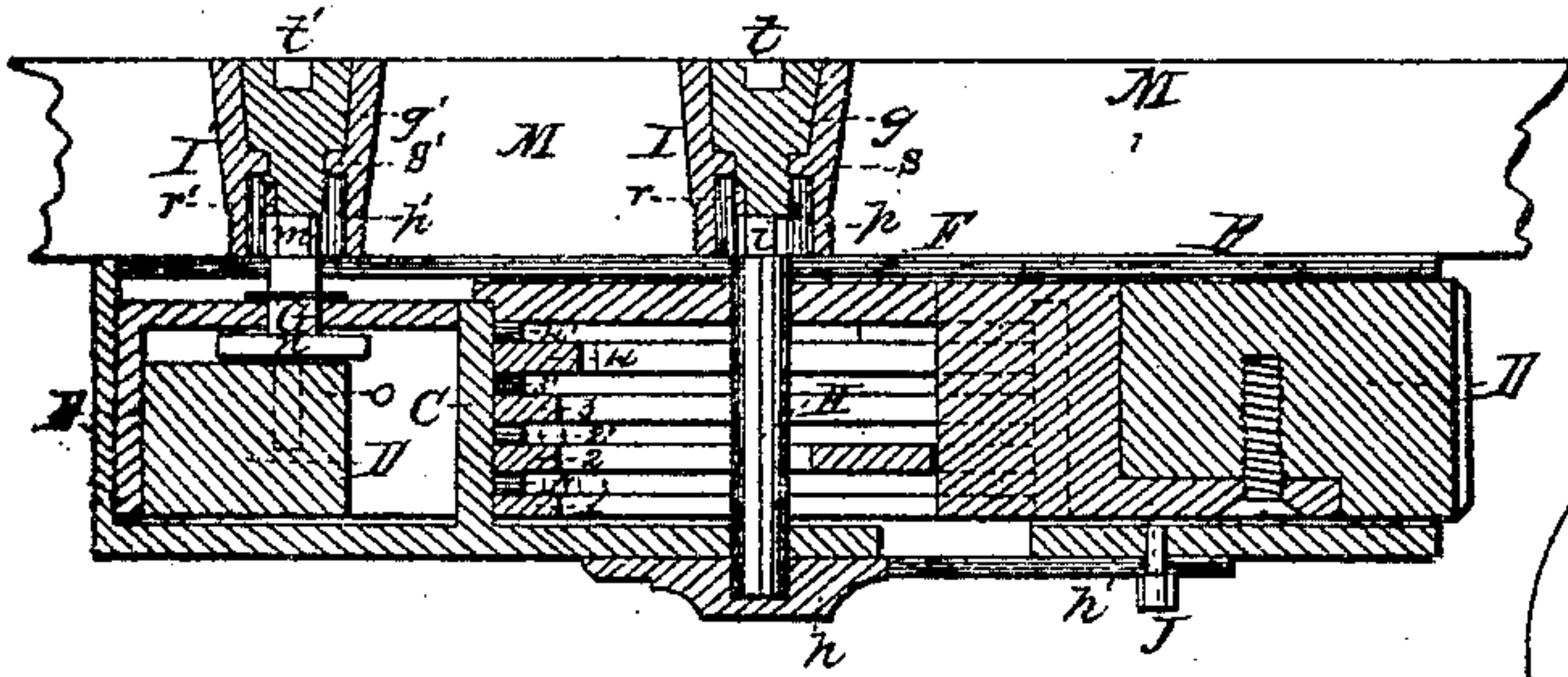
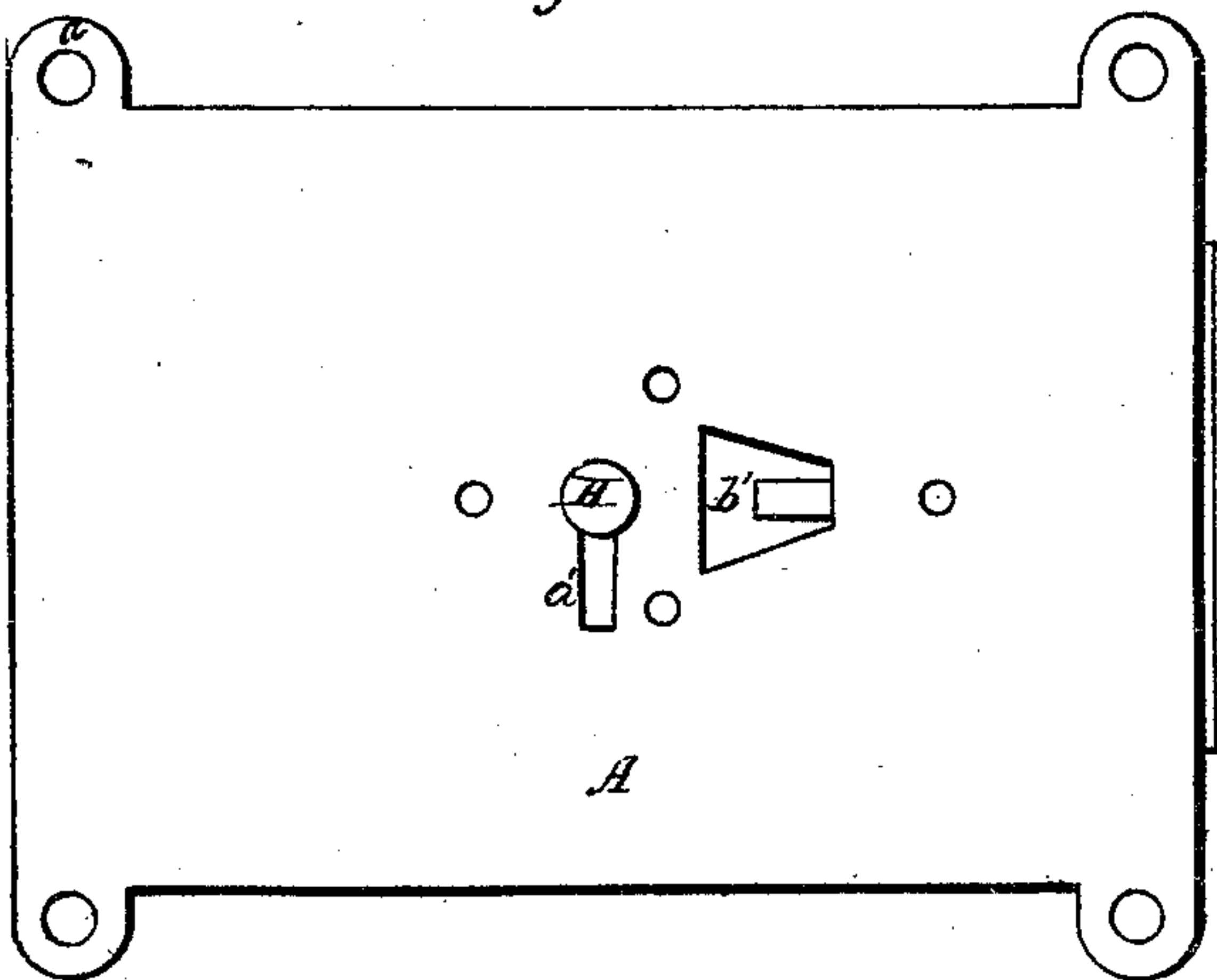


Fig: 5.



A

Fig: 7.

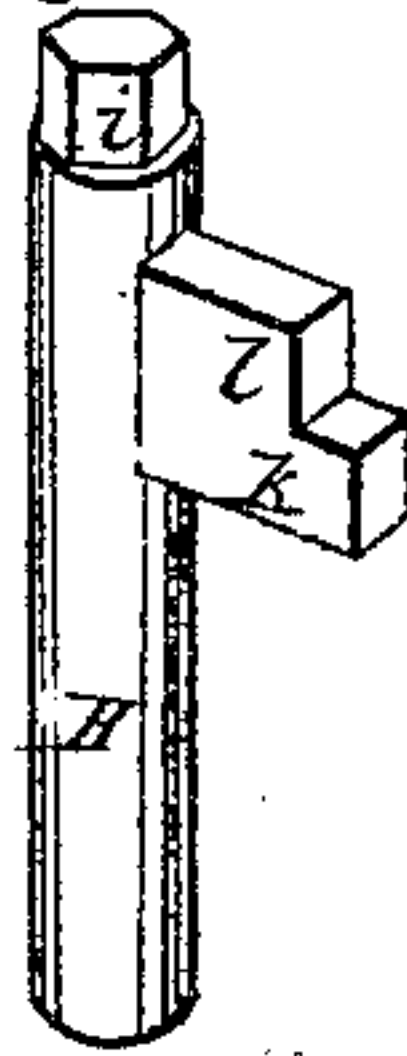


Fig: 8.

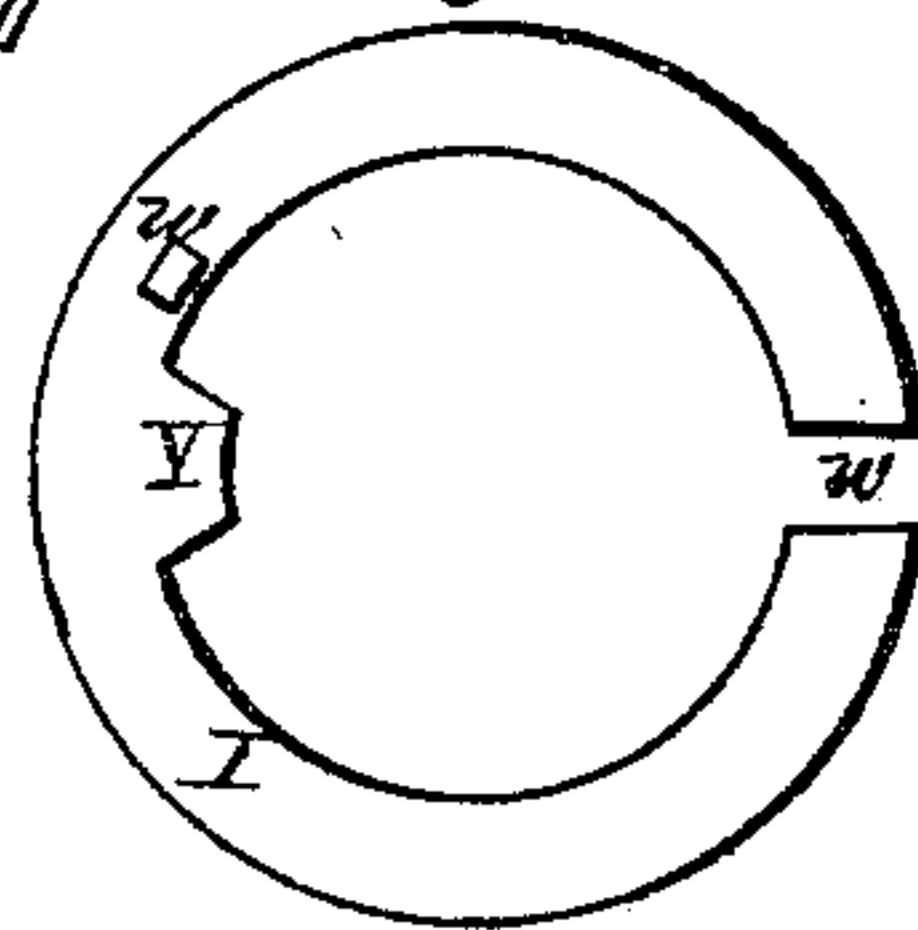
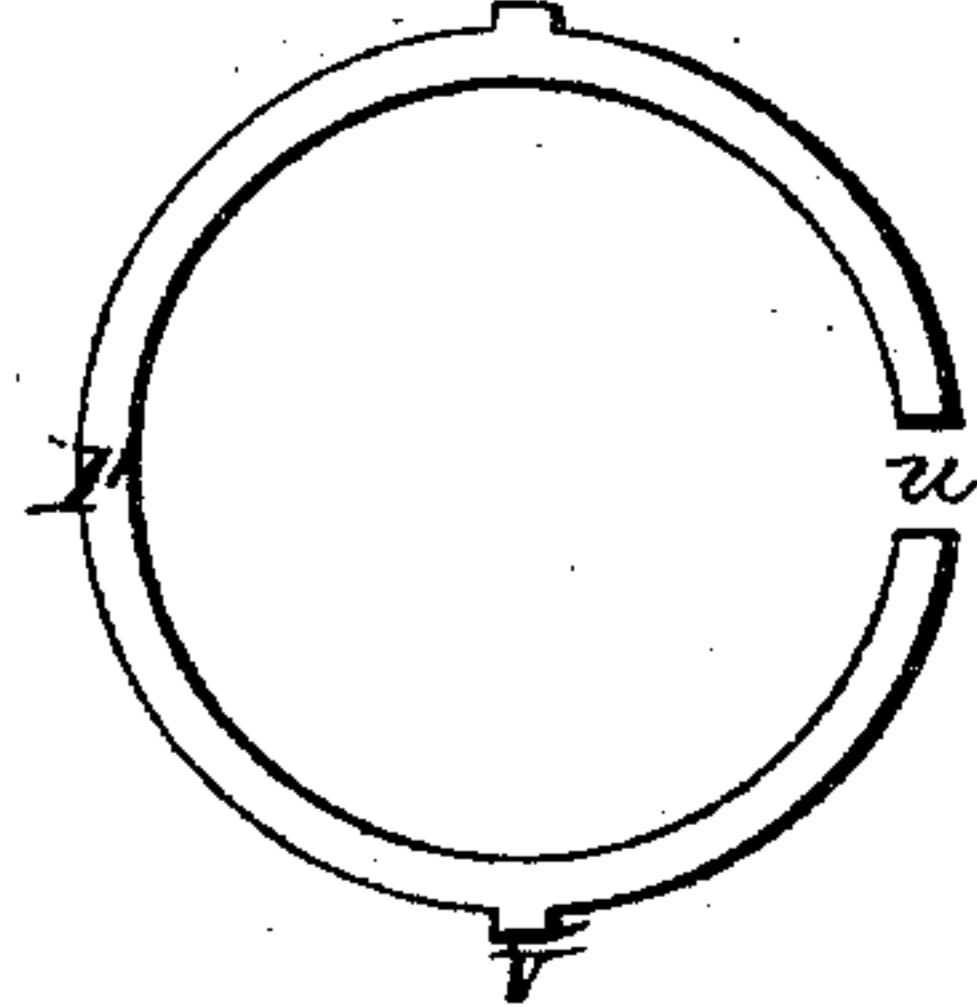


Fig: 9.



Witnesses:

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Inventor:

Joseph L. Hall



# UNITED STATES PATENT OFFICE.

JOSEPH L. HALL, OF CINCINNATI, OHIO.

## LOCK.

Specification of Letters Patent No. 30,140, dated September 25, 1860.

*To all whom it may concern:*

Be it known that I, J. L. HALL, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and useful Improvement in Combination-Locks; and I do hereby declare that the following is a full and complete description thereof, reference being had to the accompanying drawings, and characters of reference, making a part of this specification.

My invention relates to that class of locks which are opened or unlocked by rotating a key back and forth in the lock to adjust a series of tumblers according to a determined formula.

In the accompanying drawings Figure 1 is a perspective view of the interior of the lock having the central disk and central stem (see Figs. 6 and 7) removed. Fig. 2 is a plan of the front of the lock, the same as Fig. 1, but with the operating parts restored. Fig. 3 is a plan of the back of the lock. Fig. 4 is a longitudinal section of the lock. Fig. 5 is a plan of the back of the lock with the plates *h h'* shown in Fig. 3, removed. Fig. 6 is a central circular disk. Fig. 7 is the central stem by which the tumblers are rotated.

Like characters of reference indicate corresponding parts in all the drawings.

A is the outer case or shell of the lock, to which cover B shown only in Fig. 4 is secured by corner screws entering apertures in the quarter round corner blocks *a*. Half round ears project from the four corners of the outer case A having apertures *b* to receive the bolts by which the lock is secured to the door of safe or vault or other inclosure.

C is a central circular chamber. The ring which bounds the chamber is open in the direction of the front edge of the lock and the opening is occupied by the guard plate J as shown.

D is the bolt. It is constructed with an enlargement within the lock and with an elongated octagonal space which accommodates the chamber C. Its rear end is recessed, or reduced in thickness to afford space for the permanent plate E which is L shaped and secured to the end plate of the casing A by screws *c*. D is still further reduced in thickness to permit the crank *n* to rotate under the plate E as will be described.

Within the circular chamber C and nicely fitted thereto are placed a series of annular

rings or tumblers marked 1 2 3 4 and these are separated from each other by a series of stationary washers 1' 2' 3' 4', one of which is interposed between each pair of the tumblers and one between the last or outer tumbler and the circular central plate or disk F which partly enters the chamber C and partly projects above it. The part of the disk F which is above or outside of C is surrounded by a series of equal projections *d* which extend beyond the inner circumference of the chamber and rest upon the edge of the ring which bounds it, and these projections afford a series of equal spaces *e* the purpose of which will be explained. The disk F is also made with a slot *f* from the periphery toward the center, and four radial slots *g* extending at right angles from the center or a central aperture toward the periphery.

H is a central stem, one end of which has a step in a socket plate *h* and passing through the center of chamber *c* its other end passes through the front plate and projects beyond the same, its projection *i* outside of the front plate having a hexagonal form as shown. The central stem H has a fixed arm one part of which *k* is longer than another part *l*. The part *l* is adapted to enter and fill either of the radial slots *g* in the central disk F as seen in Fig. 2.

G is a stem or shaft carrying a crank *n* with a pin *o* which enters an aperture in the rear transverse part of bolt D and serves to throw the bolt out or in when operated by a key from the outside as will be explained. G is carried or supported by the fixed plate E and passes through the front plate projecting beyond it with a hexagonal projection *m* corresponding with *i* upon the end of H. The two stems G and H turn freely in their places under appropriate conditions.

Resting upon the front plate B of the lock as shown in Fig. 4 are seen two conical blocks I I', a plan of which is represented in Fig. 11. These are precisely alike in their construction and they are adapted to the two stems G and H as will appear. They are of a length corresponding accurately with the thickness of the door M to which the lock is applied so that when introduced into appropriate apertures in the door their outer faces will be flush with the outer face of the door and their inner faces flush with the inner face of the door and against the front face of the lock when the same is



properly fixed upon the door. The blocks I I' enter their apertures in the door by a screw thread and they are held from turning therein so as to return outwardly by an ordinary key driven into a key seat drilled from the inside of the door, before the lock is applied to its place. The places of the blocks in the door will of course be made to correspond with the positions occupied by the hexagonal projections *i m* when the lock is in its appropriate place. The conical blocks are cored or drilled out in a peculiar manner to receive the two part revolving arbor as shown; the part *p* (*p'*) entering the narrow end of the conical blocks being of a cylindrical form and the part *q* (*q'*) entering the larger end of the conical blocks being of a conical form. The parts *p q* (*p' q'*) are connected by a pin extended from *q* (*q'*) passing through a narrow aperture *s* (*s'*) and entering the cylindrical part *p* (*p'*) by a screw thread and when entered it is "stopped" from "returning" or unscrewing by the small key *r* (*r'*). The two cylindrical parts *p p'* have hexagonal apertures which receive the projecting stems *i* and *m*, and the conical parts *q q'* have shallow apertures *t t'* of the form shown in Fig. 11 to which the key as shown in Fig. 12 is fitted. The two part arbors in these conical blocks I I' though nicely fitted in the apertures which contain them are free to rotate therein, and being connected with the stems G and H as explained and the latter being free to rotate under certain conditions as has been mentioned, it follows that the stems G and H may be turned back and forth in their places from without by the key placed in the apertures *t t'*, and it is thus that the operation of adjusting the tumblers and throwing the bolt of the lock in either direction is performed, the key which operates the stem H, arranging the tumblers in the manner to be explained, and the key which operates the stem G, throwing the bolt out or in as desired.

The bolt D carries a guard plate J which when the bolt projects from the lock or is locked, terminates in an opening through the annular ring which bounds the chamber C, and which as the bolt is returned or unlocked must enter the chamber C, which contains the tumblers 1 2 3 4, and the washers 1' 2' 3' 4', which have been mentioned. These tumblers are each made with an opening *u* as represented in Figs. 8 and 10, and the washers are each made with an opening as shown in Fig 9, and these openings are precisely adapted to the thickness of the guard plate J. The washers are placed in the chamber C, in a position which brings the opening *u*, at a point corresponding with the opening into the circular chamber C, traversed by the guard plate J, and hence they offer no obstacle to the entrance of the

guard plate into the chamber, and the washers are held in their position, so as not to turn, and obstruct the passage of J, by lugs *v* which enter appropriate recesses in the inner face of the central chamber C. But the tumblers 1 2 3 4 are free to turn in the chamber C. Hence when the opening *u* of any one of them is in position not corresponding precisely with the space traversed by the guard plate J, the passage of the latter is obstructed by the periphery of the tumblers, and the bolt is prevented from returning or unlocking, and when all the tumblers are in position. Where their openings *u*, are out of range with J, they all interpose to prevent the return of the bolt. Moreover the circular plate F, partly entering the chamber C, opposes the return of J in all positions except the single one when the slot *f*, coincides with the space traversed by J.

One of the tumblers—that is 4, the upper or outer one of the series, a plan of which is represented in Fig. 8—has a sectoral projection *y* upon its inner or concave surface. When all parts of the lock are appropriately arranged in their places, the shorter part of the arm of the central stem H enters and fills one of the radial slots in the circular disk F, causing it to be rotated with the stem when the latter is turned by the key from without as has been explained, while the longer part *k* of the arm traverses in the annular space or central area within the tumblers; but in traversing around in this space, it encounters the projection *y* upon the internal or concave surface of the tumbler 4, which has been described, causing it to be moved around in its place accordingly as the stem H is rotated. Now upon the under surface of the circular disk F, there projects a short pin, and from the upper surface of the tumbler 4 adjacent to F there projects a pin W, in the same circular range with the pin upon the under surface of F, and in the rotation of F its pin may encounter the pin upon the adjacent tumbler 4 causing it to be rotated simultaneously with the former. Upon the under surface of the tumbler 4 a similar pin projects which in the rotation of 4 encounters a projecting pin upon the upper surface of tumbler 3, and upon the under surface of tumbler 3 there is a projecting pin, which encounters a corresponding pin upon the upper surface of tumbler 2, and upon the under surface of tumbler 2, a similar projecting pin acts upon a pin upon the upper surface of tumbler 1. These pins are all placed in the same circular range from the common center around which the tumblers turn but they may be placed at option or changed at will to alter their position with reference to the slots or openings in the tumblers, thus changing the combinations of the lock, as



will hereafter appear. It will now be apparent that by turning the key forward in one direction a certain number of times, all the pins upon the tumblers will be brought  
 5 in contact and thus all the tumblers will be turned in one direction, while by turning the key backward a number of revolutions, the opposite surfaces of the pins will be brought  
 10 in contact and all the tumblers will be turned in an opposite direction, the circular plate F, turning or rotating with the stem H, in either direction accurately as the other is turned.

Fig. 13 is a circular index plate spaced  
 15 equally and numbered from one to eight, and each space is subdivided into four minor spaces plainly denoted by lines. The index has a central octagonal aperture, the sides of which are designated by the num-  
 20 bers 1 to 8, which designate the grand divisions upon the index. To this aperture an octagonal part X upon the key, Fig. 12, is nicely adapted, and the faces upon the octagonal part of the key are numbered 1 to  
 25 8 consecutively.

Let it now be supposed that the lock has been applied, in a suitable manner to a door, the cones I, I', having been first inserted into appropriate places in the door, and secured therein as has been described, the  
 30 projecting ends  $i$ ,  $m$  of stems H and G entering their appropriate apertures in  $p$ ,  $p$ ; and let it be supposed that the door is locked by the bolt D projecting from the lock in the  
 35 usual manner, and that the tumblers in the lock have been so disordered as to obstruct the return of the guard plate J, so preventing the bolt from being returned by the key; and let it be further supposed that the  
 40 formula for opening the lock has been previously determined by a method which is to be explained. The key, Fig. 12, is first taken and inserted properly into the index plate, Fig. 13, being careful to note that the  
 45 faces upon the octagonal part of the key coincide with the faces of the octagonal aperture of the index, accurately, as may be required by the formula, which may be 1 upon the key to 1, 2, 3 or any other number  
 50 upon the index. The key may then be turned in one direction, say to the right, an indefinite number of times, until it is known that all of the tumblers have been moved, and until a certain point upon the index,  
 55 say a point indicated by the line making the second minor division between 3 and 4, ( $3\frac{1}{2}$ ), or any other point named in the formula, coincides accurately with a fixed index point  $\phi$  previously made upon the  
 60 face of the door adjacent to the circumference of the index. This will bring the opening  $u$  in the first tumbler of the series into range with or upon the space to be traversed by the guard plate J, when the bolt is  
 65 withdrawn or unlocked. The key is then

turned in an opposite direction a certain number of revolutions and until the particular point upon the index required by the formula is opposite to the fixed point  $\phi$  as before, and this will bring the opening in  
 70 the second ring of the series upon the space to be traversed by J. The key is then turned a second time to the right a certain number of revolutions and until the specific point upon the index, designated in the  
 75 formula, is brought to the fixed point  $\phi$  as before. This will bring the opening in the third ring upon the space to be traversed by J. The motion of the key is then reversed, and another specific point upon the index,  
 80 required by the formula, is brought opposite to the fixed point  $\phi$ . This will bring the opening in the fourth and last ring of the series upon the space to be traversed by J. The key is then reversed for the last time,  
 85 until the last point designated is brought to coincide with the fixed point  $\phi$ . This will bring the slot  $f$  of the circular disk F upon the space to be traversed by J and into a range with the openings in all the tumblers.  
 90 The bolt D is now free to be withdrawn or returned into the lock, the guard plate J passing through all the openings in the tumblers and into the slot  $f$  in the central disk F, to the position represented in Figs. 2  
 95 and 4, it being withdrawn by a key inserted into the key hole  $t'$  of the cone I', rotating the stem G and crank  $n$ , with its pin O entering an aperture in the transverse part of D as has been explained.  
 100

The tumblers in the central chamber  $c$  have no surface contact with each other, being separated by the stationary washers, one of which is interposed between each pair of tumblers. Hence the rotation of one  
 105 tumbler cannot impart any uncertain motion to another, the tumblers acting upon each other, or being acted upon only by means of the projecting pins. The pin upon the under surface of the disk F, and the pin  
 110 upon the upper surface of the tumbler 4, encounter each other only in one direction and if these pins were removed the part  $l$  upon the stem H would engage with the projection  $y$  in both directions, thus rendering  
 115 the pins apparently unnecessary. But the purpose of these pins is to render the actions upon the tumblers, produced by the forward and backward rotations of the key less, equal measured and less liable to be  
 120 learned, rendering the combination more obscure and intricate, particularly when a change in the combinations is established by withdrawing the central stem H, and introducing the part  $l$ , into any one of the radial  
 125 slots  $g$  other than the one in which it had been previously operated, as will be explained. The spaces or recesses  $e$  upon the periphery of F are for the purpose of preventing any attempts that may be made to  
 130



open the lock by the process of "feeling." When a pressure is employed to withdraw the bolt simultaneously with an attempt to adjust the tumblers, the guard plate J readily enters one of these spaces and thus renders it impossible to turn the stem H and operate the tumblers.

Should the position of the slot *f* in the disk F be discovered, and should it be properly arranged with reference to the guard plate J, and should an effort then be made to force or wrench back the bolt by a power sufficient to collapse the open tumblers, the tumbler 2, as shown in Fig. 10, has an internal enlargement *s* sufficient to afford a slot to accommodate the traverse of the guard plate J without destroying the continuity of metal composing the tumbler, and this would resist any force that could be brought to bear, not sufficient to break the stem *s* or ream out the hexagonal aperture in P. The shape of the cones which pass through the door to connect with the lock secures them from being forced inwardly to the injury of the lock. There is no aperture from without through which powder can be introduced. There are no parts projecting from the face of the door to be wantonly injured, and there is no dial or other essential part exposed to be defaced. The position of the fixed point  $\phi$  may be known accurately even should the mark itself be obliterated.

When the door to which the lock is secured, is opened the plates *h h'* may be removed from the back of the lock, revealing openings *a' b'* through the back plate into the lock. Through the slotted opening *a'* the center stem H projects, and it may be withdrawn entirely from the lock and then returned again with the part *l* inserted into another, and a different radial slot *g* in the circular disk E, thus establishing a new and entirely different set of combinations. Through the aperture *b'* which is under the space traversed by guard plate J, the operation of the tumblers may be observed and noted in connection with the rotation of the key and the index plate, and thus the formula for moving the tumblers in order to permit the bolt to be withdrawn or unlocked determined.

The shell or outer casing of the lock is composed of iron. The other parts may be constructed of steel, iron or brass, or partly of each, as may be thought most expedient, in view of the expense, of manufacture, and in accordance with the requirements of purchasers. I would suggest that the cones I I' be made of steel and hardened, rendering them entirely secure against the action of drills and chisels.

It is proposed to employ in the construction of the lock as many tumblers as may be desired, though it is presumed that the

combinations produced by three or four tumblers will be regarded as sufficient for any purpose.

The advantages claimed for my lock over all other combination locks and the features of difference between it and other locks of its class are numerous and important. The first and most important advantage which it presents is its security. It affords a system of combinations which are peculiarly obscure and intricate. At the same time the combinations may be so changed as to constitute a combination of almost entirely new elements, and this is accomplished by simply withdrawing the central stem through the aperture *a'* and inserting it in a new place in the central disk, and if desired in a new relative position in the hexagonal aperture in the key block, and this may be done without removing the lock from the door.

I am aware that other combination locks are capable of being changed, and some of them with but little difficulty, but I desire to call attention to the fact that the changes of which they are readily susceptible do not usually extend to but one feature or element in the combination, leaving the remaining features or elements unchanged. For illustration, the changes in the combinations of other combination locks, at least those which are readily made, are similar to that which would be produced in my lock by withdrawing the central stem and introducing it into a new position in the hexagonal aperture in the key block. By this change, though the formula for opening the lock would require to be differently stated, the comparative motion of all the tumblers would remain unchanged, and if the original combination and the structure of the lock were known, it would also be known by experts that the starting point of the new combination must be one of six equidistant points measured from the first or original point around the index. I submit that this is not such an essential change in the combinations as would render a lock safe and reliable provided an original formula for opening it were known. To the peculiar advantage possessed by my lock in this respect I desire to direct attention. It will be observed that by introducing the lug *l* into a new slot *g* in the central disk H a radical change is effected in the principal elements of the combination, for as has been explained the pin upon the under surface of the disk acts upon the pin in the upper surface of the adjacent tumbler, in one direction, while in the opposite direction the lug *l* of the stem H acts against the sectoral enlargement upon the same tumbler, so that a relative change between the stem and disk, produces an obscure change or variety in the motion of the master tumbler, and when this change is also combined with a change in the position of the stem H



in the key block the new combination becomes so obscure and intricate as to be practically incalculable. I will not extend my remarks upon the other distinctive features

5 and advantages presented by my lock further than to invite attention to the peculiar advantages secured by the employment of the conical key block I (I') over those locks which are operated by projecting knobs or  
10 those which have apertures extending into the lock to admit a key or those which have dials permanently affixed to the door which may be maliciously defaced.

The cheapness, simplicity and durability  
15 of my lock as compared with other combination locks will be apparent.

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

20 1. The peculiar construction of the bolt D, and its arrangement with reference to the other parts of the lock, whereby the whole mechanism is inclosed within and protected by the bolt.

25 2. The combination with the tumblers (1, 2, &c.) of the central plate or disk F, as constructed, the same being made to operate in connection with the central stem H, in the manner as and for the purposes specified.  
30

3. Making the tumbler 2, with an internal sectoral enlargement *r*, for the purpose of affording space *u*, for the guard plate T, without destroying the continuity of metal  
35 composing the tumbler.

4. The conical key blocks I, I' constructed substantially as described, and inserted into

the door plate with reference to the stems G and H, for the purpose of operating a combination lock from without, by means of  
40 a key, in the manner specified.

5. The peculiar construction and adaptation of the stems G, H, so that the relative position of the same with reference to their corresponding key blocks I, I', may be varied  
45 in the manner as and for the purpose specified.

6. The combined arrangement of the internal enlargement *y*, upon the tumbler 4; the pin *w*, upon the outer surface of the  
50 same, and the corresponding pin upon the under surface of disk F, and the lug *z*, upon the stem H, for the purpose of rendering the combinations of the lock and particularly the changes thereof more obscure and intricate,  
55 as described.

7. The manner of changing the combinations, without the necessity of removing the lock for that purpose, by allowing the stem H, to be withdrawn from the inside of the  
60 lock and replaced in the contemplated new position in the manner substantially as herein described.

8. The key 12, and the portable index plate 13, in combination, the former constructed  
65 with a part *x*, fitted to and entering an aperture in the index plate in various positions and forming therewith an element in the combinations of the lock.

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