

# L. Yale, Jr. Permutation Lock.

N<sup>o</sup> 98,536.

Patented Jan. 4, 1870.

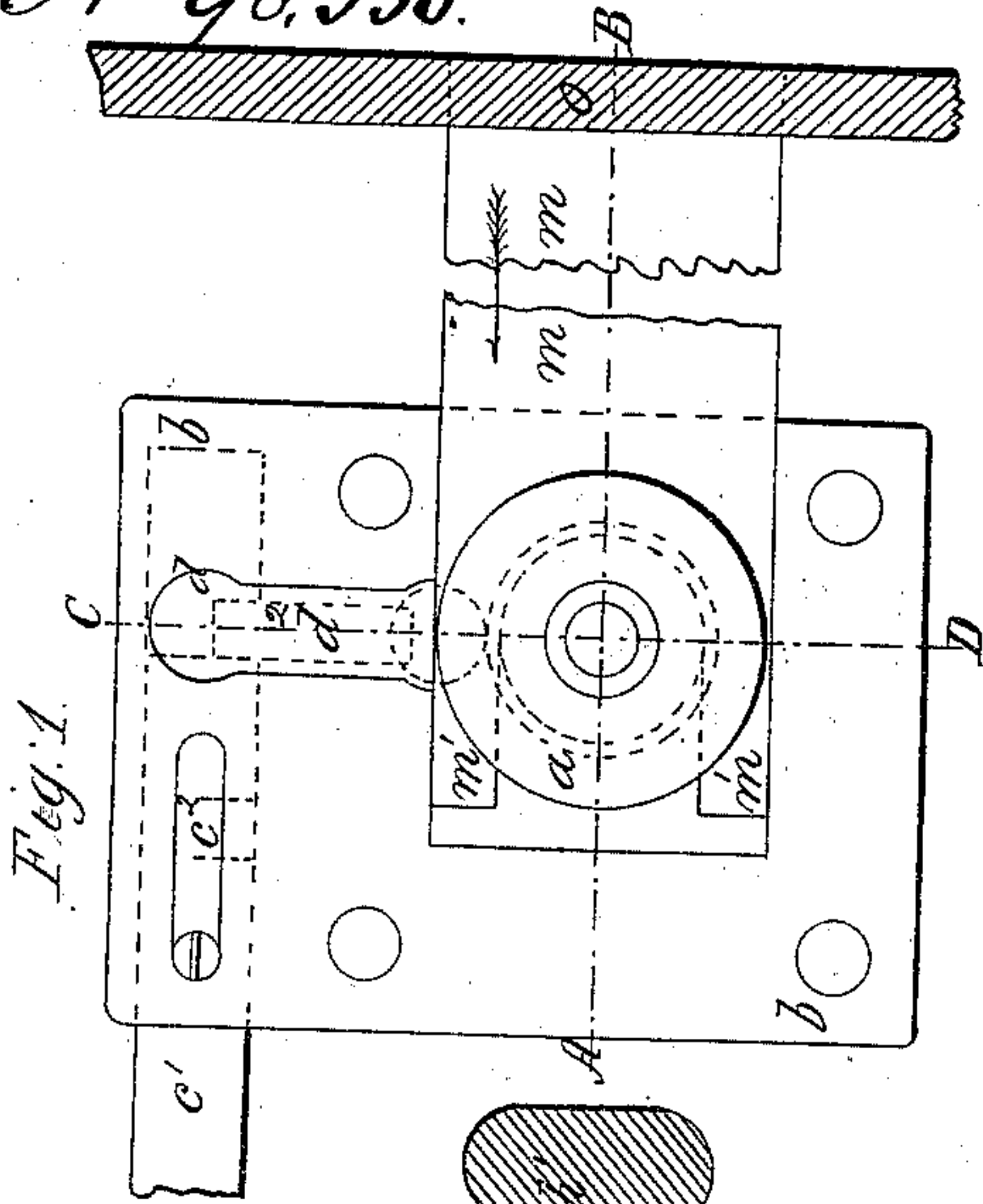


Fig. 1.

Section on C.D.  
Fig. 1.

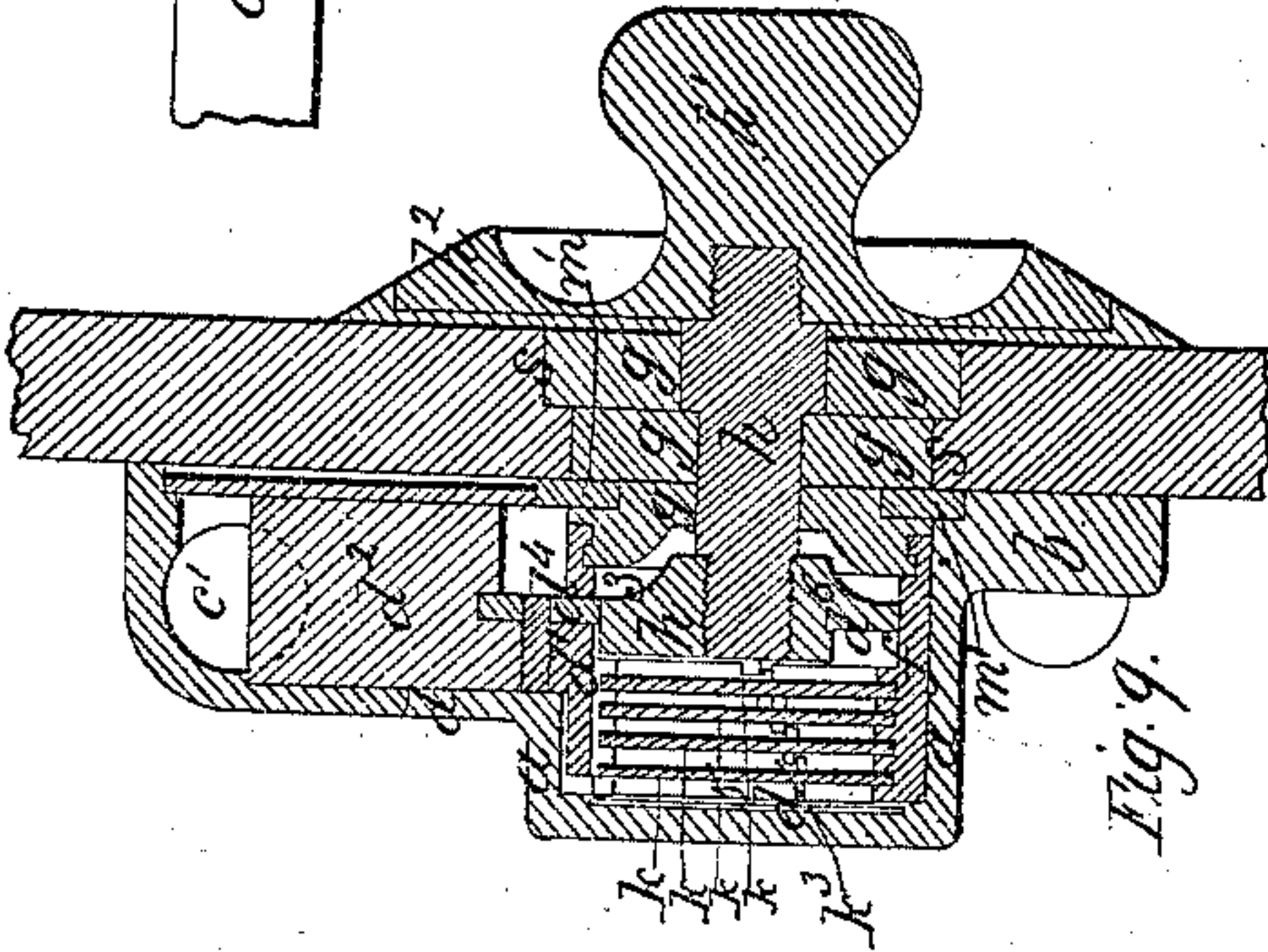


Fig. 9.

Section on A.B. Fig. 1.

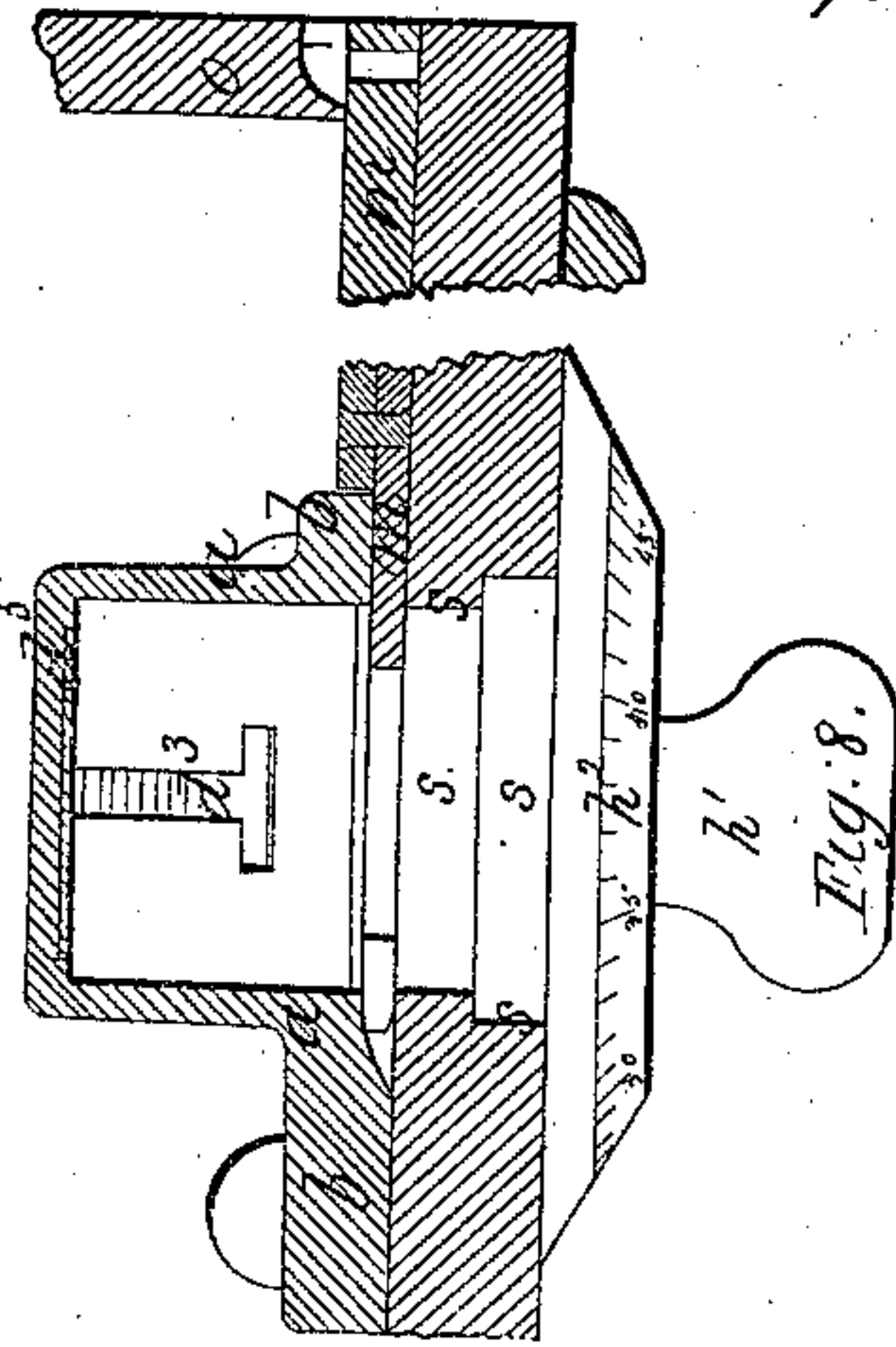


Fig. 8.

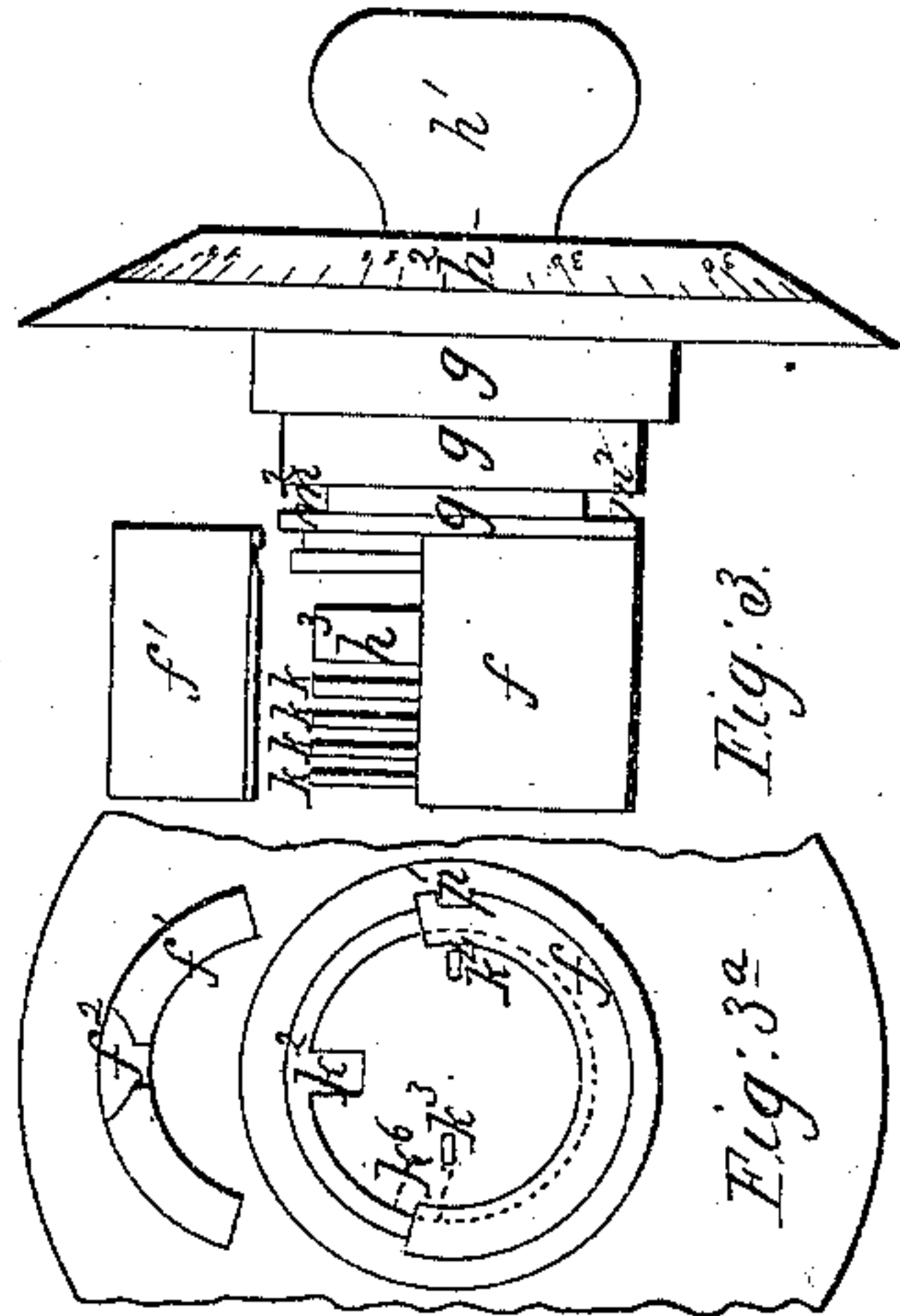


Fig. 3.

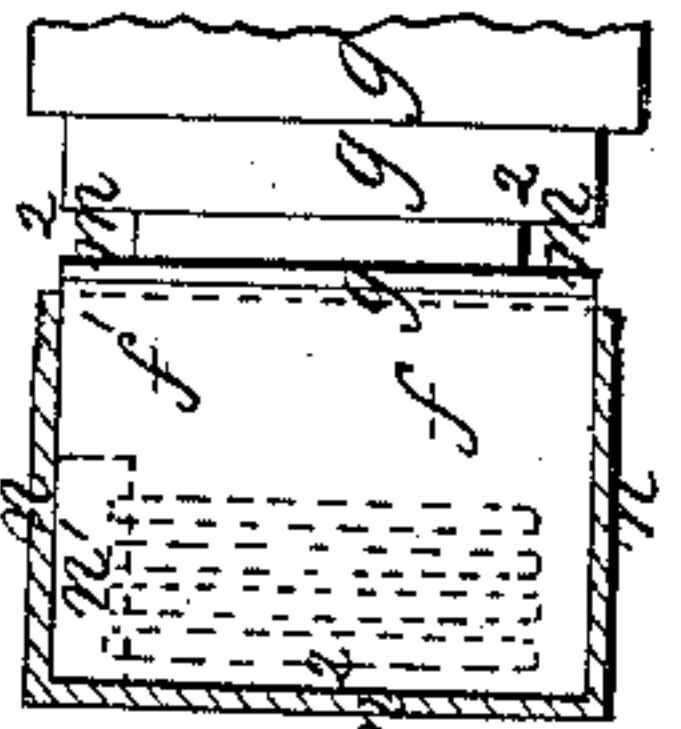


Fig. 6.

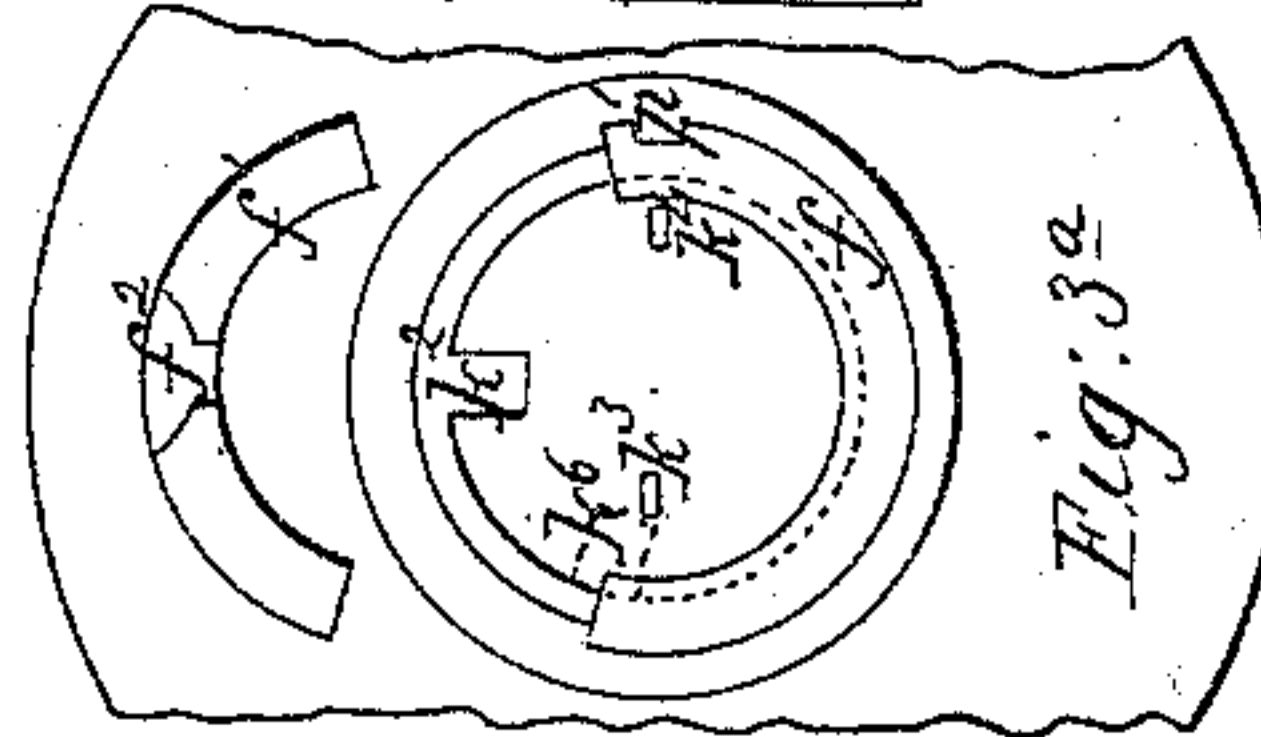


Fig. 3a.

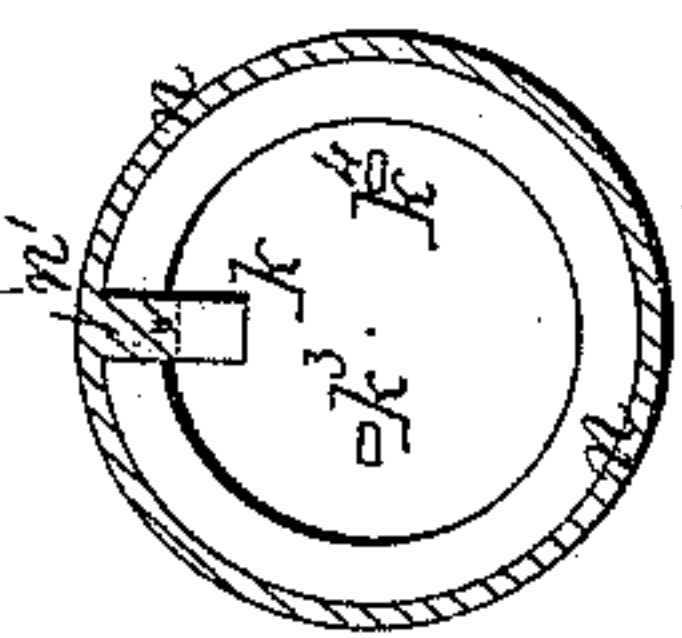


Fig. 5.

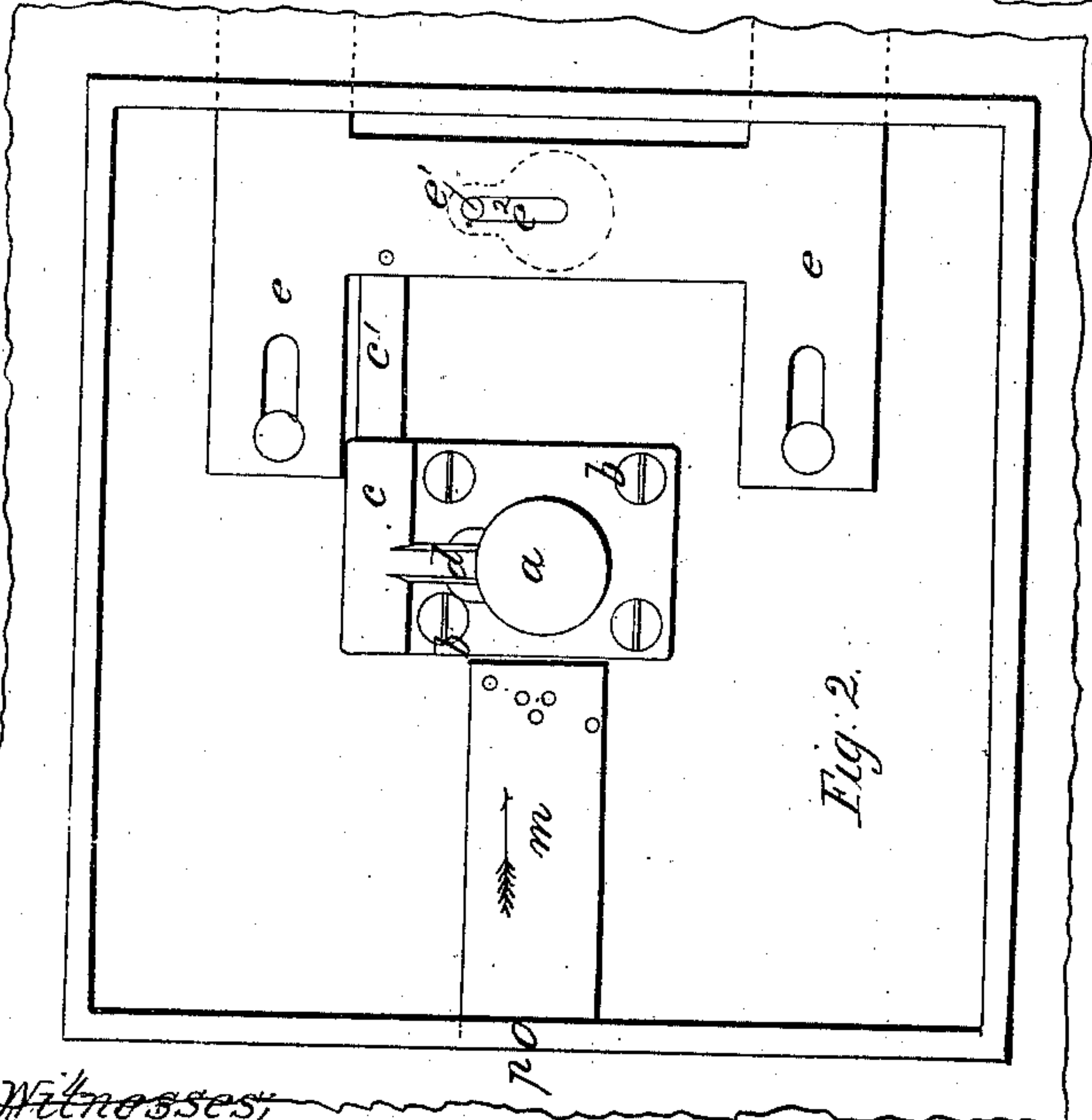


Fig. 2.

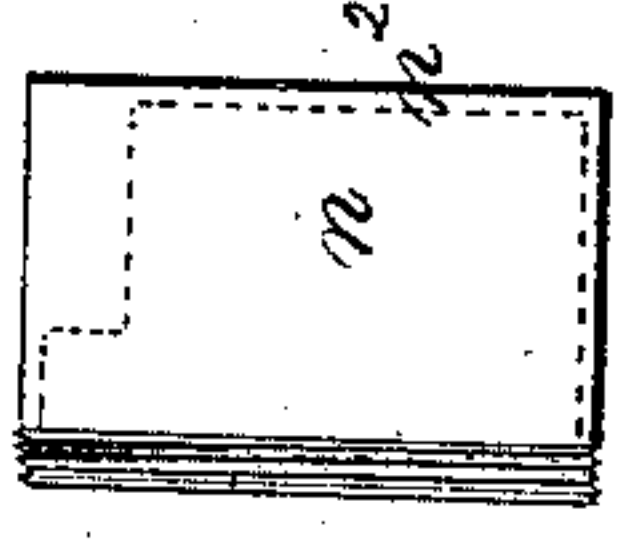


Fig. 4.

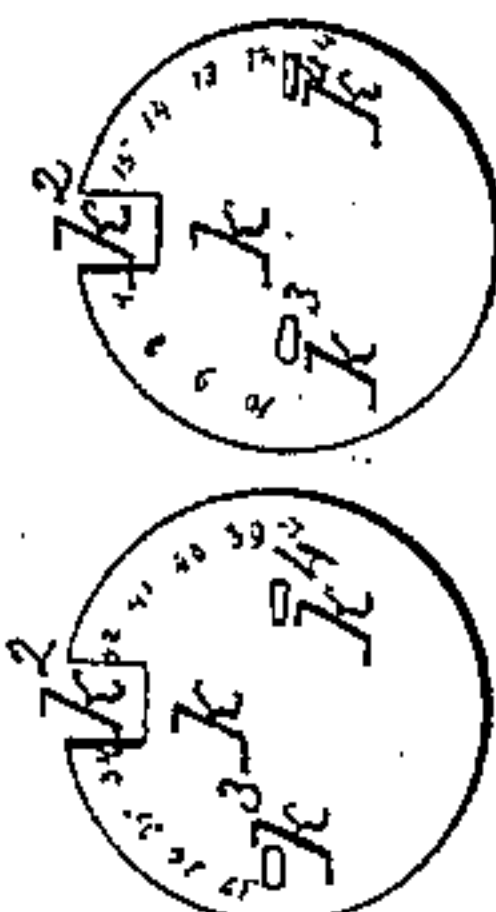


Fig. 5.

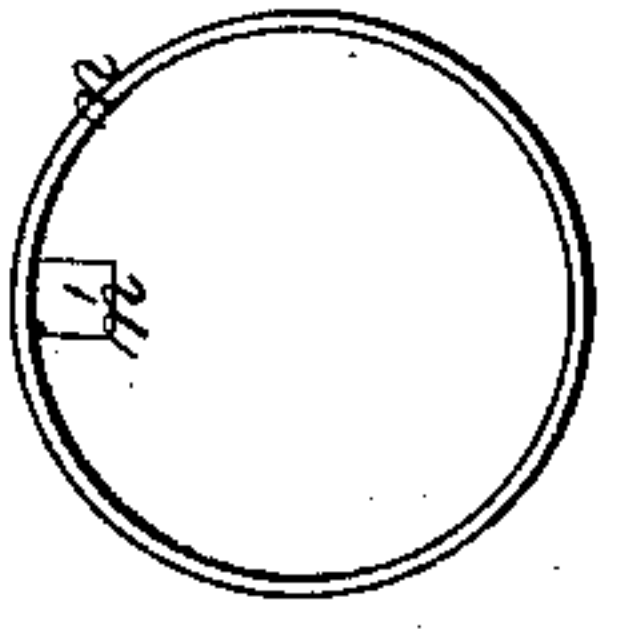


Fig. 4.

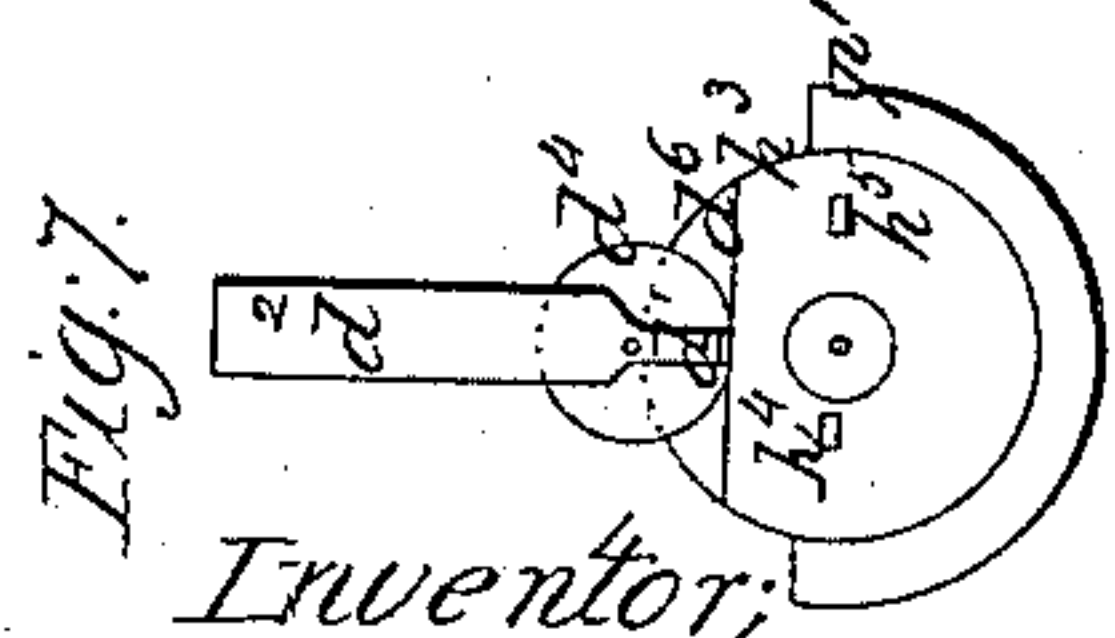


Fig. 7.

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# United States Patent Office.

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OF LINUS YALE, JR., DECEASED.

Letters Patent No. 98,536, dated January 4, 1870.

## IMPROVEMENT IN PERMUTATION-LOCKS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, LINUS YALE, Jr., of Shelburne Falls, county of Franklin, and State of Massachusetts, have invented new and useful Improvements in Safe-Locks, and in the combination thereof with doors; and that the following, taken in connection with the drawings, is a full, clear, and exact description thereof.

In the drawings—

Figure 1 is an elevation of that side of the socket and its attaching-plate, &c., which lies against the door, showing also the tumbler-case, lock, and part of the rim of the door.

Figure 2 is an elevation, from the inside, of the door of the same and other parts, showing also the door and door-frame or casing.

Figure 3 is a side elevation of the tumbler-case, dial-knob, &c., and

Figure 3, a rear elevation of the same.

Figure 4 is an elevation of the combination-indicator, and a section through the same.

Figure 5 is an elevation of two tumblers.

Figure 6 is a section through the combination-indicator, and an elevation of the tumbler-case, with the combination-indicator thereon in section.

Figure 7 is an elevation of details.

Figure 8 is a section on A B, fig. 1, and

Figure 9, a section on C D, fig. 1, through all the parts of the lock.

All the figures are full size except the second, which is on a smaller scale.

The same letters refer to the same parts in all the figures.

The object of the said invention is to provide a small, unpickable, and comparatively low-priced safe or bank-lock, chiefly, however, for use on doors that are filled in with plaster, alum, or other filling used by safe-makers, the lock being so constructed and attached to the door, that its working-parts can be removed for cleaning, or for purposes of altering the combination, without disturbing the filling.

The lock is made small, in order that it may be covered (without increasing the thickness of the door) with a sufficient depth of plaster to insure the door being fire-proof over its whole extent, or, if that be impossible, then, that only a very small portion of the door shall be insufficiently protected.

In order to secure these objects, the lock-case is a mere socket, with a proper plate or ears for attaching it to the inside of the door, and its cavity coincides with a hole or opening through the door, and the tumbler-case is removable from the front or outside of the door, instead of from the inside, as usual.

The socket *a a* is, by preference, made with a cylin-

dricul bore, and has cast or formed in one piece with it, an attaching-plate or ears, *b*, by means of which it may be bolted to the door, with its cavity coinciding with an opening, *s s*, fig. 8, formed in the iron front of the door.

An enclosure, *d*, for the stump *d*<sup>1</sup>, and bolt-stopper *d*<sup>2</sup>, and a bolt-case, *e*, for the bolt *e*<sup>1</sup>, are also formed in one piece with or attached to the door, in proper relation to the socket. These parts are secured to the inside of the door. So also is the door-bolt *e*, which is moved by a handle or knob on the outside of the door, which, when turned, causes a partial revolution of the pin *e*<sup>1</sup> in the slot *e*<sup>2</sup>, or this bolt may be actuated in any other proper or usual way.

The bolt *e*<sup>1</sup> is attached to the door-bolt *e*, and moves with it, but may merely bear against it, being pressed toward it by a spring.

The cavity of the socket connects with that of the enclosure *d* at the opening *d*<sup>3</sup>, fig. 8, and in it slide the stump *d*<sup>1</sup> and bolt-stopper *d*<sup>2</sup>. This piece is free to fall by gravity when the notches in the tumblers are properly located, and the cam, hereafter to be described, is in proper position.

It has pivoted upon it a small, slightly-eccentric roller, *d*<sup>4</sup>, which is the disconcerter. When this piece is down, the bolts can be moved by the handle to lock and unlock the door. When the door is locked, it is thrown up behind the bolt *e*<sup>1</sup>, so as to prevent the retraction of both bolts. When the door is unlocked, it may be thrown up into a notch, *e*<sup>2</sup>, in the bolt *e*<sup>1</sup>, and then neither bolt can be moved either backward or forward.

The tumbler-case *f f*<sup>1</sup> is, by preference, made cylindrical, and in two pieces. It is attached to the filling-plate *g g g*, which I prefer to make of one piece of hardened steel, although it may be made of several thicknesses, properly attached to each other.

In this filling-plate, or these plates, is supported the spindle *h*, carrying the knob *h*<sup>1</sup>, the index-plate *h*<sup>2</sup>, and the cam *h*<sup>3</sup>. All these parts are free both to revolve and slide in the filling-plate, and the cam, securely fastened upon the spindle, prevents its withdrawal from the plate. This cam has projecting from it, on the side nearest the tumblers, a pin or pins, by means of which the tumblers *k k* can be revolved.

These tumblers may, as usual, be supported upon a pin or spindle projecting from the bottom of the socket, or from the knob-spindle *h*, and when this pin is employed, I prefer so to fit it that it is free to revolve.

The best plan, however, is to employ a tumbler-case provided with grooves, (see specially figs. 9 and 3<sup>a</sup>.) the tumblers being located in the grooves, which both sup-



port and space the tumblers. I prefer to attach this case, or part of it, to the filling-plate.

Under the construction shown and described, the knob, dial, or index-plate, spindle, cam, tumbler-case, and tumblers, can all be drawn out from or shoved into the socket from the front of the door, and when they are drawn out, the piece  $d^1 d^2$  will drop down into the socket, and can also be removed, so that all working-parts of the lock proper can be withdrawn, for cleaning or change of combination, without disturbing the filling, and while the socket is still completely covered by the filling.

In order to prevent the dropping down of the piece  $d^1 d^2$ , when the tumbler-case is removed merely for the purpose of examination or for changing the combination, I locate in the bottom of the socket a spring,  $d^3$ , which, when the tumbler-case is pulled out, flies under the stump and holds it up. The spring is thrown back by the tumbler-case, when the latter is pushed home, so that the spring then cannot reach under the stump, and may be pushed back by the finger when it is desired to let the stump drop into the socket.

The tumbler-case is open at top, as at  $f^2$ , fig. 3<sup>a</sup>, so that the stump can drop into the notches  $h^2 k^2$  of the tumblers, and also so that the disconcerter  $d^4$  may fall when the cam  $h^3$  is properly located.

The cam or spindle has upon it, as before stated, one or more pins  $h^4 h^5$ , and each tumbler has one or more pins  $h^3 h^4$  projecting from each side of it. The distances between the tumblers and the length of the pins are so proportioned that one tumbler may be rotated by another, in the usual way, and the spindle, cam, and pins, which revolve with the spindle, have end-play, as usual in some revolving tumbler-locks, so that these pins may or may not engage with the pins upon the first tumbler.

That part of the cam upon which the roller  $d^4$  rides, when the spindle is shoved in, is circular, and that part of it upon which the same roller rests when the spindle is pulled out, is cut away, as at  $d^6$ .

When the piece  $d^2$  is up, preventing the motion of the bolts, and it is desired to move them, the knob is first shoved in, then the tumblers are set in succession, in the usual way, with their notches or gates all in line, and all under the stump. Then the knob is pulled out, carrying with it the cam  $h^3$ , and, as the pins moving with the spindle no longer act upon the tumblers, they stand at rest while the cavity or recess  $d^6$  is moved under the roller  $d^4$ . As this recess comes under the roller, both roller and stump drop through the opening in the top of the tumbler-case, the roller into the recess, and the stump into the gates of the tumblers. The piece  $d^2$  is then so far down that it no longer locks the bolts, and they can be moved by the handle. A further revolution of the spindle lifts the roller and stump, and the spindle may then be pushed in, and the tumblers may be set at random, in the usual way.

I have thus far described the tumbler-case and spindle, and its accessories, as being secured together, but it is evident that they might be separate, and that when pushed into the socket, the case might be put in first, and the spindle, filling-plates, &c., afterward, and the same result, in the removal of the working-parts of the lock, be attained, in substantially the same way.

I have hitherto described the tumbler-case as free to be removed at all times, although it is clear that such a construction would permit of all the working-parts of the lock being removed when the door was locked, and that when so removed the door-bolt could be retracted and the door opened. In order to prevent this, I apply to the tumbler-case, or some piece connected with it, or to the filling-piece or plates, when they are separate from the case, a bolt or catch, by which the tumbler-case and spindle, and accessories,

are firmly connected to the socket, and I so locate this catch that it is accessible only when the safe-door is open. I have devised various forms and arrangements of this catch or bolt, and have shown in the drawings the one that I prefer.

The catch  $m$  slides on the back of the door, and lies between the filling and the iron-door. It is forked at one end,  $m^1 m^1$ , and these forks enter a slot in the socket, and may be caused to enter a groove,  $m^2$ , formed in the filling-piece, by pushing the catch in the direction of the arrow. When the catch is in the groove, the filling-plate, and consequently, the spindle, &c., and the tumbler-case, cannot be removed from the socket without destroying the catch, and as this catch is inaccessible when the door is shut, the lock is secure. A burglar might bore the door, and, by introducing some instrument, withdraw the catch. In order to prevent this, I prolong the catch so that it passes through the rim or edge-plate  $o$  of the door, and when the door is closed, this end of the catch abuts against the door-casing  $p$ . It is, therefore, impossible to move the catch except when the door is open.

In order to move the catch, a small recess is formed in the rim of the door, and another in the end of the catch. (See fig. 8.) A hook may thus be applied to withdraw the catch, so as to remove the tumbler-case when the door is open.

The usual indices for setting the tumblers, so that the stump may drop, are, of course, to be applied; and as I desire to make the lock both small and cheap, I do not make the pin upon each tumbler adjustable with reference to the gates, so as to change the combination, although such tumblers may be used, but, in place thereof, intend to supply with each lock a number of tumblers, each having the pins in different radial positions with respect to the gate. Each tumbler, moreover, has upon it four pins, two on each side, and at different distances from the centre.

In consequence of this, the combination can be varied, not only by changing the tumblers, but also, as usual, by varying the order of a given set of tumblers, and, further still, by inversion of one or more tumblers, in such manner that a different side of the tumbler is toward the dial or knob.

I further enable the user to choose his own combination by means of numbers engraved upon the tumblers in certain orders and relations to the gates; but as neither the changes of combination nor the means by which a special combination may be effected are claimed herein, or affect the working of the lock, further and detailed description on this head is unnecessary.

The tumblers thus described, might have one pin only on each side thereof, but I have found by trial that when two pins on each side are employed, both of which are driving-pins, and located in the same diameter, or nearly so, then the friction of the tumblers upon the tumbler-case is much lessened, and the same result, as to lessening of friction, is observed when the tumblers are supported upon a spindle.

This combination of two pins, both on the same side of a tumbler, with the tumbler, is, I believe, new with me.

As the socket is usually to be closed at the rear, as shown, it is convenient to know, with perfect certainty, the set of the combination before the tumbler-case is introduced into the socket, and this must be done by eye, by setting the tumblers in succession under the slit in the top of the tumbler-case, and noting, as each one is set, the relative position of the pointer or index-notch and dial, and the directions in which the knob is turned.

It is difficult to judge by eye when the notches are exactly set, and to hold them by the finger in that position while noting the dial-indications. I have, there-



fore, invented an instrument which I call a combination indicator.

This instrument consists of a ring, *n*, which fits the outside of the tumbler-case, and a feather, *n'*, attached to and projecting inward from it, the feather fitting closely the opening in the top of the tumbler-case and the gates in the tumblers. The ring is to be applied on the end of the case, (see fig. 6,) and pressed upon by the finger toward the knob while it is turned.

When the last tumbler is revolved, so that its notch is opposite the feather, the finger-pressure will force the feather into the notch; the dial-indication is then to be noted; then the knob is to be revolved again in the opposite direction, rotating the tumbler next to the last. When its notch comes opposite the feather, the indicator will be pressed into it, and a note of the dial-indication is again to be made, and so on, in succession, until the whole combination is noted. I intend usually to provide the ring with a bottom, *n*<sup>2</sup>, and a cover to screw upon it; and it then forms a box for containing the spare tumblers.

I have said that I prefer to make the inside of the socket and the exterior of the tumbler-case cylindrical, although they may be square, hexagonal, octagonal, or of other figure. And I also prefer to make the case cylindrical in its interior, or of such shape that the tumblers may be held in place without the use of a spindle, and in grooves, so as to dispense with washers.

In the latter construction, the tumbler-case must be made in two parts (see figs. 3 and 3<sup>a</sup>.) in order to insert the tumblers, and I have discovered that the best plan is to make one part of the case a little more than semi-cylindrical; the tumblers can then be slipped into the grooves only when their notches are opposite the dividing edge of the case, (see *h*<sup>6</sup>, fig. 3<sup>a</sup>.) and after being thus inserted and turned, they cannot be removed or fall out, until they are turned back to the same position.

When the outside of the tumbler-case is cylindrical, I prefer to make a slot in it, parallel to its axis, as at *p*<sup>1</sup>, fig. 3<sup>a</sup>, and to form a corresponding feather in the socket. These two, together, serve as a guide for the insertion of the tumbler-case in proper angular relation to the stump, and facilitate its introduction into the socket.

It is hardly necessary to state, to those skilled in making bank-locks, that the roller *d*<sup>4</sup> prevents the stump from riding on the tumblers, when the spindle is shoved in so as to act upon the tumblers, and that this arrangement, in connection with the eccentricity of the roller, makes the lock unpickable.

I do not claim a removable tumbler-case, or tumblers in grooves, nor a socket for a tumbler-case, nor a bolt to hold a tumbler-case in place generally; neither do I claim a disconcerter, or a spindle having end-play, and provided with a cam and pins; but I believe myself to be the first inventor of a spindle provided either with pins and a cam, or with a cam only, which is secured in place by a catch or bolt, and used in combination with tumblers, and also to be the first to make a spindle or a rotary tumbler-case removable from the front of the door; and

I therefore claim as of my own invention—

1. The combination of the following parts, viz: first, a socket; second, a door with an opening in it corresponding with the tumbler-cavity of the socket; third, a filling-plate and spindle; and fourth, rotating tumblers contained within the socket, the whole being constructed so that the spindle, filling-plate, and rotating tumblers can all be withdrawn from the outer side of the door, substantially as before described.

2. Also, the combination of the following parts, viz: first, a socket or lock-case; second, a door, with an opening in it corresponding with the cavity of the socket; third, a filling-plate and spindle; fourth, ro-

tating tumblers; and fifth, a tumbler-case, the whole constructed in such manner that the rotating tumblers and the tumbler-case may be withdrawn from the outer side of the door, substantially as before set forth.

3. Also, the combination of the socket, the door having an opening corresponding with the tumbler-cavity of the socket, the filling-plate, and spindle, the rotating tumblers, and the bolt or catch to prevent the withdrawal of the filling-plate, the whole constructed in such manner that the filling-plate and rotating tumblers can be withdrawn from the outer side of the door after the bolt or catch is acted upon from the inner side of the door, substantially as before set forth.

4. Also, the combination of the socket, the door having an opening corresponding with the tumbler-cavity of the socket, the filling-plate, and spindle, the rotating tumblers, the tumbler-case, and the catch or bolt for preventing the withdrawal of the filling-plate, the whole constructed in such manner that the filling-plate, rotating tumblers, and tumbler-case can be withdrawn from the outer side of the door after the bolt or catch is acted upon from the inner side of the door, substantially as before set forth.

5. Also, the combination of the following elements or parts of a lock, viz: first, the socket or lock-case; second, the tumbler-case; and third, the spindle, when the construction is such that both the tumbler-case and the spindle may be withdrawn from the outer side of the socket, substantially as described, without removing the socket from the inside of the door.

6. Also, the combination of the following elements or parts of a lock, viz, the socket, tumbler-case, spindle, and bolt or catch passing through the socket, the construction being such that the tumbler-case and spindle can be withdrawn from the outer side of the socket when the bolt or catch is moved for that purpose, substantially as before set forth.

7. Also, the combination of the following elements or parts of a lock, viz, first, the socket or lock-case; second, the tumbler-case; third, the spindle; and fourth, the filling-plate, the construction being such that the tumbler-case, the spindle, and the filling-plate can be withdrawn from the outer side of the socket, substantially as before set forth, without removing the socket from the inside of the door.

8. Also, the combination of the following elements or parts of a lock, viz, the socket, tumbler-case, spindle, filling-plate, and bolt or catch; the construction being such that the tumbler-case, spindle, and filling-plate can be withdrawn from the outer side of the socket when the bolt or catch is moved for that purpose, substantially as before set forth.

9. Also, the combination of rotating tumblers, with a grooved tumbler-case constructed in parts, one of which is a little more than semi-cylindrical, so that the tumblers can be inserted only when their notches are opposite the dividing edge of the case, substantially as before set forth.

10. Also, the combination of the door, the removable spindle of the lock, and the catch or bolt passing through the rim of the door, so that the catch cannot be moved when the door is shut, substantially as before set forth.

11. Also, the combination of the socket or lock-case, the stump of the lock, and the spring for holding the stump out of the cavity of the socket, substantially as before set forth.

12. Also, the combination of the socket, the stump of the lock, the spring for holding the stump out of the cavity of the socket, and the tumbler-case so arranged that when in position in the socket, it prevents the spring from acting upon the stump, substantially as before set forth.

13. Also, the combination of the following elements, viz, the stump, socket, rotating tumblers, and the spindle, the construction of the whole being such that



both tumblers and spindle may be removed from the front side of the socket without the stump, substantially as before set forth, without removing the socket from the inside of the door.

14. Also, the combination of the following elements, viz, the stump-socket, rotating tumblers, spindle, and filling-plate, the construction of the whole being such that the tumblers, spindle, and filling-plate may all be removed from the front side of the socket without the stump, substantially as before set forth.

15. Also, the combination of the following elements, viz, the stump, socket, rotating tumblers, and tumbler-case, the construction of the whole being such that the rotating tumblers and tumbler-case can be removed from the front side of the socket without the stump, substantially as before set forth, without removing the socket from the inside of the door.

16. Also, the combination of the following elements, viz, the tumbler-case, tumblers, filling-plate, spindle, stump, socket, and door constructed with an opening

coinciding with the tumbler-cavity of the socket, the whole constructed in such manner that when the filling-plate and spindle are removed from the opening in the door, the tumbler-case, tumblers, and stump can be withdrawn through said opening from the outer side of the door, substantially as before set forth.

17. Also, the combination of the elements recited in the last preceding claim, with a bolt or catch for preventing the withdrawal of the spindle, filling-plate, and tumblers, substantially as before set forth.

18. Also, the combination of a revolving tumbler with two pins projecting from the same side thereof, and located in the same diametrical line or thereabout, and at different radial distances from the axis of rotation of the tumbler, the construction being substantially as described.

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Witnesses:

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