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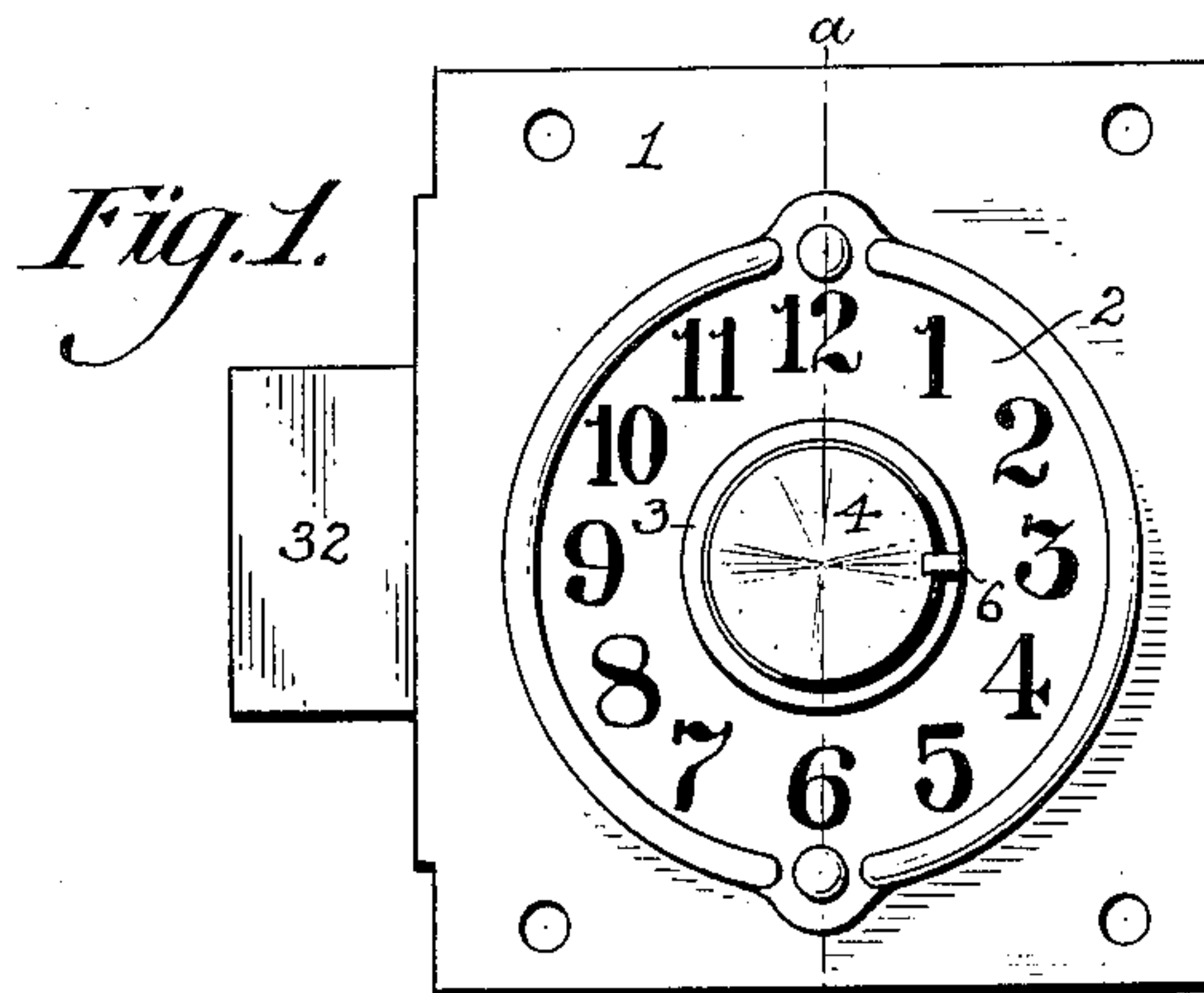
PATENTED AUG. 25, 1908.

F. SOLEY.

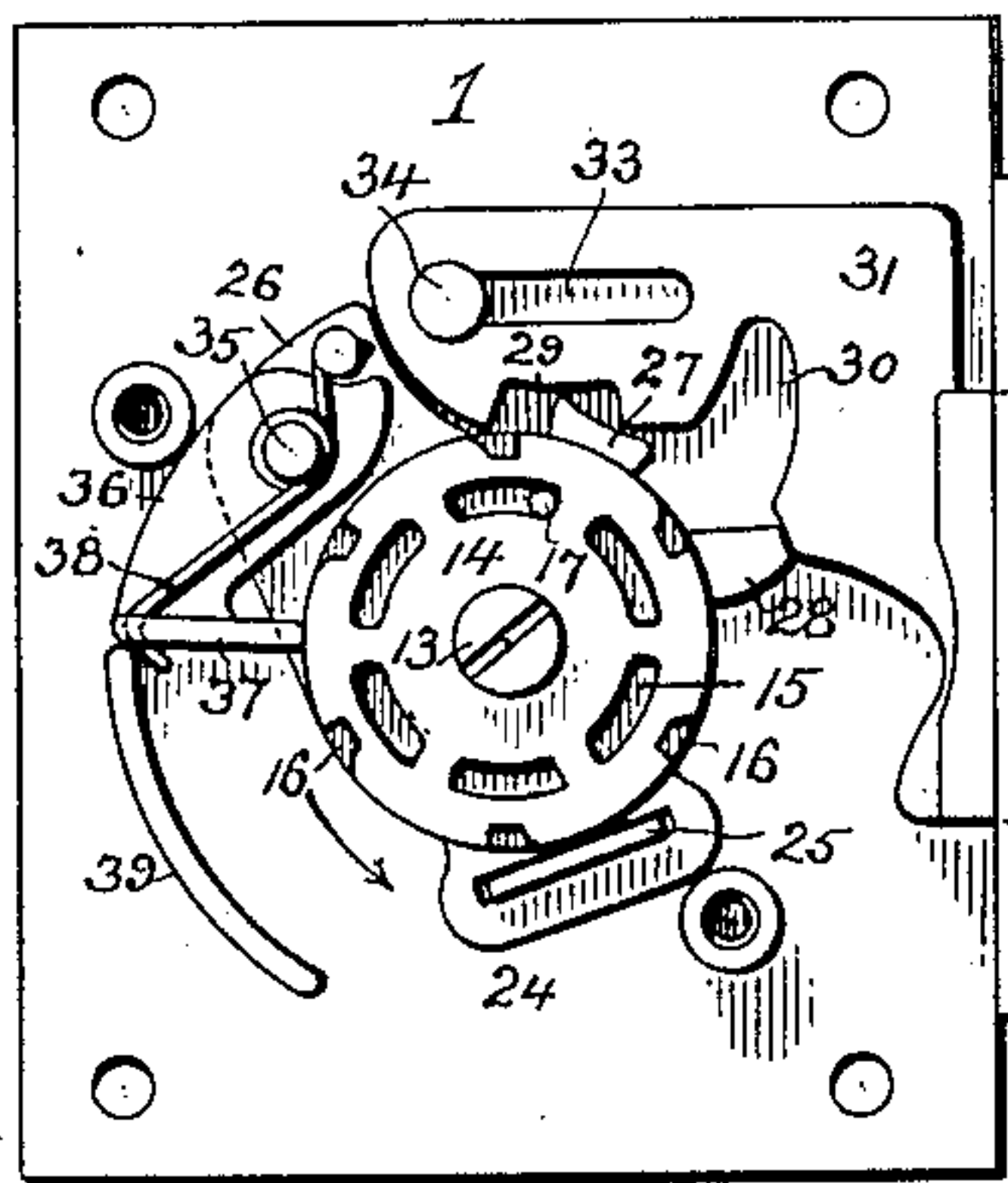
COMBINATION LOCK.

APPLICATION FILED MAY 12, 1906.

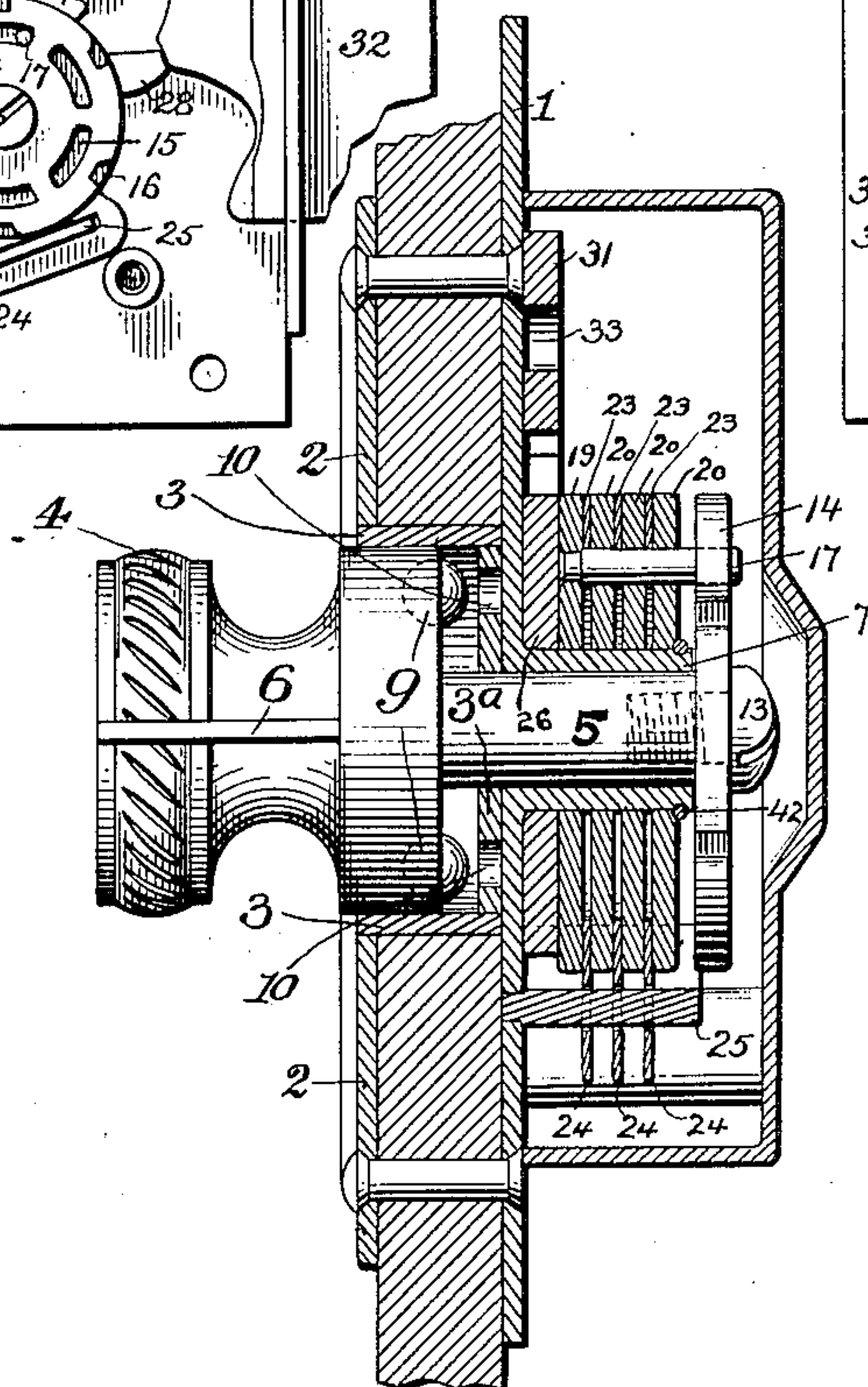
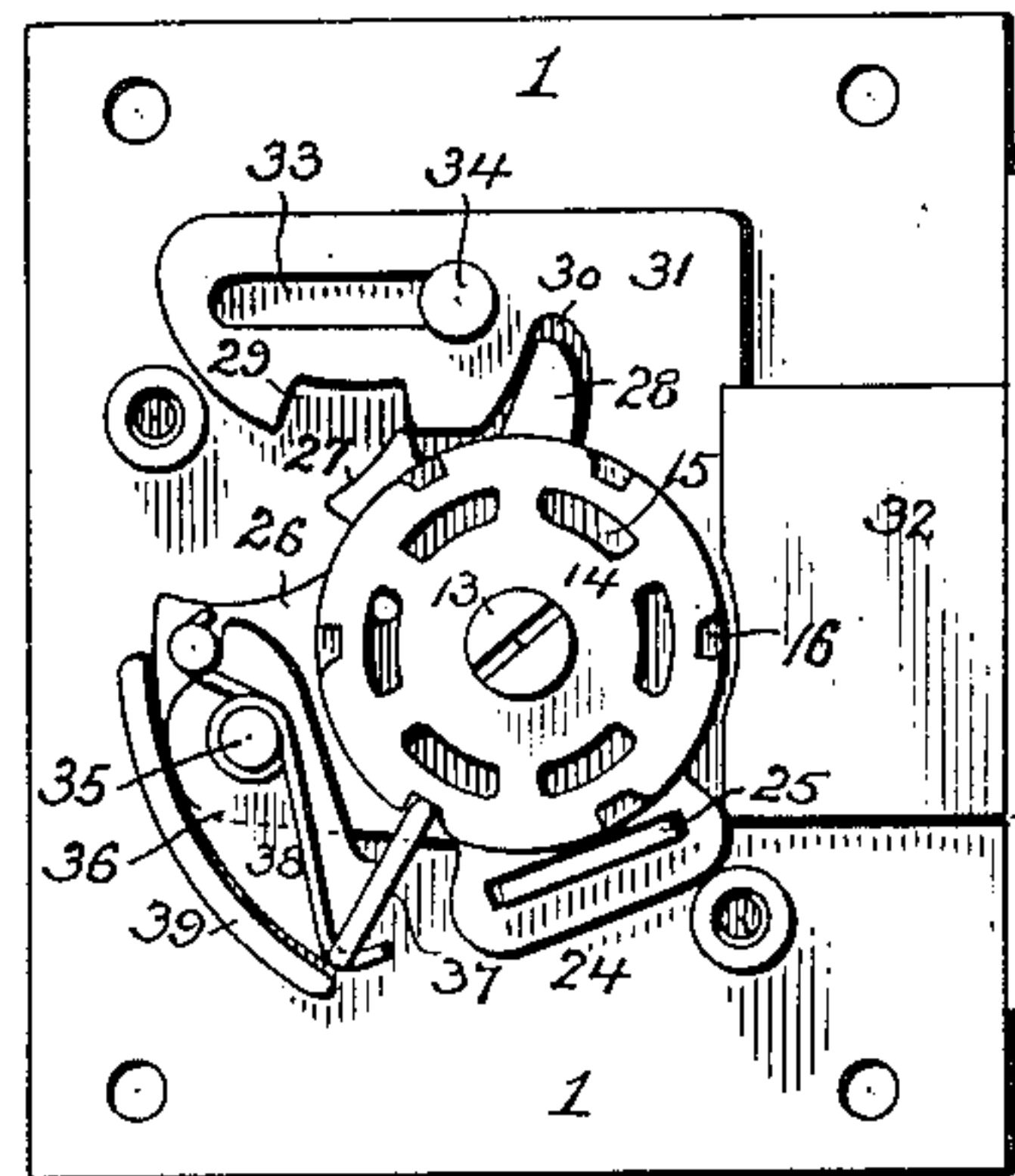
3 SHEETS—SHEET 1.



*Fig. 2.*



*Fig. 3.*



*Fig. 4.*

WITNESSES:

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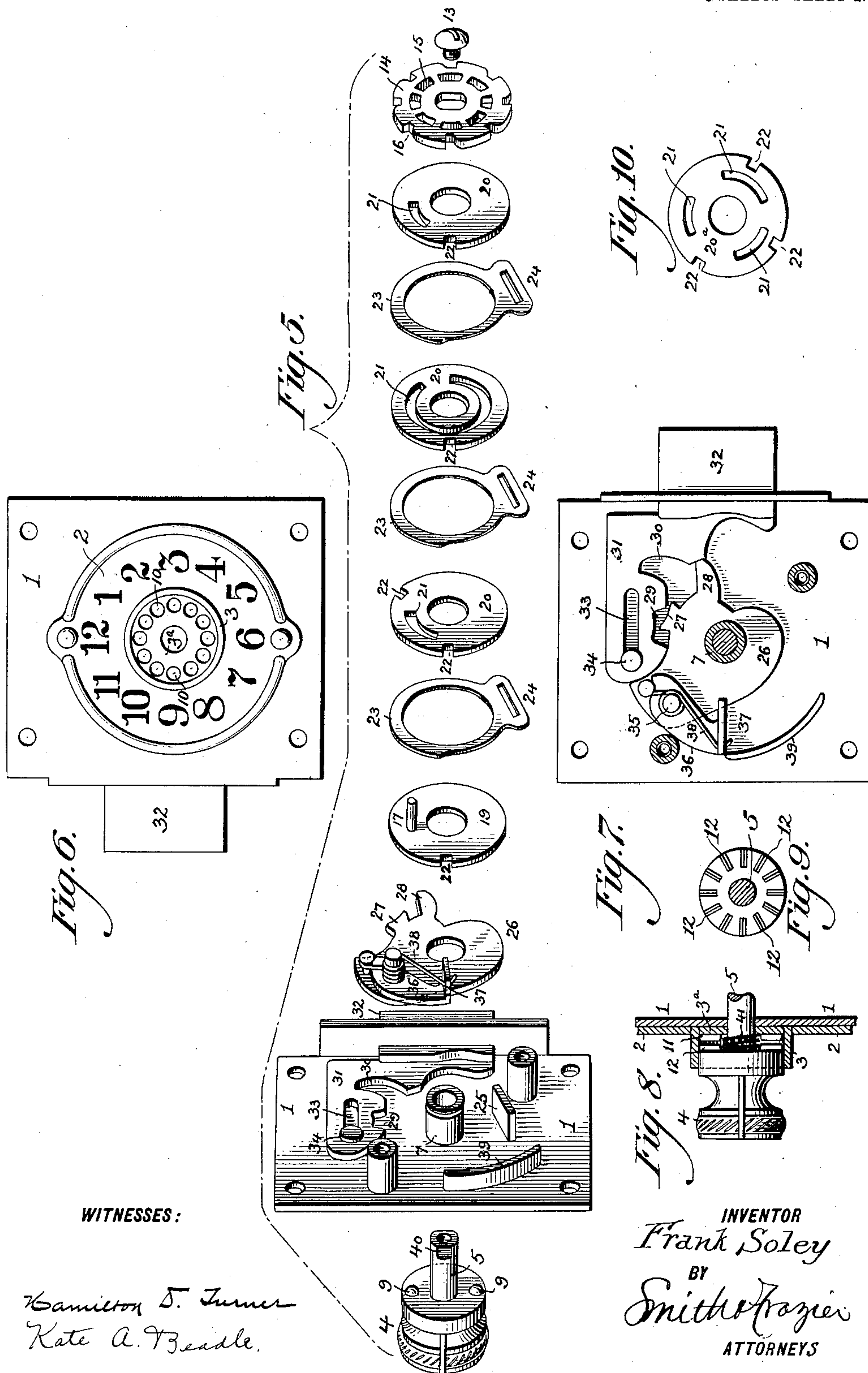
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3 SHEETS—SHEET 2.





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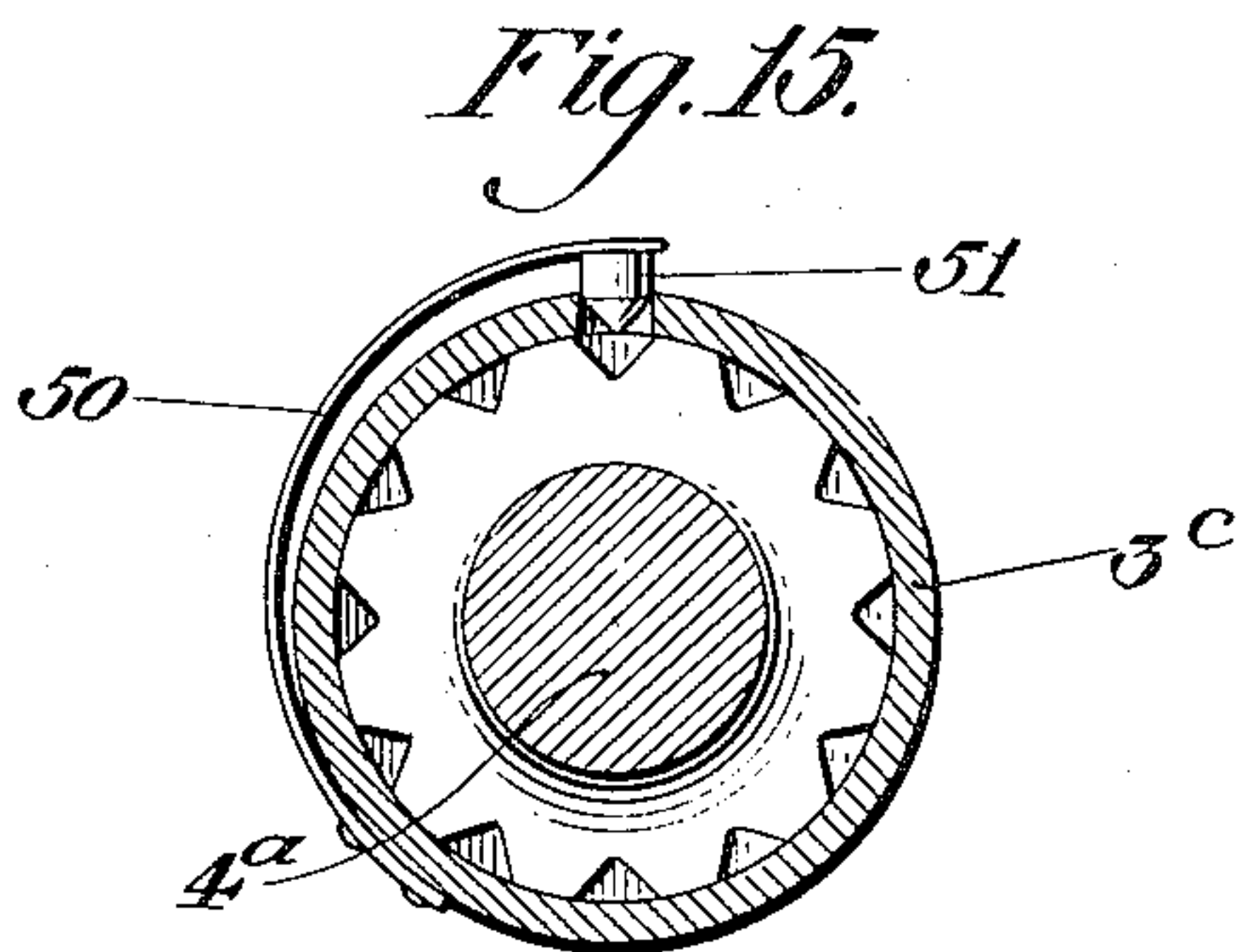
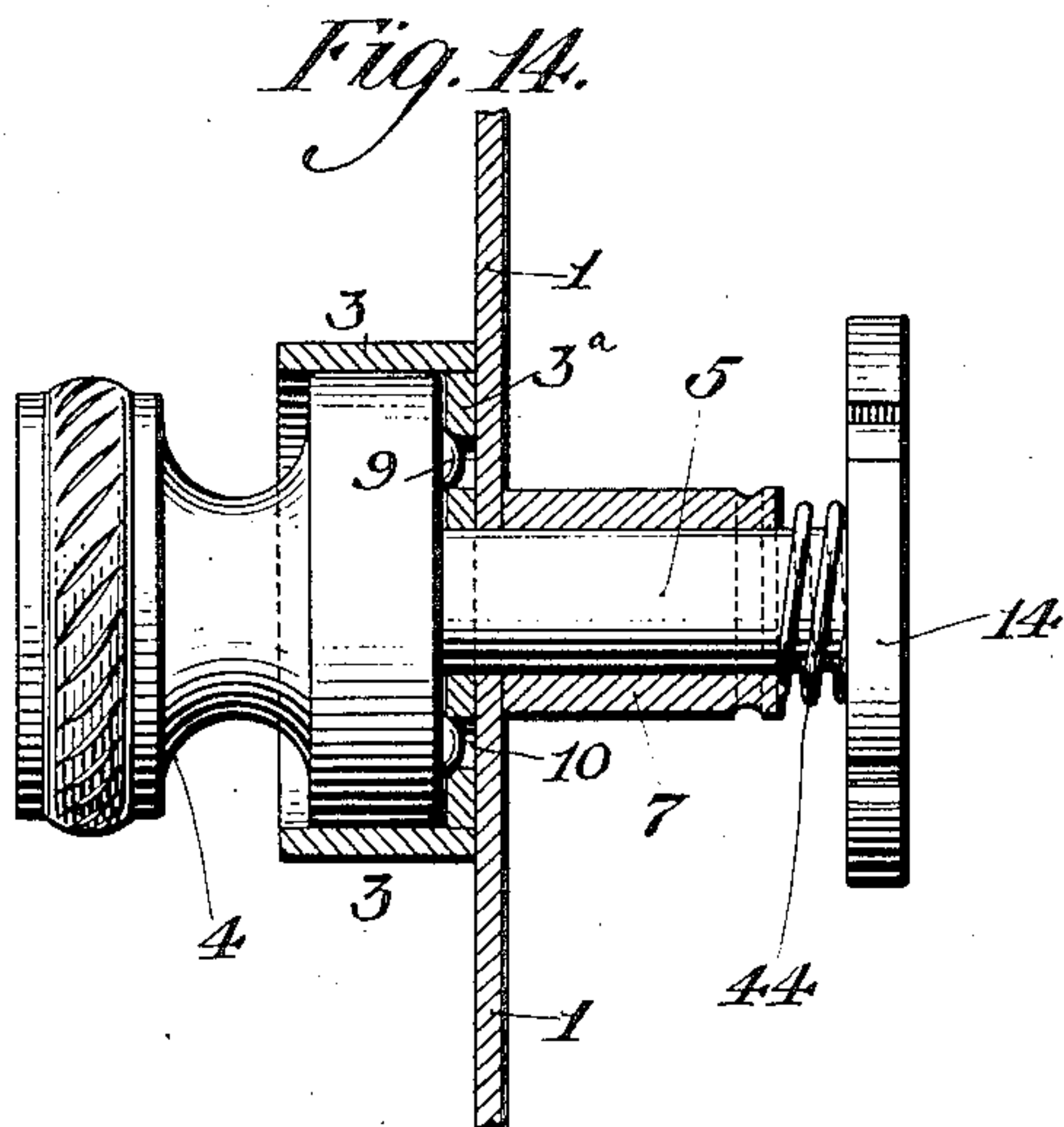
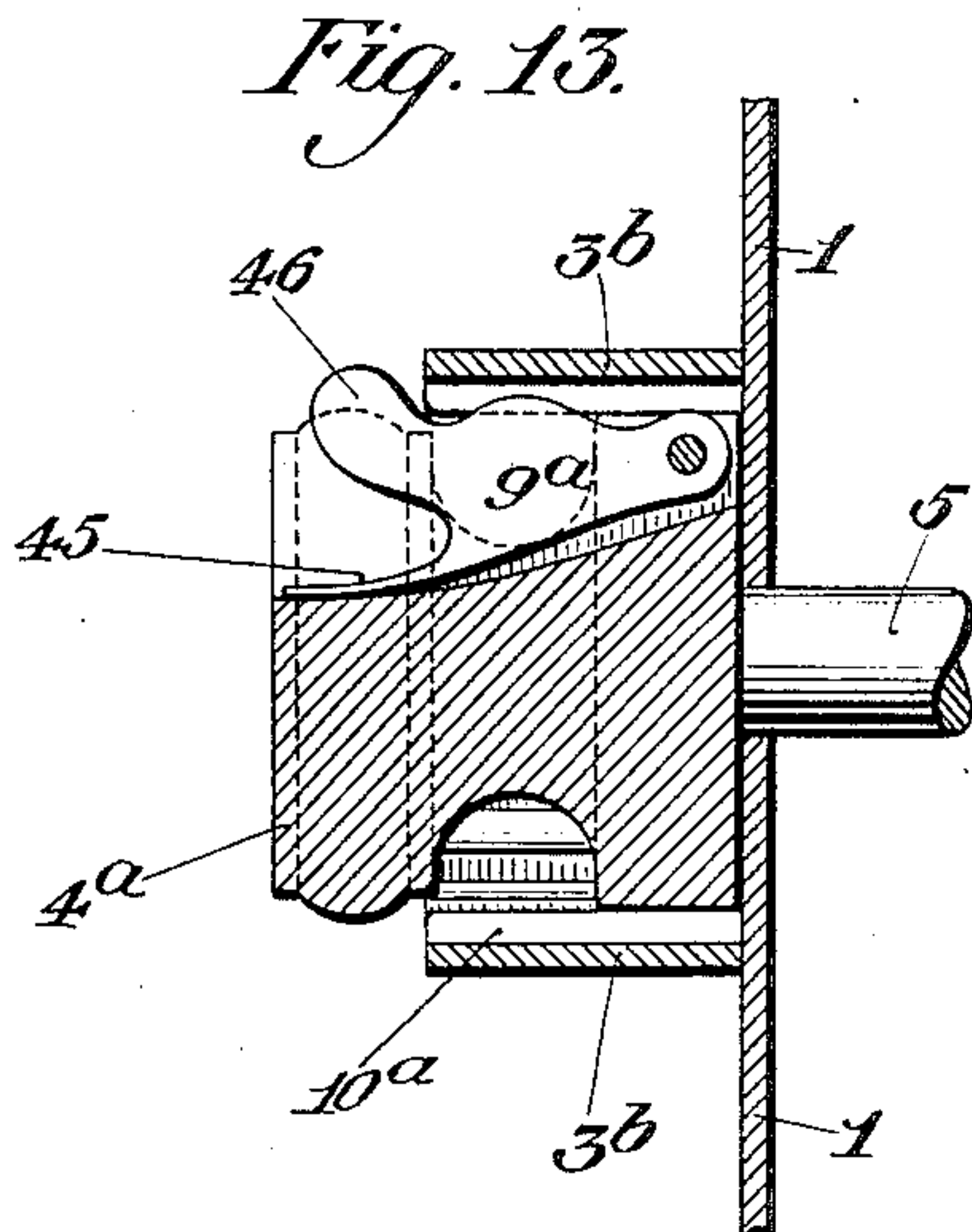
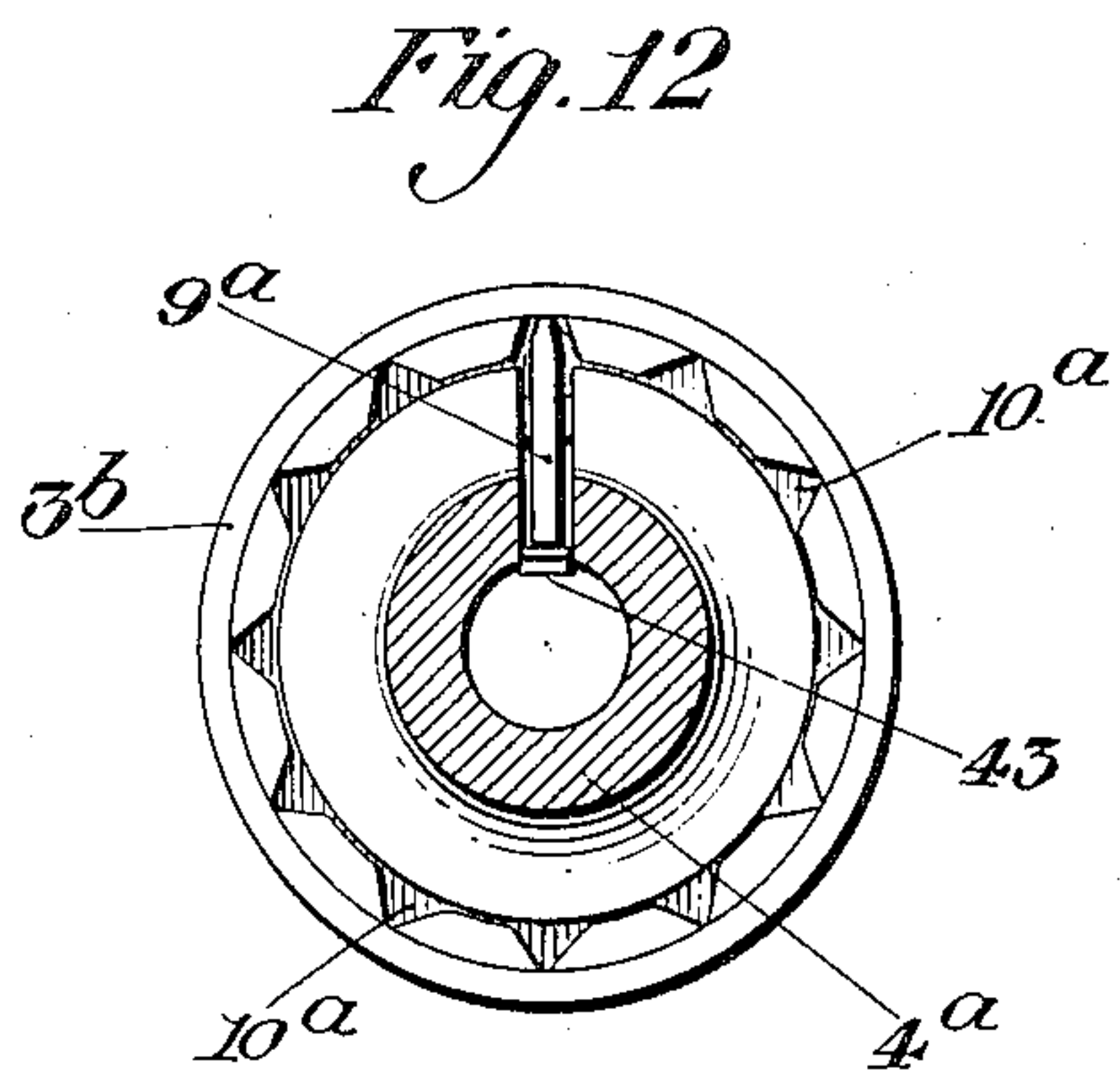
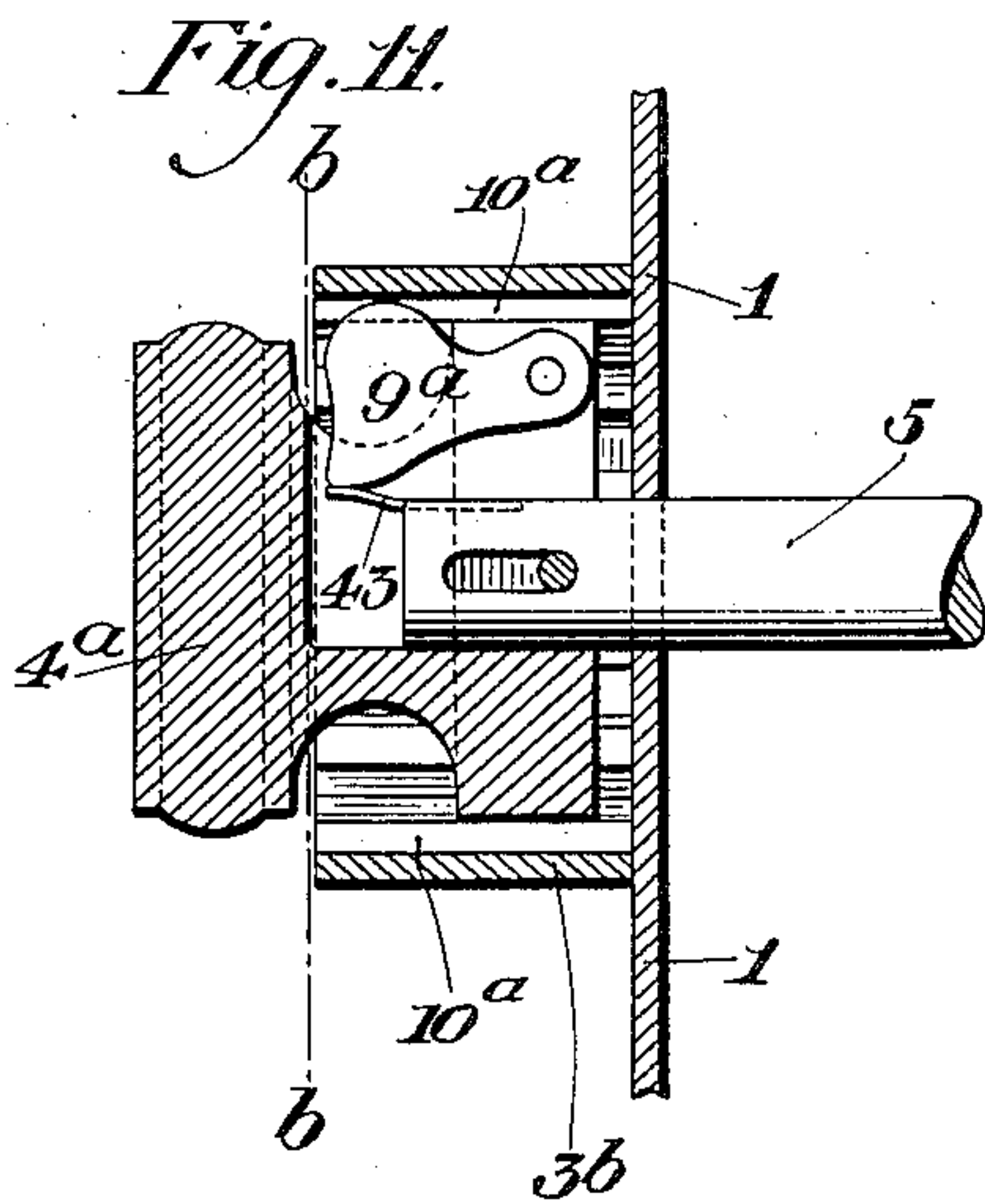
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3 SHEETS—SHEET 3.



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# UNITED STATES PATENT OFFICE.

FRANK SOLEY, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO MILLER LOCK COMPANY,  
OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## COMBINATION-LOCK.

No. 897,228.

Specification of Letters Patent.

Patented Aug. 25, 1908.

Application filed May 12, 1906. Serial No. 316,511.

*To all whom it may concern:*

Be it known that I, FRANK SOLEY, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Combination-Locks, of which the following is a specification.

The object of my invention is to provide an improved form of combination lock which responds equally to the sense of sight, hearing, or touch, and which is therefore especially available for many uses, such as in doors or drawers of boxes, lockers, tables, desks, chests, or the like.

In the accompanying drawings, Figure 1 is a face view of my improved lock showing the bolt projected; Fig. 2 is a rear view of the same, with the hood or casing removed; Fig. 3 is a similar view, but illustrating the positions of the parts when the bolt is retracted and the lock is open; Fig. 4 is a transverse section, on an enlarged scale, on the line *a—**a*, Fig. 1; Fig. 5 is a perspective view of the various elements of the lock detached from one another; Fig. 6 is a face view of the lock with the knob spindle removed; Fig. 7 is a rear view of the lock with all of the operative parts removed except the bolt and bolt thrower; Fig. 8 is a sectional view illustrating a certain modification of the invention; Fig. 9 is a view of the inner face of the knob shown in Fig. 8; Fig. 10 is a view of a modified form of tumbler; Fig. 11 is a sectional view of a modified form of knob and of that part of the lock casing which coöperates therewith; Fig. 12 is a transverse section on the line *b—b*, Fig. 11; Fig. 13 is a view similar to Fig. 11 but illustrating another modification; Fig. 14 is a view illustrating a special construction of part of the lock shown in Fig. 4; and Fig. 15 is a view of still another modification of part of the lock.

1 represents the face plate of the lock, to which is riveted or otherwise secured a tube 3, and upon the latter is mounted an annular dial 2, which can be adjusted longitudinally on the tube 3 and relatively to the face plate 1, to accord with the thickness of the door, drawer, or other object to which the lock is to be attached.

Free both to turn and to slide in the tube 3 is a knob 4, which carries the operating spindle 5 of the lock, said knob having a rib 6 or other indicating device which coöperates with the figures or numbers on the dial in ef-

fecting a proper setting of the tumblers of the lock.

The knob 4 is movable axially in the cylindrical projection 3, and the spindle 5 is likewise free to slide axially in a tubular hub 7 projecting inwardly from the face plate 1, as shown in Fig. 4.

Let into suitable recesses in the inner face of the knob 4 are a pair of balls 9 which are preferably enveloped throughout a little more than one-half of their extent, so that they cannot be accidentally dislodged from the recesses containing them, the balls being, by preference, free to turn in these recesses so as to constantly expose new faces beyond the inner face of the knob, and thus distribute the wear over the entire surface of each ball.

Secured so as to be incapable of turning within the tube 3 is a base plate 3<sup>a</sup>, in which are formed a series of openings 10, corresponding in number with the figures or numbers of the dial, whereby, when the knob 4 is pushed inwardly, the projecting portions of the balls 9 will engage these openings, and the proper movements of the knob to effect the desired adjustment of the tumblers of the lock will be indicated both to the sense of hearing and to that of touch as the projecting portions of the balls, on the rotation of the knob, enter the openings 10 in succession, and produce a clicking sound, consequently the lock can be operated in the dark as well as when the dial is visible to the operator.

The loudness of the sound and the degree of resistance to the turning of the knob are entirely at the will of the operator, who can push in the knob to any desired extent, and thus cause either a deep or a shallow engagement of the balls 9 with the openings 10.

When the knob is drawn outwardly the projecting portions of the balls 9 will be free from engagement with the openings 10, as shown in Fig. 4, and the lock can then be operated by sight and without any such response either to the sense of hearing or to that of touch as when the balls are in engagement.

Only one of the balls 9 need be used if desired or more than two can be employed, it being preferable to employ at least two, in order to balance the strain upon the knob. Instead of employing projecting balls for engaging openings in the base plate 3<sup>a</sup>, I may,



in some cases, provide said base plate with projecting ribs, as shown, for instance, at 11 in Fig. 8, the knob being provided with projecting ribs 12, as shown in Figs. 8 and 9, for engagement with those of the base plate when the knob is pushed inwardly. In thin locks the openings 10 or ribs 11 may be formed in or upon the face plate 1, the base plate 3<sup>a</sup> being dispensed with.

10 At the inner end of the knob spindle and secured thereto by a screw or bolt 13 is a driving disk 14 having a series of slots 15 and a series of notches 16, one for each slot.

With any of the slots of the driving disk 14 may engage a pin 17 projecting from a supplementary driving disk 19, mounted upon the hub 7 of the face plate, and between the main and supplementary driving disks are interposed tumblers 20, each of which has a peripheral notch 22, and also a segmental slot 21 for the reception of the driving pin 17, the length of the slots, and the relation of the peripheral notches thereto, determining the adjustment of the different tumblers necessary in order to bring their notches into line in opening the lock. This supplementary driving disk 19 also has a peripheral notch 22, and therefore acts as a tumbler in the same manner as the tumblers 20. The tumblers 20 are, like the disk 19, free to turn on the hub 7, but are prevented, by washers 23, from imparting motion one to another, except through the medium of the driving pin 17, the washers being interposed between the successive tumblers and between the first tumbler and the supplementary driving disk 19, and being prevented from rotating by reason of the engagement of slotted lugs 24 thereon with a lug 25 projecting inwardly from the face plate 1.

Between the supplementary driving disk 19 and the face plate of the lock is interposed a bolt thrower which consists in the present instance of a disk 26 with projecting teeth 27 and 28, the latter being adapted to engage respectively with notches 29 and 30 in the plate 31 of the bolt 32, said plate having a slot 33 whereby it is guided upon a headed pin 34 projecting rearwardly from the face plate.

Hung to a pin 35 on the bolt thrower 26 is a lever 36, provided with a dog 37, said lever being acted upon by a spring 38 in such manner that the dog 37 has a normal tendency to move inwardly or towards the axis of the knob spindle.

Projecting inwardly from the face plate 1 is a segmental guide 39, for a purpose described hereinafter.

60 When the lock is closed and the bolt projected the parts occupy the relation shown in Fig. 2, the tooth 28 of the bolt thrower engaging with the bolt plate 31 so as to prevent any inward movement of the bolt if an attempt is made to force the lock.

The inner end of the dog 37 rests upon the peripheries of the tumblers and driving disks, and the outer end of the dog projects beyond the upper end of the guide 39 so as to prevent any movement of the bolt thrower 26 which would cause its teeth 27 and 28 to act upon the bolt plate 31 and retract the bolt. When, however, by proper manipulation of the knob 4 the notches 22 of the tumblers and a notch 16 of the driving disk have been brought into line with each other and with the inner end of the dog 37, the latter will, by the action of the spring 38, be caused to enter said notches and the outer end of the dog will thereby be relieved from engagement with the upper end of the guide 39, in order that further movement of the parts in the direction of the arrow, Fig. 2, may be imparted to the dog, and thence, through the medium of the lever 36, to the bolt thrower, whose teeth 27 and 28, entering the notches 29 and 30 in the bolt plate, engage the latter and effect the desired retraction of the bolt. This movement, however, does not carry the dog 37 beyond the lower end of the guide 39, (see Fig. 3) and the dog must therefore remain in engagement with the notches of the tumblers and driving disks until, by a reverse movement of the knob, the bolt has been projected and the dog 37 carried beyond the upper end of the guide 39, whereupon further movement of the driving disk 14 will cause the ejection of the dog from the notches of the tumblers and driving disk, by reason of the beveled or cam-like formation of one of the walls of each of the notches of the driving disk, as shown in Figs. 2, 3 and 5.

Changes in the combination can be effected by re-adjustment of the tumblers or of the driving disk 14 on the knob spindle 5, the latter for this purpose having a flattened end 40 for adaptation to a correspondingly shaped central opening in the driving disk 14. When a lock having a greater capacity for changing the combinations is desired, the tumblers may have a series of slots 21 therein, and a correspondingly increased number of peripheral notches 22, as shown for instance by the tumbler 20<sup>a</sup> in Fig. 10.

If desired, a spring may be interposed between the inner face of the knob and the dial for the purpose of normally retaining the knob in the outward or silent position, such a spring being shown at 41 in Fig. 8, or, on the other hand, a spring such as shown at 44 in Fig. 14 might be located between the end of the hub 7 and the driving disk 14 in order to normally retain the knob in the position for being operated by the senses of hearing and touch instead of by sight.

As the driving disk 14, owing to its longitudinal movements, cannot be relied upon to retain the tumblers and washers in their proper longitudinal position upon the hub 7,



I groove said hub near the inner end of the same for the reception of a spring wire 42, which bears upon the innermost tumbler 20 and prevents dislodgment of the series of  
5 tumblers, washers, and other elements of the lock which are mounted upon the hub 7.

In that embodiment of my invention shown in Figs. 11 and 12, notches 10<sup>a</sup> are formed on the inner wall of the tube 3<sup>b</sup>, and  
10 the knob 4<sup>a</sup> has a pivoted and radially swinging trigger 9<sup>a</sup> which, when the knob is pushed into the tube 3<sup>b</sup> is acted upon by a spring 43 at the end of the knob spindle, so as to cause the outer portion of the trigger to project  
15 beyond the periphery of the knob and engage with the notches 10<sup>a</sup>, thereby adapting the knob for adjustment by the senses of touch and hearing. The uppermost or zero notch 10<sup>a</sup> by preference has more abrupt walls than  
20 the other notches, as shown in Fig. 12, thereby rendering it more difficult to remove the trigger from this special notch than from the others, and thus indicating to the operator the location of the zero notch. When the  
25 knob is drawn outward, the trigger is removed from the control of the spring 43, and hence is no longer pressed into the notches 10<sup>a</sup>, or it may, if desired, be entirely withdrawn from these notches by the outward  
30 movement of the knob when it is desired to adjust the latter by sight alone.

A pin and slot connection between the knob and its spindle permits longitudinal movement of said knob on the spindle but  
35 precludes any rotative movement of one independently of the other.

In the construction shown in Fig. 13 the knob has no longitudinal movement, the trigger 9<sup>a</sup> being normally pressed into the notches  
40 10<sup>a</sup> by the action of a spring tongue 45 formed on the trigger and bearing on the base of the slot in which said trigger is mounted, but the trigger also has a tail piece 46, which projects beyond the periphery of the knob, as shown,  
45 and can be depressed by the operator when it is desired to withdraw the trigger from the notches and effect adjustment of the knob by sight alone.

The construction shown in Fig. 15 differs  
50 from any of those previously cited in having an obstruction in the lock case movable into and out of engagement with the knob instead of having a member of the knob movable into and out of engagement with a fixed  
55 obstruction in the lock case.

In the embodiment of my invention shown in Fig. 15 a spring 50 mounted on the exterior of the tube 3<sup>c</sup> has a stud 51, which, when pressure is exerted upon the spring, projects  
60 through an opening in said tube and engages the notched periphery of the knob, thus providing for adjustment of the knob by hearing and touch, the spring normally holding the stud in its retracted position free from en-  
65 gagement with the notched periphery of the

knob as shown, and thereby permitting adjustment of the knob by sight alone. The objection to this construction is that when the knob is being adjusted by hearing or touch both hands must be employed, one for  
70 turning the knob and the other for depressing the spring, whereas in the preferred construction of the lock, shown in the other figures, one hand only is needed, whether the knob is being adjusted by sight alone or by touch  
75 and hearing.

I claim:—

1. A combination lock having a knob and an obstruction movable into and out of engagement with one another, whereby said  
80 knob can be adjusted either by the sense of sight alone, or by the senses of touch and hearing.

2. A combination lock having a knob and an obstruction movable into and out of en-  
85 gagement with one another, and means whereby they may be held in yielding engagement and the knob can be adjusted either by the sense of sight alone, or by the senses of touch and hearing.  
90

3. A combination lock having a knob and an obstruction movable into and out of yielding engagement with one another, and means whereby the strength of the resistance  
95 to the turning of the knob can be regulated by the operator.

4. A combination lock having a knob with a member movable into and out of engagement with an obstruction in the lock, where-  
100 by said knob can be adjusted either by the sense of sight alone, or by the senses of touch and hearing.

5. A combination lock having a knob with a member spring-pressed into engagement with an obstruction in the lock but movable  
105 out of engagement therewith, whereby said knob can be adjusted either by the sense of sight alone, or by the senses of touch and hearing.

6. A combination lock having a knob with  
110 a clicking or sound-producing device engaging a fixed member of the lock, and means whereby the extent of engagement of said device can be controlled by the operator.

7. A combination lock having a knob with  
115 a yielding member in engagement with an obstruction in the lock, and means whereby the strength of the resistance to the turning of the knob can be regulated by the operator.

8. A combination lock having an axially  
120 movable knob with a member adapted to be moved into and out of engagement with an obstruction in the lock by reason of such axial movement of the knob.

9. A combination lock having an axially  
125 movable knob with one or more balls each let into a recess in the inner face of the knob, substantially as specified.

10. A combination lock having an axially  
movable knob with one or more balls each  
130



let into a recess in the inner face of the knob but free to turn therein, substantially as specified.

11. A combination lock having an axially movable knob with one or more balls each  
5 let into a recess in the inner face of the knob and retained against displacement in said recess but free to turn therein, substantially as specified.

10 12. A combination lock having an axially movable knob and knob spindle, a series of tumblers, a driving disk secured to the knob spindle, and a supplementary driving disk  
15 having a projecting pin which engages the tumblers and also engages the main driving disk, substantially as specified.

13. A combination lock having an axially movable knob and knob spindle, a driving disk carried by said spindle, a series of tumblers rotatably mounted upon a fixed mem- 20  
ber of the lock, and means independent of the driving disk for retaining said tumblers in proper position upon their mounting, substantially as specified.

In testimony whereof, I have signed my 25  
name to this specification, in the presence of two subscribing witnesses.

FRANK SOLEY.

Witnesses:

WM. E. DUDLEY,  
FRED. K. MURRAY.