

(Model.)

3 Sheets—Sheet 1.

E. C. SMITH.
PERMUTATION LOCK.

No. 414,261.

Patented Nov. 5, 1889.

Fig. 1.

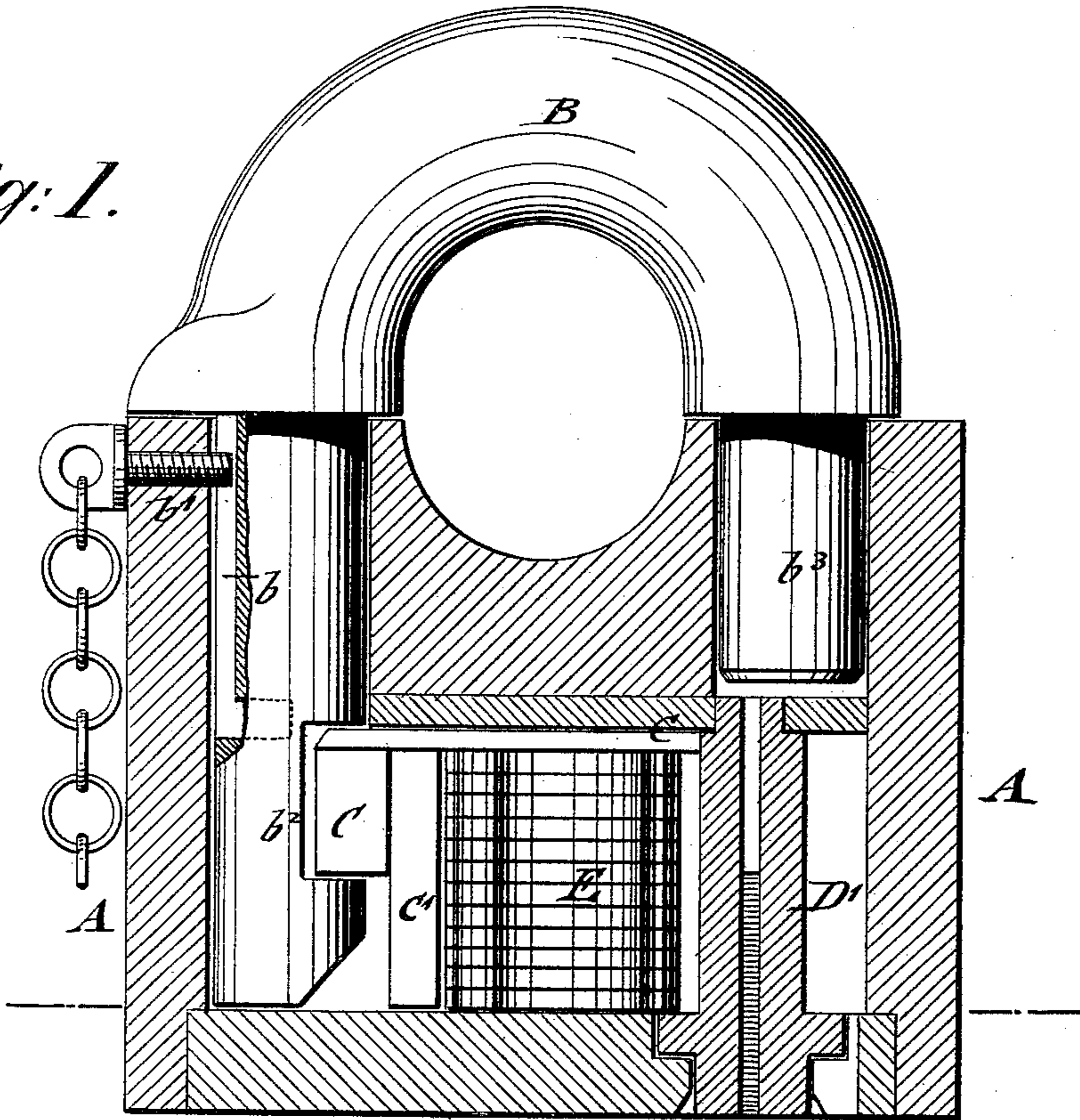


Fig. 3.

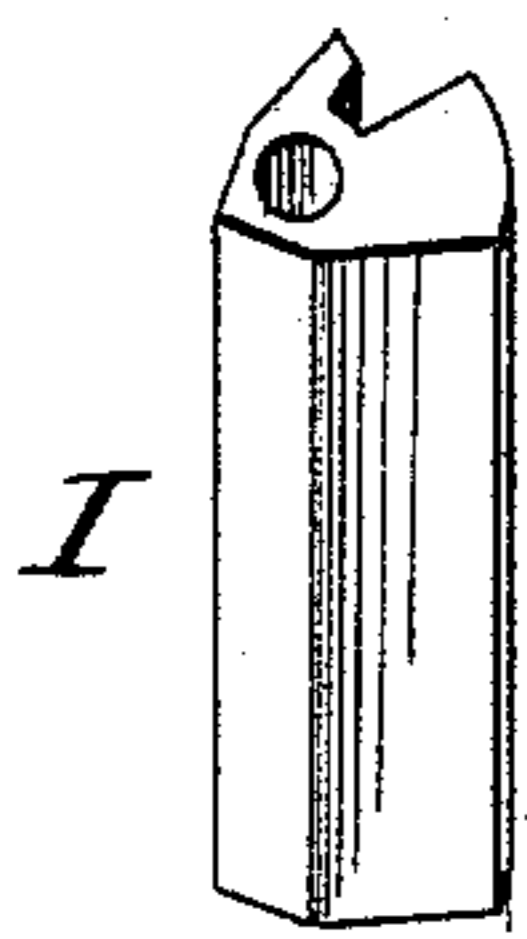


Fig. 2.

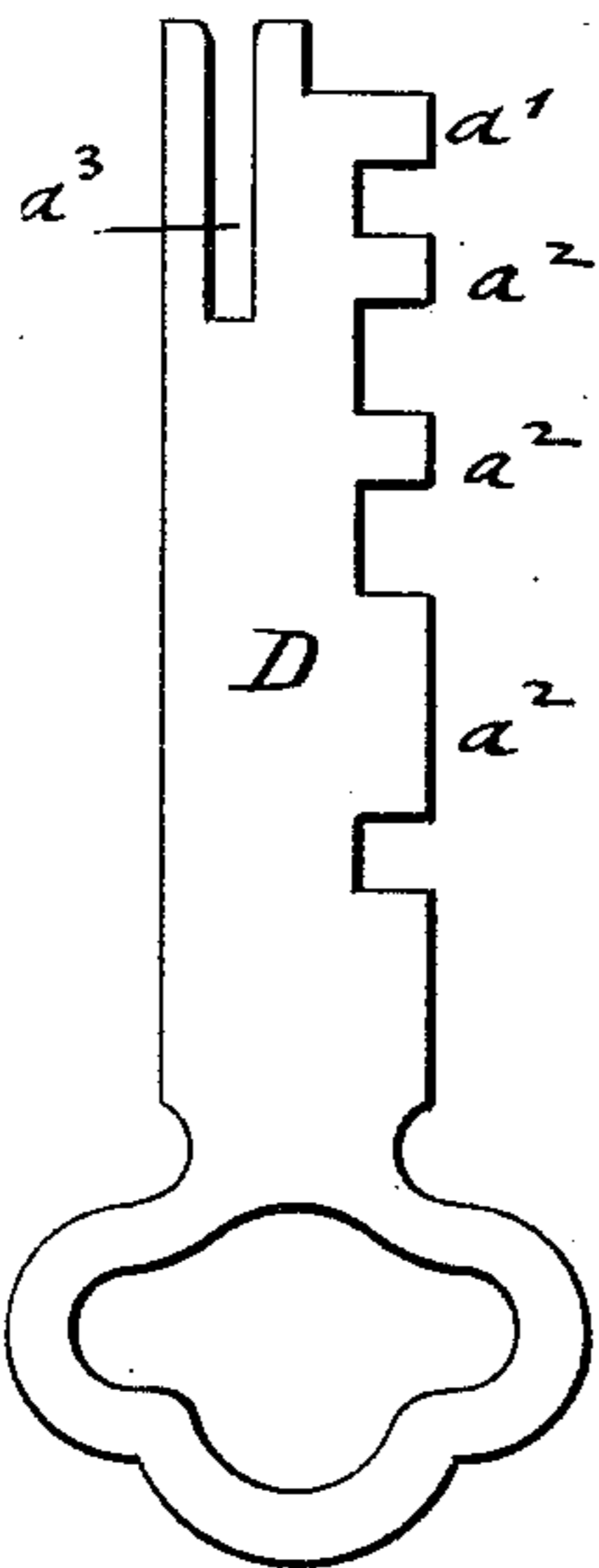


Fig. 2 a.

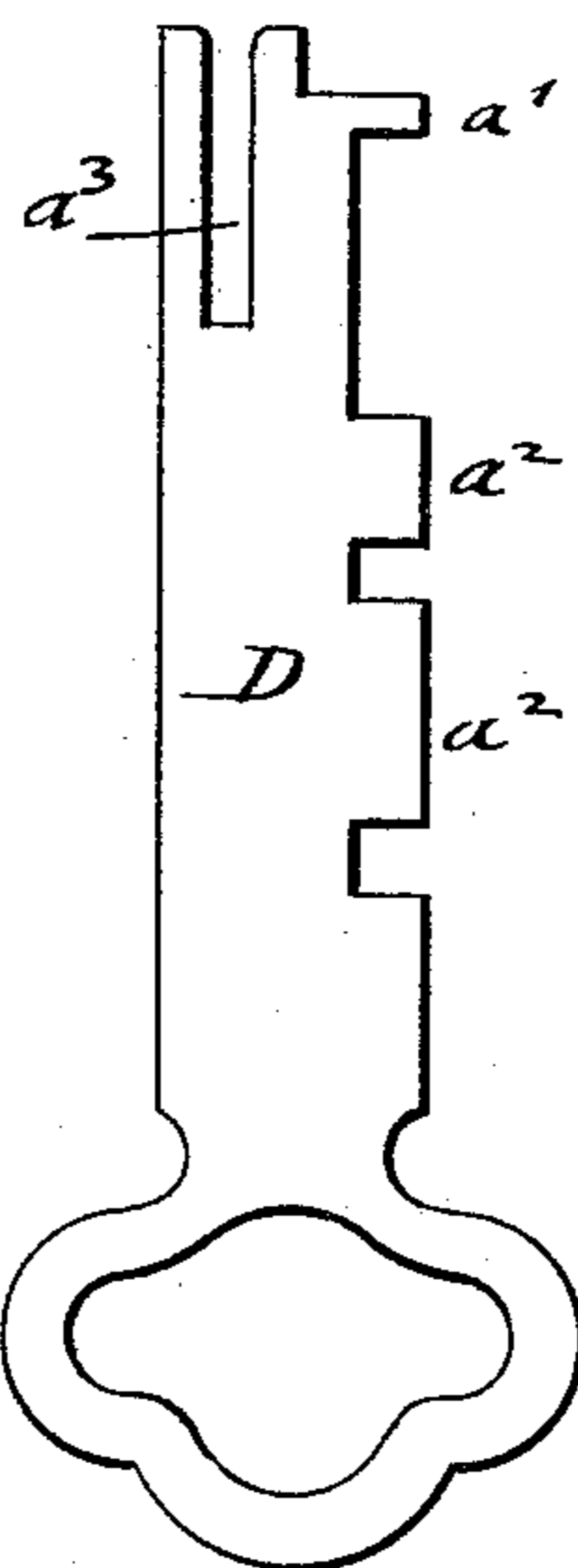
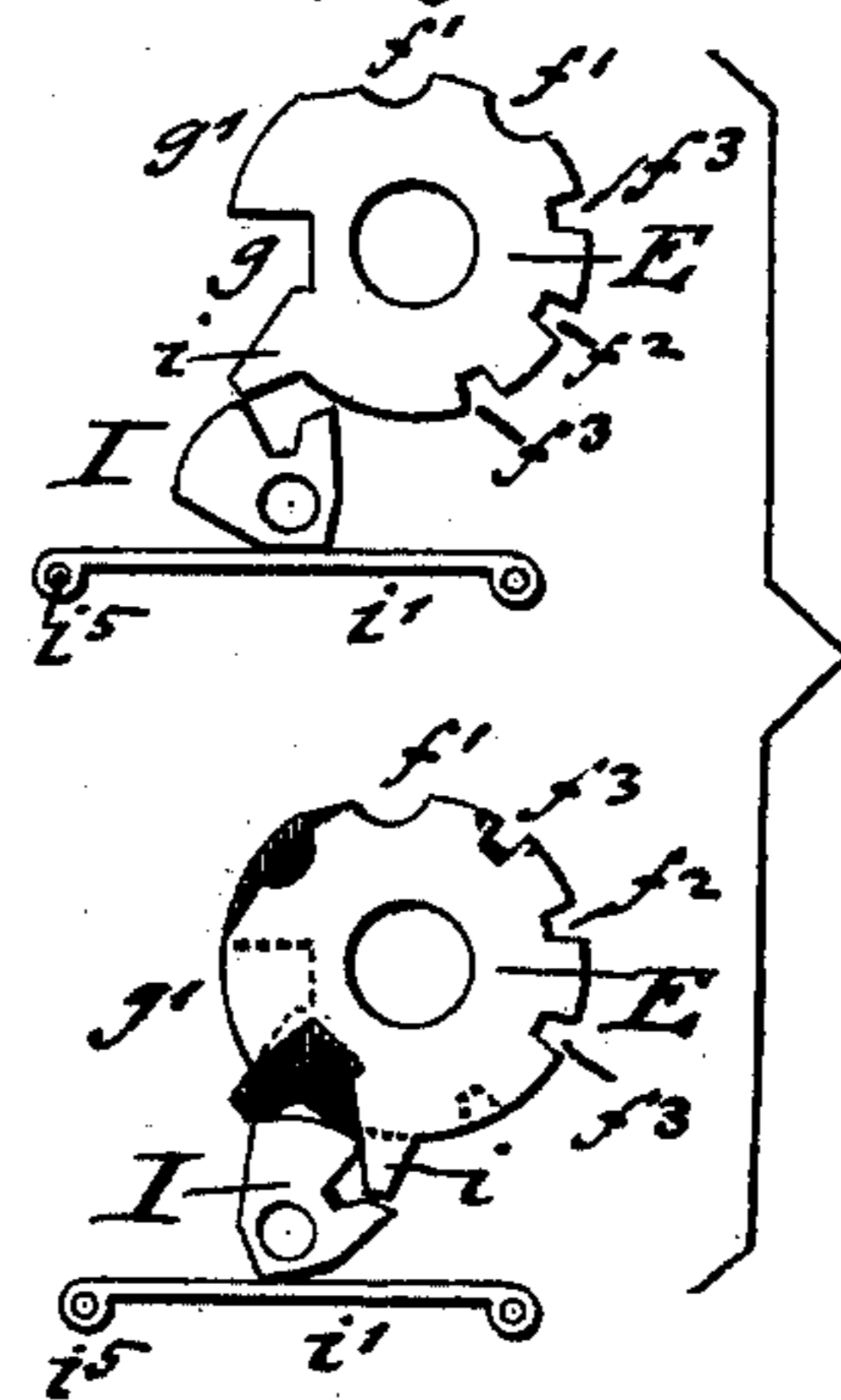


Fig. 3 a.



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Fig. 4.

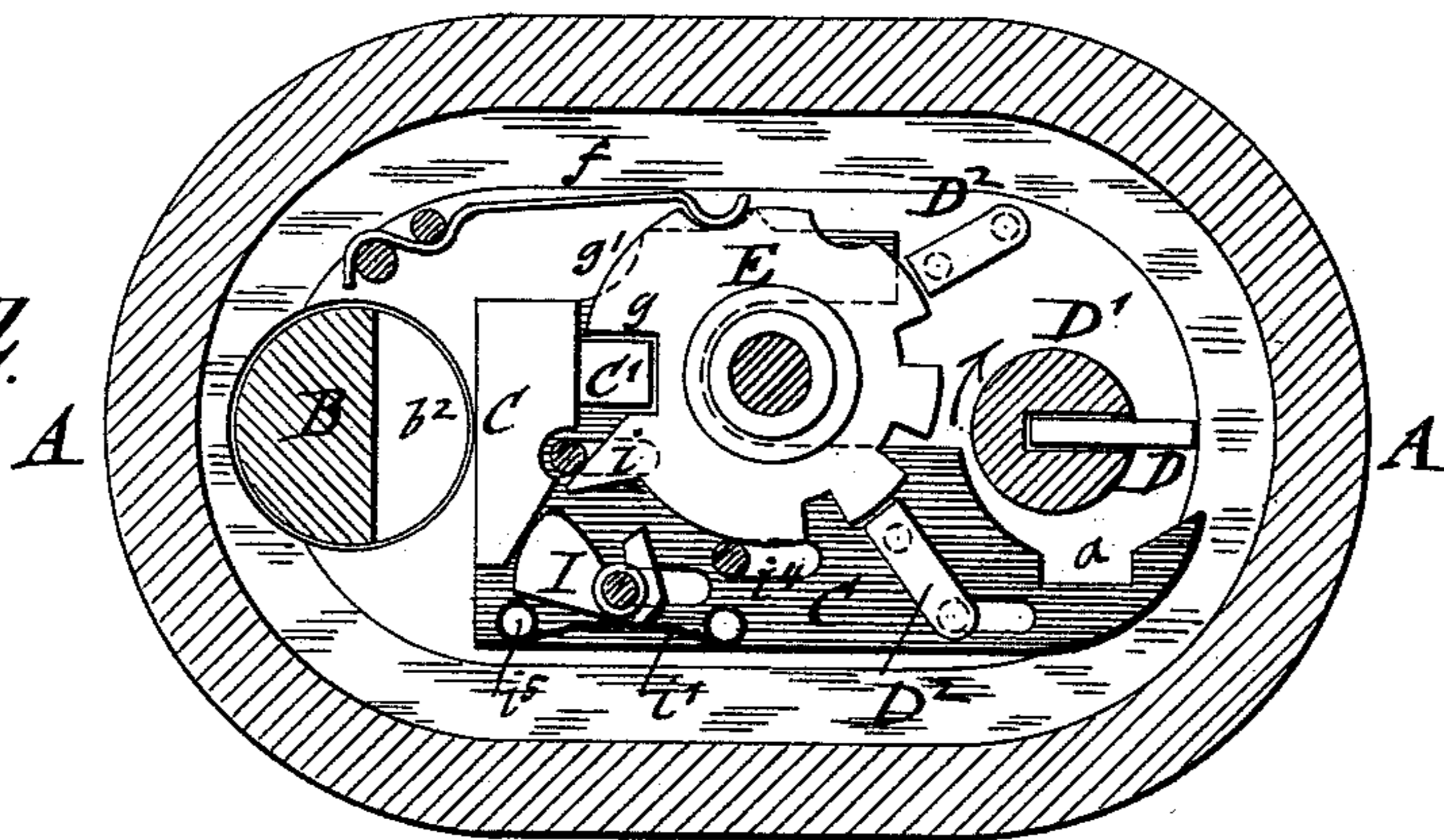


Fig. 5.

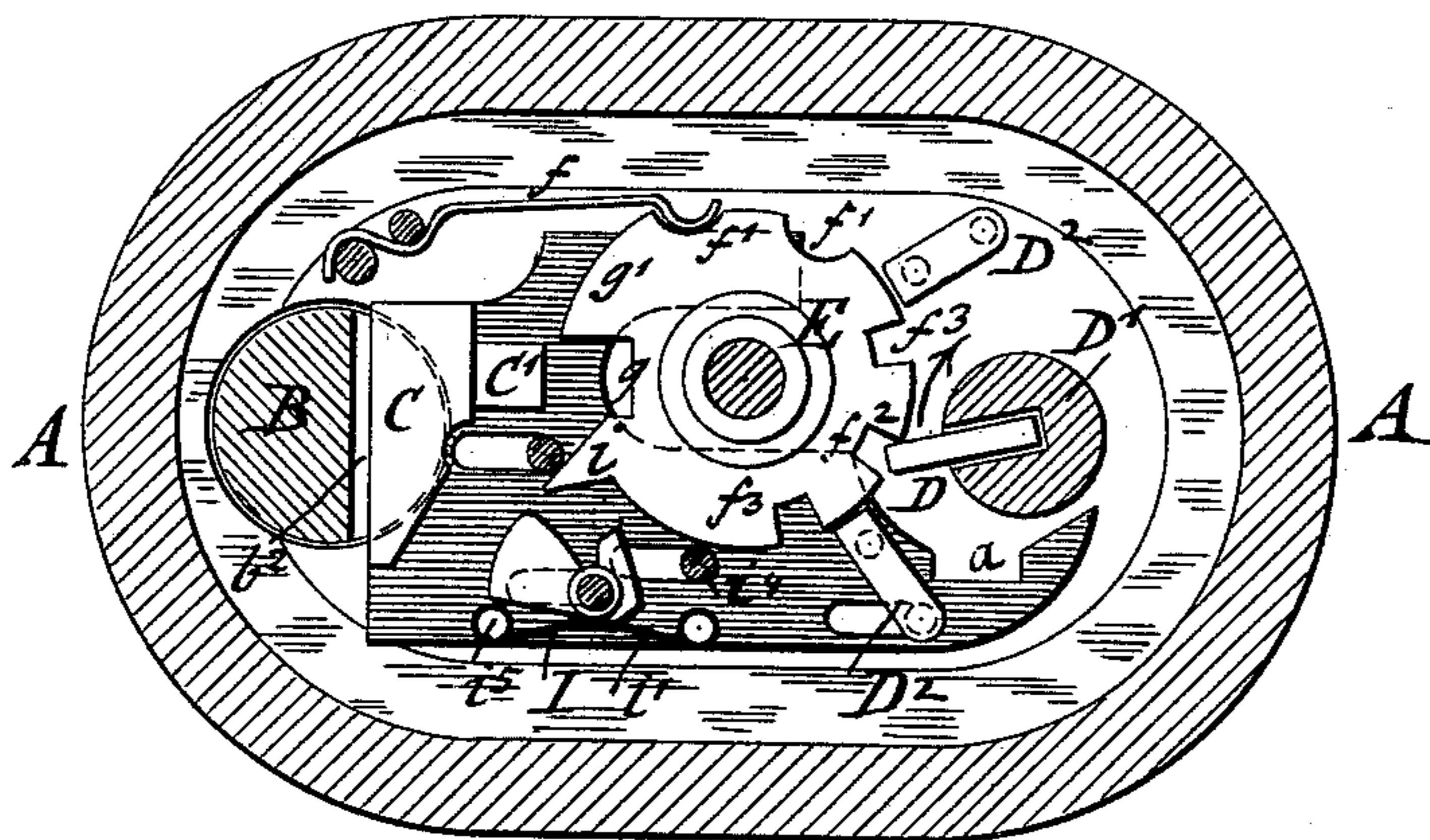
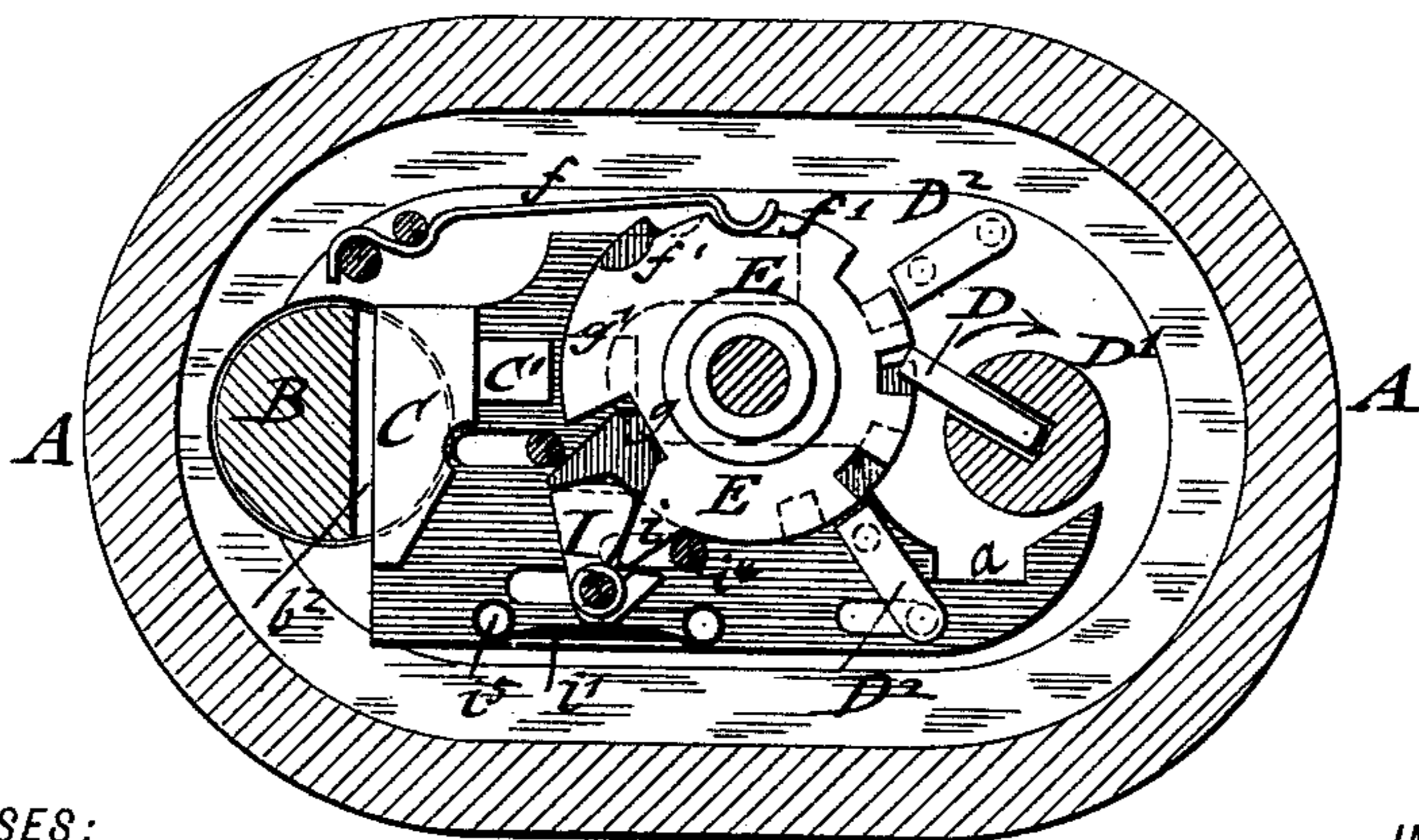


Fig. 6.



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Fig. 7.

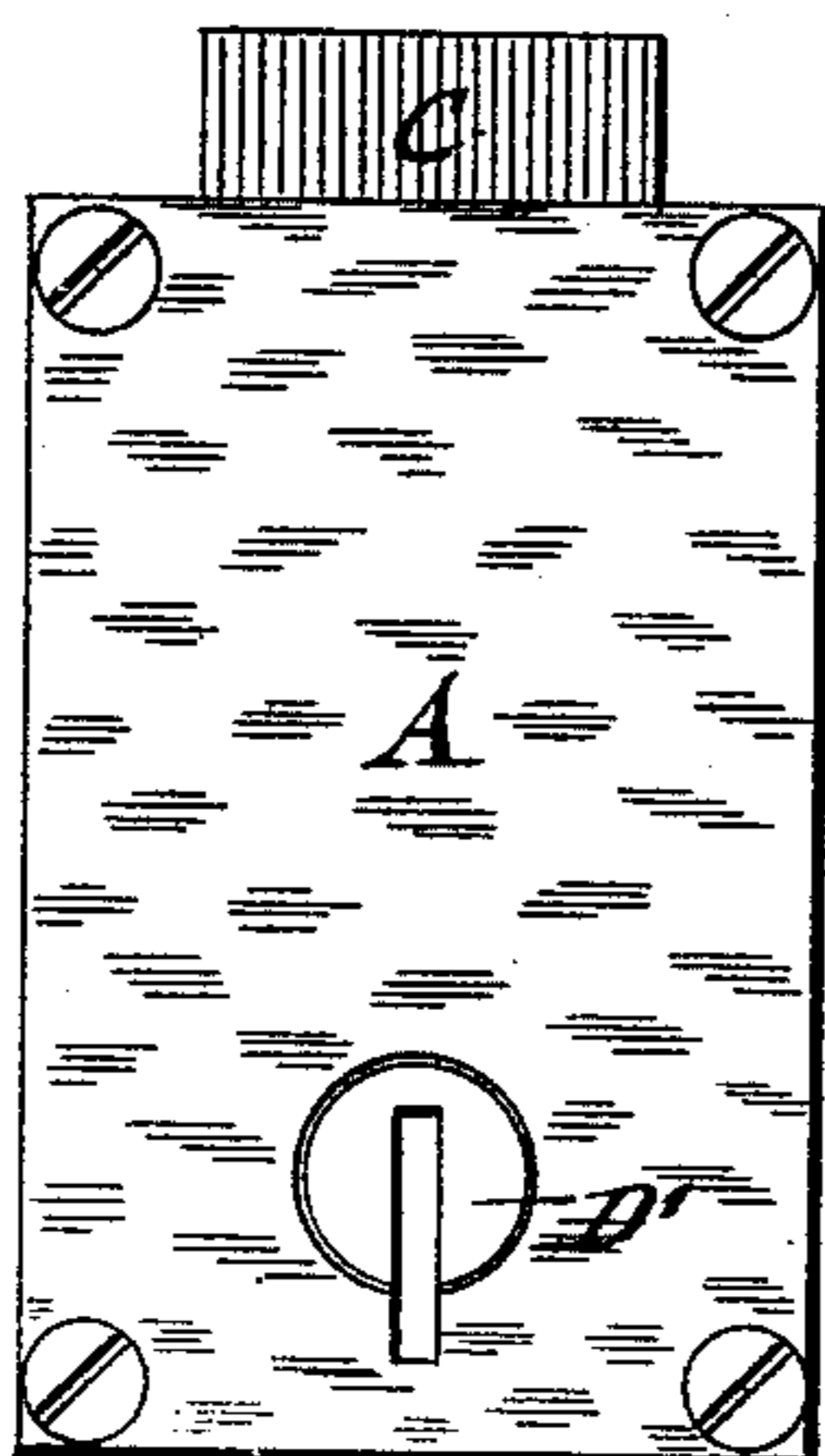


Fig. 8.

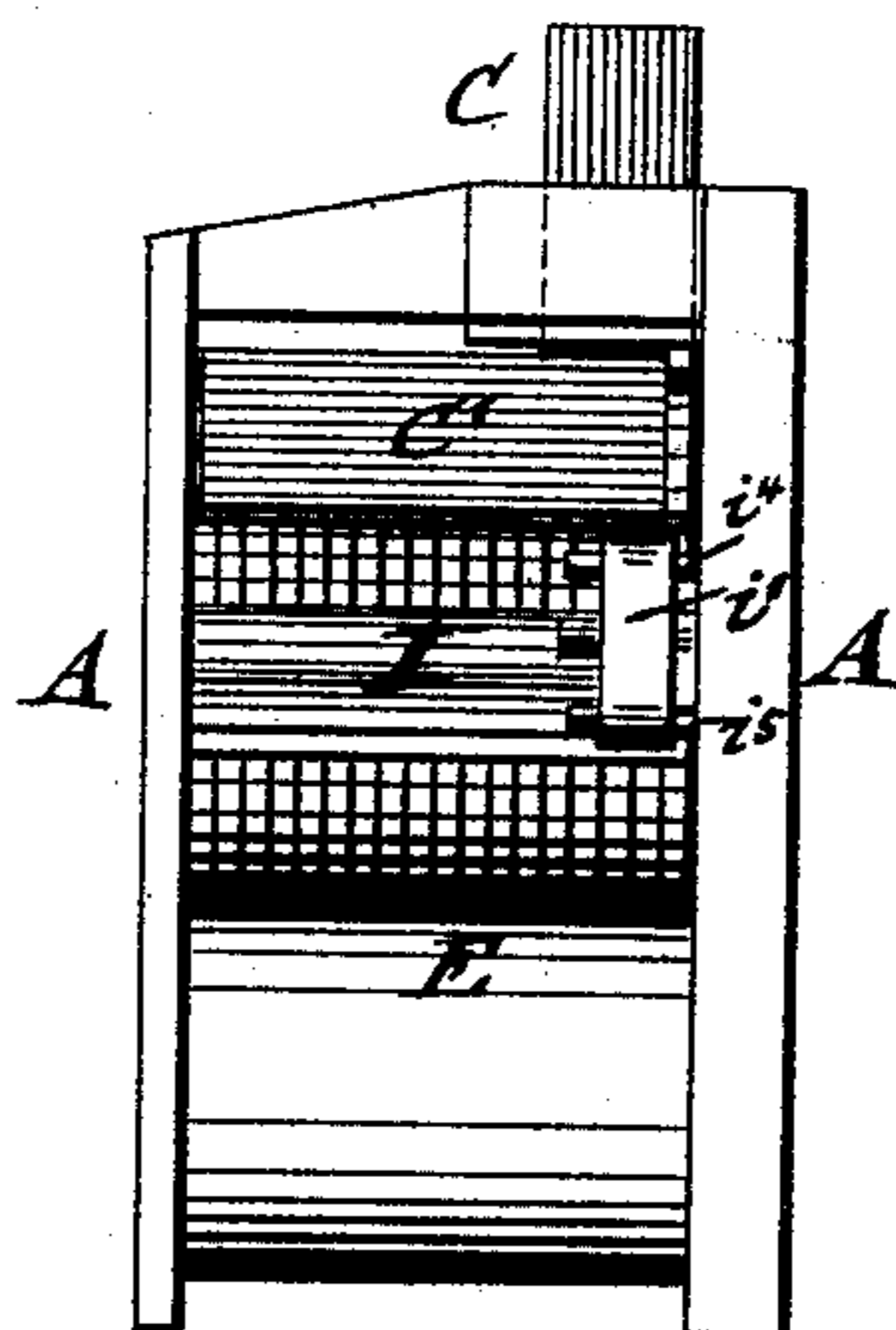


Fig. 9.

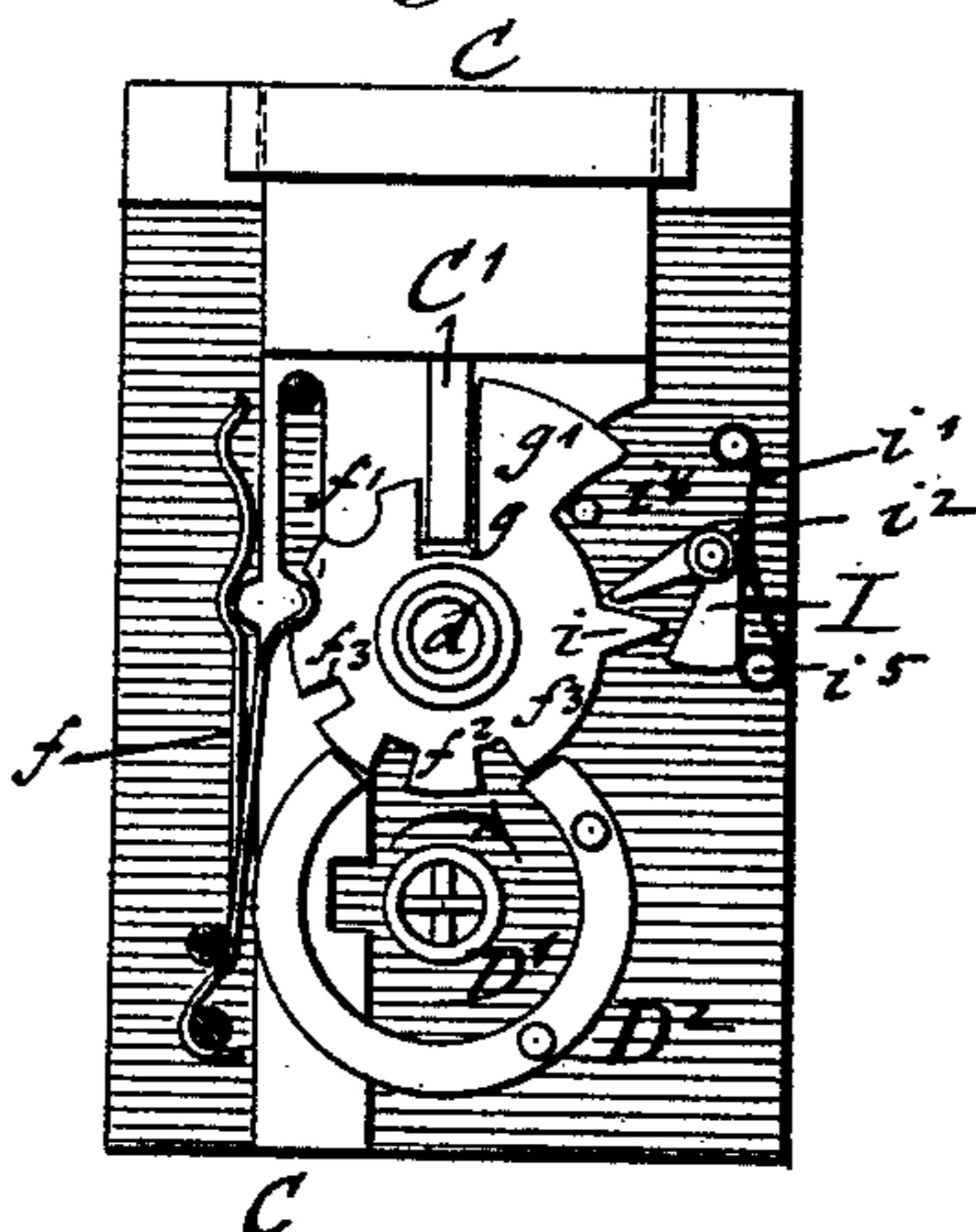


Fig. 10.

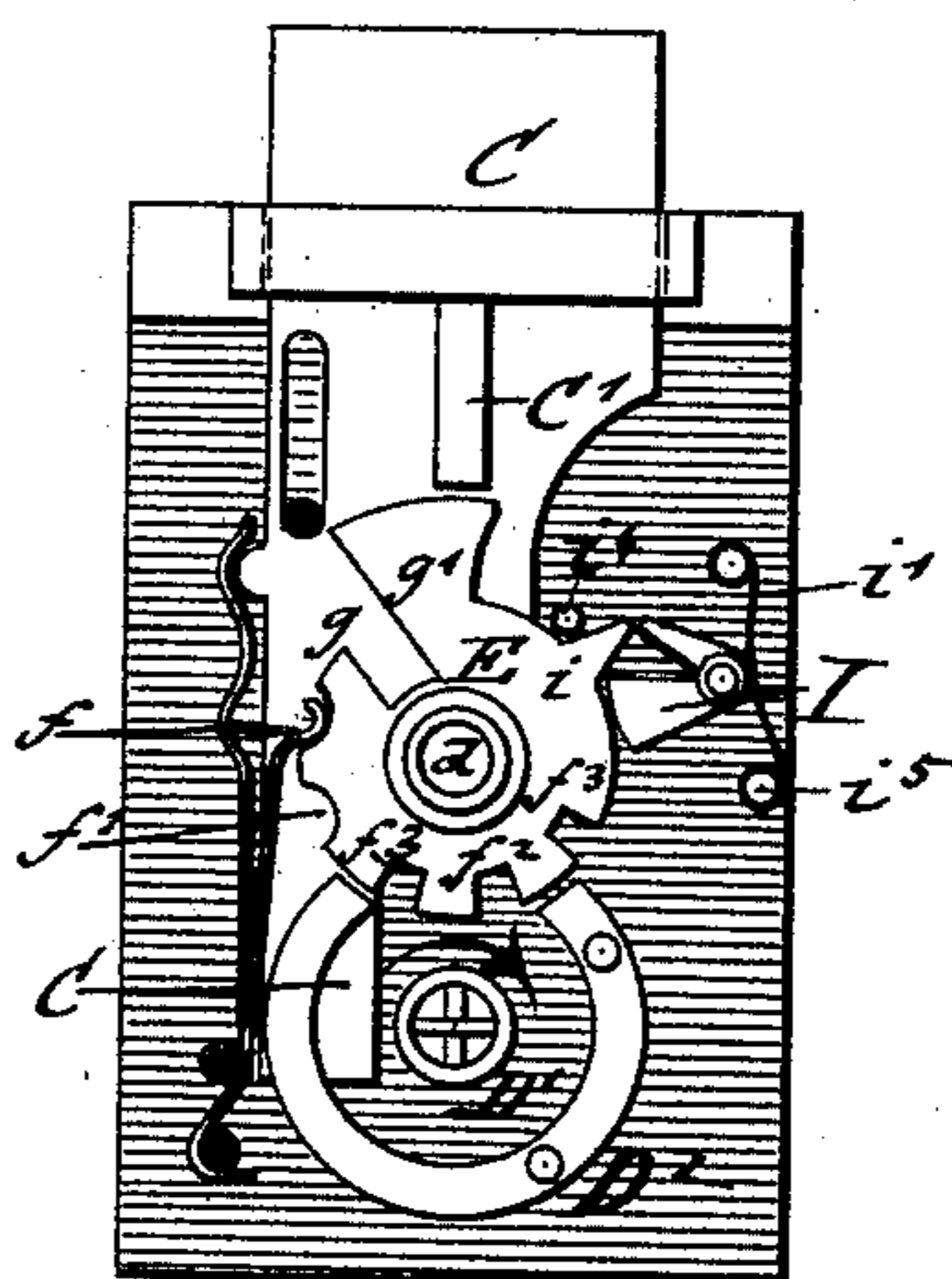
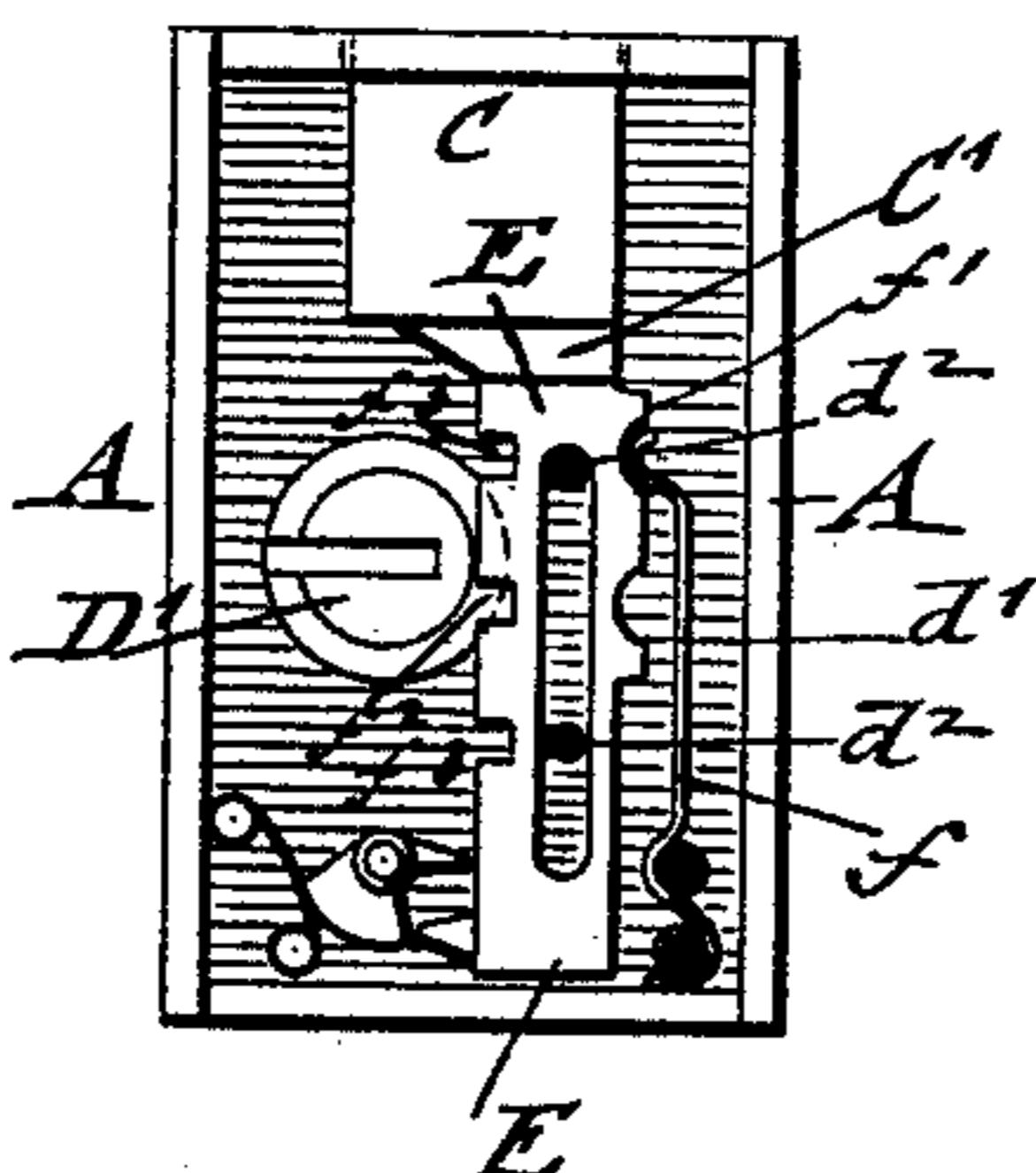


Fig. 11.



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UNITED STATES PATENT OFFICE.

EUGENE C. SMITH, OF NEW YORK, N. Y., ASSIGNOR OF ONE-FIFTH TO CHARLES F. FROTHINGHAM, OF SAME PLACE.

PERMUTATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 414,261, dated November 5, 1889.

Application filed November 14, 1888. Serial No. 290,804. (Model.)

To all whom it may concern:

Be it known that I, EUGENE C. SMITH, of the city, county, and State of New York, have invented certain new and useful Improvements in Combination-Locks, of which the following is a specification.

This invention relates to an improved combination-lock of that class which can be operated and locked by any one of a series of keys that are arranged to be used with the lock, but which can be opened only by that key by which the locking action has been accomplished, the construction being applicable to padlocks, door-locks, box-locks, and to all other uses to which the locks can be applied, and is designed as an improvement on the locks for freight-cars for which Letters Patent were granted to me heretofore under date of August 7, 1888, and Nos. 387,371 and 387,372.

The invention consists of a combination-lock in which a series of shiftable tumblers are arranged, said tumblers being provided with recesses for being acted upon by the wards of a key that is inserted into an axially-turning and longitudinally-slotted key-cylinder. The tumblers are further provided with projections in line with each other, which are engaged by a fulcrumed and spring-pressed locking-bar whenever the tumblers are shifted, the motion of the tumblers and locking-bar being limited by suitable stop-pins. The tumblers are further provided with auxiliary recesses at each side of the recesses engaged by the wards of the actuating-key, said auxiliary recesses serving as guards or blinds for preventing, in connection with fixed side guard-plates or shields, the introduction of keys or wires for picking or tampering with the lock. A slide-bolt is arranged at one end of the tumblers and thrown by the key before the same shifts the tumblers, a cam-shaped portion of the shifted tumblers engaging a projecting bar or stump of the slide-bolt, so as to rigidly hold the bolt in locked position.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of my improved combination-lock arranged in the form of a padlock. Figs. 2 and 2^a are side elevations of the keys used in connection

with my improved combination-lock. Figs. 3 and 3^a show, respectively, a perspective view of the locking-bar and the relative position of the same to the shifted tumblers. Figs. 4, 5, and 6 are bottom views and horizontal sections of the lock on line *x x*, Fig. 1, said figures showing the lock respectively before the slide-bolt is thrown and the tumblers shifted, after the bolt is drawn, and after both the bolt and tumblers are moved. Figs. 7, 8, 9, and 10 are different views showing my combination-lock applied as a box-lock, and Fig. 11 is a modified construction of my combination-lock, in which sliding tumblers are used in place of rotary tumblers.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the casing of my improved combination-lock. The casing A is provided in the case of a padlock with a shackle B, one leg of which is provided with a longitudinal recess *b*, that is engaged by a fixed screw *b'* of the casing, so as to prevent the withdrawing of the shackle B from the casing A. The leg of the shackle B has another recess *b*² at the inner side, which is adapted to be engaged by a sliding bolt C, that is guided by suitable slots on fixed pins of the casing A. The shackle B can be drawn out of the casing A when it is not engaged by the sliding bolt C, it turning then on its longer leg *b*, so that the shorter leg *b*³ swings clear of the casing into open position, and can then be applied to the staples of a door and door-jamb or to any other part of a structure with which the lock is to be used. When the combination-lock is made in the shape of a rim or flush lock, the sliding bolt C forms also the locking-bolt, and is in this case projected into a keeper of the door, box, or other article, as shown in Figs. 7 to 10. The sliding bolt C is provided at its opposite end with a recess *a*, that is engaged by a ward *a'* at the outer end of a flat key D, which is inserted into a longitudinally-slotted and axially-turning key-cylinder D'. The shape of the keys used is shown clearly in Figs. 2 and 2^a, each key being provided, in addition to the ward *a'*, with a number of wards *a*² for shifting the tumblers E of the lock, and with a longitudinal end re-

cess a^3 for engaging the key-cylinder D' and turning the same on its axis in opening or closing the lock. Any suitable combination and arrangement of the wards a^2 may be used, 5 the number of the wards corresponding with a given number of tumblers E . The tumblers E are supported on a fixed center pivot d , on which they are rotated when shifted by the key, as shown in Figs. 1, 4, 5, 6, 8, 9, and 10, 10 while sliding tumblers are shown in Fig. 11, which latter are guided by longitudinal slots d' on fixed pins d^2 . The rotary as well as the sliding tumblers are retained in position by means of springs f , which engage recesses f' 15 of the tumblers, said springs holding the tumblers in position before and after they are shifted. The tumblers E are further provided with a series of recesses f^2 , which are engaged by the wards a^2 of the key, and with 20 two series of auxiliary recesses $f^3 f^3$, which are located at opposite sides of the recesses f^2 , and which serve as blind recesses for aligning with the primary series of recesses c^2 . When some of the tumblers are shifted by the action of the 25 key, the auxiliary recesses f^3 are moved thereby into proper alignment with the primary recesses of the unshifted tumblers, so as to prevent the feeling for the tumblers by means of a wire, skeleton, or blank key. The auxiliary 30 recesses f^3 form thereby a safeguard for the primary recesses and a protection against tampering with the lock, which is assisted by fixed guard-plates or shields D^2 , which are arranged radially to the tumbler-pivot at op- 35 posite sides of the key-cylinder D' , as shown in Figs. 4, 5, and 6. The side guard-plates or shields D^2 may also be connected so as to form a shield D^2 concentric to the key-cylinder, as shown in Figs. 9 and 10. A closed 40 shield has the advantage of guiding the key in its axial motion in the lock, and has, like the side guard-plates, the additional advantage of barring access to the auxiliary recesses and preventing the picking of the lock by the in- 45 troduction of implements or skeleton-keys. The tumblers E are provided at a point diametrically opposite to the primary key-recesses with radial recesses g for engaging a project- 50 ing bar or stump C' of the sliding bolt C , which stump enters the recesses g of the tumblers when the slide-bolt is withdrawn, so as to hold them firmly in position. A cam-shaped portion g' of the tumblers E adjoining the recesses g is moved across the path of 55 the stump C' when the bolt is thrown and the tumblers are shifted, said portion g' abutting against the stump and preventing the drawing back of the bolt until the tumblers are returned into their normal position. The 60 tumblers E are locked in position after being shifted by means of an angular locking-bar l , which is fulcrumed to the casing A , and which serves to engage projections i of the tumblers E , said locking-bar being acted upon 65 by a flat spring i' , which engages a flat heel i^2 of the locking-bar l , as shown clearly in Fig. 3^a, and retains the locking-bar at either

end of its motion. In this position the larger cam-shaped arm of the angular locking-bar l enters between the projection of the un- 70 shifted and shifted tumblers, while the shorter arm of the bar l bears by its beveled edge on the outer ends of the projections of the shifted tumblers. The flat spring i' holds the locking-bar rigidly in position by pressing on 75 one of the flat sides of the heel i^2 . The joint action of the arms of the locking-bar l on the projections of the shifted and unshifted tumblers not only holds the tumblers rigidly in position, but also prevents any displace- 80 ment of the unshifted tumblers when attempting to shift the tumblers either by the accidental use of a wrong key or by endeavors to pick the lock. The larger cam-shaped arm of the locking-bar serves by 85 its size to prevent the unshifted or shifting tumblers from moving from their position and block them against shifting, except when the shifted tumblers are moved by the wards of the proper key. When the tumblers are 90 shifted by the key, the locking-bar l is actuated by the projections i of the tumblers and moved in a position so as to rigidly lock the same in connection with a stop-pin i^4 . The locking-bar l is thereby prevented from be- 95 ing returned into its normal position except by means of the same key by which the sliding bolt and the tumblers have been shifted. In withdrawing the bolt and shifting the tumblers in opening the lock, the locking-bar 100 is also returned into normal position until stopped by one of the pins i^5 , to which the spring i' is attached, as shown in Figs. 4, 5, and 6.

The combination-lock is operated as fol- 105 lows: Any one of a series of keys, of which as many may be used as combinations can be formed with a given number of tumblers, is introduced into the key-cylinder and turned 110 in the direction of the arrows shown in the drawings, by which the ward at the outer end of the key first throws the sliding bolt forward, so as to engage either the recesses of the shackle-leg or the retaining keeper in the jamb of the door, box, or other article. 115 By continuing the motion of the key-cylinder the remaining wards of the key engage the primary series of recesses f' and impart a shifting motion to as many tumblers as there are 120 tumbler-wards on the key. The shifting motion of the tumblers E is limited by the action of the retaining-springs f and the action of the locking-bar l , which is turned on its axis by the projections i . The motion of the locking-bar is limited by the stop-pin i^4 , against 125 which the projections i abut, as shown in Figs. 6 and 10. The shifting motion of the tumblers places the cam-shaped portion g' at the circumference of the same across the stump of the slide-bolt and holds the bolt 130 rigidly in thrown position until by the return of the tumblers into their normal position the bolt can be withdrawn. For opening the lock the same key which has been

used for closing is introduced in the key-cylinder and turned in the reverse direction, so as to engage first the shifted tumblers, return them with their locking-bar into normal position, and release thereby the sliding bolt, and engage next the sliding bolt and return it into the aligned recesses *g* of the tumblers, as shown in Figs. 4 and 9. A very effective and reliable construction for safety-locks of all kinds is thus obtained, which accomplishes by a comparatively few and simple elements a number of good results—as, for instance, the easy changing of the combination without any setting of tumblers or other parts by a simple change of keys, which change may be accomplished from time to time, and thereby an important safeguard obtained against the opening of the lock by means of false or imitation keys. This is of considerable importance in the case of letter-boxes, locks for mail-pouches, safe-deposit boxes, door-locks for hotels and boarding-houses, &c., in which a frequent change of keys is advisable in order to prevent the opening of the locks by unauthorized persons.

Another advantage consists in the non-pickable features of the lock, as the safeguards employed for preventing picking are very effective and reliable, so that short of forcibly opening the lock no tampering with the same is possible.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—
 1. The combination of a sliding bolt, a longitudinally-recessed and axially-turning key-cylinder, a key having wards, a series of shiftable tumblers, provided with recesses engaged, respectively, by said bolt and wards and with projections, and an angular spring-pressed locking-bar engaging the projections of said tumblers, substantially as set forth.

2. The combination of a series of shiftable tumblers provided with recesses for the actuating-key and projections at its circumference with a fulcrumed and spring-pressed angular locking-bar and stop-pins for limiting the motion of the tumblers and locking-bar, substantially as set forth.

3. In a combination-lock, a series of shiftable tumblers having a series of primary re-

cesses for the wards of the actuating-key and auxiliary or blind recesses at each side of said primary recesses, so as to prevent tampering with the tumblers, substantially as set forth.

4. In a combination-lock, a series of shiftable tumblers provided with primary recesses for the wards of the actuating-key, auxiliary or blind recesses at each side of the primary recesses, additional recesses for the slide-bolt, and projections at each side of said additional recesses respectively for the locking-bar and slide-bolt, substantially as set forth.

5. The combination of a series of shiftable tumblers having a series of primary recesses for the wards of the actuating-key and a series of auxiliary recesses at each side of the primary recesses, said auxiliary recesses serving as blind recesses, with a shield or shields arranged close to the tumblers at both sides of said primary recesses, substantially as set forth.

6. The combination, with a sliding bolt having a projecting bar or stump, of a series of shiftable tumblers having recesses for the wards of the actuating-key and additional recesses for engaging said projecting bar or stump, substantially as set forth.

7. The combination, with a sliding bolt having at one end a recess for the actuating-key and a projecting bar or stump at the opposite end, of a series of shiftable tumblers having recesses for the wards of the actuating-key, additional recesses for the projecting bar or stump, and cam-shaped portions adjoining the recesses for said stump, substantially as set forth.

8. In a combination-lock, the combination, with a series of shiftable tumblers, of an angular locking-bar fulcrumed to the case of the lock and a spring engaging a flat portion or heel of the lock-bar, so as to retain the locking-bar in its normal or shifted position, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

EUGENE C. SMITH.

Witnesses:

CARL KARP,
 MARTIN PETRY.