

(Model.)

3 Sheets—Sheet 1.

J. F. THOMPSON.
COMBINATION LOCK.

No. 407,262.

Patented July 16, 1889.

Fig. 1

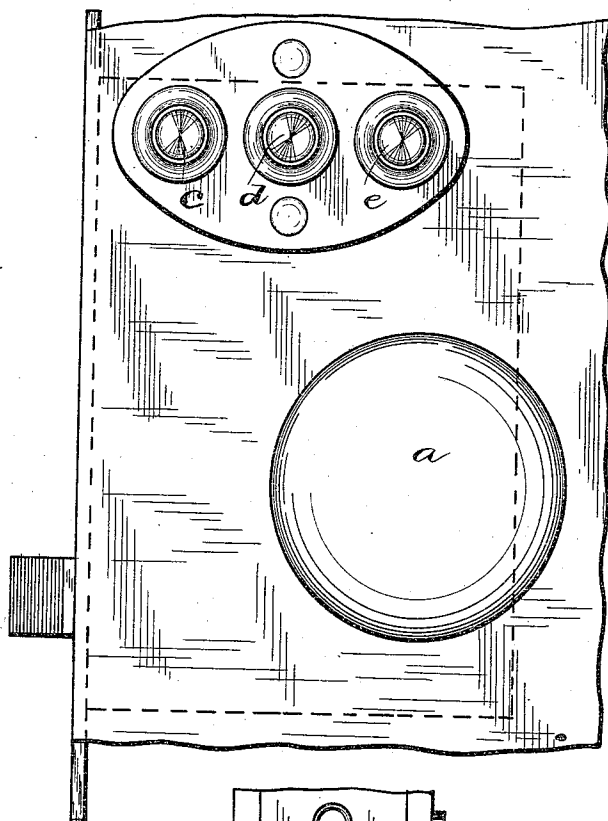
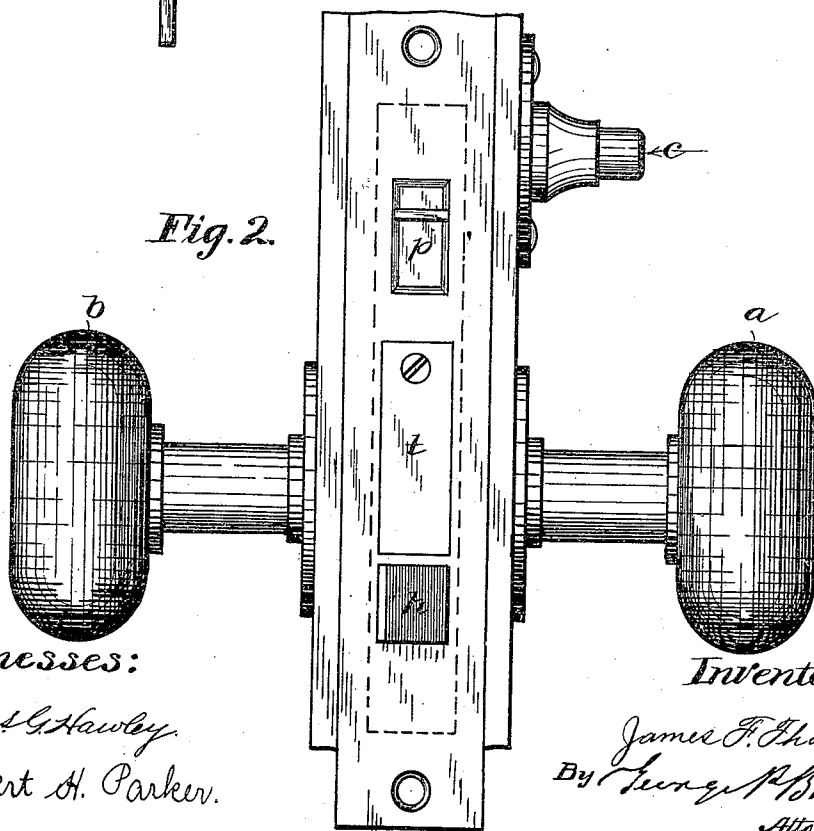


Fig. 2



Witnesses:

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Inventor:

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Attorney.

(Model.)

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Fig. 3. x

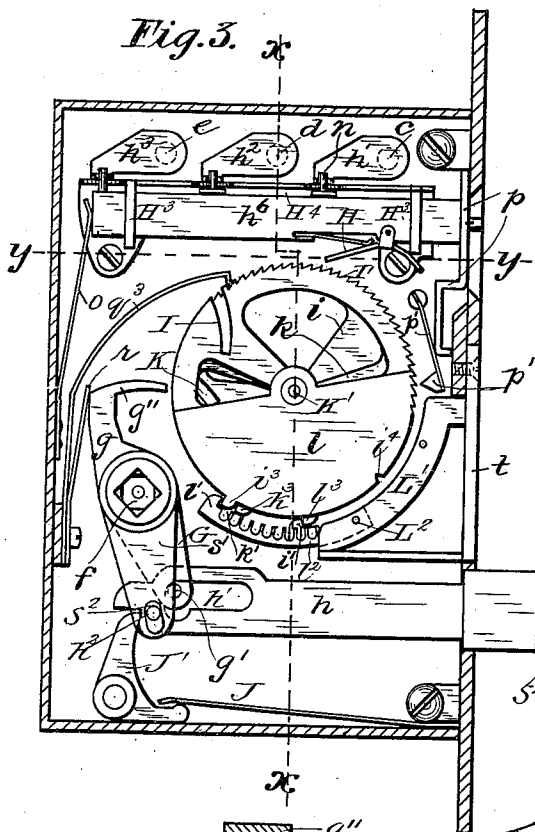


Fig. 4.

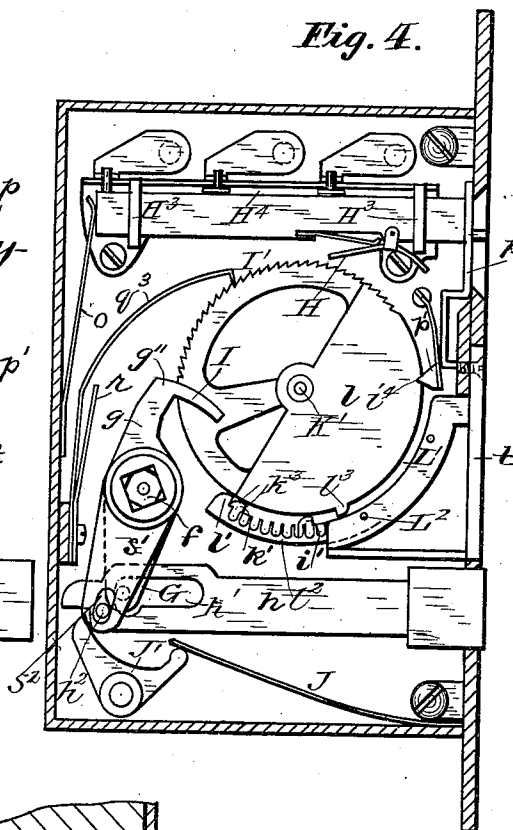
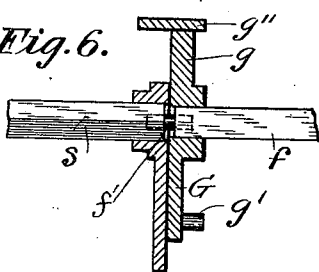
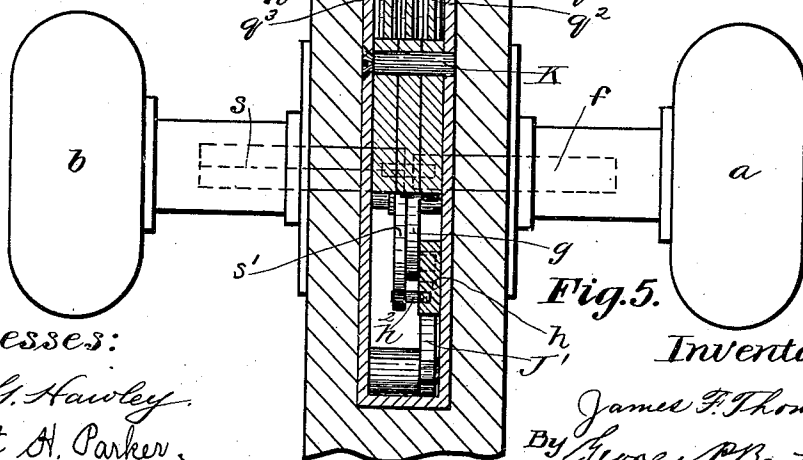


Fig. 6.



Witnesses:

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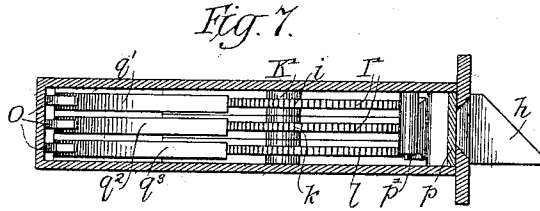
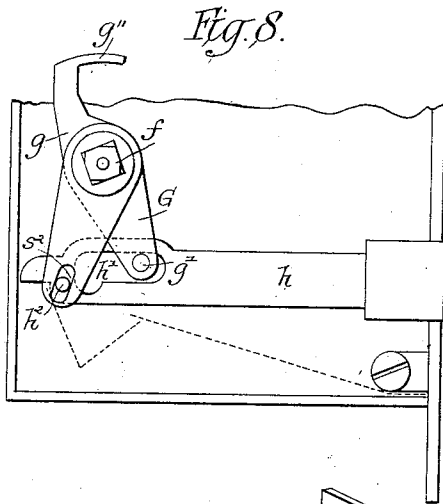
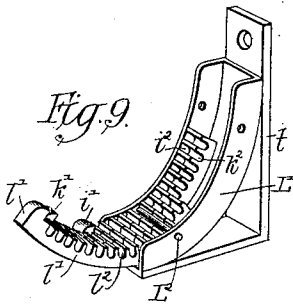
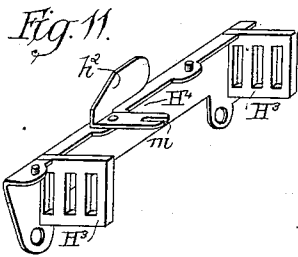
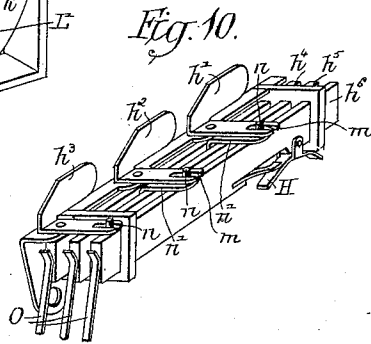
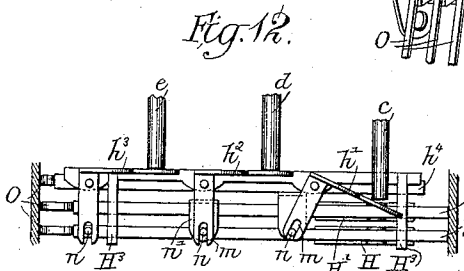
(Model.)

3 Sheets—Sheet 3.

J. F. THOMPSON.
COMBINATION LOCK.

No. 407,262.

Patented July 16, 1889.



Witnesses:-
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by: Dayton, Pole & Brown
Attorneys:-

UNITED STATES PATENT OFFICE.

JAMES FILLMORE THOMPSON, OF CHICAGO, ILLINOIS.

COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 407,262, dated July 16, 1889.

Application filed February 27, 1888. Serial No. 265,380. (Model.)

To all whom it may concern:

Be it known that I, JAMES FILLMORE THOMPSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Combination-Locks, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to improvements in combination-locks, and, while designed more especially for use in connection with house-doors, may be used on safes and all other places where the employment is desirable of a lock which may be set so that it may be unlocked only by a person knowing the combination.

The invention consists in the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a front view of my lock applied to a door. Fig. 2 is a side view of the same. Fig. 3 is an interior side view thereof in position to prevent the bolt from being withdrawn by turning the outside knob. Fig. 4 is a corresponding view, the mechanism being in position so that the bolt may be withdrawn on turning the outside knob. Fig. 5 is a sectional view thereof upon line *xx* of Fig. 3. Fig. 6 is a detail view showing the dowel-pin connection between the parts of the spindle. Fig. 7 is a sectional view upon line *yy* of Fig. 3. Fig. 8 is a detail view showing the manner of operating the bolt independently by each of the two knobs. Fig. 9 is a perspective view of the adjustable stops for limiting the movement of the tumblers and thus regulating or changing the combination from time to time as may be desired. Fig. 10 is a perspective view showing the slide-bars carrying the dogs which engage with the tumblers, and the bell-cranks for moving the different slide-bars. Fig. 11 is a perspective view of the frame or guides for holding the slide-bars. Fig. 12 is a top view of the slide-bars and the means of operating the same.

As illustrated in the said drawings, Figs. 1, 2, and 5, *a b* are handles or knobs by which the lock-bolt is actuated, said handles or knobs being arranged in the manner common

in door-latches. The knob *a* may be considered to be the outside knob, and the knob *b* as the inside knob of the door. As herein-
after more particularly described, I preferably
so construct the lock mechanism that the door
may be unlocked by turning the inside knob
at any time without reference to the action of
the mechanism constituting the combination.

c d e are push pins or buttons, which are employed for actuating the combination mechanism of the lock. Said push-pins are placed, as shown, at the outside of the door at a point adjacent to the knob *a*. Said push-pins are connected with the combination mechanism of the lock in such manner that the outside knob can be operated to withdraw the bolt only after the push-buttons have been moved or manipulated in a particular manner. It will of course be understood that the said push-pins may be varied as to form and location without departure from my invention. I have, for instance, in some instances made the push-pins flush with the escutcheon or with the surface of the door. The knob *a* is provided with a spindle *f*, which turns with the knob, and is provided inside of the casing of the lock with a rigid arm *g*, Figs. 3, 4, 5, 6, and 8. (Shown in the drawings as extending upwardly from the spindle.) Said spindle is also provided with a second rigid arm *G*, provided at its end remote from the spindle with a pin *g'*, projecting from one side of the said arm into a slot *h'* of the bolt *h*.

The bolt is thrown or cast by a spring in the ordinary manner, the spring in the instance illustrated being of flat or leaf form, as indicated at *J*, and being arranged to press downwardly upon the horizontal arm of a bell-crank lever *J'*, the vertical arm of which acts against the rear end of the bolt. The pin *g'* of the arm *G* acts against the inner end of slot *h'* when the spindle is turned to withdraw the bolt, the said slot *h'* allowing the bolt to be thrust backwardly independently of the knob-spindle, as common in spring-latches. Said slot also allows the bolt to be operated independently of the spindle *f* and combination mechanism which controls the said spindle through the medium of the knob *b*. Said knob is attached to a spindle *s*, which is made separate from and adapted to turn independently of the spindle *f*. Said

spindle *s* is provided with a rigid arm *s'*, which is provided with a slot *s²*, adapted to engage a pin *h²* in the bolt *h*. When the spindle *s* is turned in the proper direction, the bolt will be withdrawn by the action of the arm *s'* upon the pin *h²*, the pin *g'* moving through the slot *h'* as the bolt is moved.

The combination mechanism embraces as its main features a tumbler or tumblers adapted to obstruct the movement of the arm *g* and thereby prevent the turning of the knob and the backward movement of the bolt. Devices are provided for moving such tumblers to bring them into position to allow the said arm *g* to move, which will now be described.

i k l are tumblers, which are placed upon a common shaft or pivot *K'*, arranged parallel with the knob-spindle *f*, so that the said tumblers move or swing in planes parallel with the side of the door. Said tumblers, in the particular construction illustrated, are circular or disk-shaped in form; but this particular shape thereof is not essential. Said tumblers are provided with a series of notches, of which two *I K* appear in the drawings, Fig. 3, adapted to come opposite the arm *g* on the spindle when the tumblers are placed in a certain position, and thereby allow the movement of the said arm and spindle in a direction to withdraw the bolt, the tumblers being arranged to prevent movement of the said arm *g* and spindle except when said notches are in a line with each other and opposite the arm. The notches are herein shown as made narrow and of curved form and arranged to receive a tooth or projection *g²* upon the arm *g*, which tooth or projection is adapted to enter the notches when the arm *g* is moved. In case the arm *g* is made of other shape, however, the notches of the tumblers may be otherwise formed to allow movement of the arm in one position of the tumblers and to prevent such movement in other positions thereof. Said tumblers are actuated by springs or weights in a direction to carry the notches away from the arm *g*, as shown in Fig. 4. In the particular construction shown the tumblers are weighted, or, in other words, the metal of the tumblers is so arranged as to give a preponderance of weight at one side of the pivot *K'*, so that the said tumblers, when left free to turn, will swing into position with the notches at points remote from the arm *g*. The movement of the tumblers in a direction to carry the notches away from the arm *g* is limited by means of a plurality of stops *i' k' l'* upon the frame, said stops being made separately adjustable, in order that the tumblers may be arrested at different points, as hereinafter more fully described.

Devices are shown in the drawings for actuating the tumblers to bring the notches of said tumblers in a line opposite the arm *g* of the knob-spindle, said devices being constructed as shown in the drawings, as follows:

The tumblers *i k l* are provided with ratchet-teeth (shown at *I'*, Fig. 3) arranged concentric with the pivot of said tumblers. *H H'* *H²* are bodily-movable actuating-pawls adapted to engage said ratchet-teeth in such manner as to move or turn the tumblers in a direction to carry the notches of the tumblers toward the arm *g*. Said actuating-pawls are herein shown as being mounted upon and moved by the series of slide-bars *h⁴ h⁵ h⁶*, arranged to move in vertical planes, or parallel with the face of the door, said slide-bars being desirably located at the top of the lock-case above the tumblers.

Mounted upon the frame or casing of the lock are three detent-pawls *q' q² q³*, adapted to severally engage said ratchet-teeth of the tumblers. The detent-pawls *q' q² q³* serve to hold the tumblers from backward movement when the actuating-pawls are free therefrom, said detent-pawls, by their engagement with the teeth, acting to hold the tumblers in the positions to which they are moved or shifted by the action of the said actuating-pawls. In other words, the said actuating-pawls, in connection with the detent-pawls, enable the tumblers to be shifted to a desired position by a step-by-step movement, each reciprocation of an actuating-pawl carrying the tumbler engaged thereby forward one notch, while the detent-pawl passes over an intervening tooth into the next notch, and thereby prevents the tumbler from moving backward when the actuating-pawl is advanced to engage another tooth.

It follows from the construction above described that by repeated movements of the actuating-pawls the tumblers may be turned or moved to any extent desired. When, therefore, it is known to the person operating the lock the number of movements of the actuating-pawl necessary to bring the notch in one of the tumblers opposite the arm *g*, the tumbler may be easily brought to the required position by moving the actuating-pawl the desired number of times.

The actuating-pawls *H H'* *H²* may act by gravity or otherwise. As herein shown their free ends are thrown downwardly into position to engage the ratchet-teeth of the tumblers by springs attached to the slide-bars and acting upon said pawls. As a simple and convenient way of supporting the slide-bars, the latter, as herein shown, are mounted in guide-slots formed in transverse arms or bars *H³ H³* upon a plate *H⁴*, Fig. 11, which is secured to the side plate of the lock-case, as clearly shown in Figs. 3, 4, and 5. The detent-pawls *q' q² q³* are herein shown as consisting of spring-arms attached to the inner surface of the lock-casing and engaged at their free ends with the ratchet-teeth of the tumblers. As far as the operation of the other parts above described is concerned, however, said pawls may be otherwise constructed or arranged as may be found convenient or desirable.

The several slide-bars $h^4 h^5 h^6$ are actuated from the push-pins $c d e$ by devices made as follows: At points inside of the lock-case adjacent to the said push-pins are located three bell-crank levers $h^7 h^8 h^9$, said bell-crank levers being provided with arms arranged parallel with the side of the door, against the free ends of which the several push-pins $c d e$ are adapted to act, and with other arms arranged transversely to the face of the door, said transverse arms being engaged with and actuating the several slide-bars $h^4 h^5 h^6$. The ends of the several bell-crank levers which engage the slides are slotted and engage pins attached to the slide bars—as, for instance, in Figs. 10 and 12 the bell-crank lever h^7 is provided with a slot m , which is engaged with a pin n of the slide h^4 , said pin n being attached to a horizontal arm n' , which is rigidly attached to the slide h^4 and extends over the slides $h^5 h^6$, so as to support the pin n adjacent to the free end of the transverse arm of the bell-crank lever. The slide h^5 is similarly provided with an arm, which extends over the slide h^6 , to support the pin which engages the bell-crank lever h^8 , while in the case of the slide h^6 the pin engaging the transverse arm of the bell-crank lever h^9 is inserted directly in the edge of the slide. The employment of said arms, as n' , for supporting the said pins enables all of the pins to be arranged at the same distance from the side of the lock-case, and thus enables the transverse arms of the bell-crank levers to be made of the same length and the push-pins to have the same extent of movement or throw. The bell-crank levers are preferably mounted on pivot-pins attached to the upper edge of the plate H^1 , Fig. 11. The slides are severally moved in a direction to carry forward the tumblers by the push-pins, and in the opposite direction by means of springs $o o$, herein shown (Figs. 3, 4, 10, and 12) as being secured to the lock-case and acting on the ends of said slides.

For the purpose of freeing the actuating-pawls from the ratchet-teeth as the slide-bars are moved backwardly by the springs $o o$, said pawls are desirably provided with rigid arms extending rearwardly from the pivots and adapted to engage the lower edge of the transverse frame-arm H^3 in such manner that the free ends of the pawls will be lifted away from the ratchet-teeth as the pawls move backward, thereby obviating liability of the free backward movement of the tumblers being interfered with by the pawls.

The springs $o o o$ may be alone relied upon to thrust the push-pins outward; but, as herein shown, Fig. 5, said push-pins are provided with separate springs for this purpose, the said springs $o o o$ in this instance serving to move the slide-bars and bell-crank levers only.

When a number of tumblers are present, as in the lock shown, the stops $i' k' l'$ will be

arranged in different relative positions, so that the tumblers will need to be moved different distances to bring all the notches thereof in line with each other and opposite the arm g . As shown in the drawings, for instance, it will be necessary to actuate the push-pin c five times, the push-pin d eleven times, and the push-pin e thirteen times to bring the several tumblers from their thrown-off or locked position into position for opening the door.

The means shown for adjustably sustaining the stops $i' k' l'$ upon the lock-casing embraces features of novelty, and are as follows: Said stops are attached to curved strips $i^2 k^2 l^2$, which are adapted to fit side by side in a curved guideway L' , Figs. 3, 4, and 8, arranged concentrically with the pivot of the tumblers, the said strips being adapted to slide endwise in the said guideway, so as to bring the said stops in any position desired with relation to the teeth or spurs $i^3 k^3 l^3$ on the disks which engage said stops. Any suitable means may be employed for adjustably securing the said strips in said curved guideway, the means for this purpose herein shown consisting of a plurality of notches in the strips and a removable pin L^2 inserted transversely through the side walls of the curved guideway L' and through one of the notches in each of the strips. Said notches of the strips are desirably arranged at the same angular distance apart as the ratchet-teeth of the tumblers, so that by withdrawing said pin L^2 the strips may be easily shifted and secured in new positions for the purpose of shifting the points at which the tumblers will stop when released, and thereby changing the combination by which the lock may be opened.

Any suitable means may be employed for releasing the detent-pawls from the tumblers and thereby allowing the same to swing or move backwardly to carry the notches therein away from the arm g , and thus set the combination to prevent the withdrawal of the bolt. The lock herein shown, however, embraces a novel construction in means for releasing the detent-pawls from the tumblers, which consist, generally, in a part which is moved by or with the knob-spindle as said knob-spindle is turned backwardly, or in a direction opposite to that in which it is turned in withdrawing the bolt, said part which is moved by or with the spindle acting upon the detent-pawls to free the same from the tumblers. When this construction is present, it is only necessary, in order to set the combination, that the knob should be turned slightly backward from its normal position, when the tumblers will be released and come into position to prevent the spindle being turned forward and the bolt from being withdrawn. A construction embracing such piece or part moved with or by the spindle is herein broadly claimed as part of my invention.

As a simple and convenient construction in

a throwing-off device of the character above stated, I so construct the arm *g* of the knob-spindle that said arm will itself come in contact with the detent-pawls *q'* *q*² *q*³ when said arm is thrown backwardly from the position commonly occupied by it when the door is locked, as clearly shown in the drawings, Fig. 3. This construction has the great advantage of providing a throwing-off device without the necessity of increasing the number of moving parts of the lock, and this latter construction is therefore herein specifically claimed as an additional improvement.

It will of course be understood that in the lock shown, wherein the bolt is cast by a spring, the tumblers may be set for locking the door either before or after the latter is closed.

I have shown at *r* in the drawings, Figs. 3 and 4, a spring arranged behind the arm *g* and adapted for contact with said arm when the latter is free from the tumblers and in the position shown in Fig. 3. Said spring affords some considerable resistance to the backward turning of the spindle, so that the arm *g* will not be thrown against the detent-pawls through a slight accidental or inadvertent turning of the knob, it being entirely obvious that in case the said arm *g* were entirely free to swing back against the detent-pawls the latter might be accidentally released from the tumblers after the latter have been placed in position for withdrawing the bolt. By the presence of said spring, however, the throwing off of the tumblers is not likely to take place except when the same is intentionally done. It is not essential, however, that a separate spring should be employed for the purpose last above stated, for the reason that when the detent-pawls are formed or supported on spring-arms, as herein illustrated, the spring-arms themselves may be sufficiently rigid to prevent the detent-pawls being too easily released.

It may be desired to lock or hold the tumblers from movement when the latter are in position, allowing free action of the bolt in order that the lock may be operated by either knob without reference to the combination mechanism. For so locking the tumblers I have provided a locking-detent *p'*, mounted upon the lock-case and adapted to engage secondary notches *i'* *k'* *l'*, formed in the several tumblers in position to come opposite said locking-detent when the main notches of the tumblers are in position to allow the movement of the arm *g*. As a simple and convenient construction in such locking-detent, the same is provided with a spring-arm adapted to hold the detent free from the tumblers, and upon the lock-case is located a sliding piece *p*, adapted to come against the outer surface of the locking-detent and thereby thrust the same into engagement with the tumblers when said sliding piece is moved, said sliding piece

having a part which is accessible through a slot or opening located in the front edge of the lock-case, so that the locking-detent can be moved only when the door is open. When the tumblers have been set or locked by the locking-detent *p'*, it will obviously be necessary to release said locking-detent from the tumblers before the spindle is turned backwardly to free the detent-pawls *q'* *q*² *q*³ from said tumblers.

As before stated, the spindle *s* of the inside knob *b* has an arm *s'* acting upon the bolt *h* independently of the spindle *f* and arm *g*, so that said bolt may be moved by the knob *b* independently of said spindle *f*. Said spindle *f* is desirably connected with the said spindle *s* by a cylindric pin *f''*, Fig. 6, fitting in cylindric apertures in the ends of the spindles, by which said spindles are held accurately in alignment with each other.

As a separate and further improvement in locks of the general character herein shown, in which the stop for limiting the movement of each tumbler away from the unlocking position of the same is adjustably attached to the lock-frame, I provide the lock-casing with an exposed movable plate, to which the stop is adjustably attached, and which may be removed for shifting the position of the stop (for changing the combination) without disturbing other parts of the lock or lock-casing.

As herein shown, *t* is a plate, which is removably secured in the front plate of the lock, so that said plate *t* is only exposed when the door is open. To said plate *t* the guideway *L'* is rigidly attached, so that said guideway is sustained in position partially or wholly by said plate, and may be removed with the latter. The plate is shown as held in place by a single screw; but it may be otherwise connected with the lock-frame, as may be found convenient or desirable.

It is entirely obvious that a lock embracing the main features of my invention may contain one or any number of tumblers and actuating devices therefor, three tumblers being shown in the drawings for the purpose of illustration.

It is to be understood that my invention is not limited to the specific details of construction herein illustrated and described, except as to the novel details, which are made the subject of specific claims herein.

I claim as my invention—

1. The combination, with the bolt and knob-spindle, of a notched tumbler mounted on a pivot parallel with the axis of the knob-spindle and provided with ratchet-teeth, an arm or projection upon the said knob-spindle adapted to engage the notch in the tumbler, a detent-pawl engaging the ratchet-teeth of the tumbler to hold the same from backward movement, and an actuating-pawl acting upon said tumbler to move the latter, substantially as described.

2. The combination, with the bolt and knob-spindle, of a plurality of tumblers controlling the movement of the bolt, said tumblers being provided with ratchet-teeth, slides moving in planes parallel with the tumblers, actuating-pawls mounted upon said slides, push-pins, and bell-crank levers connecting said push-pins with the said slides, substantially as described.

3. The combination, with the bolt and knob-spindle, of a tumbler provided with ratchet-teeth, a detent-pawl engaging the teeth of the tumbler to hold the same from backward movement, an actuating-pawl acting upon said tumbler to move the same, and a part actuated by the knob-spindle when the latter is turned backward, constructed to engage and move the said detent-pawl for releasing the tumbler, substantially as described.

4. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, an arm or projection upon the said knob-spindle adapted to engage the notch of the tumbler, a detent-pawl engaging the tumbler, and an actuating-pawl acting on the tumbler to move the same, said arm or projection upon the knob-spindle being constructed to engage and move the detent-pawl when the spindle is turned backwardly, substantially as described.

5. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, a detent-pawl engaging the said ratchet-teeth, an actuating-pawl acting upon said tumbler to move the same, and a stop adjustably mounted on the lock-frame and adapted to engage the said tumbler, substantially as described.

6. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, a detent-pawl, an actuating-pawl acting upon said tumbler to move the same, a curved strip provided with a projection forming a stop for the tumbler, a curved guide supporting said strip, and means for adjustably securing said strip to the said guide, substantially as described.

7. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, a detent-pawl engaging the said teeth, an actuating-pawl also engaging the ratchet-teeth for moving the tumbler, a part actuated by the spindle constructed to engage and move the detent-pawl, and a locking-detent adapted to engage the tumbler for holding the same in position to allow the actuation of the bolt, substantially as described.

8. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, an actuating-pawl engaging and moving the tumbler, a part actuated by the spindle engaging and moving said detent-pawl, a spring locking-detent engaging the tumbler to hold the same from movement, and an exposed movable part or slide upon

the lock-frame constructed to thrust the locking-detent into engagement with the tumbler, substantially as described.

9. The combination, with the bolt and knob-spindle, of a plurality of notched tumblers provided with ratchet-teeth, adjustable stops limiting the movement of the tumblers, detent-pawls for holding the tumblers from backward movement, actuating-pawls engaging and moving the tumblers, slide-bars carrying said actuating-pawls, push-pins, and bell-crank levers transmitting motion from said push-pins to the slide-bars, substantially as described.

10. The combination, with the bolt and knob-spindle, of a tumbler provided with ratchet-teeth, a detent-pawl engaging the teeth of the tumbler to hold the same from backward movement, an actuating-pawl acting upon said tumbler to move the same, a part actuated by the knob-spindle in the backward movement of the latter constructed to engage said detent-pawl for releasing the tumbler, and a spring applied to resist such backward movement of the knob-spindle, substantially as described.

11. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, an arm or projection upon the said knob-spindle adapted to engage the notch of the tumbler, a detent-pawl engaging the tumbler, an actuating-pawl acting upon the tumbler to move the same, said arm or projection upon the spindle being constructed to engage and move the detent-pawl when the spindle is turned backwardly, and a spring applied to resist the backward turning of the spindle, substantially as described.

12. The combination, with the bolt and knob-spindle, of a plurality of tumblers controlling the movement of the bolt, said tumblers being provided with ratchet-teeth, slide-bars moving in planes parallel with the tumblers, actuating-pawls mounted upon said slide-bars, push-pins, and bell-crank levers, one or more of said slide-bars being provided with pins engaging the bell-crank levers, and a lateral arm or arms attached to one or more of said slide-bars to sustain the pins belonging thereto, substantially as described.

13. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, a detent-pawl engaging said ratchet-teeth, an actuating-pawl also engaging said ratchet-teeth, a slide-bar carrying said pawl, and a stationary part or arm located in position to engage the actuating-pawl and throw the same away from the tumbler in the backward movement of the said slide-bar and pawl, substantially as described.

14. The combination, with the bolt and knob-spindle, of a notched tumbler provided with ratchet-teeth, a detent-pawl, a bodily-movable actuating-pawl, an exposed removable plate secured to the lock-frame, and a

stop adjustably mounted on said removable plate and adapted to engage the tumbler, substantially as described.

15. The combination, with the bolt and
5 knob-spindle, of a notched tumbler provided with ratchet-teeth, a detent-pawl, an actuating-pawl, an exposed removable plate attached to the lock-frame, a curved strip provided with a projection forming a stop for
10 the tumbler, and a curved guide supporting

the said strip, said curved guide being attached to said removable plate, substantially as described.

In witness whereof I hereunto subscribe my name this 23d day of February, A. D. 1888.

JAMES FILLMORE THOMPSON.

Witnesses:

GEORGE P. BARTON,
CHAS. G. HAWLEY.