No. 745,081. PATENTED NOV. 24, 1903.

O. SMITH.

PERMUTATION LOCK.

APPLICATION FILED JULY 20, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 1.

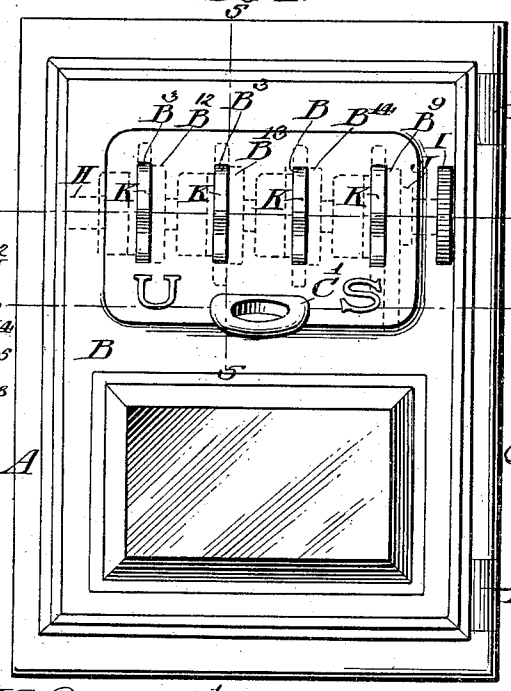


FIG. 5.

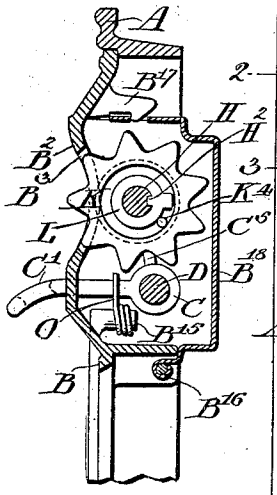


FIG. 6.

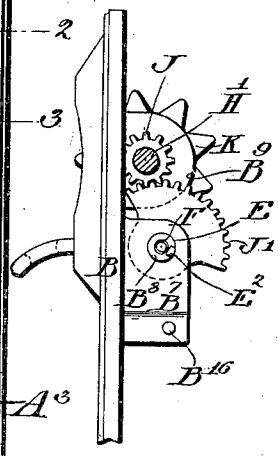


FIG. 2.

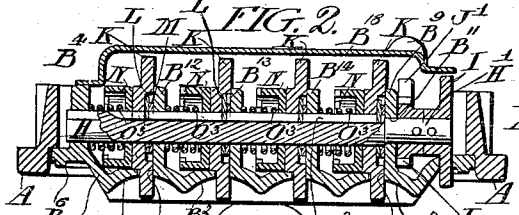


FIG. 3.

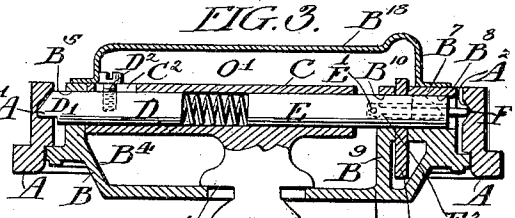
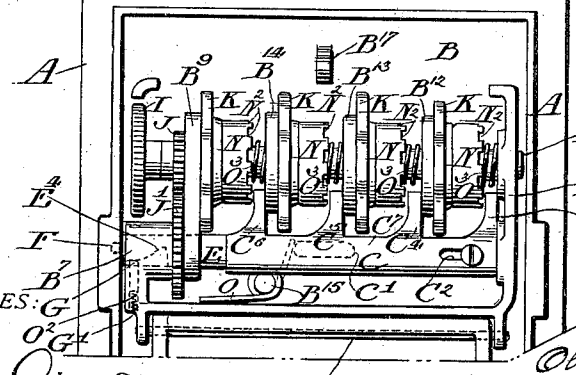


FIG. 4.



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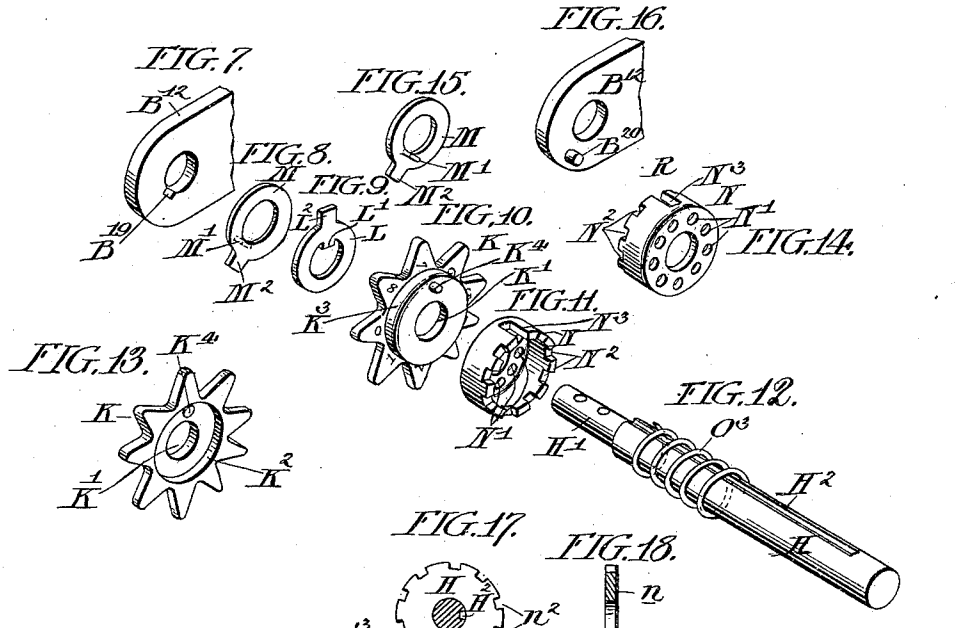
No. 745,081. PATENTED NOV. 24, 1903.

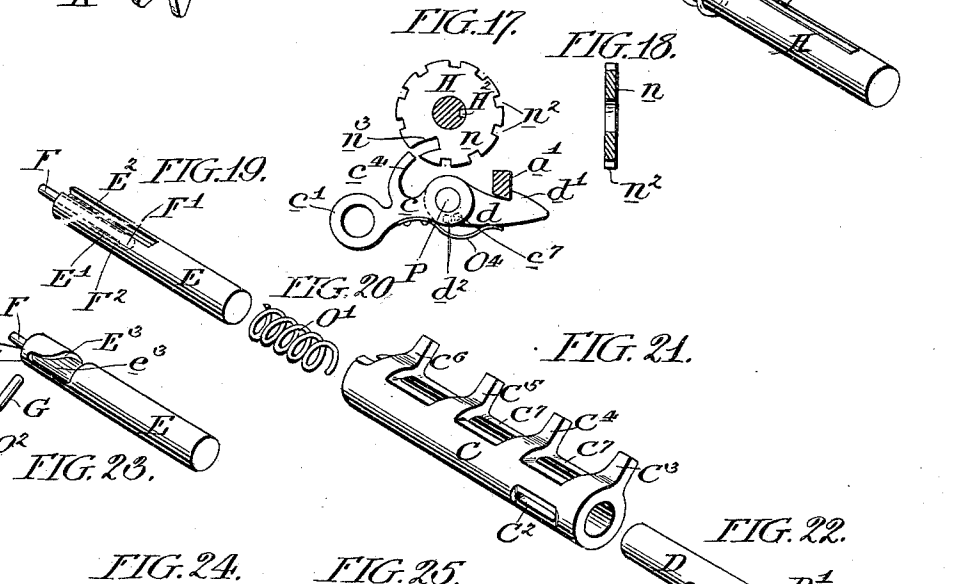
O. SMITH.

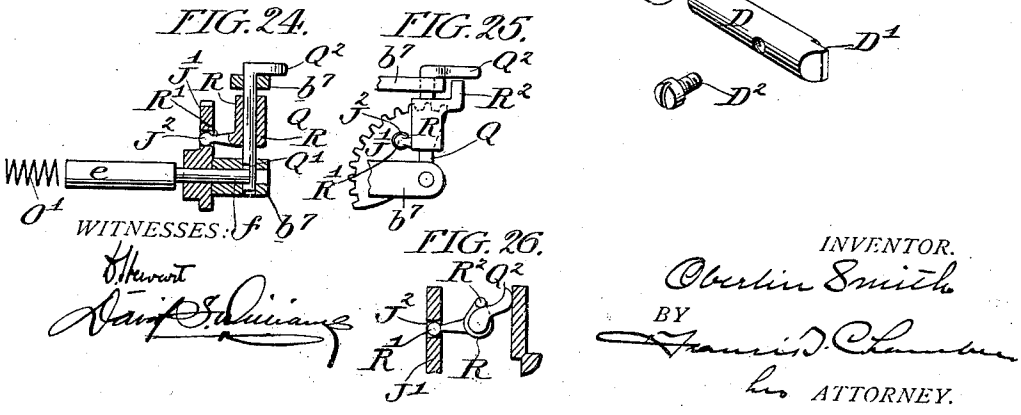
PERMUTATION LOCK.

APPLICATION FILED JULY 20, 1903.

NO MODEL. 3 SHEETS—SHEET 2.







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PERMUTATION LOCK.

APPLICATION FILED JULY 20, 1903.

NO MODEL. 3 SHEETS—SHEET 3.

FIG. 27.

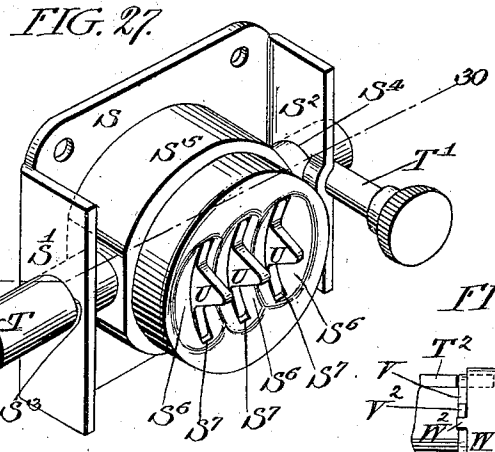


FIG. 28.

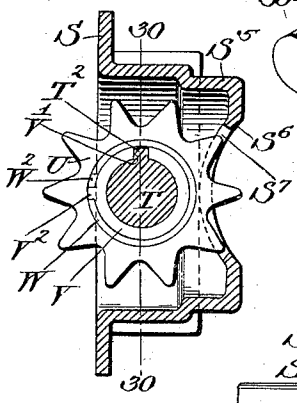


FIG. 29.

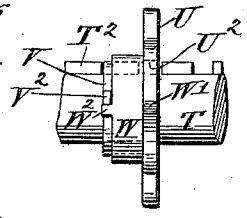


FIG. 30.

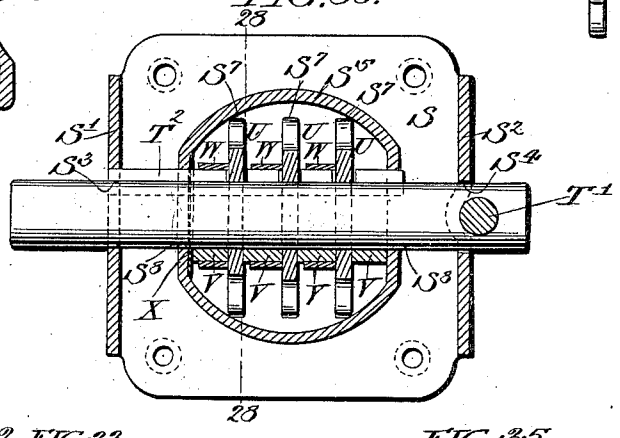


FIG. 31 FIG. 32. FIG. 33. FIG. 34.

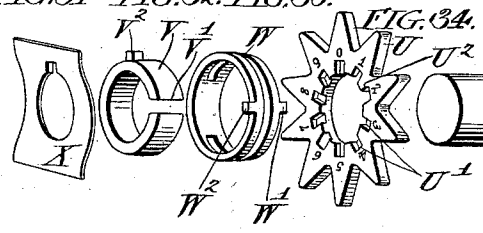
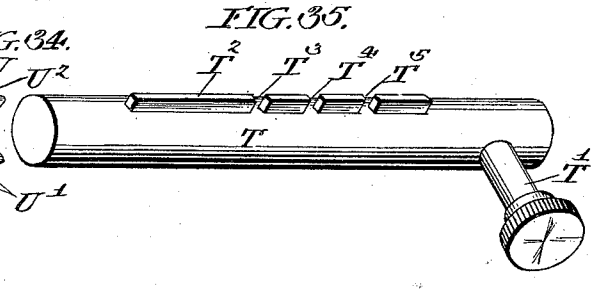


FIG. 35.



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No. 745,081. Patented November 24, 1903.

UNITED STATES PATENT OFFICE.

OBERLIN SMITH, OF BRIDGETON, NEW JERSEY.

PERMUTATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 745,081, dated November 24, 1903.

Application filed July 20, 1903. Serial No. 166,213. (No model.)

To all whom it may concern:

Be it known that I, OBERLIN SMITH, a citizen of the United States of America, residing in the city of Bridgeton, in the county of Cumberland, in the State of New Jersey, have invented a certain new and useful Improvement in Permutation-Locks, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to permutation-locks, and to a certain extent may be considered an improvement upon my former invention described in my Patent No. 494,605, of April 4, 1893, in that in my present invention I utilize the principle of giving motion to the tumblers through a device which acts upon them by a series of impulses which have simply to be counted and do not require the assistance of the eye to accurately define the extent of movement of the impelling mechanism.

Again, my invention may be considered as, in part at least, an improvement upon my pending application for Letters Patent originally filed April 3, 1902, Serial No. 101,152, forfeited, and renewed October 15, 1903, Serial No. 177,222, in that it utilizes the characteristic feature of the last-mentioned invention in employing a toothed movable part, preferably a star-wheel, to give motion to the tumblers, such toothed part being used in combination with a notched shield or plate through which one or more teeth of the wheel project and which limits the distance to which the tooth is moved by the finger.

The object of my present invention is to simplify and improve permutation-locks having the features of my former inventions; and in its most characteristic features it consists in providing a shield overlying the lock and having formed in it a series of slotted finger-notches through which extend the teeth of a series of star-wheels, all journaled on a shaft supported in the rear of the casing or plate and each one connected with a tumbler, also turning on the same shaft and preferably made adjustable with regard to the star-wheel, so as to vary the combinations, though the combinations can of course be varied by other means.

My invention also consists of a number of improvements and coacting attachments, which will be best understood as described in connection with the drawings, in which they are illustrated, and in which—

Figure 1 is a front view of a door provided with my improved lock in what I believe to be its best and most efficient form, in this case applied to a post-office lock-box. Fig. 2 is a cross-section on the line 2 2 of Fig. 1, showing also in section the walls of the doorway. Fig. 3 is a similar section on the line 3 3 of Fig. 1. Fig. 4 is a back view of the rear side of the upper portion of the door, showing my lock in position thereon. Fig. 5 is a vertical section on the line 5 5 of Fig. 1; Fig. 6, an edge elevation of the upper part of the door and the lock with the hand-wheel I removed. Fig. 7 is a perspective view of one of the brackets extending out from the door and supporting the shaft on which the star-wheels are journaled. Fig. 8 is a perspective view of one of the stop-dogs used in connection with the brackets shown in Fig. 7, the same dog being shown also in perspective, but in reversed position, in Fig. 15. Fig. 9 is a perspective view of one of the scattering-dogs. Fig. 10 is a perspective view of one of the star-wheels, such star-wheel being shown also in perspective, but in reversed position, in Fig. 13. Fig. 11 is a perspective view of one of the tumblers, which is shown also in perspective and in reversed position in Fig. 14. Fig. 12 is a perspective view of the shaft upon which the star-wheels and tumblers are journaled, showing also one of the springs utilized to hold the tumblers in locked position with regard to the star-wheels; and Fig. 16 is a perspective view of one of the brackets similar to that shown in Fig. 7, but illustrating a modification in the construction thereof. Fig. 17 is a side elevation illustrating a modification of the lock. Fig. 18 indicates a vertical section through the tumblers shown in Fig. 17. Fig. 19 is a perspective view of a shaft used in my lock and having for its chief function the automatic scattering of the tumblers. Fig. 20 is a perspective view of a spring used in connection with the shaft and with the latch to be described. Fig. 21 is a perspective view of a sleeve having extending from it arms which interlock with the locking-dogs. Fig. 22 is a perspective view of the latch. Fig. 23 is a perspective view of the shaft shown in

Fig. 19 in reverse position to that shown in said last-mentioned figure, showing also in connection with it the pin which causes the shaft to rotate. Fig. 24 is an elevation, partly in section, showing a modification of the scattering device. Fig. 25 is an end view of the said modified device; and Fig. 26, a plan view, partly in section, illustrating the same mechanism as in Figs. 24 and 25. Fig. 27 is a perspective view of a simple modification embodying the broad features of my invention. Fig. 28 is a cross-section through the modified lock, taken on the line 28 28 of Fig. 30. Fig. 29 is a detached view showing the plate and adjusting mechanism of the modified lock. Fig. 30 is a sectional view taken on the line 30 30 of Fig. 28. Fig. 31 is a perspective view of the spring used to hold the parts assembled; Fig. 32, a perspective view of the stop; Fig. 33, a perspective view of the adjusting-ring; Fig. 34, a perspective view of the operating star-wheel and tumbler combined, and Fig. 35 a perspective view of the combined shaft and lock.

Referring first to the lock illustrated in Figs. 1 to 16 and also in Figs. 19 to 23, A indicates the door-frame, having, as shown in Fig. 3, a detent A′ for the locking bolt or latch and, as indicated in Fig. 1, hinge members A^3 for the door. This door is indicated at B and is formed with a transverse slot B′ (see Fig. 3) for the passage of the sliding handle which withdraws the bolt. The portion of the face of the door which forms a shield or casing for the lock is formed with a series of finger-notches, (indicated at B^2 B^2, &c.,) each slotted, as indicated at B^3, and on the inside of the door are formed webs or flanges which serve as bearings for the parts of the lock. One of such webs (indicated at B^4) has a bearing-perforation B^5 for the latch-bolt (see Fig. 3) and above it another bearing-perforation B^6 for the shaft H. (See Fig. 2.) On the other side of the door a web B^7 is provided having a perforation B^8, which supports the shaft E, (see Figs. 3 and 6,) and, as shown, the door is also provided with the web B^9, which (see Fig. 3) has a bearing-perforation B^{10} for the shaft E and (see Fig. 2) a bearing-perforation B^{11} for the shaft H. Other webs projecting from the back of the door are indicated at B^{12} B^{13} B^{14}, these webs having perforations through which passes the shaft H, as indicated in Fig. 2.

B^{15} (best shown in Figs. 2 and 4) indicates a spring-holding stud projecting from the back of the door; B^{16}, a hinge-rod on which is hinged the back cover B^{18}, B^{17} indicating a latch-hook to hold the cover in place.

C is a sleeve having extending from it the handle C′, which projects through the slot B′ of the door and having formed in it the slot indicated at C^2 and extending from it the arms C^3 C^4 C^5 C^6, between which the sleeve is cut away, as indicated at C^7, to give clearance to the star-wheels.

D is the latch of the lock, which is supported in the sleeve C and held therein by a screw D^2, extending through the slot C^2 of the sleeve.

D′ indicates the latch end of the lock or bolt.

E is a shaft the inner end of which extends into and is supported by the sleeve C, and, as shown, this shaft is formed hollow at its outer end, as indicated at E′, and is also provided with a longitudinal slot E^2 and with a recess e^3, (see Fig. 23,) one wall of which, E^3, is of spiral shape. The rear end of the recess e^3 (indicated at E^4) slopes upward to the annular rear surface E^5 of the shaft.

F is a bearing-pin having a ball-like head F′, which extends into the recess E′, the pin being held therein by a locking-pin, such as indicated at F^2. A spring O′ (see Figs. 3 and 20) acts against the inner ends of the rods E and of the bolt D, pressing both outward.

G (see Figs. 4 and 23) is a pin supported in a bearing in the fixed part of the door and thrust outward into the recess e^3 by a spring O^2.

H is a rod or shaft supported in the bearings B^{12}, &c., of the door, and having, as shown, one end, H′, of reduced diameter and a slot H^2 extending longitudinally through its larger portion.

I, Figs. 1 to 4, is a milled wheel secured to the end H′ of the shaft H.

J is a gear-wheel also secured to the reduced end of the shaft H.

J′ is a segment engaged by the gear J and secured to the shaft E, which is thus interengaged with the shaft H, so that the two shafts will always rotate at the same time and in opposite directions.

K K, &c., are a series of star-wheels journaled on the shaft H and projecting through the slots E^3 into the finger-notches B^2 at the front of the door. These star-wheels (see Figs. 10 and 13) are centrally perforated, as indicated at K′, dished on one side, as indicated at K^2, and correspondingly pressed out on the other side, as indicated at K^3, and they have also extending through them the pins indicated at K^4, said pins extending from both sides of the star-wheel.

L L, &c., (see Figs. 2, 5, and 9,) are the scattering-dogs, formed of thin annular plates which fit over the shaft H and are provided with an inwardly-extending tongue L′, which engages the slot L^2, and an outwardly-extending tongue K^2, which comes in contact with the portion of the pin K^4 which extends into the recessed portion of the star-wheel, one scattering-dog fitting in each recessed portion of each star-wheel.

M M, &c., (see Figs. 2, 8, and 15,) are stop devices formed of thin annular rings having upwardly-extending flanges M^2, which are adapted to come in contact with the pins K^4 on the star-wheels, and laterally-extending tongues M′, which are adapted to engage in recesses B^{19} of the flanges B^{12} B^{13}, &c., extending out from the rear of the door, being

thus locked in permanent position. Where this particular construction of stop is used, it also lies within the recessed portion of the star-wheel; but in place of using this stop a stop-pin, such as indicated at B^{20}, Fig. 16, may project out from the bearing-flange B^{12}, &c., being arranged to engage the pin K^4 of the star-wheel.

N N, &c., indicate the tumblers, which are of cup-like form and fit over the shaft H, having a series of perforations N′ N′, &c., so placed that any one of them can engage the portion of the pin K^4 which extends from the outwardly-pressed portion of the star-wheel. The tumbler is also formed with a series of notches N^2 in its edge, one of the series (indicated at N^3) being deeper than the others and serving when brought to proper registry to release the lock. The tumblers are held in engagement with the star-wheels by means of springs O^3. (See Figs. 2, 4, and 12.)

It will be seen that the arms C^3 C^4 C^5, &c., extending up from the sleeve C, project beyond the edges of the tumblers N and that when all of these are turned so that their deep notches N^3 register with the arms of the sleeve the sleeve can be moved backward by its handle C′ and will carry with it the locking-bolt D. It will also be obvious that in any other position of the tumblers the sleeve C cannot be moved backward nor the lock released. It will also be obvious that in accordance with the selection of the hole N′ in the tumbler which is engaged with the pin K^4 of the star-wheel the relation of the star-wheel with the tumbler will be changed, and in this manner a great number of permutations are permitted. Knowing the particular combination for which the lock is set, the star-wheels and tumblers connected therewith are all moved backward until arrested by the impingement of the pin K^4 on the stop-lug m^2 or B^{20}, and then each star-wheel is given the proper number of impulses by the finger of the operator moving through the finger-notches B^2 and moving the star-wheel one tooth at a time through the distance regulated by the conformation of the finger-notch.

When it is desired to change the combination, it is only necessary to press the tumbler back from its appropriate star-wheel until they are disengaged from each other and then rotated independently until the proper opening N′ registers with the pin K^4.

The scattering of the tumblers can be accomplished by rotating the shaft H, which can be done from the outside of the door by the milled wheel I and can be automatically effected through the action of the shaft E. This shaft when the door is open is thrust out, so that when the door is again closed its bearing-pin F comes in contact with the doorway, as indicated in Fig. 3, pressing the shaft in against the action of the spring O′; but as the shaft moves in the pin G comes in contact with the spiral wall E^3 of the recess e^3 and causes the shaft E to rotate, with of course a similar rotative movement of the segment J′, which through its connection with the gear-wheel J rotates the shaft H, and with it the scattering-dogs L, which by coming in contact with the pins K^4 scatter the star-wheels and attached tumblers. It will be seen that as the door closes the pin G moves up the incline E^4 onto the round portion E^5 of the shaft E thereof, permitting the shaft to turn freely in either direction, which is necessary in order to prevent it from interfering with the fingering of the star-wheels to desired position. It is of course obvious that instead of using the bearing-pin F the end of the shaft E might impinge itself against the doorway; but the loose-fitting bearing-pin prevents injurious friction.

My invention in its broader features is capable of application to very many modified forms of lock. This is illustrated, for instance, in Figs. 17 and 18, where the tumblers N are indicated as mounted on the shaft H and made in disk shape, with shallow notches n^2 and a deep notch n^3 formed radially. A latch (indicated at d) is pivoted on a shaft P and provided with a hook-nose d', which engages a ledge a'. Also pivoted on the shaft P is a sleeve c, and this sleeve and the latch D are provided with interengaging lugs c^7 and d^2, which when the sleeve is rotated upward engage and release the latch from the catch, a spring O^4 enabling the latch to recede so as to latch even when the combination is not set for unlocking. The sleeve c is provided with a handle c' and with locking-fingers c^4, which when in registry with the deep notch n^3 enable the sleeve to be rotated and the lock opened.

In Figs. 24 to 26, inclusive, I have illustrated a modification of the automatic scattering devices. In this case the segment J′ is pivoted on a modification of the shaft E, (here indicated at e.) The segment is formed with a socket J^2, in which fits a ball-ended lever R′, extending out from a sleeve R, which both slides and rotates on a vertical shaft Q, flattened at the lower end Q′, the end of the shaft e pressing on this flattened portion. The upper end of the shaft Q carries a finger Q^2, and the upper end of the sleeve R carries a finger R^2. b^7 b^7 indicate bearings which support the connected parts. It will be obvious that as the door is closed the finger Q^2 will press against the wall of the door-cell and rotate the shaft Q, the movement of the flattened portion pressing in the shaft e. In this position the pin R^2 is engaged with the finger Q^2, so that the sleeve R and ball-ended lever R′ rotate with it and in turn rotate the segment J′, this going on until the downward motion of the segment carries the sleeve R down to a point where its finger R^2 disengages the finger Q^2. The connection from the segment J′ is the same as in the preferred construction already described.

Passing now to an important modification illustrated in Figs. 27 to 35, S in this construc-

tion indicates the casing surrounding the lock, said casing being, as shown, provided with flanges S' S², which partly support the two bearings S³ S⁴ and the shaft-bolt T. The casing is provided with a central dome-like projection S⁵, in the front of which are formed the finger-notches S⁶ S⁶, &c., slotted as indicated at S⁷. The bolt-shaft T serves both as the locking-bolt and as the shaft to support the star-wheels and tumblers. It is provided, as shown, with a handle T' for moving it in and out and with a projecting rib or feather T², recessed or notched out at various points, as indicated at T³ T⁴ T⁵. U U, &c., indicate in this construction the star-wheels, which are formed integral with the tumblers—that is to say, a series of shallow notches U' U', &c., are formed radially around the inner portion of the star-wheel, one of them, U², being slotted entirely through. The star-wheels are situated on the shaft T, and the rib T² is adapted to pass through the slot U², while the recesses T³ T⁴, &c., are so placed as to permit the star-wheels to rotate on the shaft when they coincide with these recesses. The star-wheels are separated from each other by slotted rings V, the slots V' of which give passage to the feather T², while on the outer rim of each ring is formed a stop-lug P². W W, &c., are circumferentially-slotted rings fitting on the rings V and having laterally-projecting fingers W' W², the finger on one side fitting into one of the notches U' of the star-wheel, while the finger on the other side is adapted to come in contact with the stop-lug V² of the ring V, on which it rests. S is a spring-plate, the function of which is to hold the parts together and in proper frictional contact when assembled, as shown in Fig. 30. It will be obvious that when all of the slots U² register with the feather T² the bolt can be moved in and out. It will also be obvious that in any other position of the star-wheels and tumblers this cannot occur, and the bolt is securely locked in position. It will also be obvious that the combination can be changed by changing the engagement of the stop-lug W' with the notches V', and in other respects the setting of the lock is the same as in my preferred construction.

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

1. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots therein, a series of star-wheels journaled on said shaft and projecting through the slots of the finger-notches, and a series of tumblers turning on the shaft with the star-wheels.

2. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots therein, a series of star-wheels journaled on said shaft and projecting through the slots of the finger-notches, a series of tumblers turning on the shaft with the star-wheels and means for adjusting the tumblers to vary the combinations of the lock.

3. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots therein, a series of star-wheels journaled on said shaft and projecting through the slots of the finger-notches, a series of tumblers turning on the shaft with the star-wheels and means for limiting the rotary movements of the tumblers and star-wheels.

4. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots therein, a series of star-wheels journaled on said shaft and projecting through the slots of the finger-notches, a series of tumblers turning on the shaft with the star-wheels, means for adjusting the tumblers to vary the combinations of the lock, and resilient means for holding the tumblers in any set combination, said resilient means being arranged to yield to permit the adjustment of each tumbler.

5. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots, a series of star-wheels journaled on the shaft and projecting through the slots into the finger-notches, a series of tumblers also journaled on the shaft, and means for attaching the tumblers to the star-wheels and angularly adjusting the tumblers and star-wheels with respect to each other.

6. In a permutation-lock, a casing overlying the lock, and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots, a series of star-wheels journaled on the shaft and projecting through the slots into the finger-notches, a series of tumblers also journaled on the shaft and movable longitudinally thereon, springs acting to thrust the tumblers toward the star-wheels, and means for interengaging the tumblers and star-wheels, said means permitting their angular adjustment when the tumblers are moved away from the wheels against the spring-pressure.

7. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots, a series of star-wheels journaled on the shaft and projecting through the slots into the fin-

ger-notches, a series of tumblers also journaled on the shaft, means for attaching the tumblers to the star-wheels and angularly adjusting the tumblers and star-wheels with respect to each other, a series of scattering-dogs secured to the shaft and arranged when the shaft is rotated to move the star-wheels thereon.

8. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots, a series of star-wheels journaled on the shaft and projecting through the slots into the finger-notches, a series of tumblers also journaled on the shaft, means for attaching the tumblers to the star-wheels and angularly adjusting the tumblers and star-wheels with respect to each other, and stops arranged to prevent the star-wheels from turning beyond a determined arc.

9. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots, a series of star-wheels journaled on the shaft and projecting through the slots into the finger-notches, a series of tumblers also journaled on the shaft, means for attaching the tumblers to the star-wheels and angularly adjusting the tumblers and star-wheels with respect to each other, a series of scattering-dogs secured to the shaft and arranged when the shaft is rotated to move the star-wheels thereon, and stops arranged to prevent the star-wheels from turning beyond a determined arc.

10. In a permutation-lock, a casing overlying the lock and having a series of slotted finger-notches formed in its face, in combination with a shaft supported in the rear of the casing and running transversely to the slots, a series of star-wheels journaled on the shaft and projecting through the slots into the finger-notches, a series of tumblers also journaled on the shaft, means for attaching the tumblers to the star-wheels and angularly adjusting the tumblers and star-wheels with respect to each other, a series of scattering-dogs secured to the shaft and arranged when the shaft is rotated to move the star-wheels thereon, a door to which the lock is secured, a door-frame, and means secured to the door and operated by the frame for imparting a rotative movement to the shaft and scattering-dogs when the door is in the act of closing.

11. In combination with a door and door-frame and a permutation-lock secured to the door, the scattering device consisting of the shaft E, having a recess e^3, with a spiral wall E^3, said shaft being held and longitudinally movable in journals secured on the door, a spring acting to force the shaft outward, a pin G, having its end held in the recess e^3, scattering devices for the locking-dogs, and means connecting the shaft E and said scattering devices.

12. In combination with a door and door-frame and a permutation-lock secured to the door, the scattering device consisting of the shaft E, having a recess e^3, with a spiral wall E^3, said shaft being held and longitudinally movable in journals secured on the door, a spring acting to force the shaft outward, a contact-pin F, loosely held at the outer end of shaft E, a pin G, having its end held in the recess e^3, scattering devices for the locking-dogs, and means connecting the shaft E, and said scattering devices.

13. In combination with a door and door-frame, secured to the door, the scattering device consisting of the shaft E, having a recess e^3, with a spiral wall E^3, and sloping outer wall E^4, said shaft being held and longitudinally movable in journals secured on the door, a spring acting to force the shaft outward, a pin G, having its end held in the recess e^3, by elastic pressure, scattering devices for the locking-dogs, and means connecting the shaft E, and said scattering devices.

14. In a permutation-lock, a rotatable shaft H, in combination with star-wheels journaled thereon, locking-dogs adjustably secured to the star-wheels, scattering-dogs secured to rotate with shaft H, and means for engaging the scattering-dogs and star-wheels.

15. In a permutation-lock, a rotatable shaft H, in combination with star-wheels journaled thereon, locking-dogs adjustably secured to the star-wheels, scattering-dogs secured to rotate with shaft H, means for engaging the scattering-dogs and star-wheels, and stops secured in fixed position to limit the rotation of the star-wheels and locking-dogs.

16. In a permutation-lock, the combination of a shaft H, a series of locking-dogs journaled thereon and having means for turning them on the shaft, a sleeve C, having arms C^3, C^4, &c., arranged to interlock with the locking-dogs, a latch D, and shaft E, supported on fixed bearings and in turn supporting the sleeve C, a spring O′, acting to thrust the latch outward, means limiting the outward movement of the latch and means for moving the sleeve and latch to withdraw said latch.

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