Aug. 30, 1927. 1,640,935

A. G. HATCH

LOCK

Filed May 4, 1926

Fig. 1.

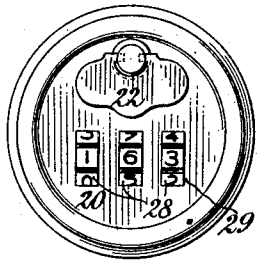


Fig. 2.

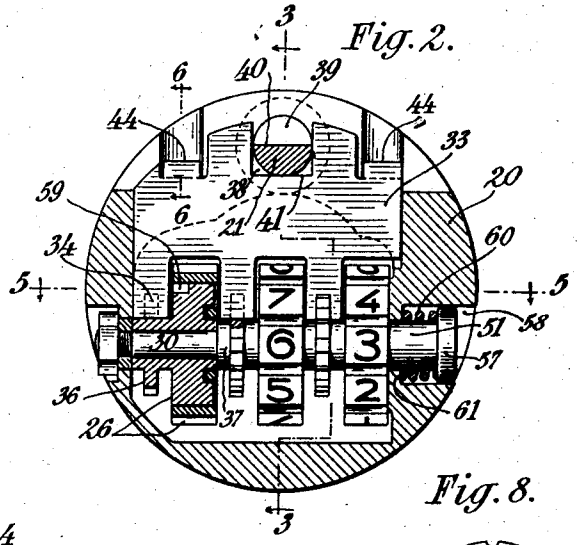


Fig. 3.

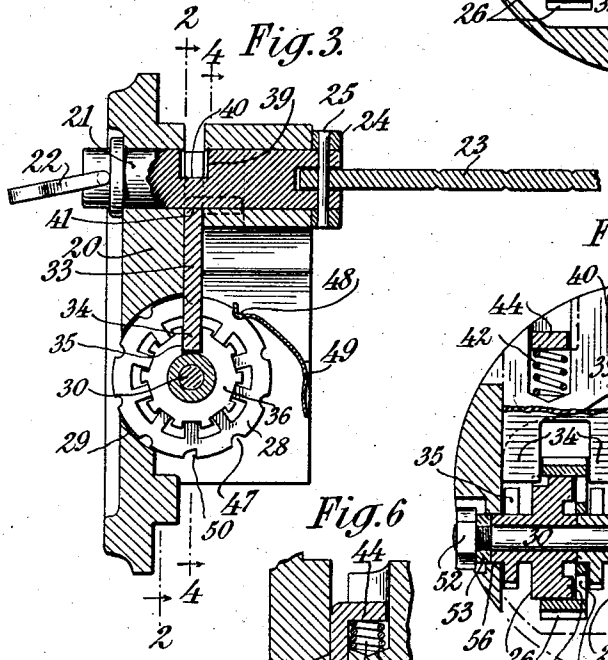


Fig. 8.

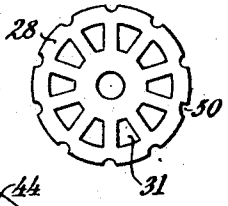


Fig. 4.

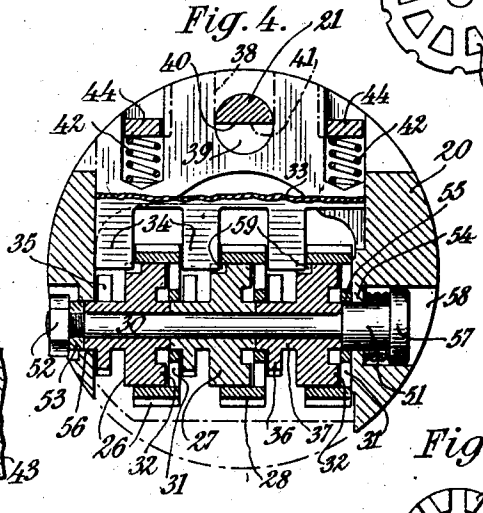


Fig. 6

Fig. 9.

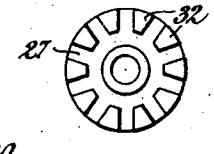


Fig. 7.

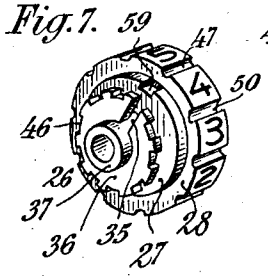
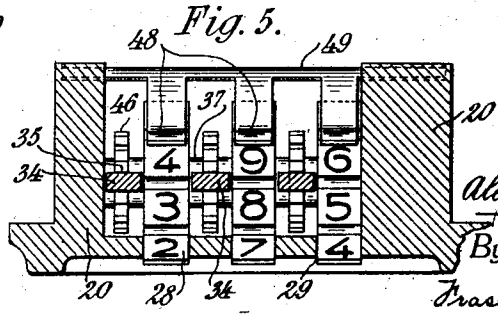


Fig. 5.



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UNITED STATES PATENT OFFICE.

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LOCK.

Application filed May 4, 1926. Serial No. 106,614.

This invention relates to improvements in keyless locks herein illustrated as applied to a lock of the cylinder type, many forms of which are well known in the art. It is peculiarly adapted for use in connection with the well-known type of cylinder lock having a bolt and a latch each capable of being operated by one and the same spindle, the latch being withdrawn by rotation of the spindle in one direction and the bolt being thrown to locked position by rotation of the spindle in the opposite direction.

It is an object of the invention to provide a permutation lock mechanism adapted for use as a substitute for the key-operated cylinder mechanism of locks of the above-described character. To this end it comprises a spindle rotatably mounted in a mounting element and a permutation lock mechanism to prevent rotation of said spindle except when the tumblers thereof have been set in a predetermined relation, at which times the spindle is free to be turned in one direction through an arc of sufficient amplitude to withdraw a latch and is also free to be rotated in the opposite direction through an arc of sufficient amplitude to operate a bolt, after which it may be again locked by moving one or more of the permutation tumblers out of set position.

In the form of the invention herein shown the setting of the permutation tumblers releases the spindle and permits it to be freely rotated without limit in either direction. The invention is intended however, to include any equivalent device in which the spindle, when released by the setting of the permutation tumblers, may be rotated through a sufficient number of degrees, usually thirty degrees or more, to form a practical operating device for a latch, and which may be rotated in the opposite direction through a number of degrees, usually sixty degrees or more, to form a practical operating device for a bolt.

The invention includes improvements in permutation mechanism and combination-changing mechanism herein disclosed as adapted for application to a lock of the above-described character, but in no manner limited to use in connection with locks of any particular type, the same being of general application to any equivalent permutation mechanism having independently settable permutation tumblers.

One of the improvements of general application herein disclosed and claimed comprises a permutation mechanism having independently settable permutation tumblers each including a lock-controlling element and a setting element, one of which may be disengaged from the other as a result of relative axial movement, thereby permitting free rotation of the setting elements while the lock-controlling elements are held fast, thus providing means whereby the combination of the lock may be readily changed. Manipulating means is provided whereby this disengagement of the parts of the tumblers may be readily effected from the exterior of the assembled lock, without moving the bolt which controls the rotation of the spindle and, in order to insure against the closing and locking of the device to which the lock is applied, with the parts in abnormal relation, motive means, herein disclosed as a spring, is provided whereby the parts of the lock are immediately restored to normal position after any change is made in the combination as soon as the tumbler-disengaging means is released.

In the drawings illustrating the preferred form of the invention,—

Figure 1 is a face view of the permutation mechanism as applied to a cylinder lock.

Fig. 2 is a sectional view through parts of the lock, the section being taken through the plane indicated by the line 2—2 of Fig. 3, and the parts being viewed in the direction indicated by the arrows.

Fig. 3 is a sectional view through the lock along the plane indicated by the line 3—3 of Fig. 2, the parts being viewed in the direction indicated by the arrows.

Fig. 4 is a sectional view through the lock along the plane indicated by the line 4—4 of Fig. 3, the parts being viewed in the direction indicated by the arrows.

Fig. 5 is a sectional view through a part of the lock, the section being taken along the

plane indicated by the line 5—5 of Fig. 2, the parts being viewed in the direction indicated by the arrows.

Fig. 6 is a sectional view through a part of the lock, the section being taken along the line 6—6 of Fig. 2, the parts being viewed in the direction indicated by the arrows.

Fig. 7 is a perspective view of one of the permutation tumblers, the parts thereof being indicated in uncoupled relation.

Fig. 8 is an end view of one of the tumbler-setting elements.

Fig. 9 is a corresponding end view of one of the lock-controlling elements of a tumbler

In each of Figs. 1 to 6, inclusive, the parts of the lock have been indicated as having been set to provide for the releasing of the lock spindle on setting the tumblers to the combination 1—6—3, and in each of these views the tumblers are represented as having been set in accordance with this combination. In each of Figs. 2 and 3 the spindle is indicated as having been rotated through an arc of 180 degrees from the position in which it may be locked by the permutation mechanism. In each of these views the parts of the permutation tumblers are represented in their normal relative positions. In Fig. 4 the spindle is indicated in the position in which it may be locked by the permutation mechanism and the parts of the tumblers are represented as having been uncoupled preparatory to a change in the setting of the combination by rotation of the setting elements independently of the lock-controlling elements.

As herein disclosed, the invention is illustrated as applied to a permutation mechanism adapted to be used as a substitute for the key-operated part of a cylinder latch and lock. It comprises a mounting element 20 in which is rotatably mounted a spindle 21 having appropriate means, as, for example, the hinged thumb-piece 22, whereby it may be manipulated. Suitable means may be provided whereby the spindle may be connected with the bolt and latch operating mechanism of a lock. This is herein disclosed as a bar 23, of rectangular cross-section, of a length sufficient to accommodate locks of different depths, the surplus length being cut off when the permutation mechanism is applied to the lock in accordance with the usual practice. The withdrawal of the spindle from the mounting member may be prevented by any suitable fastening means, herein disclosed as a ring 24 encircling the inner end of the spindle and secured thereto by a rivet 25, which may also comprise an attaching means between the bar 23 and the spindle.

Rotation of the spindle is controlled by a permutation mechanism comprising rotary tumblers 26, each tumbler consisting of a lock-controlling element 27 and a separate setting element 28, the setting elements being accessible from the exterior of the mounting member through slots 29.

The permutation tumblers may be rotatably mounted in end-to-end relation along a shaft 30 secured in, but movable endwise with respect to, the mounting element 20.

As herein disclosed, the lock-controlling elements 27 are journaled on the shaft 30 and the setting elements 28 are provided with interengaging elements normally preventing relative rotation between the lock-controlling elements and the setting elements. These interengaging elements herein comprise a number of openings 31 in the setting elements, into which extend a number of keys 32 projecting laterally from the adjacent ends of the lock-controlling elements.

Preferably the number of openings 31 in the setting elements will correspond with the number of different positions in which the tumbler is intended to be set, herein disclosed as ten, although it will be appreciated that any other number within reasonable limits may be adopted. It is not necessary, however, that each of the lock-controlling elements be provided with a number of keys 32 corresponding with the number of openings 31 in the corresponding setting element. If ten openings are provided in the setting element the corresponding lock-controlling element may be provided with a single key, or with two keys oppositely disposed, or with five equally-spaced keys, or with ten keys spaced in accordance with the ten openings in the setting element.

It is the purpose of the permutation tumblers to prevent rotation of the spindle except when the tumblers have been set in a predetermined relation. Means must, therefore, be provided whereby a portion of the permutation mechanism will lie in the path of rotational movement of a portion of the spindle except when the tumblers have been set. In the form of the invention herein disclosed, the movement-obstructing portion of the lock comprises a slidably-mounted bolt or locking plate 33, having a series of toes 34 extending from one margin thereof and so positioned with respect to the lock-controlling elements of the permutation tumblers as to be movable into radially-extending slots or clearanceways 35 provided for such purpose in ribs or flanges 36 extending outwardly from hub-portions 37 of the lock-controlling elements.

The locking plate or bolt 33, in the form of the invention herein disclosed, is provided with a recess 38 in a position adapted to embrace a portion of the spindle 21 having a notch or slot 39 therein of such form as to provide a half-round portion of the spindle

having a flat surface 40 so positioned as to cooperate with a flat surface 41 at the base of the recess 38 in the locking member 33, said flat surfaces cooperating to afford a locking engagement between the spindle and the locking member.

The above-described parts of the locking plate 33 are so disposed with respect to the cooperating parts of the spindle 21 and lock-controlling elements 27 that the rotation of the spindle, when locked, will be prevented by the opposed flat surfaces 40, 41, which will be held in close proximity by a movement-obstructing relation between the toes 34 of the locking plate and portions of the ribs or flanges 36 of the lock-controlling elements of the permutation wheels. The spindle may be released only by so setting the tumblers as to bring the slots 35 in said lock-controlling elements in alignment with the toes 34 of the locking plate.

It will be apparent from the foregoing description of parts of the invention that, if the tumblers are rotated to positions such that the slots 35 are brought into registration with the toes 34, and the spindle be rotated by means of the manipulator 22, the parts of the spindle which cooperate with the recessed portion of the locking plate will act as a cam and thereby cause the p'ate 33 to move away from the spindle and permit its continued rotation from the position indicated in cross-section in Fig. 4 to the position indicated in cross-section in Fig. 2. This rotation of the spindle may be continued in either direction without limit.

In order to provide for the automatic restoration of the locking plate 33 to the position illustrated in Fig. 4, with its toes 34 clear of the slotted portions of the flanges 36, preparatory to the relocking of the spindle by a movement of one or more of the tumblers out of set re'ation, springs 42 may be provided, as indicated in Figs. 4 and 6, each of said springs being confined between a seat 43 in the mounting element and a seat 44 which may be readily formed by providing a right-angle bend in an extended portion 45 in the adjacent part of the locking bolt.

In order to avoid detection of the location of the slots 35 by a rotation of the various permutation wheels while attempting to rotate the spindle 21 by means of the manipulator 22, thus ho'ding the toes 34 in contact with the peripheral portions of the flanges 36, said flanges may be provided with a series of recesses 46, commonly known as false slots. Such false slots will preferably be equally spaced about said flanges, shou'd have entrance portions conforming with the entrance to the real slot, and should cooperate with said real slot to form an equally-spaced series of recesses corresponding in number to the number of positions in which the permutation wheels are intended to be set.

If desired, the periphery of some portion of each of the permutation tumblers, preferably of the setting e'ement, may be provided with notches 47 adapted to receive a detent 48 (Figs. 3 and 5), secured as at 49 to any convenient portion of the mounting element. These notches should be equal in number to the number of positions in which each of the permutation tumblers may be set.

The peripheral portions of the setting elements of the tumblers, parts of which are always exposed through the slots 29, may, if desired, be provided with indicia, herein disclosed as a zero (0) and the digits 1 to 9, representative of the various positions in which the tumblers may be set. Suitab'e spaces for such markings are provided between the notches 47, and, if desired, one of the notches may be differentiated from the others, as indicated at 50, in such manner as to set up an abnormal resistance against rotation past the detent 48 in one direction, thereby affording means, detectible by the sense of touch, of locating a reference position, as, for example, the zero position of the tumbler. This ability to detect the zero position of each tumbler will enable one having knowledge of the combination to set the same without reliance upon the numbers, so that the lock may be set at night without the aid of light, as well as in the daytime. This follows because the movement of the permutation wheel from position to position may be detected by the sense of touch due to the resistance set up between the detent 48 and the wheel as each of the notches 47 passes under the detent. It will be apparent that, if the differentiated notch is provided, the application of markings of any character on the setting elements may be omitted.

A change in the combination of the lock may be effected by varying the relative positions between the lock-controlling element and the setting element of one or more of the permutation tumblers. Such change is facilitated by the two-part tumbler construction providing for the separation of the interengaging elements of the lock-controlling elements and the setting elements by relative axial movement. To this end the shaft 30 is provided with a shouldered portion 51, which engages the lock-controlling element at one end of the series, and said shaft is provided with a nut or other fastening device 52 which, through the intermediation of an extension or, if desired, a separate washer 53, engages the end of the lock-controlling element at the opposite end of the series, the three lock controlling elements being confined in end-to-end relation between said shoulder and said washer. The lock-controlling elements of the tumblers are thus

secured against relative axial movement with respect to the shaft 30, sufficient clearance being provided, however, to permit independent rotation of said elements. The shouldered portion 51 of the shaft 30 is movable endwise in a bearing 54 provided therefor in the mounting element, and is of such a diameter as to be movable axially through a circular opening 55 in the adjacent setting element. The nut extension or washer 53 is of such diameter as to move endwise in a bearing 56 provided therefor in the mounting element, and the hub portion 37 of the adjacent lock-controlling element is of such diameter that it may freely enter the bearing 56. The hub portion of each of the lock-controlling elements, except the one at the left end of the series, is of a diameter such as to freely enter the opening in the adjacent setting element.

From the foregoing construction it will be apparent that the lock-controlling elements of the various tumblers may be moved out of their engaging relations with their setting elements by moving the shaft 30 and the three lock-controlling elements to the left to a sufficient distance to disengage the keys 32 from the openings 31 forming the couplings between the parts of the tumblers. To facilitate this uncoupling of the elements of the tumblers, the shaft 30 is provided with a head or push-button 57 within a recess 58 in the mounting element in a convenient position to be accessible to the thumb or finger of the operator.

In order to prevent meddlers from changing the combination when the device to which the lock is applied is left in open condition, means is provided whereby such change can only be effected after first setting the permutation tumblers in accordance with the combination previously used. In the form herein disclosed, this is effected by the appropriate designing of the parts of the tumblers which cooperate with the toes 34 of the locking plate 33. Except when the tumblers are in set position, the lower right-hand corner of each of the toes 34 lies in the path of axial movement of a portion of the adjacent lock-controlling element. If, therefore, any one of the lock-controlling elements is not in set relation, movement of the shaft 30 and connected lock-controlling elements to the left is prevented. In order to provide for the uncoupling movement of the shaft 30 and connected lock-controlling elements, each of the lock-controlling elements is provided with a clearanceway or notch 59, preferably in axial alignment with the clearanceway or notch 35 in the movement-obstructing flange 36. On setting the tumblers in accordance with the combination of the lock, these notches 59 are brought into alignment with the toes 34, after which the shaft 30 may be moved to the left, the notches 59 receiving the toes 34, thereby forming a coupled relation between said toes and the lock-controlling element and preventing rotation of the latter during the change of the combination of the lock by rotation of the setting elements to new positions relative to their respective lock-controlling elements.

With the parts of the combination-changing mechanism constructed as herein described, a change of the combination by one not familiar with the one in accordance with which the lock is already set, may be prevented, after opening the device to which the lock is applied, by merely disturbing the combination. The combination may then be changed only by one capable of setting the lock in accordance with the combination in use at the time.

In the preferred form of the invention herein disclosed, the placing of the recesses or notches 35 and 59 in alignment makes it possible to use the toes 34 of the locking plate 33 as the stops which cooperate with the notches 59 and the parts of the lock-controlling elements in which said notches are placed as a means for preventing a change of the combination without first setting the permutation tumblers. It will be apparent, however, that the notches 59 might be differently placed, in which case it would be necessary to either provide additional stops to cooperate with the lock-controlling elements and prevent a change of the combination, except when the tumblers have been set in accordance with the old combination, or to set the tumblers in accordance with a different combination for resetting purposes than that used to release the spindle.

An important feature of the invention consists in means whereby the parts of the lock which have been moved to abnormal positions to effect a change of the combination of the lock are automatically restored to their normal positions as soon as the above-described coupling disabling means has been released, thus preventing the possibility of closing the device with the parts of the permutation tumblers in an uncoupled relation. This is of importance since, should the device become locked with the parts so positioned, the rotation of the setting elements might effect an unintended change of the combination and render it impossible to reopen the lock.

The restoring means, herein disclosed, comprises a suitable motive means, such as a spring 60, the ends of which may be confined between the under side of the head 57 on the shaft 30 and a seat 61 provided therefor in the mounting element. This spring is compressed when the coupling disabling device is moved to the left by pressing upon the button 57. As soon as the pressure is released, the shaft and parts connected therewith are moved to the right, thereby restor-

ing the various parts of the lock to their normal positions.

The invention is not intended to be limited to the specific form of the device herein disclosed and described for purposes of illustration, but is intended to include variations and modifications thereof within the scope of the appended claims.

What I claim is:

1. A permutation lock comprising a bolt independently settable rotary bolt-controlling tumblers each having a rotatable lock-controlling element, a concentrically mounted, directly accessible setting element therefor, and a coupling normally preventing relative rotary movement between said elements, said tumbler elements being relatively movable axially to disengage their coupling elements and thereby render them ineffective, a coupling disabling device, accessible from the exterior of the assembled lock and movable independently of said bolt, whereby a relative axial coupling disabling movement between the elements of a tumbler may be effected, thereby permitting one of its elements to be rotated by direct manipulation independently of the other, and motive means to restore said coupling to its normal effective relation and maintain it so.

2. A permutation lock comprising a bolt independently settable rotary bolt-controlling tumblers each having a rotatable lock-controlling element, a concentrically mounted, directly accessible setting element therefor, and a coupling normally preventing relative rotary movement between said elements, said tumbler elements being relatively movable axially to disengage their coupling elements and thereby render them ineffective, a single coupling disabling device, accessible from the exterior of the assembled lock and movable independently of said bolt, whereby relative axial coupling disabling movements between the elements of all of said tumblers may be effected, thereby permitting one element of each to be rotated by direct manipulation independently of the other, and motive means to restore said couplings to their normal effective relations and maintain them so.

3. A permutation lock comprising a bolt, rotary tumblers to control the movements of said bolt, each having a rotatable lock-controlling element and a concentrically mounted setting element, said tumbler elements having couplings comprising interengaging elements normally preventing relative angular movement, the lock-controlling element of each tumbler being movable axially to disengage its coupling elements and render them ineffective, a stop for each tumbler preventing axial movement of its lock-controlling element except when set in a predetermined position, a clearanceway in said lock-controlling element to receive said stop when so set and thereby permit such axial movement, a coupling disabling device accessible from the exterior of the assembled lock and movable independently of said bolt, whereby a set lock-controlling element may be moved axially out of its normal coupled relation with its setting element into a position in which rotation is prevented by the engaging relation between its stop and parts of said lock-controlling element adjacent its clearanceway, thereby permitting its setting element to be freely rotated while said lock-controlling element is held fast, and motive means to restore said lock-controlling element to its normal coupled relation with its setting element and to maintain it in such normal coupled relation therewith.

4. A permutation lock comprising a bolt, tumblers to control the movements of said bolt, each having a rotatable lock-controlling element and a concentrically mounted setting element, said tumbler elements having couplings comprising interengaging elements normally preventing relative angular movement, the lock-controlling element of each tumbler being movable axially to disengage its coupling elements and render them ineffective, a stop for each tumbler preventing axial movement of its lock-controlling element except when set in a predetermined position, a clearanceway in said lock-controlling element to receive said stop when so set and thereby permit such axial movement, a single coupling disabling device accessible from the exterior of the assembled lock and movable independently of said bolt, whereby all of said lock-controlling elements, when set, may be moved axially out of their normal coupled relations with their setting elements into positions in which rotation is prevented by the engaging relations between said stops and parts of said lock-controlling elements adjacent their clearanceways, thereby permitting their setting elements to be freely rotated while their lock-controlling elements are held fast, and motive means to restore said lock-controlling elements to their normal coupled relations with their setting elements and to maintain them in such normal coupled relation therewith.

5. A permutation lock comprising a casing, a shaft mounted therein, a plurality of composite permutation wheels, journaled on said shaft, each comprising a lock-controlling element and a concentrically mounted setting element, a bolt controlled in its movements by said lock-controlling elements, means preventing relative axial movement between each of said setting elements and said casing, means preventing relative axial movements between said lock-controlling elements and said shaft, couplings comprising interengaging elements normally preventing relative angular move-

ment between each of said lock-controlling elements and its setting element, said shaft and lock-controlling elements being movable axially in one direction independently of said bolt to disengage the elements of said couplings and permit said setting elements to be rotated independently of said lock-controlling elements, and a spring to return said shaft and lock-controlling elements to their normal positions and thereby restore the effectiveness of said couplings.

6. A permutation lock comprising a casing, a shaft mounted therein, a plurality of composite permutation wheels, journaled on said shaft, each comprising a lock-controlling element and a concentrically mounted setting element, a bolt controlled in its movements by said lock-controlling elements, means preventing relative axial movement between each of said setting elements and said casing, means preventing relative axial movements between said lock-controlling elements and said shaft, couplings comprising interengaging elements normally preventing relative angular movement between each of said lock-controlling elements and its setting element, said shaft and lock-controlling elements being movable axially in one direction independently of said bolt to disengage the elements of said couplings and permit said setting elements to be rotated independently of said lock-controlling elements, stops preventing axial coupling disabling movements of said shaft and lock-controlling elements except when said lock-controlling elements are set in predetermined positions, said stops and parts of said lock-controlling elements being so disposed as to be brought into engagement and prevent rotation of said lock-controlling elements when moved out of their coupled relations with said setting elements, and a spring to return said shaft and lock-controlling elements to their normal positions and thereby restore the effectivness of said couplings.

7. A permutation lock mechanism adapted for application to a lock having a bolt and a latch capable of being operated by a single spindle, said lock mechanism comprising a mounting element, a spindle rotatably mounted therein, and a spindle-locking mechanism including a movement-obstructing portion, movable into the path of rotational movement of a portion of said spindle, and independently settable permutation tumblers opposing the withdrawal of said movement-obstructing portion and thereby preventing the rotation of said spindle in either direction except when said tumblers are set in a predetermined relation, the movement-obstructing portions of said spindle and spindle-locking mechanism being so disposed and proportioned as to permit, when said tumblers are in said set relation, a latch-releasing rotation of said spindle, of not less than 30 degrees, in one direction, and a bolt-operating rotation thereof, of not less than 60 degrees, in the opposite direction.

8. A permutation lock mechanism adapted for application to a lock having a bolt and a latch capable of being operated by a single spindle, said lock mechanism comprising a mounting element, a spindle rotatably mounted therein, and a spindle-locking mechanism including a movement-obstructing portion, movable into the path of rotational movement of a portion of said spindle, and independently settable permutation tumblers opposing the withdrawal of said movement-obstructing portion and thereby preventing the rotation of said spindle in either direction except when said tumblers are set in a predetermined relation, the movement-obstructing portions of said spindle and spindle-locking mechanism being so disposed and proportioned as to permit, when said tumblers are in said set relation, a latch-releasing rotation of said spindle, of not less than 30 degrees, in one direction, and a bolt-operating rotation thereof, of not less than 360 degrees, in the opposite direction.

9. A permutation lock mechanism adapted for application to a lock having a bolt and a latch capable of being operated by a single spindle, said lock mechanism comprising a mounting element, a spindle rotatably mounted therein, and a spindle-locking mechanism including a movement-obstructing portion, movable into the path of rotational movement of a portion of said spindle, and independently settable permutation tumblers opposing the withdrawal of said movement-obstructing portion and thereby preventing the rotation of said spindle in either direction except when said tumblers are set in a predetermined relation, the movement-obstructing portions of said spindle and spindle-locking mechanism being so disposed and proportioned as to permit said spindle to be rotated in either direction without limit when said tumblers are in said set relation.

10. A permutation mechanism for a keyless lock comprising a mounting element, a spindle rotatably mounted therein, a spindle-locking element movable into and out of an effective locking position, said spindle and its locking element having opposed parts of appropriate relative size and form to prevent a rotation of said spindle in either direction when said locking element is held fast in its effective position, but permitting said spindle to be rotated from its locked position through not less than 30 degrees in one direction and not less than 60 degrees in the opposite direction when said locking element is free, motive means tending to maintain said locking element in its effective position and to return it thereto when removed therefrom, and permutation tumblers

having lock-controlling elements movable into the paths of spindle-releasing movement of parts of said locking element, said lock-controlling elements having clearance-ways so disposed as to receive the opposed portions of said locking element and permit a spindle-releasing movement to be imparted thereto only after said tumblers have been set in accordance with a predetermined combination.

11. A permutation mechanism for a keyless lock comprising a mounting element, a spindle rotatably mounted therein, a spindle-locking element movable into and out of an effective locking position, said spindle and its locking element having opposed parts of appropriate relative size and form to prevent a rotation of said spindle in either direction when said locking element is held fast in its effective position, but permitting said spindle to be rotated from its locked position through not less than 30 degrees in one direction and not less than 360 degrees in the opposite direction when said locking element is free, motive means tending to maintain said locking element in its effective position and to return it thereto when removed therefrom, and permutation tumblers having lock-controlling elements movable into the paths of spindle-releasing movement of parts of said locking element, said lock-controlling elements having clearanceways so disposed as to receive the opposed portions of said locking element and permit a spindle-releasing movement to be imparted thereto only after said tumblers have been set in accordance with a predetermined combination.

12. A permutation mechanism for a keyless lock comprising a mounting element, a spindle rotatably mounted therein, a spindle-locking element movable into and out of an effective locking position, said spindle and its locking element having opposed parts of appropriate relative size and form to prevent a rotation of said spindle in either direction when said locking element is held fast in its effective position, but permitting said spindle to be rotated in either direction without limit when said locking element is free, motive means tending to maintain said locking element in its effective position and to return it thereto when removed therefrom, and permutation tumblers having lock-controlling elements movable into the paths of spindle-releasing movement of parts of said locking element, said lock-controlling elements having clearanceways so disposed as to receive the opposed portions of said locking element and permit a spindle-releasing movement to be imparted thereto only after said tumblers have been set in accordance with a predetermined combination.

13. A permutation mechanism for a keyless lock comprising a mounting element, a spindle rotatably mounted therein, a spindle-locking element movable into and out of an effective locking position, motive means tending to maintain said locking element in its effective position and to return it thereto when removed therefrom, and permutation tumblers having lock-controlling elements movable into the paths of spindle-releasing movement of parts of said locking element, said lock-controlling elements having clearanceways so disposed as to receive the opposed portions of said locking element and permit a spindle-releasing movement to be imparted thereto only after said tumblers have been set in accordance with a predetermined combination, and said spindle and its locking element having opposed parts of appropriate relative size and form to prevent a rotation of said spindle in either direction when said locking element is held fast in effective position by said lock-controlling elements, to cause said locking element to be moved into the clearanceways in said lock-controlling elements by rotation of said spindle in either direction after setting said tumblers, and to prevent the withdrawal of said locking element from the clearanceways in said lock-controlling elements without restoring said spindle to the position in which it is to be locked.

14. A permutation tumbler for a keyless lock comprising a lock-controlling element having two cylindrical portions of different diameters connected in a concentric but axially displaced relation, the portion of smaller diameter having a radial slot therein extending inwardly from its peripheral surface, and a setting element comprising a laterally flanged disk of appropriate size and form to cap the larger of the two cylindrical portions of said lock-controlling element, said tumbler elements having coupling elements normally preventing relative rotation between said setting element and said lock-controlling element but readily separable, so as to permit such rotation, by moving said lock-controlling element axially with respect to said setting element.

15. A permutation tumbler for a keyless lock comprising a lock-controlling element having two cylindrical portions of different diameters connected in a concentric but axially displaced relation, the portion of smaller diameter having a radial slot therein extending inwardly from its peripheral surface, and the portion of larger diameter having a clearanceway therein extending in an axial direction from its lateral surface nearest the portion of smaller diameter, and a setting element comprising a laterally flanged disk of appropriate size and form to cap the larger of the two cylindrical portions of said lock-controlling element, said tumbler elements having coupling elements normally preventing relative rotation be-

tween said setting element and said lock-controlling element but readily separable, so as to permit such rotation, by moving said lock-controlling element axially with respect to said setting element.

16. A permutation tumbler for a keyless lock comprising a lock-controlling element having two cylindrical portions of different diameters connected in a concentric but axially displaced relation, the portion of smaller diameter having a radial slot therein extending inwardly from its peripheral surface, and the portion of larger diameter having a clearanceway therein extending in an axial direction from its lateral surface nearest the portion of smaller diameter, the said slot and clearanceway being in axial alignment, and a setting element comprising a laterally flanged disk of appropriate size and form to cap the larger of the two cylindrical portions of said lock-controlling element, said tumbler elements having coupling elements normally preventing relative rotation between said setting element and said lock-controlling element but readily separable, so as to permit such rotation, by moving said lock-controlling element axially with respect to said setting element.

17. A permutation mechanism for a keyless lock comprising a mounting element, a bolt-operating spindle rotatably mounted therein, and spindle-locking mechanism comprising permutation tumblers preventing a rotation of said spindle except when said tumblers have been set in accordance with a predetermined combination, the parts forming the locking connection between said spindle and said tumblers including tumbler-locking means caused to be moved into a locking relation with said tumblers by any rotation of said spindle out of a locked position, said tumblers being releasable only by returning said spindle to said locked position, either by an equal return rotation, or by an additional advance rotation of 360 degrees less the degrees of rotation previously imparted, after which said spindle may be relocked by moving said tumblers out of set position.

In witness whereof, I have hereunto signed my name.

ALEXANDER G. HATCH.