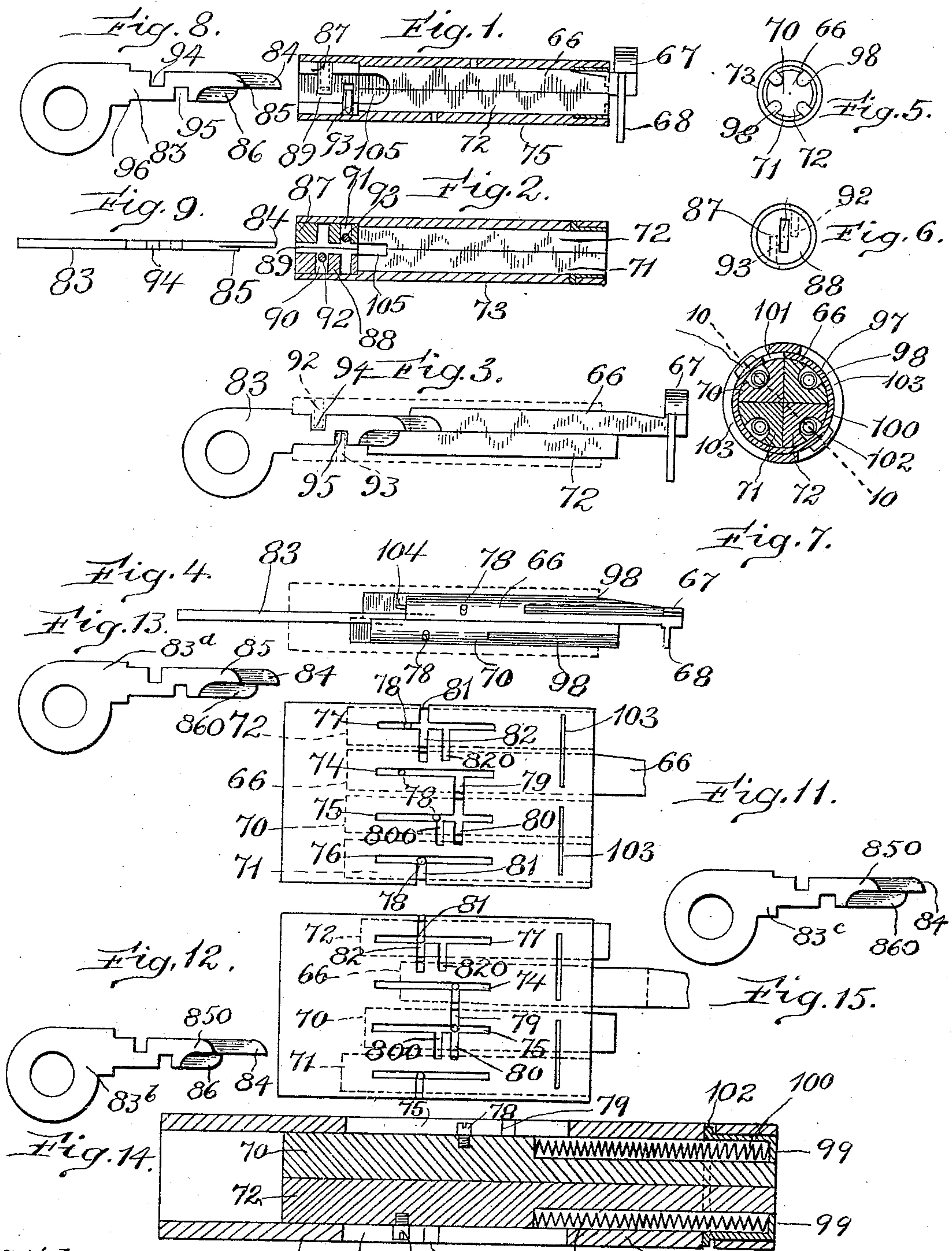


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 LOCK OPERATING DEVICE.  
 APPLICATION FILED SEPT. 29, 1908.

955,267.

Patented Apr. 19, 1910.



Witnesses  
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Fig. 10. Inventor  
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# UNITED STATES PATENT OFFICE.

WILFORD A. HILL, OF WALTHAM, MASSACHUSETTS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE HILL LOCK COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## LOCK-OPERATING DEVICE.

955,267.

Specification of Letters Patent.

Patented Apr. 19, 1910.

Original application filed May 28, 1908, Serial No. 435,539. Divided and this application filed September 29, 1908. Serial No. 455,367.

*To all whom it may concern:*

Be it known that I, WILFORD A. HILL, of Waltham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Lock-Operating Devices, of which the following is a specification.

This invention relates to devices applicable to locks of the general nature of door locks, and has for its object to provide a selective mechanism by which to prevent picking of the lock, and to render impossible actuation of the lock by any key other than the one for which the selective device is particularly designed. This selective device or mechanism is illustrated and described in my pending application for patent Serial No. 435,539, filed May 28, 1908, and is a division of the said application.

In carrying my invention into practice I have made use of a number of rotary elements which are mounted in connection with a lock so that one of them may engage and operate the locking bolt or latch of the lock mechanism, either directly or through intermediate tumbler mechanism. These elements are mounted so as to be movable longitudinally as well as rotarily, the longitudinal movement serving to put the operative element into position where it may actuate the bolt or latch, and the rotary movement permitting such actuation. The elements other than the operative one are associated therewith so as to prevent the operation of said elements by any key than the one especially designed for the device, as well as to render impossible picking of the lock by any instrument other than a key.

The preferred embodiment in which my invention is put into practice is illustrated in the accompanying drawing, in which,—

Figure 1 represents a longitudinal sectional view of a selective key-operated device for the lock. Fig. 2 represents a sectional view of the same on a plane at right angles to that of Fig. 1. Fig. 3 represents an elevation of members of this lock in connection with the key by which they are operated. Fig. 4 represents a plan view of the same parts. Fig. 5 represents a right-hand elevation of Fig. 1. Fig. 6 represents a left-hand elevation of the same. Fig. 7 represents a sectional view of the inner end of the

device on an enlarged scale. Fig. 8 represents a side elevation of a key used in connection with this form of lock. Fig. 9 represents an edge view of the key. Fig. 10 represents a longitudinal section on line 10—10 of Fig. 7. Figs. 11 and 12 represent developments of the device in which the casing thereof is represented as being in one plane, these figures showing the parts respectively in their inoperative and lock-operating positions. Figs. 13, 14 and 15 illustrate master keys by which individual groups of dissimilar lock actuators and a set of groups of such actuators may be operated.

The same reference characters indicate the same parts in all the figures.

The selective mechanism which constitutes the essence of the present invention is adapted to be mounted in connection with a lock, and has members adapted to be engaged with the lock mechanism proper when placed in suitable position so as to effect retraction of the locking bolt or latch. These members are mounted upon one element or key-operated member which is actuated directly and solely by a key inserted into a slot formed for the purpose. The key-operated member which alone is operative to actuate the lock is a bar 66 which is mounted so as to be longitudinally movable in a lock. This bar carries on its inner end fingers or blades 67 68 of such a character as to enable them to actuate the tumbler mechanism of a lock, or directly engage and operate the retractable latch or bolt of the lock. Ordinarily the bar 66 is retracted so that the fingers do not engage any part of the lock mechanism, but when a key is inserted, the bar 66 is pushed inward to engage its fingers with the part of the lock which is adapted to be directly operated thereby. Then when the key is rotated, these fingers cause the locking element to be retracted in the manner and through whatever intermediate means may be provided in the particular type of lock to which the device is applied.

In order to make the lock selective, and prevent it being turned by any but the proper key, I provide in addition to the bar 66, a number of other bars, denoted by 70 71 and 72, respectively, which lie in contact with the bar 66 so that the latter cannot be turned without moving the others. These



bars have flat abutting surfaces, but are externally cylindrical, and together form a complete cylinder which is contained in a tubular casing 73 mounted in any suitable manner in the housing or other part of a lock. This casing is secured by any suitable means, not shown, so that it cannot be itself turned, and it has longitudinal slots or grooves into which project studs on the bars so that they cannot be turned within the casing until they are longitudinally moved into certain positions. The longitudinal slots are represented by 74 75 76 and 77 on Figs. 11 and 12, which represent a development of the casing, and the projections on the bars which enter these slots are designated by 78, there being one on each bar contained in one of the longitudinal slots. These projections are preferably the heads of screws which are threaded into the outer sides of the bars. Intersecting the longitudinal slots are transverse slots 79 80 81 and 82, respectively, which permit the bars to be rotated within the casing when they have been moved longitudinally far enough to bring their studs opposite the respective transverse slots. For so moving the bars, I provide a key 83 of the general character illustrated in Figs. 3, 8 and 9, and having shoulders 84, 85 and 86, one of these shoulders being the end of the key, to engage the several bars. As will be seen from Fig. 11, which represents the position of the bars when they are retracted, the one designated by 72 is normally held so that its stud is opposite to the transverse slot 81, but the studs on the other bars are at varying distances from the transverse slots which respectively receive them, that on the bar 66 being at the greatest distance from its slot 79. It is this bar which is engaged by the end shoulder 84 of the key, while the other shoulders 85 and 86 are at distances from the end corresponding to the spacing between the slots and the several studs. In the casing at the outer end is a cylindrical block formed of two parts 87 88 which are fitted together and have a slot 89 through which the key may be passed. The members of this block have grooves 90 91 which receive screws 92 93 set inwardly from the casing. The screws prevent both removal of the block and also rotation of the key until the latter has been moved far enough to bring the notches 94 95 in its opposite edges opposite these screws. Any greater insertion of the key is prevented by a shoulder 96 which abuts against the ends of the block. When the key is thus fully inserted, its shoulders engage the bars 66 70 and 72 and move them until their lateral projections are beside the respective transverse slots. When they have been thus far moved, the fingers 67 68 on the bar 66 are engaged with the part of the lock mechanism which

they directly operate, and can then be turned by the key to operate the bolt. The bars are contained in their innermost position abutting against the block 87 88, by means of springs 97 which are set into longitudinal grooves 98 in the outer surfaces of the bars. At their inner ends these springs abut against the ends of the groove, while their outer ends abut against ears 99 which are turned inwardly from a ring 100 contained in the end of the tubular casing 73. As shown in Fig. 7, this ring is incomplete, and has an opening 101 at one side which enables it to be contracted in diameter so that lugs 102 which project outwardly from one edge can be slipped into the end of the sleeve or casing 73. The resiliency of the sleeve 100 causes it to expand when the lugs arrive at slot 103 in the casing 73, thereby moving these lugs into the slots. The sleeve 100 is thus prevented from being forced out of the casing, while it is enabled to turn as far as necessary for operating the lock. When the bars are fully retracted by the springs 97, a pin 104 on the bar 66 enters a socket in the block 87 and maintains the bars and block in such a position that the slot 89 in the latter will guide the key into correct engagement with the bars. Preferably the bars are four in number and are formed as quadrants of a cylinder, their dividing surfaces being in rectangular axial planes, and there is a recess 105 formed partially in each of the segmental bars. The shoulders on the key are formed so that each will engage only its appointed bar, by cutting away the under part and side of the key. Thus, at the end of the key the portion below its center line is cut away, and also half the width of the key is removed, leaving the end shoulder 84 of such a width that it will be wholly contained in that portion of the recess 105 which is formed in the bar 66, while the metal below the shoulder 85 is cut away at the side of the key so that this shoulder will engage only the bar 70, and will move past the bar 71. By reason also of the fact that the key is half cut away below the shoulder 85, the shoulder 86 is enabled to move past the bar 71 and operate only the bar 72. It is only the bar 66 which is actually operative to control the lock, the others being inserted to prevent operation by any but the proper key, and to prevent picking of the lock.

A great number of locks may be provided for by differences in the positions of the transverse slots and studs 78, each such difference requiring a corresponding change in location in one or more of the shoulders on the key. Even a slight difference will prevent one key from operating another lock. Although in the arrangement illustrated the bar 71 is not moved longitudinally, it is obvious that the necessity for making this bar move



also might be provided for, in which case a fourth shoulder on the key for operating the same would need to be provided. Picking of the lock is rendered impossible, because  
 5 of the fact that several bars are provided, and that each must be moved longitudinally to a certain definite position before any can be turned.

It is not essential that the bars should be  
 10 of the exact form here illustrated, and many modifications of construction may be made, but the essence of the invention is found in any structure where a number of bars are fitted together in a casing wherein they  
 15 can move laterally only in unison, and in which one or more of them must be moved longitudinally before they can be given any lateral movement whatever.

Attention has already been called to the  
 20 fact that the bar 71 need not be longitudinally moved as a preliminary to operating the lock. It should be noted, however, that the bar is capable of longitudinal movement exactly as are the others, and that this  
 25 capability of movement gives an additional safeguard against picking the lock, for, if it should be moved at all, the lock actuator could not be turned, even though all the other bars were in their proper longitudinal  
 30 positions with respect to the transverse slots of the casing 73. That is, before the lock can be key operated, three of the bars must be moved longitudinally by various amounts, and one of the bars must not be moved at  
 35 all, and therefore a pick-lock not knowing the combination, would find it practically impossible to determine which of the bars must not be moved, in addition to finding out how far each of the other bars must be  
 40 severally advanced. There is no way of trying each bar separately, for any one of the bars in locking position locks them all, so that none can be turned until all are simultaneously in the proper position and  
 45 turned together. The block 87 88 and pins 92 93 furnish an additional valuable safeguard against picking of the lock, for they prevent the rotation of any instrument other than a key, having notches such as the  
 50 notches 94 95, of a greater width than the depth, that is, the least dimension of the slot 89.

It is conceivable that attempts might be made to pick the lock by inserting wires,  
 55 one for each of the segmental blocks, and attempting by manipulation of the wires to locate the blocks with their pins adjacent the entrances to the respective transverse grooves. In order to apply sufficient leverage by any such wires, however, they would  
 60 have to be some distance from the axis of the device, and would therefore as soon as rotated, come into contact with the pins. It should be noted that the pins are set so  
 65 near the axis of the casing as to leave only

space enough for the admission of a narrow flat key, such as that illustrated. In other words, they lie close to the opposite boundaries of the slot 89. Consequently no instrument except a key having appropriately  
 70 located notches or a rod of no greater diameter than the smallest dimension of the slot can be rotated within the casing. A rod or a group of rods collectively no greater in diameter than the width of the slot could  
 75 not be given sufficient leverage to rotate the segments and retract the bolt of a lock. Therefore it may be seen that to all intents and purposes a lock operated by such a device as that hereinbefore described is inca-  
 80 pable of being picked. Also the slot may be corrugated or the pins offset and the key longitudinally grooved.

The construction of the casing having the slots or grooves and the segmental bars hav-  
 85 ing the projections contained in said grooves permits the device to be readily adapted for operation by master keys as well as by the key by which each device is particularly in-  
 90 tended to be operated.

It is to be understood that various locks are made operable only by the appropriate keys, through shifting the positions of the various transverse slots 79 80 81 82. Thus  
 95 a series of lock actuators may be alike in all respects except for the position of the slot 82, which slot will vary in the different actuators. Still another set may vary in-  
 100 dividually by differences in the location of the slot 81, and others by different positions of the slot 80. Any set of lock-actuating devices, however, may be operated by the same master key through providing an additional  
 105 transverse slot opening into one of the longitudinal slots. For instance, supposing that a set of lock actuators is made individually variant by different locations of the groove  
 110 82. These lock actuators may, however, be made operative by the same master key, such as that shown in Fig. 13, by the addi-  
 115 tion of another slot 820 which has the same position in all lock actuators of the series. The master key 83<sup>a</sup> has the shoulders 84 and 85 located as in the key 83, but the third  
 120 shoulder 860 is of different length, so as to move the projection 78 on the bar 72 a greater distance until it is opposite to the slot 820. Similarly a second set of lock  
 125 actuators, which vary from one another by having the slot 80 variously located, may be operated by the same master key 83<sup>b</sup> by  
 130 having an additional slot 800 opening into the longitudinal groove 75. The master key 83<sup>b</sup> for this group of lock actuators has shoulders 84 and 86, the same as all the keys  
 135 of this series, but has the shoulder 850 of only sufficient length to move the projection 78 up to the slot 800. Similarly other sets of lock actuators may be made individually  
 140 different through variations of the slot 81, 130



and may be all operable by one master key which moves the stud 78 up to an additional groove to be provided for the purpose. All the lock actuators of these various series, for instance all the devices of this character in an entire building, may be controlled by one grand master key 83<sup>c</sup>, which is shown in Fig. 15. This key has a shoulder 84 to move the lock-actuating bar 66, a second shoulder 850 to move the bar 70 until its pin 78 registers with the slot 800, and a third shoulder 860 to move the bar 72 until its pin 78 registers with the slot 820.

It will be readily understood from the foregoing description that a great variety of lock actuators, each operable by its appropriate key, may be made, and that yet all of such devices may be made operable by one master key by the simple expedient of making an additional slot or slots in the casing.

I claim:—

1. A selective key-operated lock-actuator consisting of a set of bars arranged side by side, a casing in which said bars are longitudinally and rotarily movable, and having longitudinal and transverse grooves, and projections on the several bars, one in each longitudinal groove, serving to prevent rotary movement of the bars until the same are moved to bring their projections to the several transverse grooves.

2. A selective key-operated lock-actuator consisting of a set of bars arranged side by side, and together forming a complete cylinder, a cylindrical casing in which said bars are longitudinally and rotarily movable, and having longitudinal and transverse grooves, and projections on the several bars, one in each longitudinal groove, serving to prevent rotary movement of the bars until the same are moved to bring their projections to the several transverse slots.

3. A selective key-operated lock-actuator consisting of a set of segmental bars arranged side by side, each being the quadrant of a cylinder and together constituting a complete cylinder, a cylindrical casing in which said bars are longitudinally and rotarily movable, and having longitudinal and transverse grooves, and projections on the several bars, one in each longitudinal groove, serving to prevent rotary movement of the bars until the same are moved to bring their projections to the several transverse slots.

4. A selective key-operated lock-actuator consisting of a set of bars arranged side by side, a casing in which said bars are longitudinally and rotarily movable and having longitudinal and transverse grooves, and projections on the several bars, one in each longitudinal groove, serving to prevent rotary movement of the bars until the same are moved to bring their projections to the several transverse slots, in combination with

a key having abutments, for engaging the bars, which abutments are located to correspond with the various spacing between the several pins and transverse grooves so as to place all the bars at once in the position wherein they can be rotated.

5. A selective key-operated lock-actuator consisting of a set of bars arranged side by side and together forming a complete cylinder, a cylindrical casing in which said bars are longitudinally and rotarily movable, and having longitudinal and transverse grooves, and projections on the several bars, one in each longitudinal groove, serving to prevent rotary movement of the bars until the same are moved to bring their projections to the several transverse slots, said bars having external longitudinal grooves, abutments on the casing extending into said grooves, and springs in the grooves bearing on said abutments and the bars with a tendency to hold the bars in their inoperative position within the casing.

6. A selective key-operated lock actuator, comprising a plurality of bars arranged side-by-side and so shaped as to be capable of independent longitudinal movement and of rotary movement only in unison, means associated with one of said bars for operating a lock when such bar is moved rotarily, means for preventing rotation of the bars until certain of the bars have been given a preliminary longitudinal movement, and means associated with one of said bars for preventing rotation of the bars in case of a preliminary longitudinal movement of said bar.

7. A selective key-operated lock-actuator consisting of a set of bars arranged side by side, a casing in which said bars are longitudinally and rotarily movable, and having longitudinal and transverse grooves, and projections on the several bars, one in each longitudinal groove, serving to prevent rotary movement of the bars until the same are moved to bring their projections to the several transverse grooves, one of said bars being normally held so that the projection thereon is in line with its respective transverse groove, whereby such bar serves to lock all the bars if moved longitudinally.

8. A selective key-operated lock-actuator, comprising a casing, and a set of bars contained in said casing with provision for longitudinal and lateral movement therein, one of said bars having provisions for operating the locking member of a lock, said casing and bars having a set of intersecting longitudinal and transverse grooves, one for each bar, and projections normally contained in the several longitudinal grooves, one in each, whereby operation of the lock is prevented until the bars have been so moved longitudinally that all the projections are at the openings of their respective



transverse grooves, there being also a second transverse groove intersecting one of the longitudinal grooves to permit operation of the lock by a key formed to move the bar corresponding to said groove through a different distance.

9. A selective key-operated lock-actuator, comprising a cylindrical casing, a set of bars contained in said casing with provision for longitudinal and rotary movement therein and arranged so that all must rotate in unison, and a projection on each of said bars, the casing having longitudinal grooves, in each of which one projection extends, and having also transverse grooves, one joining with each of the longitudinal grooves, whereby rotary movement of the bars is prevented until the bars are located by a key with their projections all at the openings to the respective transverse grooves, and the casing having also an additional transverse groove or grooves opening into one or more of the longitudinal grooves, whereby the device may be operated by a master key.

10. A key-operated lock-actuator comprising a cylindrical casing, a set of bars longitudinally and rotarily movable in said casing, one of which bars is provided with means for operating the locking member of a lock, said casing and bars having cooperating longitudinal and transverse grooves, and projections contained in the grooves, by which rotation of the bars is prevented until they are moved longitudinally through predetermined distances, a rotary block contained in the casing adjacent to the outer ends of the bars, having a slot to admit a key, and projections extending inward into grooves in said block to prevent rotation of said bars by a lock-picking instrument.

11. A key-operated lock-actuator, comprising a cylindrical casing, a set of bars longitudinally and rotarily movable in said casing, one of which bars is provided with means for operating the locking member of a lock, said casing and bars having cooperating longitudinal and transverse grooves, and projections contained in the grooves by which rotation of the bars is prevented until

they are moved longitudinally through predetermined distances, and means contained in said casing in front of said bars to prevent rotation thereof by a lock-picking instrument.

12. A key-operated lock-actuator comprising a cylindrical casing, a set of bars longitudinally and rotarily movable in said casing, one of which bars has provisions for operating the locking member of a lock, said casing and bars having cooperating longitudinal and transverse grooves, and projections contained in the grooves, by which rotation of the bars is prevented until they are moved longitudinally through predetermined distances, a block having a longitudinal groove to admit a key and transverse grooves, contained in said casing in advance of the bars, and projections extending inward into said transverse grooves, whereby said block is prevented from moving endwise but is permitted to rotate; in combination with a flat key shaped to enter the slot in said block, having shoulders on its end to move said bars, and having notches in its edges to pass over said projections when rotated.

13. A lock actuator comprising a stationary casing, segmental bars together forming a complete cylinder, and each movable longitudinally and rotarily within said casing, one of which is provided with means for operating a lock, cooperating means on said casing and bars whereby rotation of the latter is prevented until all have been placed in their appropriate positions relatively to the casing, a rotary member in said casing in front of the bars, having a narrow slot to receive a key, and pins or studs extending inward from opposite sides of the casing on opposite sides of such slot, and arranged to prevent rotation of any continuous instrument, or set of instruments having a combined width less than the width of the slot.

In testimony whereof I have affixed my signature, in presence of two witnesses.

WILFORD A. HILL.

Witnesses:

F. R. ROULSTONE,  
ARTHUR H. BROWN.