April 28, 1936. J. F. SVOBODA 2,039,126

LOCK

Filed April 14, 1934 3 Sheets-Sheet 1

Fig. 1.

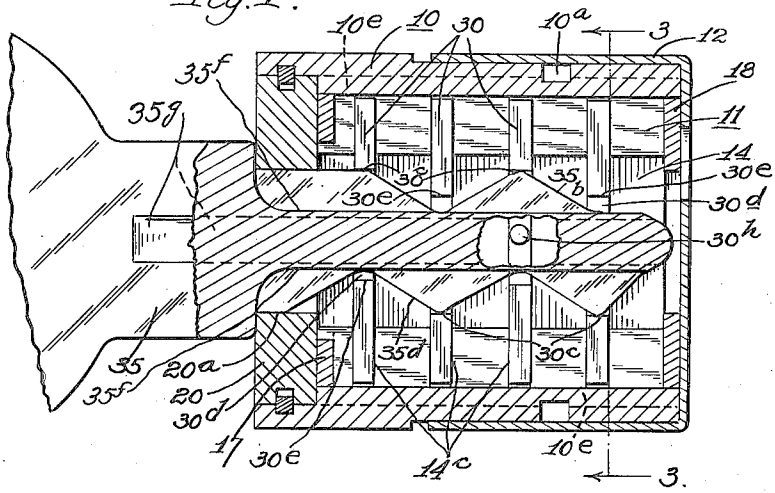


Fig. 2.

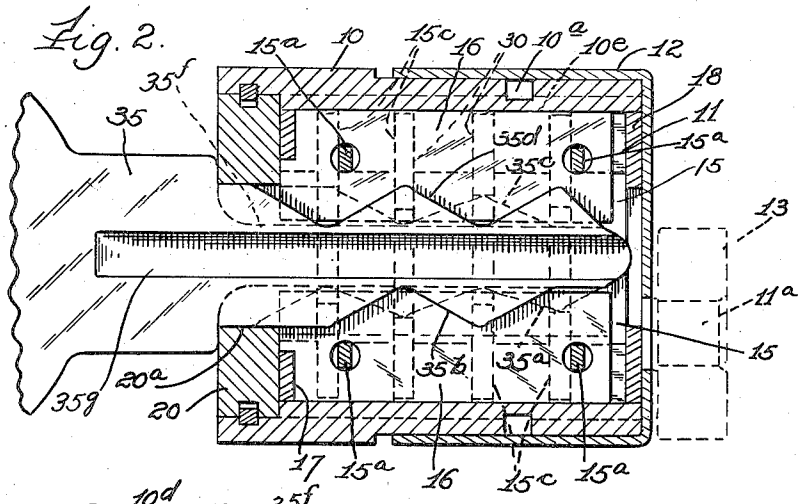
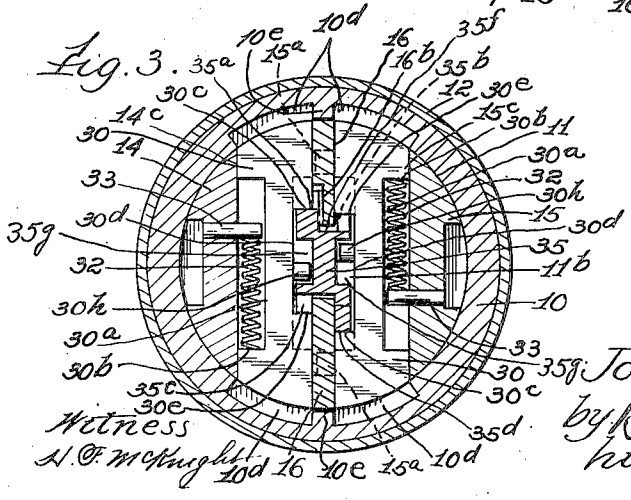


Fig. 3.



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LOCK

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Fig. 4

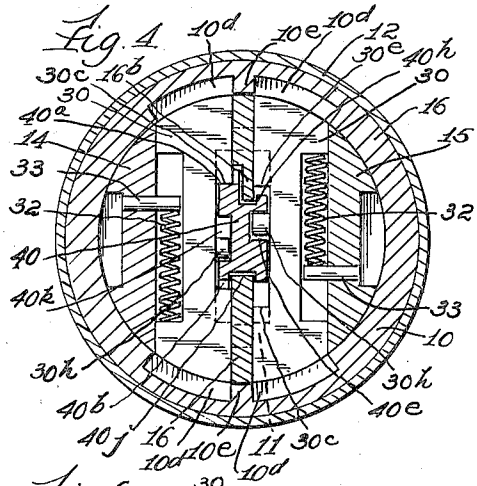


Fig. 5.

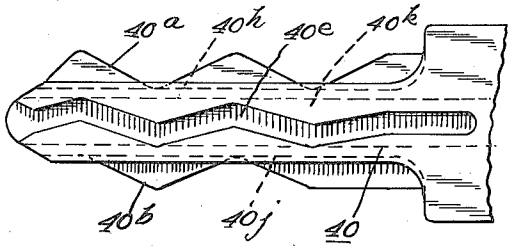


Fig. 6.

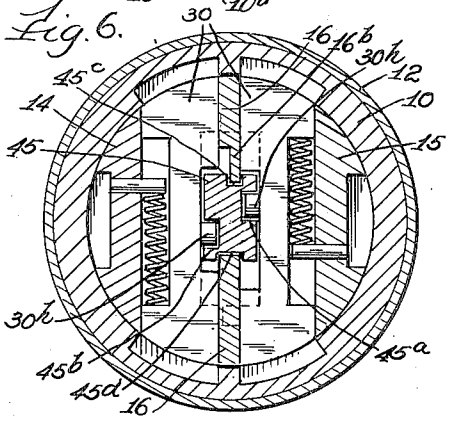


Fig. 7.

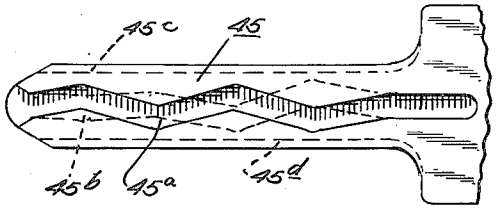


Fig. 8.

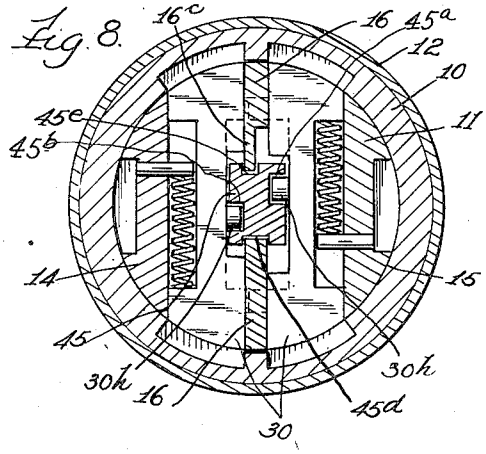
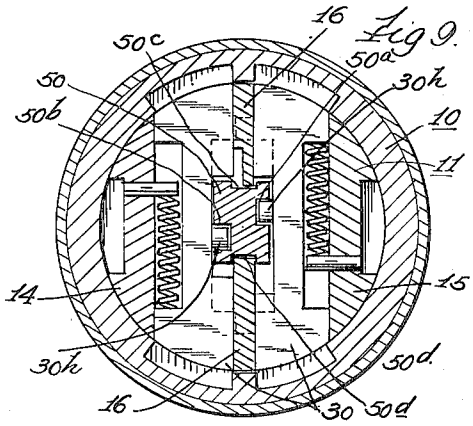


Fig. 9.



Witness
N. F. McKnight

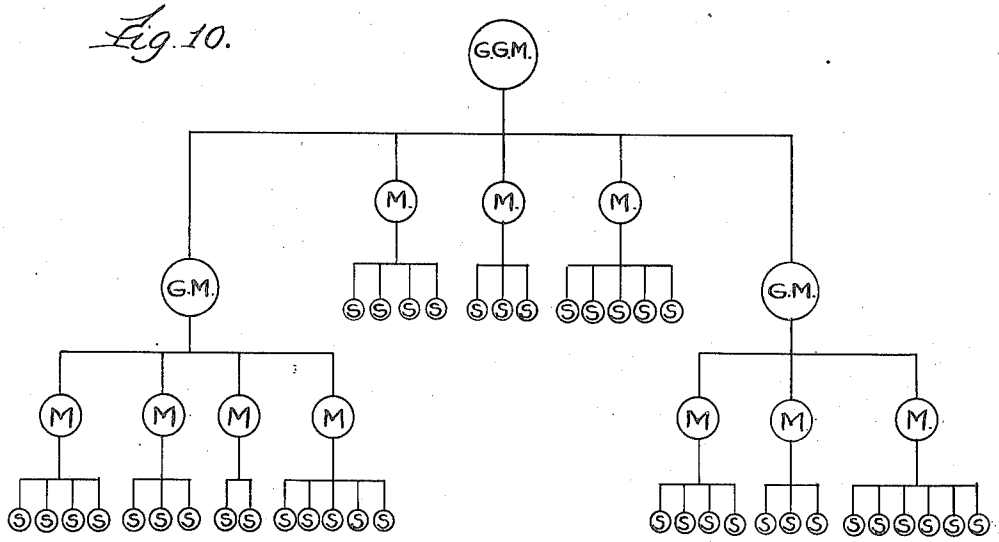
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LOCK

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Fig. 10.



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2,039,126

UNITED STATES PATENT OFFICE

2,039,126

LOCK

John F. Svoboda, Chicago, Ill., assignor to Dudley Lock Corporation, Chicago, Ill., a corporation of Illinois

Application April 14, 1934, Serial No. 720,528

18 Claims. (Cl. 70—46)

This invention pertains to locks of the rotary cylinder type adapted to be used in a system of locks in which each lock is constructed so that it may be operated by an individual "service" key, but includes features permitting several locks of a group to be operated by a single master key while all locks of a given system are operable by a single grand master key. One object of the invention is to provide the lock with features permitting the use of several keys in the manner illustrated. Another object is to secure economy in manufacture; and a further object is to insure a high degree of safety against picking of the lock.

The invention consists in certain elements and features of construction as herein shown and described and as indicated by the claims.

In the drawings:

Figure 1 is a longitudinal axial section through a lock, with the key in section, adapted for use in a lock system and embodying the present invention.

Figure 2 is a view similar to Figure 1 showing the opposite half of the lock structure.

Figure 3 is a transverse sectional view through the lock taken substantially as indicated at lines 3—3 on Figure 1, showing the tumblers in retracted or unlocked position, and showing the individual or "service" key in section in the lock.

Figure 4 is a sectional view similar to Figure 3 showing a "master" key in section in the lock, adapted for controlling the operation of a group of locks of the system.

Figure 5 is a view in side elevation of the "master" key.

Figure 6 is a sectional view similar to Figure 3 showing a "grand master" key in section for controlling the operation of two or more "master" keyed groups of locks.

Figure 7 is a view in side elevation of the "grand master" key.

Figure 8 is a sectional view similar to Figure 6 showing another form of "grand master" key in section, adapted for controlling two or more "master" keyed groups of locks of the system.

Figure 9 is a sectional view through the lock similar to Figure 3, showing a "great grand master" key in section; and

Figure 10 is a diagrammatic view illustrating a lock system embodying the present invention.

This lock construction is suitable for use in systems adapted to a large variety of situations, as in institutions of various characters, apartment buildings, schools, hospitals, and industrial plants; but it will be understood that the lock may be employed as a separate and individual unit or in a more or less elaborate system with other locks of the same type, according to requirements.

The lock illustrated as embodying my present invention is of the rotary cylinder type employing two series of transversely slidable tumbler elements arranged on opposite sides of the key slot, and for the purpose of carying out my invention to the fullest extent, I have shown the tumbler elements of each lock of the system as being each provided with two independent key-engaging abutment features which preferably are located in substantially the same planes in the general direction of movement of the tumbler elements. In the drawings these key-engaging abutment features are illustrated as transversely extending abutment shoulders for engagement by cam surfaces of the key, and as a laterally projecting nib for engagement in a sinuous groove of the key.

Referring now in detail to the drawings, the locks of the entire system are of similar construction, and each lock includes a casing, 10, of annular form, and a rotary cylinder or plug, 11, mounted in the casing for rotation therein under the control of tumbler elements when actuated by a key. Snugly fitted on the reduced rearward end portion of the casing is a cup-shaped member, 12, enclosing the rear end of the casing. This cup-shaped element is secured to the casing, 10, by a plurality of depressions (not shown) formed in its side wall and which project into the external annular groove, 10a, of the casing. The bottom of the cup-shaped member is provided with an arcuate slot through which extends a stud indicated in dotted lines at 11a, on which stud is carried a cam block indicated in dotted lines at 13, adapted to engage suitable cooperating elements which are to be operated incident to rotation of the cylinder of the lock.

The rotary cylinder is composed of two longitudinally extending sections indicated as 14 and 15, which are approximately semi-circular in cross section, and the outer marginal portions of said sections are spaced apart by longitudinally extending plates, 16, as seen in the drawings. Each of the plates is provided with apertures for registering with and mounting on transversely projecting studs, 15a, of the cylinder section, 15, as seen in Figure 2 of the drawings. The cylinder sections are secured together with the plates, 16, interposed, by a substantially annular ring member, 17, forcibly fitted on the reduced annular shoulder formed at the front end of the cylinder

sections, and the rear ends of the cylinder sections are secured together by a retaining ring, 18, forcibly seated on the annular shoulder at the rear ends of the cylinder sections. The cylinder is confined in the casing, 10, by a cap plate, 20, snugly fitted and locked into the outer end of the casing, as seen in the drawings. It will be understood that the cap, 20, is formed with a rectangular key slot, 20^a, in alignment with the longitudinally extending key slot 11^b, formed by the tumbler elements, for accommodating several different keys for operation of the lock; and further that the cap plate, 20, is provided with means for an interlocking connection with the cylinder so as to be rotatable therewith as a unit.

The cylinder sections are each provided with a series of axially spaced transversely extending slots, 14^c, and 15^c, and the slots of the respective sections are transversely aligned in pairs. Said slots would open into the key slot, 11^b, except for the plates, 16, which serve to define the individual transversely extending slots. Slidably mounted for transverse movement in these slots are tumbler elements, 30, which are dimensioned so that when they are engaged by a key, they are moved to positions of adjustment at which their outer extremities lie within the circular contour of the cylinder, 11, so as to permit rotation of the said cylinder in the casing, 10. These tumbler elements when free are yieldingly projected into longitudinally extending grooves, 10^d, formed in the inner wall of the casing, 10, for locking engagement therewith and preventing rotation of the cylinder. Said grooves, 10^d, are arranged in two diametrically opposite pairs, and the grooves of each pair are spaced apart by a longitudinally extending rib, 10^e, which serves as the abutment shoulder against which the tumblers react to prevent rotation of the cylinder. These ribs, 10^e, are substantially the same thickness as the spacing plates, 16, and are in alignment therewith when the cylinder is locked in the casing, as seen in Figure 3 of the drawings, so as to serve as continuations of the surfaces of the plates, 16, in guiding the tumbler elements as they are moved to and from locking position.

The edges of the tumblers opposite the key slot are provided with notches, 30^a, each having a transverse shoulder, 30^b, against which reacts an individual coil spring, 32, the opposite end of the spring abutting against a transversely extending pin, 33, carried by the cylinder section and extending into the tumbler notch, 30^a, as seen in Figure 3 of the drawings. The tumbler elements and the springs, 32, with their stop pins, 33, are arranged for urging adjacent tumblers of each series in opposite directions into locking engagement with the casing, and said springs also act on the respective pairs of transversely aligned tumblers in opposite relation, that is, the tumbler elements of each pair are urged in opposite directions, as seen in Figure 3 of the drawings.

The edge of each tumbler element adjacent the key slot, 11^b, is provided with an abutment feature, 30^c, adapted to be engaged by a cooperatively formed cam surface of a key, 35. In the construction shown in the drawings, the abutment feature of the tumbler is in the nature of a transverse shoulder which forms one of the edges defining an elongated notch, 30^d, in the inner edge of each tumbler element. These abutment shoulders are disposed within the key slot for engagement by a key, which moves the tumblers in a direction against the reaction of their compression springs, 32, and when these tumbler elements are freed from engagement with the key, the springs, 32, normally urge them in outward direction into locking engagement with the casing, to prevent rotation of the cylinder therein. It is to be understood that these tumbler elements are preferably different from each other, and are formed with each key-operated abutment shoulder, 30^c, located at one of a plurality of possible predetermined positions from the end of the effective locking shoulder of the tumbler element, which engages the rib, 10^e, of the casing, and it will also be understood that the key for engaging these surfaces of the tumbler elements will have its contours shaped accordingly. It will be apparent that the compact arrangement of the tumblers in the lock permits making locks of a relatively great number of different tumbler combinations, without rendering the locks unduly bulky.

One of the important features of the lock employed in my system consists in constructing and disposing the tumblers in a manner so that the abutment surfaces, 30^c, of adjacent tumbler elements of a series are acted upon by a key in opposite relation, and so that the abutment surfaces of the tumbler elements of each transversely aligned pair of tumbler elements of the respective series, as seen in Figure 3 of the drawings, are likewise acted upon in opposite relation, thus in effect, providing four independent sets of tumbler elements. To accommodate this construction, the key, 35, is provided with four independent cam-operating surfaces, 35^a, 35^b, 35^c and 35^d, for actuating the independent sets of tumbler elements of the respective series. Each of the cam surfaces of the key is of a sinuous contour, and as may be seen in the drawings, these surfaces are arranged in pairs at opposite edges of the key; and the aligned cam surfaces, 35^a, 35^c, and 35^b, 35^d, of the respective pairs have the high points of each surface in alignment with the low points of the opposite cam surface of the key.

Each of the notches, 30^d, of the tumbler elements is dimensioned so that the shoulder, 30^e, opposite the key-actuated abutment shoulder, 30^c, is disposed in close proximity to the cam-operating edge of the key, opposite the cam-operating edge of said key which actuates said tumbler, as seen in Figures 1 and 2 of the drawings. In other words, by virtue of this construction when a tumbler has been moved to withdrawn position, the shoulder, 30^e, opposite the effective key-operated abutment shoulder, 30^c, is moved toward the center of the key slot to such a position as to effectively guard the key-operated abutment shoulder, 30^c, of the next adjacent tumbler of the series; such a guard shoulder, 30^e, in all instances (when the tumbler has been moved to releasing position) will be disposed inwardly a distance beyond the position assumed by the abutment shoulder, 30^c, of the next adjacent tumbler of the series, when it has been moved to releasing position. Manifestly it will be extremely difficult to "pick" a lock so constructed, by reason of the fact that the next adjacent tumbler of the series has to be moved in a direction opposite to the direction of movement of the first tumbler, and its abutment surface, 30^c, which is the only surface convenient to be engaged by an implement or tool in "picking" the lock, will have to be moved outwardly a distance beyond the guard shoulder, 30^e, of the first tumbler, and an attempt to so move the second tumbler after the first tumbler of the

series has been so adjusted, will practically always result in moving the first tumbler out of releasing position, back into locking engagement with the cylinder.

The separating plates, 16, in addition to providing guidance for the tumbler elements, 30, in their transverse sliding movement in the cylinder, 11, are so dimensioned that their inner marginal edges project into the key slot 11b, of the cylinder a distance normally inwardly beyond the positions of the key-operated abutment shoulders, 30c, of the respective tumbler elements when they have been moved to unlocking position, as may be seen in Figure 3. Such an arrangement further hampers and renders exceedingly difficult the task of "picking" the lock, because of the curtailment of the space immediately adjacent the key-operated abutment shoulders of the tumblers. The inwardly projecting edges of these plates serve as wards and provide guidance for the key, 35, as it is inserted into the lock, and the key is provided with longitudinally extending ward grooves, 35f, at opposite edges of the key separating the pairs of cam surfaces, 35a from 35b, and 35c from 35d.

When locks of the character above described are embodied in a locking system in accordance with my invention, each tumbler element, 30, is provided with a second key-engaging abutment feature, herein shown as a laterally projecting nib, 30h, extending into the key slot, 11b, and these nibs are adapted to be engaged by cooperatively formed features of a key. These nibs, like the abutment shoulders, 30c, of the tumbler elements, may be located on the respective tumblers for making up various lock combinations for operation by a cooperatively formed "individual" or "service" key, and in the present case this second set of abutment features on the tumbler elements is employed for "mastering" and "grand mastering" certain groups of locks of the system. When it is desired to "master" key, "grand master" key, or "great grand master" key certain groups of locks of the type illustrated in Figures 1 to 3 of the drawings, the abutment shoulders, 30c, of one series of tumbler elements of all locks of a group are identically arranged. In other words, the "individual" or "service" key indicated at 35 will differ from the "individual" or "service" keys of other locks of the group only with respect to the cam surfaces for operating the other series of tumbler elements. For "master"-keying a group of locks in this system, the second series of key abutment features, 30h, on the changeable series of tumbler elements are arranged identically in all of the locks of the system. To provide clearance for the nibs, 30h, the "service" key, 35, is formed with longitudinally extending grooves, 35g, in its opposite side walls, as seen in the drawings.

Figures 4 and 5 of the drawings illustrate one form of "master" key which may be used for controlling a certain group of locks of the system, and for such purpose, it will be noted that the key includes cam surfaces, 40a and 40b, at opposite edges, which correspond to cam surfaces, 35a and 35c, of the "individual" or "service" key, and these surfaces cooperate with the abutment shoulders, 30c, of the series of tumbler elements, 30, that are identically arranged in all of the locks of the system. The opposite side wall of the key is formed with a sinuous groove, 40e, for cooperative engagement with the nibs, 30h, of the other series of tumbler elements, and as above mentioned, this series of nibs is identically arranged in all of the locks of the system. This key, 40, like the key, 35, is also formed with ward grooves, 40h and 40j, at opposite edges of the key for cooperative engagement with the ward edges of the plates, 16. The side of the key opposite the sinuous groove, 40e, is provided with a longitudinally extending groove, 40k, of rectangular cross section, as indicated in Figure 4, to provide clearance for the nibs, 30h, on the other series of tumbler elements, which tumblers are actuated by the cam surfaces, 40a and 40b, of the key.

Figures 6 and 7 illustrate one form of "grand master" key for controlling certain "master"-keyed groups of locks of the system. When the locks are to be "grand master"-keyed, the nibs, 30h, of both series of tumblers are identically arranged in all of the locks of the entire system. In this construction the key, 45, which is of substantially rectangular cross section, is provided with longitudinally extending sinuous grooves, 45a and 45b, in its opposite side walls for engagement with the nibs, 30h, of the respective series of tumbler elements of all of the locks of these "master"-keyed groups. As may be seen in the drawings, the key, 45, and the tumbler elements, 30, are dimensioned so that the edges of the key do not engage the abutment shoulders, 30c, of any of the tumbler elements of the locks. Said key, 45, is provided with ward grooves, 45c, and 45d, at opposite edges for cooperative engagement with the wards of plates, 16.

The several "master"-keyed groups of locks of the system may be arranged in several "grand master"-keyed groups, which are controlled by a "great grand master" key, 50, which will operate all of the locks of the entire system. For this purpose I have in certain "grand master"-keyed groups of locks, reduced the thickness of the inner edge of one of the ward plates, 16, as indicated at 16b, in Figures 3 to 6 of the drawings, and the cooperating ward grooves of the respective keys, 35, 40 and 45, have been formed to snugly fit said reduced portion of the ward plate. In other "grand master"-keyed groups of locks of the system, this reduced portion of the plate has been reversed, as indicated at 16c, in Figure 8, and the "grand-master" key, 45, as shown in Figure 8, is provided with an oppositely located ward groove, 45e, for accommodating said reversed reduced edge, 16c, of the ward plate, 16, and by virtue of this arrangement, I obtain two different groups of "grand master"-keyed locks, and the locks of each group are operable by its individual "grand master" key. It will be apparent that I may obtain additional "grand master" keyed groups by similarly reducing the ward edge of the opposite ward plate. By virtue of such warding, each key of the lock system may be inserted into the locks in only one position.

In Figure 9 of the drawings I have shown a section of the lock with a "great grand master" key, 50, in section, for operating all of the locks of the entire system. This key includes sinuous grooves, 50a and 50b, in its opposite side walls for cooperative engagement with the nibs, 30h, of the tumbler elements which are identically arranged in all of the locks, for withdrawing said tumblers from locking position. The key is also provided with ward grooves, 50c and 50d, at opposite edges for cooperative engagement with the ward plates, 16. It is to be particularly noted that the upper ward groove, 50c, is of substantial width to accommo-

date both reduced wards, 16b and 16c, of the upper ward plate, permitting the key to be inserted into either of the two groups of "master-keyed" locks, which are illustrated in section in Figures 6 and 8.

It will be apparent that I can obtain various other re-arrangements of the "master" keying and "grand master" keying features herein disclosed; for example, the nibs on the tumbler elements, might be employed with a cooperating "individual" or "service" key, and a key of the type illustrated in Figures 4 and 5 could be either the "master" key or a "grand master" key, while the key disclosed in Figures 1 to 3 of the drawings could also be employed as either the "master" key or a "grand master" key.

Although the various sections of the lock illustrated in the drawings are several times actual size, it was necessary to deviate slightly with respect to certain dimensions of the various features of the lock to more clearly illustrate and emphasize these features. In this connection it may be mentioned that the guard shoulder, 30c, of the tumbler element is shown in certain instances a distance away from the adjacent cam surface of the key, something more than the actual dimension which has been found practical for such a construction; and it will be understood that in the commercial form of the lock, the guard shoulder, 30c, will be brought as close as possible to the adjacent cam surface of the key (opposite the cam surface engaging the abutment shoulder of the corresponding tumbler element), and the distance will be more or less determined by the conformation of the cam surfaces of the key, so as to facilitate insertion and withdrawal of the key from engagement with the tumblers of the lock.

I have illustrated diagrammatically in Figure 10 of the drawings a hypothetical locking system including several groups of locks operated by "individual" or "service" keys, which are indicated in circles bearing the letter "S", and certain of these groups are indicated as being controlled by a "master" key indicated in circles bearing the letter "M". I have further illustrated certain of the "master"-keyed groups to be controlled by a "grand master" key, indicated in circles bearing letters "G. M."; and finally a "great grand master" key for controlling each of the locks of the entire system, indicated by a circle bearing letters "G. G. M.".

Although I have shown and described certain preferred embodiments of my invention, it will be manifest that it is capable of various modifications and re-arrangements without departing from the spirit and scope thereof. I do not wish, therefore, to be understood as limiting myself to the particular construction and arrangement herein shown and described except as indicated in the claims.

I claim:

1. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot and two series of similar tumbler elements mounted in the cylinder on opposite sides of the key slot, said tumbler elements being mounted for movement transversely to the axis of the cylinder and normally extending into locking engagement with the casing to prevent rotation of the cylinder, the tumbler elements of one series being formed with key-engaging abutment shoulders, and the abutment shoulders of certain of the tumbler elements of said series being disposed in opposite relation to the other tumbler elements of said series, said shoulders being engageable by cooperatively-formed cam surfaces formed on the opposite edges of a key for withdrawing them from locking position, and the tumbler elements of the other series having laterally projecting nibs engageable in a cooperatively formed sinuous groove in the side of said key for withdrawing the last mentioned series of tumbler elements from locking position.

2. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot and two series of similar tumbler elements mounted in the cylinder on opposite sides of the key slot, said tumbler elements being mounted for movement transversely to the axis of the cylinder and normally extending into locking engagement with the casing to prevent rotation of the cylinder, the tumbler elements of one series being formed with key-engaging abutment shoulders, and the abutment shoulders of alternate tumbler elements of the series being disposed in opposite relation and adapted to be engaged by cooperatively-formed cam surfaces formed on the opposite edges of a key for withdrawing them from locking position, and the tumbler elements of the other series having laterally projecting nibs engageable in a cooperatively formed sinuous groove in the side of said key for withdrawing the last mentioned series of tumbler elements from locking position.

3. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the key slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, the alternate tumblers of one series being urged in opposite directions, and the abutment shoulders of adjacent tumblers of said series being arranged in opposite relation for engagement by cooperatively formed cam surfaces on opposite edges of the key for withdrawing said series of tumbler elements from locking position, the other series of tumbler elements having laterally projecting nibs engageable in a cooperatively formed sinuous groove formed in the side of said key for withdrawing said last mentioned series of tumbler elements from locking position.

4. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder adjacent the key slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being formed with key-engaging abutment features, said abutment features of each series being engageable by separate cooperatively formed surfaces of a key for withdrawing said tumblers from locking engagement with the casing, one of said series of tumbler elements having a second independent series of key-engaging abutment features, engageable and operated by a second key having a cooperatively formed surface, said second key having another cooperatively formed surface for operatively engaging the said abutment features of the other series of tumbler elements for withdrawing all of the tumblers out of locking engagement with the casing.

5. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder adjacent the key slot, and normally extending

into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being formed with key-engaging abutment shoulders, and said abutment shoulders of each series being engageable by separate cooperatively formed cam surfaces of a key for withdrawing said tumblers from locking engagement with the casing, one of said series of tumbler elements also being formed with nibs extending laterally into the key slot, and said nibs being engageable by a second key having a cooperatively formed sinuous groove, and said second key also having a cooperatively formed cam surface for engaging the abutment shoulders of the other series of tumblers for withdrawing all of said tumblers of the lock out of locking engagement with the casing.

6. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumblers being formed with key-engaging abutment features, and said abutment features of each series being engageable by separate cooperative formed surfaces of a key for withdrawing said tumblers from locking engagement with the casing, one of said series of tumblers having a second independent series of abutment features, engageable and operated by a second key having a cooperatively formed surface, said second key having another cooperatively formed surface for engaging the abutment features of the other series of tumblers for withdrawing all of the tumblers out of locking engagement with the casing.

7. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the slot and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumblers being formed with key-engaging abutment shoulders, and said abutment shoulders of each series being engageable by separate, cooperatively formed cam surfaces of a key for withdrawing said tumblers from locking engagement with the casing, one of said series of tumbler elements also being formed with nibs extending laterally into the key slot, and said nibs being engageable by a second key having a cooperatively formed sinuous groove, and said second key also having a cooperatively formed cam surface for engaging the abutment shoulders of the other series of tumblers for withdrawing all of said tumblers of the lock out of locking engagement with the casing.

8. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumblers being formed with key-engaging abutment shoulders, and said abutment shoulders of each series being engageable by separate, cooperatively formed cam surfaces of a key for withdrawing said tumblers from locking engagement with the casing, the abutment shoulders of alternate tumbler elements of one series being disposed in opposite relation, the other of said series of tumbler elements being formed with nibs extending laterally into the key slot, and said nibs being engageable by a second key having a cooperatively formed sinuous groove, and said second key also having a cooperatively formed cam surface at each edge for engaging the abutment shoulders of the first mentioned series of tumblers, for withdrawing all of said tumblers of the lock out of locking engagement with the casing.

9. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the slot and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being formed with laterally extending nibs, engageable by a key having cooperatively formed sinuous grooves for withdrawing the tumblers from locking engagement with the casing, one of said series of tumbler elements also being provided with a series of abutment shoulders, said shoulders being engageable by a cooperatively formed cam surface of a second key, and said second key also having a cooperatively formed sinuous groove engageable with the nibs of the other series of tumbler elements for withdrawing all of the tumblers out of locking engagement with the casing.

10. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being formed with laterally extending key-engaging nibs, one of said series of tumbler elements being provided with an independent set of abutment shoulders, said abutment shoulders and said nibs on the other series of tumbler elements being engagegageable by a key having a cooperatively formed cam surface, said key also having a cooperatively formed sinuous groove for engaging said series of nibs for withdrawing the tumbler elements from locking engagement with the casing, the series of nibs on the series of tumbler elements having the abutment shoulders being engageable by a key having cooperatively formed sinuous grooves for both series of nibs on the respective series of tumbler elements for withdrawing all the tumbler elements from locking engagement with the casing.

11. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder at opposite sides of the slot and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being provided with key-engaging abutment features engageable by cooperatively formed surfaces of a key adapted for shifting the tumbler elements from locking position; one of the series of tumbler elements being provided with additional and independent key- engaging abutment features engageable by a cooperatively formed surface of a second key which is also provided with a cooperatively formed surface for engaging the aforesaid abutment features of the other series of tumbler elements for shifting them out of locking position; said other series

of tumbler elements being also provided with additional and independent key-engaging abutment features, engageable by a cooperatively formed surface of a third key which is also provided with a cooperatively formed surface for engaging the said additional and independent abutment features of the first mentioned series of tumbler elements so that said key will also withdraw all tumblers of the lock from locking position.

12. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder at opposite sides of the slot and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being provided with laterally projecting nibs extending into the key slot engageable by cooperatively formed sinuous grooves in the side surfaces of a key adapted for shifting the tumbler elements from locking position; one of the series of tumbler elements being provided with additional and independent key-engaging abutment features engageable by a cooperatively formed surface of a second key, which is also provided with a cooperatively formed sinuous groove for engaging the nibs of the other series of tumbler elements for shifting them out of locking position; said other series of tumbler elements being also provided with additional and independent key-engaging abutment features engageable by a cooperatively formed surface of a third key which is also provided with a cooperatively formed surface for engaging the said additional and independent abutment features of the first mentioned series of tumbler elements so that said key will also withdraw all tumblers of the lock from locking position.

13. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder at opposite sides of the slot and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being provided with laterally projecting nibs extending into the key slot engageable by cooperatively formed sinuous grooves in the side surfaces of a key adapted for shifting the tumbler elements from locking position; one of the series of tumbler elements being also provided with key-engaging abutment shoulders engageable by a cooperatively formed cam surface of a second key which is also provided with a cooperatively formed sinuous groove for engaging the nibs of the other series of tumbler elements for shifting them out of locking position; said other series of tumbler elements being also provided with key-engaging abutment shoulders engageable by a cooperatively formed cam surface of a third key which is also provided with a cooperatively formed cam surface for engaging the said abutment shoulders of the first mentioned series of tumbler elements so that said key will also withdraw all tumblers of the lock from locking position.

14. In a lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot, and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the key slot and normally extending into locking engagement with the casing to prevent rotation of the cylinder, both series of tumbler elements being provided with key-engaging abutment features adapted to be engaged by cooperatively formed surfaces of a key for withdrawing said tumblers from locking position, the key slot of the cylinder being provided with a ward engageable in a cooperatively formed groove of the key, said tumbler elements also being withdrawable from locking position by a second key having a ward groove for cooperating with the ward in said key slot, said key being formed to also withdraw the tumbler elements of another lock cylinder having a differently located ward.

15. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the key slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, the alternate tumblers of one series being urged in opposite directions, the abutment shoulders of adjacent tumblers of said series being arranged in opposite relation for engagement by the cooperatively formed cam surfaces on opposite edges of the key for withdrawing said series of tumbler elements from locking position, and the tumbler elements of the other series being arranged so that each is urged in a direction opposite to that of the transversely adjacent tumbler of the first mentioned series, said other series of tumbler elements having laterally projecting nibs engageable in a cooperatively formed sinuous groove in the side of said key for withdrawing said last mentioned series of tumbler elements from locking position.

16. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the key slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, the transversely adjacent tumblers of the respective series being movable in relatively opposite directions for release from locking position, the tumblers of one series having abutment shoulders adapted to be engaged by a cooperatively formed cam surface on the edge of a key for withdrawing said series of tumblers from locking position, and the other series of tumbler elements having laterally projecting nibs engageable in a cooperatively formed sinuous groove in the side of said key for withdrawing the last mentioned series of tumblers from locking position.

17. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot and two series of tumbler elements slidably mounted in the cylinder on opposite sides of the key slot, and normally extending into locking engagement with the casing to prevent rotation of the cylinder, the alternate tumblers of each series being movable in opposite directions for release from locking position, the tumblers of one series having abutment shoulders adapted to be engaged by cooperatively formed cam surfaces on the edges of a key for withdrawing said series of tumblers from locking position, and the other series of tumbler elements having laterally projecting nibs engageable in a cooperatively formed sinuous groove in the side of said key for withdrawing the last mentioned series of tumblers from locking position.

18. A lock including a casing, a cylinder rotatably mounted in the casing and having a longitudinally extending key slot with two series of tumbler elements slidably mounted in the cyl-

inder on opposite sides of the key slot respectively, one tumbler of each series being disposed directly opposite a tumbler of the other series, said tumblers normally extending into locking engagement with the casing to prevent rotation of the cylinder, one series of tumbler elements being formed with abutment shoulders adapted to be engaged by a cooperatively formed cam surface on the edge of a key for withdrawing said series of tumblers from locking position, and the other series having laterally projecting nibs engageable in a cooperatively formed sinuous groove in the side of such key for withdrawing the last-mentioned series of tumblers from locking position.

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