

Oct. 8, 1940.

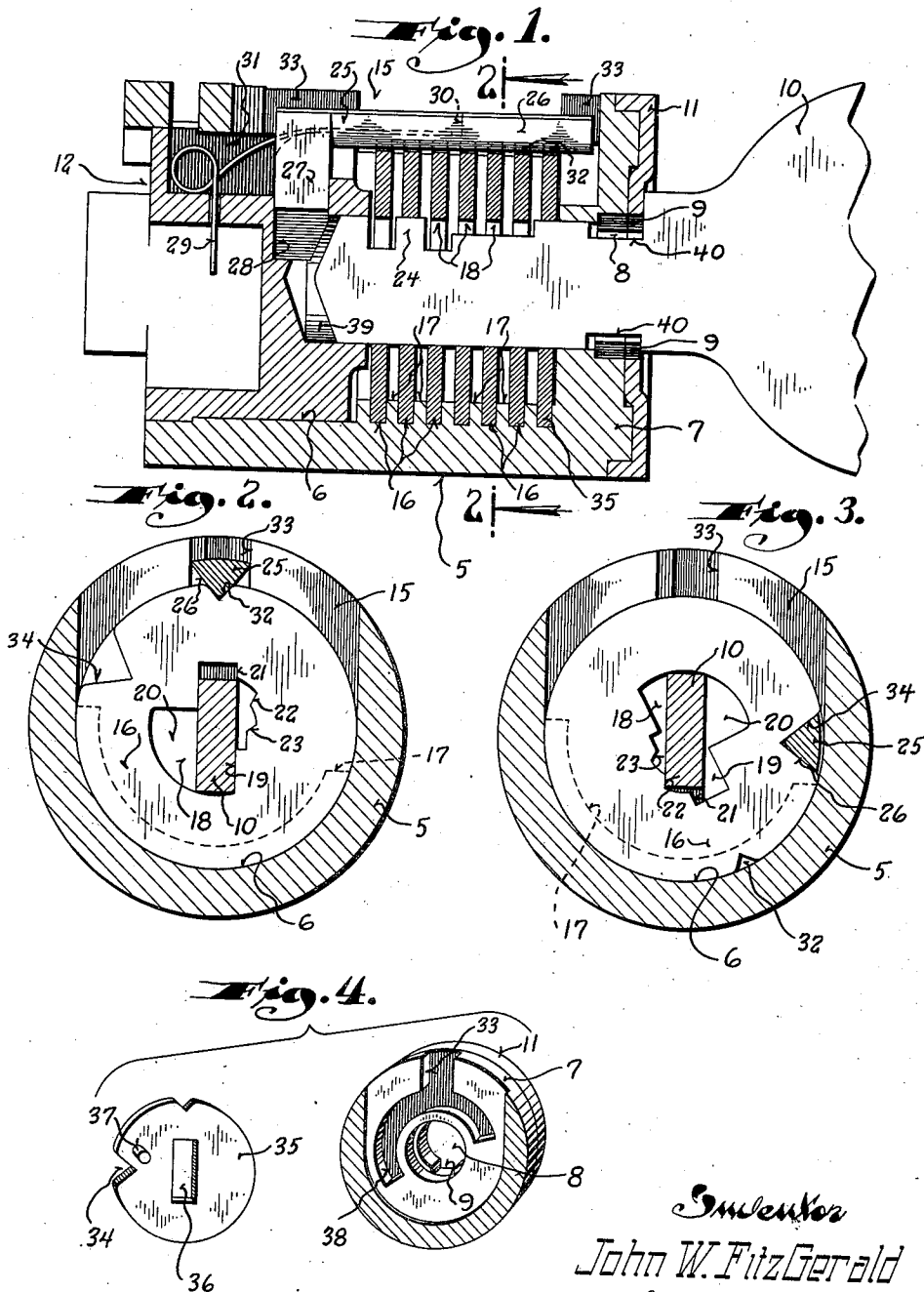
J. W. FITZ GERALD

2,217,047

LOCK

Filed June 9, 1939

4 Sheets-Sheet 1



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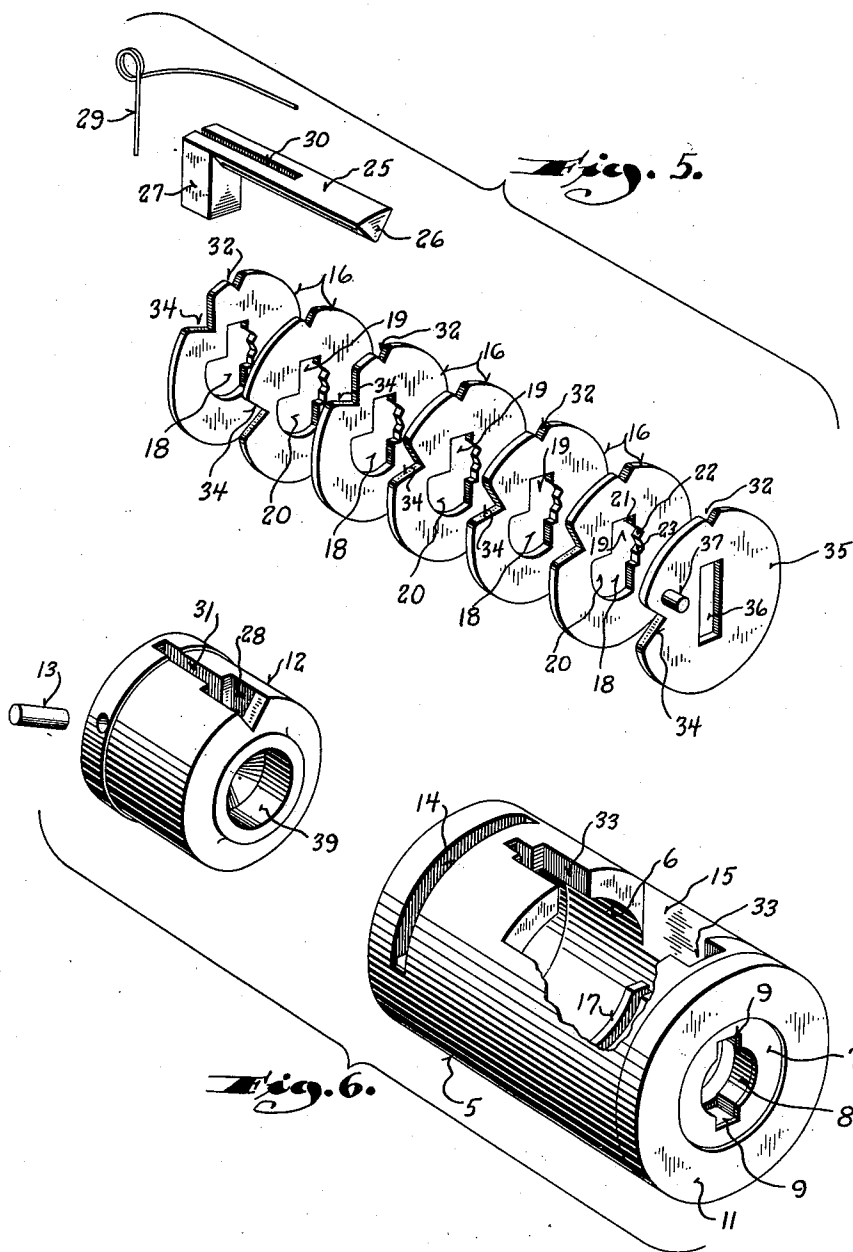
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4 Sheets-Sheet 2



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Fig. 7.

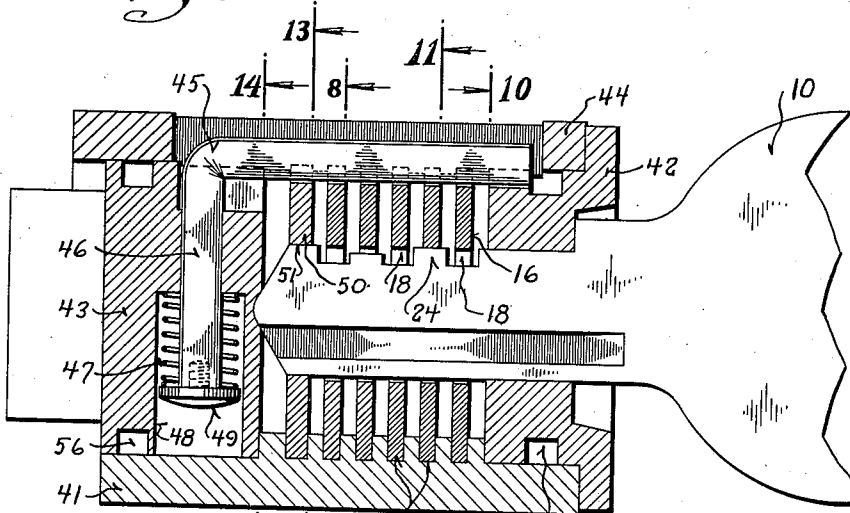


Fig. 8.

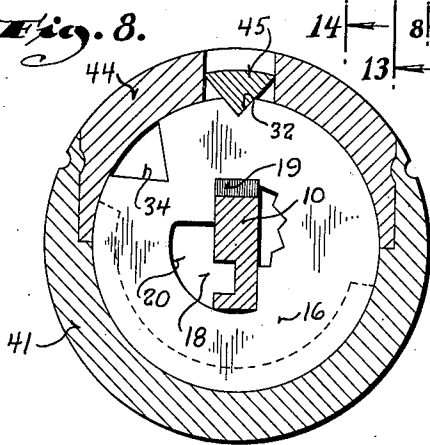


Fig. 9.

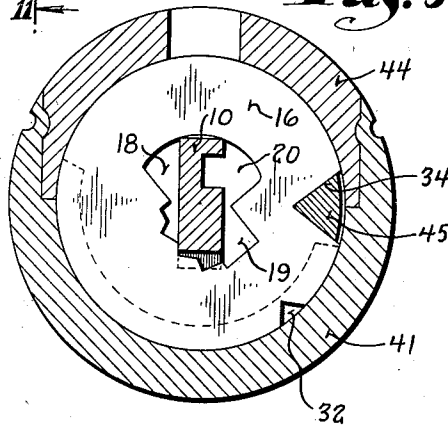
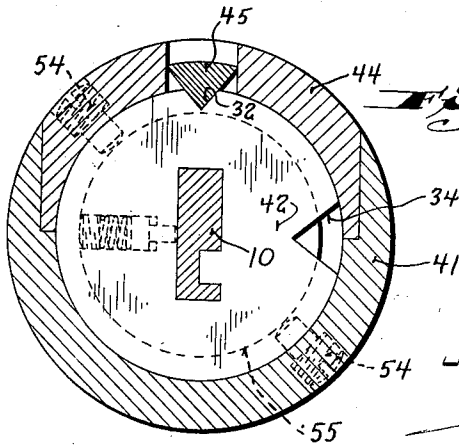


Fig. 10.



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Fig. 11.

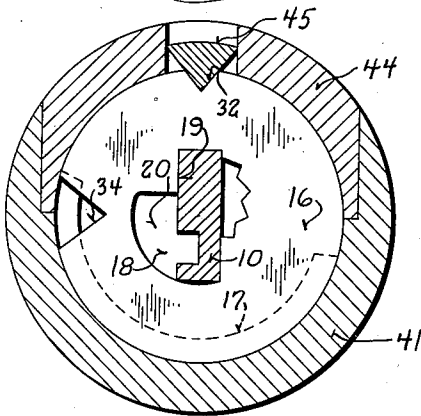


Fig. 12.

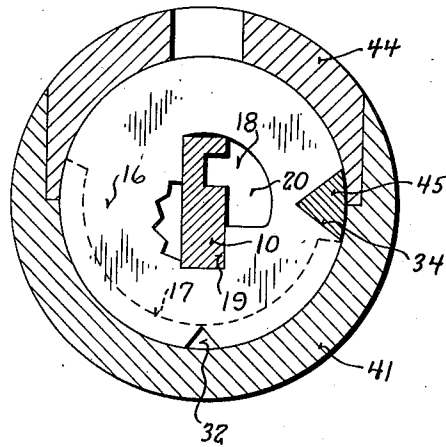


Fig. 13.

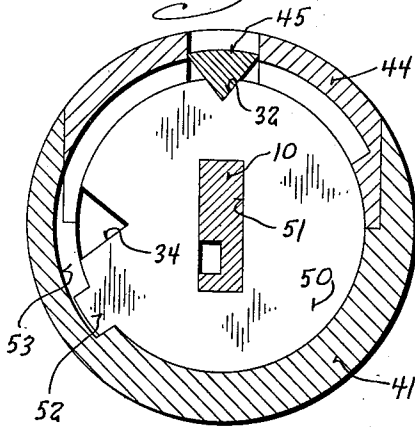
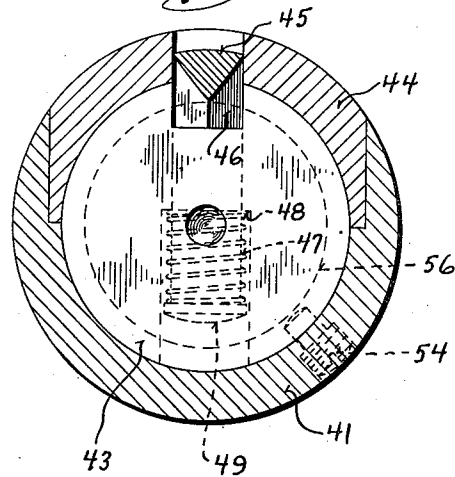


Fig. 14.



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UNITED STATES PATENT OFFICE

2,217,047

LOCK

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Application June 9, 1939, Serial No. 278,178

6 Claims. (Cl. 70—366)

This invention relates to locks, and refers particularly to small key controlled cylinder locks.

It is an object of this invention to provide a lock of the character described wherein a plurality of rotatable discs is employed in place of the usual endwise movable key controlled tumblers for securing the cylinder against rotation.

Another object of this invention is to provide a lock of the character described which because of its novel construction permits a smaller overall size without relinquishing accuracy and security.

Another object of this invention is to provide a lock of the character described which is so designed that no need exists for exceptional strength in the cylinder construction.

It is also an object of this invention to provide a lock which is capable of a greater range of combinations than locks of the past, and wherein accuracy is attained without requiring extreme exactness in the key.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate two complete examples of the physical embodiment of the invention constructed in accordance with the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a longitudinal sectional view through a lock constructed in accordance with this invention;

Figure 2 is a cross sectional view taken through Figure 1 on the plane of the line 2—2, showing the parts in their locked positions;

Figure 3 is a view similar to Figure 2, but illustrating the key and the tumblers turned to their fully unlocked positions;

Figure 4 is a perspective view showing the construction of the inner face of the front end of the casing and the adjacent face of the first disc to illustrate the manner in which the limits of rotation are defined;

Figure 5 is a perspective view of all of the tumbler discs, the locking bar and its spring arranged in their proper order of assembly;

Figure 6 is a perspective view of the casing and the rotatable plug which is insertable into the rear end of the casing;

Figure 7 is a view similar to Figure 1, illustrating

a slightly modified embodiment of the invention;

Figure 8 is a cross sectional view taken through Figure 7 on the plane of the line 8—8, showing the parts in their locked positions;

Figure 9 is a view similar to Figure 8, but illustrating the parts in their unlocked positions;

Figure 10 is a cross sectional view taken through Figure 7 on the plane of the line 10—10;

Figure 11 is a cross sectional view taken through Figure 7 on the plane of the line 11—11;

Figure 12 is a view similar to Figure 11, but showing the same parts in their unlocked positions of rotation;

Figure 13 is a cross sectional view taken through Figure 7 on the plane of the line 13—13; and

Figure 14 is a cross sectional view taken through Figure 7 on the plane of the line 14—14.

Before specifically defining the invention with reference to the drawings, it is desired to briefly state the general construction of the lock.

As distinguished from most of the present day key operable tumbler locks, the present invention contemplates a construction in which the tumblers are in the form of discs having stepped key openings whereby turning of a key having portions of different heights and properly inserted into the lock, picks up the tumblers at different degrees of rotation.

Ninety degrees of key motion are allotted to collecting or picking up all of the tumblers to carry them to positions at which V-shaped notches or recesses in their peripheries are aligned to permit a radially movable locking bar or driver, which rides on the peripheries, to fall into the notches. Continued rotation of the key turns the disc tumblers and through their engagement with the locking bar or driver transmits a turning motion to a rotatable plug in the inner end of the casing, which plug carries the usual eccentric driving lug or cam.

Upon retrograde rotation, the rotatable plug is first brought back to its initial locked position at which time the locking bar or driver is in line with a recess or recesses in the casing into which it is projected against spring pressure, by continued turning of the discs.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts, and especially to Figures 1 to 6, inclusive, the numeral 5 designates a casing having a bore 6, the front end of which is closed by an end wall 7. This end wall has a cylindrical keyhole 8 provided with opposed notches 9 to guide the

entrance of the key 10 into the lock. A finishing plate 11 is preferably secured over the front end of the casing.

Rotatably mounted in the rear end of the casing bore is a plug 12. The plug is held against disassembly from the casing and its limits of rotation are defined by a pin 13 secured in the plug and projecting radially outwardly into a segmental slot 14 in the adjacent wall of the casing bore.

Between the plug 12 and the end wall 7, the side wall of the casing is cut away to provide an opening 15 leading to the bore 6. The width of the opening 15 is at least equal to the diameter of the bore. This opening 15 permits edgewise insertion of tumbler discs 16 into the bore 6 where they are held in spaced relationship by semicircular spacing ribs 17 projecting from the wall of the bore.

The tumbler discs 16 have key openings 18 uniform in size and shape. These openings are probably best described as comprising a substantially rectangular central portion 19 with one side thereof having a quadrant-like engagement 20 and its other side enlarged to provide three radially and circumferentially spaced stops 21, 22 and 23 with which the bits 24 on the key engage as the key is turned.

Obviously, the heights of the bits on the key determine which of the stepped stops 21, 22 or 23, the key will engage upon rotation thereof. Hence, during the ninety degrees of rotation allotted to collection or picking up of the tumblers so that thereafter they all turn in unison, first one and then the other of the tumblers will be engaged and advanced in the forward direction of rotation.

As noted at the outset, a driving connection to be hereinafter more fully described is effected between the rotatable plug 12 and the plurality of discs upon ninety degrees of rotation of the key so that subsequent rotation of the discs by the key carries the plug 12 along. This driving connection consists of a locking bar or driver 25 having an elongated V-shaped part 26 which rides on the peripheries of the discs, and an angularly disposed mounting portion 27 slidable radially in an appropriate pocket 28 formed in the rotatable plug 12.

A torsion spring 29 having one end engaged with the plug and its other end engaging in a groove 30 cut into the top of the bar 26 yieldingly urges the same inwardly toward the tumbler discs. The coils of the spring are conveniently positioned in a pocket or recess 31 cut into the rotatable plug 12.

When the tumblers are in their locked positions of rotation, the V-shaped part 26 engages in shallow notches 32 in the peripheries of the discs, all of which are uniformly positioned with respect to the key openings 18. This engagement holds the discs against accidental rotation due to jarring of the lock, and inasmuch as the notches 32 are shallow, the locking bar is still projected outwardly to its operative locking position at which it engages in recesses 33 in the ends of the opening 15 so as to positively secure the rotatable plug 12 against rotation.

At the completion of ninety degrees of rotation on the part of the key, all of the tumbler discs will have been collected or picked up and moved to a position at which deep notches 34 in their peripheries are aligned. Upon such alignment of the notches 34, which unlike the notches 32 are positioned at different locations circumferentially

with respect to the key openings 18, the locking bar 25 drops down into them and the extent of this inward motion of the locking bar is sufficient to disengage it from the recesses 33. The then position of the locking bar establishes a driving connection between the discs and the rotatable plug 12 so that subsequent rotation of the key turns the plug 12.

In addition to the tumbler discs 16, there is a front disc 35 provided. This disc is mounted directly inside the end wall 7, and instead of the peculiarly shaped keyhole 18 present in the tumbler discs 16, this front disc has a rectangular key opening 36 of a size to just permit the key to pass therethrough. Consequently, any rotation of the key is manifested by a corresponding rotation of the front disc 35.

Like the tumbler discs, this front disc has a notch 32 to receive the locking bar and also a notch 34, but the notches are exactly ninety degrees apart so that the locking bar is held in its operative position until ninety degrees of rotation have been completed.

The front disc 35 also carries a pin 37 which projects forwardly into an arcuate groove 38 in the front wall. This groove has an arcuate length such that through engagement of the pin 37 with its ends, rotation of the front disc 35, and consequently the key, is limited to exactly one hundred and eighty degrees. In this manner the extreme limits of rotation for the lock are defined, and as noted hereinbefore, the first half of the total rotary motion is utilized to collect the tumbler discs and align their notches 34 with the locking bar, while the last half of the total rotation is utilized to rotate the plug 12.

As clearly shown in Figure 1, the key is guided for rotation by the circular keyhole 8 in the end wall 7 at the front of the lock, and by a round hole 39 in the rotatable plug 12 into which the end of the key projects, and by virtue of the two-diameter formation of the keyhole 8 in the front of the lock and notches 40 in the key, the key is held against endwise motion in all positions of rotation except locked and unlocked.

A slightly modified embodiment of the invention is illustrated in Figures 7 to 14, inclusive. In this construction, the casing 41 is in the form of an open ended sleeve, its front end being closed by a rotatable plug 42 and its rear end rotatably mounting the driving plug 43 which corresponds to the rotatable plug 12 of the preferred construction.

As in the construction already described, the casing has an open side to permit the insertion of the rotatable tumbler discs which are mounted in the same manner as that employed in the construction shown in Figures 1 to 6, but in this instance, a cover 44 closes the open side of the casing.

The key openings in the tumbler discs, as previously described, are so designed that rotation of the key through ninety degrees collects all of the discs and brings them into positions at which their deep notches 34 are aligned. At this time the locking bar 45 drops into position to drivingly connect the tumbler discs with the rotatable plug.

The locking bar 45 is mounted for movement in a radial plane by means of an angularly disposed portion 46 slidable in a suitable guideway in the rotatable plug 43. A coil spring 47 encircling the portion 46 and confined between the bottom of a counterbore 48 in the plug 43 and

a head 49 on the arm 46 yieldingly urges the locking bar into engagement with the peripheries of the discs.

In place of the front disc 35 of the construction previously described, this embodiment of the invention provides an inner disc 50 having a rectangular key opening 51 into which the nose of the key projects so that the disc 50 turns directly with the key. An outwardly projecting radial lug 52 on the disc 50 rides in a substantially semicircular groove 53 in the wall of the casing bore and its cover 44 to define the limits of rotation of the lock.

The rotatable plugs 42 and 43 are held in place by set screws 54 threaded into the casing and its cover with their inner ends projecting into annular grooves 55 and 56 in the plugs 42 and 43, respectively.

The mode of operation in this embodiment of the invention is identical to that of the preferred construction.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent that this invention provides an exceptionally simple lock structure which permits a wide range of combinations without entailing minute accuracy and exactness in the cutting of the key, and that by virtue of the novel construction employed, security is obtained without necessitating great strength in the cylinder construction which permits a smaller overall size and a cheaper construction.

What I claim as my invention is:

1. In a lock of the character described: a bored casing; a rotatable plug therein; a locking bar connected with the rotatable plug and movable in a radial plane toward and from the axis of the bore; the casing having a recess to receive the locking bar and thus secure the rotatable plug against rotation; a plurality of key controlled rotatable discs in the bore with the locking bar riding on their peripheries to be held thereby in the casing recess, each disc having a notch for the reception of the locking bar, said notches being deep enough to enable the locking bar to be disengaged from the casing recess upon alignment of all of the notches therewith; and means for yieldingly urging the locking bar toward the axis of the bore so as to maintain the same engaged with the discs.

2. In a lock of the character described: a casing having a bore; a driving plug rotatable therein; a plurality of tumbler discs rotatable in the bore in front of the plug, all of said discs having key openings of such configuration that rotation of a key inserted into the lock picks up and turns the discs at different degrees of rotation of the key, and whereby all of the discs may be turned in unison after a predetermined amount of rotation, said discs also having notches in their peripheries adapted to be aligned the instant the discs begin to turn in unison; and a locking bar adapted to engage in the aligned notches of the discs and connected with the rotatable plug to provide a driving connection between the discs and the plug.

3. In a lock of the character described: a casing having a bore; a driving plug rotatable therein; a plurality of tumbler discs rotatable in the bore in front of the plug, all of said discs having key openings of such configuration that rotation of a key inserted into the lock picks up and turns the discs at different degrees of rotation of the key, and whereby all of the discs may be turned in unison after a pre-

determined amount of rotation, said discs also having notches in their peripheries adapted to be aligned the instant the discs begin to turn in unison; the casing having a recess in line with the notches when the notches are first brought into alignment; a locking bar radially slidable in said recess and of a size to be maintained in said recess by the peripheries of the discs and to move radially out of said recess upon alignment of the notches in the discs; and an angular portion on the locking bar radially slidable in the rotatable plug whereby a driving connection is effected between the discs and the plug when the locking bar engages in the aligned notches of the discs.

4. In a lock of the character described: a casing having a bore; a driving plug rotatable therein; a plurality of tumbler discs rotatable in the bore in front of the plug, all of said discs having key openings of such configuration that rotation of a key inserted into the lock picks up and turns the discs at different degrees of rotation of the key, and whereby all of the discs may be turned in unison after a predetermined amount of rotation, said discs also having notches in their peripheries adapted to be aligned the instant the discs begin to turn in unison; the casing having a recess in line with the notches when the notches are first brought into alignment; a locking bar radially slidable in said recess and of a size to be maintained in said recess by the peripheries of the discs and to move radially out of said recess upon alignment of the notches in the discs; an angular portion on the locking bar radially slidable in the rotatable plug whereby a driving connection is effected between the discs and the plug when the locking bar engages in the aligned notches of the discs; and a spring acting between the rotatable plug and a part of the locking bar for yieldingly urging the bar inwardly toward the axis of the bore.

5. In a lock of the character described: a casing having a bore; a plug rotatable in the rear end of the bore; another plug rotatable in the front end of the bore, the last named plug having a key opening therethrough; the casing having an open side between said plugs of a width at least equal to the diameter of the bore; a plurality of discs in said bore between the two plugs, said discs being insertable into the bore through the open side of the casing and each having a key opening, the key openings of the different discs being so shaped that rotation of a key inserted through the key opening in the front plug picks up and turns the discs after different degrees of rotation, said discs also having notches in their peripheries adapted to be aligned the instant all of the discs begin to turn in unison; a locking bar connected with the rear plug in a manner permitting bodily movement of the bar in a radial plane toward and from the axis of the bore and having a portion extending forwardly to engage the peripheries of the discs and enter the notches therein upon alignment of the notches so as to effect a driving connection between the discs and the rear plug; and said casing having a recess to receive the locking bar when it is not in the aligned notches of the discs so as to secure the rear plug against rotation; and said recess being positioned in line with the open side of the casing so that the locking bar forms a barrier across the open side of the casing to retain the tumbler discs therein.

6. In a lock of the character described: a casing having a bore; a plug rotatable in the inner end of the casing; a plurality of discs rotatable in the bore in front of the plug, said discs having central key openings uniform in size and shape and each provided with radially and circumferentially offset steps to be engaged by different height bits on a key inserted into the key openings whereby rotation of the key engages and transmits rotation to the discs after different degrees of motion and turns the discs in unison upon the completion of a predetermined degree of rotation, said discs further having deep notches in their peripheries located at different positions with relation to their openings and in such positions as to be aligned the instant the discs begin to turn in unison; a locking bar nonrotatably connected with the plug and engageable with the peripheries of the discs to engage in said deep notches upon alignment thereof and establish a driving connection between the discs and the plug, and said discs also having shallow notches in their peripheries uniformly located with respect to their openings to receive the locking bar portion when the discs are turned to the locked positions so that the bar holds the discs against accidental rotation.
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