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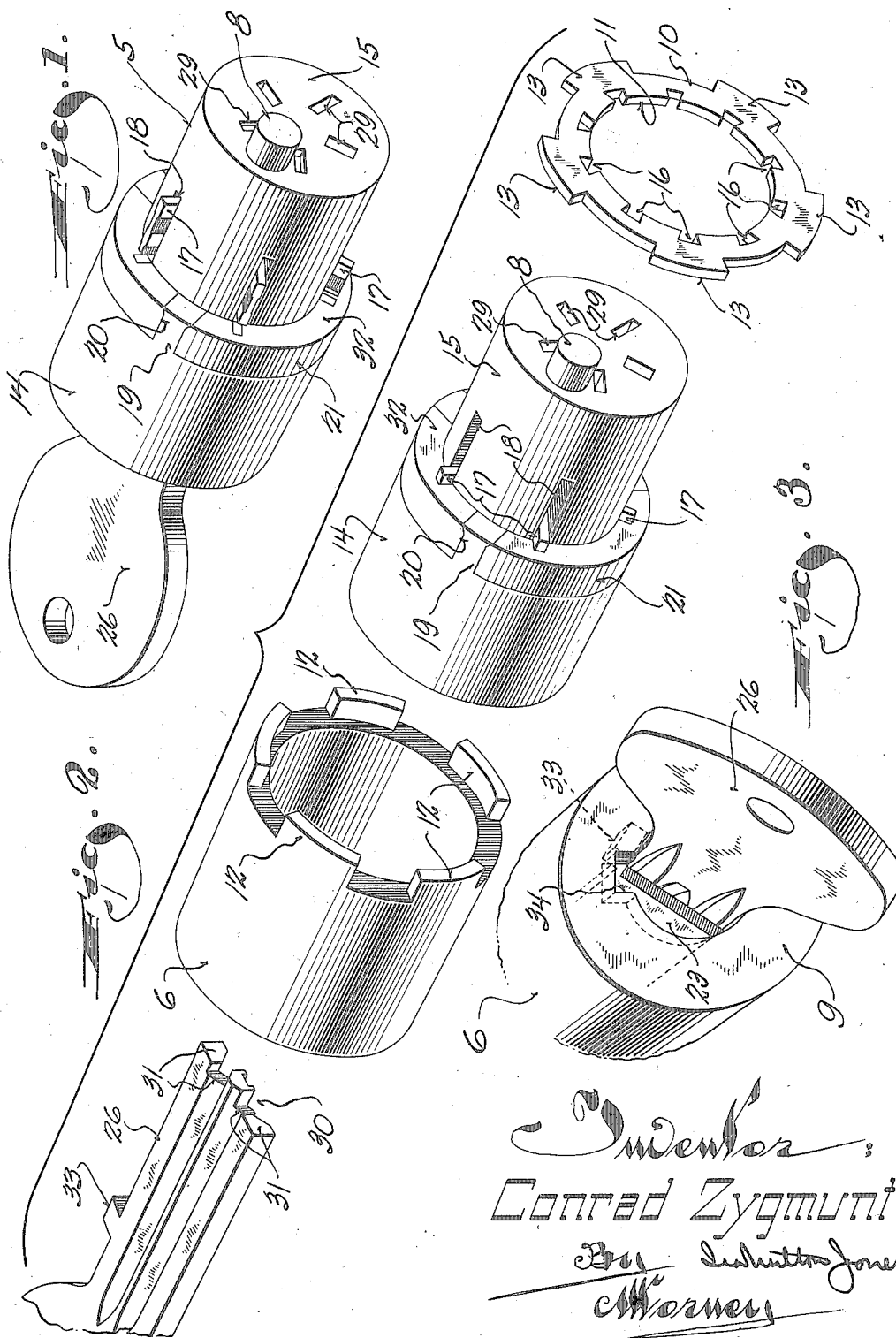
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Filed June 11, 1934

5 Sheets-Sheet 1



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Filed June 11, 1934

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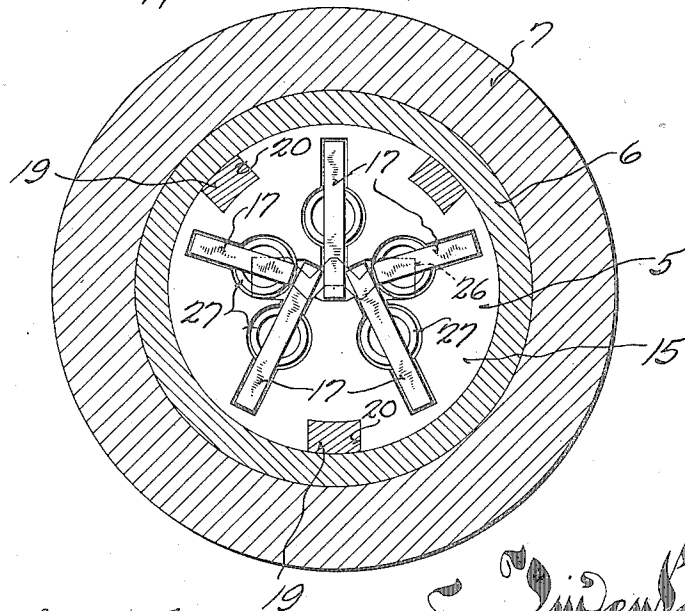
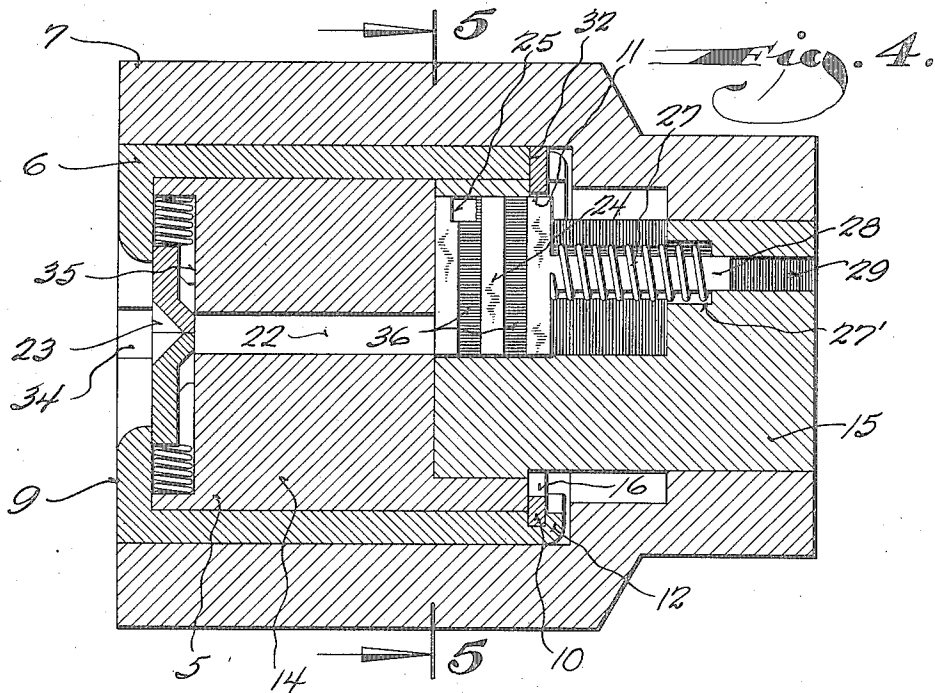


Fig. 5.


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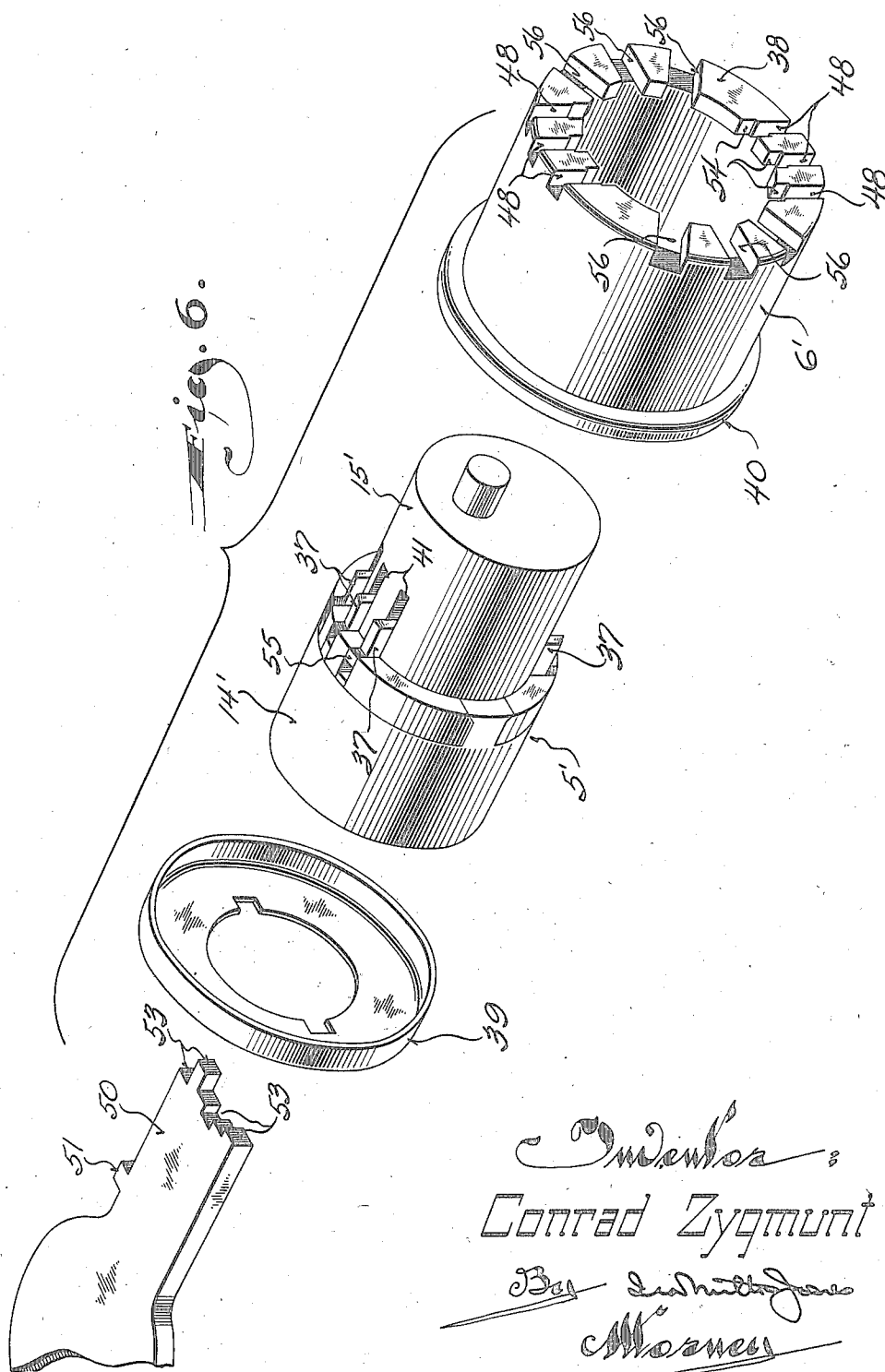
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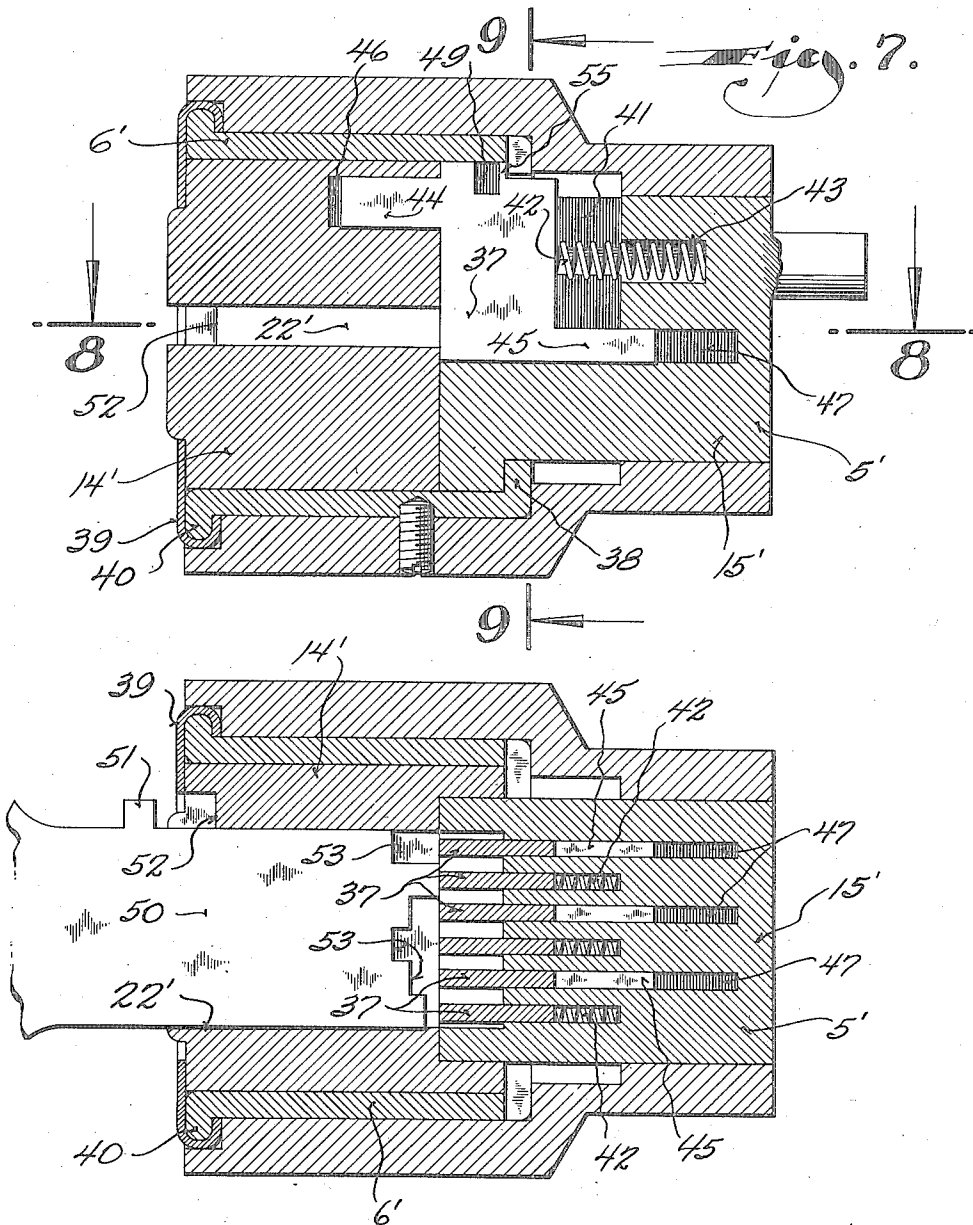


Fig. 8.

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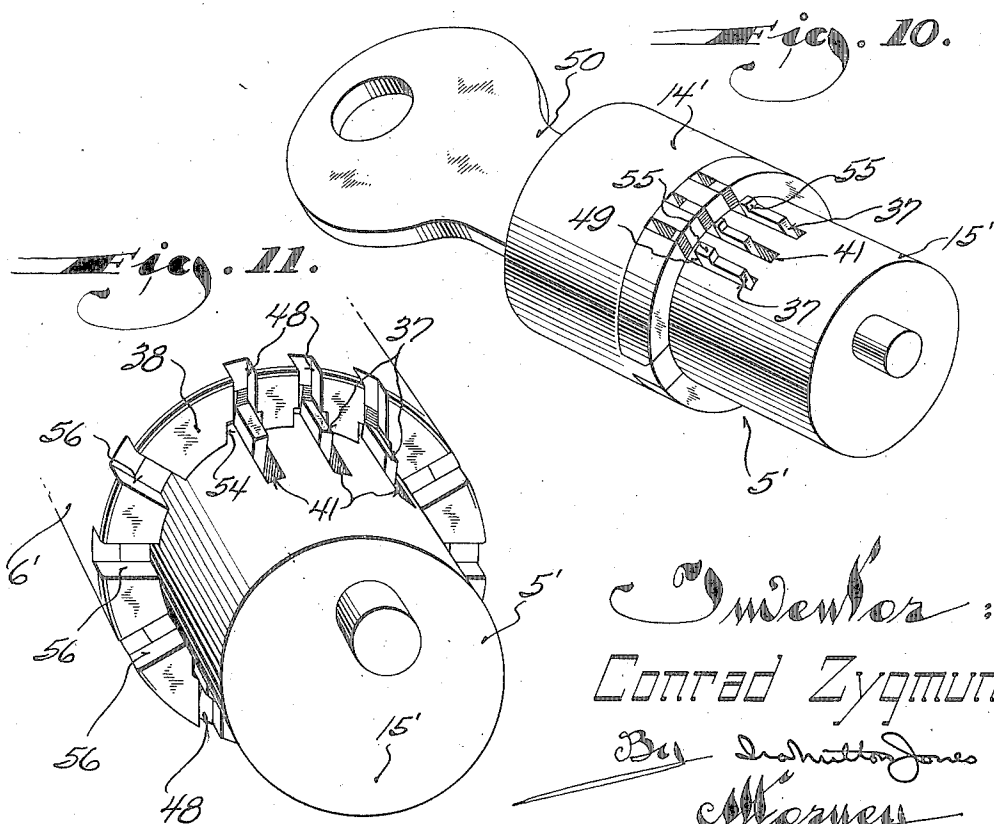
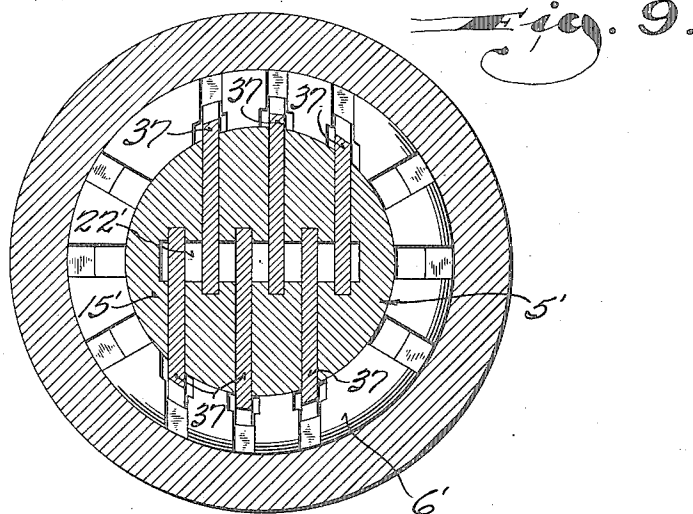
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Filed June 11, 1934

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,036,738

LOCK

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Application June 11, 1934, Serial No. 730,050

5 Claims. (Cl. 70—46)

This invention relates to improvements in locks and has as an object to provide an improved cylinder lock of the end thrust type in which the tumblers move endwise of the cylinder.

Another object of this invention is to provide a lock of the character described in which the tumblers have an interlocking engagement with a casing part to normally prevent rotation of the cylinder and which interlocking engagement is released to free the cylinder for rotation by inward pressure applied to the tumblers through a proper key.

More specifically, it is an object of this invention to provide a lock of the character described in which endwise movable tumblers have an interlocking connection with a notched flange on the casing so that the tumblers in their normal positions engage in the notches of the flange to hold the cylinder against rotation.

Another object of this invention resides in the provision of means for positively preventing retraction of the key until the cylinder has been turned to its fully locked position to preclude the possibility of leaving the cylinder in a position of rotation from which it may be turned without the use of a proper key.

Another object of this invention is to provide means whereby in the event an attempt to pick the lock is successful to the extent of freeing the cylinder for rotation, a slight turning of the cylinder in either direction will again secure the same against rotation.

Another object of this invention resides in the provision of tumblers which are grooved on their sides, so that in an attempt to pick the lock, the grooves engage the edges of the notches in which the tumblers move and prevent further actuation of the tumblers.

Another object of this invention is to so construct the interlocking portions of the tumblers and the stationary part, that upon the application of slight torsional force on the cylinder as is necessary during picking, the tumblers will be positively held against inward or longitudinal movement.

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 com-

plete examples of the physical embodiment of this invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a perspective view of a lock cylinder embodying this invention removed from its casing and showing the same with the key in place;

Figure 2 is a perspective view of the cylinder, its key, and the casing parts, separated and in their proper order of assembly;

Figure 3 is a perspective view of the front end of the lock to show particularly the means for preventing retraction of the key while the cylinder is in any but its fully locked position;

Figure 4 is a longitudinal section view through the assembled lock;

Figure 5 is a cross section view through Figure 4 on the plane of the line 5—5;

Figure 6 is a perspective view of the parts of a modified embodiment of the invention shown disassembled;

Figure 7 is a longitudinal section view through the lock, shown in Figure 6;

Figure 8 is a longitudinal section view taken through Figure 7 on the plane of the line 7—7;

Figure 9 is a cross section view through Figure 7 on the plane of the line 9—9;

Figure 10 is a perspective view of the assembled cylinder with the key in place, of the said modified embodiment of the invention; and

Figure 11 is a perspective view of the rear end of the lock showing the manner of restraining endwise movement of the tumblers during an attempt to pick the lock.

Referring now more particularly to the accompanying drawings, in which like numerals indicate like parts throughout the several views, and especially to Figures 1 to 5 inclusive, the numeral 5 designates the cylinder of the lock, which is rotatably mounted in a shell or casing 6 adapted to be secured in a supporting structure such as a housing 7.

The shell or casing 6 is in the form of a cylinder having an intumed annular flange 9 at its front end and a hardened metal disc or plate 10 fixed to its inner or rear end, and apertured as at 11 to permit the extension of the cylinder therethrough. The plate 10, which may be considered an intumed flange of the casing just as the flange 9, except that it is a separate member and preferably of hardened metal, is firmly secured against rotation with respect to the casing 6 by the inter-engagement of lugs 12 and 13 on the casing and the plate respectively, and is held

assembled with the casing by striking over the ends of the lugs 12, as shown in Figure 4.

The cylinder has an outer end portion 14 of a size to fit in the bore of the casing between the inturned flange 9 and the plate 10, and the inner or rear end portion 15 of smaller diameter to project through the bore 11 in the plate 10. At its extreme inner end, the cylinder has an eccentrically mounted cam 8 through which rotation of the cylinder may be imparted to mechanism to be actuated.

Extended radially from the periphery of the bore 11 in the plate 10 are a plurality of notches 16 with which tumblers 17 engage to normally secure the cylinder against rotation in the casing. The tumblers 17 are movable endwise with respect to the axis of the cylinder in substantially radially extending recesses 18.

To permit the formation of the recesses 18, the large and small diameter portions of the cylinder are two separate parts secured together in any suitable manner as by having lugs 19 on the large diameter portion 14 engaging in recesses 20 in a flange 21 on the small diameter portion 15 to be riveted over, as illustrated.

The large diameter portion 14 of the cylinder has a keyway 22 extending down through the center thereof to communicate at its inner end with all of the tumbler receiving recesses or pockets 18, and has its outer end closed by a two part dust cover or shutter 23.

The tumblers 17, as best shown in Figure 4, comprise substantially rectangular plates 24 provided with notches 25 on their outer edges which, upon inward axial movement of the tumblers to predetermined positions by a proper key 26, align with the plate 10 to free the cylinder for rotation. With the tumblers in their normal locked positions to which they are yieldably urged by springs 27, confined between their rear edges and the bottoms of spring pockets 27' formed as extensions of the recesses 18, unnotched portions of the tumbler edges are received in the notches 16 in the plate 10.

The tumblers are guided in their movement by rearward extensions 28, about which the springs 27 are coiled and which move in rectangular passages 29 formed as extensions of the recesses 18.

The notches 25 in the various tumblers are located at different distances from the front ends of the tumblers to require the various tumblers to be moved different distances to effect proper alignment of all of the notches 25 with the plate 10, and to so move the various tumblers, the inner end 30 of the key 26 has differently located steps 31, each of which is adapted to engage one of the tumblers, as best shown in Figure 5.

Inasmuch as the plate 10 lies flush against the shoulder 32, which forms the back of the flange 21, it follows that when the tumblers are in their unlocked positions to align their respective notches 25 with the plate, the outer edges of the notches are all flush with this shoulder 32. This facilitates the cutting of the notches, as by making a cut directly adjacent the shoulder 32 with the key in its fully inserted position, all of the notches are properly located. If desired, the cut taken to form the notches 25 may also serve to dress or finish the shoulder 32.

To define the inward limit of movement of the key 26, a lug 33 projects from one edge thereof. This lug 33 during insertion of the key, enters a recess 34 in the inturned flange 9 and passes the two part expansible dust cover or shutter 23 to engage the inner surface 35 of the pocket

in which the shutter is mounted. Such engagement of the lug 33 with the surface 35 positively limits the inward movement of the key and defines the position at which all of the tumblers are moved free of interlocking engagement with the notched plate 10.

The lug 33 is of such size as to be received in the pocket provided for the shutter 23 and to engage the inner face of the flange 9, as the key is turned from its position of insertion and retraction aligned with the notch 34. Consequently, it is impossible to retract the key except when the cylinder is in its position of rotation at which all of its tumblers are properly aligned with their respective notches 16 in the plate 10. In this manner, leaving the cylinder free for rotation without the use of a proper key is precluded.

To guard against successful picking, there are additional notches 16 in the plate 10, so that in the event an attempt to pick the lock is successful in freeing the cylinder for rotation from its fully locked position, it can be turned only a slight distance before the tumblers will again engage in notches 16 and thereby positively restrain further actuation of the cylinder.

Picking of the lock is further rendered difficult by the formation of grooves 36 on the opposite sides of the tumblers. These grooves, during an attempt to pick the lock, engage the edges of the notches 16 in the plate 10 upon the application of slight torsional force and prevent further endwise movement of the tumblers.

The embodiment of the invention illustrated in Figures 6 to 11 inclusive distinguishes from that form shown in Figures 1 to 5 inclusive, principally in the fact that the tumblers 37 in Figures 6 to 11 are all parallel and disposed side by side.

As in the embodiment described, the cylinder 5' is composed of two separate parts 14' and 15' permanently connected together during assembly. The casing 6' has an inturned flange 38 comparable to the disc 10 and the cylinder is insertable into the casing from its front end where it is retained by a cap 39 spun over a flange 40 on the casing 6'.

The tumblers 37 are slidably mounted in side by side parallel recesses 41 in the small diameter portion 15' of the cylinder and are yieldably urged forwardly by springs 42 disposed in pockets 43 which are staggered on opposite sides of the keyway 22' to permit a closer disposition of the tumblers.

Forwardly and rearwardly extending projections 44 and 45, respectively, on the tumblers slide in recesses 46 and 47 formed in the front and rear portions of the cylinder as extensions of the main tumbler receiving recesses 41.

Alternate tumblers project in opposite directions from the plane of the keyway 22', so that there are three tumblers whose outer side edges lie on one side of the cylinder and three tumblers whose outer side edges lie on the diametrically opposite side of the cylinder. These side edges of the tumblers normally engage in notches 48 in the inturned flange 38 to restrain the cylinder against rotation, and as in the embodiment herebefore described, the tumblers have notches 49 adapted to be aligned with the inturned flange 38 to free the cylinder for rotation upon inward movement of the tumblers, a proper distance by the endwise insertion of a key 50.

The inward movement of the key 50 is limited to properly align all of the tumbler notches 49 with the flange 38 by the engagement of a lug 75

51 with the bottom of a recess 52 forming a continuation of the keyway 22', as will be readily apparent from Figure 8. The inner end of the key is stepped to accord key engaging surfaces 53 of different heights as required to properly locate the tumblers.

To guard against picking, the notches 48 in the flange 38 have inner wide portions 54 to allow slight turning of the cylinder, and the tumblers are stepped as at 55 to provide shoulders engageable with the inner face of the inturned flange in the event of such slight rotation on the part of the cylinder while the tumblers are in their active positions. Consequently, when the cylinder is turned as is necessary during an attempt to pick the lock, all of the tumblers will be positively restrained against endwise movement and thus precluded from being moved to positions at which their notches 49 align with the flange 38.

Additional protection against picking is afforded by the provision of auxiliary notches 56 in the flange 38.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art to which this invention appertains, that this invention affords a novel lock of the end thrust type and that by reason of the fact that the tumblers themselves are used to interlock with a stationary casing part, simplicity of construction is assured.

It is also apparent that the lock of this invention affords exceptional security and is particularly well protected against picking and also against decoding, decoding being impossible by virtue of the fact that when all of the tumblers are brought to their inactive positions by their respective springs, the key contacting surfaces of all of the tumblers lie in a common plane.

What I claim as my invention is:

1. In a lock, a bored casing having an inwardly directed flange at each end, a cylinder rotatable in the casing and having a large diameter part disposed in the casing between said flanges and a small diameter part projecting from one end of the casing, a tumbler carried by the cylinder and yieldably maintained in a position with a part thereof disposed within said large diameter part and projecting from the shoulder at the juncture of the large and small diameter portions of the cylinder and into interlocking engagement with the adjacent flange, and said tumbler being so shaped as to be freed from interlocking engagement with the flange upon key actuated movement of the tumbler to a predetermined position to free the cylinder for rotation.

2. A lock of the character described comprising, a casing, an inturned flange at each end of the casing, a cylinder rotatable in the casing, said cylinder having a large diameter part disposed between the flanges of the casing and a small diameter part projecting beyond one flange, a plurality of tumblers slidable longitudinally in the cylinder, means to yieldably maintain the tumblers in positions with portions thereof disposed within said large diameter part and projecting from the shoulder at the juncture of the large and small diameter portions and into notches in the adjacent flange to hold the cylinder

against turning, and said tumblers having notches adapted to be aligned with said flange upon inward movement of the tumblers by a proper key to free the cylinder for rotation.

3. In a lock of the character described, a casing, a cylinder rotatable in the casing, said cylinder comprising a large diameter part disposed in the casing and a separate small diameter part permanently attached to the large diameter part and extending into the large diameter part so that its inner end is disposed inwardly of the shoulder between the large and small diameter parts of the cylinder defined by the adjacent end of the large diameter part, the small diameter part having a tumbler receiving recess extending longitudinally of the cylinder and opening to its circumference and to its inner end, whereby said end of the recess is inwardly of the shoulder and is closed by said large diameter part, a tumbler slidable longitudinally of the cylinder in said recess, spring means yieldably maintaining the tumbler in a position engaging the large diameter part in which position the tumbler projects from the shoulder at the juncture of the large and small diameter parts, a casing carried member at the juncture of said large and small diameter parts of the cylinder having a notch to receive the tumbler when in its normal position, and said tumbler having a notch adapted to be aligned with said casing carried member upon movement of the tumbler to a predetermined position by a proper key.

4. In a lock of the character described, a casing having an inturned flange at one end, an apertured disc fixed at the other end of the casing and forming a shoulder extending inwardly of the casing bore, a cylinder having a large diameter part disposed in the casing between the flange and the apertured disc and a small diameter part projecting through the aperture in the disc, a plurality of tumblers slidable longitudinally of the cylinder and yieldably maintained in a position slidably projectible from the shoulder at the juncture of the large and small diameter cylinder parts into notches in said apertured disc to normally restrain rotation of the cylinder, and said tumblers having notches adapted to be aligned with the disc to free the cylinder for rotation upon movement of the tumblers to predetermined positions by a proper key.

5. In a lock of the character described, a casing, a lock cylinder rotatable in the casing, a plurality of key operable tumblers mounted in the cylinder for movement longitudinally of the cylinder, said tumblers having portions thereof projecting from the cylindrical surface of the cylinder, a notched wall carried by the casing adjacent said tumblers, the tumblers engaging in the notches to restrain rotation of the cylinder and being so shaped as to be free of the notched wall upon movement to predetermined positions by a proper key, and said notches being of such width as to permit a slight degree of turning on the part of the cylinder with the tumblers in their operative positions and the tumblers being stepped so that upon such slight turning of the cylinder, the stepped portions of the tumblers engage the notched wall and prevent endwise movement of the tumblers.

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