July 2, 1935. H. F. KEIL 2,007,142

LOCK CONSTRUCTION

Filed Dec. 16, 1933

Fig. 1.

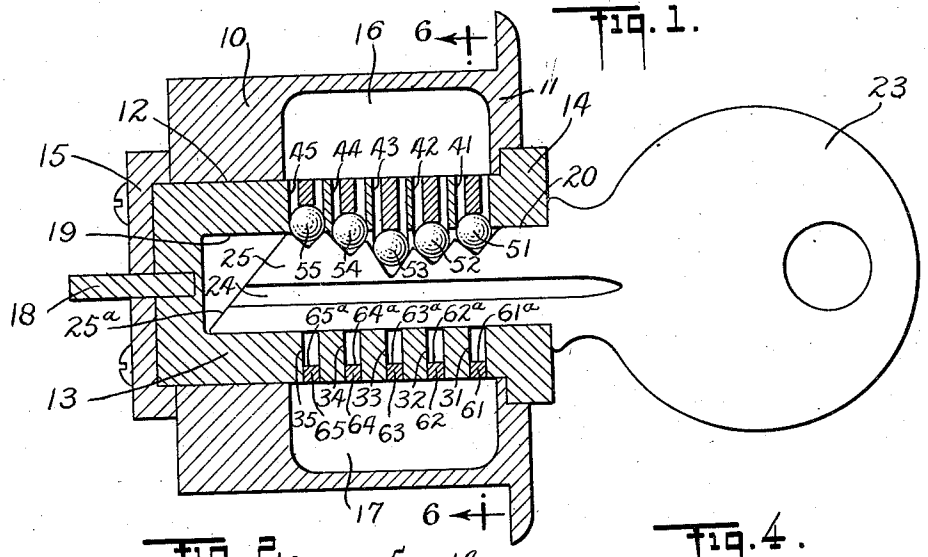


Fig. 2.

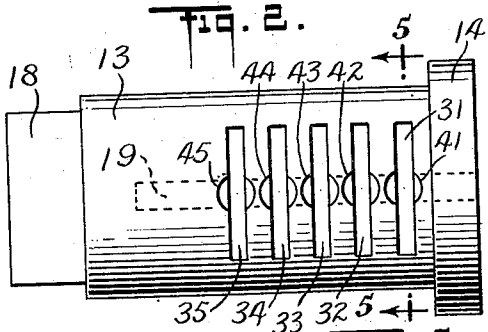


Fig. 4.

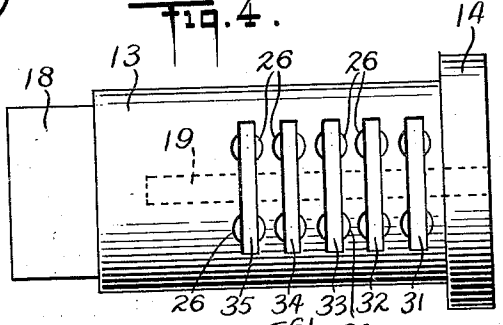


Fig. 3.

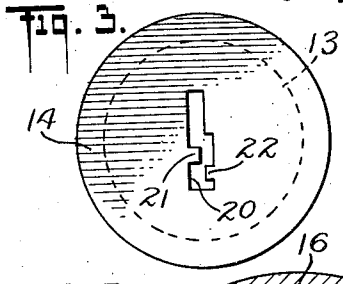


Fig. 5.

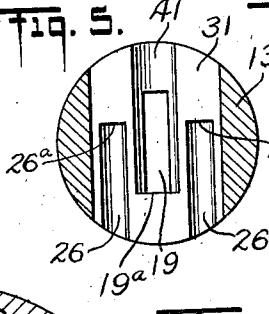


Fig. 7.

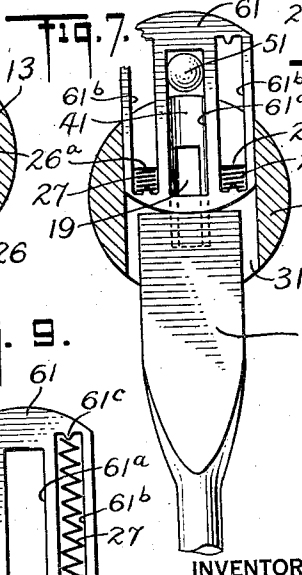


Fig. 8.

Fig. 6.

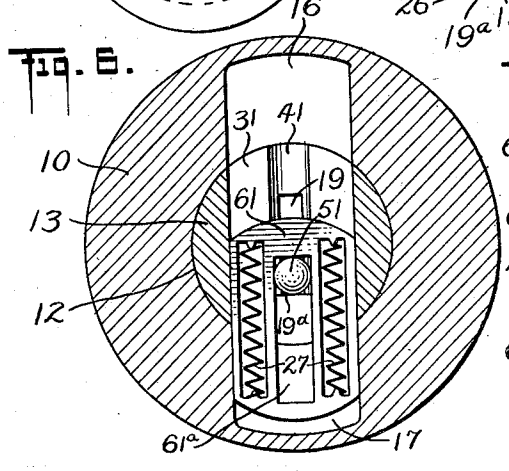
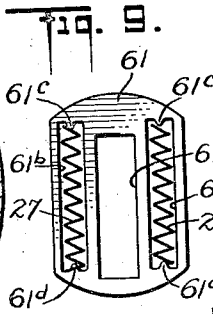


Fig. 9.



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2,007,142

LOCK CONSTRUCTION

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Application December 16, 1933, Serial No. 702,690

15 Claims. (Cl. 70—46)

This invention relates to lock construction, particularly to key-controlled lock construction.

One of the objects of this invention is to provide a simple, practical, inexpensively and efficiently-operating key-controlled lock construction. Another object is to provide a lock construction in which the actuation under the control of the key is positive, smooth, easy and reliable. Another object is to provide a lock construction in which the setting of the tumblers or the like by the coded key edge may be achieved with the minimum or manual effort, to achieve either unlocking or locking. Another object is to provide a lock construction in which sheet metal tumblers of inexpensive character may be dependably employed without danger or risk of binding action, without jamming of tumblers with respect to the key, or without offering difficulty in manual actuation of the key itself. Another object is to provide a lock construction of the above-mentioned character in which balls or rollers may be dependably employed while achieving facility of assembly, inexpensiveness of manufacture, and absence of spilling of the parts in either assembly or disassembly. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is shown one of various possible embodiments of my invention;

Figure 1 is a vertical central sectional view of my lock construction, shown with a key related thereto;

Figure 2 is a top plan view of the lock cylinder per se;

Figure 3 is an end view of the lock cylinder, as viewed from the right in Figure 2;

Figure 4 is a bottom plan view of the lock cylinder, as seen from the under side of Figure 2;

Figure 5 is a vertical sectional view of the cylinder, as seen along the line 5—5 of Figure 2;

Figure 6 is a vertical sectional view, for example as seen along the line 6—6 of Figure 1, but with the key removed;

Figure 7 is a transverse sectional view through the lock cylinder showing the manner of assembly or disassembly of certain parts;

Figure 8 is a side view of an implement that may be employed in achieving assembly or disassembly of the parts shown in Figure 7, and

Figure 9 is a front elevation of one of the tumblers associated with the lock construction.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring first to Figures 1 and 6, I provide a lock casing 10, generally cylindrical in shape, adapted to be fitted into a suitable hole or bore in a door or the like and provided with a flange or escutcheon 11 adapted to abut against a front face of the door; the casing 10 may be anchored or secured to the door in any suitable or well-known manner.

The casing 10 is provided with a cylindrical bore 12 (Figures 1 and 2) extending entirely therethrough and in which is snugly but rotatably received a cylindrical plug or lock cylinder 13 (Figures 1 and 6), the latter having a front flange 14 adapted to abut against the right-hand or outer face of the escutcheon 11 (Figure 1) and provided at its other end with any suitable detachable means 15 adapted to abut against the rear or left-hand face of the casing 10, parts 14 and 15 holding the rotatable cylinder 13 against axial movement while permitting free rotation thereof in the bore 12 of the casing 10. The casing 10 is provided with diametrically opposed longitudinally extending recesses 16 and 17 (Figures 1 and 6) into which extend or out of which may be withdrawn the tumblers carried by the lock cylinder 13, depending upon whether rotation of the cylinder 13 is to be precluded or permitted, the cylinder 13 having at its left-hand end (Figure 1) an operating or connecting means 18 by which a bolt (not shown) of any suitable form of bolt or latch mechanism (not shown) may be controlled or operated by the rotation of the cylinder 13.

Referring now to Figures 2, 4 and 5, the cylinder or plug 13 has extending along its axis a key-receiving slot 19 generally rectangular in cross-section (see also Figure 1), the front flange 14 (Figures 2 and 3) of the cylinder 13 having a key-receiving opening 20 alined with the slot 19 but shaped in any suitable manner, as indicated in Figure 3, as by the provision of prongs or projections 21—22, intended to coact with longitudinally extending grooves in the sides of the key 23 (Figure 1), one of the grooves 24 in the shank 25 of the key 23 being clearly shown in Figure 1.

Extending transversely through the cylinder 13 and extending from top to bottom thereof, as viewed in Figures 1 and 3, is a plurality of tumbler-receiving slits; these slits may be of any de-

sired or suitable number and in the drawing they are illustratively shown as five in number; accordingly, these five slits (Figures 1, 2 and 4) are indicated by the reference characters **31**, **32**, **33**, **34** and **35**, and they will be seen to be rectangular in cross-section (Figure 2) and to be shaped at suitable intervals lengthwise of the plug or cylinder **13**. This spacing in an axial direction of course determines the spacing of the five tumblers respectively received in these slits and this spacing may be of any appropriate or suitable intervals, depending upon the kind or type of coded edge desired to be employed on the shank **25** of the key **23** (Figure 1). These slits, moreover, cross or intersect the key-receiving slot **19**, so that when a key shank **25** is inserted into the slot **19**, the key passes substantially centrally but transversely across these slits.

On the under side of the cylinder **13** (see Figure 4) and extending between the remotest edges of, and parallel to the slits **31**, **32**, etc. are substantially cylindrical recesses **26**, preferably two for each slit, and one in each side of the center plane of the cylinder, formed as by drilling, and constituting virtually enlarged cylindrical channels or recesses. In Figure 5 one of the slits, such as the slit **31**, is better seen and also part of the two cylindrical recesses **26** that are connected with it. The recesses **26**, as is pointed out hereinafter, receive, and form respective housings for, helical expansible springs, the bottom edges **26a** forming a base against which one end of the respective springs abuts.

As is better shown in Figure 4, these spring-receiving recesses **26** are alternately on opposed edges of the successive slits, this arrangement being preferred in order to achieve closer spacing of the slits and hence of the tumblers carried by the latter.

Referring again to Figure 2, I provide a plurality of cylindrical channels **41**, **42**, **43**, **44** and **45**, one for each of the slits **31**, **32**, **33**, **34** and **35** respectively, and these, to facilitate a quicker understanding of the construction, may be formed by drilling cylindrical holes centrally and lengthwise of the slits, down to the bottom **19a** (Figures 5 and 6) of the key-receiving slot **19**. Of course, these channels **41**, **42**, etc. may be formed in any suitable manner, even other than the above-mentioned drilling. Moreover, the radius of the cylindrical channels **41**, **42**, etc. is greater than half the horizontal width of the key slot **19** or, stated differently, the diameter of the cylindrical channels **41**, **42**, etc. is greater than the width of the key slot **19**, as clearly appears in Figures 2 and 5.

These vertically extending channels **41**, **42**, etc., which terminate at the bottom **19a** of the key slot **19** and which are open (see Figures 1 and 2) at the top of the cylinder **13**, are to receive respectively round or roller members and, where these channels are circular in cross-section or cylindrical, as above described in connection with the preferred form of my invention, these members take the form of balls, there being one ball received in each channel, and in Figure 1 I have shown balls **51**, **52**, **53**, **54** and **55** received respectively in the guiding channels **41**, **42**, etc., being guided by the latter for up and down movement or for movement toward or away from the bottom **19a** of the key slot **19**.

These balls are snugly fitted into their respective channels and (see Figure 6) have a diameter greater than the width of the key slot **19**; thus they cannot move lengthwise of the key slot **19** though they are free to move up and down along the guiding channels **41**, **42**, etc. Also, these balls will thus be seen to be presented to the key slot **19** and hence to the coded or usually serrated edge of the shank **25** of the key **23** that is to be inserted into the key slot **19** (see Figure 1).

In the slits **31**, **32**, etc. are slidably mounted and guided a plurality of tumblers **61**, **62**, **63**, **64** and **65**, respectively (see Figure 1), these tumblers being also ball-retaining devices. The tumblers preferably are of sheet metal, generally of rectangular shape, as is better shown in Figure 6, where tumbler **61** is shown in side elevation. They are guided for free sliding movement in the respective slits **31**, **32**, etc., the recesses **16**—**17** (Figure 6) in the casing **10** being of sufficient width to receive the upper or lower ends respectively of the tumblers, depending upon the positions which they happen to have. Each tumbler has formed therein an open space and this I achieve preferably by forming in the tumbler an aperture which is preferably rectangular, thereby leaving an open space surrounded by the material of the tumbler. In Figure 1 the apertures which thus form the open spaces are indicated at **61a**, **62a**, **63a**, **64a** and **65a**, respectively, in the tumblers **61**, **62**, **63**, **64** and **65**, but as appears clearly in Figure 1, the vertical height of these rectangular apertures varies according to the code which the particular lock mechanism is to have and which, of course, the coded key shank **25** is to have. These apertures are of greater width than the width of the key slot **19** and are of sufficient width to receive therein the above-mentioned balls. In Figure 6 the aperture **61a** of the wafer-like tumbler **61** is clearly shown as having a width greater than the key slot **19** and of a width sufficient to receive the ball **51**, a similar relation existing with respect to the other tumblers and balls, even though the vertical dimension of the apertures varies as above-mentioned.

Each wafer or tumbler **61** has two laterally displaced rectangular apertures or slots **61b** (see Figure 9), each slot having prongs **61c** and **61d** projecting from top and bottom thereof for receiving thereover the respective ends of a spring **27**, the springs being snugly received within slots **61b** but projecting laterally from the two faces of the tumbler **61**. Each spring **27** is a coiled spring and is compressible, their constant tendency to continue to expand tending to hold the tumbler **61** in lowermost position, ball **51** acting as a stop, inasmuch as the ball rests against the bottom **19a** of the key slot **19**. The springs **27**, each having one end resting on the bottom **26a** of its recess, thus normally project the tumbler **61** out of its slit and into the recess **17** of the casing **10**, thus to prevent rotation of the cylinder **13** relative to the casing **10**. A similar relation of springs and ball exists, of course, with respect to the other tumblers, each of which is thus projected into the recess **17** by an amount depending upon the vertical dimension of the rectangular aperture in the tumbler. I may employ only one spring **27** for each tumbler, but the use of two gives a balanced action, particularly with respect to the key, resulting in important advantages.

The upper cross-portion of each tumbler thus blocks the ball directly underneath it from moving or dropping out of its channel; this structural relation is clearly shown in Figure 2 and also in Figure 6, the springs **27** normally maintaining the balls **51** imprisoned between the key slot bottom **19a** and the upper cross-portion of its tumbler.

This action is of great importance in assembling or disassembling the lock mechanism, particularly for purposes of repair. The cylinder 13 may be freely removed from the casing 10 without danger of the parts falling apart and without danger of losing the balls or any of them. Vice versa assembly of the assembled plug or cylinder 13 to the casing 10 and related parts may be quickly and easily achieved without having to cope with a multiplicity of minute parts, such as balls, springs, or the like.

Normally, as above noted, the balls 51, 52, etc. substantially bottom against the bottom 19a of the key slot 19; I may, however, where desired, make the channels 41, 42, etc., or any of them, of less depth, so that the balls, or any desired one or more of them, are held by the bottom or bottoms of the channels 41, 42, etc. somewhat above the key slot bottom 19a if that arrangement is desired. In either event, the balls are, nevertheless, exposed to the key slot 19 and in the path of movement of the coded edge of the shank 25 (Figure 1) of the key 23.

Accordingly, when the key is inserted into the slot 19, it passes successively through the hollow tumblers or through the apertures thereof, but in so doing the balls (in a direction from the right to the left, as viewed in Figure 1) roll up the inclined front edge 25a of the key shank 25, thus without friction, jamming, or mechanical resistance, successively raising the tumblers 61, 62, etc., the balls continuing to roll along the coded or serrated or notched edge of the key shank 25, also without friction, jamming, rasping, or mechanical resistance, the lifting movement of the wafers being opposed by the springs 27 (see Figure 6), the springs 27 insuring that the balls and hence the tumblers faithfully follow the coded key contour. When the key finally comes to rest and if it is of the proper coded edge, as shown in Figure 1, for the different dimensions or height of the apertures in the different tumblers, each ball becomes seated in its intended recess or notch in the key edge, the parts being, of course, appropriately proportioned, as will now be well understood, so that all of the tumblers are lifted out of the recess 17 in the casing 10 (Figures 6 and 1) and are brought entirely within the confines of the cross-section of the cylinder 13, as is also clearly shown in Figure 1, whereupon the cylinder 13 may be rotated by the key 23 to operate the bolt or lock or related mechanism through the member 18 (Figure 1) and if the key and plug 13 are given a 180° rotation and then the key withdrawn, the tumblers are projected out of the cylinder 13 and into the upper recess 16 in the casing 10 (Figures 1 and 6) whereupon the cylinder 13 again becomes locked against rotation.

Referring to Figure 1;—Because of the features of construction above described, I am enabled to greatly increase the range of codification, within a given number of tumblers, of locks employing this type of tumbler; it has heretofore been a vital deficiency and limitation in causing the coded key edge to operate directly upon these sheet metal tumblers because of the rasping, jamming, or binding action of the wafers with respect to the inclined edges of the coded key shank; in fact, the depth of the notches in the keys have been limited because it was impracticable, on account of the binding of tumblers against the inclined key edge, to effect lifting or movement of the tumbler out of a depressed or projected depth as great as was otherwise available. Also, the difficulty was accentuated because, particularly in inserting and in withdrawing the key, a plurality of these tumblers would bind against a plurality of inclined edges on the key. Also, inoperativeness of lock constructions has resulted from these defects.

With the construction of my invention, however, aside from features already above-mentioned, all of these deficiencies and limitations are done away with; I am enabled to use greater depths of notches in the keys and hence I am enabled to greatly enlarge the combinations or "changes" available for a given number of tumblers.

To illustrate, note the depth of the key notch in which the ball 53 in Figure 1 is seated, as compared to the depth of notch in which the bail 55 is seated. In between these two depths, assuming for illustration that they represent respectively the maximum and minimum depths, I may provide any desired or appropriate number of increments or intermediate depths, any one or more of which may be allotted to other notches in the key. But such a wide range of different depths was heretofore impossible.

Referring again to the non-spilling feature of my construction, reference may now be had to Figures 7 and 8. In Figure 7 is illustrated the mode of assembly or disassembly. First, the two springs 27 are inserted into the spring-receiving slots 61b, being engaged by the prongs 61c and 61d; then a tumbler, such as tumbler 61, is inserted into the slit 31, from the bottom thereof, as viewed in Figure 7, springs 27 entering the spring housings or recesses 26 and each bottoming its one end on bottom 26a of its guiding channel 26.

Then the insertion of the tumbler is followed by an implement 28 (Figures 7 and 8) whose thin sheet-like edge fits into the slit 31. By means of the implement 28 the wafer 61 is pushed sufficiently through to the other (upper) side of the plug 13 so that the ball 51 may now be put into the aperture 61a and dropped into its channel 41. Withdrawing the instrument 28, spring 27 expands, forcing the tumbler 61 downwardly, as viewed in Figure 7, whereupon ball 51 bottoms in the channel 41 and acts as a stop to further downward movement of the tumbler 61. Thus ball 51 becomes imprisoned, as above explained, but also ball 51 blocks the movement of the tumbler in the only direction (downwardly as viewed in Figure 7) in which it can be removed from the cylinder 13. Also, ball 51 thus prevents spring 27 from dropping out of its recess.

To disassemble, the reverse procedure is followed. Implement 28 is used to push the tumbler 61 against the action of spring 27 to a sufficient extent to expose a sufficient amount of the aperture 61a to permit the ball 51, after the latter has moved out of the channel 41, to be removed in a direction transverse to the plane of the tumbler 61.

Thus, in manufacture, assembly, disassembly, or repair, these otherwise minute parts are mutually interlocking, cannot fall apart, cannot spill, and thus repair of replacement or assembly of the parts, as well as disassembly, is achievable with great speed and facility.

Thus, it will be seen that there has been provided in this invenion a construction in which the various objects above noted, together with many thoroughly practical advantages, are achieved.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter here-

inbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being insertable into and slidably received within and guided by one of said slits, a plurality of balls respectively received within the apertures in said tumblers and insertable therein upon said tumblers being sufficiently projected out of their respective slits and upon said tumblers being moved back into their respective slits, being thereby exposed to said key-receiving slot, a plurality of channels extending parallel to said slits from the exterior of said cylinder to said key-receiving slot and dimensioned to receive therein and guide respectively said plurality of balls for movement of the latter in a direction lengthwise of said slits, whereby the coded longitudinal edge of a key inserted into said key slot is contacted by said balls and acts through the latter to shift the positions of said tumblers according to the coded edge of the key, and a plurality of spring means, one for each of said tumblers, acting upon the latter to move and hold the tumblers in their respective slits in a direction to move the respective balls inwardly of their respective channels, whereby said balls are prevented from dropping out of their respective channels, said tumblers having a range of movement in their respective slits in a direction opposite to the action of said spring means sufficient to expose the aperture in each tumbler to the other side of said cylinder, thereby to permit insertion of said balls upon said tumblers being sufficiently projected out of said slits against the action of said spring means.

2. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being slidably received within and guided by one of said slits, a plurality of round members respectively received within the apertures in said tumblers and thereby exposed to said key-receiving slot and thereby exposed to the coded edge of a key inserted into said slot, and means for preventing movement of said members in a direction lengthwise of said key slot while permitting movement thereof in the direction in which said tumblers move, said means comprising channels, one for each round member, running in the direction in which said tumblers are moved under the control of a key.

3. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being slidably received within and guided by one of said slits, said slits being open-ended on two opposite sides of said cylinder and said tumblers being shaped to be insertable into their respective slits and projectable out of either open end thereof, a plurality of round members respectively received within the apertures in said tumblers and thereby exposed to said key-receiving slot and thereby exposed to the coded edge of a key inserted into said slot, and means for preventing said members from displacement in a direction lengthwise of said key slot.

4. In lock construction, in combination a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being slidably received within and guided by one of said slits, spring means for each tumbler operating thereon to move its tumbler along its slit and away from said key slot, said tumblers having a range of movement and said spring means having a yieldability sufficient to allow each tumbler to be projected out of its slit against the action of its spring means and thereby expose its aperture exteriorly of said cylinder, and a plurality of members, one for each tumbler, received within the aperture in the tumbler for limiting said last-mentioned movement of said tumblers, said last-mentioned members being insertable in the apertures of the respective tumblers upon exposure thereof exteriorly of said cylinder when projected against the action of its spring means.

5. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being slidably received within and guided by one of said slits, spring means for each tumbler operating thereon to move its tumbler along its slit and away from said key slot, said tumblers having a range of movement and said spring means having a yieldability sufficient to allow each tumbler to be projected out of its slit against the action of its spring means and thereby expose its aperture exteriorly of said cylinder, and

a plurality of roller members each received within an aperture of a tumbler and exposed to said key slot and each acting to limit the movement of its associated tumbler under the action of the spring means acting upon its tumbler, said last-mentioned members being insertable in the apertures of the respective tumblers upon exposure thereof exteriorly of said cylinder when projected against the action of its spring means.

6. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being slidably received within and guided by one of said slits, said cylinder having a plurality of recesses extending respectively lengthwise of said slits and connected thereto, a spring in each of said recesses, means whereby said springs each engage a tumbler to move the latter along their respective slits and toward the coded edge of a key inserted into said key slot, and removable means coacting with said key slot for limiting the movement of said tumblers under the action of their respective springs and for preventing the tumblers from being disassembled from said cylinder.

7. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and along the axis, said cylinder having a plurality of transverse slits extending therethrough and spaced lengthwise of said cylinder, said key slot intersecting all of said slits, a plurality of plate-like tumblers having the shape substantially of a rectangle and each having a rectangular aperture therein whose length is greater than the larger of the two cross-sectional dimensions of said key-receiving slot, whereby a key entering said slot passes through the apertures in said tumblers, each tumbler being slidably received within and guided by one of said slits and capable of removal from either end of its slit, said cylinder having a plurality of recesses extending respectively lengthwise of said slits and connected thereto, a spring in each of said recesses, means whereby said springs each engage a tumbler to move the latter along their respective slits and toward the coded edge of a key inserted into said key slot, said springs, but for an inserted key, tending to project their respective tumblers out of their respective slits in one direction and acting to prevent projection of said tumblers out of their respective slits in the opposite direction, a plurality of rotatable members respectively received within the apertures in said tumblers and thereby exposed to said key-receiving slot, each rotatable member being insertable into the aperture of a tumbler upon the latter being sufficiently projected out of its slit against the action of its spring, and a plurality of channels extending parallel to said slits from the exterior of said cylinder and dimensioned to receive therein and guide respectively said plurality of rotatable members for limited movement of the latter in a direction toward said key-receiving slot, whereby said rotatable members limit the movement of said tumblers under the action of their respective springs and whereby said rotatable members are exposed for contact by the coded edge of a key inserted into said key slot.

8. In lock construction, in combination, a rotatable lock cylinder having a key-receiving slot extending lengthwise thereof, said cylinder having a plurality of transversely extending guiding channels, a plurality of tumblers, each insertable lengthwise into and thereby received within one of said guiding channels, said tumblers each having spring means for urging it in a direction along its guiding channel opposite to the direction in which the tumbler was inserted into its guiding channel and each having means separate therefrom but operatively related thereto and projecting transversely from the plane thereof and thereby adapted to abut against the bottom of said key-receiving slot for limiting movement of the tumbler under the action of its spring.

9. In lock construction, in combination, a rotatable lock cylinder having a key-receiving slot extending lengthwise thereof, said cylinder having a plurality of transversely extending guiding channels, a plurality of tumblers, each contained within one of said guiding channels and freely projectable out of its guiding channel in a direction transverse to said key slot, said tumblers each having therein an open space, and a plurality of roller devices, one for each tumbler, received within the open space of the respective tumblers for preventing free projection thereof in at least one direction relative to and outwardly of their respective guiding channels, said roller devices being exposed to said key-receiving slot.

10. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and having a slit extending transversely therethrough and intersecting said slot, said cylinder having a spring-receiving channel extending from one side of said cylinder alongside of and connected to and substantially parallel to said slit, a spring in said channel, a plate-like tumbler having an aperture therein and slidably mounted in said slit and having a projection received within said channel and engaged by said spring, said spring normally forcing said tumbler in one direction out of said slit, and means receivable and resting in said aperture for limiting the action of said spring and for thereby preventing said spring from forcing said tumbler out of said slit.

11. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and having a slit extending transversely therethrough and intersecting said slot, said cylinder having a spring-receiving channel extending from one side of said cylinder alongside of and connected to said slit, a spring in said channel, a plate-like tumbler having an aperture therein and slidably mounted in said slit and having a projection received within said channel and engaged by said spring, said spring normally forcing said tumbler in one direction out of said slit, and a ball member within said aperture, said cylinder having a channel open from the side thereof substantially opposite the side at which said spring-receiving channel is opened along which said ball is guided.

12. In lock construction, in combination, a solid lock cylinder having a key-receiving slot and means for guiding a tumbler relative to a key in said slot, a tumbler in said cylinder, said tumbler being apertured and having received therein a spring, said cylinder having channel means against the bottom of which one end of said

spring may abut, whereby the other end acts upon said tumbler.

13. A self-contained spring-opposed tumbler for a lock cylinder comprising a plate like member having an aperture through which a key may pass and having another aperture provided at opposed ends with means for holding a spring in said second-mentioned aperture, and a spring in said second-mentioned aperture and held in place by said means.

14. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof and having a slit extending transversely therethrough and intersecting said slot, said cylinder having a spring-receiving channel extending from one side of said cylinder adjacent to and in communication with said slit, a spring insertable into said spring-receiving channel from the said one side of said cylinder, a tumbler insertable into said slit from that end of the latter on the said one side of said cylinder and having means for engaging said spring, a second channel extending from the opposite side of said cylinder and in communication with said slit, said tumbler being projectable against the action of said spring to cause the tumbler to project out of that end of the slit on that side of the cylinder from which said second channel extends, and a ball member insertable into said second channel while said tumbler is so projected whereby, upon release of said tumbler, said spring moves the tumbler in reverse direction along its slit, said tumbler having means for engaging said ball upon its said movement in reverse direction along its slit, whereby said spring and ball mutually coact to retain each other and said tumbler in assembled relation to said cylinder.

15. In lock construction, in combination, a lock cylinder having a key-receiving slot extending lengthwise thereof, said cylinder having a plurality of slits extending transversely therethrough from opposite sides of said cylinder and intersecting said slot, said cylinder having spring-receiving channels all extending from one of said sides of said cylinder inwardly of the latter and each being alongside of and in communication with a slit and having a second plurality of channels extending from the other of said sides of said cylinder inwardly of the latter and each alongside of and in communication with a slit, a spring in each of said spring-receiving channels and insertable therein from said one side of said cylinder, a tumbler in each of said slits and insertable thereinto from said one side of said cylinder and capable of being projected, agains the action of its spring, out of its slit at the other side of said cylinder, a roller member insertable into each of said second-mentioned channels from the ends of the latter at said other side of said cylinder, each tumbler having means shaped, when the tumbler is thereupon released and returned by its spring, to engage its associated roller member and hold the latter in its channel, each roller member thereby acting to limit the movement of its tumbler under the action of its associated spring.

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