Aug. 23, 1960 T. H. JOHNSTONE 2,949,762

LOCK

Filed May 23, 1958 3 Sheets-Sheet 1

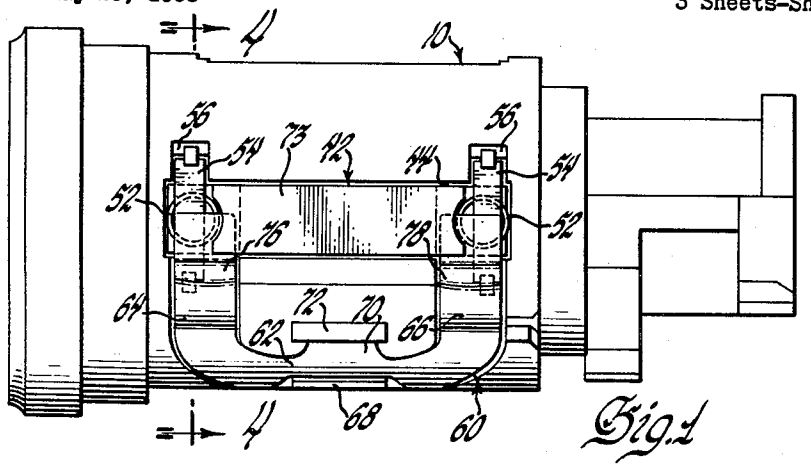

Fig. 1

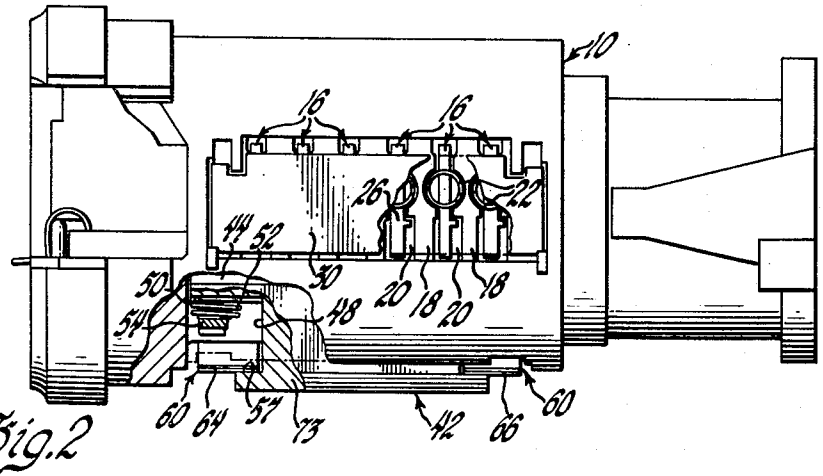

Fig. 2

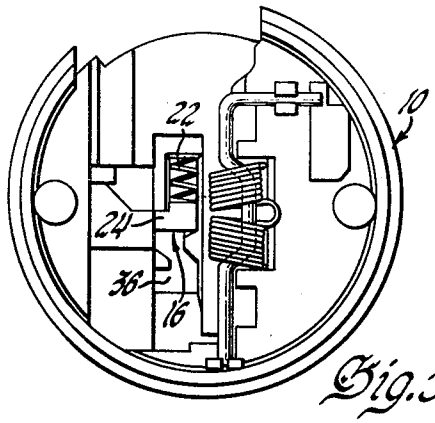

Fig. 3

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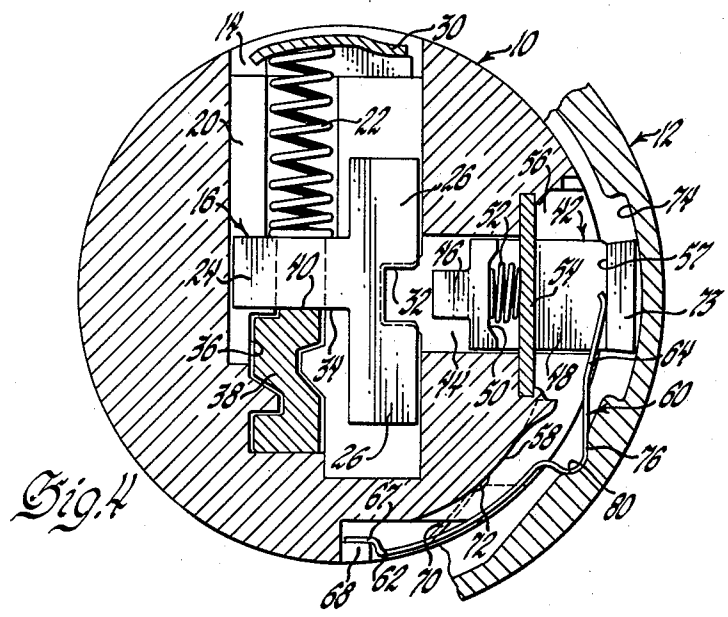

Fig. 4

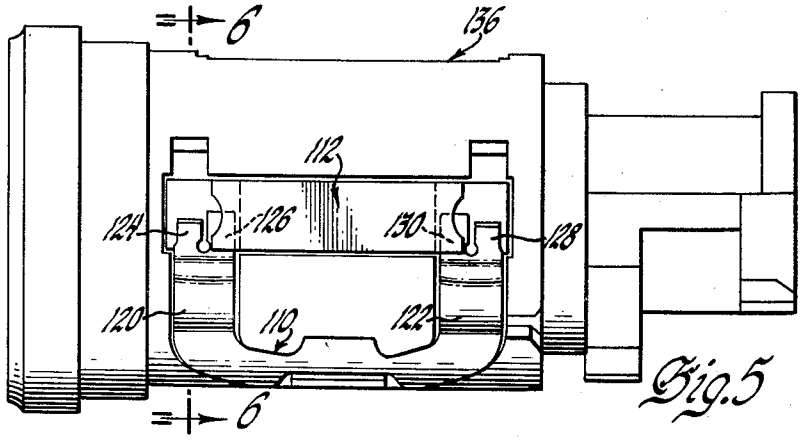

Fig. 5

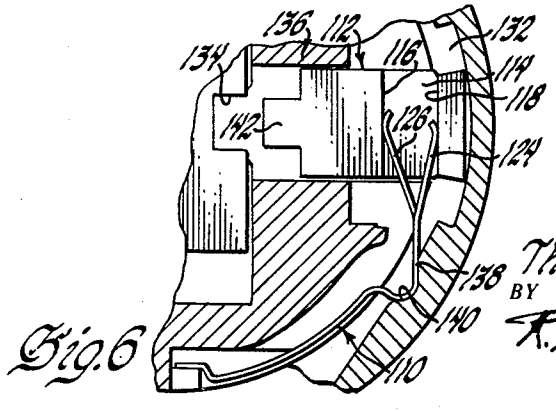

Fig. 6

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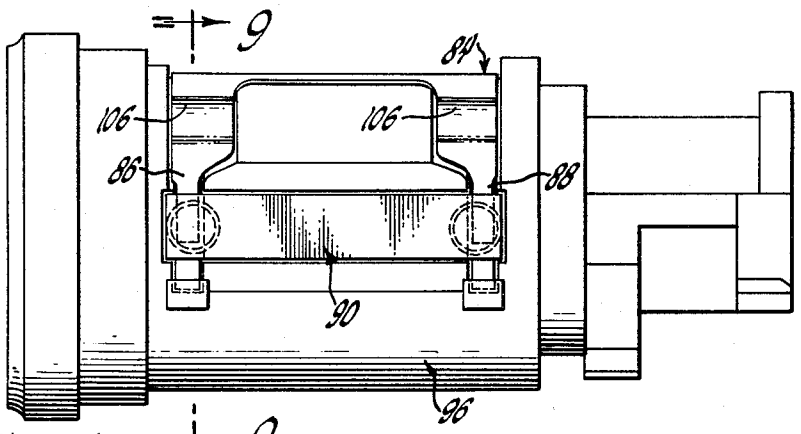

Fig. 7

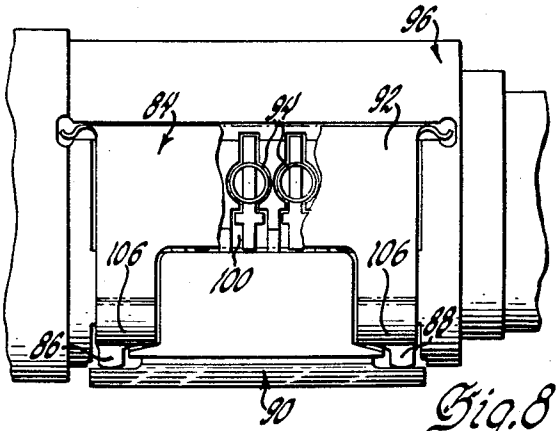

Fig. 8

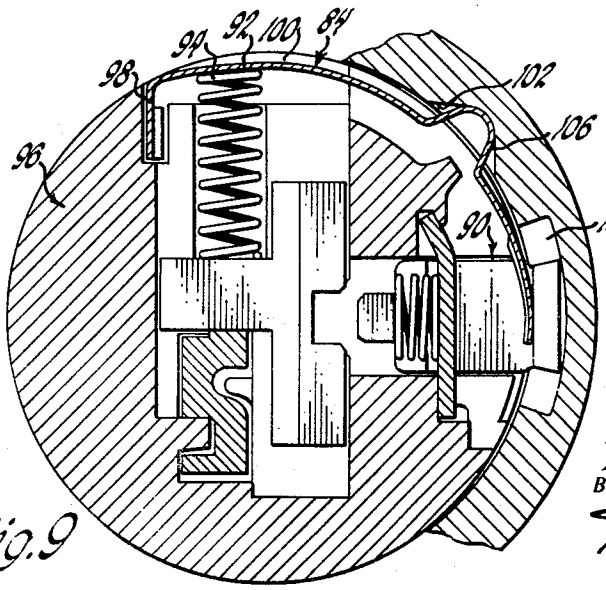

Fig. 9

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LOCK

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Filed May 23, 1958, Ser. No. 737,352

12 Claims. (Cl. 70—364)

The present invention relates to a new and improved lock construction and more particularly a lock intended for use with automotive vehicles. With locks adapted for use with automobiles there has been a serious problem of key interchangeability which the present lock mechanism seeks to alleviate.

Every lock is designed to be opened by a particular key, however, due to the geometry of the tumblers and keys coupled with tolerance build-ups during manufacture of lock mechanisms, it is possible for extraneous keys to open a given lock. This is what is referred to as interchangeability.

In the type of cylindrical lock with which the present invention is concerned, a plurality of aligned tumblers are provided and each of which tumblers has a notch therein. The tumbler notches may be aligned to permit a common side locking bar to enter therewithin thereby permitting the lock to be opened. In the traditional manner, a key is provided which when inserted in the lock cylinder will position the tumblers to align the aforesaid notches.

In previous locks of this type, it has been the practice to use a tapered end on the side bar locking member which corresponded in size and shape to the similarly tapered notches in the tumblers. The tapered design was for the purpose of permitting the spring biased tumblers to cam the side bar into a locking position when the key was removed. However, the tapered configuration of the notch and side bar locking member along with the tolerance build-up within the lock components made it possible for certain extraneous keys to line up the tumbler notches sufficiently well, even though imperfectly, to enable the tapered portion of the side locking bar to enter within the partially aligned notches to permit the lock to be opened.

The present invention represents an improvement in this type of lock construction which considerably reduces the possibility of key interchangeability by increasing the number of lock combinations which may be employed therewith. More specifically the present invention eliminates the use of tumbler notches and side locking bars of the tapered type. Instead, rectangular tumbler notches and a correspondingly rectangularly shaped side bar locking member are employed in such a way as to necessitate more nearly perfect alignment of the tumbler notches before the side bar locking member may be moved therewithin to unlock the lock mechanism.

In addition, a novel side bar actuating mechanism has been provided for coaction with the improved tumbler and side bar configuration.

Other objects and advantages of the present mechanism will be apparent from a perusal of the detailed description which follows.

In the drawings:

Figure 1 is a view of a lock cylinder removed from its housing;

Figure 2 is a view of a lock cylinder partially broken away to show the tumbler actuating mechanism;

Figure 3 is an end view of the lock cylinder;

Figure 4 is a cross-sectional view along line 4—4 of Figure 1;

Figure 5 is a view of a lock cylinder employing a modified form of the side bar actuating spring;

Figure 6 is a partial section along line 6—6 of Figure 5;

Figure 7 is a further modification employing another form of side bar actuating spring;

Figure 8 is a partially broken away view of the lock cylinder of Figure 7 showing the tumbler actuating mechanism; and

Figure 9 is a sectional view along line 9—9 of Figure 7.

Referring to the lock modification of Figures 1 through 4, a lock cylinder is shown at **10** and is adapted to be disposed within a lock housing **12**. As best seen in Figures 2 and 4, the lock cylinder has a longitudinally extending cavity **14** formed therewithin and adapted to receive a plurality of tumblers **16**. Cavity **14** is actually divided by a plurality of transverse walls **18** to provide a plurality of individual slots **20** within which each of the tumblers is disposed. The tumblers **16** are of approximately the same width as each of the cavity slots **20** and are adapted to slide therewithin.

As seen in Figure 4, the tumblers **16** are T-shaped and lie on their side so that springs **22** act against leg **24** of the tumbler to urge the same in a downwardly direction until the tumbler leg **26** bottoms within the cavity slot **20**. Each tumbler is biased by individual springs **22** which are retained by a common retaining member **30** substantially covering the open end of the cylinder cavity **14**.

Tumblers **16** are identical save for the disposition of notches **32** disposed intermediate the ends of legs **26**. Thus when springs **22** cause tumbler legs **26** to bottom in cavity **20**, notches **32** are out of alignment preventing unlocking of the lock mechanism, infra.

A keyway **36** is formed in cylinder **10** and extends longitudinally through cavity **14** in subadjacent relationship to tumblers **16**. When the appropriate key **38** is inserted within keyway **36**, the cam surfaces or bitings **40** thereon engage the appropriate tumbler surfaces **34** to move the tumblers upwardly in varying degrees against the force of their respective springs **22**. In so doing, tumbler notches **32** are aligned to form a continuous longitudinally extending notch which is adapted to receive a side bar locking member **42**.

Side bar locking member **42** is slidably supported within another longitudinally extending cavity **44** generally disposed at right angles to the tumbler cavity **14**. At its inner end side bar locking member **42** includes a tongue or projection **46** of a rectangular shape corresponding to that of tumbler notches **32**. Further and as best seen in Figures 1 and 4, the longitudinally outer ends of side bar **42** are notched or recessed at **48** to provide seats **50** for spring members **52**. The other ends of springs **52** bias against a retaining plate **54** suitably fixed, as by staking, within an enlarged portion **56** of side bar cavity **44**. Springs **52** are provided at either end of bar **42** and normally bias the latter in a leftwardly or tumbler engaging direction as viewed in Figure 4.

Spaced from spring seats **50** on side bar member **42** are an additional pair of seats **57**.

A portion of the periphery of cylinder **10** is relieved at **58** in order to support a bifurcated spring element **60** therewithin. The bifurcated spring element **60** is generally of U-shaped construction, as seen in Figure 1, and is adapted to be mounted at its closed end **62** within cylinder recess **58** in such a way that the free ends of legs **64** and **66** respectively cooperates with the seat members **57** of side bar member **42**.

Spring 60 is supported upon cylinder 10 through a depressed portion 67 of closed end 62 which extends beneath a cylinder projection 68. At the same time a spring tang 70 on spring 60 cooperates with an elevated projection 72 on cylinder 10 to bias the spring to maintain depressed spring portion 67 beneath projection 68.

Spring 60 is formed and mounted upon the cylinder so as to outwardly bias side bar member 42 with a force sufficient to overcome the springs 52. Outward movement of member 42 causes the outer portion 73 thereof to project within a longitudinally extending notch 74 formed within lock casing 12. It is apparent that with side bar locking member portion 73 disposed within notch 74, rotation of lock cylinder 10, except to a very limited extent, is impossible. This then is the locked position of the lock mechanism.

Legs 64 and 66 of spring member 60 are formed with bumps or protuberances 76 and 78 thereon and which are adapted to fit within a correspondingly shaped groove 80 formed within the casing 12.

Upon the insertion of key 38 within keyway 36 tumblers 26 are positioned so that the respective notches 32 are aligned, supra, in which condition the side bar locking member tongue 46 may be moved within the notches permitting the mechanism to be unlocked. However, as already noted, the bifurcated spring member 60 exerts a stronger force on bar 42 than do springs 52 as a consequence of which the side bar locking member would be retained in its outward or locking position unless further actuation took place.

The further actuation of side bar 42 is achieved by initial rotation of the lock cylinder 10 which is possible due to the greater width of the casing notch 74 relative to the outer end 73 of the side bar. This initial cylinder rotation then causes the bumps or protuberances 76—78 of spring member 60 to be cammed inwardly in moving out of casing groove 80. This camming action in turn causes legs 64 and 66 to be moved inwardly and away from the seats 57 of the side bar locking member permitting springs 52 to move member 42 inwardly or to the left. Side bar tongue 46 may now project within the tumbler notches 32 causing outer end 73 of the side bar member to be retracted from casing notch 74. As a consequence full rotation of lock cylinder 10 may now take place thereby unlocking the lock mechanism. Until lock cylinder 10 is rotated back to a position permitting spring protuberances 76 to drop back into casing groove 80, legs 64 and 66 of the spring member 60 will be held out of operative engagement with side bar seats 57 whereby springs 52 retain the side bar locking member in its unlocked position.

As already noted, in previous lock devices of this general type, the tumbler notches as well as the side bar locking member portion cooperating therewith were of a tapered design. The purpose of making such a tapered construction was to enable the side bar locking member to be cammed out of engagement with the notch when the key was removed from the keyway. It is apparent that this would happen if the force of the tumbler springs is made greater than the force of the springs urging the side bar member into engagement with the tumbler notches. This tapered design, however, greatly enhanced the likelihood of key interchangeability for the reason that even though all of the tumbler notches were only partially aligned it was possible for the tapered end of the side bar to at least partially project within the notches. Due to the tolerance build-up of the lock components and ensuing looseness and clearances, the partial entry of the side bar within the tumbler notches is frequently sufficient to permit the lock to be unlocked.

This type of undesired lock operation is greatly reduced with the present lock design in which the rectangular tumbler notch and side bar configuration are employed. This improvement results from the fact that the tumbler notches must be substantially perfectly aligned to permit

to any extent the entrance therewithin of the squared end 46 of the side bar member. However, with this design it is no longer possible for the force of tumbler springs 22 to cam the side bar 42 out of engagement with the notches 32 when key 38 is removed from the keyway 36. It is this change in design which has made necessary the addition of the bifurcated spring element 60 which provides the latching or outward movement force of the side bar member 42. In this way the integrity of this type of lock has been greatly enhanced reducing the serious problem of key interchangeability.

While the subject lock design has been changed to eliminate the tapered relationship between the tumbler notch and the side bar locking member as will subsequently be considered in greater detail, the relative spring strength relationship between tumbler springs 22 and side bar springs 52 has been maintained. By maintaining the strength of springs 22 greater than that of springs 52 the anti-picking integrity of the lock is retained.

In the past such locks were picked or opened without a key by inserting a suitable tool within the keyway and progressively lifting each tumbler until the side bar locking springs moved at least a portion of the side bar within the tumbler notch. The pressure of the side bar spring was relied upon to hold a tumbler in aligned position while the next tumbler similarly moved to an aligned position. When all the tumblers were thus aligned the side bar would fully enter the tumbler notches unlocking the lock cylinder. This picking technique is foiled, however, by making the tumbler springs 22 sufficiently stronger than side bar springs 52 that the side bar is unable to press against each tumbler with sufficient force to resist the downward bias of the tumblers.

Figures 7 through 9 show a modified form of the lock mechanism of Figures 1 through 4. In this modification of the invention a slight reduction in the number of parts required is affected by a unique construction and positioning of the side bar actuating spring 84. In this form, the spring 84 is still of a bifurcated construction, and includes legs 86 and 88 which cooperate with side bar 90 in exactly the same manner as in the modification of Figures 1–4. However, the base portion 92 of spring 84 is made considerably wider than the earlier modification. The purpose of widening the base portion 92 is to enable it to also serve as the retaining means for the tumbler springs 94.

Spring 84 is positioned substantially on the opposite side of cylinder 96 as compared with the earlier modification. As thus positioned spring 84 is disposed proximate tumbler springs 94. Spring base 94 includes an inwardly projecting portion 98 suitably affixed to lock cylinder 96 such that the spring base is positioned in superadjacent relationship to the tumbler springs 94 retaining the latter within the tumbler cavity 100.

Likewise casing groove 102 is positioned on the opposite side of casing notch 104 in order to coact with spring protuberances 106. The actuation of the locking mechanism, per se, is the same as in the earlier version of Figures 1–4.

In the modification of Figures 5 and 6 a bifurcated spring element 110 is formed in such a way as to be capable of providing both the locking and unlocking movement to the side bar locking member 112 and in this way eliminates the use of spring members 52 of the modifications of Figures 1 through 4 and 7 through 9. In this modification the side bar locking member 112 includes notches 114 formed respectively at opposite ends thereof and which notches form seats 116 and 118.

Bifurcated spring member 110 includes legs 120 and 122 each of which is further bifurcated to provide spring arms 124—126 and 128—130.

The spring arms 124 and 128 are shorter and hence stiffer than the spring arms 126 and 130. Arms 124 and 128 are adapted to engage with seats 118 of locking bar member 112 to urge the latter in an outwardly or locking

position within casing notch 132. Spring arms 126 and 130, on the other hand, engage with seats 116 urging side bar 112 in an unlocking direction but with a lesser force than that exerted by arms 124 and 128 in the opposite direction. Both pairs of arms 124—126 and 128—130 are confined within notches 114 so that the arms of each pair exert opposite forces on bar 112 with the force differential, however, being in an outward or locking direction to position with the parts as shown in Figure 6.

With a key inserted in the cylinder keyway to align the tumbler notches 134 and further with initial rotation of the lock cylinder 136, spring protuberance 138 will be cammed out of casing groove 140 to reduce the force of spring arms 124 and 128 and correspondingly to increase the force of spring arms 126 and 130. As a result of the change of spring forces, the locking bar member 112 is now moved by spring arms 126 and 130 in a leftwardly or unlocking direction permitting the locking bar projection 142 to extend within the aligned tumbler notches 134 to unlock the locking mechanism.

While such modification is not shown, it is apparent from the modification of Figure 6 that the spring member 110 might be further modified to utilize a single arm which would similarly be capable of providing the bidirectional movement of the side bar locking member 112.

I claim:

1. A lock mechanism comprising a casing, a cylinder member rotatably mounted within said casing, a notch in said casing, a locking member slidably disposed within said cylinder and adapted to engage with said casing notch to prevent unlimited rotation of said cylinder, first spring means biased said locking member in a direction to disengage said member from said notch, tumbler means movably mounted in said cylinder, means biasing said tumblers to a position blocking movement of said locking member, recess means formed in said tumbler means, said tumbler means being movable to a position in which said recess means are aligned permitting said locking member to be moved therewithin whereby said locking member may move out of engagement with said notch, said notch and locking member being so related that limited relative movement therebetween is possible with said locking member projecting within said notch, and second spring means urging said locking bar into engagement with said notch against the force of said first spring means, and means for moving said second spring means out of operative engagement with said locking member.

2. A lock mechanism comprising a casing, a cylinder member rotatably mounted within said casing, a notch in said casing, a locking member slidably disposed within said cylinder and adapted to engage with said casing notch to prevent unlimited rotation of said cylinder, first spring means biasing said locking member in a direction to disengage said member from said notch, tumbler means movably mounted in said cylinder, means biasing said tumblers to a position blocking movement of said locking member, means for retaining the spring biasing means within said cylinder, recess means formed in said tumbler means, said tumbler means being movable to a position in which said recess means are aligned permitting said locking member to be moved therewithin whereby said locking member may move out of engagement with said notch, said notch and locking member being so related that limited relative movement therebetween is possible with said locking member projecting within said notch, and second spring means urging said locking bar into engagement with said notch against the force of said first spring means, and means for moving said second spring means out of operative engagement with said locking member.

3. A lock mechanism as set forth in claim 1 in which said second spring means comprises a bifurcated member having a base portion and a pair of spring legs extending therefrom, the base portion of said member being fixed to said cylinder whereby said legs engage with the locking member to bias the same out of the cylinder.

4. A lock mechanism as set forth in claim 3 in which said second spring moving means comprises a protuberance on each of said spring legs, and a groove formed in said casing proximate said protuberances when said locking member is aligned with said casing notch, said protuberances being biased within said grooves, initial movement of said cylinder relative to said casing causing said protuberances to be cammed out of said grooves to move said legs out of operative engagement with said locking member.

5. A lock mechanism comprising a casing, a cylinder member rotatably mounted within said casing, a notch in said casing, a locking member slidably disposed within said cylinder and adapted to engage with said casing notch to prevent unlimited rotation of said cylinder, first spring means biasing said locking member in a direction to disengage said member from said notch, a plurality of tumblers movably mounted in said cylinder, a spring biasing each tumbler to a position blocking unlocking movement of said locking member, a recess formed in each tumbler, said tumblers being movable to a position in which said tumbler recesses are aligned permitting said locking member to be moved therewithin whereby said locking member may move out of engagement with said notch, said notch and locking member being so related that limited relative movement therebetween is possible with said locking member projecting within said notch, and second spring means urging said locking bar into engagement with said notch against the force of said first spring means, said second spring means retaining the tumbler springs within said cylinder, and means for moving said second spring means out of operative engagement with said locking member.

6. A lock mechanism as set forth in claim 5 in which said second spring means comprises a bifurcated member having a base portion and a pair of spring legs extending therefrom, the base portion of said member being fixed to said cylinder whereby said legs engage with the locking member to bias the same out of the cylinder, the base portion of said member retaining the tumbler springs within said cylinder.

7. A lock mechanism comprising a casing, a cylinder member rotatably mounted within said casing, a notch in said casing, a locking member slidably disposed within said cylinder and adapted to engage with said casing notch to prevent unlimited rotation of said cylinder, a spring member mounted upon said cylinder for rotation therewith and adapted to coact with said locking member to move the latter within said cylinder, tumbler means movably mounted in said cylinder, means biasing said tumbler means to a position blocking movement of said locking member, recess means formed in said tumbler means, said tumbler means being movable to a position in which said recess means are aligned permitting said locking member to be moved therewithin whereby said locking member may be moved out of engagement with said notch, said notch and locking member being so related that limited relative movement therebetween is possible with said locking member projecting within said notch, said spring member normally biasing said locking member into said casing notch, and means responsive to initial relative movement between said cylinder and said casing for causing said spring member to move said locking member out of engagement with said notch.

8. A lock mechanism comprising a cylindrical casing, a cylinder mounted for rotation within said casing, said casing including a notch formed in the interior surface thereof, a locking bar slidably mounted within said cylinder and including an end adapted to be moved within said notch, first seat means formed on said locking bar, first spring means adapted to coact with said seat means to urge said locking bar within said notch to prevent un-

limited rotation of said cylinder relative to said casing, second seat means formed on said locking member, second spring means cooperating with said second seat means to urge said locking bar out of said notch to permit substantial rotation of said cylinder relative to said casing, said first spring means being stronger than said second spring means, a plurality of tumbler means slidably mounted within said cylinder and adapted to block the movement of said locking bar by said second spring means, each of said tumbler means including a notch formed in the surface thereof proximate said locking bar member, a projection formed on said locking bar member corresponding in shape to the notch in each of said tumbler means, spring means urging each of said tumbler means to a position in which said notches are unaligned, said tumbler means being movable to positions in which said notches are aligned whereby said locking bar projection may extend therewithin to unlock said lock mechanism, said first spring means including a portion thereof adapted to coact with said casing whereby initial rotation of said cylinder will cause said first spring means to be moved out of operative engagement with said first seat means.

9. A lock mechanism comprising a cylindrical casing, a cylinder mounted for rotation within said casing, said casing including a notch formed in the interior surface thereof, a locking bar slidably mounted within said cylinder and including an end adapted to be moved within said notch, first seat means formed on said locking bar, first spring means adapted to coact with said seat means to urge said locking bar within said notch to prevent unlimited rotation of said cylinder relative to said casing, second seat means formed on said locking member, second spring means cooperating with said second seat means to urge said locking bar out of said notch to permit substantial rotation of said cylinder relative to said casing, said first spring means being stronger than said second spring means, a plurality of tumbler means slidably mounted within said cylinder and adapted to block the movement of said locking bar by said second spring means, each of said tumbler means including a rectangular notch formed in the surface thereof proximate said locking bar member, a rectangular projection formed on said locking bar member, spring means urging each of said tumbler means to a position in which said tumbler notches are unaligned, said tumbler means being movable to positions in which said notches are aligned permitting said locking bar projection to extend therewithin to unlock said lock mechanism, a groove in said casing, said first spring means including a portion thereof adapted to project within said casing groove when said locking member is aligned with the casing notch, initial rotation of said cylinder causing the portion of said first spring means to be moved out of said casing groove to interrupt operative engagement of said first spring means with said first seat means.

10. A lock mechanism comprising a casing, a cylinder member rotatably mounted within said casing, a notch in said casing, a locking member slidably disposed within said cylinder and adapted to engage with said casing notch to prevent unlimited rotation of said cylinder, a spring member mounted upon said cylinder for rotation therewith and adapted to coact with said locking member to move the latter within said cylinder, tumbler means slidably mounted in said cylinder, means biasing said tumbler means to a position blocking movement of said locking member, recess means formed in said tumbler means, said tumbler means being movable to a position in which said recess means are aligned permitting said locking member to be moved therewithin whereby said locking member may be moved out of engagement with said notch, said notch and locking member being so related that limited relative movement therebetween is possible with said locking member projecting within said notch, notch means formed in said locking member, said spring member including a pair of spring arms disposed within said notch means, said spring arms having different spring forces, the strong spring arm coacting with said notch means to move said locking member into said casing notch, the other spring arm urging said locking member out of said casing notch, and means responsive to initial relative movement between said cylinder and said casing for causing said strong spring arm to move out of operative engagement with said locking member notch means.

11. A lock mechanism comprising a casing, a cylinder member rotatably mounted within said casing, a notch in said casing, a locking member slidably disposed within said cylinder and adapted to engage with said casing notch to prevent unlimited rotation of said cylinder, a spring member mounted upon said cylinder for rotation therewith and adapted to coact with said locking member to move the latter within said cylinder, tumbler means slidably mounted in said cylinder, means biasing said tumbler means to a position blocking movement of said locking member, recess means formed in said tumbler means, said tumbler means being movable to a position in which said recess means are aligned permitting said locking member to be moved therewithin whereby said locking member may be moved out of engagement with said notch, said notch and locking member being so related that limited relative movement therebetween is possible with said locking member projecting within said notch, recess means formed in said locking member, the spring member cooperating with the recess means to normally urge the locking member within the casing notch, and means responsive to initial relative movement between said cylinder and said casing causing the spring member to move the locking member within the tumbler means recesses to unlock said mechanism.

12. A lock mechanism as set forth in claim 11 in which the spring member comprises a cantilever-supported spring arm means, the free end of said spring arm means being disposed within the locking member recess means and being adapted to bias the latter member for bi-directional movement.

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