

Dec. 16, 1941.

F. ADAM

2,266,579

LOCKING DEVICE

Filed March 25, 1939

3 Sheets-Sheet 1

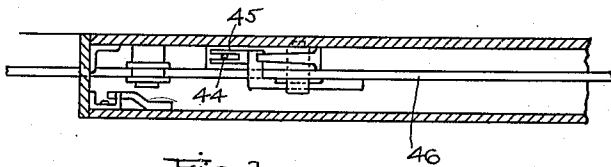


Fig. 3.

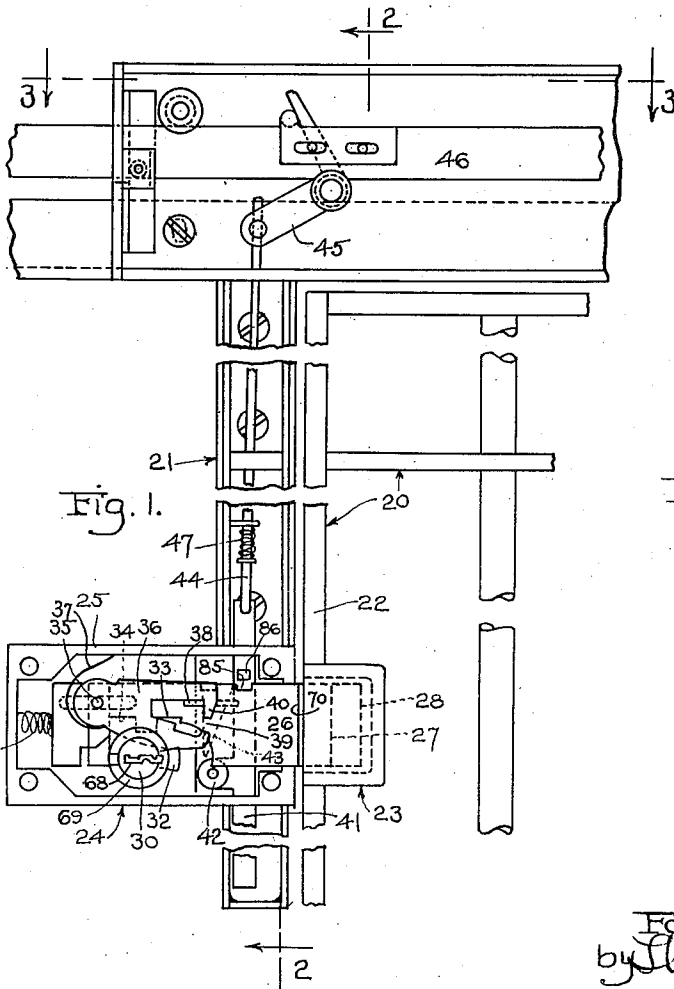


Fig. 1.

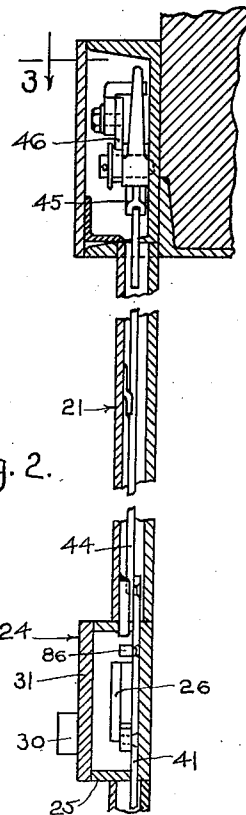


Fig. 2.

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3 Sheets-Sheet 2

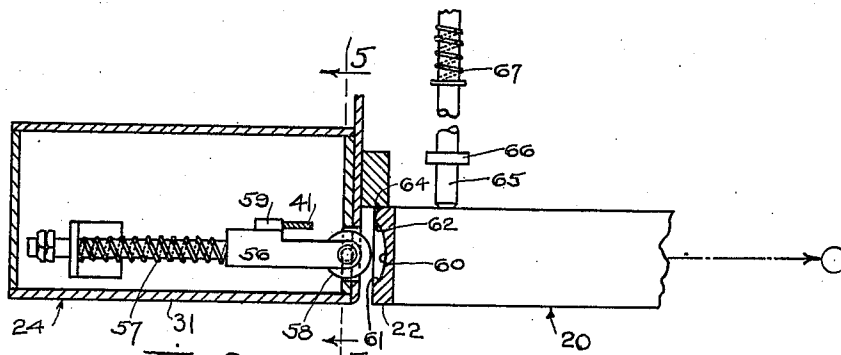


Fig. 6.

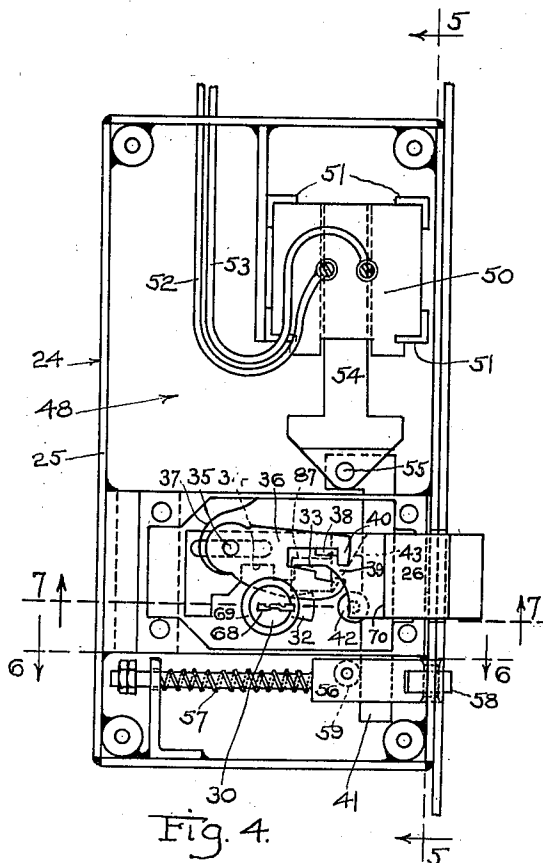


Fig. 4.

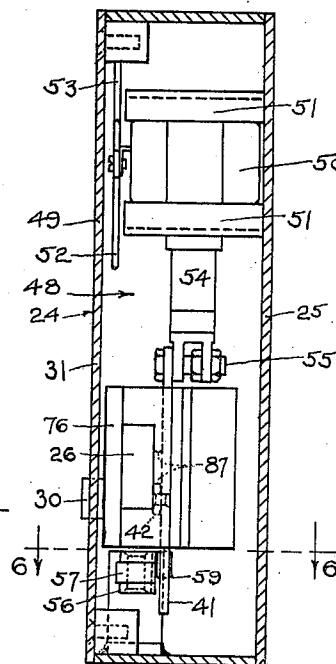


Fig. 5.

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3 Sheets-Sheet 3

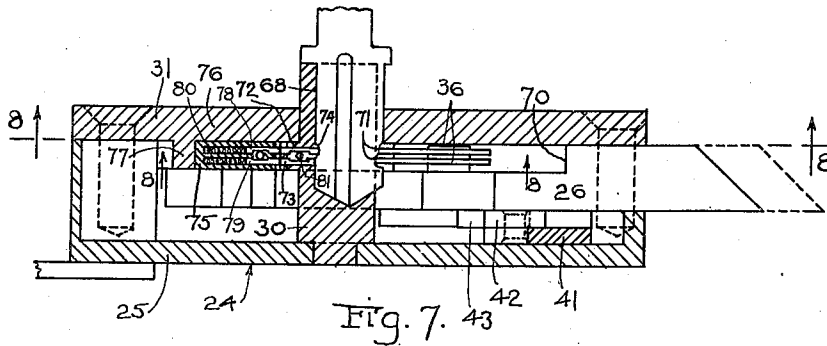


Fig. 7.

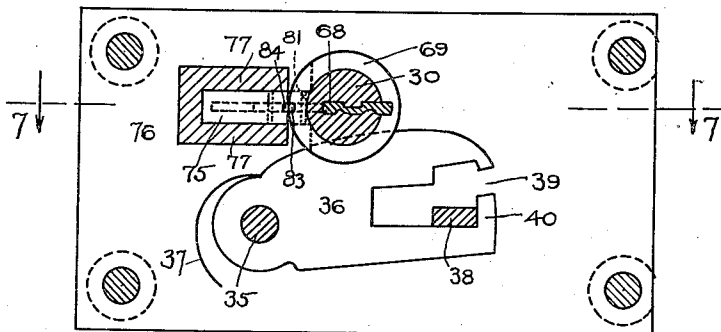


Fig. 8.

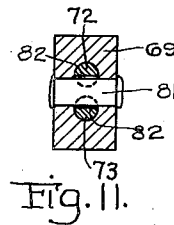


Fig. 11.

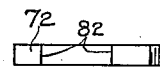


Fig. 12.

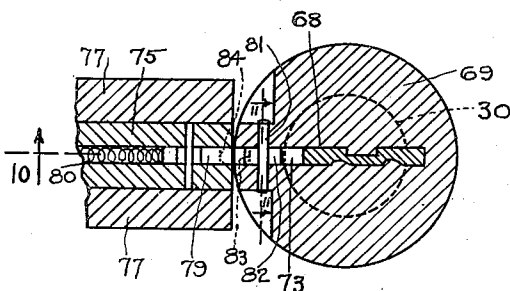


Fig. 9.

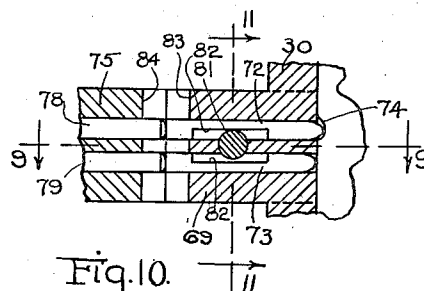


Fig. 10.

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## UNITED STATES PATENT OFFICE

2,266,579

## LOCKING DEVICE

Folger Adam, Joliet, Ill.

Application March 25, 1939, Serial No. 264,987

12 Claims. (Cl. 70—143)

This invention relates to improvements in locking devices, especially for locking swinging or sliding doors and the like. The locking devices herein disclosed are especially intended for the locking and control of the doors of cells or confinement or treatment rooms of such institutions as jails, houses of correction, etc., and the constructions herein illustrated and described have been designed especially to meet the conditions of use and operation imposed by such installation, and I shall describe certain of the operations of the locking devices in such use; but in so doing I wish it understood that I do not intend to thereby limit the scope of the invention, except as I may do so in the claims.

The locking devices herein disclosed are intended for installations wherein several locking and unlocking operations are possible. The arrangements are such that the lock bolt may be withdrawn either locally at the position of the lock, as by the use of a key, or remotely, as by the use of suitable mechanical or electrical devices; and are such that under certain conditions the lock bolt may be "deadlocked" by remote control so that said bolt may not then be withdrawn locally even by the use of a key. The arrangements are also such that the lock bolt may be moved into either of two locking positions, in either of which positions the door is locked. In the first of these two positions the bolt moves to a "snap" lock position, and in the other of these two positions the bolt moves to a position such that the door cannot be snapped shut, and also such that the "deadlocking" operation may be performed. The bolt may be moved into these positions, or may be withdrawn to unlock the door, by key operations performed at the lock position. Such key operations require the rotation of the key and cylinder for one complete rotation in the locking direction (to bring the bolt to the "deadlocked" position), or a quarter turn in the locking direction to unlock the bolt by key operation, and are therefore of an unusual nature.

The remote control operations of the locking bolt are performed by movements of a lock bar which extends through or in proximity to the lock casing. When the bolt is in its snap locked position it may be withdrawn to unlock the door by movement of this lock bar, but when the lock bolt is in its fully extended or "deadlocked" position it is not operated by the lock bar, which then rides free of the lock bolt.

One feature of the present invention relates to the provision of a key operated lock of such

construction that the bolt thereof normally stands in the snap locked position and may be moved by key rotation or movement into a further projected locking position; and which construction is such that the lock bolt may be withdrawn into unlocked position by a backward turn of the key and cylinder. In connection with the foregoing features I have provided an improved form of pin tumbler arrangement for the cylinder, which pin tumbler construction serves to lock the cylinder against rotation until the proper or authorized key has been inserted into the key opening. Pin tumbler locks have heretofore been known, but they were of a construction in which the cylinder for the key was carried within an enclosing or encircling sleeve, so that the pins of the key cylinder could not slip or drop out from the key cylinder, but were at all times confined by said sleeve. Due to the fact that I find it necessary to make provision for making one complete rotation of the key cylinder in order to perform certain of the operations of the lock bolt, and the further fact that certain bolt operations are controlled by the key cylinder by means of lever tumblers it is not feasible to use such sleeve construction of the prior art, and I have therefore found it desirable to make special provision for retaining the pins in the key cylinder when the latter is rotated away from the position of the pin tumbler block during the several key cylinder operations.

It is therefore an object of the invention to provide means for retaining the pins in the key cylinder independently of any surrounding sleeve, and independently of the companion tumbler block, so that the cylinder pins are retained within the key cylinder at all times, and constitute a self-contained unit therewith.

In connection with the pin tumbler arrangement, wherein the cylinder pins co-operate with the tumbler pins of the pin tumbler block for unlocking purposes, it is a further feature of the invention to provide an arrangement such that proper co-operation between these sets of pins will be ensured at all times, and regardless of slight inaccuracies of manufacture or assembly. When the key is inserted into the key slot or opening the serrations or openings on the back edge of the key serve to project the cylinder pins outwardly against their respective tumbler pins carried in the pin tumbler block, so as to align the tumbler pins and allow the key cylinder to be rotated. Heretofore it has been customary to provide contacting surfaces between the key cylinder and

the companion face of the tumbler pin block, and to carry the pin holes of the key cylinder and of the pin tumbler block to such surfaces; and as a result of this arrangement it has been heretofore necessary to secure exact alignment of the holes of the key cylinder and of the pin tumbler block in order to secure proper functioning of the pins. In case of nonalignment of these pin holes the tumbler pins could not enter into the pin holes of the key cylinder when the key was withdrawn, and consequently no locking action would occur.

It is therefore an object of the present invention to provide companion slots or enlarged portions on the companion surfaces of the key cylinder and the pin tumbler block, so that even in case of misalignment of the key cylinder with respect to the pin tumbler block, or vice versa, or in case of slight inaccuracies of placement of the key cylinder lengthwise with respect to the pin tumbler block, the pin tumblers may nevertheless be projected into the companion slot of the key cylinder and perform locking function to prevent rotation of the key cylinder until a proper key is inserted therein.

The foregoing feature is of further importance in connection with the construction herein disclosed wherein the key cylinder is carried at one end in the lock case, and at its other end in the removable cover plate of the lock case, and wherein the pin tumbler block is carried by the cover plate. In such construction it follows that during manufacture and assembly of the parts slight inaccuracies will have to be provided for and compensated for, and the arrangement or feature above referred to makes provision for such compensation.

A further feature of the invention relates to the forms of the contacting ends of the pins in the key cylinder and in the pin tumbler block. Heretofore it has been customary to form these contacting ends of a rounded form, rounded around the pin axis, so that theoretically each key cylinder pin and the companion tumbler pin could make only a single point of contact together. As a result, the pins' ends have been found to wear rapidly, and such wear would in time result in improper functioning, since the cylinder pin must be projected exactly the proper distance to cause unlocking of the tumbler pin when the key is inserted into the cylinder. My improvement in respect to this feature consists in the provision of pins having ends which are formed on flattened or straight line surfaces so that contact of each pin of the key cylinder with the companion pin of the pin tumbler block may occur anywhere across the entire width of the pin, and on a surface of contact as distinguished from a point of contact, as heretofore. I also provide cylindrical end surfaces on the inner ends of the key pins, said surfaces extending across the direction of movement of the key during insertion or withdrawal of the key from its slot, thus improving the action and also providing a line of contact between each pin and the key instead of a single point of contact as heretofore.

In order to prevent the pins from turning on their own axes I make use of the retaining pins which engage the pins of the key cylinder and likewise the retaining pins which engage the tumbler pins of the pin tumbler block (when used), to not only retain the cylinder pins and the tumbler pins in place within the cylinder and the pin tumbler block, respectively, but also

to retain the said pins against rotation, so that the cylindrical contacting ends of the key pins will be retained in proper positions at all times with respect to the direction of key insertion or withdrawal.

A further feature of the present invention relates to an improved arrangement for remotely operating the lock bolt for unlocking purposes, by electrical means or the like. In this connection it is an object to provide means whereby when an unlocking impulse is imparted to the lock structure so that the lock bolt is momentarily withdrawn into the unlocking position, it will be retained in said unlocked position at least until such time as the door has been opened sufficiently to prevent re-engagement of the lock bolt with the catch on the door edge. Nevertheless, the arrangement is such that as the door is opened beyond such position the lock bolt will be again released so that it will be in position to snap lock the door when the door is again moved to the fully shut position. This feature is of value especially in connection with the use of "door starters" which serve to start the door opening movement when the lock bolt is drawn into the unlocking position, since thereby it is only necessary to deliver a short impulse of current to the lock operating solenoid (or other device), which impulse will then place the parts in such position that the door opening movement may commence, and it is thus unnecessary to continue the delivery of current (or other force) until the door opening movement has been completed. Nevertheless, as the door opening movement continues the parts will be replaced in the proper condition for the ensuing locking operation at a subsequent time.

In connection with the remote control of the lock bolt movements, the arrangement may be such as to cause said movements either electrically, or by means of mechanical instrumentalities, such as flexible wires or cables, etc.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction, and combinations of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows an elevational face view of a locking device embodying the features of the present invention as used for locking a swinging door, with provision for remote control and actuation of the lock bolt by means of a "gang" bar from a remote station, the cover plates being removed to better show the interior constructions;

Figure 2 shows a vertical section on the line 2-2 of Figure 1 looking in the direction of the arrows;

Figure 3 shows a horizontal section on the line 3-3 of Figure 1 looking in the direction of the arrows;

Figure 4 shows a face view of a modified form of the locking device proper, with the cover plate removed, the device of this form of the invention being provided for remote control and operation by electrical means, and being provided with the means whereby an impulse of momentary nature will serve to move the lock bolt to the unlocked position where it will be temporarily held by suitable restraining means until the further opening movement of the door serves to release such restraining means and permit the lock bolt to again be projected into the snap lock position;

Figure 5 shows a vertical section on the line 5—5 of Figure 4, looking in the direction of the arrows, the cover plate and parts being in position;

Figure 6 shows a horizontal section on the line 6—6 of Figure 4 looking in the direction of the arrows;

Figure 7 shows a section on the line 7—7 of Figure 4 but on enlarged scale, and with the cover plate in position;

Figure 8 shows an inside face view of the cover plate of the lock box, with the pin tumblers and lever tumblers shown in position, being a section on the line 8—8 of Figure 7 looking in the direction of the arrows;

Figure 9 shows a fragmentary section through the key cylinder and the adjacent portions of the pin tumbler block and the pins and pin tumblers, on still further enlarged scale;

Figure 10 shows a fragmentary section of the line 10—10 of Figure 9, looking in the direction of the arrows;

Figure 11 shows a cross-section on the line 11—11 of Figure 10, looking in the direction of the arrows, and shows a typical arrangement of the retaining pin, and its relation to a pair of the key cylinder pins; and

Figure 12 shows a side face view of one of the key pins removed from the key cylinder, being a view thereof at right angles to Figure 10.

This application is a continuation in part of my co-pending application for improvements in Jail locking devices and the like, Serial No. 116,530, filed December 18, 1936.

Referring first to Figures 1, 2 and 3, the arrangement therein disclosed is one in which the lock of the present invention is used in connection with a swinging door, and in which the lock bolt may be controlled and operated either locally by means of a suitable key, or remotely by means of a control and operating bar from a distant station. The swinging door or gate is designated by the numeral 20. It is suitably hinged at its right hand edge (not shown), and may swing towards the observer during the opening operation. The locking device of the present invention is intended for placement on the door jamb, shown generally by the numeral 21. The edge 22 of the door carries the usual or modified form of socket 23 which is engaged by the lock bolt when the door is closed and retained in closed position by such lock bolt.

The lock of the present invention is designated generally by the numeral 24. It includes the case or housing 25 (the cover plate being removed in Figure 1). The lock bolt 26 is slidably mounted in this case, and has a beveled end portion for snap engagement with the socket 23. Normally the bolt is projected to the position of the line 27, for snap locking purposes, and in such projected position its beveled end portion can slide against the socket 23 so as to allow the door to be snapped shut. The bolt may also be projected to a further or "deadlocked" position shown by the line 28. A spring 29 serves to urge the bolt to its extended position, either 27 or 28 as the case may be.

A key cylinder 30 extends across the lock case, and finds bearing in the floor of the case and in the case cover 31 (see Figure 2). This key cylinder has the wing 32 which works in a suitable recess of the bolt; and the bolt has the two notches 33 and 34 which may be engaged by this wing. With the bolt in the normal projected position (to the line 27), rotation of the key

cylinder and wing 32 counterclockwise one-quarter rotation (or part) will withdraw the bolt to the unlocked position against the spring, and allow the door to be opened. On the contrary, rotation of the key cylinder and wing 32 in the clockwise direction one turn will permit the bolt to be projected to the position of the line 28 (assuming that the gates of the lever tumblers have been placed in proper position).

The case or cover also carries the pin 35 on which the lever tumblers such as 36 are pivoted, each such lever tumbler having a spring 37 which normally urges it to the lowered position shown in Figure 1. The bolt carries the lug 38 which can ride back and forth through the gates 39 of the lever tumblers, when said tumblers are properly aligned for that purpose. The cover also carries a pin tumbler block which co-operates with key pins of the key cylinder in the manner to be presently explained.

It will now be seen that by counterclockwise rotation of the key cylinder the bolt may be withdrawn to the unlocked position (assuming that the bolt was in the normal or snap-locked position defined by the line 27) and without the need of the lug 38 passing through the gates; but when it is desired to throw the bolt out to the "deadlocked" position defined by the line 28 it is necessary to throw the lever tumblers upwards to align their gates with the lug 38 so that said lug may pass through the gates, and lie to the outside of the fingers 40 of the lever tumblers. Then when said lever tumblers are allowed to lower said fingers will stand at the left side of the bolt lug 38 and thereby lock said bolt against unlocking movement as long as the lever tumblers are in lowered position.

Behind the bolt 26 (that is, against the bottom face of the case) there extends vertically the operating bar 41. This bar extends to the outside of the case, and connects to suitable operating and controlling instrumentalities. This bar 41 has a lateral projection carrying the roller 42; and on the back face of the lock bolt 26 there is the wedge shaped block 43. The cam or wedge face of this block is in position to be engaged by the roller 42 when the bar 41 is raised, as will be evident from examination of Figure 1. The raising of the bar 41 will therefore serve to withdraw the lock bolt towards the left or unlocking position against the spring 29. This relationship is true when the bolt stands in the normal or spring projected locking position so that the proper relationship is maintained between the roller 42 and the wedge block 43. It is not true, however, when the lock bolt is projected to the "deadlocked" position defined by the line 28.

When the lock bolt stands in the "deadlocked" position defined by the line 28, the roller 42 will ride to the left of the wedge block 43, and no co-operation between these parts will occur, and the raising and lowering of the bar 41 will be ineffective as far as the lock bolt 26 is concerned.

The controlling or operating bar 41 may be moved in any convenient manner. In the arrangement shown in Figures 1, 2 and 3 the bar 41 is connected to the lower end of a rod 44 which in turn connects to a bell-crank 45 located above the door position; and a suitable "gang" bar 46 is provided for simultaneous operation and control of a number of door locks, in any convenient manner. A spring 47 is shown for urging the rod 44 and bar 41 downwardly, if necessary.

Next, referring to Figures 4, 5 and 6, I have

therein shown a modified arrangement wherein provision is made for an electrical operation and control of the bar 41. In this case the lock case has been carried up to provide a supplemental chamber or housing 48 above the normal lock case; and either a single cover plate 49 may be used to serve both the lock case and the chamber 48, or separate covers may be provided for them individually. Within the chamber 48 is located a solenoid 50, carried by brackets 51 connected to the housing, and current for the solenoid is supplied through the lines 52 and 53 from any suitable source and from a suitable remote station. The vertically movable armature 54 of this solenoid is connected by the pin 55 to the bar 41, so that the up and down movements of the armature are communicated to the bar 41. Thus the energizing of the solenoid from a remote station will serve to raise the bar 41 for the lock bolt operations and control heretofore explained.

Now it will be evident that with the arrangements so far detailed the bar 41 will fall as soon as the solenoid is no longer energized, so that in case of a momentary or short supplying of current the bar 41 might fall before the door had been opened, and the unlocking would be of no avail. In other words, with the arrangement so far explained it is necessary to continue to supply current to the solenoid until the door has been opened at least far enough to prevent the lock bolt from re-engaging the socket 23. I have, however, provided means to retain the lock bolt in the withdrawn position, once the solenoid has been energized (or the bar 41 raised), until such time as the door has opened to a point where the lock bolt will not re-engage the socket 23, whereupon the lock bolt will be again released and be replaced in its condition for snap-locking operation, such means being as follows:

Beneath the lock bolt position, and adjacent to the lower end of the bar 41 is the cross-wise extending bar 56. This bar is normally spring urged outwardly by the spring 57, and at its outer end this bar carries the roller 58. Such roller is mounted on a vertical axis so that it will properly engage and function against the edge portion of the door during the door opening movements. This bar 56 also carries a roller 59 which may ride against the adjacent edge of the bar 41, as said bar is raised, or said roller 59 may move to a position beneath the lower end of the bar 41 when the said bar 41 is raised. In this latter position said roller will prevent the bar from falling even when the solenoid has been de-energized (or other restraining force removed).

Referring to Figure 6 it will be noted that the edge portion of the door is provided with a notch or recess 60 in line with the bar 56, and into which the roller 58 works. This recess is defined by the front and back cam surfaces 61 and 62, respectively, and when the bar 56 is projected outwardly by the spring 57 at the completion of the upward movement of the bar 41, the roller will stand in the recess 60. Then, as the door moves open to a position such that the lock bolt could no longer enter into the socket 23, the cam surface 62 will strike the roller, forcing back the bar 56 and roller 59 to a point to one side of the bar 41, thereby again allowing the bar 41 to fall into its normal position (unless, of course, the solenoid 50 should still be energized). In case the solenoid should be energized after the door has been thus opened beyond the position of the roller 58, so that the bar 41 should

be again or still in raised position with the roller 59 beneath its lower end, the subsequent shutting of the door will cause the back face 64 of the door edge to engage the roller 58 and thereby force the bar 56 back so as to release the bar 41, whereupon said bar will fall in the same manner.

In Figure 6 I have shown a "door starter" including the pin 65 which is guided by the bracket 66, and a spring 67 urges the pin 65 outwardly against the door for door starting purposes. Such a door starter, or any other suitable type, is desirable in connection with the electric remote control for the door lock, since thereby a short impulse of current delivered to the solenoid will ensure door opening movement so that the cam face 62 may ride against the roller 58 and thus ensure resetting the bars 56 and 41 in the manner already explained.

Referring now to Figures 7, 8, 9, 10 and 11 I will explain more in detail the construction of the pin and lever tumbler arrangements hereinbefore mentioned. The key cylinder 30 has the specially shaped key slot 68 with suitable ridges and grooves, and the key is similarly formed to slide into such key slot. Within the lock case the key cylinder has an enlargement 69, and at one side the key slot reaches into this enlargement as shown in Figures 8 and 9, for example. The lever tumblers ride against this enlargement (or slots or grooves therein), so that as the key is rotated the lever tumblers are at the proper times raised to position to bring the gates 39 into alignment with the lug 38 on the lock bolt, thereby allowing said lug to pass through the gates as the bolt is projected or drawn back. It may be here noted that the tumblers are placed above the bolt, and are accommodated within a grooved or reduced thickness portion of the bolt, as shown at 70. It is also noted that the front edge of the key is formed with suitable notches 71 to engage the lever tumblers in such manner as to properly align the several tumblers for the gate operation, and at the proper time.

Within the enlarged portion 69 of the key cylinder and communicating with the back edge portion of the key slot 68, are the outwardly extending key pins 72 and 73; and the back edge of the key is provided with suitable notches 74 to engage these key pins and align them when the key is inserted into the slot 68. Adjacent to the key cylinder enlargement 69 is the pin tumbler block 75, carried by the cover plate 76 of the lock case, which cover plate is for that purpose provided with a suitable recess defined by the walls 77. This pin tumbler block is provided with the pin tumblers 78 and 79 corresponding to the key cylinder pins 72 and 73, respectively, and light springs 80 are provided to urge the pin tumblers outwardly. It is here noted that when the key cylinder stands in the normal or "key out" position, the pins 72 and 73 are intended to substantially align with the corresponding pin tumblers 78 and 79, as will presently appear.

There is a cross-wise extending retaining pin 81 in the enlargement 69 and extending between the key cylinder pins 72 and 73, as well shown in Figures 7, 10 and 11; and each of the pins 72-73 and 78-79 is provided with a flattened notch portion 82 which receives the retaining pin as well shown in Figures 10 and 11. With this arrangement the retaining pins perform two functions, they prevent the pins 72-73, and 78-79 from dropping out of their holes, and they also

prevent the pins 72—73 and 78—79 from rotating on their axes. Both functions are important in the present case.

It may be here noted that the number of key cylinder pins (and the number of pin tumbler pins corresponding thereto) may be made as great or as small as desired, or there may be but a single one of each, since the multiplication of these pins merely serves to multiply the difficulty of unauthorizedly operating the lock.

Now it is noted that when the key cylinder stands in the normal or locked position with the key out, the pin tumblers 78 and 79 engage the enlargement 69 and prevent the key cylinder from being unauthorizedly turned, as by application of a pair of pliers to the projecting end portion of the key cylinder. Heretofore such engagement has been secured by the entering of the pin tumblers 78 and 79 into the holes of the key cylinder pins 72 and 73, and such engagement has of necessity implied the exact alignment of said pins and holes with each other. Any misalignment of these parts might be due either to longitudinal shifting or misplacing of the key cylinder and the pin tumbler block, or to non-parallelism of these parts. It is seen that when the pin tumbler block is carried by the cover plate of the casing as in the present structure, with the key cylinder journaled both in the body of the casing and in the cover plate, there is possibility of such misalignment occurring, so that the pins would not properly function, and consequently the desired locking of the key cylinder against rotation would not be ensured when the key was withdrawn from its slot. In order to provide against this contingency I have provided the arrangements which I shall now describe.

Instead of bringing the complete faces of the enlargement 69 and the pin tumbler block 75 together, as in the past, I prefer to provide these parts with companion axially extending slots 83 and 84 respectively, as well shown in Figures 8, 9 and 10, so that axial misalignment of the parts will not prevent entrance of the pin tumblers 78 and 79 into engagement with the enlargement 69 of the key cylinder, but said pin tumblers may engage said slot 83 of the key cylinder anywhere and still prevent rotation of the key cylinder until the pin tumblers have been forced back into disengaging position by the key pins 72 and 73 upon insertion of the key into its slot. Any amount of such misalignment up to the diameter of a pin will not prevent such proper functioning. Furthermore, the proper engagement of the key pins with their respective pin tumblers will also still occur. These slots 83 and 84 may be made of slightly greater width than the diameters of the pins so that proper functioning will occur even if the parts are not in exact axial alignment.

Heretofore it has been customary to provide the ends of the key pins and the pin tumblers with rounded faces formed about the axes of these pins, but it is noted that this arrangement presents the objection that there is only a single point of contact of each key pin with its pin tumbler. This has caused excessive wear and consequent short life of these parts whereupon they have ceased to function properly. In the present case I prefer to form the end of each of the pin tumblers and key pins with a flat face, and to form the key end of each of the key pins with a "chisel" face or a face rounded in the form of a part of a cylinder extending transversely of the axis of the key cylinder, as shown in Figures

10 and 12, in particular. By this means I provide a line of contact between each key pin and the edge of the key when inserted into the key slot, so that wear will be greatly reduced, and life prolonged.

Now it will be noted that when the key pins have once forced back the pin tumblers by insertion of the key into its slot, the key cylinder may be turned, and such turning may be continued indefinitely for one or more turns, without re-engagement of the pin tumblers with the key cylinder, as long as the key is retained within its slot. Thus the present form of lock cylinder is well adapted for use in connection with the herein described form of locking device in which it must be possible to completely rotate the key cylinder for certain of the intended operations. This is accomplished without the need of using an encircling sleeve around the key cylinder as in previous arrangements. In this connection it is also noted that such an encircling sleeve could not be used in the present form of device in which I make use of both pin tumblers and lever tumblers for the various operations.

It is also to be noted that I have placed the tumblers of both forms at the top side of the lock bolt, and the wedge block 43, operating and controlling bar 41, and roller 42 at the back face of the lock bolt, thus securing a very harmonious arrangement, and one in which the several parts are brought to the best locations to perform their several functions.

Reference to Figure 1 in particular discloses the presence of a notch 85 in the upper edge of the lock block 26, and a lug or pin 86 on the face of the bar 41 in position to engage said notch when the bar 41 is lowered to a position lower than shown in Figure 1. Such engagement of the lug or pin with the notch will "deadlock" the bolt so that it cannot be withdrawn by a key for unlocking purposes. Thus the movements of the bar 41 to positions higher than shown in Figure 1 result in operations to unlock the bolt (or to ride free of the bolt when the latter is in the second projected position), whereas movements of the bar 41 to positions lower than that shown in Figure 1 result in deadlocking the lock bolt when the bolt is in the normal locking position shown in Figure 1.

It thus appears that the following bolt operations are possible: From the position of Figure 1 the bolt may be withdrawn to unlock by key when turned counterclockwise; or the bolt may be withdrawn to unlock by upward movement of the bar 41 with consequent engagement of the roller 42 with the wedge block 43; or the bolt may be projected to the second position (shown by the line 28) by turning the key clockwise, in which position the upward movement of the bar 41 will not affect the bolt condition; or a downward movement of the bar 41 (the lock bolt being in the normal position shown in Figure 1) will result in engagement of the lug 86 with the notch 85 so that no key operation may then be performed.

Now it is to be noted that in the form of device shown in Figures 4 to 12 inclusive, and as so far described, when the lock bolt 26 is projected into the second or "deadlocking" position (shown by the line 28), by a key operation, the roller 42 rides past the back face of the wedge block 43, but does not engage the wedge block to retract the lock bolt. Nevertheless, under these conditions the bar 56 will be projected



outwards by the spring 57 and carry the roller 59 beneath the lower end of the bar 41, so that said bar will be restrained from lowering to its normal position, and it will remain in such raised position. If, then, an attendant should cause such raising of the bar 41 by sending an impulse of current into the solenoid 50, the parts would be set into such abnormal position; and if thereafter the attendant should return the lock bolt to its "snap" locked position (by one turn of the key counterclockwise), the bar 41 would still remain in its raised position (the door having not been opened), and no further impulses of current could cause opening or unlocking of the door. In order to provide against this contingency I have provided a block 87 on the back face of the lock bolt, which block is in position such that when the lock bolt is projected to the "deadlocked" position (of the line 28), said block 87 will stand above the roller 42 of the bar 41, and during this condition the bar 41 cannot be raised, notwithstanding energization of the solenoid 50. Thus an inadvertent impulse of current supplied to the solenoid 50 will not raise the bar 41, nor thereby permit the interlock bar 56 to be projected, and no such undesirable condition as above set forth will be possible. It is noted that the block 87 does not interfere with normal up and down movements of the bar 41 and roller 42 as long as the lock bolt stands in the "snap" locked position.

While I have herein shown and described only certain embodiments of the features of my present invention, still I do not intend to limit myself thereto, except as I may do so in the claims to follow.

I claim:

1. In a locking device, the combination of a lock bolt, a key operated tumbler mechanism for controlling the bolt movements, means to withdraw the bolt when the tumbler mechanism stands in one position and during one direction of key movement, means to move the bolt to a second projected locking position when the tumbler mechanism is moved to another position and during the other direction of key movement, and remote control means for withdrawing the bolt into unlocking position independently of the key movements when said bolt is in the first mentioned position, substantially as described.

2. In a locking device, the combination of a lock bolt, a key operated tumbler mechanism for controlling the bolt movements, means to withdraw the bolt when the tumbler mechanism stands in one position and during one direction of key movement, means to move the bolt to a second projected position when the tumbler mechanism is moved to another position and during the other direction of key movement, and means mounted for movement transversely of the bolt movement adapted to engage the bolt for withdrawing the same into unlocking position when the bolt is in normal locking position, and adapted to travel free of the bolt when the bolt is in the second projected locking position, substantially as described.

3. In a locking device, the combination of a lock bolt, a key operated tumbler mechanism for controlling the bolt movements, means to withdraw the bolt when the tumbler mechanism stands in one position and during one direction of key movement, means to move the bolt to a second projected position when the tumbler mechanism is moved to another position and

during the other direction of key movement, means mounted for movement transversely of the bolt movement adapted to engage the bolt for withdrawing the same into unlocking position when the bolt is in normal locking position, and adapted to travel free of the bolt when the bolt is in the second projected locking position, together with means interconnecting said bolt and said transversely movable means for deadlocking the bolt when said transversely movable means is moved to another position, substantially as described.

4. In a locking device, the combination of a lock bolt, spring means normally projecting the same into locking position, key operated tumbler means for permitting withdrawing said bolt into unlocking position when the key is turned in one direction of movement, and adapted to permit projecting the bolt into a second projected locking position when the key is turned in the other direction, means movable transversely of the bolt movement, interconnecting means on the bolt and said transversely movable means for effecting withdrawal of the bolt when said transversely movable means is moved, the bolt being in its normally projected position, and ineffective to move the bolt when the bolt is in its second projected locking position, together with means on said transversely movable means for deadlocking the bolt when in either its normally projected or its second projected locking position, substantially as described.

5. In a locking device, the combination of a lock bolt, key operated means to operate the bolt, and separate remote control means to lock the bolt against unlocking movement by key operation, substantially as described.

6. In a locking device, the combination of a lock bolt, key operated means to operate the bolt, and separate remote control means to withdraw the bolt when said remote control means is moved in one direction, and to lock the bolt against key unlocking operation when said remote control means is moved in the other direction, substantially as described.

7. In a locking device, the combination of a locking bolt, means to project said bolt into normal locking position, key operated means to project said bolt into a second projected locking position, and remote control means to withdraw said bolt into unlocking position from the normal locking position, said remote control means being ineffective to withdraw the bolt when the bolt is in the second projected position, substantially as described.

8. In a locking device having a lock bolt and a key cylinder co-operating therewith for key operations, means to operate and control said lock bolt from a remote station, comprising a bar in the locking device mounted for movement across the direction of bolt movement, a wedge block on the lock bolt, a roller on the bar in position to engage the wedge block for withdrawal of the lock bolt when the bar is moved, another member mounted for movement across the path of travel of the bar and into intercepting position when the bar is moved for bolt actuation purposes, to thereby retain the bar in its moved position, spring means tending to retain the said intercepting member in such moved position, and means in conjunction with such intercepting member adapted for engagement with a companion part to restore said member to its initial

position against such spring means, and thereby release the bar, substantially as described.

9. In a locking device having a lock bolt, a spring normally urging said bolt to a projected position and a key cylinder co-operating with said bolt to control bolt projection, means to operate and control said lock bolt from a remote station, comprising a bar in the locking device mounted for movement across the direction of movement of the bolt, co-operating parts on the lock bolt and said bar including cam means to withdraw the bolt when the bar is moved, a movable member mounted to move into position to intercept restoring movement of the bar when it is moved in bolt withdrawing direction, to thereby retain the bolt in such withdrawn position, a spring normally urging said member to intercepting position and a part in conjunction with said intercepting member in position for engagement by a co-operating part when the door opens after withdrawal of the bolt, to thereby move said member against said spring and release the interception of the bar to permit the bolt to move to its initial position, substantially as described.

10. In a locking device having a lock bolt, a spring normally urging said bolt to a projected position and a key cylinder for co-operating with said bolt to control bolt projection, means to operate and control said lock bolt from a remote station, comprising an element mounted for movement adjacent to the lock bolt, co-operating parts on the lock bolt and said element to withdraw the bolt when the element is moved, an intercepting member movably mounted in position to intercept the returning movement of the element and thereby retain the bolt in withdrawn position, a spring normally urging said member to intercepting position and another element in connection with said intercepting member in position for engagement by another member after door movement commences, to thereby move the

intercepting member against said spring and away from intercepting position and allow the bolt to return to its normal position, substantially as described.

11. The combination with a door, of a locking device therefor, including a spring actuated bolt for engagement with a door part for locking purposes, together with means to remotely control and actuate said bolt, and including a bar mounted for movement across the direction of bolt movement, co-operating elements on the bar and the bolt adapted to withdraw the bolt against its spring when the bar is moved, an intercepting device movably mounted in position to intercept the bar when it has been moved to withdraw the bolt, a door starter in position to commence door opening movement when the bolt is withdrawn, and co-operating parts on the said intercepting device and the door effective to restore the intercepting device to initial position and thereby release the bar and allow the bolt to move to locking position after the door opening movement has commenced, substantially as described.

12. The combination with a door, of a locking device therefor, including a spring actuated bolt for engagement with a door part for locking purposes, together with means to control and actuate said bolt, and including a bar mounted for movement across the direction of bolt movement, co-operating elements on the bar and the bolt adapted to withdraw the bolt against its spring when the bar is moved, an intercepting device movably mounted in position to intercept the bar when it has been moved to withdraw the bolt, and co-operating parts on said intercepting device and the door effective to restore the intercepting device to initial position and thereby release the bar and allow the bolt to move to locking position after the door opening movement has commenced, substantially as described.

FOLGER ADAM.