June 22, 1965 D. J. FOOTE ETAL 3,190,089

KEY-CONTROLLED, COMBINATION CHANGING, PERMUTATION LOCK

Filed May 4, 1962 4 Sheets-Sheet 1

Fig. 3.

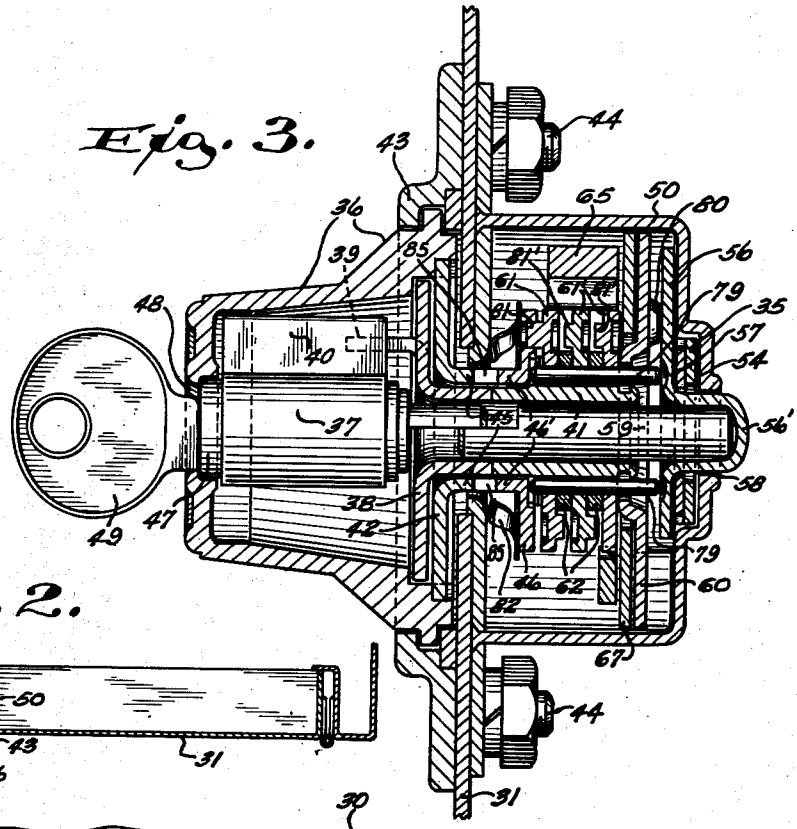


Fig. 2.

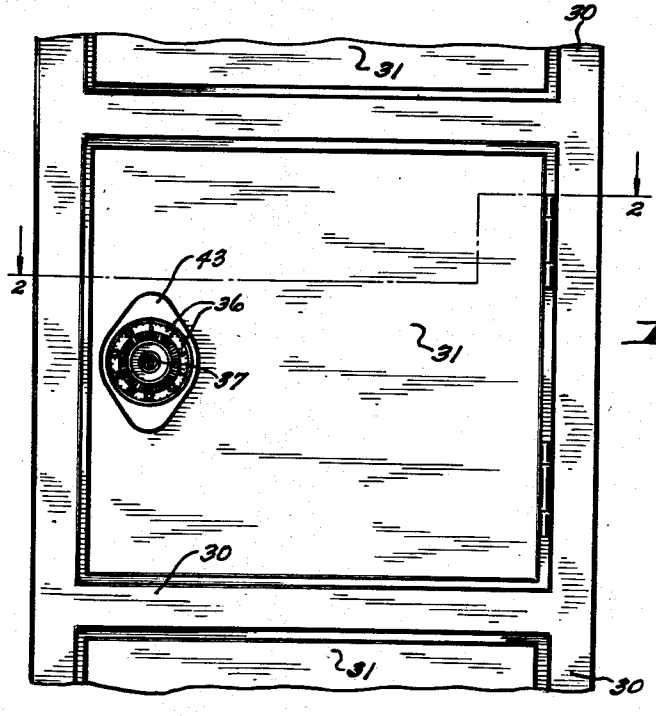


Fig. 1.

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Fig. 5.

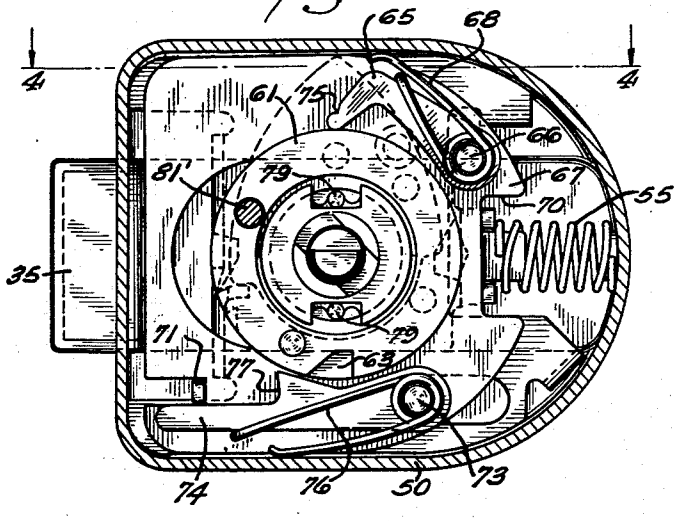
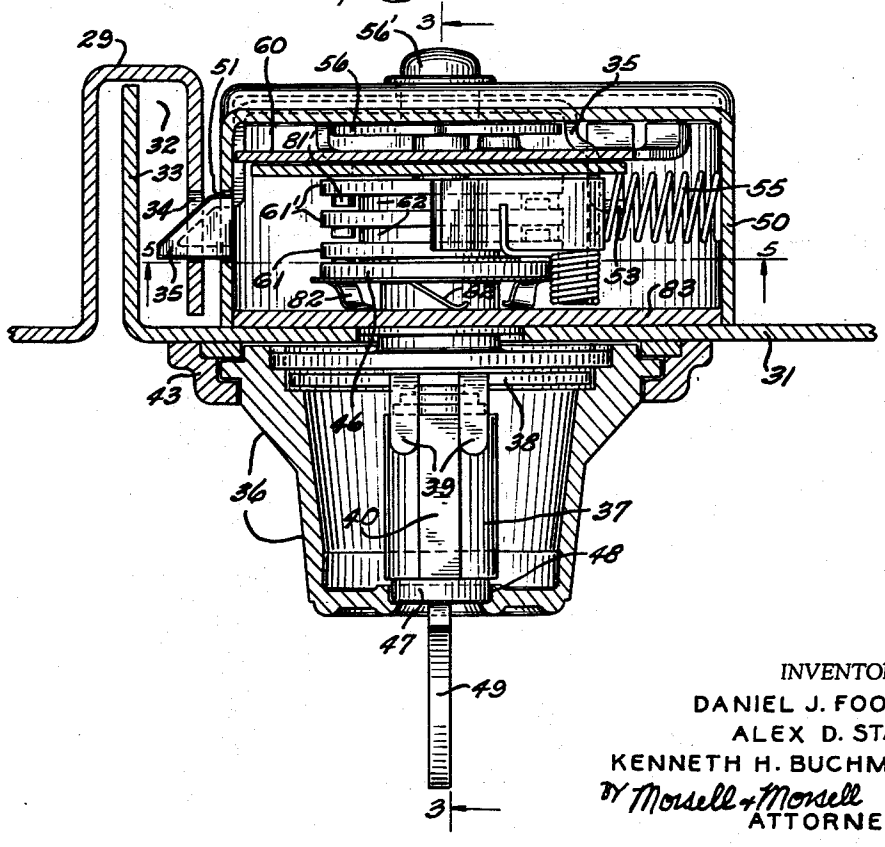


Fig. 4.



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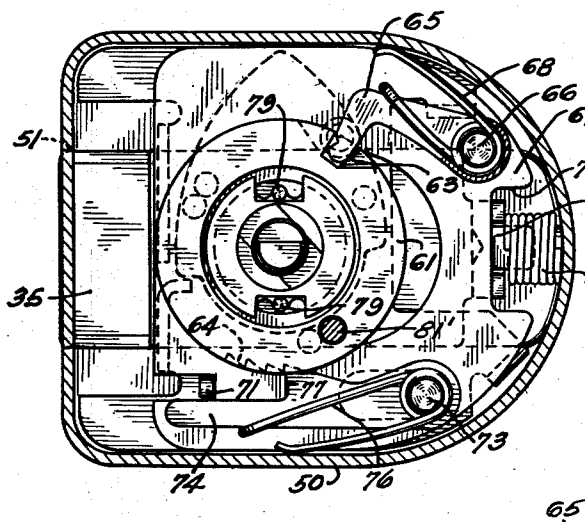


Fig. 6.

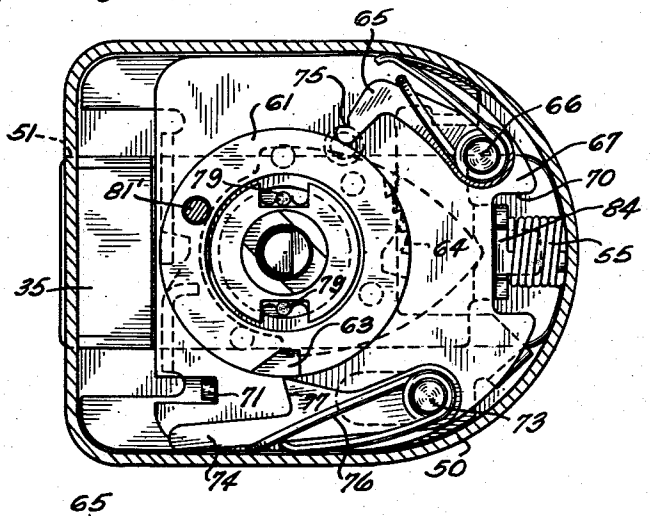


Fig. 7.

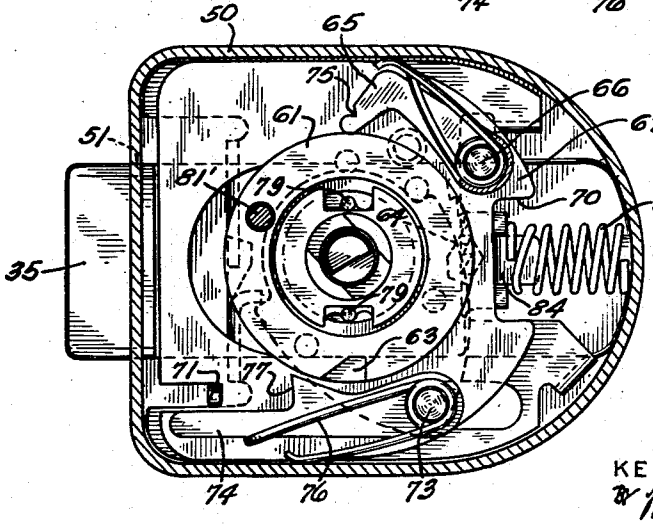


Fig. 8.

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Filed May 4, 1962 4 Sheets-Sheet 4

Fig. 9.

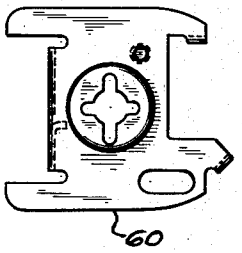


Fig. 11.

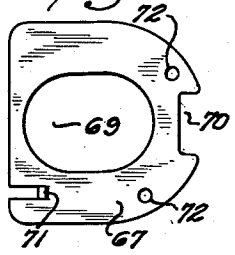


Fig. 13.

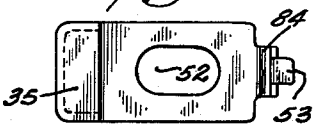


Fig. 10.



Fig. 12.

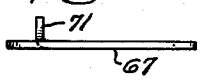


Fig. 14.

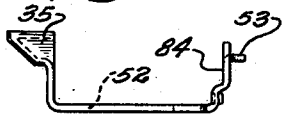


Fig. 17.

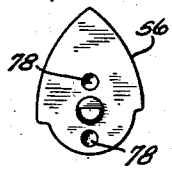


Fig. 15.

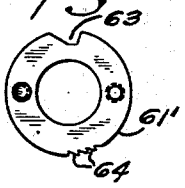


Fig. 19.

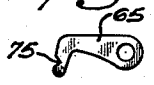


Fig. 21.



Fig. 16.

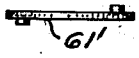


Fig. 18.

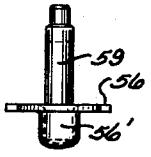


Fig. 20.

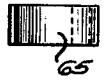


Fig. 22.



Fig. 23.

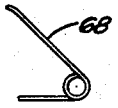


Fig. 25.



Fig. 24.



Fig. 26.



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United States Patent Office 3,190,089 Patented June 22, 1965

3,190,089

KEY-CONTROLLED, COMBINATION CHANGING, PERMUTATION LOCK

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Filed May 4, 1962, Ser. No. 192,551
9 Claims. (Cl. 70—156)

This invention relates to improvements in key-controlled, combination changing, permutation lock, and more particularly to a simplified dial and key-operated self-locking spring bolt permutation locker lock for use on box type lockers, drawers, cabinets or the like, which are devoid of automatic latching bars and handles.

Conventional permutation locker locks are normally installed in pre-punched holes in standard, upright, side-by-side, elongated lockers, each having an automatic latching bar or rod release mechanism and a locker handle, whereby the locking bolt of the permutation lock moves or is actuated vertically upwardly as the locker handle is lifted upwardly to engage or raise the latching bar, when the correct combination is dialed to open or unlock the lock to then allow the locker door to be swung open. Such lockers have two or three latching points to hold the doors secure when locked. Various features of the internal locking mechanism, key control, combination changing, and escutcheon assembly have been described in great detail in co-pending applications, Serial No. 10,760 filed February 24, 1960, now Patent No. 3,023,600, Serial No. 13,509 filed March 8, 1960, now Patent No. 3,031,876, Serial No. 15,196 filed March 15, 1960, now Patent No. 3,031,877, and Serial No. 21,306 filed April 11, 1960, now Patent No. 3,023,602.

The aforementioned permutation locks are installed on a group or series of handle-type, upright lockers, or the like, having automatic latching bars and rod release in schools or factories where students, teachers, or employees hang up or leave their clothes, coats, books, tools, or other personal belongings. Each student or individual user can have access to and open his own locker by dialing a pre-assigned combination, while the school principal, custodian, plant foreman or other authorized person may also open each lock in the group or installation by using a control or master key that will operate the key control mechanism in all of said locks without dialing each lock. Further, for protection purposes, the combination on each lock may subsequently be changed by a combination changing means or device, at the end of every term, year, or whenever desired as students or employees graduate or leave.

However, in many gym locker rooms and athletic departments of schools, colleges, clubs, bowling alleys, factories, and various public buildings, square or small sized box or compartment type lockers are used instead of the standard, elongated, upright, single or double tier lockers. These box lockers are set on top of one another in multiple tiers and in adjacent rows, to conserve space and for the storage of gym or athletic equipment and other personal belongings. Since these standard box lockers are devoid of automatic latching bars and rod release devices and usually are without operating handles, the general type of permutation locker lock where the locking bolt moves up vertically does not operate or function on such box lockers. Instead, a self-locking, dial and key-operated, spring bolt permutation lock is required and used, with the spring bolt being beveled to act as the latching device and the lock knob serving as the handle to open the locker door. Therefore, to be effective, the spring bolt lock so utilized must operate in a different manner and move horizontally under tension into and out of the lock case and thus eliminate the need for an automatic latching bar or rod release. At the same time, it is most desirable that this spring bolt lock be either dial or key operated and still be subject to having its combination changed easily by a push button mechanism.

With the foregoing in mind it is, therefore, a general object of this invention to provide an improved key-controlled permutation locker lock of the self-locking, dial and key-operated spring bolt type having a novel internal locking mechanism of simplified yet sturdy construction, and which is easy to operate.

Another object of the invention is to provide a new and improved key-controlled permutation lock of the spring bolt type for use on lockers and the like whereby the bolt under spring tension may be directly operated manually by dialing alone or by means of a control key only.

A further object of this invention is to provide a combination lock with tumbler disc and combination mechanisms effective to operate a spring bolt or latch member through dialing or by a key control or cylinder mechanism in the knob and escutcheon assembly which, by use of the proper control key, can actuate such spring bolt to open the lock, independently of operating the dialing mechanism.

A still further object of the invention is to provide in a key-controlled permutation lock of the class described a novel spring bolt actuating mechanism housed in the lock case whereby said bolt can be actuated or moved (by dialing or by use of a control key) horizontally, in either direction, depending on whether it is desired to open or close said lock or the locker door.

Another object of the invention is to provide, in a key-controlled, spring bolt permutation lock for lockers and the like, a push button operated mechanism for changing the lock combination together with the use of the proper control key turned to a "stop" position beyond its normal unlocking position, whereby the combination may be easily changed to different assigned combinations, when desired, without loosening or disassembling the lock or using any special reset key or special tools to release and reset the knob or discs, and thus providing a safeguard against unauthorized combination changing.

A still further object of this invention is to provide in a key-controlled permutation locker lock a spring bolt member and an improved and novel automatic upset mechanism whereby, when dialing manually, the combination will be upset or disturbed automatically after the spring bolt is retracted, the door is opened, and the operator's hand is removed from knob.

A further object of the invention is to provide a novel key-controlled, spring bolt permutation lock which incorporates a combination changing mechanism subject to being changed by a push button mechanism, especially adapted for box lockers and the like, which is of simple and durable construction, is easy to assemble, mount, and operate, is compact and attractive, and is well adapted for the purposes described.

With the foregoing and other objects in view, the invention consists of the improved key-controlled combination changing self-locking spring bolt permutation lock, and its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings in which the same reference characters indicate the same parts in all of the views:

FIG. 1 is a fragmentary front view, on a reduced scale, of one of the box lockers of a tier or group in which the locker door front is equipped with the improved key-controlled combination-changing permutation lock;

FIG. 2 is a fragmentary transverse sectional view taken approximately along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged vertical sectional view through a portion of a locker door showing the improved permutation lock installed therein and further disclosing the relationship of the drive lever and upset lever to the lever-retaining plate and the bottom plate and including the dialing and key-control mechanisms, said view being taken approximately along the line 3—3 of FIG. 4;

FIG. 4 is a sectional view taken approximately along the line 4—4 of FIG. 5 showing in elevation the relationship of the drive lever, drive lever spring, and drive lever plate, said view also showing the box locker door and the relationship of the spring bolt of the mounted lock to the door jamb;

FIG. 5 is a sectional view taken approximately along the line 5—5 of FIG. 4 of the portions, including the clutch spring and clutch, removed to show the opening and upsetting mechanism within the lock case in the condition in which they are when the locker door is locked and the permutation mechanism is upset;

FIG. 6 is a similar sectional view only showing the drive lever entered into the gates of the tumbler discs and the bolt retracted into the lock case resulting from a correctly dialed and opening operation of the lock, said view also illustrating the entry of the hook and upset lever into special notches on the tumbler discs preparatory to revolving them for upsetting purposes on the forward or locking movement of the bolt and lever-retainer plate;

FIG. 7 is a similar sectional view only showing the cam turned somewhat in a clockwise direction and bearing against the bolt to retract the bolt into the lock case as occurs when the lock is operated by a control key;

FIG. 8 is a similar sectional view only showing the cam further revolved in a clockwise direction to clear a protuberance on the bottom plate which condition attains when the control key is manipulated for combination-changing purposes;

FIGS. 9 and 10 are face and edge views respectively of the bottom plate of the lock mechanism;

FIGS. 11 and 12 are face and edge views respectively of the lever-retaining plate;

FIGS. 13 and 14 are face and edge views respectively of the lock bolt;

FIGS. 15 and 16 are face and edge views respectively of an inner tumbler disc;

FIGS. 17 and 18 are top and side views respectively of an operating cam;

FIGS. 19 and 20 are top and side views respectively of the drive lever;

FIGS. 21 and 22 are top and side views respectively of the upset lever;

FIGS. 23 and 24 are side and top views respectively of the drive lever spring; and

FIGS. 25 and 26 are top and side views respectively of the upset lever spring.

While the improved key controlled, combination changing permutation lock is susceptible of broader application, in the present embodiment the locks are incorporated in the hinged doors 31 of a series of identical box-type lockers 30 (see FIG. 1) which are mounted on top of one another in multiple tiers and adjacent rows. Insofar as the principles of the present invention are concerned, the direction of opening of the locker doors, and the consequent positioning and direction of the locks applied thereto, are immaterial. In FIGS. 1 and 2 the locker doors 31 are of the type which are hinged along their right-hand margins and the locks are applied to the opposite margins of the door. However, the locks could be applied to locker doors which open in a reverse direction and, in this event, the lock bolts and mechanisms are reversed over that shown in the drawings. Also, while the permutation locks are illustrated as being applied to the doors of box-type lockers, the same are equally applicable to drawers, cabinets and the like, which, as well as the box lockers, are devoid of automatic latching bars and handles.

As will best appear from FIGS. 2 and 4, the jamb 29 of a locker or the like, adjacent the swinging edge of the hingedly-mounted door 31, is provided with an inwardly-directed channel 32 to receive the inturned flange 33 on the free, vertical edge of the door 31. The innermost wall of the jamb defining the channel 32 is formed with an opening 34 to receive a spring-urged, beveled locking bolt 35 which forms part of the improved lock mechanism and which, through the mechanism later to be described, is adapted to yieldingly reciprocate into and out of the opening 34 at right angles to the plane of the channel wall containing the opening 34.

One sub-assembly of the improved permutation lock, which is mounted on an outer face portion of the box locker door 31 adjacent its free edge and which is substantially similar to the sub-assembly of the lock on the exterior of the door shown in United States Patent No. 3,031,877, includes a combined dial and knob 36, a key-receiving pin tumbler locking cylinder 37, together with means for holding the cylinder 37 against rotation, the latter comprising a cylinder-retaining plate 38 formed with a pair of forwardly-directed spaced-apart arms 39 which straddle a cylinder shell flange 40 to thereby prevent rotation of the cylinder when the dial knob is turned. The cylinder-retaining plate 38 is connected to the cylindrical portion of a tumbler disc shaft or post 41. Said exterior sub-assembly furthermore includes a notched-edge disc driving plate 42 which can be pre-arranged in a variety of circularly advanced positions so that a selected pair of diametrically-opposed notches therein will engage a pair of diametrically-opposed semi-circular lugs formed on a ring surrounding the opening in the inner end of the knob and dial assembly, all as was disclosed in said Stahl et al. U.S. Patent No. 3,023,600. Also, the notched plate 42, which has a central circular opening therein, has adjacent a marginal portion of said circular opening integral fingers 45 (see FIG. 3) at right angles to the plane of the combination-setting plate and which are adapted to register with slots 85 therefor in the hub portion 46' of a clutch plate 46 formed with a series of arcuately spaced-apart and staggered openings therein.

It will thus be seen that manual rotation of the dial knob 36 is effective, through the plate 42 carried fast thereby in a predetermined position, to turn the circular clutch plate 46, the latter being positively engaged by the fingers on the notched plate 42.

The combined knob and dial 36 is mounted in the manner shown and described in the Stahl et al. United States Patent No. 3,023,600 and includes an escutcheon plate 43 which carries a decorative overlay and which cover and renders inaccessible the heads of certain securing bolts 44 (see FIG. 3).

Similarly to the arrangement disclosed in the Foote and Buller U.S. Patent No. 3,031,876, there is incorporated within the dialing knob 36 the previously mentioned pin tumbler cylinder 37 and the cylinder-retaining plate, in addition to a plug 47. Said plug is rotatable within the cylinder 37 and extends at its forward end portion into a recess 48 therefor in the front wall of the dial knob, the front wall of the dial knob having an opening therein which registers with the front end of the plug and provides access for the insertion of a master key 49 into the keyway of the plug.

As will be obvious from the drawings, portions of the improved lock assemblage extend through an opening therefor in the locker door 31. The lock casing 50 is, in practice, secured adjacent the inner face of the door 31 and carries certain internal mechanism which controls the lock bolt 35 which projects through a slot 51 therefor in the side wall of the casing 50. The principal novel

features of the present invention reside in the internal sub-assembly which is housed within the case **50**.

The improved lock bolt **35** is shown in detail in FIGS. 13 and 14 and it will be observed that it is U-shaped in side elevation and of integral formation, being a one-piece metal stamping with the extremity of one arm portion carrying the beveled head portion to cam or ride on the locker jamb. The flat base portion of the lock bolt **35** is provided with an opening **52** therein and the end portion of the arm opposite the beveled portion carries a lug **53** to receive a coiled spring **55** (see FIG. 4), whose other extremity bears against an inner wall portion of the casing. The U-shaped formation of the lock bolt permits other internal mechanism of the internal assembly to seat therein and the flat base portion of the lock bolt is slidably accommodated by a groove or offset **54** in the rear wall of the casing **50**. Nested within the U-shaped portion of the lock bolt **35** with an interposed washer **57** is a combined key control cam and combination-changing button **56**, shown in detail in FIGS. 17 and 18, wherein its button portion **56'** projects rearwardly through the opening **52** in the base portion of the lock bolt **35** and through an opening **58** provided therefor in the rear wall of the casing **50**. The inner end portion of a plug extension **59** is secured fast to the button portion **56'** of the member **56** and said plug extension extends forwardly axially of the casing **50** in a manner so that the semi-cylindrical forward end of the plug extension **59** is engageable with a similar mating portion on the plug **47**. Inwardly of the cam **56** there is mounted a bottom plate **60**, shown in detail in FIGS. 9 and 10, whose mid portion is offset forwardly and apertured and slotted for engagement with the inner end portion of the tumbler disc shaft or post **41**.

As will best appear from FIGS. 3 and 4, an intermediate portion of the tumbler disc shaft or post **41** revolubly carries a plurality of tumbler discs **61** and **61'** with interposed non-rotating collars **62**. An inner tumbler disc **61'** is shown in detail in FIGS. 15 and 16, and it will be observed that each of said tumbler discs **61'**, as well as the outer tumbler disc **61**, is formed with a peripheral gate **63**. However, on the two innermost tumbler discs **61'**, substantially diametrically opposite the gates, the disc peripheries are formed with obliquely angled notches **64** so as to cam out the nose portion of a drive lever **65** (FIGS. 4, 5, 19 and 20), as the lock bolt is projected to the forward position of FIG. 4. With the angled notches **64** on the remote sides of said tumbler discs **61'**, when the drive lever **65** retracts the lock bolt, as will hereinafter appear, said lever will remain enmeshed with the gates of all of said tumbler discs. Thus all discs are engaged or disengaged at the same time. However, the forward tumbler disc **61** is arranged on the post with its gate **63** in a position of clockwise advancement relative to the position of the gates of the discs **61'**. Consequently, the nosed end of the drive lever **65** becomes interlocked with the gate of said tumbler disc **61** by force resulting from rotation of the dial when the lock is being released. The inner end portion of the drive lever **65** is pivotally mounted, as at **66**, on a face portion of a lever retaining plate **67**, shown in detail in FIGS. 11 and 12. The drive lever **65** is yieldingly urged into engagement with peripheral portions of the discs **61** and **61'** by a spring **68**, shown in detail in FIGS. 23 and 24, which is confined between an inner wall portion of the case **50** and an edge portion of the drive lever **65**.

The previously mentioned lever retaining plate **67** is shaped and constructed as shown in detail in FIGS. 11 and 12, having therein an ovate central opening **69**, a notch **70** in the curved peripheral portion thereof and an outwardly bent finger **71** adjacent its forward edge. Also, there are a pair of relatively small apertures **72** in the plate, one of which is utilized for the pivot post **66** for the drive lever **65**. The other aperture **72** receives a pivot post **73** for pivotally mounting an upset lever **74**, shown in detail in FIGS. 21 and 22 and shaped as illustrated therein. The outwardly bent finger **71**, adjacent the forward edge of the plate, serves as a stop to limit or restrict pivotal movement of the upset lever **74** in one direction and to prevent the upset lever from contacting or binding on the tumbler discs **61–61'** when the lock is engaged.

The drive lever **65**, in its mounted position, has its inner, pivotally mounted end adjacent the side wall of the casing **50** remote from the bolt **35**. The manner in which the drive lever is mounted and located insures contact of the drive lever with the tumbler discs during retraction of the yieldingly mounted lever retaining plate **67** and bolt **35** during the opening operation of the lock and, furthermore, resists such radial forces as would normally tend to disengage it. The outermost tumbler disc **61**, when in peripheral contact with the nose end of the drive lever relative to the abutment side of its gate **63**, engages a notch or detent **75** in the nose end of the lever **65** and thereby holds said lever **65** in contact with said tumbler disc by the rolling action of the disc, forcing the nose portion of said lever **65** downwardly into tighter engagement with the disc.

The previously mentioned upset lever **74**, which is pivotally mounted on the lever retaining plate **67**, and which is under the force of a spring **76**, has an edge portion adjacent the disc formed with a shoulder **77** for pawl and ratchet-like engagement with one of the peripheral notches **64** in a tumbler disc **61'** when the condition shown in FIG. 6 attains and the lever retaining plate **67** is in its retracted position. The forward extremity of the upset lever **74** is adapted to engage the outwardly bent finger **71** on the lever retaining plate to limit the movement of said upset lever toward the tumbler disc, as previously mentioned.

The cam portion of the member **56**, previously mentioned, is generally in the form of an arrowhead (see FIG. 17) and is formed with surface dimples or dents **78** to give safety clearance to certain clutch pins when in locked position. These clutch pins **79** are axially, movably mounted similarly to the clutch pins shown in the Foote and Arnold Patent No. 3,031,877, and the inner ends thereof are in surface engagement with portions of the key control cam member **56**. The forward end portions of said pins **79** bear against the clutch plate **46** to shift the same axially forwardly in the casing **50** (see FIG. 3) when the button portion **56'** of the member **56** is pressed inwardly.

Although the complete operation of the lock will be described more in detail hereinafter, at this point it may be stated that when the master control key **49** is inserted into the slotted plug **47** and turned, through the engagement between the inner end of the plug **47** and the plug extension **59**, the combined key control cam and combination changing cam **56** will be turned to remove the high side of the cam from a protuberance **80** on the bottom plate **60** (see FIG. 3). Then the cam **56** may be pushed forwardly axially by pressure on the externally protruding cam button **56'**. This inward movement of the cam is transferred to the disc clutch plate **46** by the axially moving pins **79**. Thus, the clutch plate **46** is removed from engagement with the forward tumbler disc **61** so that a new combination for the permutation mechanism may be selected. As will be evident, the clutch plate **46** is formed similarly to the clutch plate shown in FIGS. 10 and 11 of the Foote and Arnold U.S. Patent No. 3,031,877 and includes in its peripheral portion a pluarlity of variably spaced apart apertures adapted for selective engagement with a lug **81** projecting forwardly from an outer face portion of the outermost portion of the tumbler disc **61** and transverse slot **85** in the sleeve portion of the clutch plate interconnect with mating splines or fingers **45** formed on the disc driving plate **42**. A compressed, formed spring **82** between said clutch plate **46** and a cover plate **83** (see FIG. 4) maintains yielding contact between

the clutch plate and the forward tumbler disc **61**. It may also be stated that said cover plate is a blanked and punched element with a central aperture through which pass the interconnecting splines of the internal and external assemblies of the lock.

Operation of spring bolt combination lock by dialing the correct combination

With reference to FIGS. 3 and 6 of the drawings, operation of the permutation mechanism to open the lock is initiated by rotating in the proper directions the dialing knob **36** to rotate the tumbler discs **61** and **61'** through the action of the lost motion intercoupling action of lugs **81'** on the faces of the tumbler discs engaging in recesses therefor in the adjacent faces of companion discs. Ultimately all of the tumbler discs become aligned with their notches or gates **63** in registration, which action is well understood in the art. After this manipulation, which accomplishes the mutual registration of the tumbler disc gates, the nose end of the drive lever **65**, which is pivotally mounted on the lever retainer plate **67**, is urged by the spring **68** into the opening created by the registering tumbler disc gates. Further rotation of the dialing knob **36** in a clockwise direction relative to FIG. 4 will cause a peripheral portion of the outermost tumbler disc **61** to bear against the nose of the drive lever **65** and urge said lever laterally, which lateral movement is transferred, by the pivot post **66**, to the lever retaining plate **67**. Additionally, this lateral movement is transferred from the lever retainer plate **67** to the lock bolt **35** by contact between the inner end of the lever retaining plate and an end flange **84** on the innermost leg portion of the lock bolt in opposition to the force of the spring **55**. In this manner the beveled outer end of the lock bolt **35** will be withdrawn through the slot which accommodates it into the lock case **50**, clearing the bolt of engagement with the door jamb, whereby the locker door is unlocked and released.

Concurrently with the lock bolt retracting action described, the upset lever **74**, which is pivotally mounted on the post **73** on the lever retaining plate **67** and yieldingly urged toward the tumbler discs **61** and **61'** by the upset lever spring **76**, but restrained by the outwardly bent finger **71**, and which lever normally minutely clears the periphery of the tumbler discs, is then brought into contact with the periphery of the tumbler discs by the lateral movement previously mentioned. When the bolt **35** starts its fully retracted position within the lock case **50**, the upset lever **74**, which has been urged against the periphery of one or more of the tumbler discs, then pivots in a clockwise direction relative to FIGS. 5, 6, 7 and 8 so that its shouldered end portion **77** enters one of the disc angled ratchet notches **64**.

When the operator releases his grasp on the dialing knob **36**, after accomplishing the unlocking operation, the binding action of the drive lever **65** is relieved relative to the tumbler discs **61** and **61'** and the lever retaining plate **67**. The resilient action of the bolt spring **55** then shifts bolt **35** in a direction so that the angularly directed end flange **84** of the bolt acting against the adjacent end portion of the lever retaining plate **67** advances the same toward the left, relative to FIGS. 5, 6, 7 and 8, together with the drive lever **65** and the upset lever **74** carried thereby. The lever **74**, however, is in hooked engagement with one of the disc notches **64** and thereby causes the tumbler discs to revolve in a clockwise direction relative to the drawings and this turning movement of the disc continues until the shouldered portion **77** of the upset lever clears the last of the series of disc ratchet notches **64**, during which time the head of the lock bolt **35** has returned to its projected position of FIGS. 4, 5 and 8. The movement to the left of the lever retainer plate **67**, carrying with it the drive lever **65** and the upset lever **74**, causes the drive lever to be cammed out of the tumbler disc gates **63** by riding outwardly on the obliquely inclined edges thereof. The outermost tumbler disc **61** does not at this time have this obliquely slanted edge of its gate presented to the drive lever nose **65**. Hence, the disc **61** will be caused to revolve in a counter-clockwise direction by the action of the drive lever on its periphery and this revolving action continues until the drive lever cams out of the gate **63** and can no longer overcome the resistance of the turning movement of the outermost disc **61**, whereupon the nose portion of the drive lever rides on the periphery of all of the tumbler discs. We have heretofore seen that the outermost tumbler disc **61** connected to the dialing knob assembly **36** will, by the last-mentioned revolving action of the disc **61** by the drive lever **65**, automatically turn or revolve the dialing knob **36** completely away from the last combination number with which it was registered. This is extremely important because, when the lock has been released or opened through the permutation mechanism and the dialing knob is released, the discs will be completely "upset" and the dial markings will be removed from registration to prevent detection of any of the setting points. As was seen, the outermost tumbler disc **61** is revolved in one direction while the inner discs **61** are revolved in an opposite direction, which accomplishes the "upset" with relation to the alignment of the tumbler disc gates. A complete redialing of the combination is therefore necessary to bring the tumbler discs into such mutual alignment as will permit the lock to be opened.

Operation of the lock by using the control key

This type of operation will be described particularly with reference to FIGS. 3 and 7 of the drawings. The master control key **49** is, of course, inserted into its slot or key-way in the plug **47** and the operation of the lock plug proceeds in a manner well understood in the art. It may be stated, however, that in the present embodiment, if the key is turned one-quarter of a revolution, in a clockwise direction relative to FIG. 4, this motion is transmitted to the plug extension **59** and from thence to the key control cam **56** in the manner explained in the Foote and Arnold Patent No. 3,031,877. The cam **56** in the locked condition of the mechanism (see FIGS. 5 and 6), normally presents its "low" side to the flanged end **84** of the lock bolt **35**. However, when the cam is turned a quarter of a revolution in a clockwise direction through the operation of the cylinder plug, said cam gradually presents its higher side to the bolt flange **84** and thereby retracts said bolt head into the lock case **50** and compresses the spring **55**. Naturally, said bolt, when retracting into the case, carries with it the lever retaining plate **67**, which it engagingly straddles, together with the drive lever **65**, drive lever spring **68**, upset lever **74** and upset lever spring **76**. During this movement the drive lever and upset lever perform no functions because the tumbler discs are in disarranged or "upset" condition and the nose ends of said levers merely slide over the peripheries of the discs as they are carried along by the movement of the lever retaining plate. When the control key **49** is turned a quarter revolution counterclockwise, back to its original position, the expansive force of the spring **55** returns the bolt **35** to its initial projection position, causing the lever retaining plate **67** and the various parts mounted thereon to reciprocate toward the left relative to FIGS. 5, 6, 7 and 8.

It should also be stated at this point that the head of the bolt **35** can be retracted into the lock case **50** by a pushing action exerted directly thereon, which retraction of the lock bolt will compress the spring **55**. When pushing pressure on the bolt head is released it will be automatically returned to its projected position, without disturbing any of the mechanism of the lock, due to the expansive force exerted on the bolt flange **84** by the spring **55**. This is an action which occurs when a door or other member on which the lock is installed is closed with the bolt being pressed or retracted into the lock case by the door jamb or striker plate. Because the bolt returns to

its projected position behind the jamb, it is self-latching and is, therefore, highly advantageous when installed on box-type lockers and the like which are devoid of incorporated latching bars and the like.

Operation of changing the combination of the lock by turning the control key

Insertion of the control key **49** into the cylinder plug **47** is a prerequisite to conditioning internal assembly parts of the lock. We have heretofore seen that the lock may be opened, independently of the permutation mechanism, by turning the key a quarter of a revolution in a clockwise direction to a "click" stop relative to FIG. 4. After thus turning the key to open the lock and the locker door, the key should be turned through an additional angle of approximately one-eighth of a revolution in a clockwise direction to a "stop" position. Said additional turn of the key imparts an additional turning movement in the same direction to the plug extension **59** and the key control cam **56**. The latter in all of its positions previously referred to was blocked from inward axial movement by engagement with the protuberance **80** on the rear face of the bottom plate **60**. However, the additional turning movement imparted to the control cam **56** causes the cam to clear the protuberance **80** so that the cam **56**, plug extension **59** and other parts are free to be moved axially inwardly. The latter is accomplished by a forceful manual pressure on the button portion **56'** of the control cam **56** and such inward pressure causes the cam to react against the pins **79** which are projected axially forwardly in slots therefor in the tumbler disc post. The inner ends of said pins **79** react against the inner face of the clutch plate **46** and shift the clutch plate out of engagement with the forward tumbler disc **61**. A slight manual turning movement imparted to the dialing knob **36** at this time then places the combination numbers or delineations on the knob and dial in a new relationship relative to the gates on the tumbler discs **61** and **61'**, all as is set forth in the Foote and Arnold Patent No. 3,031,877.

When manual pressure on the bottom portion **56'** of the cam is released, the expansive force of the spring washer **82**, which was compressed when the clutch plate was shifted, automatically returns the clutch plate to clutching engagement with the forward tumbler disc **61**. The expansive force of the spring washer and the consequent return movement of the clutch plate causes the latter to react against the clutch pins **79** to reciprocate the same toward the right relative to FIG. 3. The control cam **56** is thereby forced back to its normal position of FIG. 3 with the button **56** in its normal rearwardly protruding position. Thereafter the control key **49** is turned in a counter-clockwise direction relative to the drawings, back to its normal position of FIG. 3, and said counter-clockwise movement transmitted to the cam **56** through the plug extension **59** will reposition the high portion of the cam **56** behind the bottom plate protuberance **80**, preventing forward axial movement of the cam, clutch pins and other associated parts. FIGS. 3 and 8 of the drawings may be specifically referred to in connection with the combination changing operations indicated above. If the control key **49** is finally completely removed from the key-way of the plug extension, the lock is in condition to be operated by the permutation mechanism by dialing in the manner heretofore described, but through dialing a new combination or set of dialing reference points. Of course, at any time the permutation mechanism may be by-passed and the lock may be opened by inserting and using the control key as heretofore described. The push button **56'**, which must be pressed in order to permit the attainment of a combination change, is inaccessible to tamperers except when the lock-equipped door is opened to thus expose the button **56'** on the rear wall of the lock case.

Although the lock mechanism is a master key controlled permutation lock and is, therefore, suceptible to being opened through the dialing of the correct combination or through the use of a master key, it incorporates a simple push button mechanism accessible only when the locked door is opened, which permits the lock combination to be changed without errors in an easy and rapid manner and without the use of special tools. It should further be observed that when the lock is opened through the use of a control key it is only necessary to turn the key through a quarter of a revolution and at this point a slight stop or resistance is encountered so that the operator will know by the "feel" that the key has been turned sufficiently far to accomplish the unlocking function. If it is desired to change or alter the combination for the permutation mechanism, after the key has been turned through the quarter revolution to a "click" stop it is then manually turned an additional approximate one-eighth revolution to a firm "stop" beyond the "click" position, whereupon the push button mechanism may be operated to initiate the combination changing operation. There can be no accidental disturbance of the push button mechanism when the key is turned only through the one-quarter turn for door opening purposes. When the improved lock is dialed manually the combination is automatically "upset" or disturbed after the spring bolt has been retracted and the door opened merely by releasing the dialing knob, permitting the spring bolt to be projected. In this condition the locker door may be closed and is consequently self-locking or latching in addition to the combination "upset" feature.

The improved key controlled combination changing permutation lock is especially suited to use in connection with box-type lockers, drawers, cabinets or the like which are devoid of automatic latching bars or handles. The lock, however, is easy to operate, incorporates strong, durable and efficiently operating mechanism, may be easily operated or handled by an unskilled person, and is well adapted for the purposes described.

What is claimed as the invention is:

1. A combination lock comprising, a lock casing having an opening therein, a lock bolt reciprocally mounted through the casing opening and having an integral shouldered portion extended into the casing, a spring reacting against the shouldered extension of the lock bolt to yieldingly urge it toward its projected position, a plurality of superimposed tumbler discs rotatably mounted within the casing and formed with registering gates and notched peripheral portions, means including a knob for turning said discs to a predetermined position wherein their gates are in registration, a lever retaining plate carried by the extended portion of the lock bolt to yieldingly reciprocate therewith, a spring biased drive lever pivotally mounted on said lever retaining plate and having a nose portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration, a spring biased upset lever also pivotally mounted on the lever retaining plate and having a portion engageable with the tumbler disc notches to turn and upset the same when the bolt is moved from its retracted to its extended position, a key-receiving cylinder plug independently rotatably housed within said knob and turnable upon the insertion therein of a proper key, and a cam within the casing and connected to the cylinder plug to turn therewith and engageable with a shouldered portion of the lock bolt extension to reciprocate the bolt to a retracted position when the plug is turned through an inserted key.

2. A combination lock comprising, a lock casing having an opening therein, a lock bolt reciprocally mounted through the casing opening and having a dished and shouldered portion extended into the casing, a spring reacting against the shouldered extension of the lock bolt to yieldingly urge it toward its projected position, a plurality of superimposed tumbler discs rotatably mounted within the casing and formed with registering gates and notched peripheral portions, means including a knob for turning said discs to a predetermined position wherein their gates are in registration, a lever retaining plate nest-

ed within the dished extension of the lock bolt to yieldingly reciprocate therewith, a spring biased drive lever pivotally mounted on said lever retaining plate and having a nose portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration, a spring biased upset lever also pivotally mounted on the lever retaining plate and having a portion engageable with the tumbler disc notches to turn and upset the same when the bolt is moved from its retracted to its extended position and the lever retaining plate reciprocates therewith, a key-receiving cylinder plug independently rotatably housed within said knob and turnable upon the insertion therein of a proper key, and a cam within the casing and connected to the cylinder plug to turn therewith and engageable with a shouldered portion of the bolt extension to reciprocate the bolt to a retracted position when the plug is turned through a predetermined angle by an inserted key.

3. A combination lock comprising, a lock casing having an opening therein, a lock bolt unit including a bevelled head extending through the casing opening and a dished and shouldered extension within the casing and laterally reciprocally movable therein, a spring reacting against the extension of the lock bolt to yieldingly urge it toward its projected position, a plurality of superimposed co-axial tumbler discs rotatably mounted within the casing and formed with registering gates and notched peripheral portions remote from the gates, means including a knob for turning said discs to a predetermined position wherein their gates are in registration, a lever retaining plate nested within the dished extension of the lock bolt to reciprocate therewith, the axis of the tumbler discs being perpendicular to the plane of movement of the lock bolt, a spring biased drive lever pivotally mounted on an inner end portion of said lever retaining plate and having a nose portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration, a spring biased upset lever also pivotally mounted on an inner end portion of the lever retaining plate and having a portion engageable with the tumbler disc notches to turn and upset the same when the bolt is moved from its retracted to its extended position, a key-receiving cylinder plug independently rotatably housed within said knob and extending into the casing and turnable upon the insertion therein of a proper key, and a member within the casing and connected with the cylinder plug to be turned thereby and engageable with a shouldered portion of the bolt extension to reciprocate the bolt to a retracted unlocking position independently of the disc operation when the plug is turned through a predetermined angle by an inserted key.

4. A combination lock comprising, a lock casing having an opening therein, a lock bolt reciprocally mounted through the casing opening and having a dished and shouldered portion extended into the casing, a spring reacting against the shouldered extension of the lock bolt to yieldingly urge it toward its projected position, a plurality of superimposed tumbler discs rotatably mounted within the casing and formed with registering gates, tumbler discs other than the outermost disc being formed with notched peripheral portions substantially diametrically opposite their gates, means including a knob for turning said discs to a predetermined position wherein their gates are in registration, a lever retaining plate nested within the dished extension of the lock bolt to yieldingly reciprocate therewith, a spring biased drive lever pivotally mounted on said lever retaining plate and having a nose portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration, a spring biased upset lever pivotally mounted on another portion of the lever retaining plate and having a portion engageable with the tumbler disc notches to turn and upset the same when the bolt is yieldingly returned from its retracted to its extended position and the lever retaining plate reciprocates therewith, a key-receiving cylinder plug independently rotatably housed within said knob and turnable upon the insertion therein of a proper key, and a cam within the casing and connected to the cylinder plug to turn therewith and engageable with a shouldered portion of the bolt extension to reciprocate the bolt to a retracted position when the plug is turned through a predetermined angle by an inserted key.

5. A combination lock comprising, a lock casing having an opening therein, a lock bolt unit including a bevelled head extending through the casing opening and a dished and shouldered extension within the casing and laterally reciprocally movable therein, a spring reacting against the extension of the lock bolt to yieldingly urge it toward its projected position, a plurality of superimposed co-axial tumbler discs rotatably mounted within the casing and formed with registering gates, certain of said tumbler discs also having notched peripheral portions substantially diametrically opposite their gates, means including a knob for turning said discs to predetermined positions wherein their gates are in registration, a lever retaining plate nested within the dished extension of the lock bolt to reciprocate therewith, the axis of the tumbler discs being perpendicular to the plane of movement of the lock bolt, a spring biased drive lever pivotally mounted on one end portion of said lever retaining plate and having a nose portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration and have been turned in one direction to retract the lock bolt, a spring biased upset lever also pivotally mounted on another portion of the lever retaining plate and having a portion enagageable with the tumbler disc notches to turn the same in an opposite direction and upset the discs when the bolt is moved from its retracted to its extended position, a key-receiving cylinder plug independently rotatably housed within said knob and extending into the casing and turnable upon the insertion therein of a proper key, and means within the casing connected to and operated by the cylinder plug to reciprocate the bolt to a retracted unlocking position independently of the disc operation when the plug is turned through an inserted key.

6. In a master key controlled, combination changing permutation lock having a spring lock bolt, the retraction of which is dependent upon key-actuated mechanism or permutation mechanism, there also being normally locked push button-operated mechanism operative to permit combination changing, the improvements which comprise: a key-receiving cylinder plug operatively connected with the bolt retracting mechanism and also operatively connected with the push button mechanism, the cylinder plug being turnable through a portion of a revolution by a proper key applied thereto to operate the bolt-retracting mechanism, and the cylinder plug being turnable through a greater portion of a revolution by said proper key applied thereto to unlock and permit operation of the push button operated mechanism.

7. A combination lock comprising, a casing, lock bolt controlling mechanism therewithin, permutation mechanism within the casing responsive to a pre-selected combination for operating the lock bolt controlling mechanism, a turnable dialing knob assembly extending exterially of one side of the casing for operating said permutation mechanism, a key-operated plug operatively carried by said dialing knob assembly in coaxial relation and extending to the lock bolt controlling mechanism to operate the same when turned through a first limited arc of movement, combination changing mechanism within the casing and operatively associated with the permutation mechanism, said combination changing mechanism having a normal inoperative position and a shifted combination altering position, permanently attached, manually operated means remote from said dialing knob for shifting said mechanism to its combination altering position, and means normally blocking movement of said mechanism shifting means but releasable upon key turned operation of said

plug substantially beyond the first-mentioned arc of movement.

8. A combination lock comprising, a lock casing having an opening therein, a lock bolt reciprocally mounted through the casing opening and having an extension portion within the casing, a spring reacting against the extension portion of the lock bolt to yieldingly urge it toward its projected position, a plurality of superimposed tumbler discs rotatably mounted within the casing and formed with registering gates having obliquely inclined edge portions, tumbler discs other than the outermost disc being formed with notched peripheral portions substantially diametrically opposite their gates and the outermost disc being positioned so that its gate is reversed relative to the gates of the other discs, means including a knob for turning said discs to a predetermined position wherein their gates are in registration, a lever retaining plate connected to the lock bolt extension to reciprocate therewith, a spring biased drive lever pivotally mounted on said lever retaining plate and having a nose portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration and adapted to be cammed therefrom when the discs are moved in an "upsetting" direction, and a spring biased upset lever pivotally mounted on another portion of the lever retaining plate and having a portion engageable with the tumbler disc notches to turn and upset the discs and cam the drive lever out of the disc gates when the bolt is yieldingly returned from its retracted to its extended position and thereby moves the lever retaining plate.

9. A combination lock comprising, a lock casing having an opening therein, a lock bolt reciprocally mounted through the casing opening and having an integral portion extended into the casing, a spring reacting against a portion

of the lock bolt to yieldingly urge it toward its projected position, a plurality of supermiposed tumbler discs rotatably mounted within the casing and formed with registering gates, certain of the discs having notched peripheral portions, means including a knob for turning said discs to a predetermined position wherein their gates are in registration, a lever retaining plate carried by the extended portion of the lock bolt to yieldingly reciprocate therewith, a spring biased drive lever pivotally mounted on said lever retaining plate and having a portion engageable with the gates of the tumbler discs when the latter are in a predetermined position of registration, a spring biased upset lever also pivotally mounted on the lever retaining plate and having a portion engageable with the tumbler disc notches to turn and upset the same when the bolt is moved from its retracted to its extended position, a key-receiving cylinder plug independently rotatably housed within said knob and turnable upon the insertion therein of a proper key, and a member within the casing and connected to the cylinder plug to turn therewith and engageable with a portion of the lock bolt extension to reciprocate the bolt to a retracted position when the plug is turned through an inserted key.

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