

Feb. 17, 1953

M. KLEIN

2,628,490

PUSH-BUTTON COMBINATION LOCK

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2 SHEETS—SHEET 1

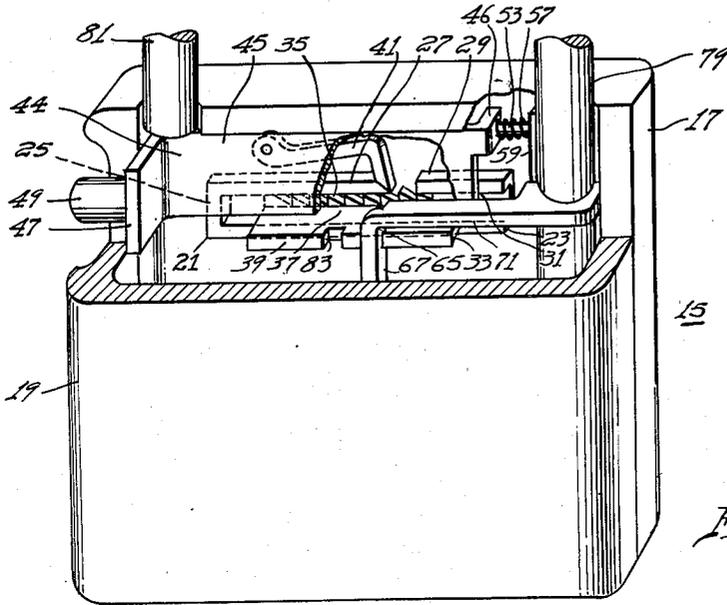


Fig. 1.

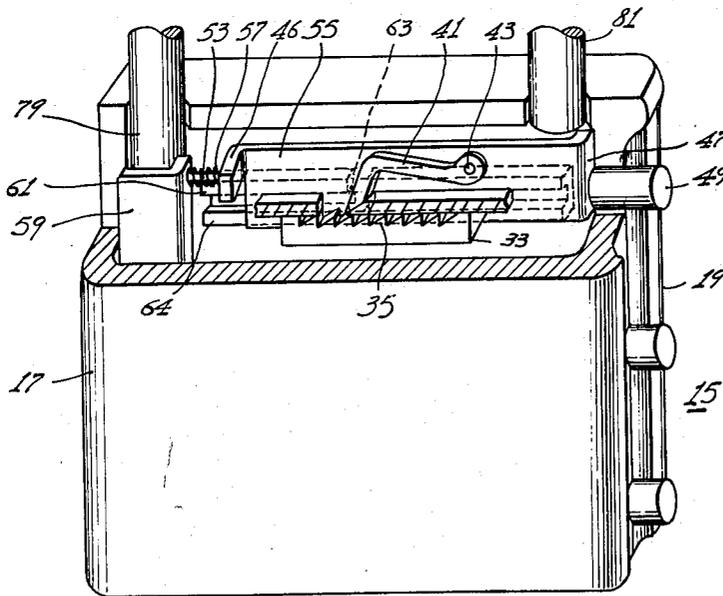


Fig. 2.

WITNESSES:

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Feb. 17, 1953

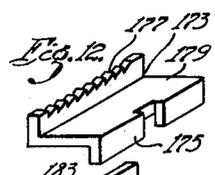
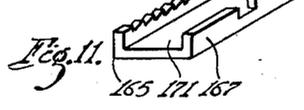
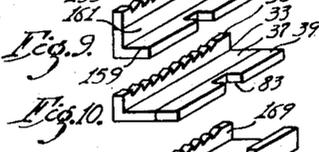
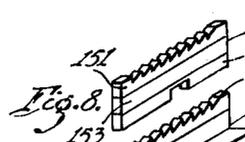
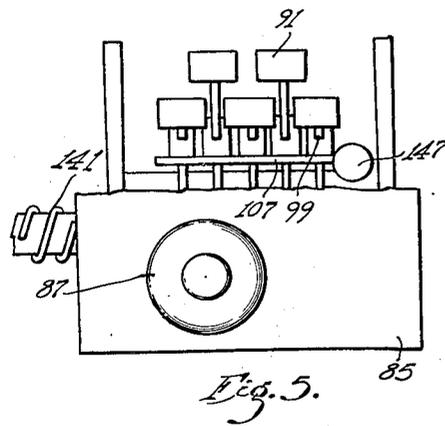
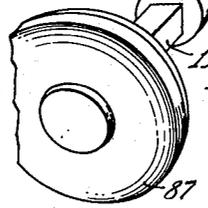
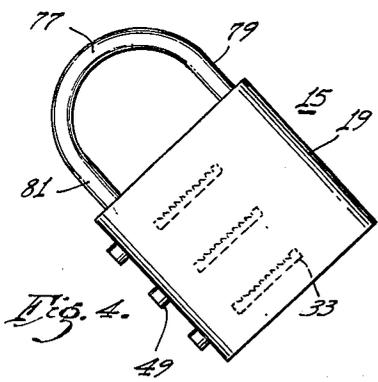
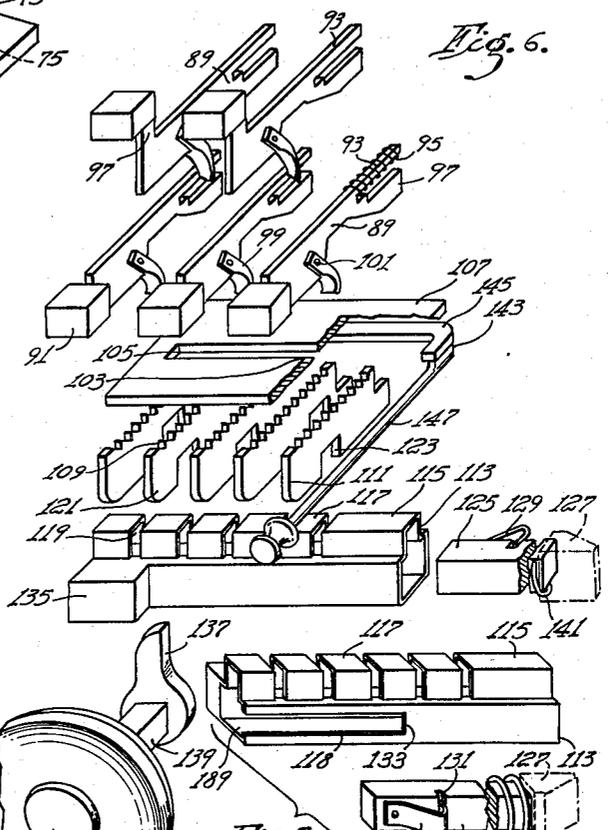
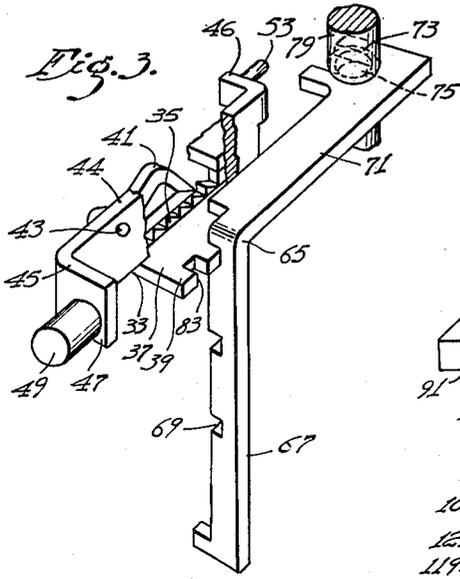
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2 SHEETS—SHEET 2



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# UNITED STATES PATENT OFFICE

2,628,490

## PUSH-BUTTON COMBINATION LOCK

Markus Klein, Pittsburgh, Pa.

Application February 11, 1947, Serial No. 727,777

11 Claims. (Cl. 70-25)

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My invention relates to locking mechanism and has particular relation to permutation locks.

Patents 359,838, Bettis, and 2,346,513, Sidelinker, are illustrative of prior art locking mechanisms of which I am aware. Since the locks shown in these patents are typical of the prior art, the difficulty with prior art locks can be conveniently described by considering their structures. In the Bettis lock, vertically mounted tumblers are actuable by pushbuttons. The bolt is released after each of the tumblers has been actuated a predetermined number of times. In the Sidelinker lock, the tumblers are horizontally mounted and are actuable by operation of the knob.

The Bettis and Sidelinker locks are of complex structure. In the Bettis lock, each of the tumblers has a complicated ratchet composed of two rows of teeth. The interaction between the push rods and the teeth is such that unless the teeth are accurately dimensioned and positioned, the lock will fail to operate. A burr or irregularity on the ratchet teeth of the Bettis lock will prevent release of the bolt. Since the Bettis tumblers are vertical a spring must be provided to hold them in position. Complex mechanisms are required to relax the springs when the tumblers are to be set in their initial positions or moved. In the Sidelinker lock, a multiplicity of complex levers and springs are interposed between the knob and the tumblers. Each of the levers must be accurately dimensioned and the springs must be accurately pre-adjusted if the lock is to operate properly. Improper positioning or dimensioning of the Sidelinker lock or an irregularity on one of the levers will prevent release of the bolt. The predicament of a person confronted with a permutation lock of the type disclosed in the patents which refuses to open need not be described in detail.

It is, accordingly, an object of my invention to provide a locking mechanism of simple structure.

Another object of my invention is to provide a locking mechanism made up of a small number of parts of simple structure.

A further object of my invention is to provide a permutation lock, the coacting movable parts of which need not be accurately dimensioned and positioned.

Still another object of my invention is to provide a locking mechanism adaptable to a variety of uses; for example, for garage doors, automobiles, luggage and like purposes.

An ancillary object of my invention is to provide a padlock of simple structure.

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Another ancillary object of my invention is to provide a doorlock of the knob type of simple structure.

More concisely stated, it is an object of my invention to provide a locking mechanism composed of a few inexpensive and simple parts and particularly adapted for use either in a padlock or in a doorlock of the knob type.

In accordance with the broader aspects of my invention, I provide a locking mechanism primarily made up of a bolt and a plurality of identical sets of three components, each for controlling the movement of the bolt. Each set consists of a tumbler, a pawl for actuating the tumbler and a push-rod for moving the pawl. The bolt and the components coact in such manner that when the tumblers have been moved a predetermined number of times, the bolt is released.

In accordance with my invention in its more specific aspects, the tumblers are mounted to move horizontally in the lock when they are to be operated to release the bolt and are pushbutton actuated. The horizontal pushbutton actuable tumblers may be included in a padlock or in a knob-operated lock. In a padlock, the tumblers may be mounted in such manner that they are free to fall under gravity into their initial positions for the unlocking operation when the padlock is turned so that the tumbler mounting is vertical. In a lock of the knob type, the tumblers may be set in their initial positions by operation of a return arm from the outside of the door.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention, itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which

Figure 1 is a view in perspective with a portion of the wall broken away of a padlock in accordance with my invention;

Fig. 2 is a view in perspective of the padlock shown in Fig. 1 as viewed from the face opposite to that shown in Fig. 1;

Fig. 3 is a view in perspective showing the principal components of the padlock shown in Fig. 1;

Fig. 4 is a view in side elevation showing how the padlock shown in Fig. 1 is set for the opening operation;

Fig. 5 is a view in front elevation with a portion of the wall broken away of a permutation lock of the knob type;

Fig. 6 is an exploded view in perspective showing the lock shown in Fig. 5;

Fig. 7 is a view in perspective showing the latch and the bolt of the lock shown in Fig. 5; and

Figs. 8 to 13 are views in perspective showing various tumblers which may be included in locking mechanism in accordance with my invention.

The padlock shown in Figs. 1 to 4 comprises a rectangular container 15 formed by fastening together by means of bolts or rivets two wall sections 17 and 19 having the shape of rectangular dishes. The wall sections 17 and 19 have substantially congruent edges. In combining them into the container 15, they are placed with their edges coincident and fastened together. The wall sections should preferably be die-cast but they may be sand cast, "hogged" out or formed in any other convenient manner.

From the internal face of one of the wall sections 17, a plurality of elongated bosses 21 extend at spaced intervals. The bosses 21 may be cast integral with the section 17. Each boss is made up of a solid lower side 23, a solid end 25 on one side (on the left in Fig. 1) and an upper side which is split into two sections 27 and 29 providing a notch between them. The edge of the section 27 is bevelled. Spaced slots 31 are thus defined along the wall section 17 between the lower and upper sides 23 and 27—29 of the bosses.

Within each of the slots 31, a tumbler 33 is disposed. Each of the tumblers is composed of a ratchet 35, a body block 37 at right angles to the ratchet 35 and a locking block 39 co-extensive with the body block. The body block rests on the inner face of the lower side 23 of the boss and the ratchet 35 extends upward so that one of its teeth is disposed directly below the notch between the upper walls 27 and 29 of the boss. The end wall 25 of the boss presents a limiting position for the tumbler 33. If the container 15 is held with the side parallel to the end walls 25 of the bosses downward, the tumblers 33 drop to a position in which they engage the side walls.

Each tumbler 33 is actuated by a pawl 41 which is pivotally supported on a pin 43 secured to the long side 44 of a push rod 45. The push rod 45 is in the form of a zig-zag bracket with a long center side 44 and short end sides 46 and 47. The end side 46 extends only for a short distance from the top of the center side but the end side 47 extends throughout the width of the center side. From the short side 47 of the push rod 45, a button 49 extends. When the push rod is mounted in the container 15, the button 49 passes through a circular hole formed between the wall sections 17 and 19 of the container on the side adjacent the closed end 25 of the boss. From a point near the upper edge of the short side 46 of each of the push rods 45, a pin 53 extends in a direction away from the long face 44. A compression coil spring 57 is wound on the pin 53.

A vertical plate 59 extends from the wall section 17 adjacent the short sides 46 of the push rods 45. The plate 59 may be a boss cast integral with the wall section 17 or it may be one side of a right angle bracket, the other side of which is bolted to the wall section. The pin 53 on the face 46 passes through a hole in the plate 59 and the spring 57 rests against the plate 59 and the short side 46 from which the pin is supported. The spring 57 is so wound

that it exerts a force urging the button 49 on the other side 47 outward. With the button in the outward position, the tip of the pawl 41 rests against the bevel of the upper wall section 27 of the elongated boss. When the button 49 is pushed inward against the force of the spring 57, the pawl 41, under gravity, drops into the notch between the upper wall sections 27 and 29 of the boss, engages the ratchet 35 and moves the tumbler 33 one step forward. When the button 49 is released, the push rod 45 returns to its initial position, the pawl 41 disengages the tumbler 33. On another operation of the pushbutton, the pawl again engages the tumbler and moves it another step forward. Repeated operation of the pushbuttons 49 causes the corresponding tumblers to advance in steps. Two or three pushbuttons may be actuated simultaneously.

From the wall section 19 a plurality of pairs of horizontal elongated slotted bosses 61 of equal length extend. The bosses 61 of each pair are colinear. The inner ends of the bosses define a vertical channel 63. The inner faces on the lower sides 64 of each pair of bosses 61 are in the same plane as the inner face of the lower side 23 of a corresponding boss on the opposite wall section 17. The locking blocks 39 of the tumblers, therefore, ride on the inner lower faces of the bosses 61.

The bolt 65 is in the form of a right angle bracket. The bolt is mounted so that its vertical side 67 is in the channel 63 formed between the pairs of bosses 61 suspended from the wall section 19. In that edge of the vertical side 67 of the bolt 65 which faces wall section 17, notches 69 are provided at spaced intervals. The positioning and spacing of the notches 69 are such that they extend over the locking blocks 39 of the tumblers 33. The tumblers are slidable in the notches. The horizontal portion 71 of the bolt 65 extends over the upper face of the upper boss 61 on the side of wall section 19 away from the pushbutton 49. It is provided at its projecting end with a widened portion 73 into which U-shaped groove 75 extends. At the groove 75 the bolt 65 is secured to the shackle 77.

The shackle 77 is of J-form with its long side 79 extending through a circular hole formed on the side of the springs 57 between the wall sections 17 and 19 and the top of its short side 81 extending into a circular hole formed on the opposite side between the wall sections. The long side 79 of the shackle 77 is constricted into a narrow neck below the point where it enters the hole between the sections 17 and 19. The bolt 65 engages the shackle at the constricted portion; the U-groove and the construction interlocking. The end of the long side 79 rests on an end bearing (not shown).

In the locked position of the padlock, the notches 69 in the vertical side 67 of the bolt 65 engage the solid portions of the locking blocks 39 of the tumblers 33 and the bolt is prevented from sliding upward. Each of the tumblers 33 is provided with a notch 83 in its locking block 39. The notch 83 is of such dimension that if it coincides with the notch 69 in the bolt 65, the bolt is free to move upward. The notches 83 in the tumblers 33 are so disposed that if the tumblers are advanced a predetermined number of times from their initial positions, the notches 69 in the bolt 65, and the notches 83 in all the tumblers will coincide. Under such circum-

stances, the bolt will be released so that it may be moved upward. The bolt 65 is free to move upward a sufficient distance to enable the tip of the short side 81 of the shackle to clear the top of the hole formed between the wall sections 17 and 19. The shackle may then be rotated with long side 79 as an axis and the lock opened.

The padlock may be set so that the tumblers 33 are in their initial positions for operation by holding it in such manner that the buttons 49 face downward (Fig. 4). The tumblers then rest against the end walls 25 of the longitudinal bosses. From this position, the operation may be initiated.

In Figs. 5, 6 and 7, a knob-type lock, in accordance with my invention, is shown. The lock is supported in a suitable bracket (not shown in detail) mounted in a mortise door 85 at a position such that a pivot 87 may be operated conveniently.

The lock comprises a plurality of pushbutton actuatable push rods 89. The push rods are mounted so that they extend perpendicular to the large area faces of the door 85 and when their pushbuttons 91 are actuated move longitudinally. At its end away from the outside face of the door 85, each push rod is forked. About the upper finger 93 of the fork, a spring 95 is wound. One end of the spring rests against the junction between the fingers 93 and 97 of the fork and the other end rests against a fixed portion (not shown) of the lock bracket. The spring 95 urges the push rod 89 outward. (The spring 95 is shown on only one rod 89 but is actually provided on all rods.)

The pushbuttons 91 extend through the outside wall of the lock bracket in two rows; a lower row of three and an upper row of two. The lower buttons are secured directly to the push rods; the upper buttons are secured to short arms 97 extending upward at right angles from the main bodies of the push rods. The main bodies of all push rods are at the same level. A pawl 99 is pivotally suspended from a pin 101 on the main body of each of the push rods 89. The pawls are at the same level. When the push rods are in the unactuated position, the pawls 99 rest on the bevelled edge 103 of the slot 105 in a slotted cover plate 107. A person adjacent the door 85 on its outside can cause the push rods 89 to move inward by pressing the corresponding pushbuttons 91. When a rod 89 is actuated, the corresponding pawl 99 drops into the slot 105 and engages the ratchet 109 on a tumbler 111, below the cover plate advancing the tumbler one step. Repeated actuation of the push rods 89 causes the corresponding tumblers to be advanced repeatedly in steps.

The bolt 113 of the lock is in the form of a hollow elongated box from the top of which a plurality of hollow projections of U-cross-section extend. The projection 115 extending from the end of the bolt adjacent the edge of the door is longer than the other projections 117. The latter are of equal length. One side face of the bolt 113 has a long slot 118 which extends from the end away from the edge of the door to the transverse center of the face. The projections 115 and 117 are spaced and define slots 119 of thickness which is somewhat greater than the thickness of the tumblers 111. Each of the tumblers is slidably disposed in a corresponding slot. When the lock is in the locked position, a solid portion of the locking block 121 of at least

one of the tumblers is disposed in its corresponding slot 119. The locking blocks 121 of the tumblers 111 have notches 123 of a width slightly greater than the width of the slots 119 (of the U projections 115-117). The bolt is released when the notches 123 of all of the tumblers 111 coincide with the slots 119. To release the bolt 113, each of the tumblers 111 must be actuated a predetermined number of times.

The latch of the lock comprises a rectangular rod 125 on one end of which the latching wedge 127 is disposed. The dimensions of the rod 125 are such that it is freely slidable in the rectangular tube of the bolt. Near the free end of the rod 125 on one of its vertical faces, a leaf spring 129 is secured. The spring is of hook form and when compressed its free end is movable into a slot 131 transverse to the rod. When the rod is inserted in the bolt, the spring 129 is compressed. When the rod 125 is thrust into the bolt to the proper distance, the spring projects through the longitudinal slot 118 and rests against its inner edge 133. When the bolt 113 is released, it is capable of sliding horizontally in a direction parallel to the large faces of the door 85 and away from that edge of the door which is moved when the door is opened.

The longitudinal slot 118 extends from the center of a side of the bolt to the edge away from the latching wedge 127. From the opposite side of the bolt near the end away from the locking wedge a rectangular projection 135 extends. A cam 137 on the shaft 139 of the outside knob 87 of the door engages the vertical face of this projection. When the bolt 113 is released, rotation of the knob 87 will cause the bolt to move away from the junction between the door and the door frame (not shown). The bolt carries the latch with it retracting the latching wedge 127 and permitting the door to open. The knob (not shown) on the inside face of the door is provided with a corresponding cam which engages the leaf spring 129 through the longitudinal slot 118. Operation of this knob causes retraction of the latching wedge independently of the locking bolt 113. When the door is locked, the latching wedge 127 is held in engagement with its cooperative opening in the door frame by the force of a spring 141 which encircles the latch rod 125. At one end the spring is secured to the rod 125, at the other it rests against a wall of the bracket in which the lock is mounted. The force of the spring urges the latching wedge outward.

The tumblers 111 are set in their initial positions by operation of a return device 143. The device comprises a bar 145 at right angles to the tumblers and it engages the tumblers at their edges. The bar 145 is movable into and out of engagement with the tumblers by a rod 147 secured at right angles to it which extends through the door to the outside. To set the tumblers in their initial positions, the rod 147 is pulled outward. When the rod reaches its extreme outward position, it is retracted and the pushbuttons 91 are actuated.

In Figs. 8 to 13, tumblers of various structures which are used in the practice of my invention, are shown. The tumbler 149 shown in Fig. 8 is of a structure similar to that included in the lock shown in Figs. 5 to 7. Its ratchet and body and locking blocks 151, 153 and 155, respectively are in one plane. In the tumbler 157 shown in Fig. 9, the locking block 159 is in a plane at right angles to the body block 161 and ratchet 163.

The tumbler 165 shown in Fig. 11, the locking block 167 and the ratchet 169 are in parallel planes perpendicular to the body block 171. Both the locking block and the ratchet extend upward from the body block. In the tumbler 173 shown in Fig. 12, the locking block 175 and the ratchet 177 are in parallel planes perpendicular to the plane of the body block 179 but the locking block extends downward. In the tumbler 181 shown in Fig. 13, the locking block 183 and the ratchet 185 are adjacent and extend upward from the body block 187.

The reference to a knob-type lock in this specification is intended to comprehend within its scope handle operated locks of all kinds and also locks in which a component corresponding to the cam 137 is push-button operated (as for example on the doors of Lincoln cars). My invention is also applicable to hasp locks such as are used on luggage.

The bolt 113 shown as a tube may be a guide of any structure. For example the lower face 189 of the bolt may be omitted. The H-section projections on the top of the bolt 113 may be solid blocks.

A locking mechanism according to my invention may be adapted to a wide variety of uses. For each use tumblers of the proper structure (Figs. 8 to 13) must be selected and the mechanism must be properly mounted.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. A locking mechanism comprising a locking bolt; a support for said bolt, said bolt being mounted movable relative to said support to locked and unlocked positions; a plurality of tumblers each mounted on said support to move relative to said support in a horizontal plane when said mechanism is disposed in position for operation, said tumblers engaging said bolt in such manner that, when said bolt is in said locked position said tumblers are movable but prevent the movement of said bolt; a pawl for moving repeatedly each of said tumblers independently of the others; a push rod, associated with each pawl, mounted on said support, each pawl being mounted on its corresponding push rod in such manner as to be urged into engagement with its corresponding tumbler by gravity; a slotted cover interposed between each pawl and each tumbler for limiting the portion of the range of movement of said pawl over which it engages said tumbler; and a push button for actuating each push rod to actuate correspondingly each of said pawls, said pawls being actuated solely by their corresponding pushbuttons; said tumblers, after each has been moved a predetermined number of times, releasing said bolt.

2. A locking mechanism comprising a locking bolt; a support for said bolt, said bolt being mounted movable relative to said support to locked and unlocked positions; a plurality of tumblers each mounted on said support to move relative to said support in a horizontal plane when said mechanism is disposed in a position for operation, said tumblers engaging said bolt in such manner that, when said bolt is in said locked position said tumblers are movable but prevent the movement of said bolt; a pawl for moving

repeatedly each of said tumblers independently of the others; a push rod associated with each pawl mounted on said support, each pawl being mounted on its corresponding push rod in such manner as to be urged into engagement with its corresponding tumbler by gravity; a slotted cover interposed between each pawl and each tumbler for limiting the portion of the range of movement of said pawl over which it engages said tumbler, said cover being bevelled on one of those sides of said slot which are perpendicular to the direction of movement of said pawls and the tips of said pawls resting on the bevel of said bevelled side in the unactuated position of said pawls; and a push button for actuating each push rod to actuate correspondingly each of said pawls; said pawls being actuated solely by their corresponding push buttons; said tumblers, after each has been moved a predetermined number of times, releasing said bolt.

3. A padlock comprising a support having holes near the opposite ends of one of the edges thereof; a bolt in the form of a right angle bracket mounted in said support with one of its right angle sides parallel to said edge, said one side having shackle engaging means at the end thereof and said bolt being mounted with said shackle-engaging means aligned with one of said holes of said edge, said other side of said bolt having a plurality of longitudinally spaced notches therein extending transversely thereof; a U-shaped shackle having a long side and a short side mounted with said long side extending through said one hole and engaging said shackle-engaging means and said short side engaging said other hole; a tumbler extending into each of said notches slidable relative to said notches, each of said tumblers having a notch adapted to engage said other side to permit movement thereof and any one of said tumblers blocking movement of said bolt when the notch of said one tumbler is out of register with the corresponding notch of said one side and means for selectively moving said tumblers independently of each other a predetermined distance.

4. A padlock comprising a shackle; means cooperative with said shackle for holding it in locked and unlocked positions, said means including an arm secured to said shackle and extending vertically when said padlock is in a position for operation and having a plurality of notches along the length thereof and a tumbler engaging each of said notches and movable in a direction substantially perpendicular to said arm which while in the locked position prevents said arm from moving in a direction perpendicular to said tumblers, each said tumbler including a ratchet having teeth; a pawl mounted so as to engage each said ratchet under force of gravity when said padlock is disposed in a position for operation and means for actuating said pawls to actuate said tumblers when said padlock is so disposed.

5. A padlock comprising a shackle; means cooperative with said shackle for holding it in locked and unlocked positions, said means including an arm secured to said shackle and extending vertically when said padlock is in a position for operation and having a plurality of notches along the length thereof and a tumbler engaging each of said notches and movable in a direction substantially perpendicular to said arm which while in the locked position prevents said arm from moving in a direction

perpendicular to said tumblers, each said tumbler including a ratchet having teeth; a pawl mounted so as to engage each said ratchet under force of gravity when said padlock is disposed in a position for operation; means for actuating said pawls to actuate said tumblers when said padlock is so disposed and means independent of said pawls and ratchets for limiting the movement of each pawl to the distance of one tooth of its corresponding ratchet on each actuation of said pawl.

6. A locking mechanism according to claim 1 characterized by a latch movable with the bolt.

7. A locking mechanism according to claim 1 characterized by a latch movable with the bolt and by a return device for setting the tumblers in a predetermined initial position at the start of an unlocking operation.

8. A locking mechanism according to claim 1 characterized by a latching mechanism in the form of a rod having a protruding portion over a relatively small portion of the length thereof, by the bolt having a slot along a portion of the length thereof, said rod being thrust onto said bolt in such manner that said protruding portion engages the edge of said bolt, by a mechanism, for causing said bolt to move said rod, on the side of said bolt away from said slot and by another mechanism for moving said rod independently of said bolt by engaging it through said slot.

9. A locking mechanism according to claim 1 characterized by the bolt being movable in a horizontal plane at right angles to the plane of movement of the tumblers and by a latch movable with said bolt.

10. A lock according to claim 9 in which the latch is a rod and the bolt a tube into which said rod is thrust, said rod and tube being provided with cooperative parts restricting the movement of the rod unless the tube is moved.

11. A locking mechanism according to claim 1 characterized by the bolt being movable in a horizontal plane at right angles to the plane of movement of the tumblers, by a latch movable with said bolt and by a return device for moving said tumblers relative to said bolt to set said tumblers in a predetermined initial position at the start of an unlocking operation.

MARKUS KLEIN.

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