This invention relates to door locks, and more particularly to combination door locks.

The main object of the invention is to provide a novel and improved keyless combination door lock which is simple in construction, which is easy to install, and which is arranged so that the door cannot be opened unless the proper combination of actuating elements thereof is simultaneously operated from the outside of the door lock.

A further object of the invention is to provide an improved combination lock which involves relatively inexpensive components, which is rugged in construction, and which remains locked unless the exact combination of plunger elements thereof is simultaneously actuated, the lock being arranged to be held in closed position if any other than the correct plunger elements are actuated by a person attempting to open the lock.

A still further object of the invention is to provide an improved combination door lock which may be easily set to locking position and which cannot be opened from the outside of the door unless the exact proper combination of plunger elements thereof is simultaneously actuated, the lock being arranged so that the combination may be readily changed if so desired.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a fragmentary perspective view of the marginal portion of a door provided with an improved keyless combination lock constructed in accordance with the present invention.

Figure 2 is a fragmentary perspective view of the door of Figure 1 taken from the inside and showing the appearance of the inside portion of the combination lock.

Figure 3 is an enlarged vertical cross sectional view taken on the line 3-3 of Figure 1.

Figure 4 is a horizontal cross sectional view taken on the line 4-4 of Figure 3.

Figure 5 is a vertical cross sectional view taken on the line 5-5 of Figure 3.

Figure 6 is an enlarged perspective view of the locking bar employed in the door lock of Figures 1 to 5.

Figure 7 is a horizontal cross sectional view taken on the line 7-7 of Figure 3.

Referring to the drawings, 11 designates a door and 12 generally designates a combination lock installed in the door in accordance with the present invention.

The lock 12 comprises an outside face plate 13 which is formed with the top arm 14 having the right angled end flange 15. As shown in Figure 1, the face plate 13 is adapted to be secured to the outside surface of the door adjacent an edge 16 thereof, with the arm 14 extending forwardly toward the edge 16 and the flange 15 overlapping said edge. If desired the edge of the door may be suitably recessed to accommodate the element 15.

The door is formed with the recess 17 over which the face plate 13 is secured, said recess containing the lock mechanism presently to be described. Designated at 19 is an inside or back plate which is secured over the inside of the recess 17 parallel to the face plate 13. The plates 13 and 19 may be connected together by headed internally threaded rivets 20 which are inserted through apertures in the face plate 13 and which threadedly receive the shanks of screws 21 inserted through apertures in the back plate 19, whereby the back plate 19 is detachably secured over the recess 17 and is detachably connected to the face plate 13. The rivets 20 extend through suitable apertures provided in the door 11, as shown in Figure 5.

Secured to the upper portion of the face plate 13 is a horizontally extending bolt housing 22 in which is slidably mounted the locking bolt 23. As shown in Figure 1, the bevelled end 24 of the locking bolt 23 is arranged to project outwardly through the flange 15, said flange being provided with a rectangular aperture through which the bolt 23 is slideable to its externally projecting position, shown in Figure 1. A coiled spring 25 is provided inside the housing 22, said spring bearing against the end wall 26 of housing 22 and the end of the bolt 23, as shown in Figure 5, biasing the bolt 23 outwardly, namely, to the left, as viewed in Figure 5.

The bolt 23 is formed with a downwardly facing recess 27 which is generally rectangular in shape, as shown in Figure 5, and extending transversely through the housing 22, and rotatably mounted in the respective plates 13 and 19 are the relatively rotatable shaft segments 28 and 29, said shaft segments being rotatively keyed together inside the housing 22 for rotation around their common axis, as shown in Figure 4 at 30 and being retained in aligned relationship by respective transverse retaining pins 31 and 32 extending respectively through the shaft segment 28 and the shaft segment 29, the pin 31 bearing against the inside surface of the wall of housing 22 adjacent the face plate 13 and the transverse pin 32 bearing against the inside wall of the housing 22 adjacent the back plate 19, as shown in Figure 4, to hold the shaft segments 28 and 29 against axial separation.

The bolt 23 is slidably supported in an inner housing 35 secured inside the horizontally extending main housing 22, as shown in Figures 3, 4 and 5 and the spring 25 bears against the common end wall 26 of inner housing 35 and the main housing 22 and the end of the locking bolt 23.

Secured on the ends of respective shaft elements 28 and 29 in a conventional manner are the respective door knobs 36 and 37. The shaft segments 28 and 29 are formed with upstanding projections 38 which are engageable against the rear inside wall surface of the recess 27 responsive to clockwise rotation of the shaft segments, as viewed in Figure 5, whereby the bolt 23 may be retracted to an unlocking position. Said shaft segments are further formed with depending projections 39 extending through registered slots 40 and 41 formed in the bottom wall portions of inner housing 35 and main housing 22, as shown in Figure 5, said projections 39 depending a substantial distance below the housing 22 into the recess 17.

Secured to the face plate 13 is a bracket member 43 having the horizontal top flange 44 and the horizontal bottom flange 45, and having the vertical bight portion 46. The bracket member 43 thus coacts with the face plate 13 to form a frame having spaced front and back walls provided by the face plate 13 and the bight portion 46 of the bracket member. Designated at 47 is a vertical locking bar extending slidably through suitable apertures provided therefor in the horizontal top and bottom flanges 44 and 45, said locking bar 47 being formed with a forked top portion 48 in which the depending projection 39 of shaft element 28 is lockingly receivable when the locking bar 47 is elevated, to thereby lock said shaft element 28 against rotation.

As shown in Figure 6, the locking bar 47 is formed on
the opposite sides thereof with the vertically spaced, upwardly tapered locking lugs 49 and is formed at its bottom end with a horizontally extending arm 50, the arm 50 extending through a vertical slot 51 formed in the lower portion of the back plate 19. Designated at 52 are respectively vertically spaced plunger elements slidably mounted in apertures provided in the face plate 13 and in the right portion 46 of bracket member 43, the plunger elements 52 being preferably non-circular in cross section, as for example, being square in cross section, and the apertures in the face plate 13 and in the right portion 46 of bracket 43 being of an expanding shape to receive the plunger members 52 and to prevent rotation thereof. The plunger members 52 extend adjacent opposite sides of the vertical locking bar 47 and normally extend between the laterally projecting locking lugs 49 on the respective opposite sides of the locking bar 47, the upper plunger members 53 normally being above the uppermost locking lugs 49, and being disposed immediately below the forked member 48, as shown in Figure 5. The plunger members 52 are biased forwardly through the face plate 13 by respective coiled springs 54 surrounding the rear portions of the plunger members and biasing the right portions 46 of bracket 43 and respective transverse pin members 55 engaged through the plunger members. Additional transverse pin members 56 are removably secured in the forward portions of the plunger members 52, said pin members 56 engaging against the inside surface of the face plate 13 to limit outward movement of the plunger members to the positions thereof shown in Figure 3. Each plunger 52 has two pin elements projecting therefrom, one designated by the numeral 59 and the other by the numeral 60. These pin elements project from opposite sides of the plungers and the pin elements 59 are in each case farther back from the front end of the plunger than are the pin element 60, the spacing of the pin elements being such that in the normal positions of the plungers the pin elements 59 are in line with the locking bar while the elements 60 are forwardly of the locking bar. Hence any plunger which has its pin element 59 facing the locking bar will be part of the lock combination since its pin element will lie between the adjacent locking lugs to block descent of the locking bar until that plunger and the other plungers similarly positioned are pushed in. Conversely, any plunger which has its pin element 59 facing the locking bar will not be part of the combination, but if depressed will dispose its pin between adjacent locking lugs and thereby block descent of the locking bar.

The plungers are removable from the lock body upon withdrawal of their stop pins 56 and their abutment pins 55, and upon removal may be turned 180° and then reinserted to change the combination of the lock.

In using the lock, the bolt member 23 may be operated in the normal manner by means of knobs 36 and 37 with the locking bar 47 in the non-locking position thereof, shown in Figure 3. When it is desired to set the lock, the user elevates the arm 50 to engage the forked member 48 with the depending projection 39 of the shaft element 28, the pins 59 moving past the inclined surfaces of the sub-adjacent locking lugs 49 as the locking bar 47 is raised and then snapping into position below the locking lugs to hold the locking bar 47 in its elevated locking position wherein rotation of the shaft element 28 is positively prevented, while the inner shaft element 29 may still be rotated by knob 37. The door can then be closed, whereby the beveled end 24 of the locking bolt 23 is first moved inwardly and then pushed outwardly by the associated spring 25, causing the bolt 23 to be held in locking position with the door closed. In order to open the door from the outside, it is necessary to push the proper combination of plunger members 52 inwardly, to thus move the pin elements 59 from below the locking lugs 49. When the proper combination of plunger members 59 is pushed inwardly, the locking bar 47 is released and drops by gravity to the position thereof shown in Figure 3, whereby the shaft element 28 is released and whereby the bolt 23 can be retracted by rotating the outside door knob 26. However, as above explained, if other than the proper combination of plunger members 52 is pushed inwardly, one or more pin elements 69 will be positioned beneath locking lugs 49 and will prevent the locking bar 47 from dropping, whereby the door cannot be opened.

While a specific embodiment of an improved combination door lock has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A combination lock comprising a face plate adapted to be secured vertically to a door adjacent one edge of the door, a horizontally extending bolt slidably mounted in said housing and being arranged to at times project outwardly from said edge, spring means biasing said bolt outwardly, an operating shaft extending transversely into said housing, said bolt being formed with a recess receiving said shaft, a first projection on said shaft engageable with a wall of said recess to retract the bolt responsive to rotation of said shaft, a second projection on said shaft normally depending therefrom, a bracket member secured to said plate, a vertical locking bar slidably engaged with said bracket member for vertical sliding movement, means on said bar lockingly engageable with said second projection to lock said shaft against rotation when the bar is elevated, a plurality of vertically spaced, upwardly tapered locking lugs on said bar, respective horizontal plunger elements slidably mounted in said plate and said bracket member and being disposed between adjacent locking lugs, said plunger elements being disposed at opposite sides of the locking bar out of the path of said bar, spring means biasing said elements outwardly through said plate to predetermined normal positions, a pin element on each plunger element projecting laterally from the plunger element in the direction of said locking bar, a second pin element on each plunger element projecting laterally from the plunger element in a direction away from the locking bar, the pin elements of each plunger element being spaced longitudinally of their associated plunger element, and some of the named pin elements being normally disposed between adjacent locking lugs of the locking bar, the remaining ones of the first named pin elements being located normally forwardly of the locking bar and being movable between adjacent locking lugs when their associated plunger elements are pushed inwardly, said pin elements being removable from the plate and bracket member and being rotatable through 180° before being returned to position, to dispose the second named pin elements in positions in which they project in the direction of the locking bar, when said combination is to be changed.

2. In a lock of the character described: a frame having spaced front and back walls; a vertically disposed locking bar longitudinally slidably mounted in the frame between said front and back walls for movement between a raised locking position and a lowered unlocking position; a row of spaced apart lugs projecting from a side edge of the locking bar in a direction parallel to the front and back walls of the frame, each lug having a downwardly facing substantially horizontal surface; a row of plungers slidably in aligned holes in the front and rear walls of the frame, there being one plunger for each lug on the bar, the holes in the front and rear
walls being so positioned with respect to the locking bar that the plungers lie adjacent to the side of the bar from which the lugs project but beyond the path of said lugs so that any plunger may be axially withdrawn from the frame without hindrance from the locking bar; a spring encircling each plunger and confined between the back wall and an abutment on the plunger rearwardly of the locking bar to yieldingly bias the plunger forward with its front end protruding from the front wall to provide a push button; means limiting the forward spring produced motion of the plungers; and a pair of pins on each plunger projecting horizontally therefrom at axially spaced points on the plunger and with one pin on that side of the plunger which faces the locking bar and the other pin projecting from a side of the plunger which does not face the bar, the spacing of the pins along each plunger being substantially equal to the distance the plunger is depressible push button-wise and the locations of the pins on the plungers being such that in the normal free position of each plunger, its rearmost pin aligns with the locking bar and the other pin lies forwardly of the locking bar, the pins all being long enough to project into the space between the lugs on the locking bar and have restraining engagement with the downwardly facing surfaces on the lugs, providing that the pins are on that side of the plunger which faces the bar, so that a plunger is an active part of the locking combination when the side thereof from which its rearmost pin projects faces the bar whereas when the plunger is removed and rotated to have the side thereof from which its foremost pin projects face towards the bar after reinsertion, depression of said plunger causes it to block descent of the bar; the plungers having a non-circular uniform cross section for the length thereof and the holes in the front and back walls of the frame in which the plungers slide having a corresponding non-circular shape so that each plunger is restrained against rotation with one or the other of its pins facing the locking bar.

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