

[54] **TIME DELAY COMBINATION LOCKS**

3,220,523 11/1965 Hepner.....192/41 S X
2,879,657 3/1959 Eichberg70/267

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[57] **ABSTRACT**

[21] Appl. No.: **116,967**

The disclosure is of a time delay combination lock of simplified construction in which all parts, except the bolt and the lever through which the bolt is actuated, are aligned and mounted for rotative movement about an axis common to the axis of the knobbed dial by which the combination is set.

[52] U.S. Cl.....**70/269, 70/273, 70/303 A, 192/41 S**

[51] Int. Cl.**E05b 43/00**

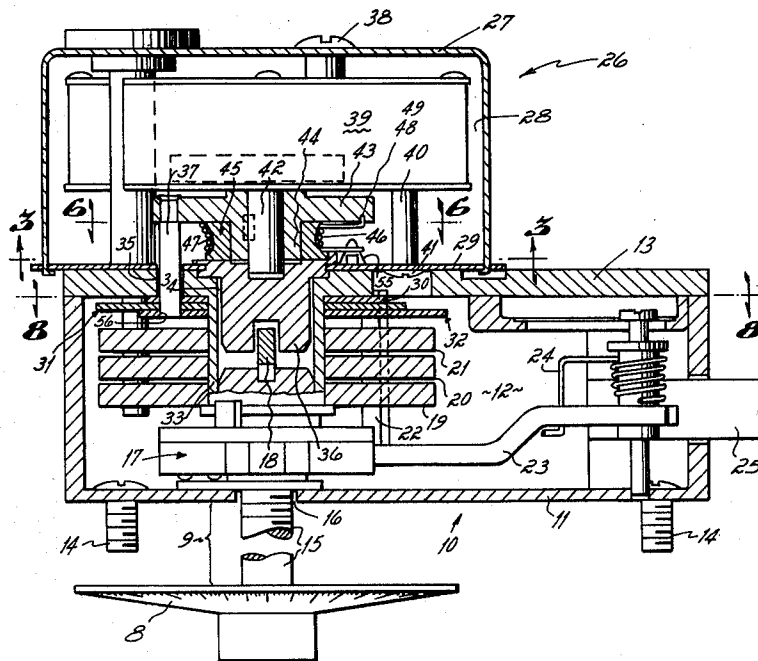
[58] Field of Search.....**70/267, 268, 269, 270, 272, 70/273; 192/41 S**

[56] **References Cited**

5 Claims, 12 Drawing Figures

UNITED STATES PATENTS

2,029,272 1/1936 Miller.....70/268



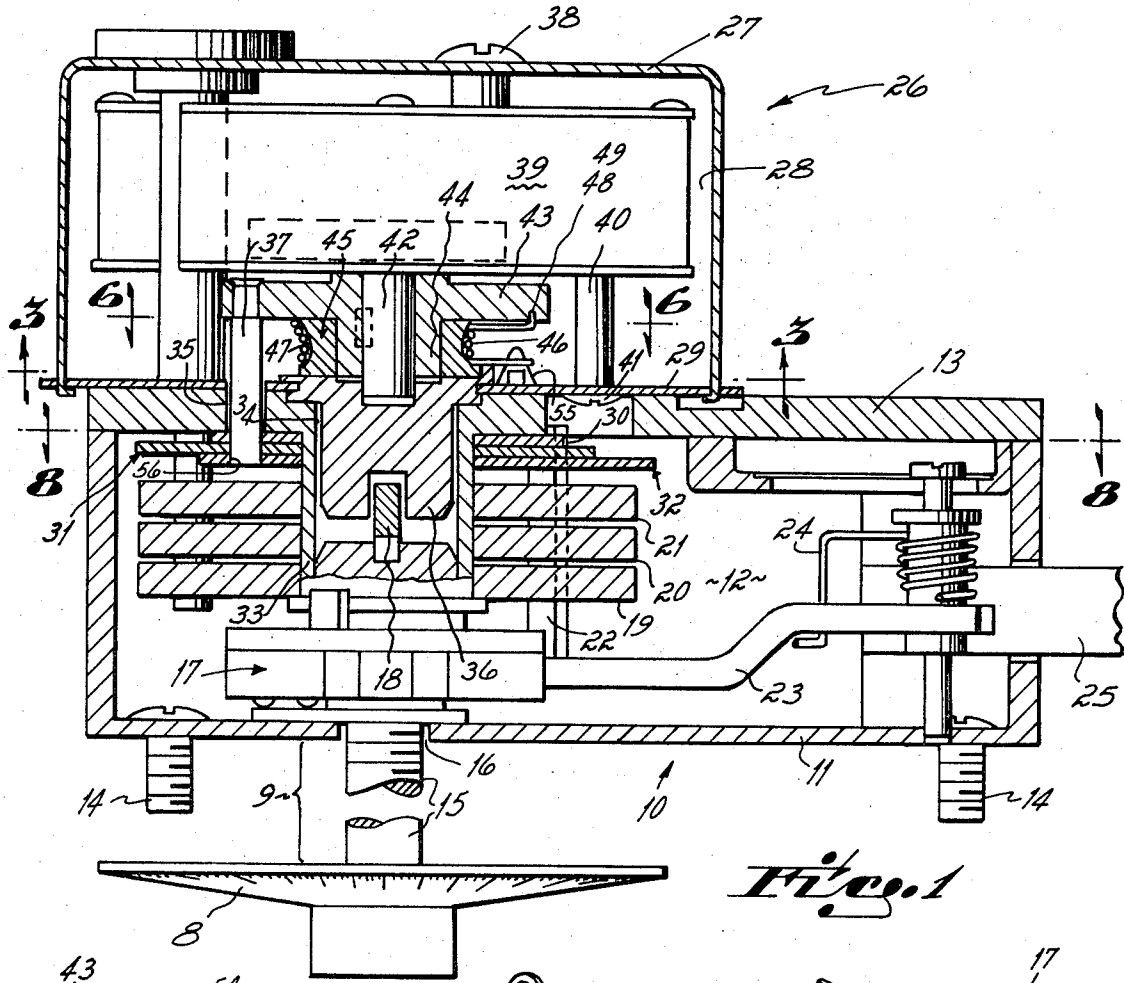


Fig. 1

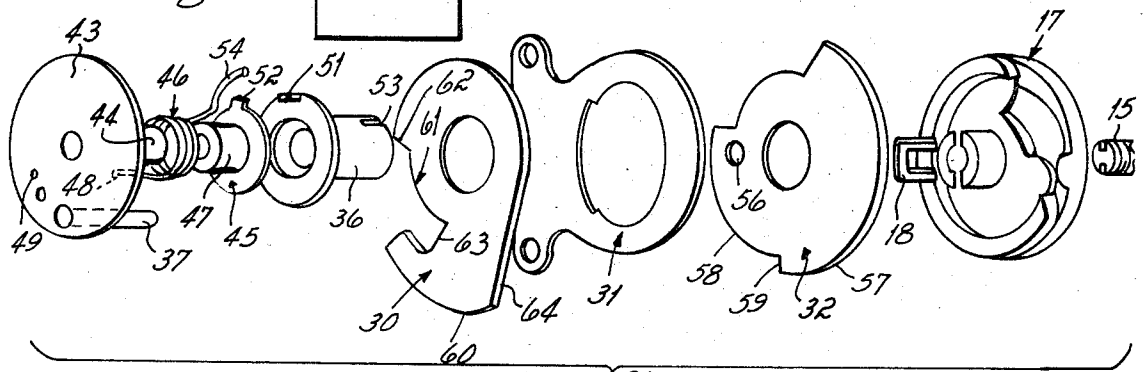
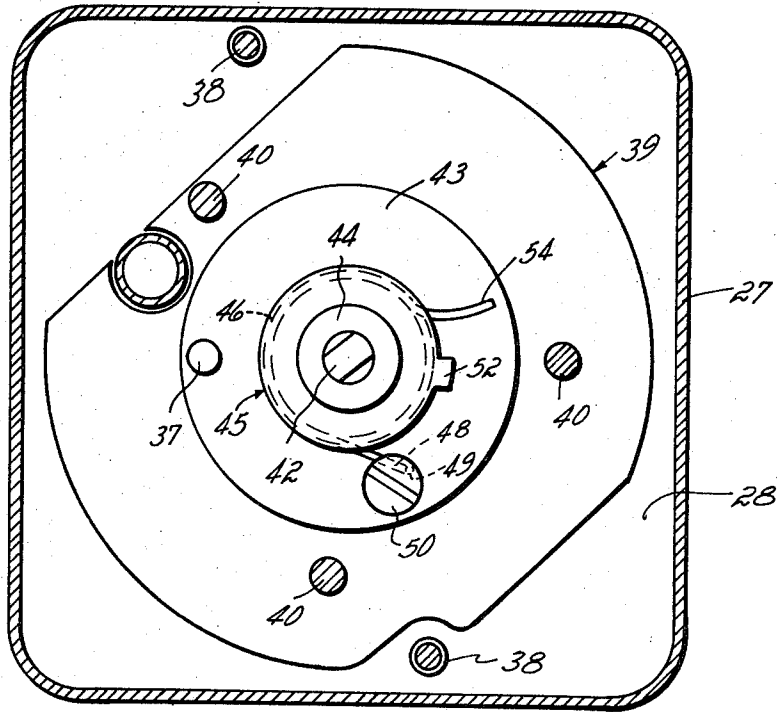


Fig. 2

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Fig. 3

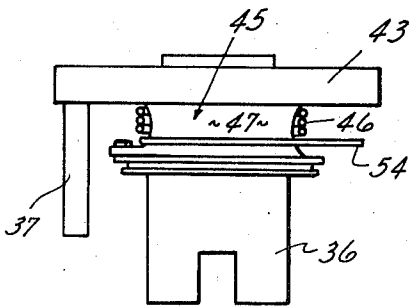


Fig. 4

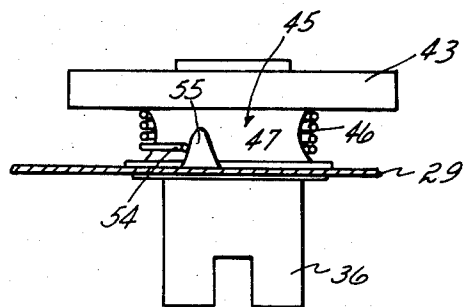


Fig. 5

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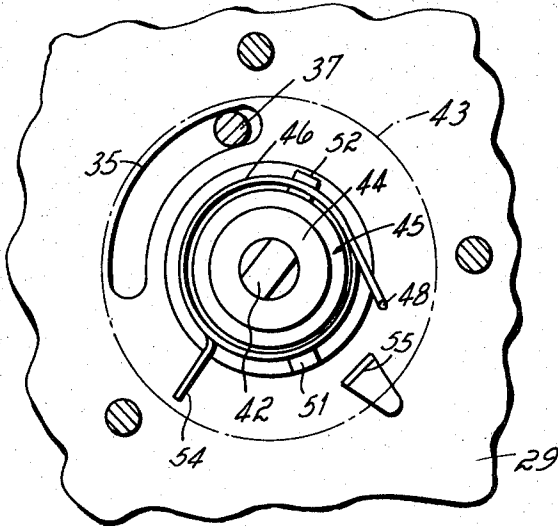


Fig. 6

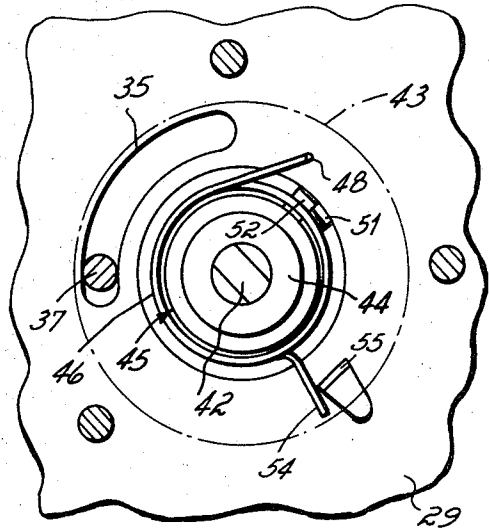


Fig. 7

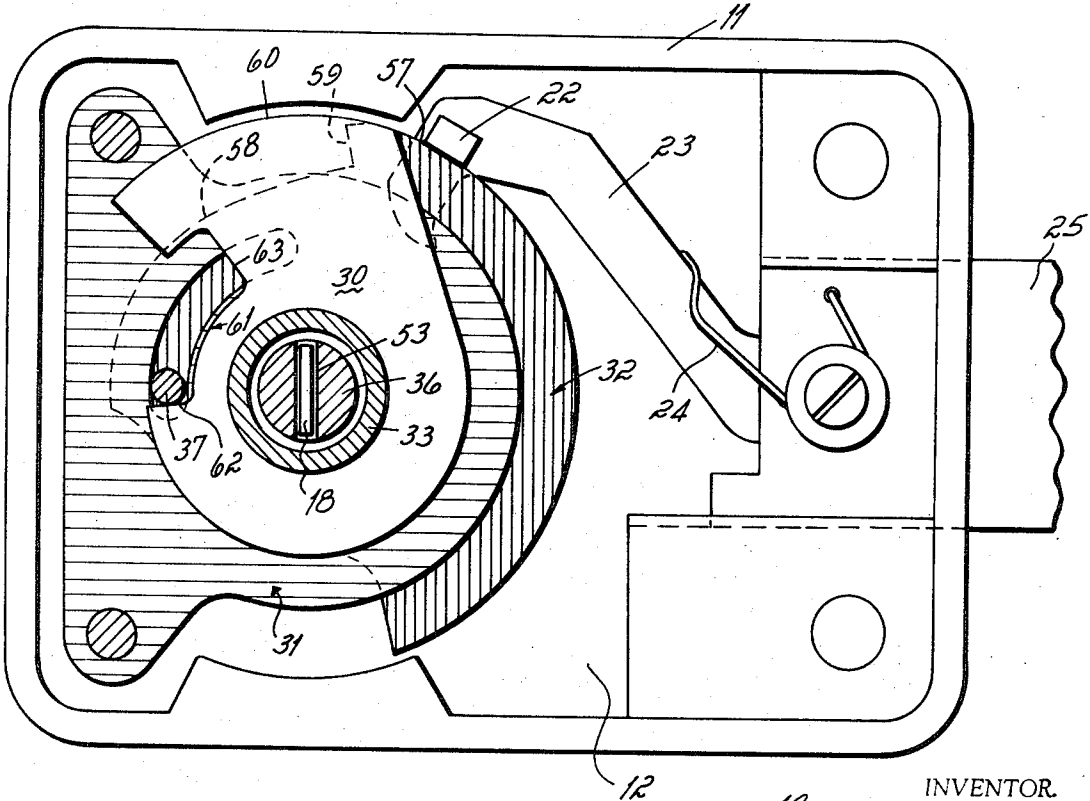


Fig. 8

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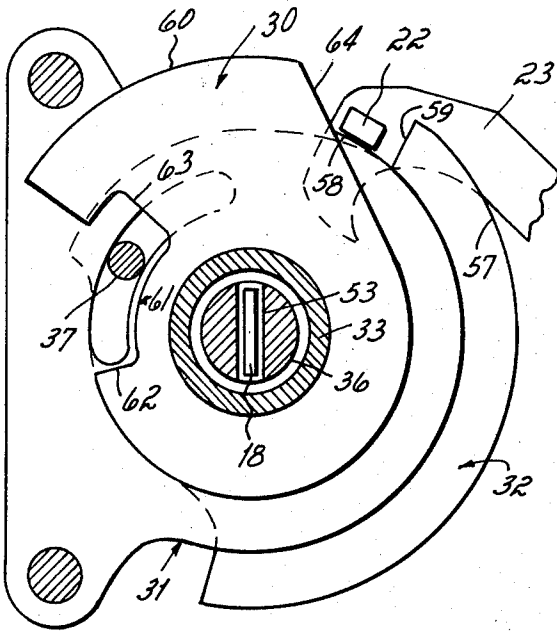


Fig. 9

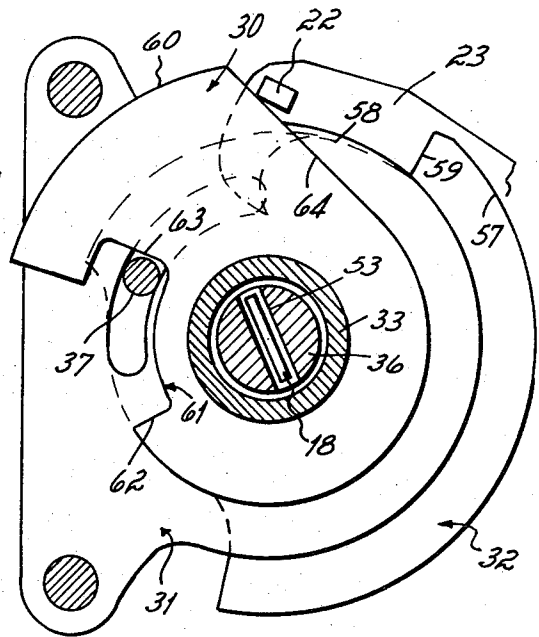


Fig. 10

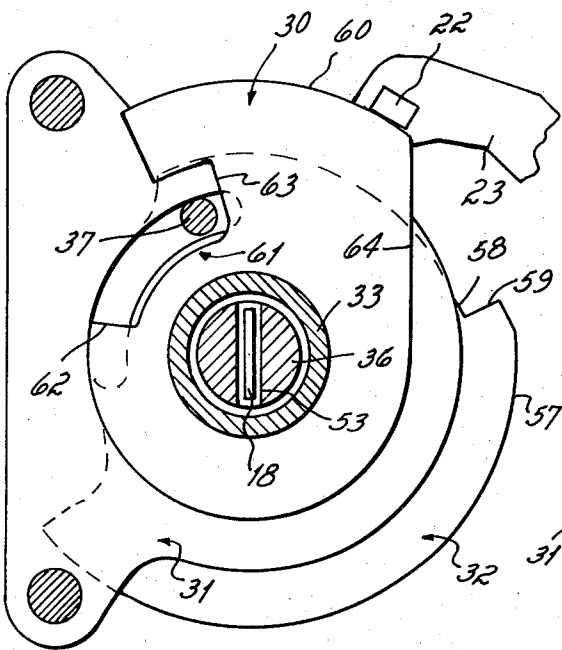


Fig. 11

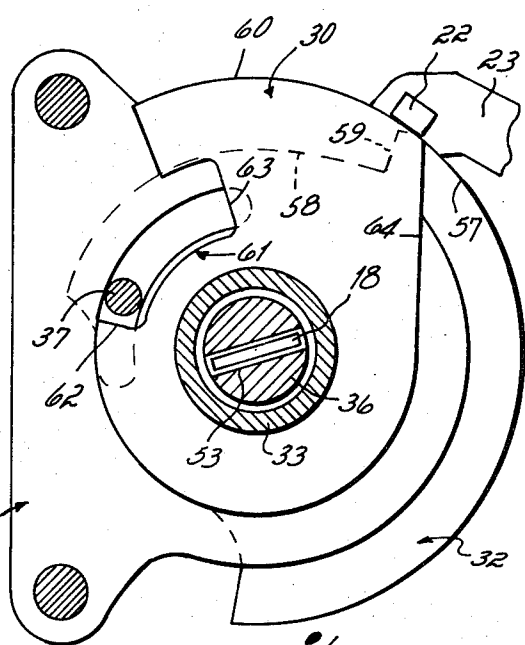


Fig. 12

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TIME DELAY COMBINATION LOCKS

This invention relates to time delay combination locks for safe doors. With a lock of this type a safe door cannot be opened except during a permissive time interval following a predetermined time delay period that begins with the setting of the tumblers for opening.

Locks of this general type are disclosed in a number of U.S. patents, including U.S. Pat. Nos. 2,029,272, 2,036,767 and 2,097,035. The purpose of such a lock is to frustrate would-be robbers or hold-up men. Typically, the safe door carries a bold notice, clearly explaining the time delay nature of the lock. Of course, the notice gives no specific times, and faced with an unknown wait, a hold-up man is more inclined to flee than remain at the safe for fear of apprehension.

The invention is directed to improvements in locks of the type set forth, the primary objective being to provide a time delay combination lock of compact and simplified construction that is adapted to be manufactured and sold at a substantially lower cost than such locks heretofore available.

The lock of this invention is similar to prior art locks in that the parts relating to the time delay feature are essentially additive in nature. That is, a standard three tumbler combination lock is the basic component. Setting the combination for opening positions the three tumblers such that their gates are aligned with a fence on the bolt lever. Thus aligned, the fence may enter the tumbler gates, moving by spring pressure acting on the bolt lever. At the same time a nose on the bolt lever enters a gate of a driver assembly that is keyed to the knobbed dial. Thereafter rotation of the dial in the proper direction causes the bolt to be withdrawn so that the safe door may be opened.

The time delay feature is primarily a matter of blocking the fence from entering the tumbler gates for a predetermined length of time after the tumbler gates have been aligned. Blocking the fence is by mechanical means under the control of a standard runaway escape-clock mechanism, which mechanism is wound through a connection to the dial such that winding occurs during the manipulation of the dial to set the tumblers for opening. In the prior art, (one) the mechanical means provided for blocking the fence, (two) the means for winding the clock mechanism, and (three) the means provided to connect the clock mechanism to (one) above typically have been mounted for rotation about two or more spaced axes, thus spreading the components and requiring gearing to interconnect them.

By contrast, in the locks of this invention all components comprising (one), (two) and (three) above are mounted on a single axis that is common to the axis of the knobbed dial. This arrangement of the components is more compact than in prior art locks and the parts involved are fewer and simpler, being less expensive to manufacture.

The simplification of construction achieved in the lock of this invention has not been at the sacrifice of any of the desired features of prior time delay locks. For example, relocking occurs at the expiration of the permissive opening time interval. And in the lock of this invention, once the opening time interval expires, the security afforded by the time delay means cannot be circumvented, it being necessary to start over again with the resetting of the tumblers and waiting through

the time delay period to the permissive opening time interval.

Other objectives and advantages of the invention will be readily apparent to those skilled in the art from the following detailed description of the drawings in which:

FIG. 1 is a horizontal cross sectional view of a time delay combination lock embodying a preferred form of the invention;

FIG. 2 is an exploded view showing those parts comprising the means for winding the clock mechanism and those parts interposed between the clock mechanism and the combination lock itself which provide the time delay feature and relocking feature;

FIG. 3 is a cross sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is an elevational view of a sub assembly comprising a movement driver, drum and clutch spring, and a spindle extension;

FIG. 5 is a view similar to FIG. 4 illustrating the manner in which the clutch spring is released;

FIG. 6 is a cross sectional view taken along line 6—6 of FIG. 1. In this view the parts shown are in the positions they assume with the clock mechanism run down and the time delay components in relock condition;

FIG. 7 is a view similar to FIG. 6 in which the parts shown are in the positions they assume with the clock mechanism in fully wound condition;

FIG. 8 is a cross sectional view taken along line 8—8 of FIG. 1;

FIG. 9 is a fragmentary cross sectional view similar to FIG. 8 illustrating the parts in the positions they assume during the permissive opening interval;

FIG. 10 is a view similar to FIG. 8 showing the parts in the positions they assume with the bolt withdrawn such that the safe door may be opened;

FIG. 11 is a view similar to FIG. 8 showing the parts in the positions they assume during relock condition;

FIG. 12 is a view similar to FIG. 11 illustrating the parts in the positions they assume under a condition in which the clock mechanism is only partially re-wound.

In the drawings the numeral 8 designates a knobbed dial of the type normally utilized for a combination lock. This lock is outside the safe door which occupies the area generally designated by the numeral 9. A preferred combination lock construction embodying the principles of this invention is designated generally by the numeral 10. This lock includes a rectangular shaped case 11 having an internal chamber 12 closed by a lid 13. In a typical installation, case 11 is affixed to the inside surface of the safe door by mounting screws 14. Following usual practice the dial 8 is keyed or fixed to a shaft 15 that extends through the door and into case 11 through an opening 16. As will be seen, the longitudinal central axis of shaft 15, which is common to the central axis of the dial 8, is also common to all of those parts involved with the time delay mechanism of this invention. This axis is hereinafter referred to as the common axis. As will be seen, the only parts that are not mounted on, around or concentric to the common axis, are those associated with the bolt mechanism to be described.

The inner end of shaft 15, where it projects through opening 16 in case 11, is threaded and is slotted axially to provide a key slot on two diametrically opposite sides. A driver assembly 17 is threaded onto shaft 15

and it is keyed positively onto position by a two-pronged, U-shaped key 18 the head of which extends beyond both the inner end of shaft 15 and the hub portion of driver assembly 17. As in a normal combination lock operation, rotation of driver assembly 17 in the correct combination sequence positions tumblers 19, 20 and 21 with their gates (not shown) accessible to a fence 22 that is affixed to and extends at right angles rearwardly from a bolt lever 23. The nose of bolt lever 23, urged by a spring 24, is permitted to enter a gate of driver assembly 17 such that rotation of the dial assembly withdraws bolt 25.

This invention is concerned primarily with those elements illustrated in FIGS. 1 and 2 contained in or associated with a timing unit designated generally by the numeral 26. This unit, external of the lock case 10 includes a generally square shaped case 27 enclosing a chamber 28 and closed by a base plate 29. Related parts not within the timing unit 26, either wholly or in part include a relock ring 30, a spacer plate 31, and a timing tumbler 32. Another related part comprises a lock tumbler post 33 and it will be noted that relock ring 30 and timing tumbler 32 are fitted to rotate freely on this lock tumbler post 33.

Lock lid 13 is fitted with a counter bored hole 34 centered with the central axis of shaft 15. Lid 13 and base plate 29 each have a coextensive arc shaped slot 35 therein that is centered on the common axis. Counter bored hole 34 receives a spindle extension 36 providing a bearing in which it may be rotated. Arc shaped slot 35 has a driver pin 37 extending through it. Lock lid 13 is also fitted with other holes suitably located to permit screws not shown to pass through and into base plate 29 thereby securely affixing timing unit 26 to lock lid 13. Screws 38 pass through the timing unit and the lock lid 13 to securely hold the entire assembly to the lock body.

A standard run away escapement type clock movement 39 is mounted inside timing unit 26, being suitably oriented and held securely in position by spacers 40 and screws 41. The movement 39 has a keyed drive shaft 42 projecting forwardly therefrom on which a movement driver 43 is rotationally secured. A hub 44 that is part of the driver movement 43 extends forwardly from escapement movement 39. A clutch drum 45 is fitted to rotate freely on hub 44. A helical clutch spring 46 fits snugly around a concave surface 47 of the clutch 45 with one end 48 of the spring fitted in a hole 49 in the forward face of movement driver 43, being secured therein by the head of a screw 50 (FIG. 3). Spindle extension 36 is suitably journaled to rotate freely and be maintained in base plate 29. Spindle extension 36 has a raised tang 51 which rotates on the same radius as an extended tang 52 on the clutch drum 45 (see FIG. 2). It can readily be seen that whenever rotation direction is reversed spindle extension 36 will turn nearly one full rotation before tangs 51 and 52 engage and clutch drum 45 starts to rotate.

As in a standard three tumbler combination lock, the opening procedure requires that the dial 8 be turned three complete turns counter clockwise (CCW) and stop at a first number, thence two complete turns clockwise (CW) and stop at a second number, thence one complete turn CCW and stop at a third number, and then turned CW to open position which withdraws the locking bolt to free the safe door for opening.

In the lock shown, combination dialing sequence caused the following things to occur. When dial 8 is first turned CCW, shaft 15 rotates therewith causing key 18 to engage a closed slot 53 in the outer end of spindle extension 36 thus rotating this spindle extension in the same direction as dial rotation. CCW rotation of spindle extension 36, for the first number of the combination, brings tang 51 into engagement with tang 52 thereby turning clutch drum 45 in the same CCW direction. However, it will be noted that the helix direction of clutch spring 46 allows the clutch drum 45 to rotate freely in the CCW direction. Otherwise expressed, dial 8 is not connected to movement driver 43 when the dial is rotated in the CCW direction.

On the other hand, in the reverse direction or CW dialing of the second number of the combination, the spindle extension 36 rotates with shaft 15 and at the beginning of the second turn of spindle extension 36 tangs 51 and 52 engage thereby turning clutch drum 45. However in this instance, going CW, due to the helix direction of the clutch spring 46 the coils thereof tighten onto the concave surface 46 of the clutch drum 45 causing the clutch spring to turn with the clutch drum. Now, with CW rotation, the end 48 of the clutch spring 46 being secured to the movement driver 43, gives rotational force to the driver 43. Since the driver 43 is secured to the keyed drive shaft 42 of the escapement movement 39, the movement 39 is wound. When the fully wound position is reached, driver pin 37 is in the position shown in FIG. 8, and the free end shown at 54 of the clutch spring 46 engages a tab 55 on the base plate 29. This engagement of the free end 54 with tab 55 releases the clutch spring's grip on the concave surface 47 of the clutch drum thereby permitting clutch drum 45 to continue turning but without causing any more winding force to be transmitted through the clutch spring to the driver 43. This condition prevails until the second combination number is set. Thereafter CCW turning for the third number produces the same effect as for the first number. That is, such turning has no effect upon the movement driver 43, because of the helical direction of the clutch spring 46. Thereafter the dial is turned to lock opening position.

At this time in the dialing sequence lock tumblers 19, 20 and 21 are in lock opening position but the bolt 25 cannot be withdrawn.

As stated the driver pin 37 is affixed to movement driver 43, extending at right angles therefrom toward the front of the lock, with its axis paralleling the common axis. Pin 37 extends through the slot 35 in both base plate 29 and lid 13 and its forward end passes through a hole 56 in the timing tumbler 32. The timing tumbler 32 being mounted to rotate freely on lock tumbler post 33 thus turns with movement driver 43 so that when the clock movement is wound up the timing tumbler 32 is rotated during the winding movement. Further, when the clock movement starts ticking off time, the timing tumbler again rotates, now being driven by the clock mechanism. When the clock mechanism is fully wound an arcuate edge 57 of timing tumbler 32 is positioned as shown in FIG. 8 such that it blocks fence 22 from moving into the gates of tumblers 19-21. As shown, the arcuate edge 57 extends through substantially less than one half of the diameter of timing tumbler 32, the rest of the timing tumbler being configured on an arcuate edge 58 of lesser diameter,

the two different arcuate edges meeting at a step shown at 59.

The relock ring 30 also has an arcuate edge thereon designated 60 the radius of which is equal to the radius of arcuate edge 57. Relock ring 30 also has a slotted-out area therein shown generally at 61 within the arc traversed by driver pin 37. One end of slotted-out area 61, designated 62 is contacted by driver pin 37 where driver pin 37 is swung during the winding movement of the clock mechanism. At the opposite end of the slotted-out area, an edge is provided at 63 that is contacted by driver pin 37 during the last portion of the movement of pin 37 occurring as a result of the running down of the clock mechanism. Thus, in the latter part of the running out of the time ticked off by the clock mechanism, pin 37 contacts edge 63 to shift the relock ring 30.

In the run down condition of the clock mechanism the driver pin 37 is positioned as shown in FIG. 6. With the clock mechanism fully wound it is in the position shown in FIG. 7. In the instance shown its movement between these two extreme positions is something less than 90°. In FIG. 8 the driver pin 37 is also shown positioned in the fully wound condition of the clock mechanism. In this position it will be noted that fence 22 is blocked by arcuate edge 57 and that the pin 37 can move through a substantial number of degrees before coming into contact with the end 63 of the slotted-out area 61. Thus it is only in the last part of the winding down movement of the clock mechanism that relock ring 30 moves with pin 37. FIG. 9 shows driver pin 37 in an intermediate position in which it has driven the timing tumbler 32 to a point where step 59 has passed fence 22 and it is adapted to swing into the position shown in this Figure. In this position it is engaged in the gates of tumblers 19-21. This is the permissive opening condition for the lock since the nose of bolt lever 23 is engaged in the gate of driver assembly 17 and turning movement of the dial will retract bolt 25.

However, if the dial is not turned to withdraw bolt 25, with the parts shown in the positions illustrated in FIG. 9, continued movement of driver pin 37 with the unwinding of the clock mechanism brings pin 37 into contact with edge 63 of the relock ring 30 and now a cam surface 64 that is on a cord line through relock pin 30 comes into engagement with fence 22 such that continued movement of pin 37 elevates fence 22 out of the gates of tumblers 19-21, so that it is no longer possible to withdraw bolt 25. This condition is shown in FIG. 11 of the drawings.

It is to be noted that the relock ring 30 is in front of spacer plate 31. It is mounted on lock tumbler post 33 for rotation but with sufficient friction in its fit on the post and with spacer plate 31 that it does not turn freely. Thus, the relock ring remains in the position shown in FIG. 11 such that the lock cannot be opened until a complete rewinding of the clock mechanism takes place. FIG. 12 shows a condition in which the clock mechanism is partially wound. It will be noted that pin 37 has not yet contacted the end 62 of the slotted-out area 61 in the relock ring 30. It is only when the clock mechanism is fully wound into the condition shown in FIG. 8 that the relock ring 30 is moved from its position of blocking fence 22. However, again referring to FIG. 12, the leading end of the arcuate edge 57 is already

under fence 22, locking the fence before any movement is imparted to the relock ring by engagement of pin 37 with the end 62 of the slotted-out area 61. In the fully wound condition of the clock mechanism, the relock ring is shifted from the position shown in FIG. 12 to the position shown in FIG. 8 so that during the ticking-off of the time of the clock mechanism to rotate the timing tumbler 30 from the position shown in FIG. 8 to the position shown in FIG. 9, the step 59 passes fence 22 permitting it to enter the gates of tumblers 19-21 for lock opening.

It will be seen therefore that there is nothing the operator of the lock can do to circumvent the timing mechanism. The movements of both the timing tumbler 32 and the relock ring 30 are solely under the control of the clock mechanism. A partial winding is ineffective as previously explained because it does not move the relock ring from its blocking position with respect to fence 22. In fact, with the relock ring 30 in its blocking position (FIG. 11) the only way in which the combination lock can be opened is to re-dial the complete combination sequence to reset the clock mechanism as described. Further the resetting of the timing mechanism has to be done fully since the one-way clutch provided in the combination of helically wound spring 46 and clutch drum 45 does not engage until the dial 8 is turned CW by more than one full turn which would automatically scramble at least one lock tumbler from its open position.

There is provided therefore an exceptionally compact time delayed combination lock construction in which the clock mechanism is wound during the normal operation of the combination sequence, and there is no way that the security of the time delay feature can be circumvented by the operator.

I claim:

1. In a time delay combination lock having a knobbed dial and three tumblers arranged on a common axis such that the turning of said dial for the setting of the combination in the proper sequence aligns gates of the tumblers for the entry therein of a spring urged fence, the improvement comprising a run away escapement clock mechanism of the type having a single shaft that winds in one direction and unwinds in the other, means mounting said clock mechanism with the axis of said shaft aligned with said common axis, rotatable means driven by said clock mechanism effective to block the entry of said fence for a predetermined time after the winding of said clock mechanism, means mounting said rotatable means between said tumblers and said clock mechanism for rotation about said common axis, and a one-way rotatable clutch also mounted for rotation about said common axis and providing means to connect said dial to said single shaft for winding purposes effective only during the setting of the middle one of said three tumblers.

2. In a time delay combination lock as set forth in claim 1 in which said one-way rotatable clutch comprises a drum having a helical spring wound thereon.

3. In a time delay combination lock as set forth in claim 2 in which said drum has a concave surface.

4. In a time delay combination lock as set forth in claim 1 in which relock means is rotatably mounted for rotation about said common axis adjacent said rotatable means, said relock means driven by said clock

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mechanism and effective to block the entry of said
fence following a time interval after said predetermined
time and until said clock mechanism completely un-
winds.

5. In a time delay combination lock as set forth in 5

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claim 4 in which said rotatable means and said relock
means are mounted for free rotation about said com-
mon axis and adapted for rotative movement only by
said clock mechanism.

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