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TAMPER PROOF COMBINATION LOCK

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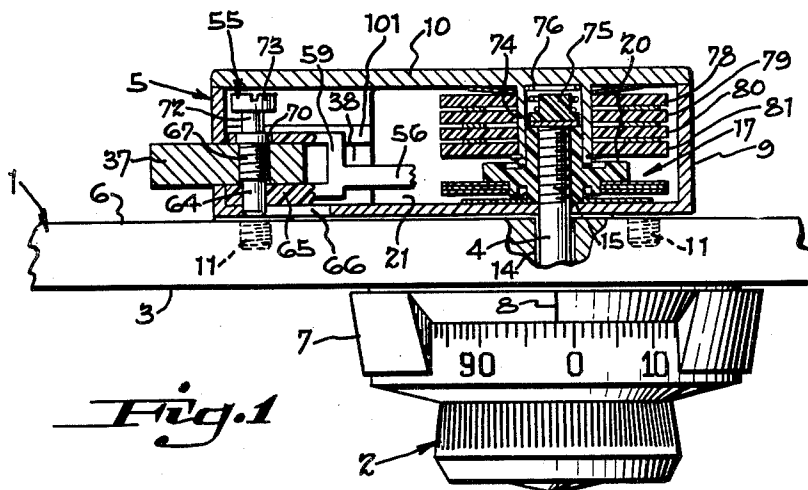


Fig. 1

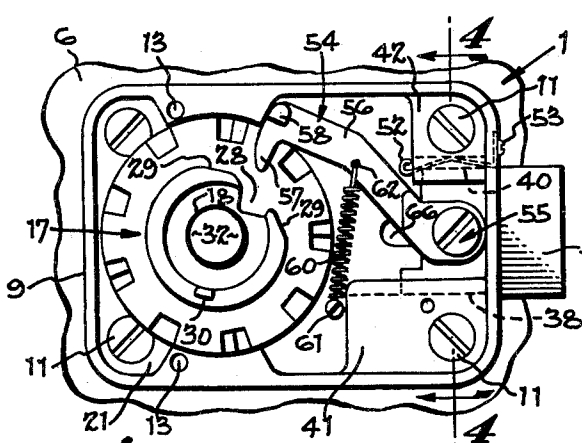


Fig. 2

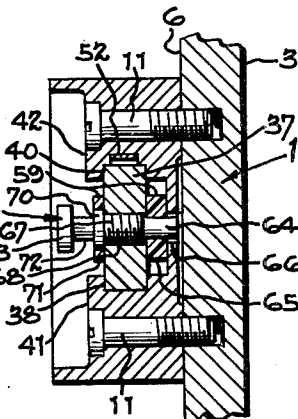


Fig. 4

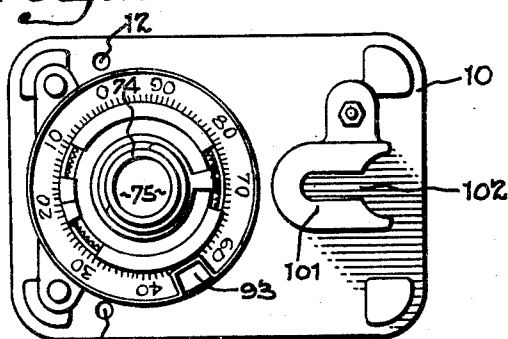


Fig. 3

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TAMPER PROOF COMBINATION LOCK

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3 Claims. (Cl. 70-443)

This invention relates to combination locks of the type employed on safes and vaults. It is specifically directed to a combination lock having improved means for protection against inadvertent lockout.

This application is a division of my co-pending application Serial No. 25,074, filed April 27, 1960, entitled "Tamper Proof Combination Lock."

Combination locks of the type to which this invention generally relates comprise a rotatable dial on the outside of the safe which is coupled through a driver connected to the dial shaft, to a set of circular tumblers in a lock case on the inside of the safe. Each tumbler is provided with a gate in its periphery and is so interconnected to the other tumblers by dogs and lost motion couplings that the gates of all the tumblers can be aligned at a given angular position only by a precise and unique set of left and right turns applied to the dial. When all the gates are aligned with respect to one another and are properly angularly oriented, a fence drops into the slot formed by the aligned gates, simultaneously establishing a drive connection between a notch in the driver and a dog integral with the fence. When the dial is further rotated in the proper direction, the dog draws in the bolt, to which it is connected by an angle bar, so that the lock may be opened. Locks of this general structure are conventional, and afford the background for the present invention.

A principal objective of this invention is the provision of means for preventing inadvertent lockout, that is, closing and locking the safe after a new combination has been improperly set on the tumblers, whereby the correct new combination must be operated before the safe can be locked.

Another objective is the provision of means whereby the cover plate can be fastened in place on the lock case only when the lock is in locked position, to facilitate replacement of the cover.

Further objectives and advantages of the invention can best be made apparent by reference to the following detailed description of the drawings in which a preferred embodiment of the invention is disclosed.

In the drawings,

FIGURE 1 is a top view, partly in section, of a combination lock in accordance with this invention mounted on a safe door, showing the arrangement of the respective elements in the lock case;

FIGURE 2 is a view of the case with the cover plate removed, showing the bolt in the extended or locked position;

FIGURE 3 is a view of the cover plate subassembly showing the T-slot provided thereon; and

FIGURE 4 is a sectional view taken on line 4-4 of FIGURE 2 showing the manner in which the bolt is coupled to the angle bar.

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In FIGURE 1, a combination lock incorporating the principles of this invention is shown mounted on a safe door denoted generally by 1. A dial 2 for setting the combination and operating the lock is located on the outside 3 of the door. The dial is rotatably connected through the safe door by an arbor 4 to the lock assembly proper, which is denoted generally at 5 and is mounted on the inside 6 of the door.

The dial 2 is journaled in a fixed frame 7 provided with an index mark 8. A series of numbers is embossed around the circumference of the dial in the usual manner.

The invention particularly relates to the lock assembly 5 mounted on the inside of the door. This assembly is enclosed within a generally rectangular housing comprising a hollow case 9 and a cover plate 10. Certain of the lock elements are mounted from the case while other cooperating elements are mounted on the cover plate, as will be more fully described.

The case 9 is mounted on the safe door 1 by machine screws 11. The cover plate 10 is secured to the case by machine screws (not shown) which pass through openings 12 in the cover plate and are threaded into the case at 13.

The drive shaft or arbor 4 is positively connected to the dial and is journaled in the frame 7, extending through an opening 14 in the safe door and into the interior of the case. The arbor is externally threaded at 15 and is provided with a pair of diametrically opposite longitudinal keyways 16 at the end which extends into the case.

A driver indicated generally at 17 (FIGURES 1 and 2) is threaded on the arbor in the interior of the case and its bore is equipped with keyways 19 which match the keyways 16.

The driver comprises a hollow cylindrical shaft 18 and a shoulder 20 of large diameter. The circumference of the shoulder 20 is configured with a notch 28, the shape of which can best be seen from FIGURE 2. The portions 29 of the circumference of shoulder 20 on either side of notch 28 constitute inwardly sloping cam surfaces, as will be explained. A drive dog 30 extends outwardly from the forward face of shoulder 20 near its periphery.

The driver is preferably made of nylon so as to be self-lubricating and silent in operation, while the drive dog 30 is of metal for durability, being formed as a flange on a circular plate 31 which is molded within the driver. The driver 17 is positively keyed to the arbor 4, onto which it is threaded for axial adjustment, by means of the two-pronged key 32 as shown in FIGURE 7. When the dial is turned and the arbor rotated, the driver is thus positively rotated with it.

The bolt 37 of the lock is a generally rectangular bar which is longitudinally movable in slots 38 and 40 respectively presented by two corner blocks 41 and 42 formed integrally with the case. When the bolt is in the position shown in FIGURE 2 in which it extends outwardly through an opening in the case wall, its outer end engages a cooperating slot in the safe frame, not shown, whereby the safe door is locked. Withdrawal of the bolt inside the case permits the door to be opened. The bolt is freely slidable in slots 38 and 40 so that it may readily be drawn in when the proper combination has been set. The two corner blocks 41 and 42 and the slots milled in them are shown in section in FIGURE 4. It will be seen that the bolt is spaced by the slots

from the case bottom 21 to provide room for the jaws of the angle bar, as will be described.

The upper bolt slot 40 is provided with a detent spring 52 which is fastened to the case at one end by means of a screw 53. This spring, bearing against the inner end of the bolt, tends to throw the bolt outwardly from a partially extended position into its most extended position.

Movement of the bolt in slots 38 and 40 is governed by angle bar generally designated by 54, which connects the inner end of the bolt to the driver 17 once the proper combination has been set, so that an angular rotation of the driver is transformed into a linear movement of the bolt. The angle bar is best pictured in FIGURES 1, 2 and 4. At one end, the angle bar is provided with a clevis 59, to straddle the bolt. The clevis is pivotally connected to the bolt by a stud 55.

Shank 56 of the angle bar 54 extends diagonally from the bolt to the upper part of the case, above the driver. At its other end, the angle bar has a downwardly extending dog 57 for engagement in the notch 28 with the driver. A fence 58 extends laterally from the angle bar adjacent the dog and is so arranged that when the dog 57 engages notch 28, the fence engages the aligned gates. A tension spring 60 is connected from a post 61 presented by the case to a point 62 on the shank 56 of the angle bar so that the bar is constantly urged downwardly (counterclockwise in FIGURE 2), whereby dog 57 rides on the periphery of shoulder 20.

Stud 55, by which the clevis jaws 59 of the angle bar are pinned to the bolt, has a relatively narrow end portion 64 which extends through the rear jaw 65 of the clevis and rides in a horizontal slot 66 formed in the casing back, behind the bolt. An enlarged portion 67 of the stud is externally threaded into a bore 68 provided in the bolt, the depth of its insertion into the bolt being limited by a collar 70 which passes through a bearing in the forward jaw 71 of the clevis. Outwardly of the clevis, the stud 55 is provided with a narrow neck portion 72 and an enlarged slotted head 73.

The cover plate subassembly, FIGURES 1 and 3, may next be described. This subassembly is held to the case by mounting screws and a T-slot arrangement to be described.

Extending into the interior of the case from the plate 10 in axial alignment with arbor 4 is a hollow cylindrical bearing 74. When the cover plate is mounted on the case, this bearing 74 encircles the outer portion of arbor 4 and driver shaft 18. A nylon friction plug 75 and a compression spring 76 is set inside bearing 74. The diameter of the coils of spring 76 is such that the spring holds itself frictionally inside the bearing, while a small coil at the end of the spring is press-fitted around the neck 77 of plug 75.

Rotatably journaled on bearing 74 are the lock tumblers, four in the embodiment shown, numbered 78, 79, 80 and 81. These tumblers may be conventional and need not be described in detail herein.

The cover plate is provided with a T-slot member 101 which engages the large head 73 of the stud connecting the angle bar clevis 59 to the bolt. The relationship of T-slot 101 to the bolt and stud is shown in FIGURES 2 and 3. Thus, the slot 101 is spaced from the cover plate, and is of a width sufficient to pass the neck 72 but not the head 73 of the angle bar stud, while the open end 102 of the slot is enlarged to provide clearance for the head of the stud. When the bolt is in the unlocked position, stud head 73 will not clear the slot, so that the cover plate cannot be removed from or fastened to the case. However, the cover plate can be removed or put on only when the bolt is extended, since then but only then is the stud head in registry with the enlarged opening 102 in the slot.

When the dial 2 has been properly turned to align the tumbler gates 93, dog 57 is permitted to engage notch

28, the fence simultaneously moving into the gates. As the driver is rotated counterclockwise, dog 57 is driven to the left, the angle bar pulling stud 55 with it, the bolt sliding in slots 38 and 40. The longitudinal movement of the bolt with respect to the case is limited by the length of slot 66 in which the tip 64 of stud 55 rides. During this operation the head 73 of stud 55 moves freely in slot 101.

The provision of a rear clevis jaw 65 and a forward clevis jaw 71 on either side of the bolt prevents the angle bar from twisting about stud 55 when it is moved in either direction by the driver. This prevents an indication of gate position from being given by feel or sound when dog 57 moves either onto or off of the driver cam surfaces 29.

Against this description of the general operation of the lock, following is a description showing the manner in which the new elements of the lock, in accordance with this invention, operate to prevent inadvertent lockout.

To prevent the safe from being accidentally locked when, for any reason, the cover plate has been removed, the lock is provided with a mechanism whereby the cover plate may be removed only when the bolt is in its extended position, in which condition the safe door cannot be shut and locked.

Only when the bolt is extended does the head 73 of stud 55 register with the enlarged opening 102 at the end of T-slot 101. Therefore, only when the bolt is extended can the cover plate be removed. This effectively prevents locking the safe without the cover plate having been first replaced; the bolt cannot be drawn in because the plunger pins it in extended position in the absence of the cover plate.

The T-slot mechanism also prevents inadvertent lockout when a new combination has been improperly set on the tumblers, because the operator is compelled to set the new combination to which the lock has actually been set before the bolt can be drawn in prior to closing the safe door.

While the present invention has been disclosed herein in relation to a preferred embodiment, it is to be understood that the invention is not limited to that embodiment alone, but may be used in other locks coming within the scope of the following claims.

Having described my invention, I claim:

1. A combination lock comprising a lock case, a cover member for said case, a bolt slidable within said case between lock and unlock positions, and an angle bar for establishing a drive connection to said bolt, a stud pivotally connecting said bolt to said angle bar, said stud having an enlarged head, means presented by said cover member defining a T-slot positioned to receive slidably the head of said stud when said cover is in normal closure position on said case whereby removal of said cover is prevented, said T-slot having a gap dimensioned and positioned to clear the head of said stud only when said bolt is in said lock position, whereby said cover member can be removed from said case when said bolt is in lock position.

2. A combination lock adapted to prevent inadvertent lockout, said combination lock comprising a lock case, a cover member for said lock case, a bolt movable with respect to said lock case between lock and unlock positions, an angle bar, a stud pivotally connecting said angle bar to said bolt, a set of tumblers rotatably mounted on said cover member, said tumblers being engageable in drive connection with said bolt through said angle bar when the tumblers have been set to proper combination, said stud having an enlarged head, means presented by said cover member defining a T-slot, the head of said stud being engaged in said T-slot when said cover member is in normal closing position on said lock case, said T-slot having an enlarged opening positioned to pass said head only when said bolt is in said lock position, whereby said

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cover member cannot be removed from said case except when said bolt is in said lock position.

3. A combination lock comprising, a lock case, a cover member for said lock case, a bolt member movable with respect to said lock case between lock and unlock positions, one of said members presenting a stud having an enlarged head, the other of said members having a T-slot for slidably receiving the head of said stud when said cover member is in normal closing position on said case, said T-slot having a gas to clear said stud head only when

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said bolt is in said lock position, whereby the interengagement of said head and said T-slot prevents cover removal except when said bolt is in said lock position.

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