Oct. 4, 1927. 1,644,650

P. S. MILLICE

COMBINATION LOCK MECHANISM

Filed April 9, 1926

Fig. 1.

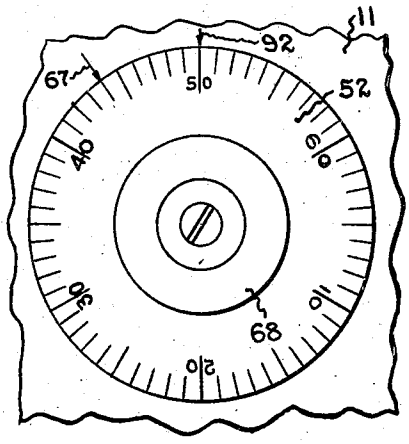


Fig. 2.

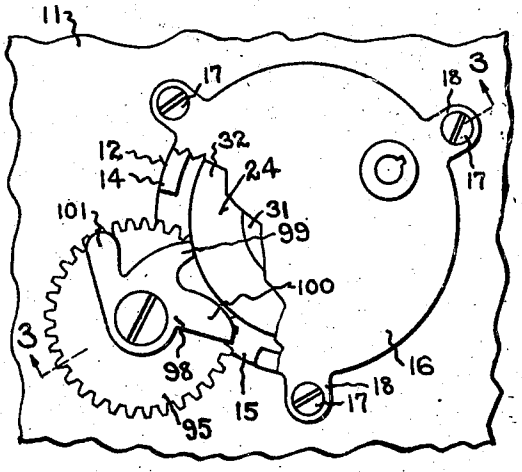


Fig. 8.

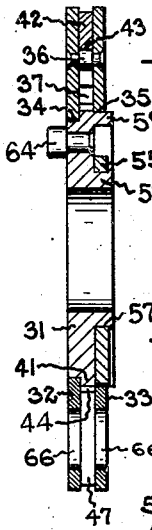


Fig. 4.

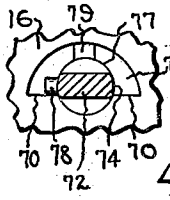


Fig. 3.

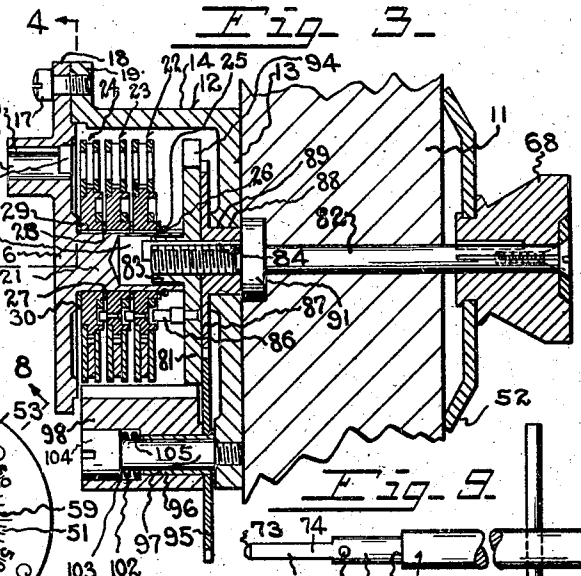


Fig. 5.

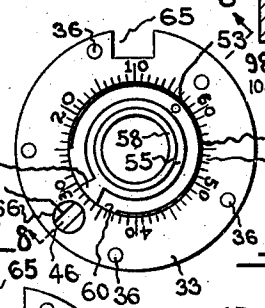


Fig. 9.

Fig. 6.

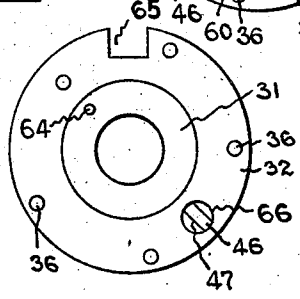
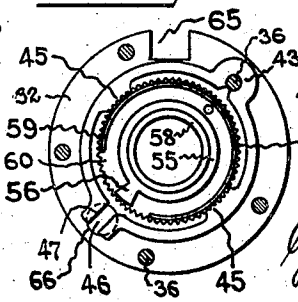


Fig. 7.



INVENTOR.

Paul S. Millice,

by B. F. Berdolet

His Attorney.

Patented Oct. 4, 1927. 1,644,650

UNITED STATES PATENT OFFICE.

PAUL S. MILLICE, OF HAMILTON, OHIO, ASSIGNOR TO HERRING-HALL-MARVIN SAFE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

COMBINATION-LOCK MECHANISM.

Application filed April 9, 1926. Serial No. 100,804.

It is the object of my invention to provide novel means in a combination lock whereby the tumblers may be set by means of a key whilst the tumblers are retained in the lock and, whereby, further, the tumblers may be readily separately set whilst removed from the lock.

It is the object of my invention further to provide novel means whereby the locking means for the respective coaxially arranged tumblers may be released progressively from the inner end of the lock in order that rearrangement of the tumblers may be effected without knowledge of the previous setting of the tumblers; and, further, to provide novel means whereby the key cannot be withdrawn without inter-locking the members of the respective tumblers, whether collectively or separately set.

It is the object of my invention further to provide a novel tumbler assembly, and novel means whereby resetting of the respective tumblers is obtained; and, further, to provide novel means whereby a key is employed for resetting the tumblers without knowledge of the previous combination to which the lock had been set, or after disarrangement of such previous setting, in order that the combination may be reset, for instance, during the day, when successive employees have access to the compartment which is locked by the combination lock.

The invention will be further readily understood from the following description and claims, and from the drawings, in which latter:

Fig. 1 is a front elevation, showing an exemplified dial of my improved lock.

Fig. 2 is a rear elevation of my improved device, partly broken away.

Fig. 3 is a central axial section of the same, taken in the plane of the line 3—3 of Fig. 2.

Fig. 4 is a cross-section of a detail of the same, taken in the plane of the line 4—4 of Fig. 3, showing the key in the lock.

Fig. 5 is a front elevation of one of my improved tumblers.

Fig. 6 is a rear elevation of the same.

Fig. 7 is a front elevation of the same, with one of the disks removed for exposing the interior of the tumbler.

Fig. 8 is a central axial section of the same, taken on the line 8—8 of Fig. 5; and,

Fig. 9 is a side elevation of the key.

11 represents the wall of the safe or compartment on which my improved combination lock is mounted. This is usually the door of a safe or compartment. The casing of the lock is shown at 12, and comprises a front wall 13, an annular side wall 14, in which there is an opening 15, and a rear wall 16. The rear wall is removable, and is arranged to be attached to the casing by means of screws 17 passing through holes in lugs 18 on the rear wall, and threaded into lugs 19 on the casing.

An axle 21 extends forwardly from the rear wall and forms a journal on which tumblers 22, 23 and 24 are preferably releasably held, as by means of a spring-ring 25, received in a groove 26 in the inner end of the axle.

The respective tumblers are separated by washers 27, provided with lugs 28, received in a key-way 29 in the axle, one of these washers being located between the outer tumbler and the spring-ring 25. The inner washer bears against a narrow annular flange 30, extending inwardly from the rear wall. This construction provides ease of rotation of the tumblers and prevents one tumbler being rotated by the other by mere friction.

The tumblers, assembled on the rear wall, are arranged to be moved as an assembly into and out of the cavity in the casing.

The tumblers are readily removable by removal of the spring-ring 25, for separate setting of the tumblers when removed from the lock. The reset tumblers and the washers are readily replaced about the axle, and the spring-ring snapped into place, for reassembling the parts.

Each of the tumblers comprises a hub 31 and disks 32, 33. The hub is provided with annular rabbets 34, 35, in which the disks are seated in such manner that relative rotation may be obtained between the disks and the hub. The disks are united and spaced apart by means of shoulder rivets 36, the disks resting upon the shoulders of the rivets for determining the space 37 therebetween, the outer ends of the rivets being upset for holding the disks in place. The hub forms an inner member and the united disks an outer member of the tumbler.

The inner edges of the disks form bearings about the hub. The hub has a radially extending flange 41, which is received in the space 37 between the disks, for associating the hub and the disks in axial directions.

A locking part 42, shown as a split-spring locking ring, is positioned by a bearing 43 about one of the rivets 36. The outer periphery of the hub 31 is provided with teeth 44, the teeth being shown on the outer periphery of the radial flange of the hub in the space 37. The inner face of the locking ring is at its sides provided with toothed faces 45 coacting with the teeth 44, for holding the hub and the disks in relatively adjusted relations.

The locking ring is provided with a slot 46 at the split therein, forming walls 47, between which a key is arranged to be inserted for spreading the locking ring, and releasing the locking engagement between the locking ring and the hub, when relative adjustment between the hub and the disks is desired, the locking ring being permitted to contract, for again maintaining the hub and disks in newly adjusted relation, after the resetting of the tumblers has been accomplished.

The outer face of one of the disks is provided with a dial 51, the graduations of which correspond with the graduations of the dial on the dial-plate 52 at the outside of the wall 11. It will be noted that the graduations of these dials form a complete circle, the entire circle being available for graduations in my improved device.

The hub is provided with a mark 53, with which any one of the graduation marks on the dial 51 which is arranged to be placed in registry, for determining the relation between the inner member, exemplified as the hub 31, and the outer member, exemplified as the connected disks 32, 33, of the tumbler, and consequently the setting of said tumbler for the combination of the lock.

The hub is provided with a fly-ring 55, having a fly 56 thereon, this fly-ring being in an annular groove 57 in the face of the hub. This annular groove forms an inner annular flange 58, which forms a journal for the fly-ring, and an outer annular flange 59, in which there is a space 60, the fly being received in this space, and arranged to reciprocate back and forth therein, about the axis of the tumbler. The fly-ring is suitably held to the annular flange 58.

The fly-ring is located at one face of the tumbler. A pin 64 extends from the other face of the tumbler, into range with the fly 56 of the next adjacent tumbler, for causing propulsion of one tumbler by the other, for setting the tumblers. The fly has rotary movement between the end walls of the recess 60 in the outer annular flange 59 of the hub. The parts are so related, that the axis of a pin, engaging opposite sides of the fly, when the fly is moved against opposite end walls of the recess, respectively, is in the same position relative to the hub.

The respective disks of the respective tumblers are provided with notches 65 which register with each other, and with holes 66 which register with each other and with the slot 46 between the end walls 47 in the locking ring. A suitable key is arranged to be received through these holes, the walls of which form bearings for the key, and the slot 46 in the locking ring, for spreading the locking ring, in order to release the locking relation between the inner and outer members of the tumbler, for resetting the tumbler.

These holes 66 in all of the tumblers are caused to register with each other, by employing the combination to which the lock has been set, in registry with a setting mark 67 on the wall 11, in order that the key may be inserted through all the bearings 66 in all of the disks, and all of the locking rings spread, whereby the inner and outer members of all the tumblers are released from each other, for resetting the lock to a new combination by means of its knob 68, whereupon the key is withdrawn for maintaining the parts in their new relation.

The key for spreading the split locking ring 42 is shown at 71. It comprises a flat shank 72 having a wedge-shaped end 73 for readily entering the slot 46, the edges 74 of said shank being guided by the walls of the bearings 66 for centering said shank. The shank is preferably received flatwise between the end walls 47 of the locking ring, without unlocking effect upon the locking ring. Rotation of the shank spreads the locking ring, this rotation being preferably to the extent of one-fourth of a revolution in either direction. The locking ring is held in spread relation by the pressure of its end faces upon the key. The rotation of the key may be limited by providing the key with a ward 78 which is received in a recess 75 in the front face of the rear wall 16, provided with shoulders 70 against which the ward is arranged to strike for limiting rotative movement of the key.

The key is also provided with a journal-shank 76 rotatable in a bearing 77 in the rear plate 16. The ward 78 is on the inner end of the shank 76 and is received through a slot 79 in the bearing 77. The ward is arranged to move across the inner end of said bearing during rotation of said key, the inward movement of the key being arrested by a shoulder 80 thereon striking the bearing 77.

The key is held endwise by coaction of its ward and shoulder with the bearing when the key has been rotated. The ward 78, the walls of the slot 79, the side walls of the

reduced shank 72, and the end walls 47 in the locking ring 42 extend in the same directions whilst said ward is in said slot in entering and removing the key, so as to insure that the locking rings have been contracted upon their respective hubs before removal of the key.

The key may be withdrawn directly from the separate tumblers without rerotating or reshifting the same.

In each instance that the key is withdrawn from a separate tumbler or from the associated tumblers, return of the locking ring into locking relation is compelled, in order to prevent the members of any of the tumblers remaining in unlocked relation, whereby relative shifting of said members after being set is prevented.

A driving wheel 81 is mounted on a spindle 82, as by having a threaded hub 83, in which the inner end of the spindle is threaded, a key 84 being received in complemental grooves in said spindle and said driving wheel for rotatively securing the spindle and driving wheel together. The inner end of the spindle and the hub of the driving wheel are received in an axial recess 85 in the outer end of the axle 21. The driving wheel is provided with a pin 86 arranged to coact with the fly of the outer fly-ring of the outer tumbler mounted on the axle.

A gear 87 is fixed to the driving wheel, and is provided with an outwardly extending journal 88, journaled in a bearing 89 in the outer wall 13 of the casing. The outer face of the gear bears against the inner end of said bearing for locating the gear and driving wheel in axial direction.

The spindle is provided with an annular flange 91, preferably integral therewith. This flange is of greater diameter than the diameter of the bearing 89, for arresting inward movement of the spindle, and thereby preventing the spindle from being driven inwardly. The dial-plate 52 and the knob 68, are suitably secured to the spindle.

The front face of the wall 11 is provided with a mark 92, with which the graduations on the dial-plate are caused to register for manipulating the combination for opening the lock. The graduations on the dial-plate are arranged to register with the mark 67 when manipulating the combination for resetting of the combination.

The manipulation of the combination to which the lock has been set, in registry with the mark 67, sets the tumblers so that the bearings 66 therein and the slots 46 in the split-rings, register with the bearing 77 in the inner plate, so that the key may be inserted into said holes and slots for releasing the outer members from the inner members of said tumblers. This may be done for the purpose of resetting the tumblers, and may also be done for disarranging the setting of the tumblers in order to conceal a previous setting, used by one employee, from another employee, who is next placed in charge of the safe or compartment, and who in turn resets the lock according to his combination, and then withdraws the key.

My improved lock is also so constructed that a previous employee may disarrange the setting of the tumblers and may withdraw the key, and a subsequent employee may, the door remaining open, insert the key without knowledge of the previous combination, or without any definite setting of the combination of the lock having been made. In my improved lock, further, the bearings and slots for the key in the respective tumbler may be alined with the key-hole in the inner wall 16 and the key inserted, in spite of disarrangement of the set-up relation in any of the tumblers.

This is accomplished by reason of the fact, that in the manipulation of the lock for setting the combination, the inner tumbler next to the key-hole in the lock is set first. The key may be pushed inward in the key-hole, and the knob turned, for instance, toward the left, until the key, by axial pressure thereon, enters the bearing and slot in the inner tumbler. The knob is next turned toward the right until the key by axial pressure thereon enters the bearing and slot in the second tumbler. Thereupon the knob is turned toward the left until the key, by outward axial pressure thereon by the fingers, enters the bearing and slot in the outer tumbler, whereupon the key may be turned for releasing the outer members from the inner members of the respective tumblers, and the tumblers reset according to a new combination, by manipulation of the knob according to the setting desired for the new combination, employing the setting mark 67 for the purpose. The key is then turned into release position, and pulled out of the lock, which fixes the relations between the inner and outer members of the tumblers according to the new setting of the combination.

A pinion 95 meshes with the gear 87. It is provided with a bearing sleeve 96. The bearing sleeve is received about a journal 97.

A rockable member 98 is provided with a fence 99, a positioning wing 100, and an actuator wing 101. The latter is usually connected with the bolt of the lock, for manipulating the bolt. The fence is arranged to enter the notch 94 in the driving wheel and the notches in the respective tumblers, when the combination has been properly manipulated for opening the lock.

The journal 97 is shown in the form of a screw, which is threaded into the front wall of the casing. A spring 102 is located in an enlarged recess 103 in the rockable member, between the head 104 of the screw and

a shoulder 105 in the bottom of said recess, for normally urging the rockable member toward the pinion 95, in order to create sufficient friction between said rockable member and said pinion to cause the rockable member to move with the pinion, for entrance of the fence into the notches in the driving wheel and tumblers in manipulation of the lock when the tumblers have been properly set, but permitting independent rotation of the pinion when resistance is offered to the rotation or locking movement of the rockable member.

The proper setting of the tumblers places the respective notches thereon alongside of the fence 99, and the movement of the driving wheel 81 by means of the outer knob causes the fence to enter said notches and the notch in the driving wheel, the engagement of one of the walls of the notch in the driving wheel rocking the rockable member about its axis for moving the actuator wing 101, which has any suitable or usual connection with the bolt of the lock, for withdrawing the bolt, whereupon the door may be opened.

By means of my improved device, the tumblers may be removed from the lock, and separately reset whilst removed from the lock, and replaced in the lock to form a new combination, or the key may be employed for the purpose of resetting the tumblers whilst they are retained in the lock.

It is of course obvious that changes may be made in the parts and their construction and arrangement, within the scope of the appended claims, without departing from my invention.

What I claim as new and desire to secure by Letters Patent is:

1. In a combination lock, the combination of a casing, a series of tumblers whose axes of rotation are coincident located in said casing, each of said tumblers comprising a pair of relatively adjustable members and adjusting means therefor for setting said tumbler, each of said tumblers provided at one face thereof with an inner flange and an outer flange forming a facial groove between them, said outer flange provided with a space, and a fly-ring in said groove having a bearing about said inner flange and provided with a fly in said space in said outer flange, and a driving wheel in the front portion of said lock, said driving wheel and said respective tumblers provided with pins respectively coacting with said flies and constructed and arranged whereby the tumbler most distant from said driving wheel is first positioned and the tumblers successively nearer said front portion of said lock are successively positioned whilst manipulating said tumblers for unlocking relation thereof, said tumblers provided with key receiving means, and constructed and arranged for successively alining said key receiving means by manipulation of said tumbler rotating mechanism beginning with the key receiving means farthest removed from said front portion of said lock whereby a key is successively insertable in said key receiving means of said respective tumblers beginning with the tumbler farthest removed from said driving wheel and progressing through successive tumblers toward said front portion of said lock.

2. In a combination lock, a tumbler comprising an inner member and an outer member having coincident axes of rotation and adjustable relatively to each other about said axes, and locking means for locking said members in adjusted relations, said locking means comprising opposed parts normally urged in opposite directions for locked relation in said locking means, said opposed parts provided with contact faces spaced apart for permitting insertion of a flat portion of a key flatwise between them whilst said locking means are maintained in locked relation, said opposed parts arranged to be reversely moved by rotation of said flat portion between them and thereby presenting said flat portion edgewise between said contact faces for releasing said locking means and permitting relative adjustment between said members, and constructed and arranged for compelling locked relation of said locking means upon withdrawal of said key regardless of rerotating said key.

3. A tumbler for a combination lock comprising a hub having an annular face-groove in one face thereof forming an inner annular flange and an outer annular flange, said outer annular flange provided with a space, a fly-ring in said annular face-groove journaled about said inner annular flange and provided with a fly in said space, said hub provided with annular rabbets at its respective ends and an intermediate peripheral annular flange provided with peripheral teeth, spaced-apart disks having bores whose walls are located in said rabbets, said peripheral annular flange and teeth located in the space between said disks, means connecting said disks, a pivot-pin between said disks in said space between said disks, an integral split spring locking ring provided with a bearing about said pivot-pin and with wings encompassing said toothed peripheral annular flange, said wings provided with complemental teeth normally urged into locking relation with the teeth of said peripheral annular toothed flange, and bearings for a key in said respective disks in line with and at the respective sides of the split in said ring, the walls of said split provided with contact faces for said key received in said bearings, said key arranged to be rotated in said bearings whereby to spread said split spring locking ring.

4. A tumbler for a combination lock comprising a hub having an annular face-groove in one face thereof forming an inner annular flange and an outer annular flange, said outer annular flange provided with a space, a fly-ring in said annular face-groove journaled about said inner annular flange and provided with a fly in said space, said hub provided with annular rabbets at its respective ends and an intermediate peripheral annular flange provided with peripheral teeth, spaced-apart disks having bores whose walls are located in said rabbets, said peripheral annular flange and teeth located in the space between said disks, means connecting said disks, a pivot-pin between said disks in said space between said disks, an integral split spring locking ring provided with a split-bearing about said pivot-pin and forming substantially semicircular wings at the respective sides of said pivot-pin about said toothed peripheral annular flange, said wings provided with complemental teeth normally urged into locking relation with the teeth of said peripheral annular toothed flange, and bearings for a key in said respective disks in line with and at the respective sides of the split in said ring, the walls of said split provided with contact faces for said key received in said bearings for separating said wings by rotation of said key and thereby releasing the teeth of said split spring locking ring from said peripheral annular toothed flange, and constructed and arranged for compelling reengagement of said teeth of said split spring locking ring with said peripheral annular toothed flange upon withdrawal of said key regardless of rerotating said key.

In testimony whereof, I have hereunto signed my name.

PAUL S. MILLICE.