Nov. 10, 1953 H. C. BEHRENS 2,658,374

COMBINATION LOCK

Filed March 2, 1950 2 Sheets-Sheet 1

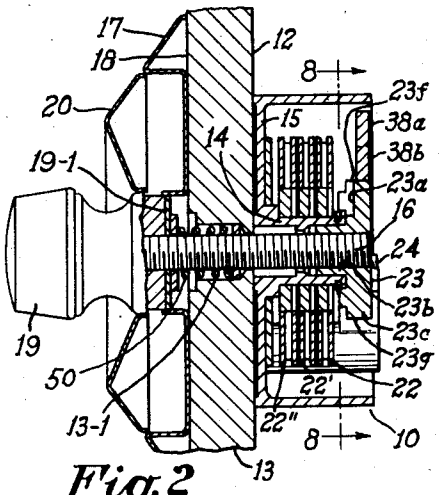


Fig. 2

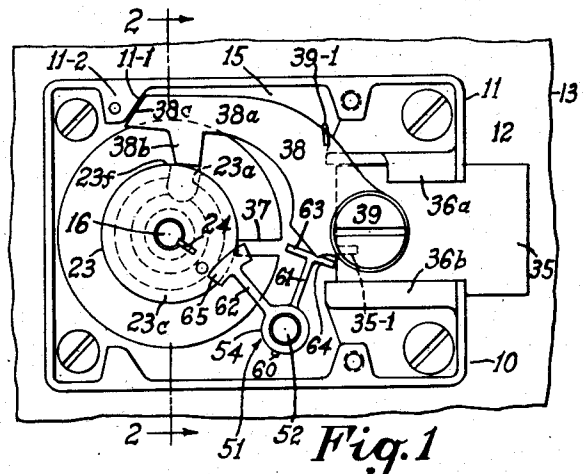


Fig. 1

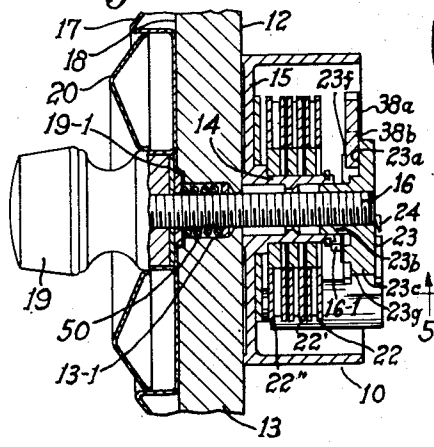


Fig. 4

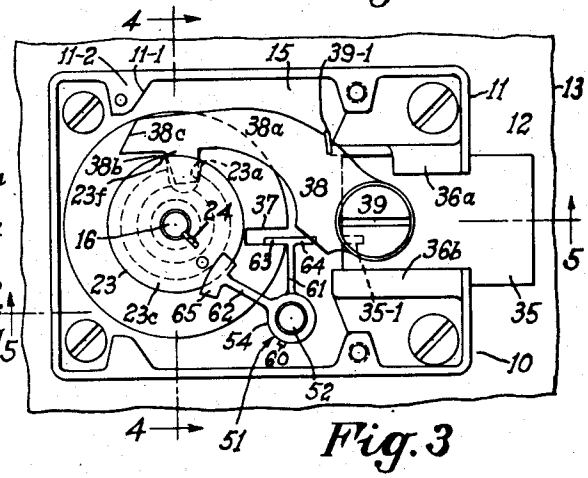


Fig. 3

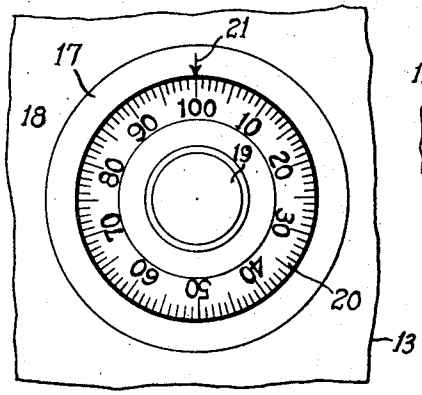


Fig. 6

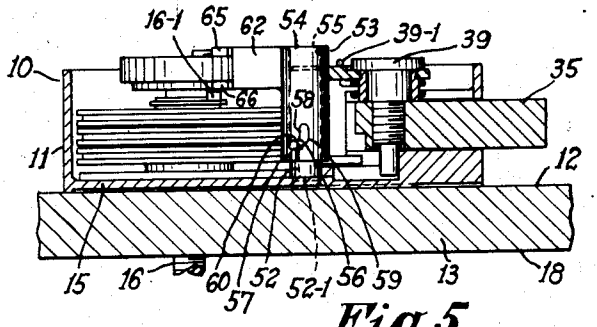


Fig. 5

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Nov. 10, 1953 H. C. BEHRENS 2,658,374

COMBINATION LOCK

Filed March 2, 1950 2 Sheets-Sheet 2

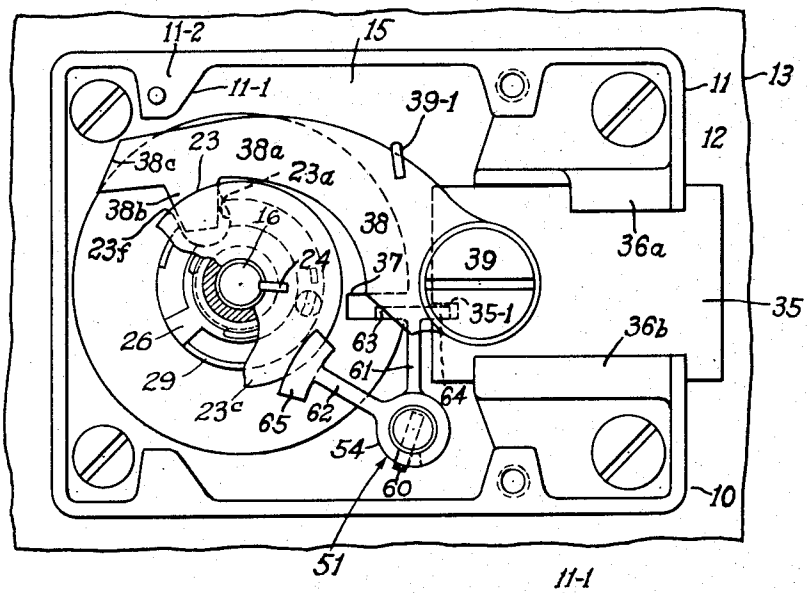


Fig. 7

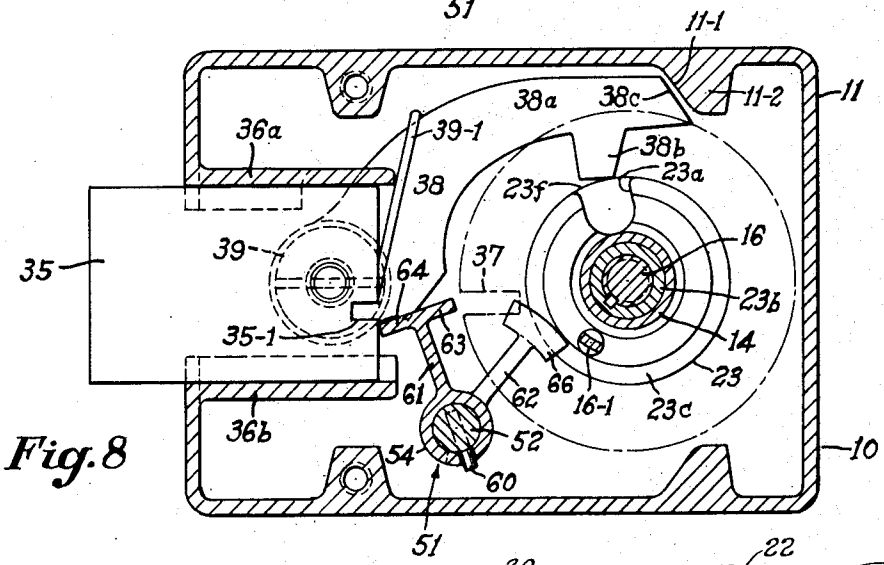


Fig. 8

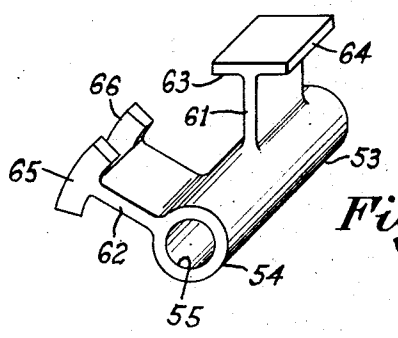


Fig. 9

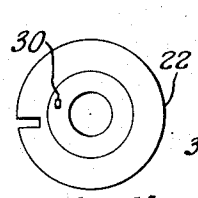


Fig. 11

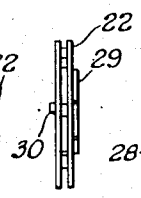


Fig. 10

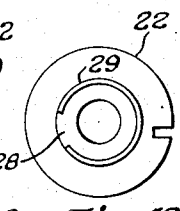


Fig. 12

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UNITED STATES PATENT OFFICE

2,658,374

COMBINATION LOCK

Herbert C. Behrens, Canton, Ohio, assignor to Diebold, Incorporated, Canton, Ohio, a corporation of Ohio

Application March 2, 1950, Serial No. 147,267

6 Claims. (Cl. 70—133)

1

My invention or discovery relates to combination locks generally, and more particularly to a combination lock such as set forth in my application for U. S. Letters Patent, Serial No. 130,722, filed December 2, 1949, the combination lock set forth in said application constituting improvements in the combination lock set forth in U. S. Letters Patent No. 1,956,304, issued to Albert L. Abbott and Charles H. Miller April 24, 1934.

The combination lock set forth in said Abbott and Miller U. S. Letters Patent No. 1,956,304 includes a case on the rear of the door equipped with the lock, one or more coaxial cylindrical tumblers having equal diameters and being rotatably mounted in the case, a spindle extending from the outside of the door through the door and into the case and the spindle having a dial with a knob mounted on its outer end rotatable within a dial ring on the outer face of the door and the spindle having on its inner end beyond the tumblers a cylindrical cam with an operating notch. Usual pin, lever and circular segment means coact between the cam and the innermost tumbler, and between each tumbler and the next outer tumbler, whereby by manipulation of the dial and setting the combination, the notches of the tumblers are aligned with each other and with the operating notch of the cam for unlocking the lock.

The lock furthermore includes a reciprocable bolt pivotally connected with one end of an operating lever including an upper arm having a cam follower tongue depending from its outer end, and a stop arm or fence extending from the inner side of the upper arm parallel with the axis of the tumblers. The operating lever is spring pressed towards the tumblers, and when the tumbler notches are aligned with each other and the operating notch of the cam which is located in the aligned position below the cam follower tongue of the upper arm, the fence is permitted to drop into the tumbler notches and the cam follower tongue is permitted to drop into the operaing notch of he cam, whereby the bolt may be withdrawn from its extended locking position, and whereby the bolt may be also extended to locking position when the door is again colsed and locked by suitable rotations of the dial and spindle. After the bolt is extended into locking position, the spindle is then spun in either direction to scramble the combination by turning the tumblers so that their notches are out of alignment with each other.

Such a lock as set forth in said Abbott and Miller U. S. Letters Patent No. 1,956,304, with respect to the parts above described is similar to other

2

usual combination locks. When the bolt is extended and the combination scrambled the fence rests upon the cylindrical peripheries of the tumblers. If such a lock is made in a laboratory to extreme accuracy, and assembled with extreme precision, the lock cannot be manipulated by an unauthorized person so as to detect the combination and effect unlocking. In the usual mass production of the parts of such a lock and the assembly of the same, the extreme accuracy necessary for preventing manipulation cannot be attanied. Unless the bottom surface of the fence is exactly parallel with the axis of rotation of the tumblers, and unless the diameters of the tumbler discs are all exactly the same, when the fence rides over the opening formed by one of the tumbler notches, even though its bottom surface is riding on the peripheries of the remaining tumbler discs, very minute movements of the fence as it rides over the corners of such a notch can be felt in rotating the dial by the fingers of an unauthorized person who knows the internal construction of the lock. In this manner the combination for which the lock is set can be detected. Ordinarily, a person skilled in breaking the combination of such a lock can determine the combination by manipulation in the manner described in about thirty minutes.

From a broader standpoint, the construction of combination locks in commercial production and use insofar as known to the present inventor is such that relative motion may be obtained between the tumblers and operating lever, between the tumblers and bolt, or between the tumblers, bolt, operating lever, and the spindle or driving cam, enabling a skilled lock manipulator to sense or feel the engagement of these relative parts at the combination setting and the alignment of the tumbler notch openings by the said relative motion of the parts.

In my application for U. S. Letters Patent, Serial No. 130,722, there is set forth a combination lock including, in combination with or modification of parts of the combination lock set forth in said Abbott and Miller U. S. Letters Patent No. 1,956,304, an operating lever including an upper arm having a cam follower tongue depending from its outer end and without a fence, and on the rear end of the bolt the provision of a tongue adapted to extend into the oppositely aligned notches of the tumblers when the combination is set, and the spindle being arranged for movement in the direction of its longitudinal axis and being normally spring pressed in the direction of the dial knob, and the cam on the inner end

of the spindle having an operating notch in a portion immediately adjacent the tumblers and having a complete cylindrical portion beyond the notched portion.

The objects of the present invention or discovery, from a broad standpoint, include the provision of an improved combination lock in which the direct performance of the throwing of the bolt is not dependent upon the engagement of the bolt or the engagement of the throwing or operating lever with the tumblers, and in which the throwing of the bolt is governed only by the engagement of the throwing or operating lever with the spindle or driving cam.

The objects of the present invention or discovery more particularly include the provision of an improved combination lock of the type set forth in my said application for U. S. Letters Patent, Serial No. 130,722, in which neither the spindle may be pushed inwardly a substantial distance, nor the cam follower tongue on the upper arm of the operating lever may drop into the operating cam notch, nor the bolt may be retracted, until the combination has been set.

Further objects of the present invention or discovery include the provision of such an improved combination lock in which the improvements may be effected by the addition of or modification of a limited number of parts of the combination lock set forth in said Abbott and Miller U. S. Letters Patent No. 1,956,304, and which is thus adapted for economical manufacture without the necessity of manufacturing an entirely new set of parts for the improved lock.

The foregoing and other objects are attained by the combination lock, construction, improvements, parts, combinations, and sub-combinations which comprise the present invention or discovery, the nature of which is set forth in the following general statement, and preferred embodiments of which together with their mode of use are set forth by way of example in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the improved combination lock of the present invention or discovery may be stated in general terms as including, in combination with other usual parts of a combination lock such as set forth in said Abbott and Miller U. S. Letters Patent No. 1,956,304, the improvements set forth in my said application for U. S. Letters Patent, Serial No. 130,722, and in which improved intermediate control means are interposed and operative between the spindle cam, the tumblers, and the bolt, whereby after the bolt has been extended to the locked position and the combination scrambled, it is necessary to set the combination before the spindle may be pushed inwardly, and whereby inward movement of the spindle serves to operate the intermediate control means to permit unlocking retraction of the bolt.

The intermediate control means include flanges or tongues extending between the tumblers and the bolt, and the construction and arrangement of the intermediate control means is such that the flange extending towards the tumblers is immovable towards the tumblers until the pin on the spindle or driving cam is out of engagement with the adjacent tumbler, thereby preventing rotation of the tumblers against the flange extending towards them.

The construction and arrangement of the intermediate control means is furthermore such

that the bolt cannot be moved towards or forced against the flange extending towards it until the combination is correctly dialed. The bolt is held in the extended position by contact of the operating lever against the case and by contact of the operating lever cam follower tongue against the completely cylindrical portion of the spindle or driving cam.

The construction and arrangement of the improved combination lock as thus set forth in general terms is furthermore such that there is no direct connection between the bolt or the operating lever and the tumblers.

By way of example, preferred embodiments of the combination lock of the present improvements and parts thereof are illustrated in the accompanying drawings forming part hereof, in which:

Figure 1 is a fragmentary rear elevational view of one embodiment of the improved combination lock looking towards the rear face of the door on which the lock is mounted and with the cover plate of the lock removed, and showing the parts of the lock in their relative positions when the bolt is in its fully extended locking position, and with the tumbler wheels having their notches aligned after setting of the combination, and the cam follower tongue of the operating lever seated on the cylindrical portion of the spindle cam, and with the operating notch of the spindle cam ready to receive the cam follower tongue;

Fig. 2 is a transverse sectional view thereof as on line 2—2, Fig. 1;

Fig. 3 is a view similar to Fig. 1 showing the parts of the lock in their relative positions when the bolt is in its fully extended locking position, and with the tumbler wheels having their notches aligned after setting of the combination, and after the spindle has been pushed in and the cam follower tongue of the operating lever has dropped into the operating notch, and after the bolt stopping and releasing cam has been actuated by the pushing in of the spindle cam to permit retraction of the bolt;

Fig. 4 is a transverse sectional view as on line 4—4, Fig. 3;

Fig. 5 is a transverse sectional view thereof as on line 5—5, Fig. 3;

Fig. 6 is a fragmentary front elevational view looking towards the front face of the door, and illustrating the dial and knob, and the dial ring of the lock;

Fig. 7 is an enlarged view similar to Figs. 1 and 3 showing the parts of the lock after the bolt has been retracted, and illustrating details of the drive between the cam and the adjacent tumbler wheel;

Fig. 8 is an enlarged sectional view as on line 8—8, Fig. 2;

Fig. 9 is an oblique view showing the bolt stopping and releasing cam;

Fig. 10 is a detached side elevational view of one of the tumbler wheels.

Fig. 11 is a detached elevational view of the pin face of the tumbler wheel of Fig. 10; and

Fig. 12 is a detached elevational view of the lug face of the tumbler wheel of Figs. 10 and 11.

Similar numerals refer to similar parts throughout the drawings.

One embodiment of the improved combination lock is indicated generally at 10, and includes a case 11 which is mounted on the inner face 12 of a door 13, which may be the door of a safe, and the lock may be used for stopping boltwork, not shown, in a usual manner. The lock

10 includes certain parts not shown in detail and which are substantially identical with such parts as shown and described in said Abbott and Miller U. S. Letters Patent No. 1,956,304, whereas other parts of the lock construction of said Abbott and Miller U. S. Letters Patent No. 1,956,304 pertinent to the present improvements, are shown and described in detail herein, as well as modified parts of the lock construction of said Abbott and Miller U. S. Letters Patent No. 1,956,304, and parts added thereto for the attainment of the present improvements.

The case 11 includes a tube 14 extending from the base wall 15 of the case, and the base wall is abutted against the inner face 12 of the door 13.

The bore of the tube 14 communicates with a registering aperture formed in the base or front wall 15 of the case, and with an aperture formed in the door 13, and an operating spindle 16 is journalled in the tube 14 and extends through the apertures of the base wall 15 and door 13. The operating spindle 16 is also slidable in the tube 14 in the direction of its longitudinal axis.

A dial ring 17 is secured upon the front face 18 of the door 13, and the spindle 16 also extends through an aperture formed in the dial ring, and a knob 19 and dial 20 are secured upon the outer end of the operating spindle 16.

The dial may have inscribed thereon 100 equally spaced division lines, each tenth division line of which is numbered successively from 10 to 100.

A single preferably vertically extending mark or arrow 21 is formed or inscribed on the dial ring above the knob, and the mark 21 is utilized in conjunction with rotation of the dial 20 both for operating the combination, and for changing the combination, by reason of the improvements of the several mechanisms of the lock set forth in detail in said Abbott and Miller U. S. Letters Patent No. 1,956,304.

Within the case 11 of the lock 10, tumbler wheels 22, 22', and 22'' are journalled on the tube 14 between the base wall 15 and a spindle cam 23, the cam being removably secured upon the extremity of the spindle 16 within the case, as by means of cooperating screw threads on the cam and spindle and a key 24 interposed in keyways formed in the cam and spindle.

The wheel 22 adjacent the spindle cam 23 is driven by a usual pin 16—1 mounted on the spindle, preferably on the inner face of the spindle cam 23 which is secured as aforesaid on the spindle. The drive from the pin 16—1 on the cam to the adjacent wheel 22 is by usual means such as a lever 26 journalled on the tube 14 and having one side abutted by the cam drive pin and the other side abutting one end of a segmental flange or lug 29 on the hub or center 28 of the wheel 22. Similar drive means such as a pin 30, carry the drive from the wheel 22 to the wheel 22', and from the wheel 22' to the wheel 22''. Such drive means are set forth in detail in said Abbott and Miller U. S. Letters Patent No. 1,956,304.

Each of the wheels 22, 22', and 22'' are preferably of the construction set forth in detail in said Abbott and Miller U. S. Letters Patent No. 1,956,304, and each wheel may be described generally as including a spaced pair of outer ring disc members releasable and engageable with the hub or center 28, and the means for effecting the drive from the spindle cam 23 to the wheel 22, and from the wheel 22 to the wheel 22', and from the wheel 22' to the wheel 22'' include the

segmental lug or flange 29 on one side of the hub or center, and the pin 30 on the other side of the hub or center of each wheel.

The lock 10 furthermore includes a bolt 35 mounted in suitable ways 36a and 36b formed in the case 11, for movement to and from the extended locking or bolting position, illustrated in Figs. 1, 3, 5, and 8.

Movement of the bolt 35 to and from locking or bolting position may only be made after the tumbler wheels have been rotated to certain positions relative to each other as determined by the particular combination for which the lock is set. That is to say the combination is determined by the relative location of each wheel center with respect to its outer discs, and the discs of each wheel have outwardly opening registering notches 37 formed therein which must be aligned with the notches of all the other wheel discs when the combination is set.

The bolt moving means include an operating lever 38 which is pivotally mounted on the bolt 35 as by means of a pivot screw 39. The lever 38 includes an operating arm 38a extending upwardly from the pivot screw 39 and above the cam 23.

The operating arm 38a has formed thereon a cam follower tongue 38b which extends from the arm 38a towards the axis of the spindle shaft and in line with the cam 23, and the cam 23 has a lever operating notch 23a formed therein which cooperates with the follower tongue 38b for moving the operating lever and bolt when the tongue is permitted to be inserted into the cam notch 23a. A spring 39—1 normally presses the lever arm 38a towards the cam 23.

The cam 23 includes a hub 23b and an enlarged cylindrical head 23c, the hub having an internally threaded bore and a keyway formed therein for connection with the spindle 16 as above described. The head 23c has a substantial thickness and the cam notch 23a is formed in one end 23f of the head, which is adjacent the tumblers and is the front end of the head 23c with reference to the door 13 on which the lock is mounted. The other or rear end 23g of the head 23c is cylindrical around its entire periphery.

The hub 23b of the cam 23 rotatably and slidably fits in a counterbore formed in the rear end of the bore of the tube 14. The spindle aperture in the door 13 is provided with a forwardly opening counterbore 13—1 in its front face, and a compression spring 50 is located around the spindle 16 in the counterbore 13—1, one end of the compression spring 50 reacting against the bottom of the counterbore 13—1 and the other end reacting against the rear end 19—1 of the knob 19, through one or more washers, as shown. The spindle 16 is thus spring pressed forwardly so that the cam 23 is normally urged against the rear end of the tube 14 as best shown in Fig. 2. Pushing the knob 19 rearwardly towards the door 13 displaces the cam 23 rearwardly to the position shown in Figs. 4 and 5.

For the purposes of the present improvements, the bolt 35 is provided on its inner end with an inwardly opening notch 35—1. When the combination is set, the tumbler notches 37 are aligned with each other and with the bolt notch 35—1 as shown in Figs. 1, 3, 7 and 8.

Further for the purposes of the present improvements, the lock 10 is provided with intermediate control means indicated generally by 51, and which is actuated by the rearward and forward movement of the spindle 16. As shown, the intermediate control means being offset

from the spindle and includes a stub shaft **52** whose forward end **52—1** is secured as by riveting to the base wall **15** of the lock case **11**. The shaft **52** extends rearwardly from the base wall **15** and is located between the tumbler wheels and the rear end of the bolt **35**, and below the axes of the spindle **16** and the lever pivot screw **39**.

The intermediate control means furthermore includes a spindle actuated stop cam indicated generally by **53** and which includes a sleeve **54** having a bore **55** which slidably and rotatably fits on the shaft **52**. As best shown in Fig. 5, the front end of the sleeve **54** has formed therein a longitudinally extending cam slot **56** having a front straight portion **57** circumfertially offset from a rear straight portion **58** and connected therewith by an angled portion **59**. An actuating pin **60** extends radially outwardly from the shaft **52** through the slot **56**.

The stop cam **53** furthermore includes intermediate its ends a stop arm **61** extending radially outwardly from one side of the sleeve **54**. At the rear end of the stop cam **53** an actuating arm **62** extends outwardly from the sleeve **54**, and the arms **61** and **62** lie in planes passing through the longitudinal axis of the sleeve **54** and which are angularly displaced from each other.

At the outer end of the stop arm **61** there extends from opposite sides of the arm **61** flanges **63** and **64** which are at right angles to the arm **61** and as shown are coplaner. At the outer end of the actuating arm **62** there extend a pair of arcuate segmental guide members **65** and **66** which are parallel with each other and at right angles to the longitudinal axis of the sleeve **54**. The segment guide members **65** and **66** are spaced from each other in the direction of the longitudinal axis of the sleeve **54**, a distance equal to the thickness of the cam head **23c** which is located between the guide members **65** and **66** as best shown in Fig. 5. Details of construction of the stop cam **53** are clearly shown in Fig. 9, which is a detached view of the cam **53**.

In the assembled lock **10**, the stop arm **61** extends upwardly from the sleeve **54** between the inner end of the bolt **35** and the tumbler wheels **22**, **22'**, and **22''**, the flange **63** extending towards the tumbler wheels and the flange **64** extending towards the inner end of the bolt.

The actuating arm **62** extends from the sleeve **54** towards the spindle cam head **23c**, and the guide members **65** and **66** are always on opposite sides of the cam head **23c** forming an outwardly opening U guideway for the cam head.

When the bolt **35** is extended to the locking position as shown in Figs. 1 and 8, the cam follower tongue **38b** on the operating arm **38a** of the operating lever **38** is seated on the cylindrical rear end portion **23g** of the cam **23**, and the sloping outer end face **38c** of the lever arm **38a** is opposed by the complementary sloping face **11—1** on a boss **11—2** extending from one or more of the walls of the case **11** into the compartment thereof, as shown in Figs. 1 and 8, whereby retraction of the bolt is prevented independently of other parts of the lock.

The operating arm **38a** having no fence, when the lock is being manipulated, there is no feel transmitted from the tumbler notches **37** through the knob to the fingers of the person manipulating the lock.

When the combination has been set also as shown in Figs. 1 and 8, the notches **37** are aligned with each other and with the bolt notch **35—1**, and the cam follower tongue **38b** rests on a sector of the rear cylindrical portion **23g** at the rear side of the lever operating notch **23a**. The knob **19** is then pushed in towards the door **13** displacing the cam head **23c** rearwardly so that the cam follower tongue **38b** drops down into the notch **23a** as shown in Fig. 2.

The pushing of the knob **19** inwardly and the displacement of the cam head **23c** rearwardly simultaneously causes the cam head to push rearwardly against the segmental guide member **65** on the cam **53** and thus push the cam **53** rearwardly. During the rearward movement of the cam **53**, the stationary actuating pin **60** extending radially from the shaft **52** operating in the came slot **56** causes rotation of the cam **53** so that the arms **61** and **62** move towards the tumblers so that the tumbler side tongue or flange **63** of the stop arm **61** enters the aligned tumbler notches **37** as shown in Fig. 3. In this position of the lock parts, the bolt side tongue or flange **64** of the stop arm **61** moves from the bolt stopping position shown in Fig. 1 to the position shown in Fig. 3 in which the flange **64** is aligned with the bolt notch **35—1**, thereby permitting retraction of the bolt to the unlocked position shown in Fig. 7 by rotation of the spindle **16** through turning the knob **19**.

In the unlocked position shown in Fig. 7, the tumbler notches **37**, the bolt notch **35—1**, and the stop arm flanges **63** and **64** are all aligned with each other as shown. It is noted that the flanges **63** and **64** may be radially spaced from each other on the stop arm **61** with an accommodating different location of the bolt notch **35—1**.

It is also noted that unless the combination has been set as shown in Fig. 1, there can be substantially no longitudinal motion of the spindle, since such motion would be stopped by the abutment of the outer end of the tumbler side tongue or flange **63** against the cylindrical faces of the tumblers. Thus, the tongue **38b** on the operating lever arm **38a** is not permitted to drop into the notch **23a**, in the present improved lock **10**, until after the combination has been set, the spindle pushed in, and the cam **53** rotated from the position shown in Figs. 1 and 8 to the position shown in Fig. 3.

It is also noted that when the spindle **16** is pushed rearwardly, from its outermost position, that there is first a straight longitudinal movement of the cam **53** on the pin **52** produced by the rear straight cam slot section or portion **58**, and no rotary motion is imparted to the arms **61** and **62** until the spindle pin **16—1** is disengaged from the tumbler **22**, the straight cam slot section or portion **58** being sufficiently long for this purpose, and thereby there is prevented any relative or simultaneous motion between flange **63** and the tumblers **22**, **22'**, and **22''**, when the flange **63** is finally brought into contact or engagement with the tumblers by action of the angled throw section or portion **59** of the cam slot **56** in the cam **53**.

If the cam slot **56** had only the angled portion or section **59**, a manipulator might move the tumblers back and forth across the end of the flange **63**, and thus feel out the location of the tumbler notches and the lock combination.

When the bolt **35** is returned to the extended locking position from the unlocked position shown in Fig. 7 by turning the knob **19** in the proper direction, after the tongue **38b** has ridden out of the notch **23a** and inward pressure of the operator has been released from the knob **19**,

the outward movement of the spindle 16 due to the action of the spring 50 causes a reverse rotation of the cam 53 and a return of its parts to the positions shown in Figs. 1 and 8.

The action of the spring 39—1, or spring in the operating arm 38 itself, or other spring means, serves to urge the outer end of the operating arm 38*a* rearwardly so that after the bolt has been extended to the locking position and the tumblers are scrambled the cam follower tongue 38*b* rides on the cylindrical rear end portion 23*g* of the cam 23.

In the foregoing description, certain terms have been used for brevity, clearness, and understanding. Such words are used for descriptive purposes herein and are intended to be broadly construed.

Moreover, the embodiments of the improved construction illustrated and described herein are by way of example, and the scope of the present invention is not limited to the exact details of construction.

Having now described the invention or discovery, the construction, the operation, and use of preferred embodiments thereof, and the advantageous new and useful results obtained thereby; the new and useful constructions, and reasonable mechanical equivalents thereof obvious to those skilled in the art, are set forth in the appended claims.

I claim:

1. In combination lock construction, a base wall, a tube extending from one side of the base wall, a spindle journalled and longitudinally slidable in the tube, one or more tumblers journalled on the tube, a dial knob on the spindle on the other side of the base wall, a cam on the spindle beyond the tube and the tumblers, the spindle cam including a head and the spindle cam head having a portion adjacent the tube and tumblers formed with an outwardly opening cam notch, the remaining peripheral sector of the notched portion of the spindle cam head being cylindrical and the portion of the spindle cam head beyond the notched portion being entirely cylindrical and merging with the cylindrical peripheral sector of the notched portion, the tumblers each being formed with an outwardly opening notch, drive means operative between the spindle cam and the adjacent tumbler and drive means operative between each adjacent pair of tumblers, a bolt mounted on the base wall for movement to and from an extended locking position, the bolt having an inner end adjacent the tumblers and the inner end of the bolt having a notch formed therein and opening towards the tumblers, an operating lever, a pivotal connection between the operating lever and the bolt, the operating lever including an upper arm extending above the spindle and having a cam follower tongue depending towards the spindle cam, the spindle cam head notch being arranged for alignment with the cam follower tongue in the direction of the longitudinal axis of the spindle when the combination is set, spring means operative to yieldingly maintain the spindle cam head against the opposite end of the tube when the bolt is in the extended locking position and during setting of the combination, and the cam tongue riding on the entirely cylindrical portion of the spindle cam head when the bolt is in the extended locking position and during setting of the combination, the cam tongue being arranged to drop into the spindle cam notch when the dial knob is pushed towards the base wall after setting of the combination and the spindle and the spindle cam are moved so that the spindle cam head notch is beneath the cam tongue, spindle actuated intermediate stop means interposed and operative between the spindle cam and the tumblers and the bolt, and the intermediate stop means including an actuating member interfitting with the spindle cam head and movable thereby and a stop member located between the bolt and the tumblers, the stop member being movable by movements of the actuating member, the stop member including oppositely extending first and second tongues, the first tongue extending towards the tumblers, and the second tongue extending towards the bolt, the first tongue being located to be moved into the aligned notches of the tumblers when the combination is set and the spindle is moved to the position with the spindle cam head notch beneath the cam follower tongue and the second tongue being located to be then aligned with the bolt notch.

2. In combination lock construction as set forth in claim 1, and in which the intermediate stop means includes a cylindrical cam, means mounting the cylindrical cam for rotation about an axis parallel to the longitudinal axis of the spindle, the cylindrical cam having a cam slot formed therein, and a cam follower pin extending from the mounting means into the cam slot, and the actuating member and the stop member each extending radially from the cylindrical cam.

3. In combination lock construction as set forth in claim 2, and in which the actuating member and the stop member are located in angled radial planes passing through the axis of rotation of the cylindrical cam.

4. In combination lock construction as set forth in claim 2, and in which the cylindrical cam is a sleeve having a bore, and the mounting means is a stub shaft extending from the base wall through and fitting the sleeve bore, and the cam follower pin extends from the stub shaft.

5. In combination lock construction as set forth in claim 2, and in which the cam slot includes a straight portion and an angled portion connecting with each other, the straight portion being parallel with the cam axis, and the cam follower pin being located in the straight portion when the spindle cam is in its position closest to the adjacent tumbler, and the length of the straight portion of the cam slot being such that the drive means between the spindle cam and the adjacent tumbler is disengaged therefrom when the dial knob is pushed towards the base wall and before the angled portion of the cam slot is engaged by the cam follower pin.

6. In combination lock construction, a base, a bolt mounted on the base for translatory movement with respect to a first axis, a spindle mounted on the base for translatory and rotary movement with respect to a second axis in a plane at an angle to the first axis, a cam head on the spindle, the spindle cam head having a portion formed with an outwardly opening notch, the remaining peripheral sector of the notched portion of the spindle cam head being cylindrical and the portion of the spindle cam head beyond the notched portion being entirely cylindrical and merging with the cylindrical peripheral sector of the notched portion, an operating lever, a pivotal connection between the operating lever and the bolt, the operating lever including an arm extending above the spindle and having a cam follower tongue depending towards the spindle cam head, the spindle cam head notch

being arranged for alignment with the cam follower tongue in the direction of the spindle axis by rotation of the spindle, the cam follower tongue riding on the cylindrical portion of the cam head when the bolt is in its extended locking position furthermost away from the spindle, the cam follower tongue being arranged to drop into the spindle cam head notch after alignment of the cam head notch and the cam tongue and translatory displacement of the spindle, intermediate stop means interposed and operative between the spindle cam head and the bolt, and the intermediate stop means including a cylindrical cam, means mounting the cylindrical cam for rotation about an axis parallel to the longitudinal axis of the spindle, the cylindrical cam having a cam slot formed therein, and a cam follower pin extending from the mounting means into the cam slot, and an actuating member and

a stop member each extending radially from the cylindrical cam, the actuating member interfitting with the spindle cam head and being movable thereby and the stop member being located between the bolt and the spindle, the stop member being movable to and from a stopping position with respect to the bolt by movements of the actuating member.

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