June 22, 1943. S. M. ARCHER 2,322,724

COMBINATION LOCK

Filed Jan. 30, 1941 3 Sheets-Sheet 1

Fig. 1.

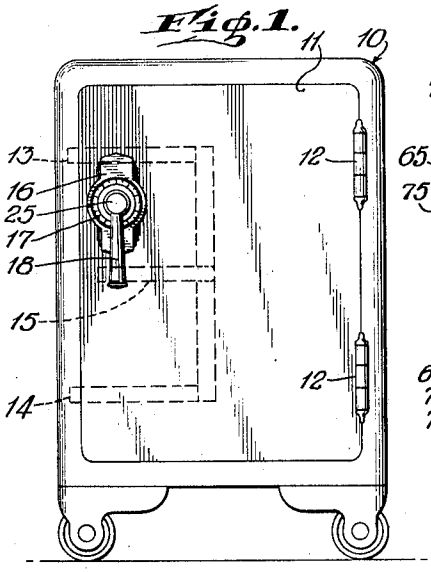


Fig. 7.

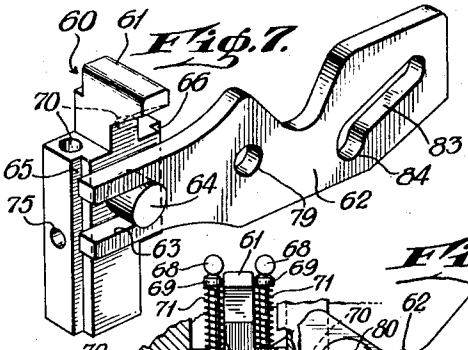


Fig. 8.

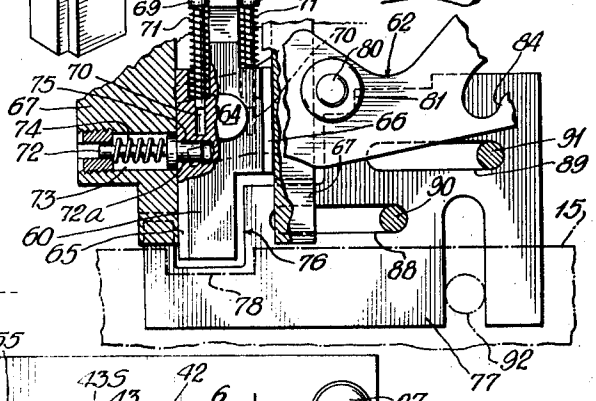
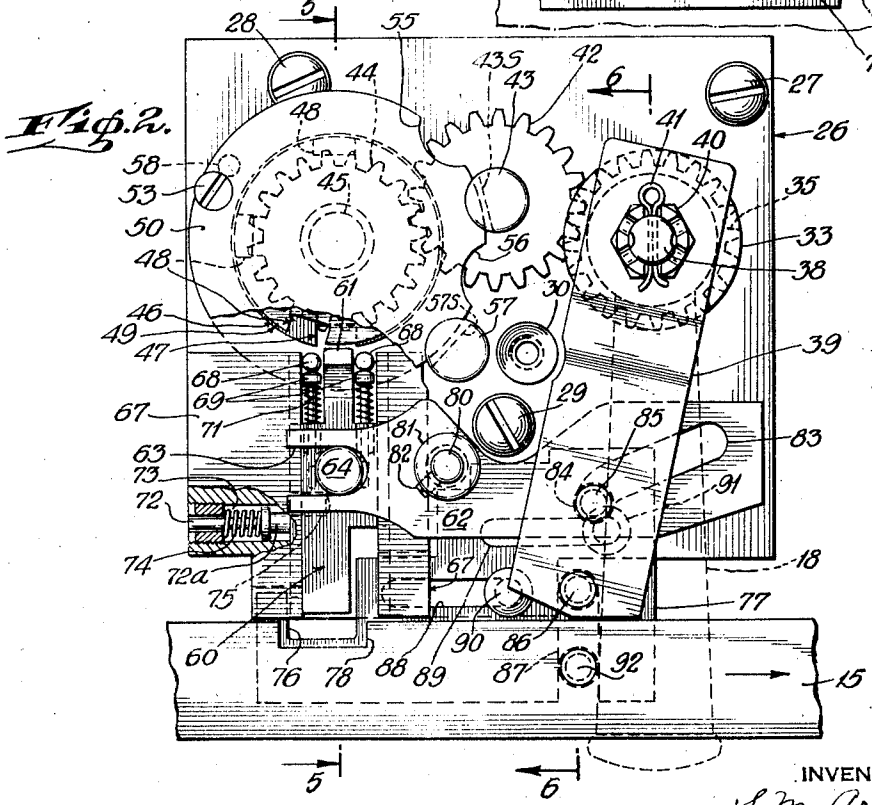


Fig. 2.



INVENTOR
S. M. Archer
BY
A. H. Golden
ATTORNEY

June 22, 1943. S. M. ARCHER 2,322,724

COMBINATION LOCK

Filed Jan. 30, 1941 3 Sheets-Sheet 2

Fig. 3.

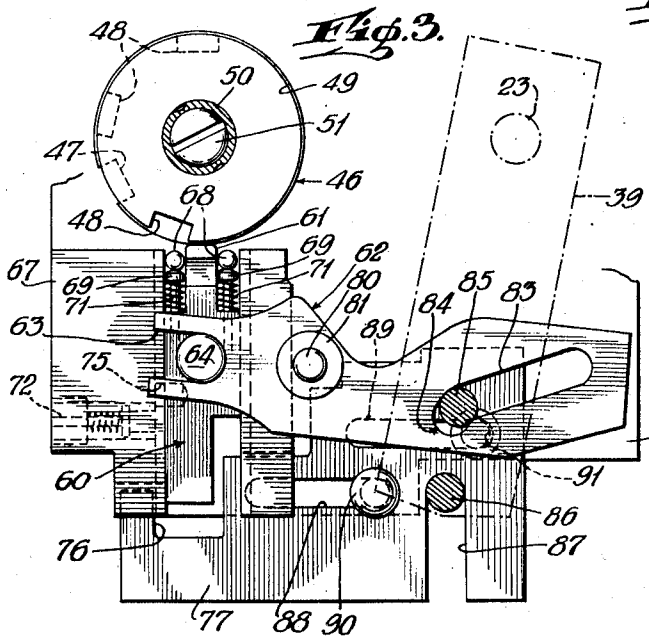


Fig. 5.

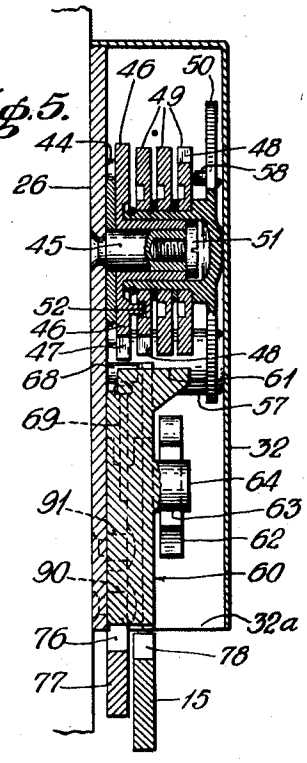
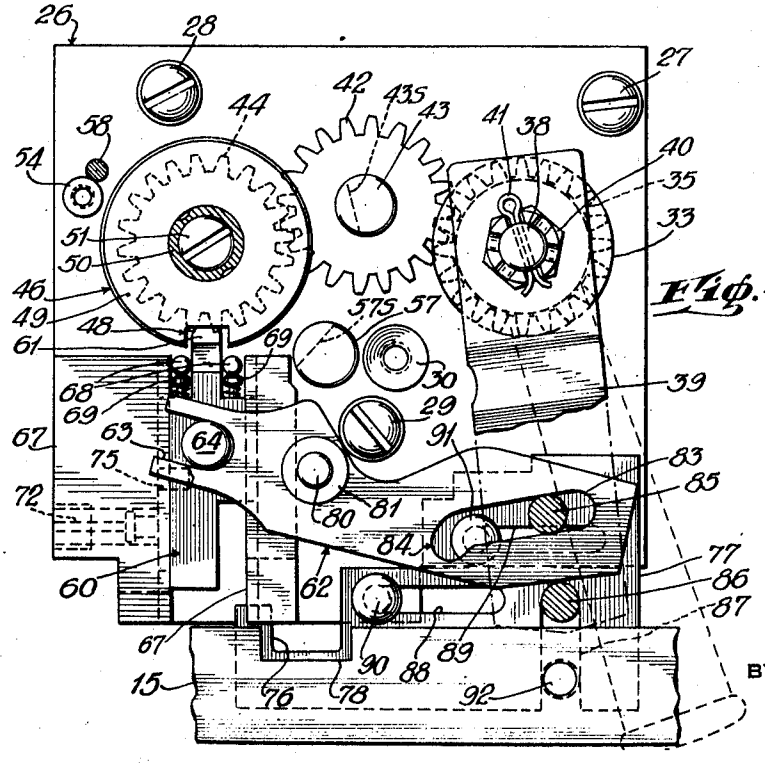


Fig. 4.



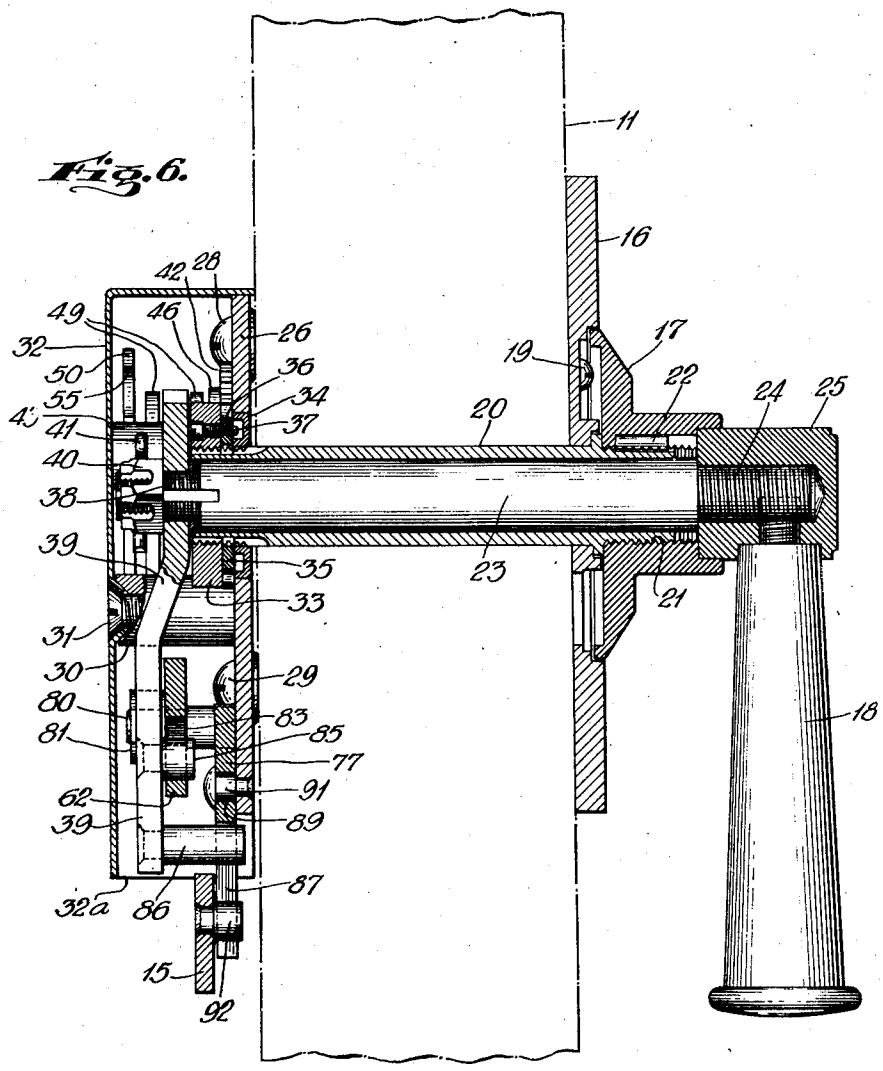
INVENTOR
S. M. Archer
BY
A. H. Golden
ATTORNEY

June 22, 1943. S. M. ARCHER 2,322,724

COMBINATION LOCK

Filed Jan. 30, 1941 3 Sheets-Sheet 3

Fig. 6.



INVENTOR
S. M. Archer
BY
A. H. Golden
ATTORNEY

Patented June 22, 1943

2,322,724

UNITED STATES PATENT OFFICE

2,322,724

COMBINATION LOCK

Sylvanus M. Archer, Stamford, Conn., assignor to The Yale & Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Application January 30, 1941, Serial No. 376,574

22 Claims. (Cl. 70—1.5)

This invention relates to combination locks, and more especially to a combination lock of the type adapted for use on a safe, for controlling the retraction of the locking bolts of the safe.

As a feature of my invention, I utilize, preferably, manual means for retracting the locking bolts of the safe, while simultaneously projecting the fence of the combination lock into the aligned gatings of the combination lock tumblers. As a further feature of this construction, the means whereby manual pressure may be applied by said manual means for moving the fence into the tumbler gatings, are arranged so that but a small part of the total manual pressure is actually effective. Preferably, I utilize a cam arrangement between the manual means and the fence, with the cam so designed that the application of force against the fence is very slight. In this way, it is impossible for considerable force to be applied by the manual means to the fence and against the tumblers of the combination lock, all as will be appreciated by those skilled in the art.

A further important feature of the invention resides in means for deadlocking, or relocking, the entire combination mechanism, should force be applied thereagainst. More in detail, this feature of the invention comprises limit means for preferably limiting the throw of the fence, means being provided for locking the fence permanently against release movement when the said limit means are disabled. Naturally the limit means are designed to be disabled readily upon attack, so that the fence will be locked.

Even more in detail, the limit means for maintaining the fence against projection from the tumblers beyond its normal limit, comprises means of connection between the fence and the manual bolt retracting mechanism so that should this manual bolt retracting mechanism be destroyed, a relocking will occur to prevent the opening of the safe mechanism. Still more in detail, this relocking occurs through the movement of the fence into coaction with the bolt retracting mechanism, and if desired, into locking coaction with one of the safe bolts.

I have thus described generally the more important features of my invention, but it will be understood that there are other important features which will be described in the detailed description of my invention which follows, and which will be claimed. Naturally, my invention may be embodied in mechanism specifically different from that which I shall herein describe and show, so that I should not be limited to that specific mechanism.

Referring now more particularly to the drawings, Fig. 1 is a front view of a safe to which my lock has been applied. Fig. 2 is a view of the base plate of my lock applied to the back of the door of the safe in Fig. 1, and showing the bolt retracting mechanism and one of the safe bolts. Fig. 3 illustrates the action which results when it is attempted to operate the bolt retracting mechanism before the tumblers are properly set. Fig. 4 is a view similar to Fig. 3 showing the operation of the bolt retracting mechanism after the combination has been set. Fig. 5 is a sectional view taken substantially along lines 5—5 of Fig. 2. Fig. 6 is a view taken substantially along lines 6—6 of Fig. 2, but showing the safe door and the method of applying the lock thereto. Fig. 7 is a perspective view of the fence and the pivoting lever for moving the fence into the tumbler gatings. Fig. 8 is a view similar to Figs. 2, 3 and 4 showing the fence deadlocked against movement towards the tumbler gatings.

Referring now more particularly to the drawings, and especially Fig. 1, reference numeral 10 indicates a safe having a front door 11 hinged to the safe body as at 12 and locked by bolts 13 and 14 against movement to open position. The bolts 13 and 14 are shown joined for retraction together through what I shall term a central bolt 15. The combination lock in Fig. 1 is shown as comprising an escutcheon 16, a rotatable dial 17, and a bolt operating handle 18.

Referring now more especially to Fig. 6, the escutcheon 16 is shown as secured to the safe door 11 through screws 19, and supported by the escutcheon in bearing relation thereto is a sleeve 20. The sleeve 20 is threaded as at 21 so that the dial 17, which is internally threaded, may be screwed on to the sleeve into a particular adjusted position, in which position it may then be keyed as through the key 22. Thereafter, it is obvious that the dial 17 and the sleeve 20 will rotate together, the sleeve 20 being utilized for setting the combination lock tumblers, all as will be indicated hereinafter.

Maintained within the sleeve 20 and for rotation independently of the sleeve 20, is a shaft 23 which is threaded as at 24 for the mounting of the handle sleeve 25 which carries the handle 18, as is clearly shown in Fig. 6. The shaft 23 is sometimes termed an operating spindle, and is rotatable by the handle 18 relatively to the sleeve 20 for retracting the bolts 13 and 14 of the safe through the central bolt 15, all as will be indicated hereinafter.

The combination lock comprises a base plate 26

which, as is probably best seen in Fig. 2, is secured to the safe door through three screws 27, 28 and 29. A stud 30 extends from the base plate 26 and is internally threaded for a screw 31, which secures in place the sheet metal cover 32, this sheet metal cover fitting about the periphery of the base plate 26, as is probably best shown in Fig. 6, the cover 32 being open at the bottom 32*a*, as is also best shown in Figs. 5 and 6.

That end of the sleeve 20 which extends through the base plate 26 and into the lock, is threaded for the mounting thereon of the internally threaded disk 33, whereby to adjust the sleeve 20 relatively to the lock casing while securing the sleeve against axial movement away from the lock. Keyed to the sleeve 20 and slidable thereon between the disk 33 and a knock-out disk 34 forming part of the back plate 26, is a gear 35 provided with a series of holes 36 into any of which may extend the stud end of a screw 37 which is mounted in the disk 33. In this way, the disk 33 is, in effect, keyed to the sleeve 20, after being properly adjusted thereon. The knock-out disk 34, as will be understood by those skilled in the art, is adapted to give way readily upon attack of the lock from the outside, and thus prevents the application of the full force of the attack against the base plate 26. It is not per se part of my invention herein set forth.

The end of the shaft 23 is turned down somewhat at 38, and on the portion 38 there is keyed the arm 39. A nut 40 is mounted on the threads of the turned down end 38 of the shaft 23, and maintains the arm 39 against movement off the shaft, all as will be quite apparent. Preferably, a cotter pin 41 is used to maintain the nut 40 against release rotation.

The gear 35 cooperates with an intermediate gear 42 which is loosely mounted on a stud 43 extending from the plate 26, and this gear 42 is in further engagement with a gear 44 loosely mounted on a stud 45 extending from the base plate 26, as is more clearly shown in Fig. 5. The gear 44 is made integral with a tumbler operating disk 46, also mounted about the stud 45. It will now be appreciated that rotation of the dial 17 will rotate the sleeve 20, which in turn will rotate the disk 33 and gear 35, and through gears 42 and 44 will rotate the tumbler operating disk 46. The tumbler operating disk 46 is somewhat larger in diameter than the remaining tumblers, and has a gating 47 which is adapted to be aligned with the gatings 48 of the three additional tumblers designated by reference numeral 49. The three additional tumblers 49 are mounted for rotation on the curb 50, this curb 50 being mounted about the stud 45 and in covering relation to the screw 51 threaded into the stud 45, and utilized to hold in position on the stud the gear 44 and its tumbler operating disk 46. The mounting of the several tumblers 49 on the curb 50, and their operation by the tumbler operating disk 46 and its upstanding lug portion 52, is well understood by those skilled in the art and is not per se part of this invention.

The curb 50, which supports the several tumblers, is maintained in position relatively to the base plate 26 by a screw 53 extending through a suitable bore in the curb 50 and into an internally threaded stud 54, which extends upwardly from the base plate 26. The curb 50, as will be noted, is scalloped as at 55 and 56 so that it may escape the stud 43 and a further stud 57, which extends upwardly from the base plate 26, when the curb is first slipped over the stud 45 on which it is itself mounted. The studs 43 and 57 are slotted as at 43S and 57S, respectively, so that the curb 50 may then be rotated to bring the solid portion of its periphery into the said slots 43S and 57S, for retaining the curb against axial movement relatively to those studs and relatively to the curb supporting stud 45. A pin 58 extending from the curb 50, and best shown in Fig. 4, strikes the stud 54 when the curb is properly located relatively to the studs 43 and 57, and with the opening in the curb through which the screw 53 passes aligned with the threaded opening in the stud 54. With the parts as described, the tumblers are now in position to be operated by the dial 17. It may be well to point out that the mounting of my curb 50 I consider novel in this art.

The fence of my combination lock is designated generally by the reference numeral 60, and is shown in perspective in Fig. 7. The upper end of the fence, designated by reference numeral 61, is adapted to enter the several gatings of the tumblers when they are aligned, as is shown in Fig. 4, through manipulation by the lever 62, which is bifurcated as at 63 for cooperation with the pin 64 extending from the fence 60, all as is best shown in Fig. 7.

The fence is cut away at its opposite sides at 65 and 66 to cooperate with a bearing way formed in a bearing block 67, which is secured to the plate 26, it being obvious that the bearing block will thus guide the fence 60 for vertical sliding movement relatively to the locking structure and the base plate 26.

Upstanding from the base plate 26 are a pair of pins 68, and abutting these pins 68 are headed rods 69 which extend into vertical bores 70 formed in the sides of the fence 60. Springs 71 fit about each of the headed rods 69 and extend into the bore 70, whereby to urge the fence downwardly and away from the tumblers and the tumbler gatings, all as will be quite apparent. This downward movement of the fence 60 by the springs 71 is limited to the position of Fig. 2 by the lever 62, whose bifurcated portions 63 cooperate with the pin 64 of the fence. It will be quite obvious that should an attempt be made to destroy the lock as through the driving in of the shaft 23, and should the lever 62 be driven away, there will be nothing to prevent the full downward projection of the fence 60 by the springs 71. Should this occur, a relocking pin 72 mounted in a bore 73 of the bearing block 67 will be forced by its spring 74 to enter a relocking bore 75 in the fence. Thereafter, it will be impossible for the fence to move upwardly towards the tumbler gatings.

This deadlocking of the fence is best illustrated in Fig. 8, wherein the end portion 72*a* of the relocking pin 72 is shown within the bore 75 of the fence, and obviously locks that fence against any movement whatsoever. In this deadlocked or relocked position of the fence 60, it will be noted that the lower end of the fence rests within a slot 76 formed in what I call the bolt retractor 77, and in a further slot 78 formed in the central bolt 15. Obviously, both the bolt retractor 77 and the central bolt 15 will now be locked against any movement, and it will be impossible to get into the safe except through destroying the door 11.

In an actual test performed by the Insurance Underwriters Laboratory, dynamite was inserted in a lock such as here described while mounted on a door, after the shaft 23 had been forced inwardly, destroying the mechanism and forcing

away the lever 62. This dynamite completely destroyed most of the parts of the lock, but the deadlocking of the fence 60 effectively prevented the operation of the safe bolt mechanism.

The lever 62 is adapted not only to limit the movement of the fence 60 through cooperation with the pin 64 of that fence, but is adapted to move the fence so as to bring its portion 61 into the tumbler gatings when the gatings have been aligned through proper operation of the dial 17. For such action, the lever 62 is bored as at 79 for mounting on a stud 80 projecting from the base plate 26. A disk 81 secured as by a screw 82 to the stud 80, maintains the lever 62 in proper pivotal relation to the lock. The lever 62 is formed with a cam slot having a usual cam portion 83 and what is termed a dwell 84.

A pin 85 extends from the arm 39 into coaction with the dwell 84 and the cam portion 83, so that rotation of the operating shaft 23 by the handle 18 of the safe will pivot the lever 62 to move the fence 60 towards the gatings. The purpose of the dwell 84 is to prevent the application of considerable force by the fence 60 against the tumblers when the tumbler gatings are not aligned. Thus, when manual pressure is applied to the handle 18, and therefore the arm 39, the dwell prevents the application of more than a slight portion of the force applied to the arm 39 against the lever 62 in a direction urging the fence against the tumblers. Because of this relationship of the parts, it is impossible to exert considerable force against the tumblers when they are in locking position. At this point, it may be well to indicate that in the preferred form of my invention, the tumbler operating disk 46 being larger in diameter than the tumblers 49, it accepts any force which may be applied against the tumblers through fence 60. Naturally, when the tumblers are all aligned, even the very slight moment of the force which may be applied from the arm 39 through its pin 85 to the lever 62, is sufficient to move the fence into the gatings, after which the pin 85 operating against the cam portion 83 readily transmits full movement to the fence 60 and fully projects the same into the gatings, as is best illustrated in Fig. 4.

In addition to the pin 85 extending from the arm 39, there is a further pin 86, this pin fitting into a slot 87 formed in the bolt retractor 77 so that as the arm 39 moves the fence into the gatings, it simultaneously moves the retractor 77 in a bolt retracting direction. The retractor 77 is itself slotted further as at 88 and 89 for slidable mounting on studs 90 and 91 extending upwardly from the base plate 26. While the bolt retractor 77 may operate in any one of many ways, preferably it actuates the central bolt 15 through a pin 92 extending from the central bolt 15 into the slot 87. Thus, when the bolt retractor moves to the position of Fig. 4, it moves therewith the central bolt 15 and retracts the safe bolts 13 and 14, all as is now quite apparent.

While the description of my invention so far given seems to be rather complete, it is thought best to present a description of the operation of my lock in order that any points not so far clarified, will now be fully understood.

The tumblers of the lock, it will be remembered, are mounted on the curb 50 which is secured over the stud 45 so that the tumbler operating disk 46 may actuate the tumblers 49 to align their gatings as the said tumbler operating disk is rotated through its gear 44 and gears 42 and 35 by the sleeve 20 actuated by dial 17. With the tumblers all set in position, a rotation of the handle 18 will rotate the shaft 23 and therefore the arm 39. The pin 85 of the arm 39 will first cooperate with the dwell 84 of the lever 62, and then with the cam portion 83 of the lever 62 for moving the said lever on the stud 80. This movement of the lever 62 moves the fence into the tumbler gatings. At the same time, a pin 86 extending from the arm 39 cooperates with the bolt retractor 77 for moving the retractor and the central bolt 15 into release position.

Should the tumblers not be properly set with their gatings all aligned, as in the position of Fig. 3, the coaction of the dwell 84 with the pin 85 of the arm 39 will be such that but a slight portion or moment of the force transmitted through the arm 39 will be applied to the lever 62 in a manner tending to rotate that lever to bring the fence against the tumblers. Moreover, should the lock be tampered with as through the driving in of the shaft 23, the lever 62 will probably be carried away from cooperation with the pin 64 of the fence 60. This will allow downward projection of the fence 60 by the springs 71 so as to force the lower end of the fence into the slots 76 and 78 of the bolt retractor 77 and the central bolt 15, respectively, thereby effectively locking those two parts against any possible release. The deadlocking pin 72 will, of course, lock the fence against release movement thereafter.

It will be noted, of course, as is well illustrated in Fig. 2, that the fence 60, while normally locking the arm 39 against movement and thereby preventing transmission of movement from this arm to the bolt retractor 77, also locks the retractor against substantial movement through the cooperation of its downwardly extending portion with the slot 76 in the bolt retracting slide 77.

I now claim:

1. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a cam connection between said handle and fence, and through which said handle moves said fence into said gatings, said cam connection being formed so that but a slight portion of the manual force applied to said handle is in turn applied toward the moving of said fence into said gatings.

2. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a compound cam connection between said handle and fence, and through which said handle moves said fence into said gatings, said compound cam connection being formed so that but a slight portion of the manual force applied to said handle is applied to said fence at the beginning of the handle movement toward the moving of said fence into said gatings, while a greater portion of the manual force is thereafter applied to said fence.

3. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a connection between said handle and fence comprising a pin and compound cam surface, and through which said handle moves said fence into said gatings, said pin first cooperating with one portion of said compound cam surface formed so that but a slight portion of the manual force applied to said handle is applied to said fence at the beginning of the handle movement toward the moving of

said fence into said gatings, said pin cooperating thereafter with another portion of said compound cam surface formed so that a greater portion of the manual force is applied to said fence.

4. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a pivoted lever extending between said handle and said fence and through which said handle moves said fence into said gatings, a pin and cam connection between said lever and handle through which said handle moves said lever and therefore said fence, said cam having a compound surface with one portion of said surface formed so that but a slight portion of the manual force applied to said handle is applied to said fence at the beginning of the handle movement toward the moving of said fence into said gatings, said pin cooperating thereafter with another portion of said compound cam surface formed so that a greater portion of the manual force is applied to said fence.

5. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a compound cam connection between said handle and fence, and through which said handle moves said fence into said gatings, said compound cam connection being formed so that but a slight portion of the manual force applied to said handle is applied to said fence at the beginning of the handle movement toward the moving of said fence into said gatings, while a greater portion of the manual force is thereafter applied to said fence, a bolt, and means of connection between said handle and said bolt whereby substantially all said manual force is applied to retract said bolt as the handle moves said fence toward said gatings.

6. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a connection between said handle and fence comprising a pin and compound cam surface, and through which said handle moves said fence into said gatings, said pin first cooperating with one portion of said compound cam surface formed so that but a slight portion of the manual force applied to said handle is applied to said fence at the beginning of the handle movement toward the moving of said fence into said gatings, said pin cooperating thereafter with another portion of said compound cam surface formed so that a greater portion of the manual force is applied to said fence, a bolt, and means of connection between said handle and said bolt whereby substantially all said manual force is applied to retract said bolt as the handle moves said fence toward said gatings.

7. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a pivoted lever extending between said handle and said fence and through which said handle moves said fence into said gatings, a pin and cam connection between said lever and handle through which said handle moves said lever and therefore said fence, said cam having a compound surface with one portion of said usrface formed so that but a slight portion of the manual force applied to said handle is applied to said fence at the beginning of the handle movement toward the moving of said fence into said gatings, said pin cooperating thereafter with another portion of said compound cam surface formed so that a greater portion of the manual force is applied to said fence, a bolt, and means of connection between said handle and said bolt whereby substantially all said manual force is applied to retract said bolt as the handle moves said fence toward said gatings.

8. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, means mounting said fence for movement normally away from said gatings, limit means limiting the movement of said fence away from said gatings to a predetermined position, and means for deadlocking said fence against movement back toward said predetermined position once said fence moves beyond said predetermined position as when said limit means is destroyed by an attack on the lock.

9. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a spring normally pressing said fence away from said gatings, limit means limiting the movement of said fence away from said gatings to a predetermined position, and means for deadlocking said fence against movement back toward said predetermined position once said fence moves beyond said predetermined position as when said limit means is destroyed by an attack on the lock.

10. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a spring normally pressing said fence away from said gatings, limit means limiting the movement of said fence away from said gatings to a predetermined position, means for deadlocking said fence against movement back toward said predetermined position once said fence moves beyond said predetermined position as when said limit means is destroyed by an attack on the lock, a bolt element, and means whereby said bolt element is deadlocked against movement when said fence is moved by said spring beyond said predetermined position.

11. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, means of connection whereby said member moves said fence into said tumbler gatings, means mounting said fence for movement normally away from said tumbler gatings, the connection of said fence with said member limiting the movement of said fence to a predetermined position, means for deadlocking said fence against movement towards said tumblers once said fence moves beyond said predetermined position as when said means of connection are destroyed by an attack on the lock, a bolt element, and means whereby said bolt element is deadlocked by said fence gainst movement when said fence moves beyond said predetermined position.

12. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, means of connection whereby said member moves said fence into said tumbler gatings, means mounting said fence for movement normally away from said tumbler gatings, the connection of said fence with said member limiting the movement of said fence to a predetermined position, and means for deadlocking said fence against movement towards said tumblers once said fence moves beyond said predetermined position as when said means of connection are destroyed by an attack on the lock.

13. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, a lever pivoted in said lock and having portions in engagement with said member and said fence whereby it is rotatable on its pivot by said member to move said fence into said tumbler gatings, means mounting said fence for movement normally away from said tumbler gatings, the connection of said fence with said lever limiting the movement of said fence to a predetermined position, and means for deadlocking said fence against movement towards said tumblers once said fence moves beyond said predetermined position as when said lever is removed by an attack on the lock.

14. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, a lever pivoted in said lock and having portions in engagement with said member and said fence whereby it is rotatable on its pivot by said member to move said fence into said tumbler gatings, means mounting said fence for movement normally away from said tumbler gatings, the connection of said fence with said lever limiting the movement of said fence to a predetermined position, means for deadlocking said fence against movement towards said tumblers once said fence moves beyond said predetermined position as when said lever is removed by an attack on the lock, a bolt element, and means whereby said bolt element is deadlocked against movement by said fence when said fence moves beyond said predetermined position.

15. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, a lever pivoted in said lock and having portions in engagement with said member and said fence whereby it is rotatable on its pivot by said member to move said fence into said tumbler gatings, means mounting said fence for movement normally away from said tumbler gatings, the connection of said fence with said lever limiting the movement of said fence to a predetermined position, means for deadlocking said fence against movement towards said tumblers once said fence moves beyond said predetermined position as when said lever is removed by an attack on the lock, a bolt element retractible by movement of said member incidental to the movement of said fence into said gatings, and means whereby said bolt element is deadlocked against movement by said fence when said fence moves beyond said predetermined position.

16. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, a lever pivoted in said lock and having portions in engagement with said member and said fence whereby it is rotatable on its pivot by said member to move said fence into said tumbler gatings, a spring normally pressing said fence away from said tumbler gatings, the connection of said fence with said lever limiting the movement imparted to said fence by said spring to a predetermined position, and means for deadlocking said fence against movement towards said tumblers once said fence is moved by said spring beyond said predetermined position as when said lever is removed by an attack on the lock.

17. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually movable member, a lever pivoted in said lock and having portions in engagement with said member and said fence whereby it is rotatable on its pivot by said member to move said fence into said tumbler gatings, a spring normally pressing said fence away from said tumbler gatings, the connection of said fence with said lever limiting the movement imparted to said fence by said spring to a predetermined position, means for deadlocking said fence against movement towards said tumblers once said fence is moved by said spring beyond said predetermined position as when said lever is removed by an attack on the lock, a bolt element retractible by movement of said member incidental to the movement of said fence into said gatings, and means whereby said bolt element is deadlocked against movement by said fence when said fence is moved by said spring beyond said predetermined position.

18. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a handle rotatable from the outside of the lock, a member in said lock forming in effect a part of said handle, a lever pivoted in said lock and extending between said fence and said member, a cam connection between said member and said lever whereby rotation of said member by said handle actuates said lever to move said fence into said gatings, a bolt, and a direct connection between said member and bolt whereby said member retracts said bolt as it is rotated by said handle to move said fence into said gatings.

19. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually rotatable member, a lever pivoted in said lock at a point between its ends, a pin and slot connection between one end of said lever and said fence, a cam connection between the other end of said lever and said member, whereby rotation of said member rotates said lever and moves said fence into said gatings, a spring pressing said fence away from said gatings, the pin and slot connection between said lever and member limiting the movement of said lever and therefore of said fence, away from said gatings.

20. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a rotatable member, a lever pivoted in said lock at a point between its ends, a pin and slot connection between one end of said lever and said fence and a cam connection between the other end of said lever and said member, whereby rotation of said member rotates said lever and moves said fence into said gatings, a bolt retractor, and a pin and slot connection between said bolt retractor and said member whereby said member moves said bolt retractor as it moves said fence into said gatings.

21. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a handle rotatable on the outside of the lock and extending as a shaft into the lock, a tumbler operating dial mounted for rotation on said shaft and extending in the form of a sleeve into said lock, gear means whereby said dial sets said tumblers, a lever pivoted in said lock at a point between its ends, a connection between one end of said lever and said fence, and a connection between the other end of said lever and said member, whereby rotation of said handle rotates said lever and moves said fence into said gatings, a spring pressing said fence away from said gatings, the connection between

said lever and member limiting the movement of said lever, and therefore of said fence away from said gatings to a predetermined position, means for deadlocking said fence against movement towards said tumblers once said fence is moved by said spring beyond said predetermined position as when said lever is removed by an attack on the lock, a bolt element retractible by said handle and said member incidental to the movement of said fence into said gatings, and means whereby said bolt element is deadlocked against movement by said fence when said fence is moved by said spring beyond said predetermined position.

22. In a lock of the class described, a series of tumblers having gatings, a fence adapted to enter said gatings, a manually operated handle for moving said fence into said gatings, a cam connection between said handle and fence and through which said handle moves said fence into said gatings, said cam connection being formed so that but a slight portion of the manual force applied to said handle is applied to said fence toward the moving of said fence into said gatings, a bolt, and means of connection between said handle and said bolt whereby substantially all said manual force is applied to retract said bolt as the handle moves said fence toward said gatings.

SYLVANUS M. ARCHER.