Jan. 13, 1925. 1,522,573

E. M. BENHAM

CHANGEABLE COMBINATION KEY LOCK

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Fig. 1,

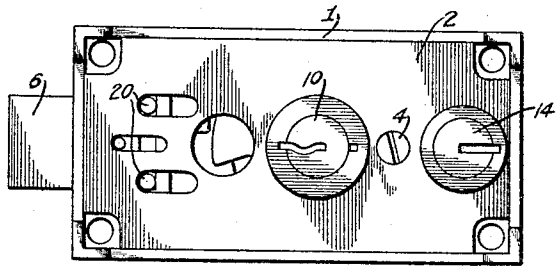


Fig. 2,

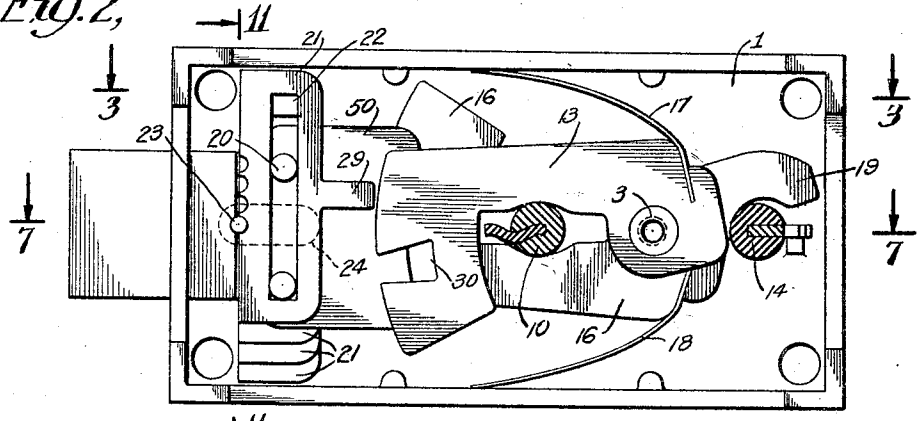


Fig. 3,

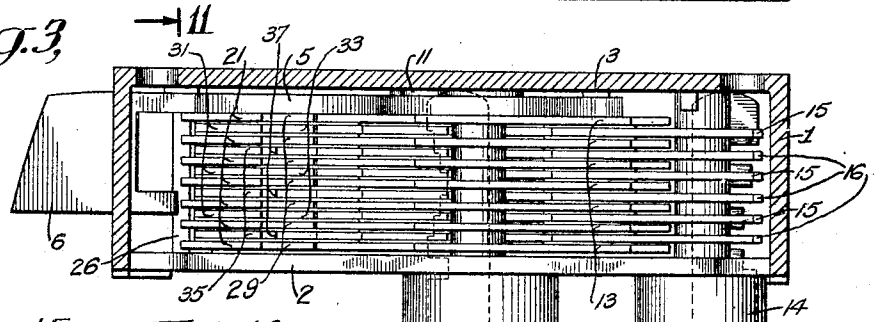


Fig. 15,

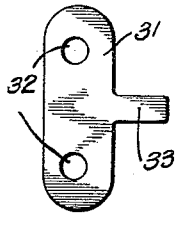
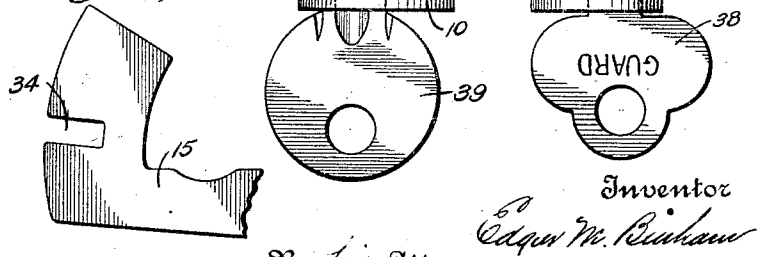


Fig. 16,



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CHANGEABLE COMBINATION KEY LOCK

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Fig. 4,

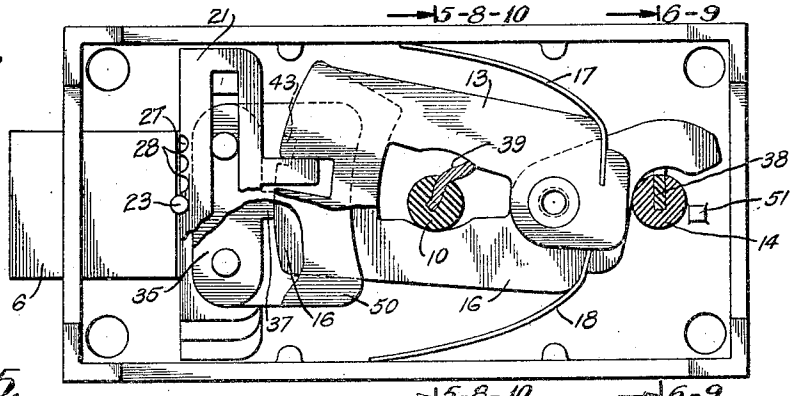


Fig. 5,

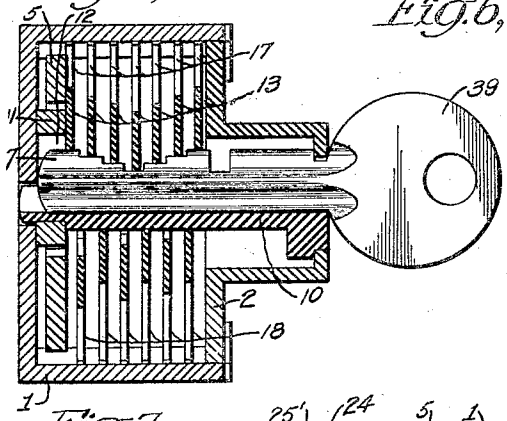


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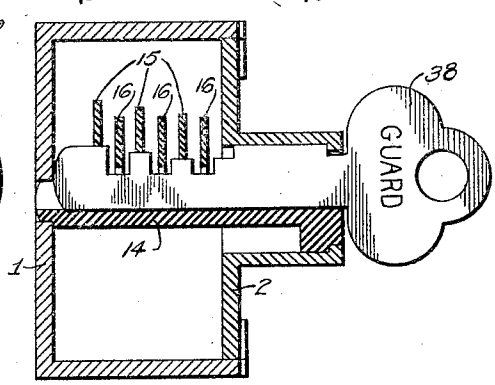


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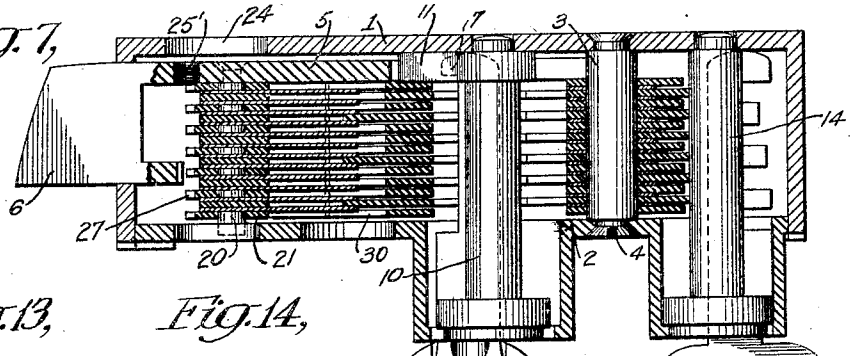


Fig. 13,

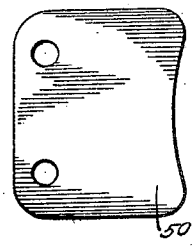
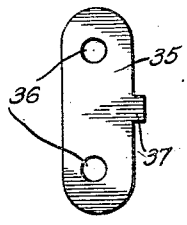
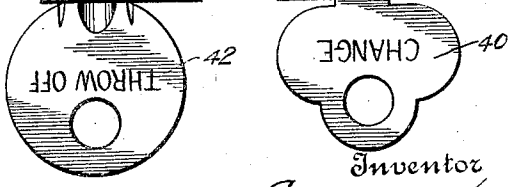


Fig. 14,





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CHANGEABLE COMBINATION KEY LOCK

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Fig. 8,

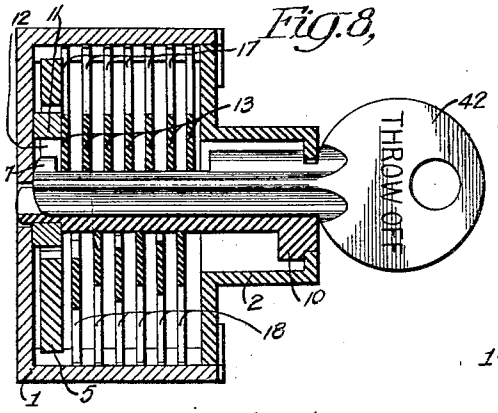


Fig. 9,

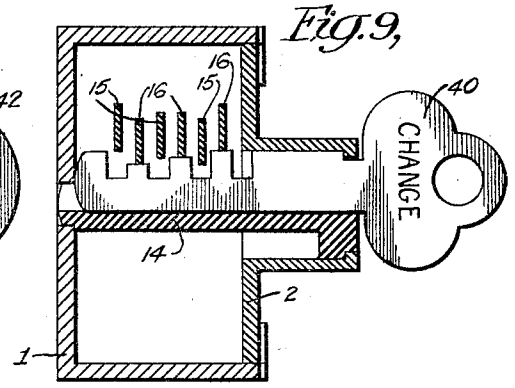


Fig. 10,

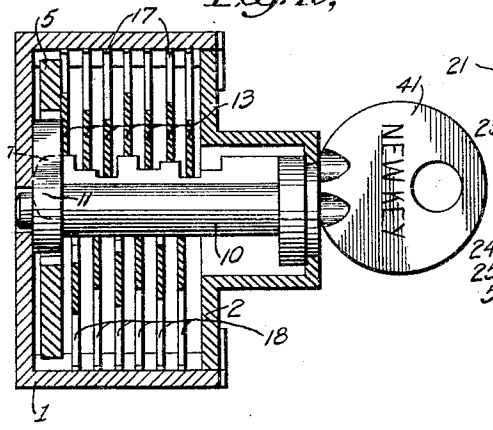


Fig. 11,

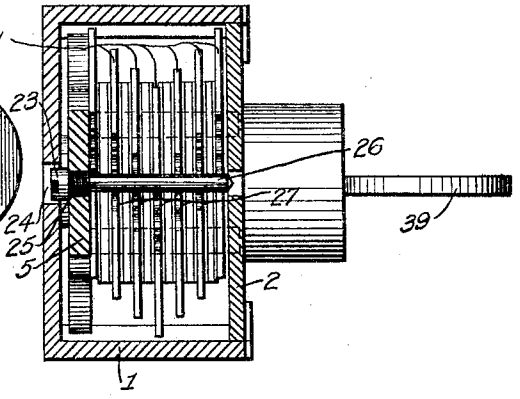
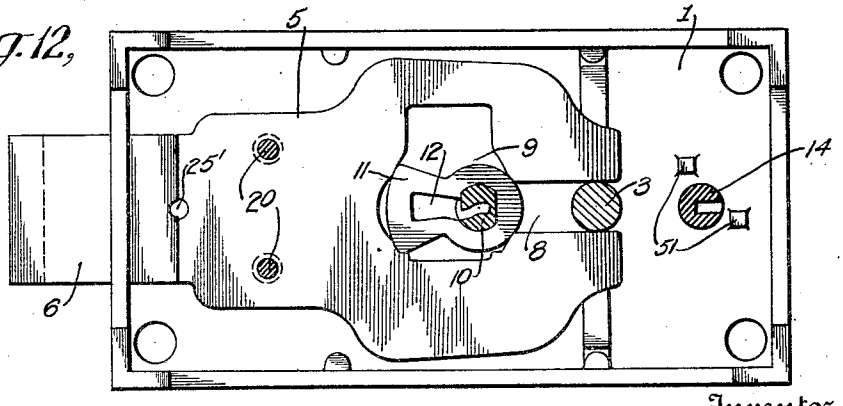


Fig. 12,



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By his Attorney

J. O. Edwards

Patented Jan. 13, 1925. 1,522,573

UNITED STATES PATENT OFFICE.

EDGAR M. BENHAM, OF NORWOOD, OHIO, ASSIGNOR TO THE MOSLER LOCK COMPANY, OF COVINGTON, KENTUCKY, A CORPORATION OF OHIO.

CHANGEABLE COMBINATION KEY LOCK.

Application filed April 26, 1922. Serial No. 556,709.

To all whom it may concern:

Be it known that I, EDGAR M. BENHAM, a citizen of the United States, residing at Norwood, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Changeable Combination Key Locks, of which the following is a specification.

My invention relates to locks, and more particularly to locks of the type commonly known as changeable combination key lock, and to locks which are adapted for use on safety deposit boxes.

In my co-pending application, Serial Number 483,674, filed July 11, 1921, for improvements in locks, I have described a new and improved lock of the change key type. In accordance with the invention disclosed in said application, the lock includes two separate sets of tumbler plates nested together and pivoted on a common pin, the two sets being movable in a scissor-like manner in response to the turning of two keys. One of these sets of tumbler plates presents noses extending in one direction and the other set presents noses extending in the opposite direction. These noses are adapted to dog the bolt bar, and are notched or recessed so that when the noses of the two sets are properly aligned with each other and with the bolt bar by the operation of the keys, the bolt bar may be moved inwardly to withdraw the bolt. Each of these two sets of tumbler plates is adapted to be actuated from a separate key tube and preferably arranged to be responsive to different keys. The lock described in said application, is not adapted to be adjusted so as to be responsive to a different key except by cutting or interchanging the tumblers to present key engaging surfaces at changed distances from the axis of the key.

It is the aim of the present invention to provide a lock employing the style of tumbler construction and arrangement described in my said application, which lock, however, may readily and easily be adjusted without taking the lock apart so that it may be operated by any chosen one of a number of different keys. My improved tumbler system permits the use of about eight hundred thousand different keys, whereas, changeable combination key locks heretofore constructed, have not permitted the use of over fifty thousand different keys.

Heretofore, in attempting to adjust combination key locks to become responsive to a different key, a wrong adjustment of the tumblers is often effected, as when the key bits misplace a tumbler or pick up the wrong tumbler. When this happens, the lock cannot be operated, nor can this condition be remedied without disassembling the entire lock and reassembling the parts. It is another object of my invention to provide a lock of that type, but one so constructed that when a faulty adjustment of the tumblers is made, the fault may be remedied without taking the lock apart and even without removing the lock from the door.

Further objects of my invention include the provision of a lock of the changeable combination type, and one which is very efficient and sure in operation and at the same time is strong, very durable, and one which permits the use of keys of sturdier construction than has been permitted by lock mechanisms of this class heretofore known. Further objects of my invention include the provision of a lock of the above type, and one which permits the use of keys having a maximum length and strength in its key bit, so that the keys are permitted to have more play in the key tube, with the result that the failure of the key to assume exact position is not as liable to prevent the operation of the lock thereby nor to improperly set up the parts when the mechanism is being adjusted for a different key. Other objects will be in part obvious and in part pointed out hereinafter.

In accordance with my invention, instead of arranging a tumbler system such as is described in my said co-pending application so that it will dog the bolt bar directly, I construct the lock so that each tumbler of one set will dog a projecting finger of a set of vertically adjustable comb members which are mounted on the bolt bar to move back and forth therewith. The other set of tumblers is arranged to dog, individually, inwardly extending fingers carried by another set of plates which are also mounted for movement with the bolt bar. These plates are preferably stationary, and the fingers thereon are so disposed that when the proper guard key or change key is turned in its key tube, the fingers of these pieces will be adapted to enter the recesses

in that set of tumblers. Normally the comb pieces are held in such adjusted vertical position that when the proper key is operated in the other key tube, the fingers on these comb pieces will be in alignment with the respective recesses in the corresponding set of tumblers. When both sets of tumblers have been properly set by their keys, the mechanism is preferably so arranged that the further turning of the main key will engage and unlock the bolt, this movement being permitted because the recessed portions of the tumblers are all in alignment with the corresponding finger portions above mentioned. In connection with the above construction, I provide means for releasing the comb pieces for vertical adjustment, so that when the fingers of the other plates are in the recessed portions of the set of tumblers, by inserting a different key in the main key tube and turning the key one-quarter revolution, the comb members assume adjusted vertical positions in which they cooperate with the tumblers when actuated by that key. Now, by locking the comb members in their new adjusted vertical positions, the lock is adjusted for the new key and will be responsive thereto until another adjustment is made. I also provide means whereby, if the tumblers and the comb pieces are not properly adjusted relatively by a new key, as for instance, when the new key takes up a wrong tumbler, the comb pieces may be released to destroy their faulty adjustment and the adjustment of the mechanism may be repeated by operating upon the lock with a specially constructed key known as the "throw-off key" in combination with the use of the "guard key" and "change key" and the key for which the mechanism is to be adjusted.

In order that a clearer understanding of my invention may be had, attention is hereby directed to the accompanying drawings forming a part of this application and illustrating one possible embodiment of my invention. In the drawings Fig. 1 is a top plan view of a lock embodying my invention; Fig. 2 is a top plan view of the lock with the upper wall of the casing removed, keys and key tubes, however, being shown in section; Fig. 3 is a sectional view of the lock taken on the line 3—3 of Fig. 2; Fig. 4 is a view similar to Fig. 2 but with the main key and the guard key turned and the bolt in retracted position; Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4, with the original main key to tumbler setting position; Fig. 6 is a sectional view taken on the line 6—6 of Fig. 4, with the guard key turned to tumbler setting position; Fig. 7 is a sectional view taken on the line 7—7 of Fig. 2, with the throw-off key and change key in their key tubes; Fig. 8 is a sectional view on the line 5—5 of Fig. 4, with the throw-off key partially turned in its key tube; Fig. 9 is a sectional view on the line 9—9 of Fig. 4, with the change key turned in its key tube; Fig. 10 is a sectional view on the line 10—10 of Fig. 4, with the new key turned to tumbler adjusting position in its key tube; Fig. 11 is a sectional view taken on the line 11—11 of Fig. 2, showing the means for securing and releasing the combs; Fig. 12 is a top plan view of the lock showing the bolt bar and operating means therefor, the tumblers and the top of the lock casing being removed; Fig. 13 is a plan view of a spacer plate used in connection with the comb pieces and tumblers; Fig. 14 is a plan view of one of the set of finger members which are movable with the bolt bar and normally engage tumblers which are operated by the change key; Fig. 15 is a plan view of a finger member of a set which cooperates with tumblers operated by the guard key; and Fig. 16 is a plan view of a fragment of one of the tumblers, showing the nose and the recess therein. Similar reference characters designate similar parts throughout the several views of the drawings.

Referring to the drawings, I house the lock mechanism in the usual box casing, which comprises a base 1 and a cover 2. Upon the base is mounted a pin 3, containing a threaded recess in its upper end and adapted to receive a screw 4 whereby the two parts of the casing are secured together. Inside of the casing and on the bottom of the base I mount a bolt bar 5, providing at its outer end a bolt portion 6 which extends through a suitable perforation in one end of the lock casing. Bolt bar 5 contains a slot 8 through which the pin 3 of the base extends to aid in guiding the movement of the bolt bar. The bolt bar is supplied with another slot or recess 9 through which the key tube or post 10 extends. In recess 9 is a cam member 11 secured to the key post 10 and recessed as at 12 to receive the highest bit 7 of a key, whereby the cam member 11 may be turned, so as to engage the bolt bar at one side or the other of the recess 9 to effect the locking and unlocking of the bolt.

About the post 3 I separately and pivotally mount a plurality of tumbler plates. As shown, the tumbler plates are divided into two sets, one set comprising seven separate tumbler plates and the other set comprising six separate tumbler plates. The tumbler plates of one set are adapted to be manipulated by keys positioned in the key tube 10. All the tumblers of this set are designated 13. The tumblers of the other set are adapted to be manipulated by means of keys positioned in another key tube 14 which is carried by the casing to the rear of the pin 3. Three of the six tumblers of this set are numbered 15 and are adapted

to be manipulated by a certain key which will be referred to hereafter as the guard key. The other three tumblers of this set, preferably arranged in alternate relation with the first mentioned three, are designated 16 and are adapted to be manipulated by means of a key which hereafter will be called the change key. Each tumbler 13 carries a spring 17 which presses against the inner side of the casing. These springs 17 continually press the tumblers 13 toward the key post 10 so that they will be in position for manipulation by a key and will follow the key bits as the key is turned. The tumblers 15 and 16 are also similarly supplied with springs 18 which continually press the tail portions 19 of these tumblers toward the key post 14, to maintain them in position for manipulation by a key at that point.

Tumblers 13 have noses extending in one direction and tumblers 15 and 16 have noses extending in the opposite direction. The noses of the two sets of tumblers overlap each other and are preferably placed in alternating relation. When operated by means of keys in key posts 10 and 14, the tumbler sets move relatively in a scissor-like manner. The noses of these tumblers function to dog the bolt bar indirectly, except when they have been manipulated into releasing positions by means of the proper keys, as will now be described.

On the bolt bar 5 and some distance in front of the noses of the tumblers, I secure a pair of vertically extending pins 20 carrying for vertical adjustment thereon, seven comb members 21, each comb member 21 being adapted to cooperate with one of the seven tumbler plates 13, which are manipulated by a key in post 10. Each comb piece 21 has a vertically extending slot 22 through which the pins 20 extend, permitting a certain extent of vertical movement to each comb piece. I provide means for holding these comb pieces in relative vertical adjustment with respect to each other and consequently also with respect to the bolt bar and with respect to the tumblers 13. Such means may suitably comprise a screw having a head 23 placed in a slot 24 provided in the under side of the casing and having an adjacent threaded portion 25 engaging a threaded perforation 25′ in the bolt bar 5, and having an extended shank 26 which is adapted to be removably received in any one of several grooves or recesses 27 provided along the outer edge 28 of each comb member 21. When the pin 23 is withdrawn from the casing, gravity causes all the members 21 to fall into their lowermost position, and when adjusted in the desired relative vertical position, they may be locked in such position by inserting the screw 23 and screwing it fast on the bolt bar. Each comb piece 21 is provided with an inwardly extending projection or finger 29 which is adapted to abut against the outer edge of the nose portion of a cooperating tumbler 13 to prevent movement of the bolt bar into unlocked position, except when the tumbler has been moved by the proper key in tube 10 to bring a recess 30 in the edge of the tumbler 13 into alignment with the finger 29, in which case, if no other interference is present, the finger portion 29 of the comb member 21 may be withdrawn into the recess 30 in the co-operating tumbler 13, to permit movement of the bolt into unlocked position. From the above it will be apparent that so far as tumblers 13 and comb members 21 are concerned the bolt may be unlocked by a key 39 operating in the key tube 10 and is so designed that the key bits will move all the tumblers 13 to such an extent that each tumbler will present its recess 30 in alignment with the finger piece 29 of the corresponding comb piece 21. Now, if that key 39 could be withdrawn from the key tube 10 while the finger portions 29 of the comb pieces 21 are seated within the recesses 30, the lock can be adjusted very easily and quickly for manipulation by means of any desired one of a great number of different keys. To do this key 39 is withdrawn after a full half turn in unlocking direction, placing finger 29 in recesses 30, and the screw 23 is withdrawn to release the comb member 21 for vertical adjustment, either before or after key 39 has been removed. When both the screw 23 and the key 39 have been removed, spring 17 move all the tumblers 13 against the key post 10, the tumblers carrying the comb members 21 with them. Now, when a different key 41 is inserted in key tube 10 and turned for a quarter of a revolution in locking direction, the tumblers 13 will take relative positions corresponding to the particular arrangement of the bits of the new key 41. Since finger portions 29 of the comb piece 21 are seated in the recesses 30 of the tumblers 13, these comb pieces 21 also will become adjusted into new vertical positions, which correspond to the new positions assumed by the tumblers under the influence of the new key. The comb members 21 may now be locked into the new vertically adjusted positions by inserting the screw 23. In the absence of other interference, and so far as the tumblers 13 and comb pieces 21 are concerned, the lock may now be operated by means of this new key and cannot be operated by another regular key until another adjustment of the comb pieces 21 is effected. Such new adjustment may be made in the above manner whenever desired, and, as before pointed out, on account of the novel tumbler arrangement, the adjustment may be made for

any desired one of an enormous number of different keys.

Although it is within the contemplated scope of my invention to construct a lock adapted to be operated in the above manner, without additional interference, or without requiring another key or other tumblers, I preferably include in my construction the tumblers 15 and 16, operable, as aforementioned, from the key tube 14. Some of these tumblers, such as 15, I arrange to cooperate separately with finger pieces 31, which have two spaced perforations 32 to receive the two spaced posts 20 of the bolt bar and whereby these pieces 31 are carried. Each piece 31 also has an inwardly extending projection or finger 33 arranged to abut against the outer edge of the tumblers 15 except when the proper key (guard key) 38, operating in tube 14, has moved recesses 34, provided on the outer edge of the tumblers 15, into alignment with the finger portions 33. The cooperation between the tumblers 15 and the finger pieces 31 are such that movement of the bolt bar 5 into unlocking position will be prevented except when recesses 34 of the tumblers 15 are in alignment with the fingers 33, the result being that unless this adjustment has been made an attempt to open the lock, even by means of the proper key 39 operating in the key post 10, will be futile.

I further provide means for preventing the withdrawal of the proper key 39 from the key post 10 except when the lock is in locked condition, but arrange such means that they can be made inoperative by the manipulation of the proper key (the change key) 40 in the key tube 14. These means comprise the three tumblers 16, each cooperating with a finger plate 35 which is carried on the posts 20 of the bolt bar, each plate 35 having two spaced perforations 36, one for each post 20. The plate 35 also carries a reduced finger portion or projection 37 which engages against the outer edge of its corresponding tumblers 16 when the bolt bar has been moved into unlocked position. This engagement takes effect before the key in the key post 10 has completed a half revolution and thereby prevents the key 39 from being withdrawn when the lock is in unlocked condition. However, since it is necessary to permit of the withdrawal of the key from the key tube 10 with the lock in unlocked condition, whenever it is desired to adjust the lock for operation by a different key, I provide a key 40, called the change key, which is adapted to operate in the key tube 14 upon tumblers 16 so as to move recesses 43, provided on the outer edges of the tumblers 16, into alignment with the finger portions 37, and permit of the turning of the key 39 in the key tube 10 for a complete half revolution in unlocking direction so that it may then be withdrawn. Preferably between the finger pieces and combs I place on the posts 20 a spacing and guiding plate 50 which extends between the tumblers so as to insure proper alignment of the finger portions 29, 33 and 37 with the outer ends of the corresponding tumblers. These plates also prevent undesirable frictional engagement between the parts. Two lugs 51 may also be provided on base 1 to limit movement of a key operating in spindle 14.

A lock constructed in accordance with the above description is particularly well suited for use on safe deposit boxes. It may be mounted on such a box in the usual manner, and, preferably, in regular operation requires the use of both a main key and a guard key. The depositor has possession of the main key 39, which is operable in the key tube 10, and the bank retains the possession of all the other keys, these comprising the guard key 38 which must be manipulated in the key tube 14 before the depositor can open the box with his key, and also the change key 40 which must be used when the lock is adjusted for operation by a different main key, and also a number of different main keys, such as key 41, for any one of which the lock may be adjusted, and also a throw-off key, the function of which will be hereinafter described. In the normal operation of the lock the bank custodian inserts the guard key 38 into the key tube 14 and turns it counter-clockwise for a quarter revolution, leaving the key in such position until the depositor has inserted the main key 39 and unlocked the box therewith. The custodian may then withdraw the guard key. Meanwhile the depositor is unable to turn the key 39 a complete half turn and therefore cannot withdraw his key until he has returned it to the original position, thereby moving the bolt to locked position.

Should it be desired to make the lock responsive to a different main key this may be accomplished readily and easily in the following manner. First, the lock is unlocked in the manner above described. The guard key is then withdrawn from the key post 14 and the change key 40 inserted and turned a quarter revolution counter clockwise. As above described, this operation aligns the recesses 43 in the tumblers 16 with the fingers 37 and permits the main key 39 to be turned for a complete half turn and to be withdrawn from the opened lock. The change key 40 having now served its function may be withdrawn. When the lock mechanism is in this condition the fingers 29 of the comb members 21 are seated in the recesses 30 of the main tumblers 13. The screw 23 is now withdrawn, and since the head of the screw is exposed at the rear of the door, this is readily and easily accom-

plished. The new key 41 for which it is desired to adjust the lock, is now inserted in the key tube 10 and turned counter clockwise for a quarter revolution. On account of the pin 23 being absent, the tumblers 13 and the comb pieces 21 will be moved to positions determined by the arrangement of the key bits on the new key. The screw 23 is now replaced with the shank 26 of the screw registering in the newly aligned recesses 27 of the comb members 21, thus locking these members in their new adjusted relative position. Upon further movement of the new key 41 in counter clockwise direction the bolt is locked and thereafter the lock is responsive to this new key 41 in combination with guard key 38 in the manner above described.

In addition to the features of construction above described I provide means whereby trouble is avoided when the depositor has lost his main key or when, for any reason, as for instance, when changing the adjustment of the mechanism for a new key, a faulty adjustment appears. In either of the above cases, it has been necessary heretofore not only to remove the lock from the door, but also to disassemble the lock completely and then to reassemble the parts in proper adjustment. Locks as heretofore constructed could not be restored into operative condition in any other manner. I avoid the necessity of disassembling the lock under any of the above conditions and also the necessity of removing the lock from the door except when the box is locked and the depositor's key is missing. For this purpose I provide a special key 42, called the throw-off key, which is minus all bits except the bottom one 7 which operates the bolt bar 5 through the cam member 11. This throw-off key is useful under many circumstances. For instance, it some times happens that in adjusting the tumblers with a new key, the new key has failed to pick up or has misplaced one or more of the tumblers, so that after the combs have been locked in the faulty position, the lock cannot be unlocked by the intended key. To remedy this condition screw 23 is removed, allowing all the combs 21 to fall into their lowest position and in which fingers 29 align with the recesses 30 of tumblers when in their released position. Then by operating guard key 38 and change key 40 in the regular manner the lock may be unlocked by throw-off key 42, which may be removed from key post 10 and the desired main key inserted and operated as described to adjust the lock for this key.

Also, should the main key, by any chance, be withdrawn while the box is unlocked the custodian of the bank may lock the same by inserting the throw-off key in post 10 and turning it in locking direction.

As many changes could be made in the above construction and as many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. In a lock, in combination, a plurality of tumblers, a comb plate coacting with one of said tumblers and a finger piece coacting with another of said tumblers.

2. In a lock, in combination, a plurality of tumblers, a comb plate coacting with one of said tumblers and a finger piece coacting with another of said tumblers, and a finger plate coacting with a third one of said tumblers.

3. In a lock, in combination, two sets of alternately overlapping tumblers, and comb plates coacting with tumblers of one of said sets.

4. In a lock, in combination, two sets of alternately overlapping tumblers, comb plates coacting with tumblers of one of said sets, and finger pieces coacting with certain tumblers of said other set.

5. In a lock, in combination, two sets of alternately overlapping tumblers, comb plates coacting with tumblers of one of said sets, finger pieces coacting with certain tumblers of said other set, and finger plates coacting with certain other tumblers of said last mentioned set.

6. In a lock, the combination with a bolt and a plurality of tumblers, of comb plates carried on said bolt and coacting with certain of said tumblers to prevent and to permit unlocking movement of said bolt, and finger pieces carried on said bolt and coacting with certain others of said tumblers to prevent and to permit complete unlocking movement of said bolt, and finger plates carried on said bolt and coacting with certain others of said tumblers to prevent and to permit further movement of said bolt in unlocking direction.

7. In a lock, the combination with a bolt and a plurality of tumblers, of comb plates carried on said bolt and coacting with certain of said tumblers to prevent and to permit unlocking movement of said bolt, a main key for operating these tumblers, and finger pieces carried on said bolt and coacting with certain others of said tumblers to prevent and to permit complete unlocking movement of said bolt, and a guard key for operating these tumblers; and finger plates carried on said bolt and coacting with certain others of said tumblers to prevent and to permit further movement of said bolt in unlocking direction, and a change key for operating the tumblers.

8. In a lock, in combination, a bolt, comb-members mounted on said bolt and means releasably holding them thereon in adjusted position, tumblers having recesses normally aligned with fingers on said comb-members when released on said bolt, and a throw off key for unlocking said bolt when said comb members are in released position thereon.

9. In a lock, in combination, a bolt, a key tube and bolt-dogging mechanism including main tumblers operable from said key tube, of means, comprising a throw off key operable in said key tube and by-passing said tumblers, for moving said bolt into and out of locking position.

10. In a lock, in combination, a bolt, a comb member adjustably carried on said bolt, recesses in said comb-member, and a pin removably mounted on said bolt and engageable within any one of said recesses, for holding said comb-member in adjusted position.

11. In a lock of the character described, the combination with a bolt bar, of a plurality of plates carried on said bolt bar, means, comprising a plurality of movable tumblers, one for each plate and each in dogging position behind one of said plates, to prevent movement of said bolt bar in unlocking direction, means, comprising a key, for moving certain of said tumblers out of dogging position, means, comprising a second key, for moving certain others of said tumblers out of dogging position, means, comprising a third key, for moving certain others of said tumblers out of dogging position, and means engaging said bolt bar and engaged by said first mentioned key whereby turning of said key effects movement of said bolt bar.

12. In a lock of the character described, the combination with a movable bolt bar, a key tube, and means, comprising a key in said tube, for moving said bolt bar in unlocking direction, of means for limiting the extent of turning movement of said key in unlocking direction in said key tube, said means including a plurality of plates carried on said bolt bar and a plurality of movable tumblers, one for each plate, and each positioned to dog a plate after a certain amount of movement of said bolt bar in unlocking direction, and means, comprising a key, for moving said tumblers simultaneously out of dogging position to render said limiting means inoperative and to thereby permit further turning movement of said key in unlocking direction in said key tube.

This specification signed and witnessed this 21 day of April, 1922.

EDGAR M. BENHAM.