July 21, 1959 E. N. KENNEDY 2,895,323

CHANGE KEY LOCK

Filed March 31, 1955 4 Sheets-Sheet 1

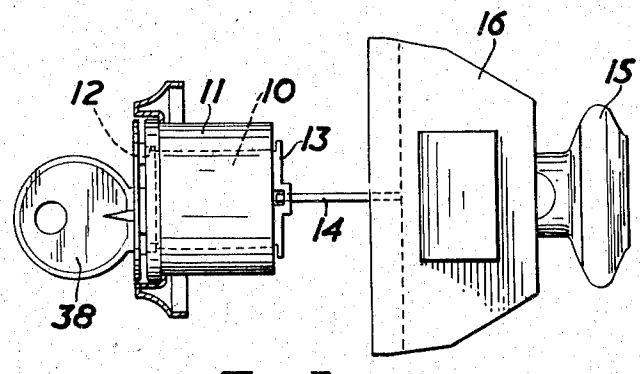


FIG. 1.

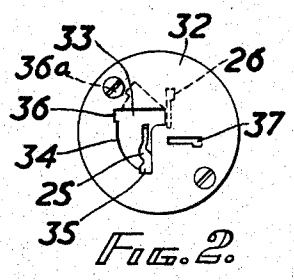


FIG. 2.

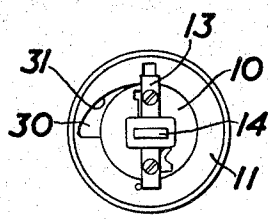


FIG. 3.

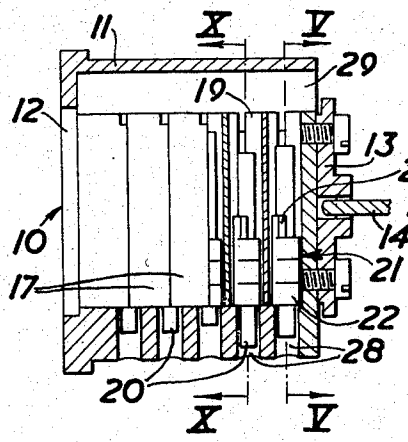


FIG. 4.

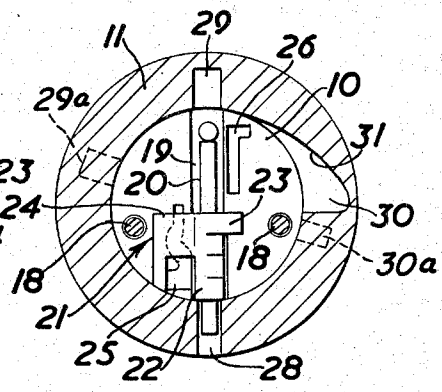


FIG. 5.

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CHANGE KEY LOCK

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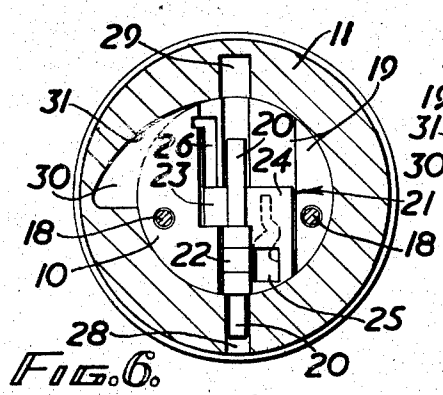


FIG. 6.

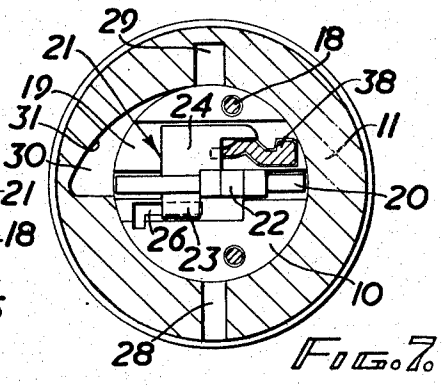


FIG. 7.

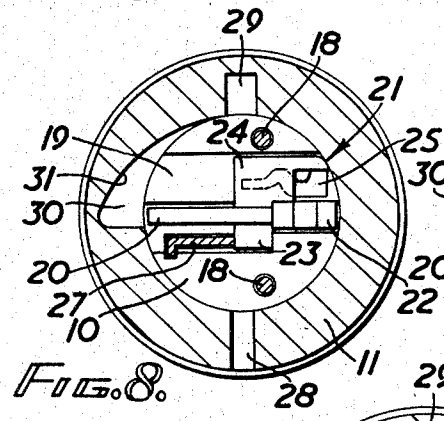


FIG. 8.

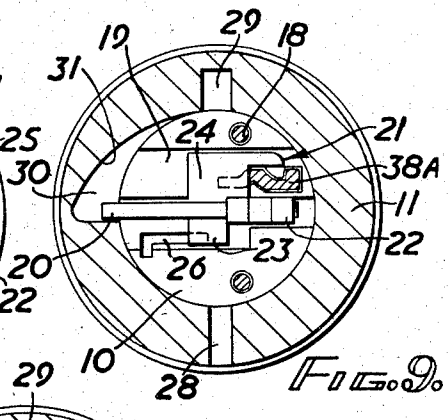


FIG. 9.

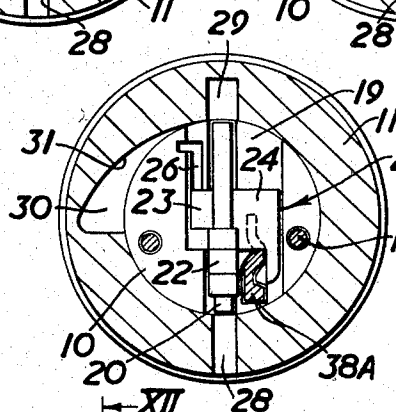


FIG. 10.

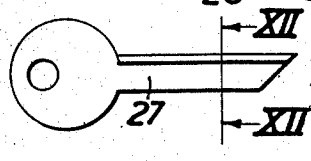


FIG. 11.



FIG. 12.

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CHANGE KEY LOCK

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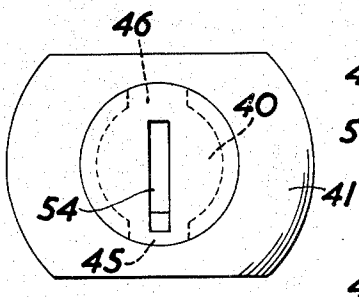


FIG. 13.

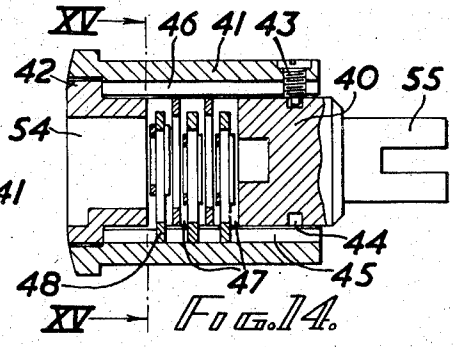


FIG. 14.

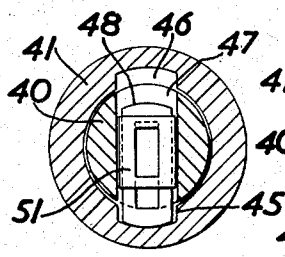


FIG. 15.

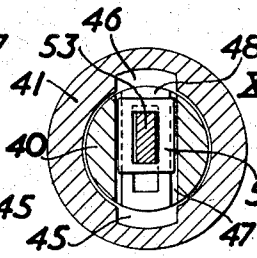


FIG. 16.

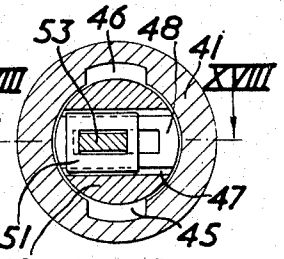


FIG. 17.

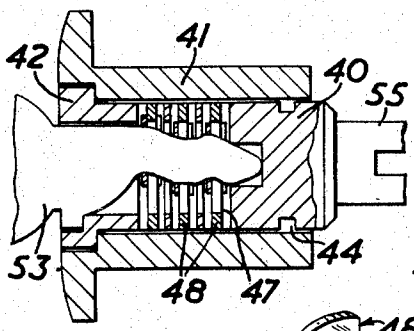


FIG. 18.

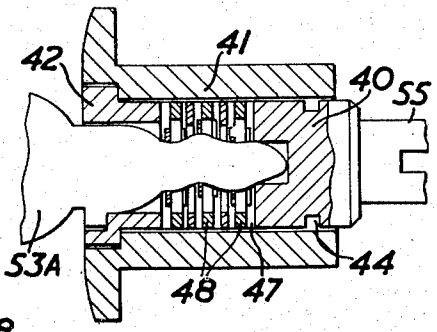


FIG. 19.

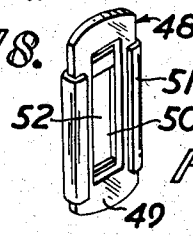


FIG. 20.

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CHANGE KEY LOCK

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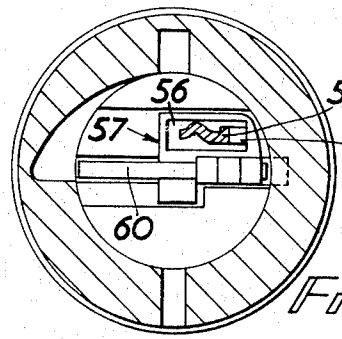


FIG. 21.

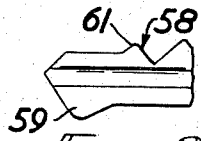


FIG. 22.

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United States Patent Office 2,895,323
Patented July 21, 1959

2,895,323

CHANGE KEY LOCK

Ernest Norbert Kennedy, London, England

Application March 31, 1955, Serial No. 498,373
Claims priority, application Great Britain April 5, 1954
10 Claims. (Cl. 70—383)

This invention relates to change key locks the mechanism of which can be altered at will to work with any one of a number of different keys.

Hitherto such locks have had elaborate and costly mechanism requiring complicated adjusting operations. In some cases a special key was necessary the wards of which were capable of being adjusted to take up various positions.

One object of the present invention is to provide a change key lock of inexpensive construction having simple means for altering the mechanism to enable the lock to be operated by any one selected key out of a number of different keys. A further object is to provide a lock in which the alteration is effected by the selected key itself, so that thereafter, until subsequent alteration is made, the lock can be operated only by this key or by one identical to it.

A change key lock according to the present invention comprises a fixed part and a movable part which carries sliding tumblers adapted to be lifted by the correct key from a position in which they prevent movement of the movable part to a position in which they permit such movement, and the effective length of at least one tumbler is adjustable so that the lock can be altered to operate with keys of different patterns.

By the term "lifted" as applied to the tumblers is meant the movement which is imparted to the tumblers by the insertion of the correct key, whether this movement is against the action of gravity or some other force.

By the "effective length" of a tumbler is meant the distance between a point on the tumbler that touches the key and an end of the tumbler that lies flush with a contact surface between the movable part and the fixed part when the correct key is in the lock.

The invention is applicable to locks of the rotatable cylinder type in which the cylinder constitutes the movable part and the barrel the fixed part, and also to locks of the type in which the movable part can slide in the fixed part.

Each adjustable tumbler may comprise a shank which constitutes, or cooperates with, a locking member which locks the movable part by extending across a contact surface between the movable part and the fixed part and occupying grooves or holes in both these parts when the lock is in the locked condition, and a lifting member which is engaged by the key and which is in frictional engagement with the shank so as to be slidable thereon to alter the effective length of the tumbler but only by the application thereto of a force substantially in excess of that normally required to lift or lower the tumbler.

One form of the invention is suitable for use with constant depth keys, that is to say keys in which the profile of one edge is the reverse of the profile of the opposite edge. In a lock suitable for use with such keys, the lifting members may be engaged by both edges of the key such that insertion of a key when the shanks are held against sliding movement in the movable part adjusts the position of the lifting members on the shanks in comformity with the profile of this key.

Preferably the adjustment of the effective length of the adjustable tumbler or tumblers is effected automatically by inserting a new key when the movable member is in a position away from the locked position. Certain forms of the lock include means for adjusting the tumblers to their maximum effective length, and means for reducing their effective length, where necessary, to suit the profile of an inserted key. This is the case more particularly where the key is of the type having its operating profile along only one edge.

The means for adjusting the tumblers to their maximum effective length may comprise a member (termed herein for convenience the neutralising member) insertable from outside the lock, when the key is removed, to engage the lifting members and force them in the lowering direction (i.e. the direction opposite to the lifting direction) while the shanks are restrained against movement in the lowering direction. After insertion and withdrawal of the neutralising member, all the lifting members are set to the maximum effective tumbler length. Inserting a key will now move each lifting member in the lifting direction. If the shanks were also restrained against movement in this direction, the lifting members would then be adjusted into a position corresponding to the highest point on the key profile which has passed beneath them, and might therefore not correspond to the actual height of the part of the key profile that corresponds to this lifting member. In order to overcome this difficulty, the shanks are permitted to move in the lifting direction with the lifting members, so that their ends will project beyond the contact surface, and the fixed part of the lock includes means for forcing the shanks back flush with the contact surface as the movable part is moved by the key towards its locked position. Thus the effective length of each tumbler is adjusted to conform to the corresponding part of the key profile.

In another form of lock suitable for use with keys having their operating profile on only one edge, the adjustment of the effective length of the adjustable tumbler or tumblers may be effected automatically solely by inserting a new key when the movable member is in a position away from the locked position and then moving the movable member, with the key in place, out of the position in which the new key was inserted. In one such lock the means for setting the lifting members to the maximum effective tumbler length comprises a ramp formation on the key and corresponding surfaces on the lifting members which are engaged by the said ramp formation as the key is withdrawn from the lock when the movable part is away from the locked position and the shanks are restrained against movement in the lowering direction of the lifting members whereby all the lifting members are forced along the shanks to the maximum extent in the lowering direction, and the fixed part of the lock includes means for forcing the

shanks back flush with the contact surfaces after a key has been inserted and the moving part is being moved towards its locked position so that the effective length of each tumbler is adjusted to conform to the corresponding part of the key profile.

In the case of a lock of the cylinder type, the means for forcing the shanks back flush with the cylinder surface may comprise a cam surface in the barrel, leading from the outer limit of the recess into which the shanks are lifted by the insertion of the key to the normal barrel diameter at or near a position opposite the groove or holes in the barrel which the shanks engage when the lock is in the locked condition.

In one form of lock embodying the invention there is a special position of the movable member for the insertion of a new key to adjust the lock, into which special position the movable member can be moved from the locked position or from the unlocked position only by the key to which the lock is already adjusted.

In order to prevent withdrawal or insertion of a key except in those positions of the movable member in which such withdrawal or insertion are permissible, there may be a guard member which engages a notch in an inserted key and which partially obstructs the keyhole to prevent withdrawal or insertion of the key at all positions of the movable member except those in which such withdrawal or insertion are permissible, the keyhole lying clear of the guard member in these positions so that keys can then be freely inserted and withdrawn. In the case of a lock for which a neutraliser member is necessary, the guard member may also serve to obstruct access to the aperture through which the neutraliser member is inserted, except when the movable member is in a position appropriate for the insertion of the neutralising member.

The lock may be so disposed that the tumblers fall into their locked position by gravity, with or without the assistance of springs. Alternatively, spring force alone may be relied on.

The invention may be performed in various ways and two different forms of lock embodying the invention will now be specifically described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a side view of one of the locks for use with a key having only one operative edge;

Figure 2 is a front view of the lock shown in Figure 1;

Figure 3 is a rear view of the lock shown in Figure 1;

Figure 4 is a longitudinal section through the barrel of the lock of Figure 1 in the locked condition, with part of the cylinder in section;

Figure 5 is a cross-section taken on the line V—V of Figure 4;

Figures 6 to 10 are cross-sections taken on the line X—X in Figure 4 showing the lock in various conditions;

Figure 11 is a side view of the neutralising member for the lock of Figure 1;

Figure 12 is a section of the neutralising member taken on the line XII—XII in Figure 11;

Figure 13 is a front view of the other lock, which is for use with a constant depth key;

Figure 14 is a longitudinal section of the lock shown in Figure 13;

Figures 15 to 17 are cross-sections taken on the line XV—XV in Figure 14;

Figures 18 and 19 are horizontal sections taken on the line XVIII—XVIII in Figure 17, with two different keys in place;

Figure 20 is a perspective view of a tumbler of the lock shown in Figures 13 to 19;

Figure 21 is a cross-section, similar to Figure 7, of a modified form of rotatable cylinder lock; and

Figure 22 is a view of the tip of a key suitable for use for the lock shown in Figure 21.

The lock shown in the Figures 1 to 10 is of the rotatable cylinder type, that is to say it comprises a rotatable cylinder **10** mounted for rotation in a barrel **11** which is fixed in the door or other part that is to be locked. The cylinder is prevented from being withdrawn rearwardly, i.e. towards the right in Figures 1 and 4, by a flange **12** around its left-hand end which fits into a corresponding recess in the barrel. Withdrwal of the cylinder forwards, i.e. towards the left in Figures 1 and 4, is prevented by a cross-piece **13** which is screwed to the rear end of the cylinder and which also provides the connection for a tail piece **14** which passes through the thickness of the door and engages the knob **15** which is provided on the latch portion of the lock which is fitted on the inside of the door. The cylinder is built up from several discs **17** which are clamped together by screws **18**. The inner faces of the two end discs, and both faces of all the intermediate discs, are provided with depressions which in the assembled cylinder define transverse recesses **19** which accommodate the tumblers.

Each tumbler comprises a shank **20** in the form of a round pin, and a lifting member **21**. The lifting members are made of spring steel bent to form a tubular part **22** with a firm frictional grip, a small wing portion **23** and a large wing portion **24**. The frictional grip of the tubular part **22** of each lifting member is such that its position in relation to the shank can only be altered by the application of a force substantially greater than that which is normally required to lift and lower the tumblers.

Running longitudinally through the cylinder is a keyway **25** and a hole **26** for a neutralising member **27** (Figures 11 and 12).

Formed in the bottom of the barrel **11** is a line of holes **28** while formed in the top of the barrel is a longitudinal groove **29**. Formed in one side of the barrel there is a recess **30** which has a cam surface **31**.

Mounted in front of the lock and fastened to the barrel **11** there is a guard plate **32** which has in it an aperture **33** provided with a quadrant-shaped edge **34** terminating in two notches **35** and **36**. The lower notch **35** registers with the bottom of the key-way **25** when the lock is in the locked condition while the upper notch **36** registers with the bottom of the key-way **25** when the lock is in the unlocked condition. Also formed in the guard plate **32** is a slot **37** which when the lock is in the unlocked condition registers with the hole **26** for the neutralising member, which is blanked off at all other times. The key **38** is provided with a notch in its lower edge which when the key is inserted is in line with the quadrant **34**. The quadrant **34** enters the notch in the key whenever the key is in a position intermediate between the locked and unlocked positions to prevent withdrawal of the key. In these extreme positions, however, the lower edge of the key registers with the notch **35** or with the notch **36** of the guard plate so that the key can be withdrawn and re-inserted.

The lock works as follows:

When the lock is in the locked condition the cylinder is in the position in which it is shown in Figures 4, 5 and 6 in which the lifting members lie at the bottoms of the recesses **19** so that the lower ends of the shanks **20** project into the holes **28** at the bottom of the barrel and prevent the cylinder from rotating in the barrel. If now the lock is to be unlocked, the correct key (i.e. the key corresponding to the actual positions of adjustment of the lifting members) is inserted into the key-way **25**. When the key is fully inserted the profile of the upper edge of the key lifts each of the tumblers to the extent that the lower end of its shank is lifted just clear of the hole **28**, so that the ends of all the shanks lie substantially flush with the surface of the cylinder. If the wrong key were inserted it would lift one or more of the tumblers either too much or not enough, so that at least one shank would still project either into one of the holes **28** at the bottom of the barrel or into the groove **29** at the top, so that the cylinder could not be rotated. With the

correct key in place, however, the shanks **20** are clear of the holes **28** and of the groove **29** so that the cylinder can be rotated to unlock the lock as shown in Figure 7. If now it is desired to adjust the lock to suit a different key, the lock is held in the unlocked position of Figure 7 by holding the knob **15**, and the original key **38** is withdrawn. The neutralising member **27** is then inserted into the hole **26**. As the neutralising member is inserted it presses on the small wing portions **23** of the lifting members and forces the lifting members to the right hand end of the shanks as shown in Figure 8. The shanks **20** cannot move during this operation since their right hand ends are pressing to the right against the interior surface of the barrel. The new key **38A** is then inserted, as shown in Figure 9. This moves all the tumblers to the left. They can move freely in this direction because the left-hand ends of the shanks **20** are free to enter the recess **30**. The distance by which a tumbler is moved to the left corresponds to the highest point of the profile of the key **38A** that has touched the larger wing **24** of its lifting member during the insertion of the key. The knob **15** is then released and the cylinder is turned back into the locked position. During this movement the projecting ends of the shanks **20** will come into contact with the cam surface **31** which will progressively force the shanks back into the cylinder. However, the lifting members **21** can only move until they come up against the corresponding part of the profile of the key, so that the shanks will be forced along through the tubular parts **22**. Finally, when the lock has been returned to the condition shown in Figure 10 the relative adjustment of the lifting members and the shanks is complete. The key **38A** can now be withdrawn, and the lower ends of the shanks will fall once more into the holes **28**. The lock can now only be unlocked by the new key **38A**. The provision of the guard plate **32** with its quadrant **34** prevents the key **38A** from being withdrawn until the cylinder has been fully returned to the position shown in Figure 10, thereby ensuring that the lifting members **21** will all take up their correct positions of the adjustment on the shanks **20**. The cylinder need not be built up from discs **17**, but could be made in one piece, for instance as a die casting.

In a modification of the lock shown in Figures 1 to 10, the lock can be left in the unlocked condition without risk of its being adjusted to suit a new key by someone not in possession of the original key, since it must be turned by the original key into a special position before the adjustment can be carried out. In this modification, depicted in dotted lines in Figures 2 and 5, additional grooves and/or rows of holes **29*a*** and **30*a*** are provided opposite both ends of the shanks **20** and into which the shanks **20** can enter when the lock is in the unlocked condition and the original key is withdrawn. Thus, in this modification the angle between the locked and unlocked positions of the cylinder is rather more than 90°. In order to adjust the lock, the cylinder is turned by the original key until the shanks **20** are opposite the deep end of the recess **30**. The original key is then withdrawn, the neutralizer is applied, the new key is inserted, and the cylinder is turned into the locked position. An additional notch **36*a*** is provided in the quadrant of the guard plate **32** for the unlocked position, the notch **36** being at the said special position, to permit the withdrawal of the original key.

In a further modification shown in Figures 21 and 22 the lock is constructed so that it can be used with a key having its operating profile on only one edge and without a neutralising member. In this modification apertures **56** of a uniform depth are formed in all the lifting members **57**, the upper edge of each aperture being the part that comes into contact with the operating profile of the key **58**. The key **58** itself has a ramp-like formation **59** on its under side (i.e. the side opposite to the operating profile) and near to its tip, so that as it is withdrawn from the lock when the movable part is away from the locked position (i.e. when the bottoms of the shanks **60** are held flush with the contact surface) the ramp formation comes into contact successively with the bottom edges of the said apertures **56** in the lifting members **57** and forces all the lifting members down to their lowest positions on the shanks. Insertion of a new key will lift the tumblers without altering the positions of the lifting members in relation to the shanks because, as the ramp formation **59** is near the tip of the key, it will already have passed each lifting member before this lifting member is reached by the leading part **61** of the operating profile of the key. Thus the ramp formation cannot hinder the lifting of the tumblers. Final adjustment of the lifting members on the shanks to suit the new key profile is effected by turning the key back to the locked position as described in connection with the lock shown in Figures 1 to 10.

If the tumblers are to be lifted against gravity both in the locked and unlocked positions, the lock may be so positioned that in the locked position the shanks of the tumblers lie at approximately 45° to one side of the vertical central plane of the lock, and in the unlocked position they lie at approximately 45° to the other side of this plane, so that the tumblers will fall into their lowest positions on removal of the key in either the locked or unlocked positions.

Another form of lock embodying the invention is shown in Figures 14 to 20. This form of lock is suitable for use with constant depth keys (i.e. keys of which the top and bottom edges have complementary profiles) and no neutralising member is required.

This lock is also of the rotatable cylinder type, and comprises a cylinder **40** which can rotate in a barrel **41**. Withdrawal of the cylinder from the barrel is prevented by the provision of a flange **42** on the front of the cylinder and by a set screw **43** which engages in a circumferential groove **44** in the cylinder. Extending longitudinally through the barrel are a lower groove **45** and an upper groove **46**. Extending transversely through the cylinder are three slots **47** in which are accommodated tumblers **48**.

Each tumbler (see Figure 20) comprises a shank **49** which contains a rectangular slot **50**, and on the shank is mounted a lifting member **51**. Each lifting member is made of spring steel with its edges bent over to grip the sides of the shank with a firm frictional grip. In each lifting member there is a rectangular slot **52** which is shorter than the rectangular slot **50** in the shank and which is of substantially the same length as the depth of the constant depth keys **53** and **53A** which can be used in the lock. A key-way **54** passes through the centre of the cylinder **40**. Attached to the rear end of the cylinder is a formation **55** by which the cylinder is connected to the latch.

This lock works as follows:

When the lock is in the locked condition as shown in Figures 14 and 15 the tumblers drop into their lowest positions in which the lower ends of the shanks all project into the lower groove **45** of the barrel. In order to unlock the lock the correct key **53** is inserted which, as shown in Figure 16, lifts all the lifting members to a height sufficient to bring their associated shanks wholly within the cylinder. The key can then be turned into the position shown in Figure 17 to unlock the lock. If the key **53** is withdrawn when the lock is held in the unlocked position and a new key **53A** is inserted, as shown in Figure 19, this will have the effect of moving the lifting members along their shanks into new positions of adjustment corresponding to the profiles of the new key. The shanks **49** are prevented from moving during this operation because their ends lie against side walls of the barrel away from the grooves **45** and **46**. The lock has now been re-adjusted to suit the new

key 53A, and after it has been moved into the locked position only the new key 53A will be able to unlock it.

In the examples described the tumblers fall by gravity into the locked position so the lock must be mounted in such a way that when it is in the locked condition the tumblers are vertical. If it is desired so to position the lock that the locking movement of the tumblers is other than vertically downwards, then it will be necessary to provide springs which act on the tumblers to ensure that they return to the locked position on withdrawal of the key.

In order to ensure that the relative positions of the lifting members and shanks are not altered inadvertently, the construction may be such that only the lifting member comes in contact with any part of the lock or key during the operation of locking or unlocking, the shank being protected from contact with any member or part of the lock, other than lifting member, except during the operation of resetting with a new key or endeavouring to unlock the lock after the insertion of a wrong key.

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

1. A change key lock comprising a fixed part, a movable part with a keyway formed therein mounted in said fixed part, a plurality of slidable tumblers of adjustable effective length carried by said movable part and adapted to be lifted, by a key of a profile corresponding to the actual effective lengths of said tumblers inserted into said keyway, from a position in which they prevent movement of said movable part to a position in which they permit such movement, each of said tumblers comprising a shank and a lifting member which is adapted to be engaged by any key inserted into said keyway and which is in frictional engagement with said shank so as to be slidable thereon to alter the effective length of the tumblers but only by the application thereto of a force substantially in excess of that normally required to move said tumblers, means operative to engage said lifting members to force said lifting members along said shanks in the direction to increase the effective length of said tumblers while said shanks are held against movement in the same direction by engagement of said shanks with said fixed part, and means operative to engage said tumblers during relative movement between any key inserted into said keyway and said fixed part to produce relative movement between said lifting members and said shanks in the opposite direction to decrease the effective length of said tumblers to an extent determined by the profile of the inserted key engaging said lifting members.

2. A change key lock as claimed in claim 1, for use with keys having parallel upper and lower profiles, in which the lifting members have portions engaged by both profiles of the keys such that insertion of any such key when the shanks are held against sliding movement in the movable part adjusts the position of the lifting members on the shanks in conformity with the profiles of this key.

3. A change key lock according to claim 1 in which said means operative to engage said lifting members to increase the effective length of said tumblers consist of means operative to force said lifting members of all the tumblers along said shanks into a position in which all said tumblers have their maximum effective length.

4. A change key lock as claimed in claim 3 in which said means for adjusting said tumblers to their maximum effective length comprises a neutralising member insertable from outside the lock, when there is no key in said keyway, to engage the lifting members and force them in the lowering direction while the shanks are restrained against movement in this direction, and in which said means operative to decrease the effective length of said tumblers comprises a portion of the fixed part of said lock having a contact surface contacting said movable part and shaped to force the shanks back flush with said contact surface after any key has been inserted and the movable part is being moved towards its locked position, so that the effective length of each tumbler is adjusted to conform to the corresponding part of the profile of said inserted key.

5. A change key lock as claimed in claim 4 in which there is a guard member which engages a notch in an inserted key and which partially obstructs the keyway to prevent withdrawal and insertion of the key at all positions of said movable member except those in which such withdrawal and insertion are permissible, said keyway lying clear of said guard member in these positions so that keys can then be freely inserted and withdrawn, and in which said guard member also prevents insertion of said neutralizing member except when said movable member is in a position appropriate for the insertion of said neutralizing member.

6. A change key lock as claimed in claim 3 in which said means for adjusting said tumblers to their maximum effective tumbler length comprises a ramp formation on a key presented in said keyway and corresponding surfaces on the lifting members which are engaged by the said ramp formation as said key is withdrawn from the lock when the movable part is away from the locked position and the shanks are restrained from movement in the lowering direction of the lifting members whereby all the lifting members are forced along the shanks to the maximum extent in the lowering direction, and in which the fixed part of the lock has a contact surface contacting said movable part and includes said means adapted to decrease the effective length of said tumblers, said last-mentioned means being means for forcing the shanks back flush with said contact surface after any key has been inserted and the movable part is being moved back towards its locked position so that the effective length of each tumbler is adjusted to conform to the corresponding part of the profile of said inserted key.

7. A change key lock as claimed in claim 3 which is of the rotatable cylinder type in which said movable part consists of a cylinder and said fixed part consists of a barrel having a cylinder bore in which said cylinder is rotatably mounted, and said means operative to decrease the effective length of said tumblers comprises a cam surface in said barrel leading from the outer limit of a recess into which the shanks are lifted by the insertion of any key, to said cylinder bore opposite at least one other recess in the barrel which the shanks enter when the lock is in the locked condition.

8. A change key lock as claimed in claim 1 in which there is a special position of the movable member for the insertion of a new key to adjust the lock, into which special position the movable member can be moved from the locked position or from the unlocked position only by the key to which the lock is already adjusted.

9. A change key lock as claimed in claim 1 in which, in order to prevent withdrawal or insertion of a key except in selected positions of the movable member, there is a guard member which engages a notch in an inserted key and which partially obstructs the keyway to prevent withdrawal or insertion of the key at all positions of the movable member except those in which such withdrawal or insertion are permissible, the keyway lying clear of the guard member in said selected positions so that keys can then be freely inserted and withdrawn.

10. A change key lock comprising a fixed part, a relatively movable part, a keyway formed in one of said parts, a plurality of slidable tumblers of adjustable effective length carried by said one part and adapted to be lifted, by a key of a profile corresponding to the actual effective lengths of said tumblers inserted into said keyway, from a position in which they prevent movement of said movable part to a position in which they permit such movement, each of said tumblers comprising a shank and a lifting member which is adapted to be engaged by a key inserted into said keyway and which is in

frictional engagement with said shank so as to be slidable thereon to alter the effective length of the tumbler but only by the application thereto of a force substantially in excess of that normally required to move said tumbler, means adapted to force said lifting members along said shanks in the direction to increase the effective length of said tumblers carried by said one part while said shanks are held against movement in the same direction by engagement of said shanks with said other part, and means operative by relative movement of said two parts adapted to produce relative movement between said lifting members and said shanks in the opposite direction to decrease the effective length of said tumblers

to an extent determined by the profile of the inserted key engaging said lifting members.

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