March 1, 1966 D. A. WILLIAMS 3,237,436

TUMBLER LOCK STRUCTURE

Filed Jan. 6, 1964 3 Sheets-Sheet 1

Fig. 1

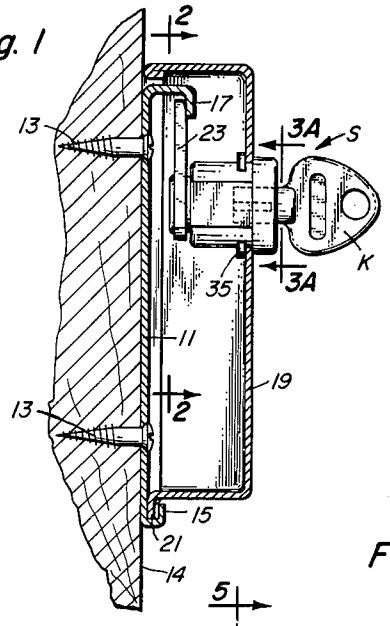


Fig. 2

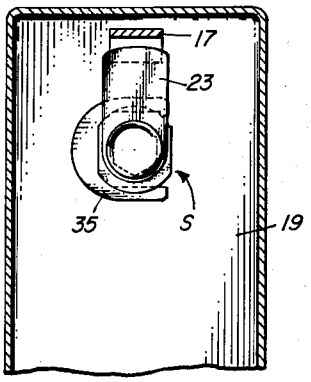
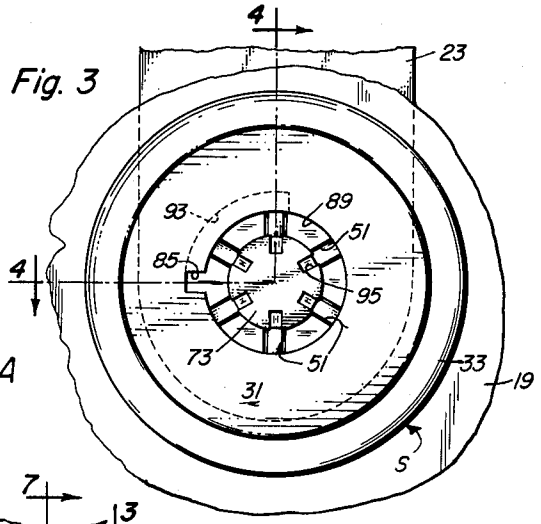


Fig. 3



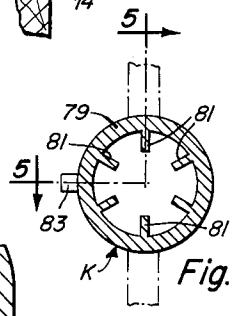
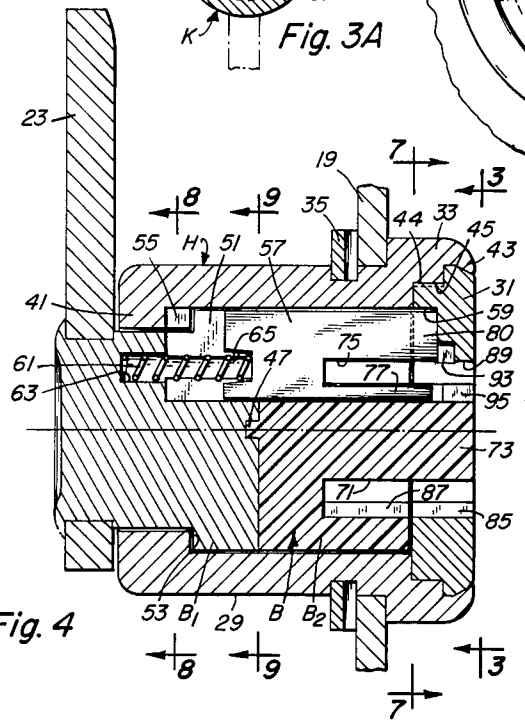


Fig. 3A

Fig. 4



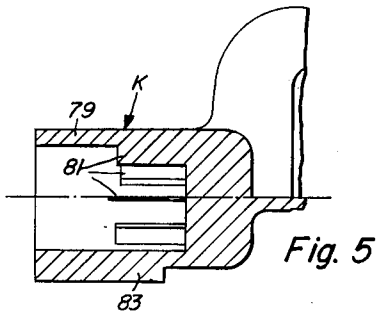


Fig. 5

DELBERT A. WILLIAMS
INVENTOR.

BY
BUCKHORN, BLORE, KLARQUIST & SPARKMAN
ATTORNEYS

March 1, 1966 D. A. WILLIAMS 3,237,436

TUMBLER LOCK STRUCTURE

Filed Jan. 6, 1964 3 Sheets-Sheet 2

Fig. 6

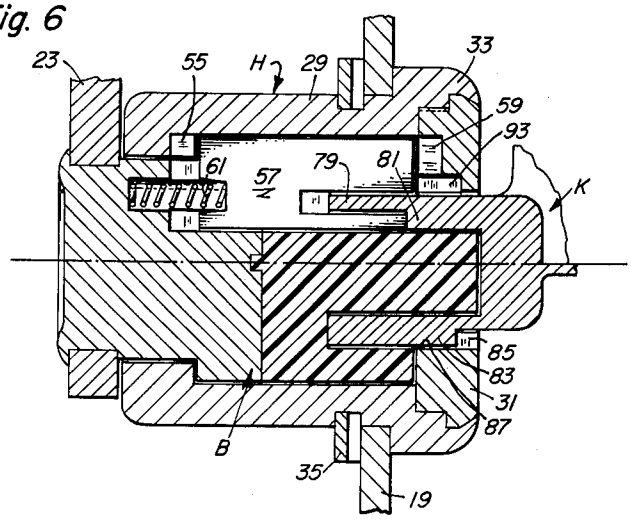


Fig. 7

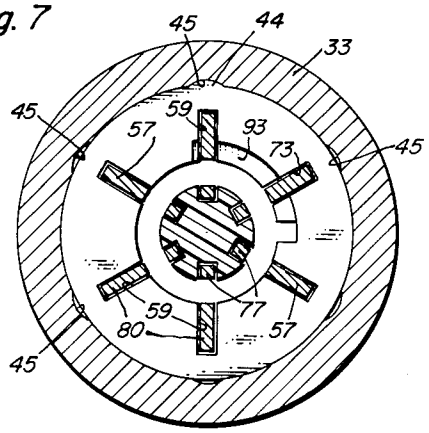


Fig. 8

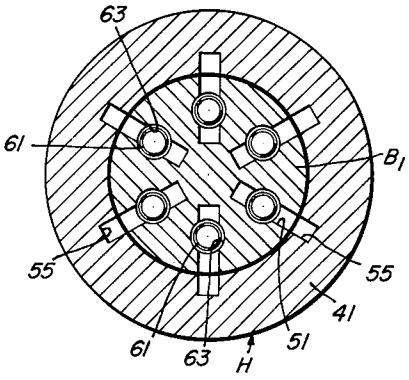
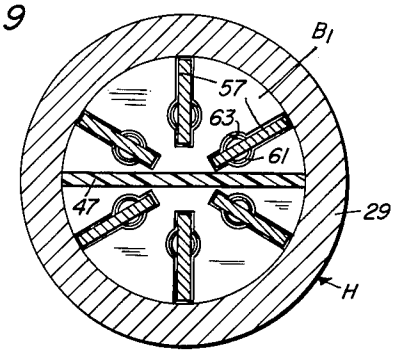


Fig. 9



DELBERT A. WILLIAMS
INVENTOR.

BY
BUCKHORN, BLORE, KLARQUIST & SPARKMAN
ATTORNEYS

March 1, 1966 D. A. WILLIAMS 3,237,436

TUMBLER LOCK STRUCTURE

Filed Jan. 6, 1964 3 Sheets-Sheet 3

Fig.10

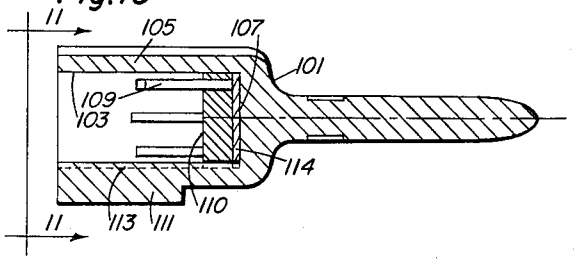


Fig.11

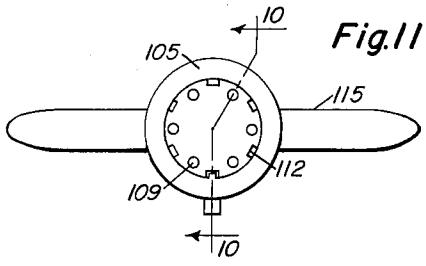


Fig.12

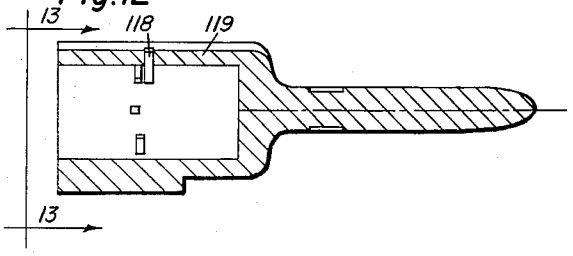


Fig.13

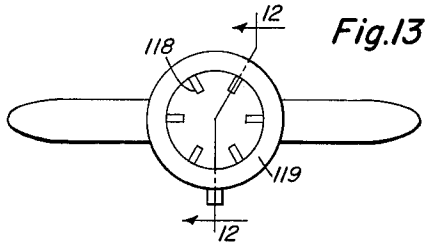
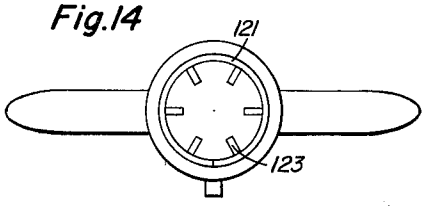


Fig.14



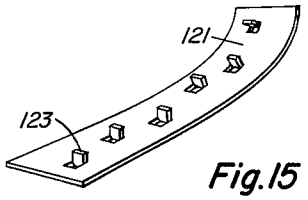


Fig.15

DELBERT A. WILLIAMS
INVENTOR.

BY
BUCKHORN, BLORE, KLARQUIST & SPARKMAN
ATTORNEYS

United States Patent Office

3,237,436
Patented Mar. 1, 1966

3,237,436

TUMBLER LOCK STRUCTURE

Delbert A. Williams, 1057 Schurman Drive, Salem, Oreg.

Filed Jan. 6, 1964, Ser. No. 335,957
16 Claims. (Cl. 70—363)

This invention relates to a tumbler lock structure and particularly one in which the lock and key are so designed that picking of the lock and duplication of the key are difficult.

My prior patent, No. 3,084,532, shows a portable key safe which is designed so that it can be readily mounted or hung on the exterior of a dwelling or other building structure and contains a key to such structure. The key safe, and similar key safes on other dwellings, can be opened by use of a common special key carried by the party having the right to enter such places.

In my portable key safe, I incorporate a lock structure wherein the lock and key are so designed that duplication of the key is difficult. For instance, on some of my locks I use a bell key and on other locks I use a duo key. Both of these types of keys are much more difficult to duplicate than are ordinary keys which are serrated only on one edge. While these lock structures give more security than ordinary key structures, even higher security is desired if this is possible to obtain with reasonable expense.

It is the main object of the present invention to provide a lock structure which is particularly useful with my portable key safe and wherein the key is much more difficult to duplicate than is the key of prior lock structures, and which lock structure can be manufactured for a cost not greatly different from the common lock structure.

Another object of the invention is to provide a structure as described above in which the lock is more difficult to pick than prior locks used for such purposes.

Various other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a vertical midsectional view through a portable key safe which incorporates a lock structure of the present invention;

FIG. 2 is a fragmentary sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary elevational view of the lock of my lock structure taken from the front thereof, the view being taken generally in the direction of the arrows 3—3 in FIG. 4, and on an enlarged scale as compared to FIGS. 1 and 2;

FIG. 3A is a vertical section through the key taken along line 3—3 of FIG. 1;

FIG. 4 is a vertical midsectional view of my lock taken along lines 4—4 of FIG. 3;

FIG. 5 is a sectional view through the key taken along line 5—5 of FIG. 3A, showing the key with reference to FIG. 4 in the position it would occupy just before being inserted into the lock of FIG. 4;

FIG. 6 is a view similar to FIG. 4, but showing the key inserted into the lock;

FIGS. 7, 8 and 9 are vertical cross sectional views through the lock taken along lines 7—7, 8—8 and 9—9, respectively, of FIG. 4;

FIG. 10 is a longitudinal sectional view through a modified form of key taken along line 10—10 of FIG. 11;

FIG. 11 is an end view of the key of FIG. 10 taken in the direction of the arrows 11—11 of FIG. 10;

FIG. 12 is a longitudinal sectional view through another form of key taken along line 12—12 of FIG. 13;

FIG. 13 is an end view of the key of FIG. 12 taken in the direction of the arrows 13—13 in FIG. 12;

FIG. 14 is an end view of still another form of key; and

FIG. 15 is a view of a portion of the key prior to assembling the key.

Referring to the drawings, the lock structure of the present invention is shown as being incorporated in a portable key safe of the type which is intended to be mounted on a building structure or on an object near a building structure. The lock structure could obviously be incorporated in other porable key safes and in other places as desired.

The key safe shown in FIG. 1 includes a mounting plate 11 secured by screws 13 to a building structure 14. The mounting plate has a lower hook portion 15 and an upper hook portion 17 to cooperate with a case 19 and a lock structure S in securing the case to the mounting plate. The case has a lower flange 21 to fit in the lower hook portion 15 and the lock structure S has a latch element 23 to fit under the hook portion 17. One or more keys, not shown, are contained within the case and usually secured to a chain which is attached to the case. By unlocking the lock structure, the case 19 can be removed to gain access to the keys within the case to enable the building structure to be opened.

Referring to FIGS. 3 and 4, the lock structure S includes a tubular housing H which is made up of a tubular shell 29 and a cap or closure portion 31. The shell 29 is formed with an enlarged head portion 33 for abutting engagement with the front of the case 19, as shown in FIGS. 1 and 4. A spring clip 35 fits in notches formed in the outer surfaces of the shell 29 to secure the housing H to the case 19. The shell just rearwardly of the head portion 33 is non-circular to non-rotatably fit within a non-circular hole in the case 19.

The shell 29 has an inwardly extending rear flange 41. The cap member 31 provides an inwardly extending flange at the forward portion of the shell 29. The cap is secured in place by working over at 43 certain portions of the front end of the shell 29. The cap has a fixed detent 44 which fits within any one of six recesses 45 formed on the shell 29. The reason for six recesses is explained hereinafter.

Prior to securing the cap to the shell 29, a barrel generally entitled B is inserted into the housing H. The barrel is shown as comprising a rear section B_1 and a forward section B_2 which are non-rotatably connected together by a key 47 (FIG. 4). The barrel could be formed of one piece, but I have found it convenient to cast the rear section B_1 of a die-cast metal and cast the part B_2 from nylon or similar hard plastic material. For convenience in description, the barrel may at times be considered as being of one-piece construction. The barrel section B_1 has a rearwardly projecting non-circular stud on which the latch element 23 non-rotatably fits.

The barrel is formed with a plurality or series of circumferentially spaced radial grooves 51 formed therein opening through the peripheral surfaces of the barrel, as is evident from FIG. 4. These grooves extend longitudinally of the barrel from the front end thereof through which they open rearwardly to a point near the rear end of the barrel, but spaced from such rear end. More specifically, the grooves extend past a rearwardly facing shoulder 53 formed on the barrel section B_1 to a point approximately even with the rear ends of a series of notches 55 (FIG. 4) formed in the flange 41. The notches 55 are in alignment with the grooves 51 and are designed to accommodate a series of tumblers 57 under certain operating conditions of the lock. The tumblers 57 are slidably mounted in the grooves 51.

Each of the tumblers is in the form of an elongate, flat metal piece of rectangular cross section and of a size to substantially fill the grooves **51** and thus have slidable engagement with the interior of the shell **29**.

The cap **31** has a matching series of notches **59** which are in alignment with the notches **55**. Each of such notches has a width substantially the same as a groove **51** so that it can accommodate, receive and engage the associated tumbler **57**. A series of coil springs **61**, contained in bores **63** provided in the barrel section B_1, are received within notches **65** formed in the rear ends of the tumblers **57** to urge the tumblers to assume positions in which the forward ends thereof are received by the notches **59**.

At this point it is apparent that in the rest position of the lock, the tumblers **57** fit in the notches **59**, as shown in FIG. 4, to prevent rotary movement of the barrel B and thus of the latch member **23**. It is also evident that if at the time a key is inserted in the lock all the tumblers **57** are not pressed rearwardly sufficiently far to clear the notches **59**, the barrel B and thus the latch member **23** cannot be turned. It is further evident that if any of the tumblers are pressed rearwardly an extent such as to engage the associated notch **55**, this will prevent rotary movement of the barrel and thus of the latch member **23**.

The front barrel section B_2 is provided with a circular concentric groove **71** which groove surrounds a central stud portion **73** of the barrel section B_2. Each of the tumblers **57** has an axially extending notch **75** (FIG. 4) formed therein which is in register with the groove **71**, as is evident from FIGS. 4 and 7. This groove provides a forwardly projecting finger portion **77** to fit within a tubular portion **79** of a key K and also provides a forwardly projecting outer portion **80** to engage in the notches **59**. The portion **80** is disposed adjacent the exterior of the tubular portion **79** of the key K when the key is inserted into the lock, as is apparent from FIG. 6.

The tubular portion **79** is adapted to bottom against the bottom wall of the circular groove **71** of the barrel section B_2 as shown in FIG. 6 when the key is fully inserted into the lock.

Formed interiorly on the tubular portion **79** of the key K is a plurality of fins **81** (FIGS. 3A and 5) which have the same circumferential spacing as the grooves **51**. A guide lug **83** on the exterior of the tubular portion **79** is adapted to fit (FIG. 4) within matching grooves, one **85** being formed on the cap **31**, and the other **87** being one of six formed in the barrel section B_2. When the key is inserted into the lock with the lug fitting within the grooves **85** and **87**, the fins **81** are located in alignment with the finger portions **77** of the tumblers **57**.

It is here pointed out that the cap **31** has a central concentric opening **89** of a size to accommodate the tubular portion **79**, and, of course, accommodate the stud **73** of the barrel B_2.

The fins **81** are of varying lengths and the fingers **77** are of varying lengths, and for a particular lock and key combination, the length of the fingers are of inverse length with respect to lengths of the fins **81**. Thus, when the key K is fully inserted into the lock, all the tumblers are moved rearwardly to the position shown in FIG. 6 to occupy intermediate positions in which they are free of the front or forward notches **59** and also of the rear notches **55**. Thus, in this position of the tumblers, when the key is rotated, the fins **81** will apply a thrust force in a circumferential direction against the radial walls of the grooves **51** to turn the barrel B and thus swing the latch arm or member **23**. During such rotary movement or turning movement of the key K, the right-hand end of the lug **83**, as the parts are shown in FIGS. 4 and 6, moves within an arcuate recess **93** (compare FIGS. 4 and 7) formed within the inner face of the cap **31**.

Where the lock and key are of relatively small size, for instance, where the diameter of the tubular portion of the key is one-fourth inch or less, the fins **81** should be rather thin in order to adapt the key to be readily manufactured without great difficulty. To assure proper alignment of these thin fins with the somewhat thicker tumblers **57**, the forward portions **95** of the grooves **51** are made narrower than the remaining portions of the grooves **51**, as is evident by comparison of FIGS. 3 and 4. These narrow groove portions thus serve as guides for guiding the thin fins **81** into full abutting engagement with the forward end faces of the fingers or finger portions **77** and also conceal the code of the finger portions **77** of the tumblers.

It is pointed out that the fins **81** can be provided in other ways than as shown in FIG. 5, i.e., other ways than being cast in place as an integral part of the body metal. One way would be to insert steel fins in a mold and cast a body or shell to include such fins.

FIGS. 10 and 11 show a modified form of key in which the key body **101** has a cylindrical socket **103** defined by a cylindrical wall portion **105** and a bottom wall **107**. A plurality of pins **109** are fixedly secured in a cylindrical plug **110** in parallel relation to one another and in circular disposition about the central axis of the body. The front faces of the pins are disposed in staggered relation longitudinally of the key to match the code or staggering of the front or end faces of the finger portions **77** of the tumblers of the lock.

The cylindrical pin plug **110** has a press fit in the socket **103**. The key body has a guide lug **111** thereon, and the orientation of the plug **110** relative to the guide lug **111** is determined by which of a plurality of notches **112** (FIG. 11) on the plug periphery is arranged in engagement with a keying lug **113** formed on the interior of the cylindrical wall portion **105**.

The code of a key can be determined at the time the plug is forced into the key body, and plugs having pins with exactly the same pin heights can be used to form different codes by orienting the plugs differently relative to the guide lug **111**.

The combination or code of the key can also be determined at the time a key is assembled by inserting one or more blank plugs, one **114** being shown, into the socket **103** prior to inserting the pin plug **110** in place.

The pins **109** may be press fitted in a series of holes which are formed in the pin plug **110** and which are located in equally spaced relation along a circle which is concentric with the axis of the plug. Of course the spacing of the pin holes (and thus the pins) could be unequal if the finger portions **77** they are to engage are similarly unequally spaced. If desired, the rear ends of the holes in the pin plug **110** can be countersunk to receive heads (not shown) on the pins **109** so that the extent of projection of the pins through the pin plug would be determined by the contact of such heads with the head.

It is possible to cast the pins **109** directly into the body **101**, but a substantial saving is made by use of the FIG. 10 construction. The reason for this is that the bodies of all keys will be identical regardless of the code of the pins (with the FIG. 10 construction). Thus a large number of key bodies can be formed at one time and the code determined later as and when the various orders for keys and locks are received. On the other hand, if the code has to be determined at the time of casting, the keys are custom made rather than mass produced, and thus are more expensive than the FIG. 10 key.

If desired, the pins **109**, in FIG. 10 could be of non-circular cross section fitting in similar cross section holes formed in the pin plug **110**.

The key of FIGS. 10 and 11, and the other keys of the present invention, may be grasped and manipulated by means of a wing portion labeled **115** in FIG. 11.

FIGS. 12 and 13 show another form of key in which the bits are provided by a plurality of short pins **118** which project in fixed relation through the wall **119** of the key in staggered relation longitudinally of the key

to provide the desired code. The outer ends of the pins may be concealed in any desired manner.

FIGS. 14 and 15 show still another form of key in which a metal strip **121** has inwardly punched portions **123** to provide the bits of the key. The staggering of the bits is apparent from FIG. 15. The strip is flexible so that it may be bent to fit in the cylindrical socket of the key. The strip is secured in place by an adhesive material or in any other suitable way.

It is apparent that the present invention has provided a lock structure in which the key is very difficult to duplicate because there are no available blanks, and furthermore duplication is further rendered difficult because the fins are disposed on the interior of the tubular portion **79** where they are not very accessible. Also, the thin groove portions **95** make it difficult to pick the lock since only a very thin instrument can be used and because of the dimensions of the parts, a typical lock would have dimensions such that a straightened paper clip would be too large to be inserted into the notch **95**. Furthermore, since the tumblers **57** have both forward and rearward locking positions, this would present a further obstacle to the picking of the lock.

Another advantage of my lock is that the combination can readily be changed or varied from one lock to the next (or even for the same lock) by locating the detent **44** of the cap **31** in different recesses **45** with the same loading pattern for the barrel. Since the barrel has six lug-receiving grooves **87**, a key K will be properly received by its lock regardless of which of the six positions the cap occupies.

While the lock shown has six tumblers (which means six of various other parts) more or less tumblers (and corresponding parts) could be employed.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. In a tumbler lock structure,
a tubular housing having a front end and a rear end,
a barrel mounted in said housing for coaxial rotation therein, and having a rest position and an operative position circumferentially displaced from said rest position,
said barrel having formed therein a series of grooves extending radially and axially of said barrel,
said housing having front and rear series of notches which are in alignment with said grooves in the rest position of said barrel,
a key having a tubular portion projecting into said housing,
a series of tumblers slidably disposed in said grooves and having finger portions projecting forwardly into the interior of said tubular portion of said key,
means urging said tumblers to assume positions in engagement with said front notches but yieldable to allow said tumblers to engage said rear notches,
said key having within the interior of said tubular portion a series of bits to engage said finger portions and force said tumblers rearwardly to separate them from said front notches without causing any of them to engage in said rear notches, and
a latch member fixed to said barrel to be moved between operative to inoperative positions upon appropriate rotation of said barrel.

2. In a tumbler lock structure,
a tubular housing having a front end and a rear end,
a barrel mounted in said housing for coaxial rotation therein, and having a rest position and an operative position circumferentially displaced from said rest position,
said barrel having formed therein a series of grooves extending radially and axially of said barrel,

said housing having front and rear series of notches which are in alignment with said grooves in the rest position of said barrel,
a key having a tubular portion projecting into said housing,
a series of tumblers slidably disposed in said grooves and having fingers portions projecting forwardly into the interior of said tubular portion of said key,
means urging said tumblers to assume positions in engagement with said front notches but yieldable to allow said tumblers to engage said rear notches,
said key having within the interior of said tubular portion a series of bits to engage said finger portions and force said tumblers rearwardly to separate them from said front notches without causing any of them to engage in said rear notches, and
a latch member fixed to said barrel to be moved between operative to inoperative positions upon appropriate rotation of said barrel,
said tumbler having other portions projecting forwardly exterior of said tubular portion of said key for engagement in said front notches.

3. In a tumbler lock structure,
a tubular housing having a front end and a rear end,
a barrel mounted in said housing for coaxial rotation therein, and having a rest position and an operative position circumferentially displaced from said rest position,
said barrel having formed therein a series of grooves extending radially and axially of said barrel,
said housing having front and rear series of notches which are in alignment with said grooves in the rest position of said barrel,
a key having a tubular portion projecting into said housing,
a series of tumblers slidably disposed in said grooves and having finger portions projecting forwardly into the interior of said tubular portion of said key,
means urging said tumblers to assume positions in engagement with said front notches but yieldable to allow said tumblers to engage said rear notches,
said key having within the interior of said tubular portion a series of bits to engage said finger portions and force said tumblers rearwardly to separate them from said front notches without causing any of them to engage in said rear notches,
a latch member fixed to said barrel to be moved between operative to inoperative positions upon appropriate rotation of said barrel,
said tumblers also having portions in slidable engagement with the interior of said housing to be guided thereby.

4. In a tumbler lock structure,
a tubular housing having a front end and a rear end,
a barrel mounted in said housing for coaxial rotation therein, and having a rest position and an operative position circumferentially displaced from said rest position,
said barrel being formed with a series of longitudinal guideways,
said housing having front and rear series of notches which are in alignment with said guideways in the rest postion of said barrel,
a key having a tubular portion projecting into said housing,
a series of tumblers slidably disposed in said guideways and having finger portions projecting forwardly into the interior of said tubular portion of said key,
means urging said tumblers to assume positions in engagement with said front notches but yieldable to allow said tumblers to engage said rear notches,
said key having within the interior of said tubular portion a series of bits to engage said finger portions and force said tumblers rearwardly to separate

them from said front notches without causing any of them to engage in said rear notches, and

a latch member fixed to said barrel to be moved between operative and inoperative positions upon appropriate rotation of said barrel.

5. In a tumbler lock structure,

a tubular housing having a front end and a rear end,

a barrel mounted in said housing for coaxial rotation therein, and having a rest position and an operative position circumferentially displaced from said rest position,

said barrel being formed with a series of longitudinal guideways,

said housing having front and rear series of notches which are in alignment with said guideways in the rest position of said barrel,

a key having a tubular portion projecting into said housing,

a series of tumblers slidably disposed in said guideways and having finger portions projecting forwardly into the interior of said tubular portion of said key,

means urging said tumblers to assume positions in engagement with said front notches but yieldable to allow said tumblers to engage said rear notches,

said key having within the interior of said tubular portion a series of bits to engage said finger portions and force said tumblers rearwardly to separate them from said front notches without causing any of them to engage in said rear notches, and

a latch member fixed to said barrel to be moved between operative and inoperative positions upon appropriate rotation of said barrel,

said tumbler having other portions projecting forwardly exteriorly of said tubular portion of said key for engagement in said front notches,

said tumblers also having portions in slidable engagement with the interior of said housing to be guided thereby.

6. In a tumbler lock structure including

a lock comprising a tubular housing having a front end and a rear end,

said housing having a forward and a rearward inwardly extending flange,

said flanges being axially spaced from one another,

a plug-like barrel mounted in said housing and having portions of circular cross section slidably engaging the inner surface of said housing at places between said flanges and having oppositely directed, axially facing portions slidably engaging the inner faces of said flanges,

said barrel having a portion of reduced diameter projecting rearwardly from said housing past said rearward flange,

a latch member secured to the just mentioned portion,

said barrel having a series of circumferentially spaced, radial grooves formed therein opening through the peripheral surface of said barrel,

said grooves extending longitudinally of said barrel,

a generally flat tumbler for each groove slidably disposed therein for longitudinal movement with respect thereto,

said tumblers slidably engaging the interior of said housing to be guided thereby,

each of said flanges having formed therein, in the inner face thereof, a series of notches which are in alignment with the grooves in said barrel in one position of rotation of said barrel with respect to said housing and which are of a size to slidably receive said tumblers,

spring means urging said tumblers forwardly to occupy forward positions in engagement with notches of said forward flange and hence prevent rotary movement of said barrel relative to said housing,

said tumblers being capable of being moved rearwardly to assume intermediate positions where they are free of both series of notches and also capable of being moved further rearwardly to engage in the notches of said rearward flange,

said barrel having a circular, coaxial grove formed in the forward portion thereof which intersects said radial grooves intermediate the radial length of said grooves,

a key having a tubular portion projecting into said groove,

each tumbler having an axially extending notch formed in the forward portion thereof which is in register with said circular groove so as to provide a finger portion projecting within said tubular portion of said key and to provide a notch engaging portion projecting forwardly next to the exterior of said tubular portion of said key,

said finger portions being of varying length,

the tubular portion of said key having radial inwardly projecting fins extending axially of said key for engaging said finger portions and hence shift said tumblers rearwardly,

said fins being of varying and inverse length with respect to said finger portions so as to assure that all of said tumblers occupy their intermediate positions to permit rotation of said barrel,

said fins engaging the walls of the radial grooves in said barrel to transmit a circumferentially directed thrust force from said key to said barrel.

7. A tumbler lock as set forth in claim 6 in which said barrel comprises a front section and a rear section, and in which there are keying means connecting the sections together.

8. In a tumbler lock structure including

a lock comprising a tubular housing having a front end and a rear end,

said housing having a forward and a rearward inwardly extending flange,

said flanges being axially spaced from one another,

a plug-like barrel mounted in said housing and having portions of circular cross section slidably engaging the inner surface of said housing at places between said flanges and having oppositely directed, axially facing portions slidably engaging the inner faces of said flanges,

said barrel having a portion of reduced diameter projecting rearwardly from said housing past said rearward flange,

a latch member secured to the just mentioned portion,

said barrel having a series of circumferentially spaced, radial grooves formed therein opening through the peripheral surface of said barrel,

said grooves extending longitudinally of said barrel,

a generally flat tumbler for each groove slidably disposed therein for longitudinal movement with respect thereto,

said tumblers slidably engaging the interior of said housing to be guided thereby,

each of said flanges having formed therein, in the inner face thereof, a series of notches which are in alignment with the grooves in said barrel in one position of rotation of said barrel with respect to said housing and which are of a size to slidably receive said tumblers,

spring means urging said tumblers forwardly to occupy forward positions in engagement with the notches of said forward flange and hence prevent rotary movement of said barrel relative to said housing,

said tumblers being capable of being moved rearwardly to assume intermediate positions where they are free of both series of notches and also capable of being moving further rearwardly to engage in the notches of said rearward flange,

said barrel having a circular, coaxial groove formed in the forward portion thereof which intersects said

radial grooves intermediate the radial length of said grooves,
a key having a tubular portion projecting into said groove,
each tumbler having an axially extending notch formed in the forward portion thereof which is in register with said circular groove so as to provide a finger portion projecting within said tubular portion of said key and to provide a notch engaging portion projecting forwardly next to the exterior of said tubular portion of said key,
said finger portions being of varying length,
the tubular portion of said key having radial inwardly projecting fins extending axially of said key for engaging said finger portions and hence shift said tumblers rearwardly,
said fins being of varying and inverse length with respect to said finger portions so as to assure that all of said tumblers occupy their intermediate positions to permit rotation of said barrel,
said fins engaging the walls of the radial grooves in said barrel to transmit a circumferentially directed thrust force from said key to said barrel,
said forward flange having a radial notch formed in the inner peripheral edge thereof,
said barrel having a recess formed in the forward portion thereof in alignment with the just-mentioned notch,
said key having an exterior lug for fitting in such notch and recess,
said forward flange having a recess on the inner face thereof communicating with the notch in said flange to accommodate said lug at the time of rotation of said barrel.

9. In a tumbler lock structure including
a lock comprising a tubular housing having a front end and a rear end,
said housing having a forward and a rearward inwardly extending flange,
said flanges being axially spaced from one another,
a plug-like barrel mounted in said housing and having portions of circular cross section slidably engaging the inner surface of said housing at places between said flanges and having oppositely directed, axially facing portions slidably engaging the inner faces of said flanges,
said barrel having a portion of reduced diameter projecting rearwardly from said housing past said rearward flange,
a latch member secured to the just mentioned portion,
said barrel having a series of circumferentially spaced, radial grooves formed therein opening through the peripheral surface of said barrel,
said grooves extending longitudinally of said barrel,
a generally flat tumbler for each groove slidably disposed therein for longitudinal movement with respect thereto,
said tumblers slidably engaging the interior of said housing to be guided thereby,
each of said flanges having formed therein, in the inner face thereof, a series of notches which are in alignment with the grooves in said barrel in one position of rotation of said barrel with respect to said housing and which are of a size to slidably receive said tumblers,
spring means urging said tumblers forwardly to occupy forward positions in engagement with notches of said forward flange and hence prevent rotary movement of said barrel relative to said housing,
said tumblers being capable of being moved rearwardly to assume intermediate positions where they are free of both series of notches and also capable of being moved further rearwardly to engage in the notches of said rearward flange,

said barrel having a circular, coaxial groove formed in the forward portion thereof which intersects said radial grooves intermediate the radial length of said grooves,
a key having a tubular portion projecting into said groove,
each tumbler having a axially extending notch formed in the forward portion thereof which is in register with said circular groove so as to provide a finger portion projecting within said tubular portion of said key and to provide a notch engaging portion projecting forwardly next to the exterior of said tubular portion of said key,
said finger portions being of varying length,
the tubular portion of said key having radial inwardly projecting fins extending axially of said key for engaging said finger portions and hence shift said tumblers rearwardly,
said fins being of varying and inverse length with respect to said finger portions so as to assure that all of said tumblers occupy their intermediate positions to permit rotation of said barrel,
said fins engaging the walls of the radial grooves in said barrel to transmit a circumferentially directed thrust force from said key to said barrel,
said forward flange having a radial notch formed in the inner peripheral edge thereof,
said barrel having a recess formed in the forward portion thereof in alignment with the just-mentioned notch,
said key having an exterior lug for fitting in such notch and recess,
said forward flange having a recess on the inner face thereof communicating with the notch in said flange to accommodate said lug at the time of rotation of said barrel,
said fins being narrower than said tumblers,
each of the radial grooves in said barrel being narrower at the front portions thereof than the associated tumbler so as to guide the associated fin into full abutting engagement with such tumbler.

10. In a tumbler lock structure,
a tubular housing having a front end and a rear end,
a barrel mounted in said housing for coaxial rotation therein, and having a rest position and an operative position circumferentially displaced from said rest position,
said barrel having formed therein a series of grooves extending radially and axially of said barrel,
said housing having a series of notches which are in alignment with said grooves in the rest position of said barrel,
a key having a tubular portion projecting into said housing,
a series of tumblers slidably disposed in said grooves and having finger portions projecting forwardly into the interior of said tubular portion of said key,
means urging said tumblers to assume positions in engagement with said notches but yieldable to allow sepration therefrom
said key having within the interior of said tubular portion a series of bits to engage said finger portions and force said tumblers rearwardly to separate them from said front notches, and
a latch member fixed to said barrel to be moved between operative to inoperative positions upon appropriate rotation of said barrel.

11. In a tumbler lock structure including
a lock comprising a tubular housing having a front end and a rear end,
said housing having a forward and a rearward inwardly extending flange,
said flanges being axially spaced from one another,
a plug-like barrel mounted in said housing and having portions of circular cross section slidably engaging

the inner surface of said housing at places between said flanges and having oppositely directed, axially facing portions slidably engaging the inner faces of said flanges,

said barrel having a portion of reduced diameter projecting rearwardly from said housing past said rearward flange,

a latch member secured to the just-mentioned portion,

said barrel having a series of circumferentially spaced, radial grooves formed therein opening through the peripheral surface of said barrel,

said grooves extending longitudinally of said barrel,

a generally flat tumbler for each groove slidably disposed therein for longitudinal movement with respect thereto,

said tumblers slidably engaging the interior of said housing to be guided thereby,

each of said flanges having formed therein, in the inner face thereof, a series of notches which are in alignment with the grooves in said barrel in one position of rotation of said barrel with respect to said housing and which are of a size to slidably receive said tumblers,

spring means urging said tumblers forwardly to occupy forward positions in engagement with the notches of said forward flange and hence prevent rotary movement of said barrel relative to said housing,

said tumblers being capable of being moved rearwardly to assume intermediate positions where they are free of both series of notches and also capable of being moved further rearwardly to engage in the notches of said rearward flange,

said barrel having a circular, coaxial groove formed in the forward portion thereof which intersects said radial grooves intermediate the radial length of said grooves,

said circular groove adapted to receive a tubular portion of a key,

each tumbler having an axially extending notch formed in the forward portion thereof which is in register with said circular groove so as to provide a finger portion for projecting within the tubular portion of such key and to provide a notch engaging portion for projecting forwardly next to the exterior of the tubular portion of such key,

said finger portions being of varying length to adapt them for mating engagement with radial inwardly projecting fins on the tubular portion of such key to enable said tumblers to be shifted rearwardly.

12. A key for a tumbler type lock of the type having a plurality of tumblers mounted for movement along parallel paths which are disposed in spaced circumferential relation about a predetermined axis, said key comprising,

a body having a cylindrical wall portion for insertion into such lock in surrounding relation to at least certain portions of said tumblers and in coaxial relation to said axis,

a plurality of bits within said cylindrical wall portion and disposed in spaced relation about the axis of said cylindrical wall portion so as to register with said certain portions of said tumblers,

the inner portions of said bits being disposed inwardly of the inner surface of said cylindrical wall portion,

the front faces of said bits being staggered in relation to the length of said cylindrical wall portion so as to provide a code matching the code of the lock,

said bits being fixedly secured to and carried by said body,

said bits comprising fins projecting inwardly from the cylindrical wall portion.

13. A key for a tumbler type lock of the type having a plurality of tumblers mounted along parallel paths which are disposed in spaced circumferential relation about a predetermined axis, said key comprising,

a body having a cylindrical wall portion for insertion into such lock in surrounding relation to at least certain portions of said tumblers and in coaxial relation to said axis,

a plurality of bits within said cylindrical wall portion and disposed in spaced relation about the axis of said cylindrical wall portion so as to register with said certain portions of said tumblers,

the inner portions of said bits being disposed inwardly of the inner surface of said cylindrical wall portion,

the front faces of said bits being staggered in relation to the length of said cylindrical wall portion so as to provide a code matching the code of the lock,

said bits being fixedly secured to and carried by said body,

said bits comprising a plurality of pins projecting radially through said cylindrical wall portion.

14. A key for a tumbler type lock of the type having a plurality of tumblers mounted for movement along parallel paths which are disposed in spaced circumferential relation about a predetermined axis, said key comprising,

a body having a cylindrical wall portion for insertion into such lock in surrounding relation to at least certain portions of said tumblers and in coaxial relation to said axis,

a plurality of bits within said cylindrical wall portion and disposed in spaced relation about the axis of said cylindrical wall portion so as to register with said certain portions of said tumblers,

the inner portions of said bits being disposed inwardly of the inner surface of said cylindrical wall portion,

the front faces of said bits being staggered in relation to the length of said cylindrical wall portion so as to provide a code matching the code of the lock,

said bits being fixedly secured to and carried by said body,

said cylindrical wall portion including an outer portion and an inner portion,

said inner portion comprising a strip which is separate from said outer portion and which has inwardly bent portions which constitute said bits.

15. A key for a tumbler type lock of the type having a plurality of tumblers mounted for movement along parallel paths which are disposed in spaced circumferential relation about a predetermined axis, said key comprising:

a cylindrical portion for insertion into such lock in surrounding relation to at least certain portions of said tumblers and in coaxial relation to said axis,

a plurality of bits within said cylindrical portion and disposed in spaced relation about the axis of said cylindrical portion so as to register with said certain portions of said tumblers,

the front faces of said bits being staggered in relation to the length of said cylindrical portion so as to provide a code matching the code of the lock,

said bits being in the form of pins,

a plug carrying said pins,

said plug being fixedly disposed in said cylindrical portion,

said plug having a plurality of peripheral recesses,

said cylindrical portion having a keying lug therein optionally to fit in said recesses.

16. A key for a lock of the type having coded elements which must be matched by coded elements of said key to enable said key to be rotated within said lock,

said key comprising a body having a cylindrical wall portion for insertion into such lock,

a plurality of bits within said cylindrical wall portion and disposed in spaced relation about the axis thereof and being variously dimensioned in a direction parallel to said axis in a manner to match the code of the coded elements of said lock whereby to facilitate ro-

tation of said key relative to said lock after said key has been inserted therein,

said bits comprising elements fixed to said cylindrical wall portion and projecting inwardly from the inner surface of said cylindrical wall portion.

References Cited by the Examiner

UNITED STATES PATENTS

6,272	4/1849	Smith	70—351
1,092,223	4/1914	Muller	70—363
1,375,521	4/1921	Laskey	70—363 X
1,664,042	3/1928	McGinley	70—404 X
1,721,747	7/1929	Radosevic	70—393 X
2,993,361	7/1961	Van Lahr	70—363

FOREIGN PATENTS

534,215	1/1922	France.

JOSEPH D. SEERS, *Primary Examiner.*

ALBERT H. KAMPE, *Examiner.*

B. R. GAY, *Assistant Examiner.*