Feb. 26, 1963 D. MORRISON, JR 3,078,705

LOCKS

Filed May 19, 1959

Fig. 1.

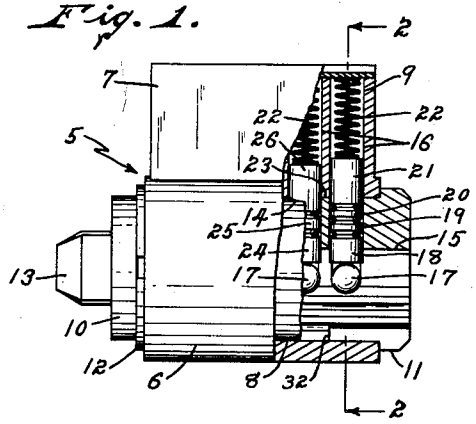



Fig. 2.

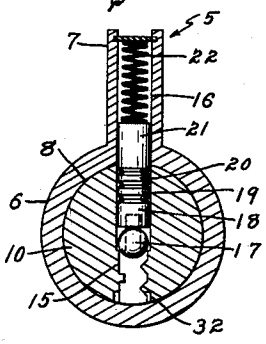



Fig. 3.

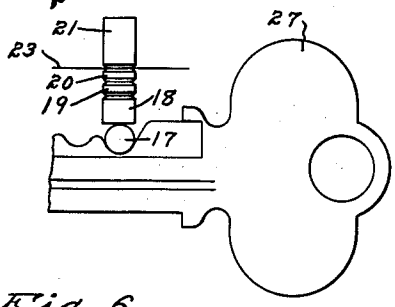



Fig. 4.

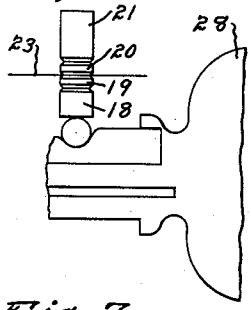



Fig. 5.

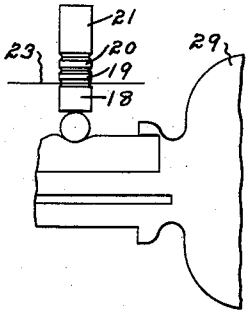



Fig. 6.

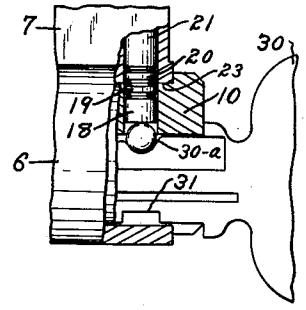



Fig. 7.

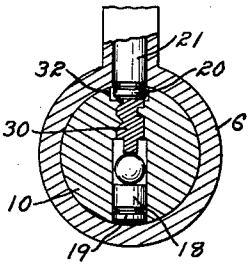



Fig. 8.

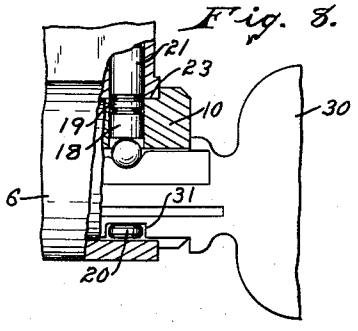



Fig. 9.

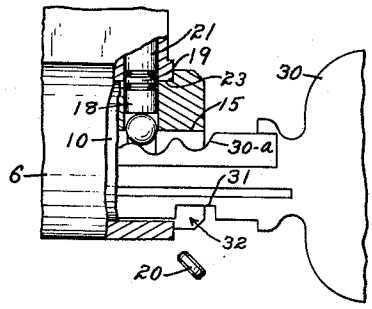
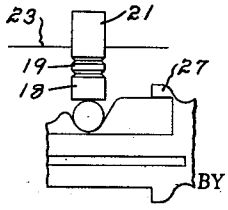



Fig. 10.




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3,078,705

# LOCKS

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14 Claims. (Cl. 70—383)

This invention relates to locks, and more particularly to key operated lock cylinders of the well known pin-tumbler type which are used to a great extent in door locks, night latches, padlocks and many other types of locking devices.

Pin-tumbler lock cylinders now in general use must be completely disassembled in order to change the combinations thereof. This generally requires the services of a skilled locksmith, and in cases where is it necessary to change the combinations of a large number of lock cylinders, the task is both time consuming and expensive.

The primary object of this invention is to provide a lock cylinder whose combination may easily be changed without disassembling the lock cylinder.

A further object of the invention is to provide a lock cylinder whose combination may be changed simply by the use of a key.

A still further object of the invention is to provide a lock cylinder which is so constructed that one or more of the pin-tumblers may be removed from its initial position therein without disassembling the lock cylinder in order to change its combination.

An important object of this invention is to provide a master-keyed lock cylinder which is normally operable by a plurality of keys, but which may be rendered permanently unresponsive to one or more of said keys without disassembling the lock cylinder.

Another object of this invention is to provide a master-keyed lock cylinder which is initially provided with a temporary pin-tumbler which may be removed from the lock cylinder in order to change its combination.

A further object of this invention is to provide a master-keyed lock cylinder which may initially be operated by a temporary master key, a permanent master key and a service key, but which may be rendered unresponsive to the temporary master key by means of a special "disabling" key.

A still further object of the invention is to provide a master-keyed lock cylinder having a temporary pin-tumbler in one or more of its pin-bores which may be permanently removed therefrom by means of a disabling key so that said lock cylinder cannot thereafter be operated by the temporary master key.

One of the practical uses for locks embodying the present invention is in the door locks of a large building. During the construction of a building, each of the contractors is usually given a temporary or "construction" master key which will operate any number or all of the lock cylinders so that the contractor may enter the building at any time to do his work. When the building has been completed, it is common practice to change the pin-tumbler combinations of the various lock cylinders therein so that they can no longer be operated by the temporary master key, thus preventing entry into the building by unauthorized or unscrupulous persons who might have gained possession of a temporary master key. Heretofore, it was necessary to disassemble each lock cylinder to change its pin-tumbler combination, but, with the present invention, the combinations of the lock cylinders may be easily, quickly and permanently changed by an authorized person possessing the proper disabling key.

A preferred form of lock constructed in accordance with the present invention is illustrated in the accompanying drawing wherein:



FIG. 1 is an elevational view of a master-keyed, pin-tumbler lock cylinder, partly in central vertical section, showing the initial combination of pin-tumblers in the first pin-bore arranged in accordance with the present invention.

FIG. 2 is an end view of said lock cylinder taken on line 2—2 of FIG. 1.

FIG. 3 is a diagrammatic view illustrating the pin-tumblers in the first pin-bore of the lock cylinder of FIG. 1 and the positions which said pin-tumblers occupy with respect to the "shear line" of the lock cylinder when the temporary master key is inserted in the keyway thereof.

FIG. 4 is a similar view illustrating the positions occupied by said pin-tumblers when the permanent master key is inserted in said keyway.

FIG. 5 is a view similar to FIGS. 3 and 4 illustrating the positions to which said pin-tumblers are moved by the service key for the lock cylinder.

FIG. 6 is a fragmentary, elevational view, partially in central vertical section, illustrating the positions assumed by said tumblers when the disabling key is inserted into the keyway.

FIG. 7 is a sectional, end view of the lock cylinder of FIG. 6 illustrating an intermediate step in the removal of the temporary pin-tumbler from the lock cylinder by the disabling key.

FIG. 8 is a view similar to FIG. 6 illustrating a further step in the removal of the temporary pin-tumbler from the lock cylinder.

FIG. 9 is a view similar to FIGS. 6 and 8 illustrating the final step in the removal of the temporary pin-tumbler from the lock cylinder.

FIG. 10 is a diagrammatic view illustrating the positions assumed by the pin-tumblers with respect to the shear line of the lock cylinder when an attempt is made to operate the key plug with the temporary master key after the temporary pin-tumbler has been removed.

In the lock cylinder shown in the drawing, I have utilized only the first pin-bore of the lock cylinder to illustrate the novel features of my invention. It will be understood, however, that the invention may be incorporated in any one or all of the pin-bores of the lock cylinder disclosed and in many other types of pin-tumbler lock cylinders. In addition, many other combinations and arrangements of pin-tumblers may be used according to the keying system desired.

The lock cylinder illustrated is, for the most part, of the conventional pin-tumbler type and includes a housing 5 comprising a cylindrical portion 6 and an integral, radially extending chamber portion 7. The cylindrical portion 6 of the housing contains an axial opening 8, and a plurality of equally spaced holes 9 extend radially from the opening 8 into the chamber portion 7.

A key-plug 10 is rotatably mounted in the axial opening 8 and is provided at its outer end with a flange 11 which abuts the outer end of the housing 5 and prevents inward axial movement of the key-plug with respect thereto. Axial movement of the key-plug 10 in an outward direction with respect to the housing 5 is prevented by a retaining ring 12 which is mounted in an annular groove formed in the key-plug and abuts the inner end of the housing 5. A blade 13 extends axially from the inner end of the key-plug and is adapted to engage and actuate the locking mechanism of the door lock or other locking device in which the lock cylinder is mounted.

The key-plug 10 contains a plurality of equally spaced, radially extending holes 14 in one side thereof, and an axially extending keyway 15 which intersects said holes and opens to the opposite side of the key-plug. The holes 14 are aligned with the holes 9 in the housing 5 when

the key-plug is in its normal locked position, as illustrated in FIGS. 1 and 2 of the drawing, and said holes **9** and **14** form elongated pin-bores **16** which communicate with the keyway **15**. Each of said pin-bores **16** contains a series of conventional tumbler elements of predetermined lengths which are slidable in said bores, and in the lock cylinder shown in the drawing, the tumbler elements in all but the first pin-bore are arranged in combinations common to master-keyed lock cylinders and function in a conventional manner.

In the first pin-bore, where I have chosen to illustrate my invention, the tumbler elements include an anti-friction ball **17**, which facilitates insertion and withdrawal of a key, a service pin **18**, a master pin **19**, a special temporary pin **20** and a driver pin **21**. The said tumbler elements are urged toward the keyway **15** by a spring **22**, and, in the illustrated embodiment of the invention, the driver pin **21** extends across the "shear line" **23** of the lock cylinder to prevent rotation of the key-plug **10**; the "shear line" being defined as the line formed by the peripheral surface of the key-plug **10** and the wall of the opening **8**. Each of the remaining pin-bores of the lock cylinder contains tumbler elements arranged in a conventional manner and including an anti-friction ball **17**, a service pin **24**, a master pin **25**, a driver pin **26** and a spring **22**. The temporary pin **20** contained in the first pin-bore is absent from the other bores, but it will hereinafter be understood that said temporary pin could be used in any one or more of the pin-bores in accordance with the teachings of the present invention.

The lock cylinder illustrated herein is initially adapted to be operated by a temporary master key **27**, a permanent master key **28** and a service key **29**, all of which are bitted in the conventional manner and lift the pin-tumblers in each of the pin-bores to shear position upon insertion thereof into the keyway **15**.

When the temporary master key **27** (see FIG. 3) is inserted into the keyway **15**, the pin-tumblers in the first pin-bore are moved to a position wherein the abutting ends of the driver pin **21** and the temporary pin **20** are aligned with the shear line **23**, thus permitting rotation of the key-plug. When the permanent master key **28** (see FIG. 4) is used to operate the lock cylinder, said pin-tumblers are moved to a position wherein the abutting ends of the temporary pin **20** and the master pin **19** are aligned with the shear line **23**. The service key **29** (see FIG. 5) is so bitted that, when inserted into the keyway **15**, it will lift the pin-tumblers in the first pin-bore to a position wherein the abutting ends of the master pin **19** and the service pin **18** are aligned with the shear line **23** of the lock cylinder. It will thus be understood that the original arrangement of the pin-tumblers in the lock cylinder permits operation thereof by any one ot the three keys above mentioned, and any person, for instance, a building contractor, possessing a temporary master key **27**, may operate the lock cylinder.

The present invention provides means whereby the temporary pin-tumbler **20** may be removed from the first pin-bore without disasembling the lock cylinder to thereby change the combination of the lock cylinder so that it cannot be operated by the temporary master key **27**.

Removal of the temporary pin-tumbler **20** is accomplished through the use of a special disabling key **30** in the manner illustrated in FIGS. 6 to 9. Said disabling key is preferably made from the same key-blank as the other keys for the lock cylinder and, in the present case, the first bitting **30**–*a* thereof is cut to the same depth as the first bitting of the permanent master key **28**. In addition, the disabling key **30** is provided in its lower edge with a recess in the form of a notch **31** that is aligned with the first pin-bore when the key is fully inserted into the keyway **15**, and the length and depth of the notch **31** are such that the temporary pin **20** will fit thereinto as will be hereinafter described. In order to allow the temporary pin **20**, which is larger in diameter than the width of the keyway **15**, to enter the notch **31** in the disabling key **30**, the opposite sides of the keyway are cut away to form a recess or slot **32** in the periphery of the key-plug The slot **32** is slightly wider than the diameter of the temporary pin **20** and defines a passageway in said lock extending from a point inwardly of the first pin-bore to the front end of the key-plug as best illustrated in FIG. 1.



When it is desired to change the combination of the lock cylinder so that it cannot be operated by the temporary master key **27**, the disabling key **30** is inserted fully into the keyway **15**. Since the depth of the first bitting **30**–*a* of said key is the same as that of the permanent master key **28**, the pin-tumblers in the first pin-bore will be moved to a position wherein the abutting ends of the temporary pin **20** and the master pin **19** will be aligned with the shear line **23** of the lock cylinder as shown in FIG. 6. The temporary pin **20** is thus disposed in that part of the pin-bore within the lock housing **5**, and when the key plug **10** is rotated by the disabling key, the temporary pin will remain stationary while the service pin **18** and the master pin **19** are carried around with the key-plug. When the key-plug has been rotated 180°, to the position illustrated in FIG. 7, the slot **32** therein and the notch **31** in the disabling key are aligned with the pin-hole **9** whereupon said temporary pin **20** is urged into said slot **32** and into the notch **31** by the compression spring **22** as illustrated in FIG. 7. The depth of the notch **31** in the disabling key is such that the end of the driver pin **21** is prevented from entering said notch and is positioned on the shear line **23** so as not to interfere with the rotation of the key-plug. When the key-plug is rotated back to its normal position, the temporary pin **20** will be carried therewith in the slot **32**, as shown in FIG. 8, and upon withdrawal of the disabling key **30** from the keyway **15**, the temporary pin **20** will be carried out of the keyway in the notch **31** and will drop out of said notch when it clears the end of the lock housing as shown in FIG. 9.

The pin-tumbler combination in the first pin-bore is thus changed by the removal of the temporary pin **20**, and should an attempt be made thereafter to operate the lock cylinder with the temporary master key **27**, the pin-tumblers in the first pin-bore will assume the positions illustrated in FIG. 10 wherein the driver **21** is disposed across the shear line **23** and will thus prevent rotation of the key plug. The lock cylinder may, however, be operated by the permanent master key **28** or the service key **29** since removal of the temporary pin **20** does not affect the location of the master pin **19** or of the service pin **18**.

I claim:

1. In a lock, a housing, a unitary key plug mounted in said housing for movement between locking and unlocking positions and having a keyway, there being at least one tumbler bore in said housing and said keyplug communicating with said keyway, a series of tumbler elements movable in said bore to a release position wherein movement of the key plug to unlocking position is permitted, a first used key and a second change key insertable into said keyway and bitted for cooperation with said series of tumbler elements, the initial combination of said series of tumbler elements being such that said series of tumbler elements is moved to a release position when either said first key or said second key is inserted into said keyway so that said key plug is operable by either of said keys, and a recess in said unitary key plug communicable with said bore for receiving and effecting permanent removal of at least one of said tumbler elements from said bore the first time second key is used to operate said key plug to thereby provide a permanent new series of tumbler elements in said bore, the combination of said new series of tumbler elements being such that said new series of tumbler elements is moved to a

locking position, wherein movement of said key plug to unlocking position is prevented, when said first key is inserted into said keyway thereby permanently preventing operation of said key plug by said first key after the initial series of tumbler elements has been changed.

2. In a lock, a housing, a unitary key plug mounted in said housing for movement between locking and unlocking positions and having a keyway, said housing and said key plug having tumbler holes which are alignable and form a tumbler bore communicating with said keyway, a series of tumbler elements movable in said bore to release positions wherein movement of the key plug to unlocking position is permitted, a first used key and a second change key insertable into said keyway and bitted for cooperation with said series of tumbler elements, said series of tumbler elements initially including a temporary tumbler element sized to permit movement of said series of tumbler elements to a release possition when either said first key or said second key is inserted into said keyway, said temporary tumbler element being moved to a first position when said first key is used and to a second position when said second key is used, and a recess in said unitary key plug communicable with said bore for receiving said temporary tumbler element from said bore the first time said key plug is operated by said second key and with said temporary tumbler element in its said second position to thereby effect permanent removal of said temporary tumbler element from said series of tumbler elements and thereby provide a permanent new series of tumbler elements in said bore, said new series of tumbler elements being moved to a locking position, wherein movement of said key plug to unlocking position is prevented, when said first key is inserted into said keyway thereby permanently preventing operation of said key plug by said first key after the temporary tumbler element has been removed.

3. In a lock, a housing having an opening therein, a unitary key plug mounted in said opening for movement between locking and unlocking positions and having a keyway, said housing and said key plug having tumbler holes which are alignable and form a tumbler bore extending across the shearline of said lock defined by the adjacent surfaces of said keyplug and said opening and communicating with said keyway, a series of tumbler elements movable in said bore to release positions wherein the abutting ends of adjacent tumbler elements are aligned with said shearline to permit movement of said keyplug to unlocking position, a first used key and a second change key insertable into said keyway and bitted for cooperation with said series of tumbler elements, said series of tumbler elements initially including a temporary tumbler element sized to permit movement of said series of tumbler elements to a release position when either said first key or said second key is inserted into said keyway whereby said key plug is operable by either of said keys, said temporary tumbler element being disposed in the tumbler hole in said housing adjacent said shearline when said second key is inserted into said keyway, said unitary key plug having a recess therein movable into communication with the tumbler hole in said housing through movement of said key plug by said second key and adapted to receive said temporary tumbler element from said tumbler hole in said housing, whereby, when said second key is first used to operate said key plug, said temporary tumbler element is permanently removed from said series of tumbler elements in said recess to thereby provide a permanent new series of tumbler elements in said bore, said new series of tumbler elements being moved to a position wherein one of said new series of tumbler elements is disposed across said shearline when said first key is inserted into said keyway thereby permanently preventing operation of said key plug by said first key after the initial series of tumbler elements has been changed.

4. The subject matter set forth in claim 3, wherein said recess comprises a slot in the periphery of said key plug opening to an end thereof and adapted to receive said temporary tumbler element from the tumbler hole in said housing whereby said temporary tumbler element may be removed from said lock through the open end of said slot.



5. In a lock, a housing, a key plug mounted in said housing for movement between locking and unlocking positions and having a keyway, there being at least one tumbler bore in said housing and said key plug communicating with said keyway, a series of tumbler elements movable in said bore to a release position wherein movement of the key plug to unlocking position is permitted, a first used key and a second change key insertable into said keyway and bitted for cooperation with said series of tumbler elements, the initial combination of said series of tumbler elements being such that said series of tumbler elements is moved to a release position when either said first key or said second key is inserted into said keyway so that said key plug is operable by either of said keys, and a passageway in said lock communicable with said bore and leading to the exterior of said lock for receiving and effecting permanent removal of at least one of said tumbler elements from said lock when said second key is first used to operate said key plug to thereby provide a permanent new series of tumbler elements in said bore, the combination of said new series of tumbler elements being such that said new series of tumbler elements is moved to a locking position, wherein movement of said key plug to unlocking position is prevented, when said first key is inserted into said keyway thereby permanently preventing operation of said key plug by said first key after the initial series of tumbler elements has been changed.

6. In a lock, a housing, a key plug mounted in said housing for movement between locking and unlocking positions and having a keyway, there being at least one tumbler bore in said housing and said keyplug communicating with said keyway, a series of tumbler elements movable in said bore to release positions wherein movement of the key plug to unlocking position is permitted, a first used key and a second change key insertable into said keyway and bitted for cooperation with said series of tumbler elements, said series of tumbler elements initially including a temporary tumbler element sized to permit movement of said series of tumbler elements to a release position when either said first key or said second key is inserted into said keyway and being moved to a first position when said first key is used and to a second position when said second key is used, and a passageway in said lock communicable with said bore and leading to the exterior of said lock for receiving and effecting permanent removal of said temporary tumbler element from said lock the first time said key plug is operated by said second key and with said temporary tumbler element in its said second position to thereby provide a permanent new series of tumbler elements in said bore, said new series of tumbler elements being moved to a locking position, wherein movement of said key plug to unlocking position is prevented, when said first key is inserted into said keyway thereby permanently preventing operation of said key plug by said first key after the initial series of tumbler elements has been changed.

7. The subject matter set forth in claim 6, wherein said passageway in said lock is in said key plug and is in the form of a slot which is adapted to receive said temporary tumbler element and opens to one end of said key plug, said temporary tumbler element being removable from said lock through said slot.

8. In a lock, a housing, a key plug mounted in said housing for movement between locking and unlocking positions and having a keyway, a series of tumbler elements movable in said housing and said key plug to a release

position wherein movement of the key plug to unlocking position is permitted, a key bitted to position said tumbler elements in a release position upon insertion thereof into said keyway to permit movement of said key plug to unlocking position, said key having a recess therein adapted to receive one of said tumbler elements from said housing whereby said one tumbler element may be removed from said lock in said recess upon withdrawal of said key from said keyway to thereby provide a new series of tumbler elements in said lock.

9. The subject matter set forth in claim 8, wherein said keyway opens to the outer surface of said key plug and wherein the recess in said key receives said one of said tumbler elements through the open side of said keyway.

10. In a lock, a housing, a key plug mounted in said housing for movement between locking and unlocking positions, said key plug having a keyway and at least one tumbler bore therein communicating with said keyway, a series of tumbler elements movable in said bore to a release position wherein movement of the key plug to unlocking position is permitted, a temporary key and a disabling key insertable into said keyway and bitted for cooperation with said series of tumbler elements, the initial combination of said series of tumbler elements being such that said series of tumbler elements is movable to a release position when either said temporary key or said disabling key is inserted into said keyway so that said key plug is operable by either of said keys, and means whereby one of said tumbler elements is removed from said series of tumbler elements when said disabling key is used to operate said key plug to thereby provide a new series of tumbler elements in said bore, the combination of said new series of tumbler elements being such that said new series of tumbler elements is movable to a locking position, wherein movement of said key plug to unlocking position is prevented, when said temporary key is inserted into said keyway to thereby prevent operation of said key plug by said temporary key after the initial series of tumbler elements has been changed, said means including a recess in said disabling key adapted to receive said one of said tumbler elements whereby said one tumbler element may be removed from said lock in said recess upon withdrawal of said disabling key from said keyway.

11. In a lock, a housing having an opening therein, a key plug rotatable in said opening and having a radial tumbler hole in one side thereof and an axial keyway, the upper edge of said keyway intersecting said tumbler hole and at its lower edge opening to the periphery of said key plug, said housing having a tumbler hole extending radially from the opening therein and with which the tumbler hole in said key plug is alignable to form a tumbler bore communicating with said keyway and extending across the shear-line of said lock defined by the periphery of said key plug and the surface of said opening, a series of abutting tumbler elements slidable in said tumbler bore, a temporary key and a disabling key each having a blade insertable into said keyway and provided with an upper edge bitted to locate said series of tumbler elements in a shear position, wherein the abutting ends of adjacent tumbler elements are aligned with said shear-line, to permit rotation of said key plug, the blade of said disabling key having a lower edge portion which is spaced radially inwardly from the periphery of said key plug and registers with said tumbler bore when said disabling key is inserted in said keyway, and at least one of the tumbler elements remaining in the tumbler hole in said housing when said disabling key is used to operate said key plug being adapted to enter the space in said keyway between said lower edge portion of said disabling key and the periphery of said key plug when said key plug is rotated by said disabling key to bring said lower edge of the keyway into register with said tumbler hole in the housing, whereby said one tumbler element is permanently removed from said series of tumbler elements in said keyway upon rotation of said key plug to provide a new permanent series of tumbler elements in said tumbler bore, said new series of tumbler elements being movable to a position wherein one of said tumbler elements is disposed across said shear-line when said temporary key is inserted into said keyway to thereby permanently prevent operation of said key plug by said temporary key after said one tumbler element has been removed.

12. The subject matter est forth in claim 11, wherein said lower edge portion of said disabling key forms the bottom of a notch in said key, said notch being adapted to receive said one tumbler element whereby said one tumbler element is removed from said keyway in said notch upon withdrawal of said key.

13. The subject matter set forth in claim 11, wherein said temporary key has a lower edge which is disposed substantially flush with the periphery of said key plug when said temporary key is inserted in said keyway to prevent the tumbler element in the tumbler hole in said housing from entering said keyway when said key plug is rotated by said temporary key.

14. The subject matter set forth in claim 11, wherein said one tumbler element is larger than the width of said keyway and the opposite sides of said keyway are cut away to form a slot in the periphery of said key plug which opens to the outer end thereof and is adapted to accommodate said one tumbler element.

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