Nov. 18, 1969 E. L. SCHLAGE 3,478,549

PICK RESISTANT LOCK UNIT

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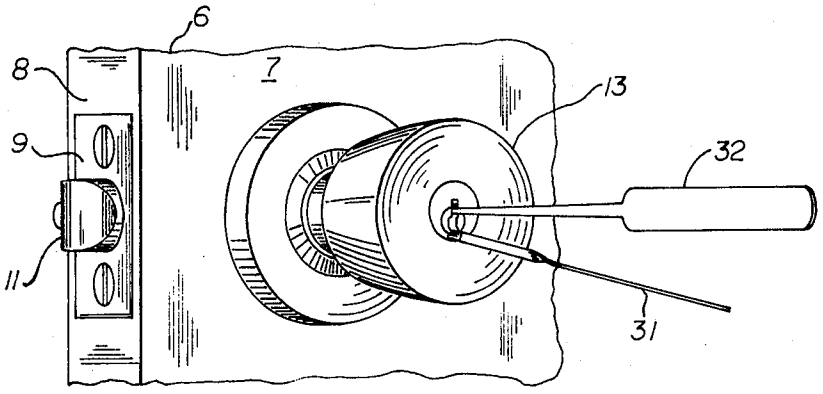


FIG. 1

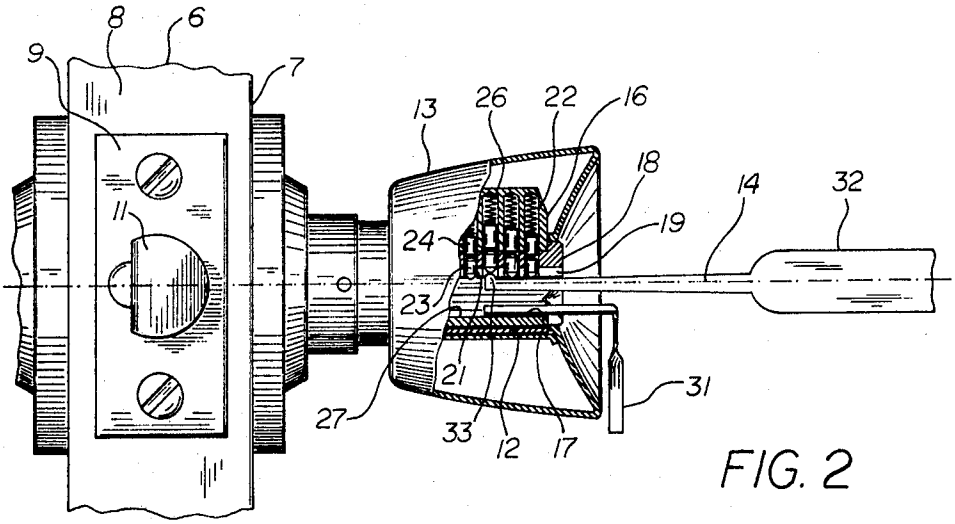


FIG. 2

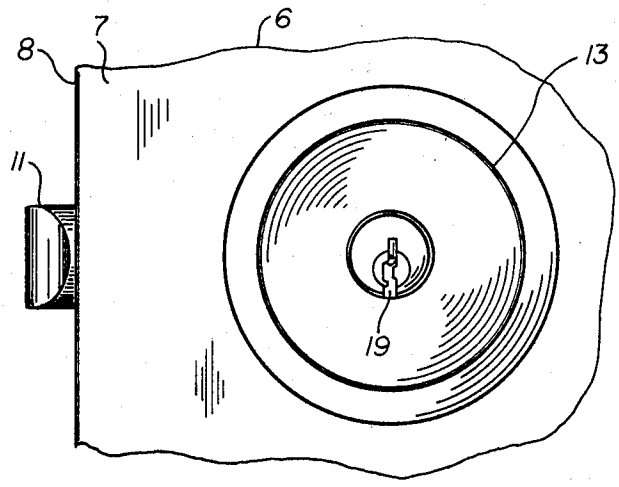


FIG. 3

INVENTOR.
ERNEST L. SCHLAGE
BY Lothrop & West
ATTORNEYS

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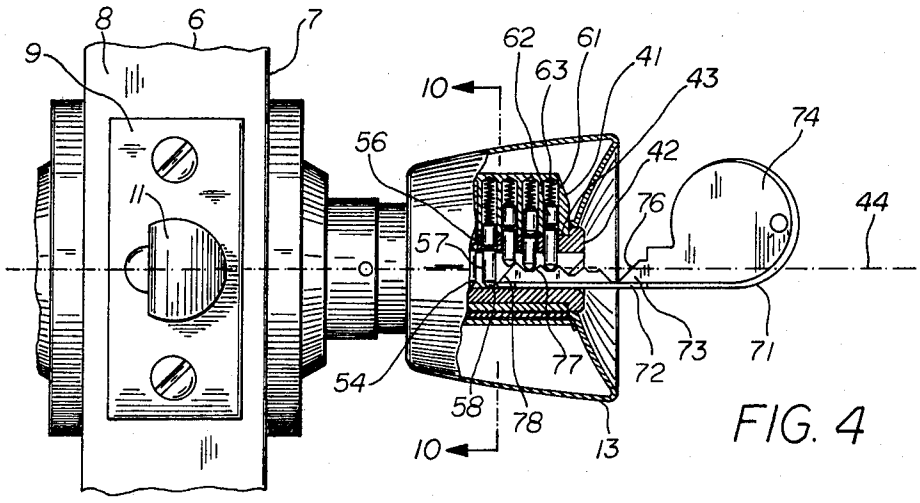


FIG. 4

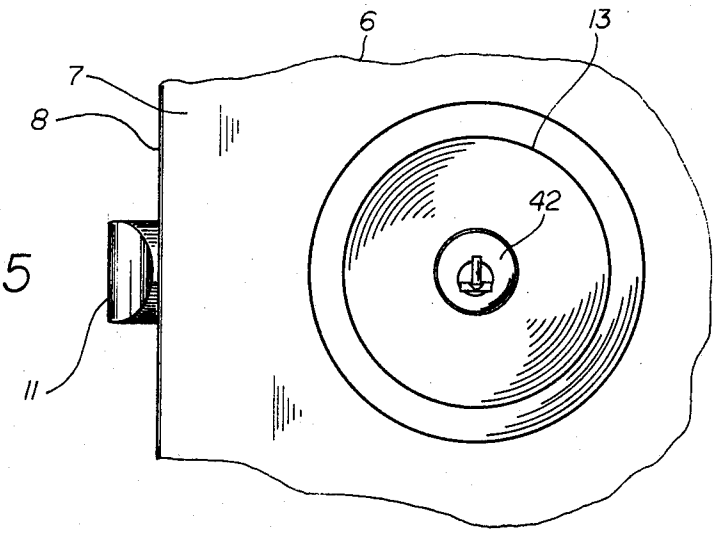


FIG. 5

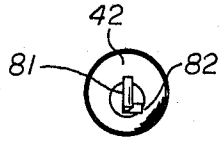


FIG. 6

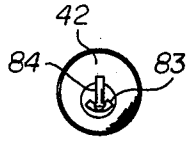


FIG. 7

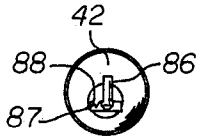


FIG. 8

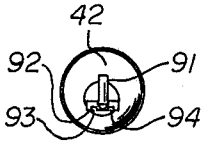


FIG. 9

INVENTOR.
ERNEST L. SCHLAGE

BY
Lothrop & West
ATTORNEYS

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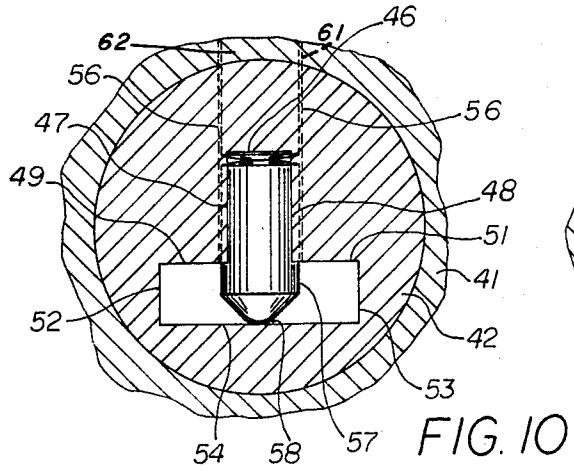


FIG. 10

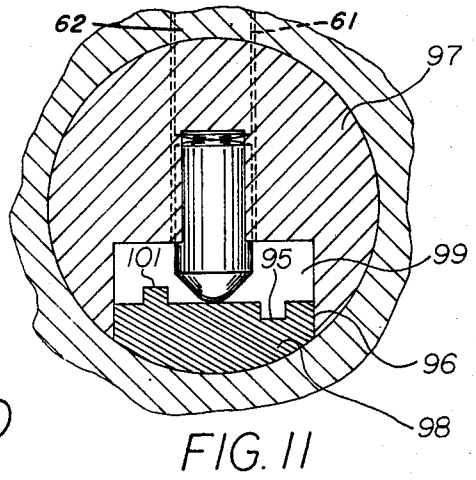


FIG. 11

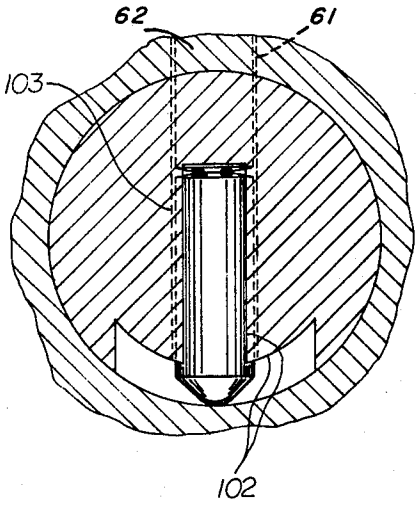


FIG. 12

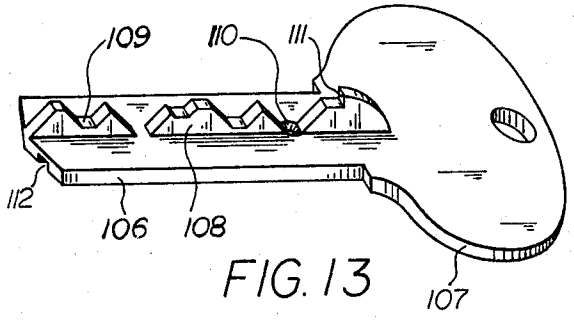


FIG. 13

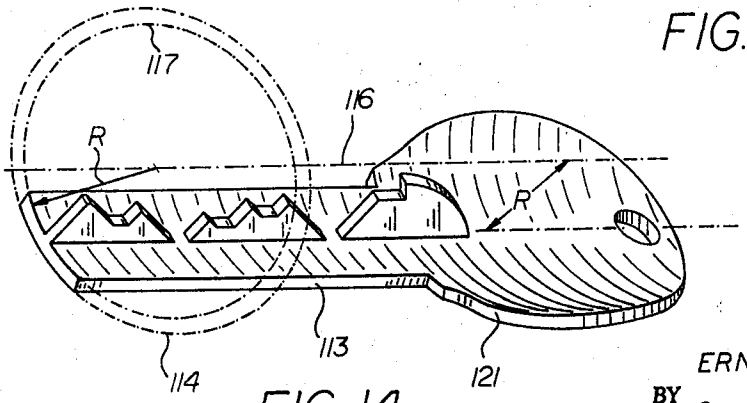


FIG. 14

INVENTOR.
ERNEST L. SCHLAGE
BY Lothrop & West
ATTORNEYS

United States Patent Office

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3,478,549

PICK RESISTANT LOCK UNIT

Ernest L. Schlage, Burlingame, Calif., assignor to Schlage Lock Company, a corporation

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Int. Cl. E05b 15/08, 63/00, 19/04
U.S. Cl. 70—421 3 Claims

ABSTRACT OF THE DISCLOSURE

A lock cylinder unit has a body with a circular cylindrical bore in which a circular cylindrical plug turns about the bore axis. At least partly formed in the plug is an axial keyway having in transverse section an upright channel and a cross channel arranged in the shape of an inverted T. A number of tumbler pin bores in the plug are arranged along the upright channel and extend into the keyway opposite the bottom wall thereof. In one rotated position of the plug, the tumbler pin bores in the plug align with respective ones of corresponding driver pin bores in the body. In that rotated position of the plug, the ends of tumbler pins in the tumbler pin bores are urged into substantial abutment with the bottom wall by spring pressed driver pins in the driver pin bores. The blunt nose of a lock pick endeavoring to advance in the keyway is blocked by the side of the tumbler pin first encountered. The sharp nose of an advancing lock pick enters the small space in the upright channel between the bottom wall and the substantially abutting end of the first encountered tumbler pin. In advancing farther, the higher body of the sharp-nosed pick lifts the first encountered tumbler pin across the shear line and thus prevents plug rotation even though subsequently encountered tumbler pins are flush with the shear line. The key for the lock cylinder unit has a portion occupying only the small space in the upright channel and is strengthened by another key portion occupying the cross channel.

My invention relates primarily to pin tumbler cylinder lock units utilized in doors and the like and is especially concerned with an arrangement to inhibit operation of the lock cylinder plug by unauthorized means.

In the customary lock unit there is a lock cylinder body within which a plug is rotatable. A keyway, usually of elaborate cross section, is formed at least partially in the plug. A number of cross bores intersect the keyway and extend through the plug and into part of the body. A tumbler pin, a driver pin and possibly other pins are disposed in linear abutment in each one of several of the cross bores. The pins are spring urged toward the opposite or bottom wall of the keyway. Customarily, the tumbler pins are held or blocked away from the opposite or bottom wall of the keyway. This allows space for the ready introduction of the V-shaped point of the proper key. Tumbler pin engaging notches in the key edge extend only partway into the key shank so as to leave sufficient material for adequate strength.

Introduction of an authorized key into the keyway moves the tumbler, driver or other pins out of their rest positions straddling the shear line into active positions with abutting ends coinciding with the shear line, thus allowing free plug rotation when the key is turned. Access in the absence of the proper key is had by manipulation of a lock pick introduced into the keyway beneath the tumbler pins. A twisting force is simultaneously put on the plug by another tool inserted into the keyway. The various tumblers are individually worked out of position straddling the shear line, are so held by slight plug rotation and when all of the tumblers have been so positioned the plug can be rotated to unlocked position. To be effective, the pick must engage the bottom end of each tumbler pin and move that pin upwardly along the pin axis. Since the customary lock can be picked in this fashion, the degree of security is less than that desired from the lock cylinder unit.

It is therefore an object of my invention to provide a lock unit in which customary lock picks cannot be effectively utilized.

Another object of the invention is to provide an improved lock unit using substantially standard parts and manufacturing methods but secure against lock picking to a higher degree than customary.

Another object of the invention is to provide a lock unit in which some manufacturing operations are simplified.

A further object of the invention is to provide a lock unit in which various key cross sections can be utilized.

A still further object of the invention is to provide a pick resistant lock unit having a deeply notched but strong key.

A still further object of the invention is in general to provide an improved pick resistant lock unit.

Other objects together with the foregoing are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIGURE 1 is an isometric view, with portions being broken away, showing a standard form of cylinder construction embodied in a lock unit on a door panel with lock picking tools in position;

FIGURE 2 is a side elevation of the structure shown in FIGURE 1 with a portion of the knob broken away on a vertical transverse plane indicating the interior construction of the cylinder with lock picking tools therein;

FIGURE 3 is a front elevation of the structure disclosed in FIGURE 1;

FIGURE 4 is a figure similar to FIGURE 2 but showing a construction pursuant to the invention with a key partially inserted;

FIGURE 5 is a view similar to FIGURE 3 but showing a construction pursuant to the invention;

FIGURES. 6, 7, 8 and 9 are front elevations of the plug portion of a cylinder construction, each keyway having a different cross sectional configuration;

FIGURE 10 is a view in cross section to an enlarged scale, the plane of section being indicated by the line **10—10** of FIGURE 4;

FIGURE 11 is a view similar to FIGURE 10 but showing a different plug construction;

FIGURE 12 is a view similar to FIGURE 10 but showing a still different plug construction;

FIGURE 13 is an isometric view showing a modified form of the key shown in FIGURE 4; and

FIGURE 14 is an isometric view showing a modified form of key.

In a typical installation of a customary lock unit a door panel **6** is mounted for swinging movement about a vertical axis and has a front surface **7** and a side surface **8**. On the side surface is a face plate **9** of a substantially standard lock unit. A latch bolt **11** reciprocates within an opening in the face plate between extended and retracted positions. Connected to the latch bolt is a hollow spindle **12** (FIGURE 2) on which a knob **13** is mounted. When the knob and spindle are rotated about an axis **14**, the latch bolt **11** is correspondingly translated.

The knob **13** carries a cylinder body **16** having an axially extending circular cylindrical bore **17** within which a cylinder plug **18** is relatively rotatable about the axis **14**. An axially extending keyway **19** of irregular cross section is formed at least partially within the plug **18**. The bottom wall of the keyway may be in the plug itself or, as is usual, the bottom wall of the keyway may be the portion of the interior wall of the bore **17** that momentarily completes the perimeter of the keyway cross section. Reference to the "bottom" wall is for convenience only since the lock units can be installed in or can occupy various different orientations. The relationship of the parts remains the same, so the phraseology applies to all positions of installation.

Intersecting the keyway are one or more tumbler pin bores **21** in the cylinder plug. These pin bores **21** are usually arranged in line with their own axes parallel to each other and normal to the axis **14**. Of any two bores, the one nearest the keyway entrance is the "near" bore and the other is the "far" bore. Corresponding driver pin bores **22** are formed in the cylinder body, particularly in a tongue extending axially and radially therefrom. One of a number of tumbler pins **23** is freely slidable in its respective bore **21** and at its upper end abuts the lower end of a driver pin **24** in the corresponding bore **22** when the pin bores are aligned as shown in FIGURE 2. Other intermediate pins are sometimes used but are not illustrated as they do not alter the mode of operation described. Coil springs **26** in the driver pin bores **22** urge the driver pins and the tumbler pins aligned therewith toward the bottom wall **27** of the keyway, in this instance identical with part of the wall of the bore **17** in the body **16**. The tumbler pins **23** do not project very far into the keyway **19**, but are blocked so as to leave a large portion of the keyway free for key insertion. Inturned shoulders or rims in the bores **21** serve as tumbler pin stops.

The standard construction described operates well upon the insertion of a proper key into the keyway and rotation of the key and plug, but can be otherwise actuated or picked. Common picking tools are shown in FIGURES 1 and 2. A thin, flat strip **31** of cranked material is introduced into the keyway. The strip **31** is pressed to impose a rotary force on the plug **18**, which does not turn appreciably since one or more of the driver pins is astride the shear line between the plug and the body. Yet, a binding force is imposed on the straddling pins. A picking tool **32** including a narrow, thin strip with an enlargement **33** on one end is also introduced into the free space in the keyway. The picking tool **32** is manipulated to position the successive tumbler pins and driver pins so that their abutting ends coincide with the shear line, thus freeing the binding force and allowing slight plug rotation to hold the displaced pins in plug releasing position. The plug can then be rotated to withdraw the latch bolt **11** to allow access to the enclosure.

Pursuant to my invention as successfully embodied for commercial use, the construction of the lock unit is as previously described up to and including the cylinder body, now designated **41**. A plug **42** (FIGURES 4–10) is rotatable within the bore **43** of the cylinder body **41** about an axis **44**. The plug **42**, as shown in FIGURE 10, does not have therein the customary keyway of somewhat meandering cross-section. Rather, I provide a special keyway characterized by an approximately T-shaped transverse section. Usually, and as shown, the T is inverted in that the cross channel is below the upright channel. The keyway is defined partly by a stop wall **46** and a pair of parallel side walls **47** and **48** merging with lateral walls **49** and **51** both in substantially the same transverse plane and extending approximately equal amounts on opposite sides of the center. End walls **52** and **53** merge with the lateral walls and also merge with a generally planar bottom wall **54**.

Formed in the plug **42** are various pin tumbler bores **56**. These are preferably parallel to each other, and may be in any number from two up to five or six or more. The bores **56** extend radially of the plug **42** with uniform cross section from the exterior or shear surface or shear line of the plug well into the keyway and to or not far from the bottom wall **54**.

A typical one of the bores **56** lodges a tumbler pin **57** having an edge-beveled, bullet-nosed or curved bottom end surface **58**. The tumbler pin **57** is freely movable along its axis within the tumbler pin bores **56** and unless displaced abuts or comes close to the bottom wall **54**. Although several tumbler pins are used, at least one of them is long enough to extend substantially from the bottom wall of the keyway to the shear line between the plug and the body. Reference to substantial abutment is intended to include either actual physical contact or a very close approach.

The body **41** has one or more driver pin bores **61** arranged in one rotated position of the plug **42** to align with the tumbler pin bores **56**. All or most of the driver pin bores are respectively provided with driver pins **62** backed by coil springs **63** urging the driver pins to abut the tumbler pins and so urging both kinds of pins toward the bottom wall **54**. Sometimes one or more master pins intervene between one or more of the driver pins and the tumbler pins, but the tumbler pin operation is the same.

In the absence of a key, at least one of the near tumbler pins **57** occupies substantially all of the vertically available room or space in the upright channel of the keyway. If an attempt is made to insert a pick or similar tool, the pick encounters a near tumbler pin. If the pick has a blunt nose, as shown in FIGURE 2, the enlargement **33** abuts the side of the tumbler pin and is so blocked from further insertion. If the pick has a sharp nose, it lifts the near tumbler pin. Even a slight lift causes the near tumbler pin to straddle the shear surface and so keeps the plug from being turned. Even though the pick actually passes beneath the near tumbler pin and engages the end of and lifts a far tumbler pin or lifts all the far tumbler pins to shear line position, the lifted near tumbler pin prevents plug rotation. The same action occurs with other pairs of near and far tumbler pins should one or more of the near pin bores be vacant. The lock is consequently much more nearly pick-proof than the usual construction.

To actuate the lock, a key **71** is provided. In its active shank portion, the key is T-shaped in cross section to fit snugly and slidably within the keyway. The cross bar **72** of the key is a sliding fit within the cross or transverse channel of the keyway, whereas the upright leg **73** of the key is a sliding fit within the upright channel of the keyway. The cross bar **72** and the upright leg **73** are securely fastened together, if made of two pieces, or are formed integrally. The leg **73** merges with a coplanar bow or grip portion **74** adapted to be engaged by the thumb and fingers of the user, while the cross bar **72** preferably tapers and curves around at least a part of the grip portion to afford a reinforcement and grip pockets.

The T-shaped key section is a stiff beam and is quite strong in resisting torque about the axis **44**. In fact, since the cross bar **72** is easily made massive for any desired beam strength and to transmit almost any desired torque, the upright leg **73** need not have any beam or torque strength of its own. The serrated surface **76** of the leg **73** can be provided with deep notches having walls **77** extending entirely through the leg **73** and down to and even through the cross bar **72** itself. In the usual key, the notches, especially adjacent the bow portion **74**, are shallow in order to leave sufficient material to afford adequate beam and torque strength in the key. This sacrifices many otherwise possible notch patterns. In the present key the upright leg **73** is not relied upon at all for beam or torque strength. Any or all of the notches can therefore be cut to full depth, thus making available the full gamut of notch patterns.

The serrated edge **76** has an inclined forward end surface **78** approaching or even encroaching upon the cross

bar **72**. The surface **78** can engage under the end surface **58** of the tumbler pins and so cam the tumbler pins upwardly from their lowermost position even through they are against or very close to the bottom of the keyway. When the proper key is fully inserted, the pins are all in position to coincide at their ends with the shear surface and the plug can be rotated in the body in the customary fashion.

Reference to a T-shaped cross section for the keyway and key is intended to include all of the cross-sectional shapes shown herein and equivalents thereof. For example, as illustrated in FIGURE 6, one of the portions of the cross channel can be eliminated to provide a keyway something like an L-shape but still having an upright channel **81** and a partial cross channel **82**. In FIGURE 7 a variation of the T-shape is shown in which a curved cross channel **83** joins an upright channel **84**. In FIGURE 8 is shown a keyway **86** that is T-shaped and has an intrusion **87** or irregularity extending from a bounding surface **88**. To operate in such a keyway, the corresponding key is provided with a groove or complementary irregularity in its meeting surface. The intrusion **87** or irregularity excludes keys which do not have the appropriate groove or complementary irregularity.

FIGURE 9 shows a keyway **91** having a bottom surface **92** with one or more intrusions **93** and **94**. The only keys which can enter the T-shaped keyway **91** are keys with slots therein accommodating the intrusions **93** and **94**.

Preferably the cross bar of the key section is defined by any one of several variations on the upper depending intrusions, like **87**, of FIGURE 8 and the lower, upstanding intrusions or irregularities **93** and **94** of FIGURE 9. The intrusions can be made of a unit size or multiples of the unit size and can be arranged in chosen numbers on opposite sides of (above and below) the cross bar of the keyway. Proper T-shaped keys have corresponding longitudinal channels overriding the intrusions. As shown in FIGURE 11, the keyway may have not only an intrusion but may have a groove **95**, the key being correspondingly contoured.

The key notching along the upright leg **73** and the key "section" as defined by the contour of the shank to meet the intrusions and the depressions or grooves of the keyway are entirely independent. Notching can be done as desired without substantially affecting the cross bar, and the cross bar can be contoured or "sectioned" as desired without affecting the notching. Each has its own territory and does not, as is the ordinary case, encroach upon the territory of the other.

The T-shaped keyway can be formed in the plug by various techniques. Keyways entirely surrounded by one body of material can be formed by casting or by powder metallurgy sintering, for example. As an alternative, the construction shown in FIGURE 11 may be employed. In this instance, a channel **96** is cut or otherwise formed along the plug **97** and an insert **98** is positioned and held therein partly to define the keyway **99**. The insert can be changed from time to time in order to present different intrusions **101** and grooves **95** and thus change the accessibility of the plug to various keys.

The T-shaped keyway can be located in the plug in various locations. In FIGURES 4 to 11, for example, the keyway bottom wall is disposed close to the lower end of the usual tumbler pins and so is relatively far from the outside of the plug. By moving the bottom of the T-shaped keyway to or toward the bottom of the plug and by using longer tumbler pins, as shown in FIGURE 12, several advantages are gained. The keyway **102** is easily formed by broaching or milling and does not require special manufacture or a special insert like the insert **98** since the plug bore wall serves as the bottom wall of the keyway. The extra height of the upright channel of the keyway and of the tumbler pin bores **103** allows for longer pins and more pin increments than usual and so allows for many more pin combinations with the same increment.

The T-shaped keys also can be varied. In the FIGURE 13 embodiment, the cross bar **106** of the shank is enlarged and extended in the same plane so as to form a grip portion **107** or bow. The center leg **108** carries notches **109** of any depth, even a notch **110** or notches extending through the shank cross bar. The center leg may project into the grip portion and may be extended to provide a stop wall **111** to limit the depth of insertion of the key into the keyway. The cross bar **106** may be contoured in cross section by the provision of one or more grooves **112** or protrusions to match the corresponding keyway.

As shown in FIGURE 14, the cross bar **113** of the key can be substantially arcuate in cross section to be readily received by keyways of the cross-sectional shapes shown in FIGURES 7 and 12, for instance. The arcuate cross bar outer surface is defined by a portion of a circle **114** centered on the cylinder and plug axis **116**. The arcuate cross bar inner surface is defined by a portion of a circle **117** at a selected radial distance R from the axis **116**. Notches in the central leg can, if desired, extend to the inner surface defined by the circle **117**. They can even penetrate the cross bar as in FIGURE 13. The bow **121** or grip portion of the key may be itself planar, merging smoothly with the arcuate cross bar, or may be slightly dished as a continuation of the arcuate cross bar. The bow **107** as well as the bow **121** is offset or displaced from the turning axis **116** an amount approximately equal to the distance R. This eccentric location of the bow is useful in orienting the key by touch and in practice turning the keys of FIGURES 13 and 14 is a more comfortable rotary motion than the usual co-axial twist. The user inserts the key into the keyway by grasping the bow portion between his thumb and fingers with the thumb against the inner surface. The center of his thumb end is then about on the axis **116** and his thumb and forearm are about in line with that axis. Rotation of the key is accomplished not just by a twist of the key bow, but rather by a rotation of the key bow bodily around the axis. The longitudinal central axis of the user's thumb in effect then rotates approximately concentrically on the axis **116**. This in practice is a comfortable operation even through the work done by key is considerable.

What is claimed is:

1. A pick resistant lock unit comprising a cylinder body, means in said body defining a plug bore extending along an axis, a plug within said plug bore rotatable about said axis, means partially in said plug forming an axially extending, inverted T-shaped keyway having an upstanding portion and a lateral portion and having a bottom wall defined by said plug bore, an insert disposed in and extending laterally across said lateral portion of said keyway with one wall of said insert abutting said plug bore and the opposite wall of said insert exposed, means forming an axially extending irregularity on said exposed wall, means in said plug defining a tumbler pin bore intersecting said upstanding portion of said keyway opposite said exposed wall alongside said irregularity, means in said body defining a driver pin bore adapted to align with said tumbler pin bore in one rotated position of said plug in said body, and a tumbler pin in at least one of said pin bores movable into and out of substantial abutment with said exposed wall, the length of said tumbler pin being substantially equal to the distance from said exposed wall to the opposite end of said tumbler pin bore.

2. A device as in claim **1** including a key adapted to be received in said keyway and having a substantially T-shaped transverse contour complementary to said keyway and having a complementary longitudinally extending irregularity on the cross bar of said key.

3. A key as in claim **2** in which the central leg of said key is extended axially outwardly in the same plane to

provide a grip portion and the cross bar of said key is extended around at least part of said grip member.

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MARVIN A. CHAMPION, Primary Examiner

ROBERT L. WOLFE, Assistant Examiner

U.S. Cl. X.R.

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