# United States Patent

[11] 3,572,070


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[54] SETTABLE KEY AND SETTING MECHANISM FOR TUBULAR LOCK

8 Claims, 11 Drawing Figs.


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[51] Int. Cl. ..... E05b 19/18
[50] Field of Search ..... 70/411, 394, 384, 395, 398, 363; 33/174 (F), 174 (H); 81/3; 70/431



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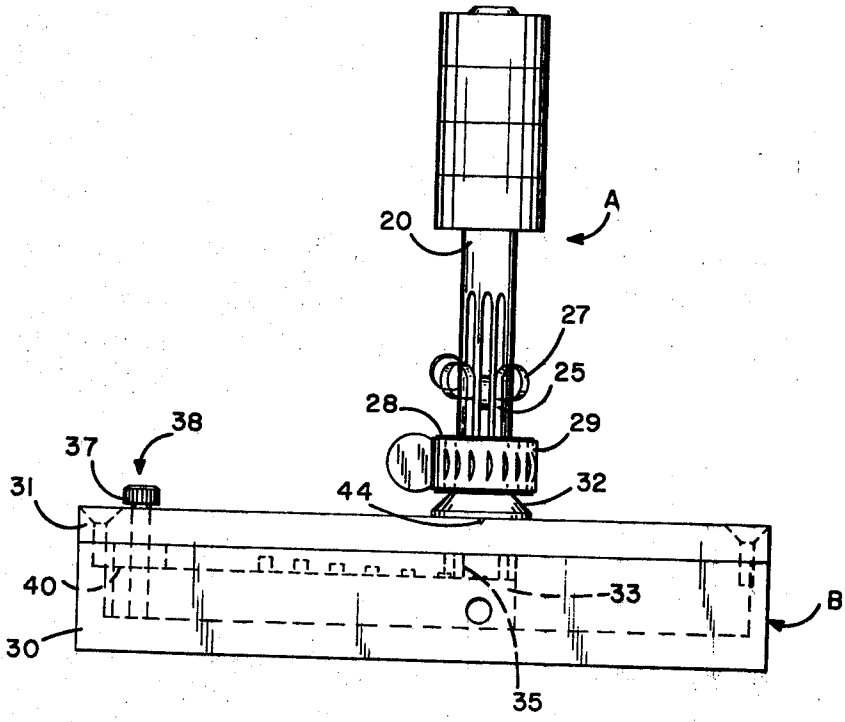
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ABSTRACT: An elongated block having a plurality of abutments of successively varying height aligned lengthwise of its upper surface, is mounted for longitudinal slidable movement in a boxlike housing. A key-receiving bushing is fitted into the top of the housing with the path of movement of the abutments extending through a notch in the bushing. Detent means centers any selected one of the abutments in the notch in the bushing bore. A settable key for a tubular lock comprises a tubular body insertable in the bushing and having a plurality of tumbler-actuating pins mounted for independent longitudinal adjustment in individual grooves located symmetrically about the periphery of the body. The pins are enclosed by an encircling resilient sleeve enclosed by a compressible steel band. With the key inserted in the bushing and bearing on the block, the pins are adjusted in predetermined sequence to contact code-determined ones of the abutments and are retained in adjusted or set position by the resilient pressure of the band enclosed sleeve.

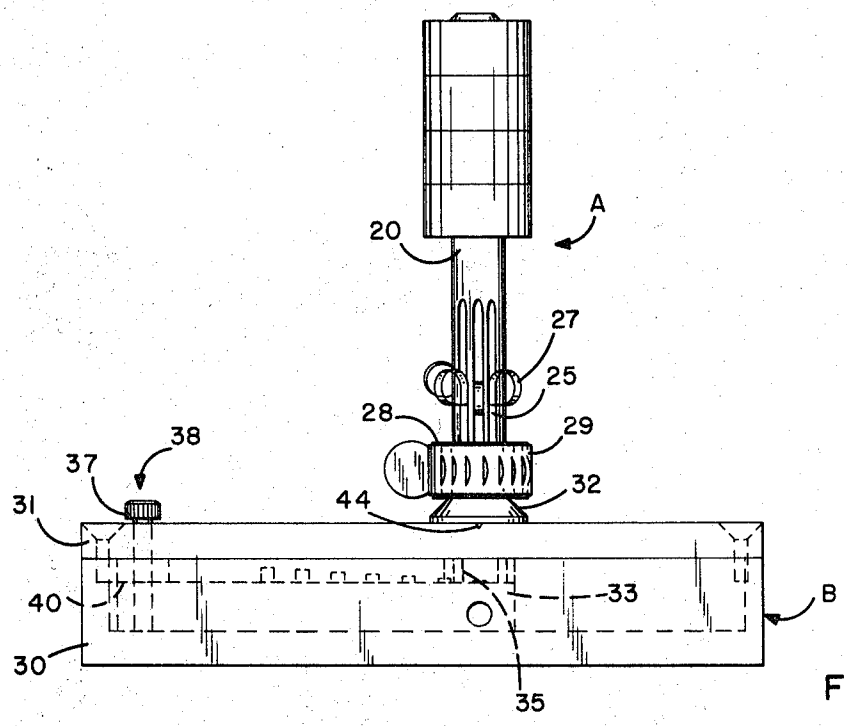



FIG.1

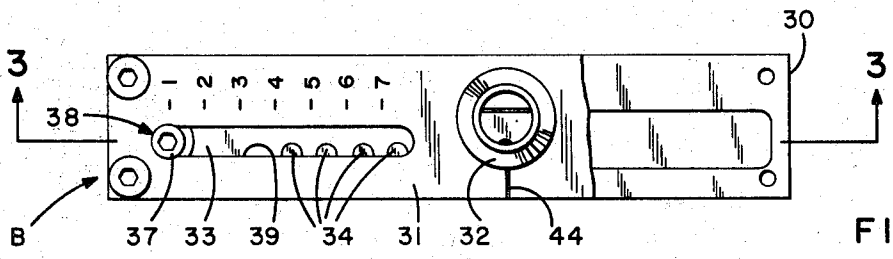



FIG.2

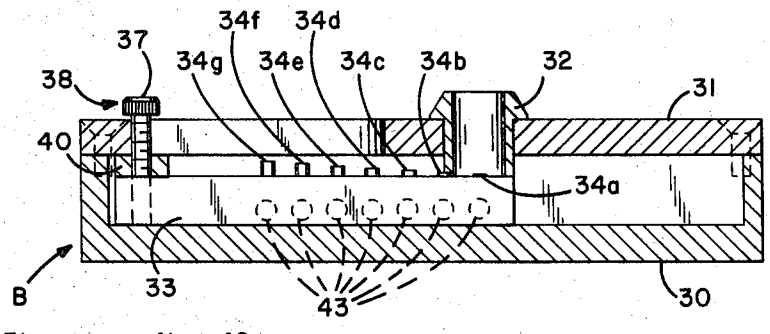



FIG.3

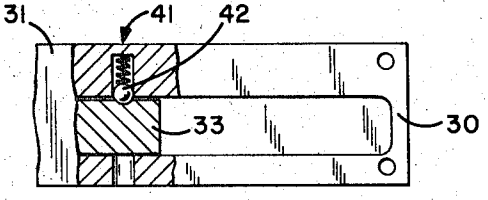



FIG. 4

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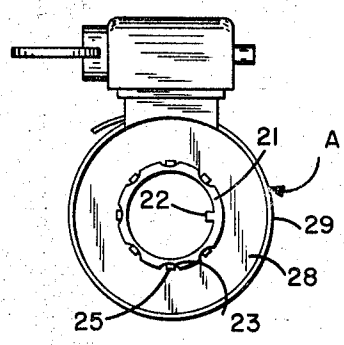



FIG. 5

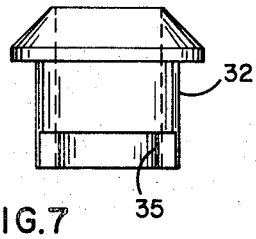



FIG. 7

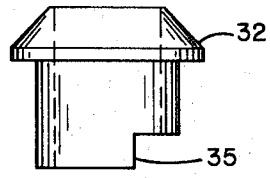
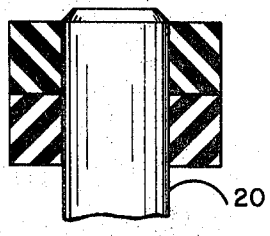



FIG. 8



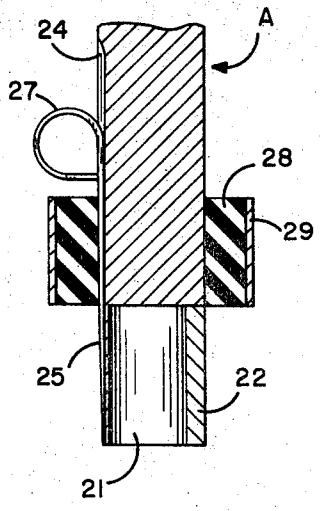




FIG. 6

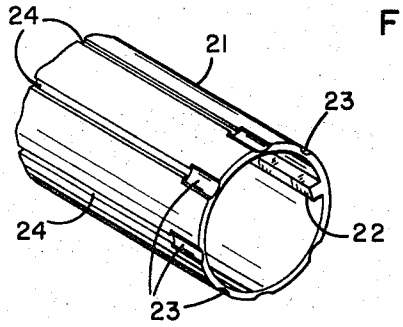



FIG. 9

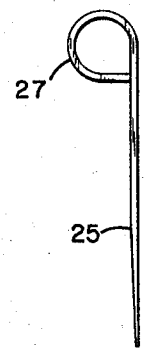



FIG. 11

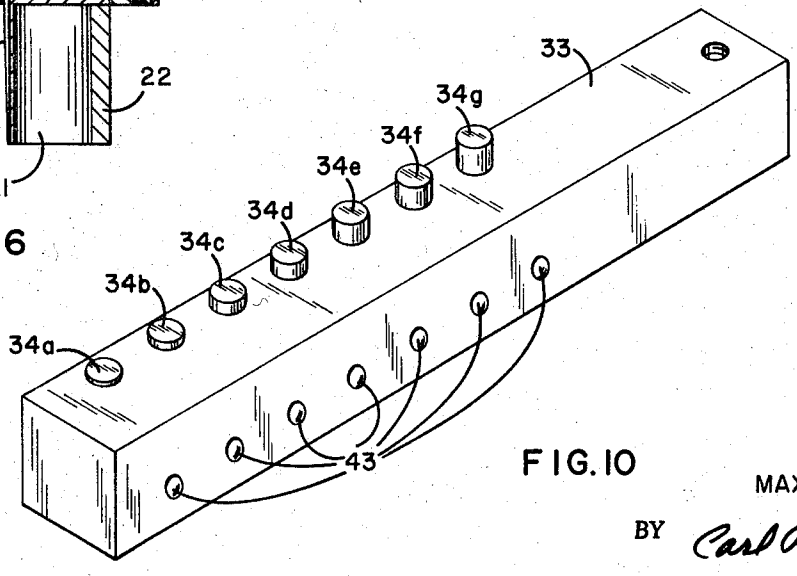



FIG. 10

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# SETTABLE KEY AND SETTING MECHANISM FOR TUBULAR LOCK

## BACKGROUND OF THE INVENTION

Tubular type locks having a plurality of axially spring biased tumblers of different code-determined lengths, arranged in axially parallel relation, at equal radial distances from a central axis to define a cylinder, are now widely used in many types of coin-controlled mechanisms. A key used to open the lock is tubular and has a radially inwardly extending locating ridge positioned to enter a notch in a circular keyhole in the lock when the key is inserted therein to properly position the key in the lock. The diameter of the tubular key is slightly greater than that of the cylinder defined by the radially inward sides of the tumblers However, tumbler-receiving grooves are provided in the periphery of the key to receive the tumblers, each groove being of code-determined axial length complementary to the code-determined length of its associated tumbler so as to bring the other ends of the tumblers onto a common plane transversely of the central axis of the tumblers, which allows the lock to be turned for opening.

At present, when a service man goes out on a route to service machines using this type of lock, he usually takes along a large number of keys, one for each of the machines to be serviced. However, if it should become necessary for him to service some other machine while he is out, he would have to return to his office to get the key for such other machine, since it would be impractical for him to carry the enormous number of keys required for all of the machines in use in a city or town of even medium size. The need for a settable key for emergency use arises quite frequently, for example, in the case of a "ringer" i.e., the sounding of an automatic alarm which indicates that a machine is being tampered with or pilfered or when the services of a locksmith are required. While some steps have been taken toward the provision of a settable key which could be adjusted to the code requirements of an individual lock of this type and means for setting such key, none is presently available which is precise and compact enough to meet the needs of ordinary route or locksmith use.

## SUMMARY OF THE INVENTION

It is a general objective of this invention to provide a settable key for a tubular lock, together with a mechanism for setting the key in accordance with a code individual to each lock for which the key is to be used. The objective is attained in general terms by providing a tubular key having a required number of adjustable, tumbler-engaging pins mounted about its periphery to register with the tumblers of a lock into which the key is inserted, together with a setting mechanism for adjusting the individual pins of the key to selective, code-determined distances from the end of the key.

The foregoing objectives and advantages of the invention will be apparent from the following description of a presently preferred embodiment of the invention and the accompanying drawings thereof, wherein:

FIG. 1 is a side elevational view of a settable key inserted in a key-setting mechanism, interior portions of the key-setting mechanism being shown in broken lines;

FIG. 2 is a top plan view of the key-setting mechanism of FIG. 1;

FIG. 3 is a sectional view taken along lines 3–3 of FIG. 2, the sliding block being shown in elevation;

FIG. 4 is a fragmentary top plan view generally similar to the right-hand portion of FIG. 2, portions being broken away to show the detent mechanism for holding the sliding block in adjusted position;

FIG. 5 is a bottom end view of the key shown in FIG. 1;

FIG. 6 is a longitudinal, sectional view of the key shown in FIGS. 1 and 5;

FIG. 7 is a diametrical, side elevational view of the key-receiving bushing looking into the notch;

FIG. 8 is a side elevational view of the bushing rotatively offset 90° from its position in FIG. 7;



FIG. 9 is a fragmentary, perspective view of the tubular lower or operating end of the body of the key shown in FIGS. 1, 5, and 6;

FIG. 10 is an enlarged perspective view of the sliding block, showing the opposite side thereof from that shown in FIG. 3; and

FIG. 11 is an enlarged side elevational view of one of the adjustable tumbler actuating pins of the key.

Referring to the drawings in detail, a settable key A comprises a body 20 having a tubular operating end portion 21 of a size to enter the circular keyhole of a tubular lock of a type for which the invention is intended. A radial inwardly projecting locating ridge 22 is provided in the end portion 21, and seven tumbler-receiving grooves 23, one for each tumbler of a lock for which the key is intended, are provided in the periphery of the tubular end portion 21. One groove 23 is centered in each of seven octants of the tubular end portion 21, while the locating ridge 22 is in the eight octant. A tubular lock and its tumblers of the type for which the present invention is intended are not shown, but such locks are well known to those associated with the art of coin controlled mechanisms. Each tumbler-receiving groove 23 in the key end portion 21 is of an axial length which will permit the maximum projection required of any tumbler intended to fit therein when the key A is inserted in a lock to open it. A smaller, pin-receiving groove 24, see FIG. 9, extends longitudinally from the center of each tumbler-receiving groove 23, and a tumbler-actuating pin 25, of stiff metal, such as mild spring steel, and having a handle loop 27 formed on its upper end, is mounted for longitudinal, slidable adjustment in each of the smaller grooves 24. A resilient sleeve 28, which may be of rubber or neoprene, fits snugly around the key body 20 and the pins 25 in their respective grooves 24, and an adjustable compression band 29, which may be a conventional hose clamp with a screw type-tautening mechanism fits around the sleeve 28 and may be tautened to exert a desired restraining pressure on the pins 25 to anchor them in adjusted position.

For adjusting the pins 25 to selected code-determined positions, a setting mechanism B is provided and comprises a boxlike housing 30 with a flat cover 31. A key-receiving bushing 32 is mounted in a hole provided therefor in the housing cover 31, the bushing being of a length to have bearing engagement with an elongated block 33, which fits for longitudinal sliding movement in the housing 30. The top of the block 33 is spaced from the housing cover 31 by a distance sufficient to provide clearance for the highest of a plurality of pin-setting abutments 34 which are mounted in longitudinally aligned, spaced relation on the upper side of the block 33. A notch 35, see FIGS. 7 and 8, in the lower end of the bushing 32 provides clearance for the abutments 34 as the block 33 is moved lengthwise in the housing 30 to center a selected one of the abutments 34 in the bushing notch 35.

Each of the abutments 34 is in the form of an axially upright cylinder of a diameter equal to, or less than, that of the tumblers of a lock for which the key A is intended and any of the abutments when centered in the notch 35 is the same radial distance from the axis of the bushing 32 as the radial distance of the tumblers of a lock for which the invention is intended from their central axis. Seven of the abutments 34 are provided, varying in height progressively, by code-determined increments, from the shortest 34*a* to the longest 34*g*. In the illustrative key-setting mechanism B, each such increment is assumed to be .016 inches, which conforms to the incremental difference between the coded lengths of the tumblers of a well-known type of tubular lock for which the illustrative embodiment of the invention is intended. Since there are seven tumblers in a lock for which the illustrative invention is intended, and each tumbler may be any of seven code-determined lengths, it is obvious that several hundred thousand code combinations are possible.

An actuating knob 37, for moving the block 33 to center a selected one of the seven abutments 34 in the bushing notch 35, comprises the head of a machine screw 38 which projects

above the housing cover **31**. The threaded end of the screw **38** is screwed into a threaded hole provided therefor in the sliding block **33** and rides in a slot **39** provided in the housing cover **31**. A lock nut **40** threads on the screw **38** and locks the screw **38** in its threaded engagement with the sliding block **33**.

Detent mechanism **41** for centering a selected abutment **34** in the bushing notch **35** comprises a spring-pressed ball **42** mounted in a blind hole in a side of the housing at a height to enter in succession each of seven spherical indentations **43** provided along the facing side of the sliding block **33**. Each indentation **43** is in alignment transversely of the block **33** with one of the abutments **34** and the center of the spring-pressed ball **42** is in a transverse plane of the housing **30** diametrically of the bushing **32**. Thus, as each indentation **43** is entered by the spring-pressed ball **42**, its associated abutment **34** is entered in the bushing notch **35**.

Indicia numbers **1—7** are provided alongside the slot **39** in the cover **31** with an indexing line alongside each indicia number. These numbers are so located that when the block actuating knob **37** is in indexed, detent-anchored position opposite the number **1**, the abutment **34*a*** is centered in the bushing notch **35**, and so on.

A sighting line **44** is provided on the upper surface of the housing cover **31** in the transverse plane of the housing diametrically of the bushing **32**, so that by sighting along this line an operator can align a selected one of the pins **25** of a settable key A inserted in the bushing **32** as shown in FIG. **1** with a selected one of the abutments **34** centered therebeneath by the detend mechanism **41**.

## OPERATION

In using the invention, a service man out on a route, or a locksmith servicing a machine, would telephone in and be given the code number for a specific lock to be opened. It will be assumed that the code number for such specific lock is **1-3-5-8-4-7-6** and that these code numbers refer to the code height, in increments of .016 inches, of the tumblers located clockwise around the lock as viewed looking at the keyhole and beginning with the first tumbler clockwise from the notch into which the locating ridge **22** fits.

In preparing or setting his key A for opening the lock, the service man or locksmith initially withdraws all seven of the pins **25** endwise clear of their respective tumbler-receiving grooves **23**, and inserts the tubular end portion **21** in the bushing **32** of his key-setting mechanism B to bear on the block **33** as shown in FIG. **1**. He then moves the sliding block **33** by means of the knob **37** to position the knob opposite the indicia number **1** on the cover **31**, which is the first digit of the assumed code number. At this point the detent **41** anchors the block **33** with the abutment **34*a*** centered in the bushing notch **35**. The operator then turns the key A in the bushing **32** to bring the first pin **25** to the left of the locating ridge **22** of the key A, as viewed along the sighting line **44**, into alignment with said sighting line, and adjusts this first pin downwardly into endwise engagement with the abutment **34*a*** therebeneath, thereby adjusting the first pin to code-determined height. He then turns the key A counterclockwise to center the next successive pin **25** in alignment with the sighting line **44**, moves the knob **37** into index position opposite the indicia number **3** on the cover **31**, the second digit of the code, and adjusts said second pin **25** downwardly into endwise engagement with the abutment **34*c*** therebeneath. The same procedure is repeated for setting the remainder of the pins **25** in accordance with their respective code designations. The band **29** is then tightened, if necessary, to insure that the pins **25** will not slip during use and the key A is ready to open the lock for which it has been set.

The invention provides a simple, inexpensive, compact and easily used mechanism for opening any tubular lock of the type designated, provided the code number of the individual lock is known.

I claim:

**1.** A key-setting mechanism for setting to code-determined position each of a plurality tumbler engaging members of a key for a tubular lock, each tumbler-engaging member being constructed and arranged for adjustment axially of the key, said setting mechanism comprising;

a support with an opening therein for receiving the end of the key having a plurality of axially movable tumbler engaging members;

a plurality of abutments of varying, code-determined, incremental heights positioned on a surface below said opening;

means for positioning each of said abutments in alignment with each of the tumbler-engaging members with the end of the key being movable through said opening into engagement with said surface;

said opening having sufficient diameter for rotating the end of the key therein;

said surface comprising a block mounted for movement in guided relation to the support and transversely beneath the key-receiving opening in position to have arresting, abutting relation with the end of the key inserted through said opening.

**2.** A settable key for a tubular lock of the type having a plurality of axially spring biased tumblers arranged in axially parallel relation about a central axis to define a cylinder, and having a circular keyhole centered on the axis and having an indexing element therein, said key comprising;

a body having a tubular end portion for insertion in indexed position through the keyhole into the lock;

a plurality of endwise adjustable tumbler-engaging members mounted at circumferentially spaced intervals about the key body for axial alignment of one tumbler-engaging member with each lock tumbler when the body end position is inserted in indexed position in the keyhole;

means resiliently pressing on each tumbler-engaging member for retaining said tumbler-engaging members in endwise adjusted position on the body end portion during adjustment of the tumbler-engaging members,

means for increasing the pressure of the means pressing on each tumbler-engaging member for anchoring the tumbler-engaging member in adjusted position on the body end portion for actuating, against their spring bias, the tumblers of a lock for which the key is intended,

the resilient means for lightly retaining the tumbler-engaging members in adjusted position comprises a short tubular portion of rubber like material;

and the means for increasing the pressure on the tumbler-engaging members comprises a band of relatively nonstretchable material surrounding the tubular portion and having means for tautening the band;

the relatively nonstretchable band and its tautening means is a conventional hose clamp;

a block mounted for guided movement on the support beneath the key receiving opening, and positioned to engage and arrest a key body end portion inserted in such key-receiving opening;

a plurality of abutments of incremental, code-determined heights on the block and positioned for guided movement along a path located to position in sequence selected ones of the abutments beneath selected tumbler-engaging members of a key body end portion inserted in the key-receiving opening and turned to position such tumbler-engaging members in selected sequence on a diametrical plane of the key-receiving opening disposed transversely across the path of movement of the abutments past said plane;

a means for securely anchoring the tumbler-engaging members in code-determined position for tumbler actuation.

**3.** A key-setting mechanism for setting to code-determined position, each of a plurality of tumbler-engaging members of a key for a tubular lock, each tumbler-engaging member being constructed and arranged for adjustment axially of the key, said setting mechanism comprising;

a support with an opening therein for receiving the end of a key, which key has a plurality of axially movable tumbler-engaging members;

said support has a surface below said opening with a series of abutments of progressive, code-determined, incremental heights rigidly secured on said surface below said opening and in a position to be contacted by said tumbler-engaging members and being incompressible and immovable relative to said surface;

means for selectively positioning each of said abutments individually in alignment with each of said tumbler-engaging members individually, and said alignment being selectively changeable;

and the end of the key is movable through said opening into engagement with said surface with one of said tumbler members engaging one of said abutments whereby the axial positioning of said tumbler member is said equal to the height of said abutment on said surface.

4. A key-setting mechanism as defined in claim 3 wherein;

said positioning means includes means for moving said abutments in sequence individually beneath each one of the movable tumbler-engaging members.

5. A key-setting mechanism as defined in claim 4 including;

means for releasable holding said abutments in given positions, in which positions each abutment is located in alignment with the height of a given one of the tumbler engagement members relative to said surface.

6. A key-setting mechanism as defined in claim 3 including;

indicia means for indicating the position of each abutment relative to each of the tumbler-engaging members.

7. A key-setting mechanism as defined in claim 1 which;

said support is an elongated housing having an elongated opening therein;

and said block is mounted for longitudinal, slidable movement in said elongated opening.

8. A key-setting mechanism as defined in claim 7 including;

a block positioning member that projects through a slot in said housing is connected to the block for movement therewith;

and indexing indicia is marked on said housing adjacent each position of said block positioning member in which the abutment is aligned with one of the movable tumbler-engaging members.