

[54] MULTIPLE-AXIAL-PIN TUMBLER LOCK

[72] Inventor: **Ronald F. Sturgeon**, 25 Linden Road, Bognor Regis, Sussex, England

[22] Filed: **Dec. 3, 1968**

[21] Appl. No.: **780,637**

[30] Foreign Application Priority Data

Dec. 7, 1967 Great Britain.....55,660/67

[52] U.S. Cl.70/363, 70/367, 70/378, 70/419

[51] Int. Cl.E05b 15/14, E05b 27/08

[58] Field of Search.....70/363, 367-369, 70/378, 386, 389, 419-421, 370, 371

[56] References Cited

UNITED STATES PATENTS

3,204,437	9/1965	Drefus.....	70/350
3,270,538	9/1966	Kerr	70/363
1,619,252	3/1927	George.....	70/363
2,525,344	10/1950	Garniss.....	70/364
3,380,268	4/1968	Perrill.....	70/363

3,339,384	9/1967	Greenwald	70/363
913,942	3/1909	Bodge.....	70/364
1,891,214	12/1932	Falk.....	70/368
2,292,515	8/1942	George.....	70/363

FOREIGN PATENTS OR APPLICATIONS

940,428 10/1963 Great Britain.....70/363

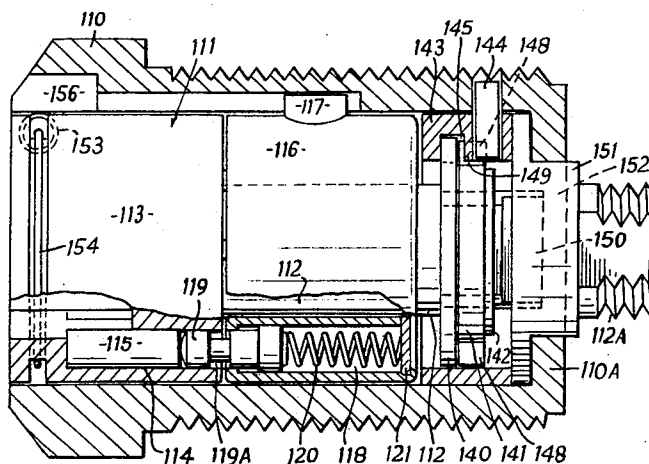
Primary Examiner—Robert L. Wolfe

Attorney—Laforest S. Saulsbury

[57] ABSTRACT

A key-operated lock of the multiple-axial-pin tumbler type comprises a stationary magazine carrying driver pins and a rotary magazine carrying spring-loaded pins, and is provided with the following features: (a) the key comprises a tubular shaft and has fingers which are clamped in position in axial grooves around the shaft and which are replaceable to adapt the key readily to any one of a range of lock combinations; (b) the stationary magazine is removable or has a removable part to permit withdrawal and rearrangement or replacement of the pins; and, (c) the spring-loaded pins have non-uniform strokes to increase the difficulty of determining the pin depressions required to open the lock.

3 Claims, 11 Drawing Figures



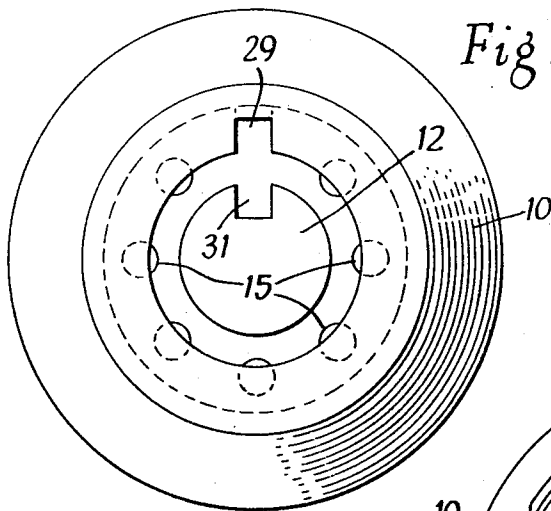
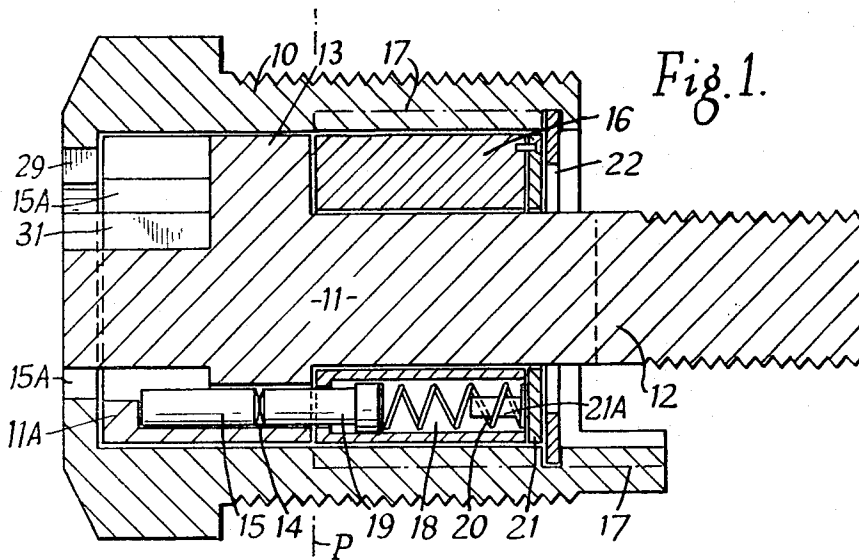
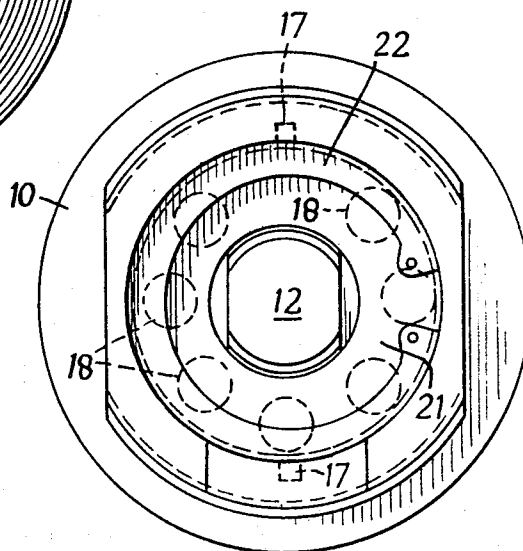
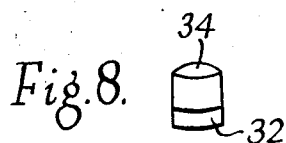
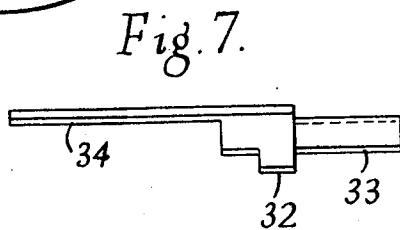
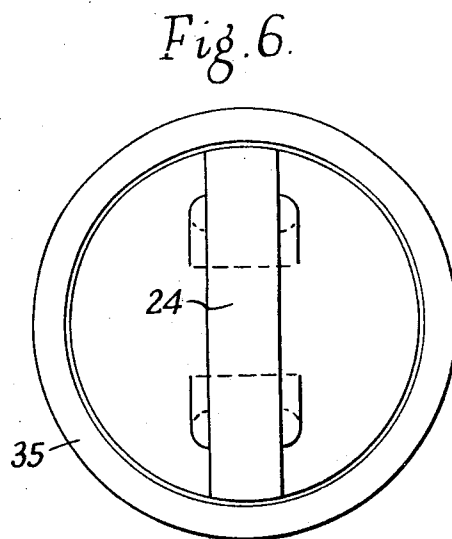
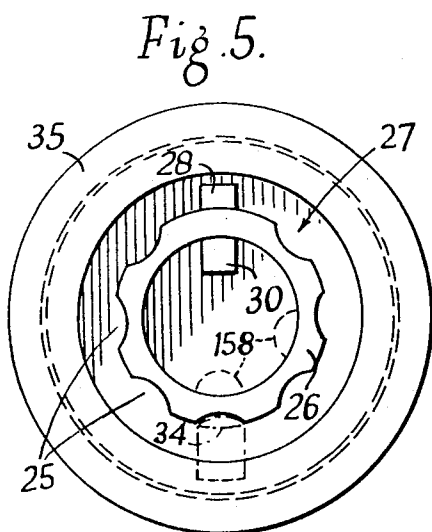
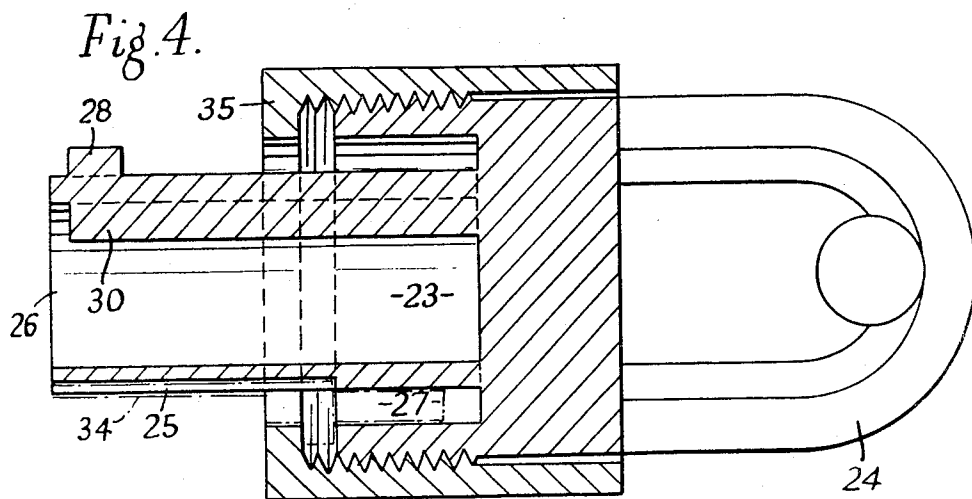


Fig. 3.

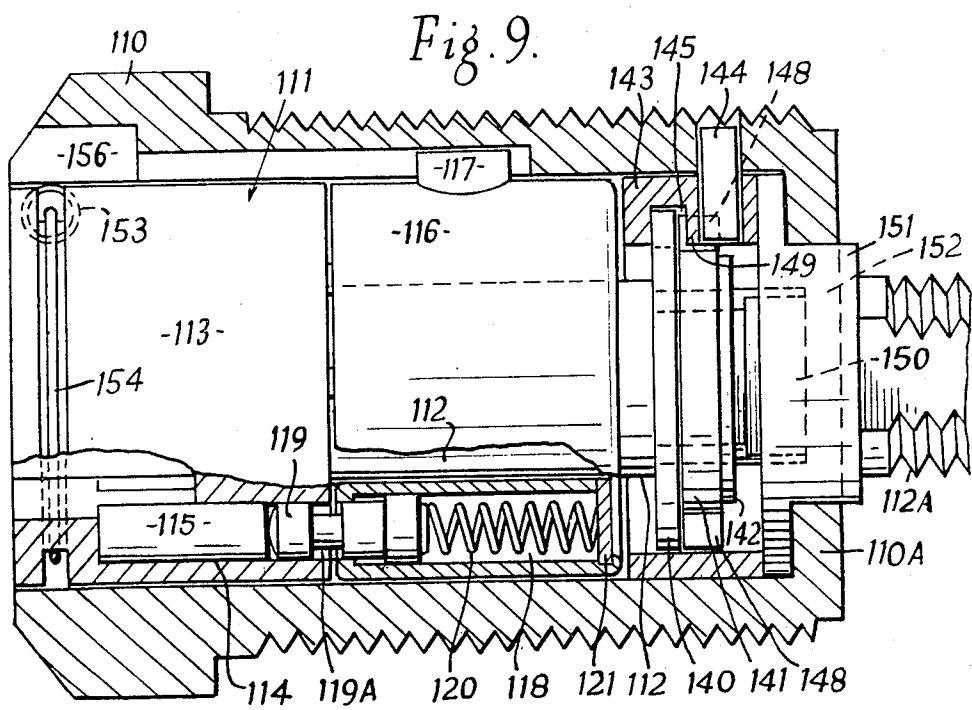


Ronald Frederick Sturgeon,
Inventor.

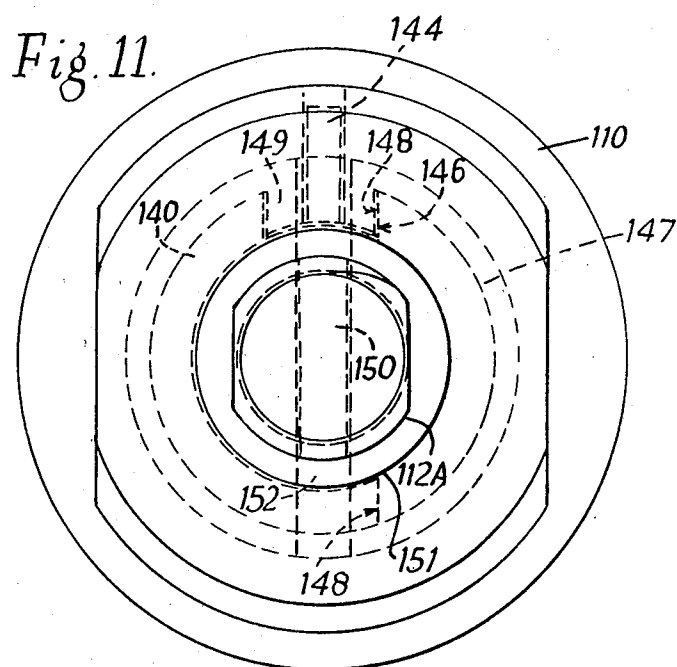
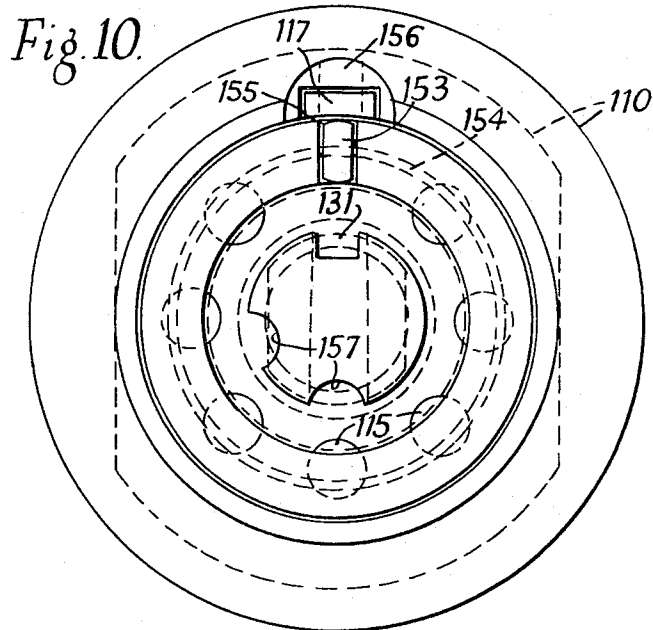
By *Polach & Saulsbury*
ATTORNEYS



Ronald Frederick Sturgeon,
Inventor.
By *Glacher & Saulsbury*
ATTORNEYS



Ronald Frederick Sturgeon,
Inventor.
By *Polach & Sandberg*
ATTORNEYS



Ronald Frederick Sturgeon
Inventor.
By *Goldacker & Saulsbury*
ATTORNEYS

MULTIPLE-AXIAL-PIN TUMBLER LOCK

BACKGROUND OF THE INVENTION

This invention relates to key-operated locks of the multiple-axial-pin tumbler type, and to the keys for such locks.

Multiple-axial-pin tumbler locks are operated by a tubular key having its working end shaped to coact with a ring of pairs of axial pins in the lock body. The outer or driver pins of each pair are of different lengths and the locks can be turned when the contacting faces of each pair of pins are aligned in a plane which separates a stationary magazine in which the inner spring-loaded pins are slidable, from a magazine in which the outer pins are slidable and which may be turned by the key. Examples of such locks are described in British Pat. Nos. 940,428 (Lowe & Fletcher Ltd.) and 1,106,193 and 1,132,531 (Chicago Lock Co.).

It is an object of the present invention to provide, for a lock of the above multiple-axial-pin type, a key which can be adapted to any required one of a range of lock combinations.

It is another object of the present invention to provide a lock of the above type in which the lock combination can be changed without special tools.

It is a further object of the present invention to improve the degree of safety against unauthorized opening in a lock of the above type.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a key comprising a tubular shaft adapted to be inserted into the lock and formed on its outer face with a series of axial recesses, a set of locking fingers of selected lengths seated in said recesses, and clamping means holding said fingers selectively in position in register with said recesses which support the fingers.

In further accordance with the present invention there is provided a multiple-axial-pin tumbler lock in which the stationary magazine is removable or is formed with a closure member which is removable, to permit withdrawal and rearrangement or replacement of the pins.

In further accordance with the present invention there is provided a multiple-axial-pin tumbler lock in which said inner pins are also of different lengths or otherwise have different full strokes.

Other objects and features of the invention will appear from the following descriptions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevation showing one form of a seven-axial-pin tumbler lock according to the invention;

FIG. 2 is a front view corresponding to FIG. 1;

FIG. 3 is a rear view corresponding to FIG. 1.

FIG. 4 is a sectional view showing a key according to the invention, for the seven-axial-pin tumbler lock;

FIGS. 5 and 6 are end views corresponding to FIG. 4;

FIGS. 7 and 8 are side and end elevations showing a key finger;

FIG. 9 is a largely sectional elevation showing another form of seven-axial-pin tumbler lock according to the invention;

FIG. 10 is a front view corresponding to FIG. 9; and,

FIG. 11 is a rear view corresponding to FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 to 3 of the drawings, the lock comprises a cylindrical casing 10 arranged to be secured in the article to be locked, and a body part 11 arranged to be rotated by a key such as shown in FIGS. 4 to 8 and hereinafter described.

The body part 11 comprises a screw-threaded shaft 12 and an integral magazine 13 which carries, in a ring of axial bores 14, a series of seven front or driver pins 15.

A collar 16, secured to the casing 10 by keys indicated at 17 in FIGS. 1 and 3 (or alternatively by one or more radial pegs or fingers), provides a stationary magazine which carries, in a ring of axial bores 18, a series of seven rear pins 19 which are loaded by compression springs 20.

The rear ends of the bores 18 are closed by a washer 21 which is secured to the collar magazine 16, and the collar with this washer are secured in position by a circlip 22.

In use, when the front pins 15 are depressed by a tubular-shaft key being inserted into annular opening 15A and against the action of the springs 20, until the abutting ends of all the pairs of pins 15/19 are aligned in plane P which separates magazine 13 from magazine 16, the body part 11 can be rotated to turn a locking lever or the like (not shown) secured to the rear end of shaft 12.

In prior locks, the rear pins 19 were of uniform length and it was therefore possible to determine the lock combination by fully depressing each pair of pins by means of a feeler inserted into opening 15A. However, according to the present invention, the rear pins 19 are also of different lengths and thus it is impossible to determine, by such a feeler, the respective depressions required for the front pins. Alternatively, the washer 21 may be formed with a series of different indents indicated at 21A in FIG. 1 which acts as stops for the pins 19, or the springs 20 may be adapted to bottom at different depths.

According to a further feature of the invention, the circlip 22 can be removed to allow withdrawal of the collar magazine 16 and the body part 11; this allows the pins 15 to be readily rearranged (or replaced) to change the combination of the lock, and it will be noted that the body part 11 is formed with an outer shoulder 11A which acts to prevent the pins 15 dropping out (forwardly) when the body 11 is removed; the collar magazine 16 complete with the captive pins 19, may also, be alternatively, be replaced.

It is also to be noted that an existing lock can be modified by replacing the original collar 16 or by slicing off the rear part of the original collar to provide for access to rear pins 19 and also to driver pins 15. A washer 21 and a circlip 22 would also be provided.

Referring now to FIGS. 4 to 8, the key comprises a body part 23 having a finger piece 24, and formed with a series of seven axial recesses or grooves 25 which extend along tubular shaft 26 of body part 23 and enter annular recess 27. The left-hand end of the tubular shaft 26 is formed with a short outer rib 28 to enter locating notch 29 in the lock casing and body part (FIGS. 1 and 2) and an inner rib 30 extends along the shaft to enter locating groove 31 in the lock body part.

A set of seven fingers is provided for the key and each finger, as shown in FIGS. 7 and 8, comprises a central shoulder 32, a positioning limb 33, and a working limb 34; the limbs 33 are all of the same length whereas the lengths of limbs 34 are different. Each limb 34 has an inner face curved to mate with a groove 25.

In use, the fingers of the set are selectively positioned on the grooves 25, in accordance with the required lock combination, and a clamping collar 35 is then screwed onto the body part 23 to engage the shoulders 32 and clamp the fingers in their required positions. For simplicity, only one finger is shown, in broken lines, in FIGS. 4 and 5. The limbs 34, which are slender and relatively fragile, are guarded against damage by nesting in the grooves 25. It will be appreciated that keys can readily be supplied to order, the supplier having stocks of key bodies and of numbered fingers of the various required lengths; it will also be appreciated that a key can be changed to suit the new combination of an altered lock.

Referring now to FIGS. 9 to 11, the lock comprises a cylindrical casing 110 and a rotary body part 111. The body part 111 comprises a shaft 112 and an integral magazine 113 which carries, in a ring of axial bores 114, a series of seven front or driver pins 115.

A collar 116 having a key 117 which engages in a slot in the casing 110, provides a stationary magazine which carries, in a ring of axial bores 118, a series of seven rear pins 119 which are loaded by compression springs 120. The rear ends of the bores 118 are closed by a washer 121 which is secured to the collar 116.

The rear pins 119, which are of different lengths, are also formed with intermediate waisted portions 119A which act to foil attempted "picking" of the lock. In some prior multiple-axial-pin tumbler locks, it was possible to open the lock by urging the body part 111 to turn, and then depressing the individual pins whereby the inner ends of the outer pins 115 engaged the outer mouths of the stationary magazine bores 118. However, when the rear pins 119 are waisted, the shoulders at the ends of the waisted portions 119A engage the bore mouths and, of course, the lock cannot be opened with the pins 119 in this position.

The inner end part of the shaft 112 is of reduced, non-circular section and carries discs 140 and 141 which are held in position by circlip 142. The discs are arranged to rotate, with shaft 112, in a shaped sleeve member 143 which is secured in position in casing 110 by a pin 144. The front disc 140 engages in a short groove 145 and is formed with a cut-out 146 which, when aligned with the front wall of groove 145, allows the disc to pass forwardly free of the member 143. The rear disc 141 includes an almost semi-circular part 147 having ends 148 arranged to engage part 149 of sleeve member 143 and so provide two limits to the rotation of body part 111.

The end of the shaft 112 is formed as a flat blade 150 and an output member 151 is formed with a slot 152 in which the blade 150 is in driving engagement. Shoulder 110A on the casing 110 prevents rearward removal of the magazines. The outer end of member 151 comprises a screw-threaded shaft 112A to which a locking lever or the like (not shown) is secured.

The lock shown in FIGS. 9 to 11 operates in a manner similar to that shown in FIGS. 1 to 3, but the

magazine withdrawal arrangement is different. In the lock shown in FIGS. 9 to 11, the body part 111 together with the magazine 116 may be withdrawn forwardly when the key is turned to the appropriate position and the disc 140 is free to move out of its recess in member 143.

At the front end of the lock, a key-retaining roller 153 is carried by a split spring ring 154 and located in a recess 155 in the body portion 111. The key in this case is formed with a projection, such as 28 in FIG. 4, and, when the key is inserted into the lock, the roller is pushed outwardly into cavity 156 in the casing 110. Thus, the key can only be inserted and removed when the roller 153 is aligned with the cavity 156. It will be appreciated that after the key projection has passed the roller 153, the roller returns to recess 155 and the key can be rotated. It will also be appreciated that when the magazines are being withdrawn, the key may be retained and this will facilitate retraction of the body part 111.

In the present embodiment, only one body cavity 156 is provided and so the key can only be inserted and withdrawn when the body part 111 is in one predetermined position.

As can be seen from FIG. 10, the lock body part is formed with a principal locating groove 131 and two supplementary locating grooves 157, and, in this case, corresponding inner ribs 158, shown in broken lines in FIG. 5, are provided on the key shaft. According to yet a further feature of the present invention, the number of possible lock combinations can be increased by varying the number and/or position of the additional locating grooves 157 in the lock and ribs 158 on the key.

Further modifications may also be made without departing from the scope of the invention.

What is claimed is:

1. A multiple-axial-pin tumbler lock comprising: a tubular body part; a removable unit mounted within said tubular body part and comprising a rotary magazine carrying a series of driver pins and adapted to be turned by a key having fingers engageable with said driver pins and a stationary magazine carrying a series of spring-loaded pins of different non-uniform lengths and adapted to be depressed by the driver pins to free the rotary magazine so that it can be turned relatively to the stationary magazine, said rotary magazine having means adapted to cooperate with its driver pins and prevent their displacement forwardly from the rotary magazine, the rotary magazine and the stationary magazine being provided with interengaging means permitting separation of the two magazines forming said unit for removal from the tubular body part to permit replacement of the said driver pins, said stationary magazine having means for retaining the spring-loaded pins captive therein upon separation of the two magazines from one another, the full strokes of movement of the spring-loaded pins in said stationary magazine being non-uniform in extent and selected at random so that they have no relationship to the lengths of the driver pins which conform respectively to the finger lengths of the keys, at least certain of the said spring-loaded pins have waisted portions intermediate of their ends and the stationary magazine is provided with stepped bores for receiving said pins, each said bore comprising an internal part of greater diameter

5

6

than the spring-loaded pin contained thereby and a mouth portion corresponding in diameter to an intermediate part of the spring-loaded pin having an enlarged base slidable within the larger one of said stepped bores such that upon depression of the spring-loaded pins while attempting to rotate the rotary magazine, an intumed flange on the mouth portion making positive engagement in the waisted portion of the spring-loaded pin preventable of depression of said spring-loaded pin to the extent necessary to free the rotary magazine.

2. A multiple-axial-pin tumbler lock of claim 1, in which said spring-loaded pins are loaded by springs ar-

ranged to bottom at different effective positions, and including a spring-loaded roller carried by said rotary magazine, said lock key including a projection on which said roller is engageable, and said body part of the lock including structure defining a single cavity allowable of the roller to be displaced outwardly by said projection, such that the key can be withdrawn when the roller is adjacent said cavity.

3. A lock as claimed in claim 1, in which said spring-loaded pins are loaded by springs arranged to bottom at different effective positions.

* * * * *

15

20

25

30

35

40

45

50

55

60

65