United States Patent

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[15] **3,681,957**

[45] **Aug. 8, 1972**

[54] **MULTIPLE-AXIAL-PIN TUMBLER LOCK**

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[21] Appl. No.: **41,934**

Related U.S. Application Data

[62] Division of Ser. No. 780,637, Dec. 3, 1968.

[30] **Foreign Application Priority Data**

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

[52] **U.S. Cl.**.....**70/411,** 70/404

[51] **Int. Cl.**.....**E05b 19/18**

[58] **Field of Search**.....70/404, 411, 394, 382–385

[56] **References Cited**

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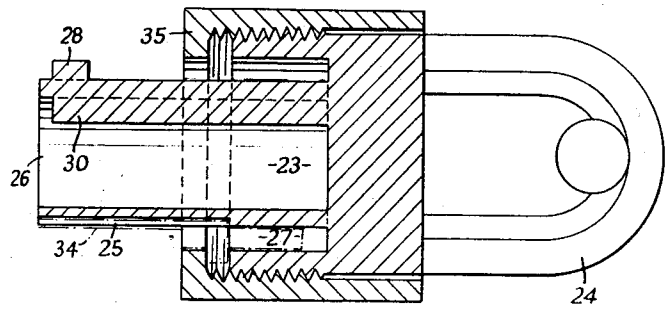
Primary Examiner—Robert L. Wolfe

Attorney—Polachek, Saulsbury & Hough

[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.

4 Claims, 11 Drawing Figures



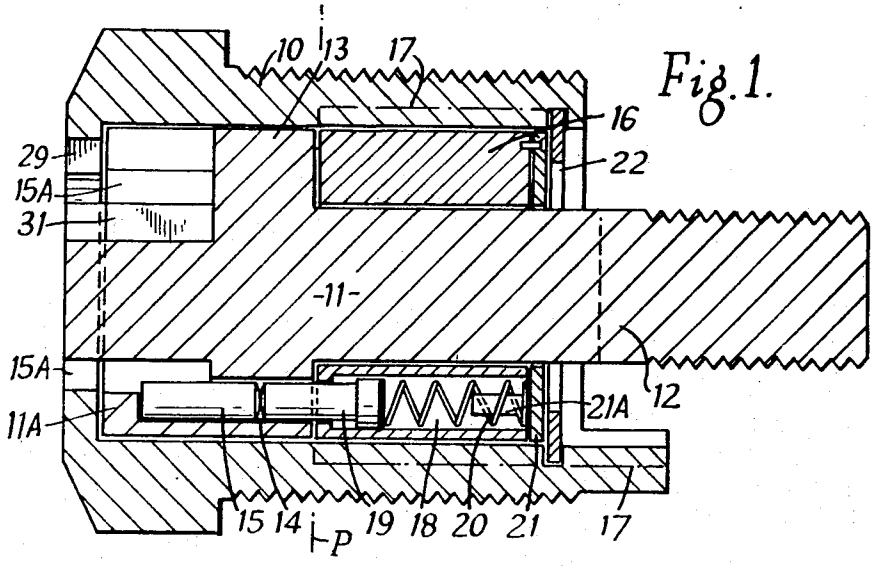


Fig. 1.

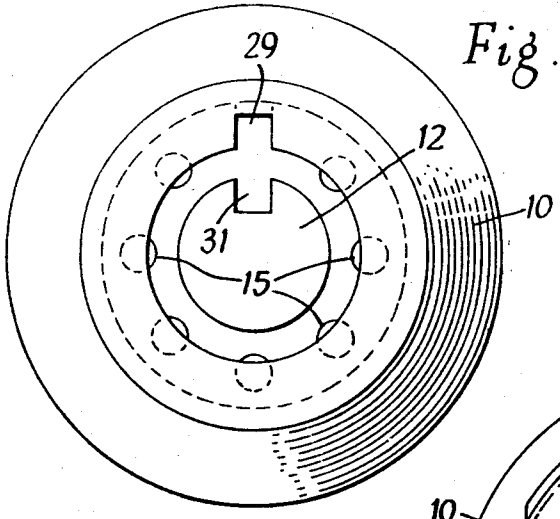


Fig. 2.

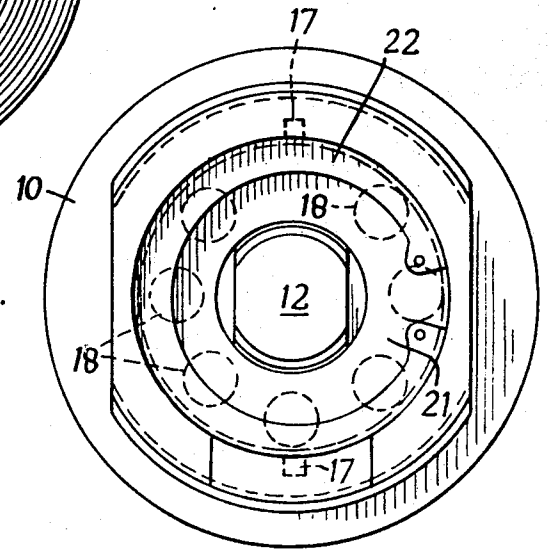


Fig. 3.

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Fig. 4.

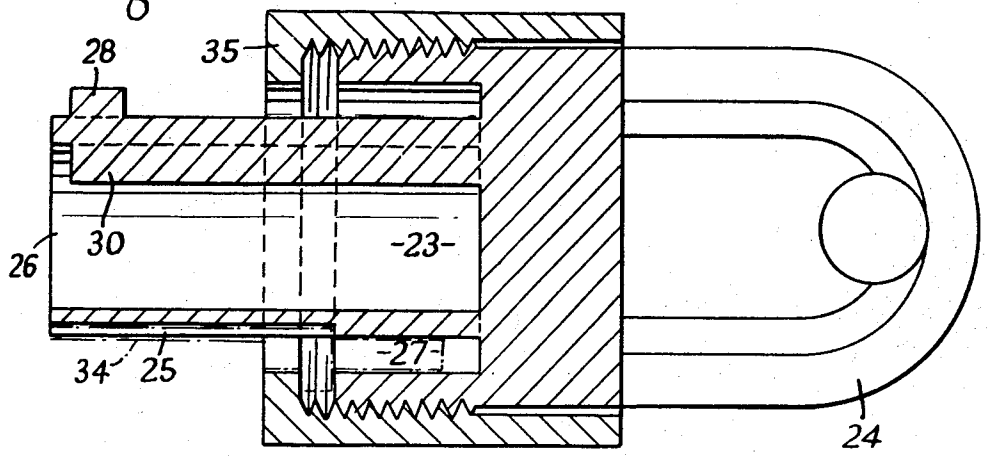


Fig. 5.

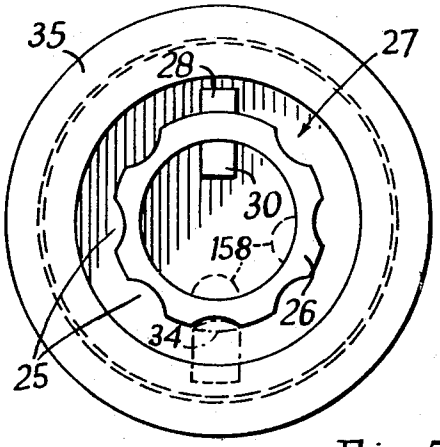


Fig. 6.

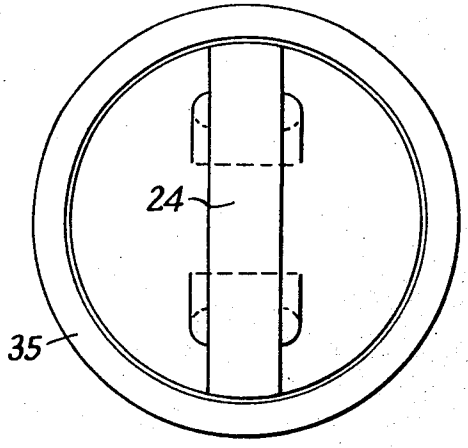


Fig. 7.

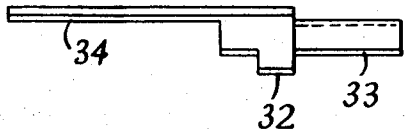
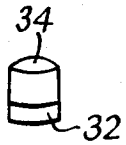
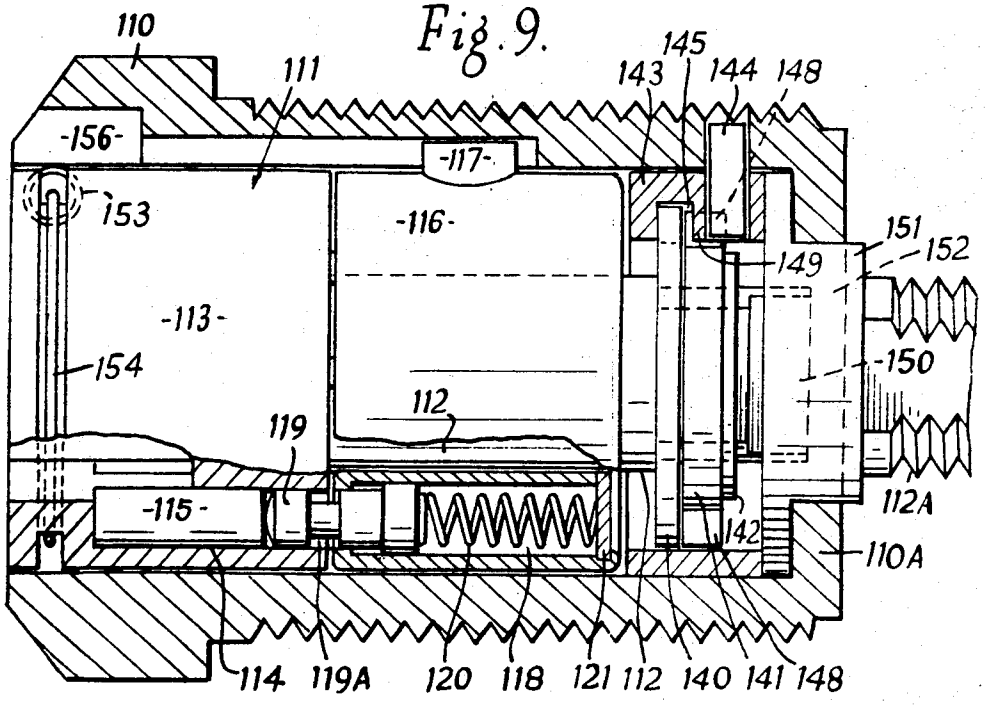


Fig. 8.



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Fig. 9.



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Fig. 10.

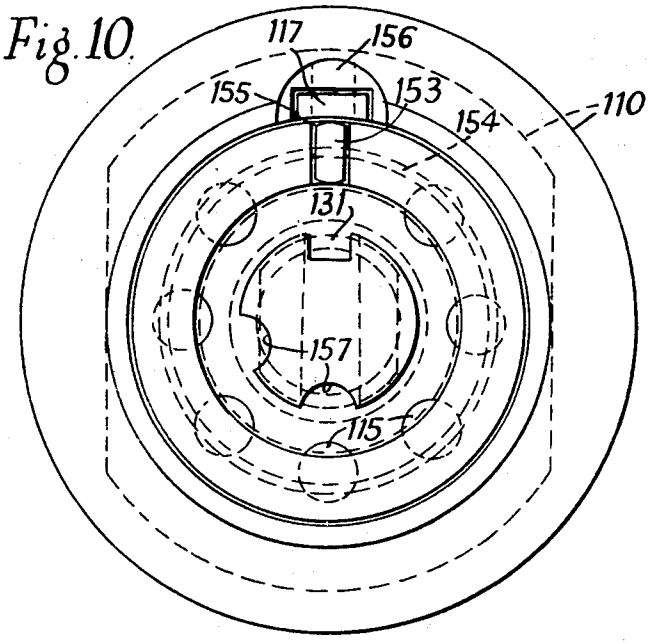
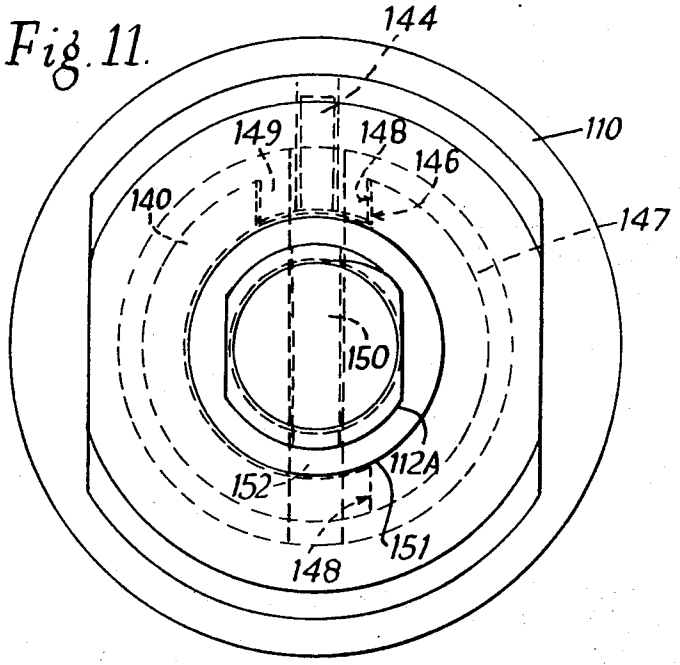


Fig. 11.



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MULTIPLE-AXIAL-PIN TUMBLER LOCK

This application is a divisional of the parent application, U.S. Ser. No. 780,637, filed Dec. 3, 1968 and entitled to the convention priority date of Dec. 7, 1967. The present application is Ser. No. 91,934 filed Dec. 16, 1970.

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 **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 **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 part is removed; the collar **16** complete with the captive pins **19**, may also, or 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 **12**, 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 stationery 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 stationery 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 **12** 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 **12**, 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. For a multiple-axial-pin tumbler lock, a key comprising: a tubular shaft of a shape insertable into the lock and on its outer face having structure defining a series of axial recesses; a set of locking fingers of selected predetermined length fixedly seated in said recesses, each finger having an abutment; clamping means fixedly holding each finger in a predetermined position in register with the recess structure which supports the finger, by engagement with said abutment on each said finger, said abutment of each finger comprising a generally central shoulder adapted to be clamped in position, the finger further comprising a positioning limb extending rearwardly from the shoulder, and a working limb extending forwardly from the shoulder and seating in one of said grooves; and a male-threaded body part; said clamping means comprising a female-threaded collar matable with said male threaded body part and said clamping means being clampable of said shoulder in a sandwiched position between said collar and said body part.

2. For a multiple-axial pin tumbler lock, a key comprising (a) a key body having a front extremity in the form of a tubular shaft adapted for insertion into the lock and provided with a series of axial recesses formed on its outer face, and, at the rear of said front extremi-

ty, a radially outwardly extending shoulder portion including an internal axial recess extending rearwardly from each axial recess of said front extremity, (b) a set of locking fingers each comprising a front working limb seated in an axial recess of said front extremity, a rear positioning limb seated in the recess of said shoulder portion and a radially extending abutment arranged between said limbs and engaging with said shoulder portion, the said working limbs of said set of fingers being of selected lengths, and (c) a clamping collar located around said shoulder portion and holding said radially extending abutments of said fingers clamped against said shoulder portion.

3. A key according to claim 2 wherein said internal axial recess of said shoulder portion comprises a cylindrical recess coaxial with said front extremity.

4. A key according to claim 2 wherein said clamping collar is in screw threaded relation to the circumference of said shoulder.

* * * * *