(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 103 532**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **83630145.7**

(51) Int. Cl.³: **E 05 B 27/00**

(22) Date of filing: **09.09.83**

(30) Priority: **10.09.82 IL 66766**

(43) Date of publication of application: **21.03.84 Bulletin 84/12**

(84) Designated Contracting States: **CH DE GB IT LI**

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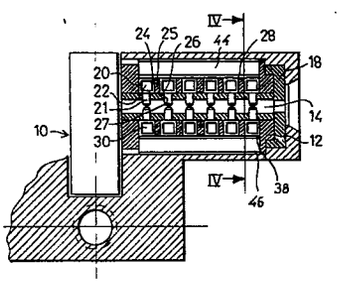
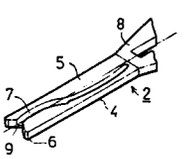
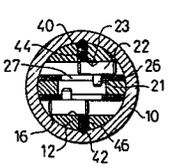
(54) Cylinder lock.

(57) A cylindrical lock comprises a plug (12) rotatable within its bore and having a keyway (14) for reception of a key (2) having a shank (4) formed with a longitudinally-extending groove (7) of special configuration, and a line of pins (20, 30) carried by the plug and movable transversely along a line eccentric thereto. Each of the pins is formed with a notch (23) which are all alignable when the pins are moved to their unlocking positions by the key. The plug further includes an elongated locking pin (44, 46) normally seated within axially-extending grooves (28, 38, 40, 42) of the plug and housing (10) such as to lock the plug against rotation within the housing, but when all the notches of the pin are axially aligned by a proper key, the locking pin unseats from the axially-extending groove of the housing to free the plug for rotation within the housing.







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CYLINDER LOCK.

The present invention relates to cylinder locks of the type including a housing and a plug, or cylinder, rotatable within the housing when a proper key is inserted in the keyway of the plug.

Cylinder locks of the conventional pin-tumbler type have been known for a long time, and many variations and improvements have been made. One of the known variations is adapted to be used with keys having shanks formed with one or more longitudinally-extending grooves of special configuration for each key, which grooves are engageable by the pins carried by the plug such that the pins are moved to their unlocking positions flush with the shear line between the plug and housing when the proper key is used. In this known type of construction, the pins resemble the conventional pin tumblers, and are moved by the key in the radial direction in or out of recesses formed in the housing. A disadvantage of this known construction is that it also requires the springs used in the conventional pin-tumbler lock.

An object of the present invention is to provide a cylinder lock of the foregoing type, namely, one for use with keys having shanks formed with specially-configured longitudinally-extending grooves, but which provides a number of additional advantages over the previously-known lock of this type, and also over the conventional pin-tumbler lock.

According to a broad aspect of the present invention, there is provided a cylinder lock including a housing formed

with a cylindrical bore; a cylindrical plug rotatable within said bore and formed with a keyway for receiving a key to rotate the plug, which key includes a shank formed with a longitudinally-extending groove of special configuration for the respective key; and a plurality of pins carried by said plug in a line extending axially thereof and engageable by said key shank such that the pinks are moved to their unlocking positions by the longitudinally-extending groove of a proper key; characterized in that said plurality of pins are movable transversely of said plug along a line eccentric thereto; each of said pins being formed with a notch on its outer face, the notches of all the pins being alignable along a line extending axially of the plug when the pins are moved to their unlocking positions by said key, the outer face of said plug being formed with an elongated groove extending axially of the plug and being open at its inner end to the outer faces of said pins; the inner face of said housing being formed with an elongated axially-extending groove alignable with that of said plug; said plug further including an elongated locking pin normally seated within said axially-extending grooves of the plug and housing such as to lock the plug against rotation within the housing, but being seatable within said notches of the pins, when axially aligned by a proper key, to thereby unseat from said axially-extending groove of the housing and to free the plug for rotation within the housing.

A cylinder lock in accordance with the foregoing features provides a number of important advantages over the above-mentioned previously known cylinder locks. One important advantage is that it does not require springs. Also, whereas both of the pin-tumbler type locks described above depend, for locking strength, on the number of pins not moved flush with the shear line, in the present invention the locking strength is made uniformly high by the use of the elongated locking pin which applies the same locking strength for its complete length unless all the pins are moved to their released positions by the proper key. In addition, in both of the above types of pin-tumbler locks, the locking force applied by the pins depends on the transverse shear strength of the pins. In the present invention, however, the force applied to the elongated locking pin is a wedging force, partially in compression and partially in longitudinal shear for the complete length of the elongated pin, thereby substantially increasing the locking strength of the lock.

Further features and advantages of the invention will be apparent from the description below.

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is an end elevational view illustrating one form of cylinder lock constructed in accordance with the present invention;

Fig. 2 is a longitudinal sectional view of the lock of Fig. 1;

Fig. 3 is a three-dimensional view illustrating the shape of a key to be used with the lock of Fig. 1;

Figs. 4a and 4b are transverse sectional views along lines IV--IV of Fig. 2, showing the locking and unlocking positions, respectively, of the locking pins;

Figs. 5 and 6 are side and end elevational views, respectively, of one of the plurality of slidable pins, Fig. 6a illustrating a variation;

Figs. 7 and 8 are side and end elevational views, respectively, of the elongated locking pin, Fig. 8a illustrating a variation;

Fig. 9 is a transverse sectional view illustrating another cylinder lock constructed in accordance with the invention; and

Figs. 10, 11 and 12 are side and sectional views, respectively, of a key for use with the lock of Fig. 9.

The lock illustrated in Figs. 1 and 2 of the drawings is intended to be used with the key illustrated in Fig. 3. Such a key, therein designated 2, is formed with a shank 4 of rectangular section so that its opposed faces 5 and 6 are flat. Each of the faces is formed with a longitudinally-extended groove, as shown by groove 7 for face 5. Each of these grooves is of a special individual configuration for each key, as will be more particularly described below. One end of key 4 is formed with an enlarged head 8 adapted to be gripped by the user when manipulating the key; and the opposite end is formed with a V-shaped notch 9.

The cylinder lock with which key 2 is to be used includes a housing 10 formed with a cylindrical bore receiving a cylindrical plug 12. Plug 12 is in turn formed with a keyway 14 for receiving the key 2 illustrated in Fig. 3 which key, where a proper one, unlocks plug 12 to be rotated within housing 10 along the shear line 16. A rotatable end disc 18 provides protection against drilling.

Plug 12 receives an upper group of six pins 20 on one side of the keyway 14, and a lower group of six pins 30 on the opposite side of the keyway. As shown particularly in Figs. 5 and 6, each of the pins 20 (and likewise each of the pins 30) is of T-configuration, including a center leg 21 and a cross-leg 22 at a right-angle to leg 21. The outer face of the cross-leg 22 is formed with a notch 23.

The six pins 20 are each disposed within six slots 24 each extending transversely across,and eccentric to,the plug 12. The six slots 24 for the six pins 20 are spaced from each other axially of the plug and are defined by partition walls 25 joined at their inner ends by an inner wall 26 also formed with slots 27 to define ledges for supporting the pins 20 within the slots 24.

Plug 12 is further formed with an elongated groove 28 extending axially of the outer face of the plug. Groove 28 is open at the outer surface of the plug, and its lower end is defined by the partition walls 25 of the slots 24 receiving the pins 20.

The cross-bar 22 of each pin 20 is disposed within its respective slot 24, with the center leg 21 of the pin

extending through slot 27 of the supporting ledge 26 into the keyway 14. The center legs 21 projecting into the keyway 14 are of the same width as the specially-configured groove 7 formed in the shank 4 of key 2. Thus, when the key is inserted within keyway 14, groove 7 of the key cause the center legs 21 of the pins 20 to slide them transversely across the plug 12 to positions according to the shape of the groove. As indicated earlier, groove 7 is formed in the key shank 4 such that, when a proper key is inserted, all the pins 20 are shifted to locations wherein their notches 23 are aligned to form a straight line underlying the center of groove 28 extending axially of the plug.

The other group of pins 30 at the opposite side of the keyway 14 are of the same construction as the pins 20, and are movable within slots corresponding to slots 24 and 27 of pins 20 but formed in the opposite side of the keyway 14. They are thus also positionable by a specially-configured groove, corresponding to groove 7 in key 2 but on the opposite face 6 of the key shank 4, such that their notches, corresponding to notches 23 for pins 20, are aligned in a straight line underlying an elongated groove 38 (corresponding to groove 28) extending axially of the plug when a proper key is inserted.

The inner face of housing 10 is formed with axially-extending grooves 40 and 42 on opposite sides of keyway 14 in alignment with grooves 28 and 38, respectively, and with the line of notches 23 of the two groups of pins 20 and 30 when shifted by the proper key. Elongated locking

pins, 44 and 46, respectively, are disposed within these elongated grooves 28 and 38. Pin 44 is illustrated in Figs. 7 and 8, and pin 44 is of identical configuration. Thus, locking pin 44 is of a length equal to the axial length of grooves 28 and 40 formed, respectively, in the plug and in the inner face of housing 10. The upper and lower edges of locking pin 44 are each of V-shape, corresponding to the V-shape of elongated groove 40 in housing 10 and of the notches 23 in the pins 20.

The width of locking pin 44 is such that whenever its lower edge 48 engages an unnotched surface of one of the pins 20 its opposite edge 47 projects into the elongated groove 40 formed in the inner face of the housing 10, thereby preventing the rotation of plug 12 within the housing; but when the pins 20 are aligned so that their notches 23 form a straight line, the lower edge 48 of the elongated pin seats within the straight line of notches whereby the upper edge 47 of the pin withdraws from the elongated groove 40 of the housing. That is to say, when notches 23 are aligned, locking pin 44 does not project past the shear line 16 between plug 12 and housing 10, thereby permitting the plug to rotate within the housing. The lower elongated locking pin 46 cooperates with the lower set of pins 30 and housing groove 42 in the same manner.

The operation of the lock illustrated in Figs. 1 and 2 by the use of the key illustrated in Fig. 3 will now be apparent. Thus, normally the upper six locking pins 20

and the lower six locking pins 30 are in random positions within their slots (e.g., slots 24 for the upper pins 20) so that their notches (notches 23 for pins 20) are not in alignment. This is the condition illustrated in Fig. 4a, wherein it will be seen that the two elongated locking pins 44 and 46 are forced to be seated within the elongated grooves 40 and 42 in the innerface of housing 10, thereby locking the plug 12 against rotation within the housing.

When the proper key 2 (Fig. 3) is inserted, its groove 7 on its upper face 5, and the corresponding groove on its lower face, receive the center legs 21 of the pins 20 and 30, and shift them transversely, according to the configuration of the respective groove, such that all their notches 23 are aligned in a straight line. When both groups of pins 20 and 30 are thus positioned by the proper key, the two elongated locking pins 44 and 46 are received within the aligned notches. Rotation of the plug 12 by the key 2 causes the elongated locking pins 44 and 46 to unseat from their respective housing grooves 40 and 42, thereby permitting the plug to be freely rotated within the housing.

A number of variations and modifications of the disclosed embodiment may be made. Thus, whereas the pins 20 (and also the pins 30) are formed with their cross-legs 22 of square section, as shown in Figs. 5 and 6, it will be appreciated that such legs may be of other section, e.g., cylindrical section as shown at 22a in Fig. 6a. In addition, whereas the outer edges 47 and 48 of the elongated locking

pins 44 and 46 are of V-shape as shown in Figs. 7 and 8, it will be appreciated that they could also be of rounded shape as shown by edges 47a, 48a of pin 44a in Fig. 8a. In such a case, the elongated grooves 40 and 42 formed in the inner face of housing 10, and the notches 23 formed in the pins 20 and 30, would be of complementary rounded shape.

It will also be appreciated that the lock could include only one group of pins, e.g., group 20, movable by one elongated slot (corresponding to slot 7) formed in the key 2, or two groups cooperable with two key slots on opposite sides of the key but of different configurations.

Figs. 9-12 illustrate a still further variation, wherein the invention is embodied in a hybrid lock, namely one in which one-half includes the above-described construction, and the other half includes the construction of a conventional pin-tumbler type lock. Such a lock is to be used with a hybrid-type key, such as illustrated in Figs. 10-12, therein designated 102. Thus, key 102 includes one face 105 (Fig. 11) formed with a specially-configured longitudinally-extending groove 107, corresponding to groove 7 in Fig. 3; and the other face 106 (Fig. 10) is formed with a plurality of blind bores 109 of different depths, one for each of the pin tumblers of the conventional lock, for moving the pin tumblers to the shear line between the plug and the housing of the lock. The lock itself, as shown in Fig. 9, includes a housing 110 receiving a cylindrical plug 112 formed with a keyway 114 adapted to receive a key which,

if the proper one, will permit the plug to be rotated within the housing along shear line 116. Thus, the upper half of plug 112 carries a plurality of pins 120 each of the same structure and formed with the same notch 123, as pins 20 in the previously-described embodiment, which notches 123 are cooperable with an elongated locking pin 144, corresponding to pin 44 in the above-described embodiment. The lower half of plug 112 is formed with conventional pin tumblers, therein designated 150, each constituted of two segments 151, 152, urged by a spring 153 such that, normally, segments 152 project within the shear line 116 between the plug 112 and the housing 110, thereby blocking the rotation of the plug within the housing.

It will thus be seen that both groups of pins, namely the slidable pins 120 acting on the elongated locking pin 144 and the pin tumblers 150, block the rotation of the plug 112 within the housing 110. However, when the proper key 102 is inserted, groove 107 formed on one face 105 of the key moves the upper pins 120 to align their notches 123 such as to receive the elongated locking pin 144 and to permit it to be retracted to the shear line 116 between plug 112 and housing 110; and the blind bores 109 formed on the opposite face 106 of the key move the pin tumblers 150 such as to bring the abutting surfaces between their two segments 151, 152 to the shear line 116. The plug 112 is thus free to rotate within the housing 110.

What is Claimed is:

1. A cylinder lock including a housing formed with a cylindrical bore; a cylindrical plug rotatable within said bore and formed with a keyway for receiving a key to rotate the plug, which key includes a shank formed with a longitudinally-extending groove of special configuration for the respective key; and a plurality of pins carried by said plug in a line extending axially thereof and engageable by said key shank such that the pins are moved to their unlocking positions by the longitudinally-extending groove of a proper key; characterized in that said plurality of pins are movable transversely of said plug along a line eccentric thereto; each of said pins being formed with a notch on its outer face, the notches of all the pins being alignable along a line extending axially of the plug when the pins are moved to their unlocking positions by said key; the outer face of said plug being formed with an elongated groove extending axially of the plug and being open at its inner end to the outer faces of said pins; the inner face of said housing being formed with an elongated axially-extending groove alignable with that of said plug; said plug further including an elongated locking pin normally seated within said axially-extending grooves of the plug and housing such as to lock the plug against rotation within the housing, but being seatable within said notches of the pins, when axially aligned by a proper key, to thereby unseat from said axially-extending groove of the housing and to free the plug for rotation within the housing.

2. The lock according to Claim 1, wherein each of said plurality of pins is of T-configuration, including a first leg extending into said keyway so as to be engageable by said key groove, and a second leg at a right angle to the first leg and slidable in a slot extending transversely across the plug, the outer face of said second leg being formed with said notch.

3. The lock according to Claim 2, wherein said second leg of each of the plurality of pins is of rectangular section.

4. The lock according to Claim 1, wherein the end of said key is formed with a V-shaped notch.

5. The lock according to Claim 1, wherein said elongated locking pin is formed with opposed edges of V-shape; the axially-extending groove on the inner face of the housing, and the notches formed on the outer faces of the plurality of pins, being of complementary V-shape.

6. The lock according to Claim 1, wherein said elongated locking pin is formed with opposed rounded edges; the axially-extending groove on the inner face of the housing, and the notches on the outer faces of the plurality of pins, being of complementary rounded shape.

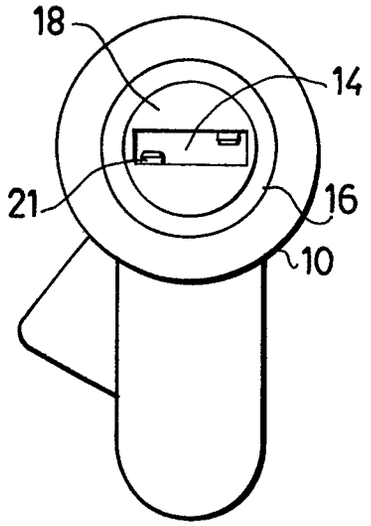
7. The lock according to Claim 1, wherein both of the diametrically-opposed sides of said plug include a line of said pins, an elongated axially-extending groove formed in the outer face of said plug and in the inner face of said housing, and one of said elongated locking pins

normally seated in said grooves, which lock is to be used with a key having a shank formed with a said specially-configured longitudinally-extending groove on both of its opposed faces.

8. A lock according to Claim 1, wherein only one side of said plug includes a line of said pins, an elongated axially-extending groove formed in the plug and in the inner face of the housing, and said elongated locking pin seated in said grooves.

9. The lock according to Claim 8, wherein the opposite side of said plug includes a line of conventional pin tumblers, which lock is to be used with a key having a shank formed with said specially-configured longitudinally-extending groove on one of its faces, and with conventional recesses for the pin tumblers on its opposite face.

FIG 1



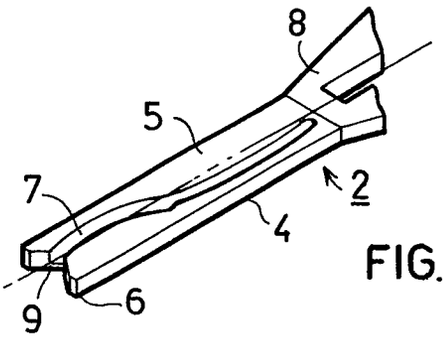
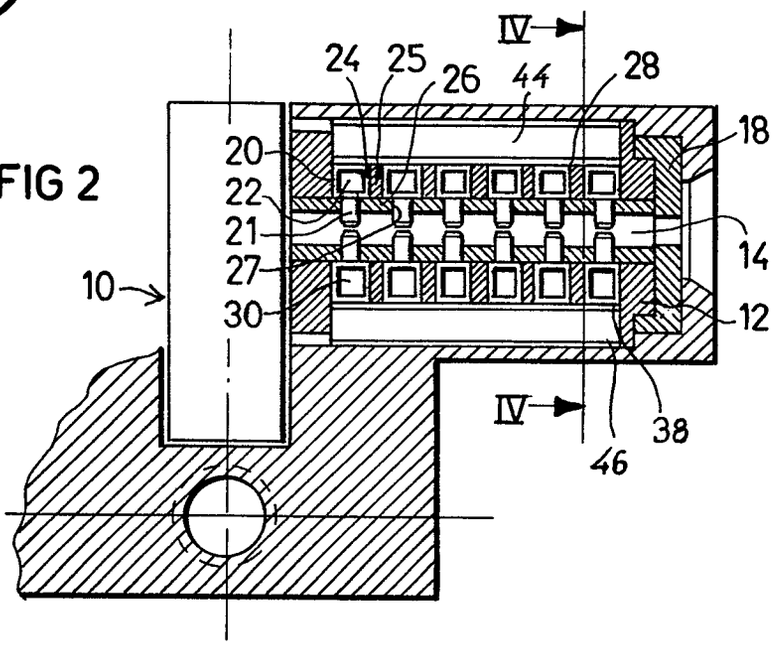


FIG. 3

FIG 2



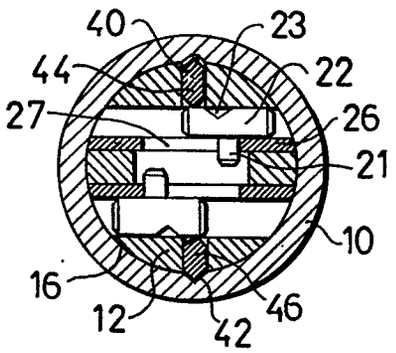


FIG 4a

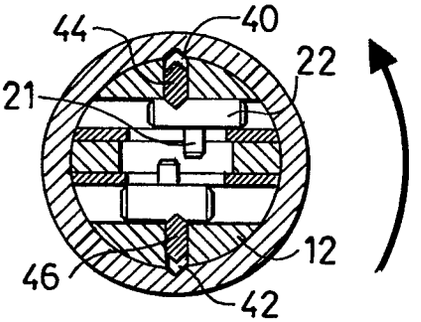


FIG 4b

FIG 5

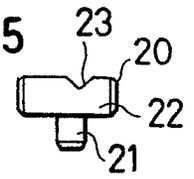


FIG 6

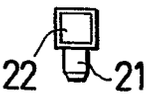
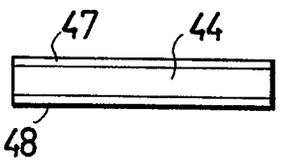


FIG 6a

FIG 7



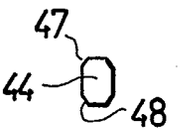


FIG 8

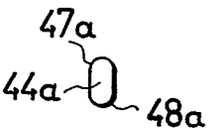
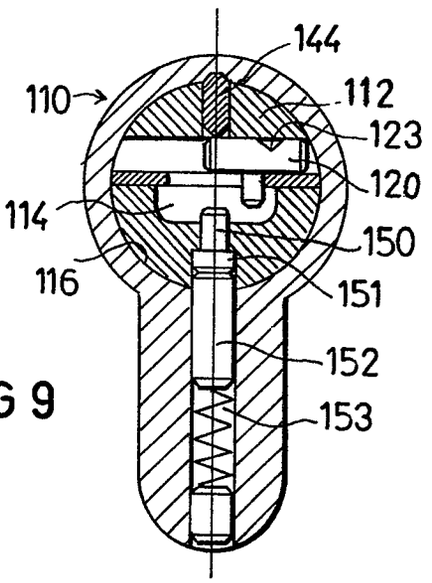


FIG 8a

FIG 9



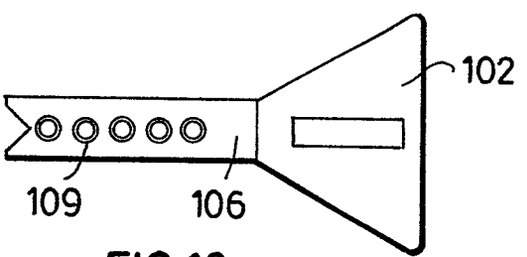
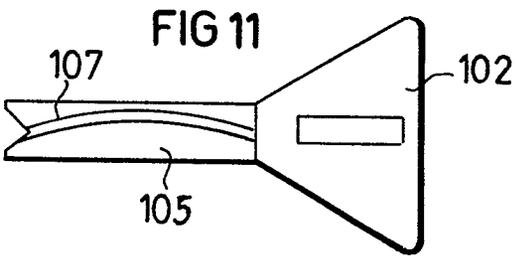


FIG 10

FIG 11



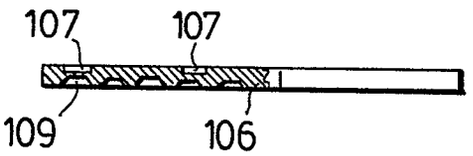


FIG 12