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(54) Cylinder lock with improved effraction-resistant pin assemblies

(57) A cylinder lock provided with coding pins (18) and driver pins (9,11), the mutually contacting ends (15,20) of the coding pins (18) and of the driver pins (9,11) having a reduced diameter with respect to the holes (6) that accommodate them, additional reduced-diameter regions (14) being formed on the remaining portion of at least some of the coding pins and driver pins, separation collars (12,13) being formed between the reduced-diameter regions and the ends.

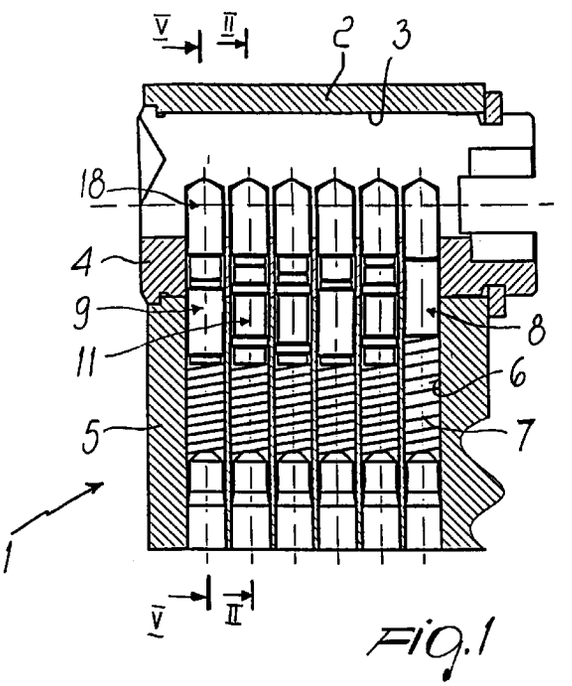

Fig.1

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Description

The present invention relates to a cylinder lock provided with improved effraction-resistant pin assemblies.

A conventional cylinder lock comprises a body in which a cylindrical seat is formed; said seat rotatably supports a plug. A bit is rotationally rigidly coupled to one end of the plug in order to actuate a bolt or spring-latch. A keyway for inserting the key is formed axially in the plug and intersects a first set of holes, which are formed in a radial plane of the plug and in which a first set of coding pins is guided. The coding pins have conical ends which protrude into said keyway and on which the key is meant to act with a coded portion. A second set of holes, equal in number to the first set , is formed in said body so that each hole, in a given angular position of the plug, is aligned with a respective coding pin. A plurality of driver pins and a plurality of springs are guided in said second set of holes; by acting on said plurality of driver pins, said springs keep each driver pin in contact with a respective coding pin.

When the key is removed from the keyway, the springs push the driver pins and the coding pins into a position in which the conical ends of the coding pins abut against the wall of the keyway and the driver pins intersect the shearing plane of the seat and the plug, preventing rotation of the plug.

Viceversa, when the key is inserted in the plug, the plane where contact occurs between the coding pins and the driver pins is shifted until it lies on the shearing plane, allowing rotation of the plug in its seat of the body.

The weakness of cylinder locks of the described type resides in the fact that the coding pins can be accessed from outside through the front inlet of the keyway and can be moved by using suitable picking tools, so as to allow to turn the plug.

The method most widely used by burglars to align the contact plane of the coding pins and the driver pins with the shearing plane of the plug and its seat in the body is the so-called Hobb method. A detailed description of said method is contained in the introduction of German patent 1,157,960 (column 1, line 28 to column 2, line 33). In this method, while the key is removed and therefore the lock is in the locked position, the plug is forced to turn by means of a suitable tool inserted in the keyway.

Owing to the different radial tolerances that always occur in the driver pins that protrude into the holes of the plug and in the diameters of the holes in the body, it is possible to lock the driver pin that has the least play. Said driver pin can be easily located by means of a picking tool inserted in the keyway, because of the fact that since it cannot slide it opposes greater resistance to the action of the picking tool. When said driver pin has been moved until the plane of contact with the corresponding coding pins lines on the shearing plane between the plug and the seat of the body, the action that locked the driver pin and was applied by means of the forced rotation of the plug ceases. The plug can thus perform a minute additional rotation, until a new driver pin, whose play is the next smallest with respect to the released driver pin, is locked. By acting with the picking tool as described above on this new driver pin and by repeating the same operations on all the remaining driver pins, it is possible to place the contact points between the coding pins and the driver pins on the shearing plane of the seat and the plug and turn the plug.

Various solutions have been proposed in order to obviate fraudulent opening of cylinder locks according to the described method; they consist mainly in providing, in the driver pins, regions having a reduced diameter or grooves which are located at the shearing plane when the key is removed. When the plug is forced to turn fraudulently, said regions allow the cylinder to rotate by an extent which is greater than the play of the driver pins in their holes and is therefore such as to prevent the movement of the driver pins.

These solutions are disclosed for example in US patents 1,593,513, 2,629,249, and 3,762,193, in German patent 628,600 and in European patent 92,812.

In particular, European patent 92,812 discloses a cylinder lock in which both the coding pins and the driver pins have regions with a smaller diameter which form respective heads at their opposite ends.

The heads are not as high as the coding step of the lock and are inclined at 45°. In this manner, the reduced-diameter regions are assuredly always in the shearing plane and the heads are prevented from lying on said plane.

The aim of the present invention is to further improve cylinder locks provided with coding pins and driver pins, so as to offer greater resistance to effraction attempts.

Within the scope of this aim, an object of the present invention is to provide improvements which can be implemented without compromising the low cost of the lock.

This aim, this object and others which will become apparent hereinafter are achieved by a cylinder lock comprising: a body; a cylindrical seat formed in said body; a plug which can rotate in said seat; an actuation bit which rotates rigidly with said plug; a keyway for inserting a key, formed axially in said plug; a first set of holes, which are formed on a radial plane in said plug and intersect said keyway; a first set of coding pins, which can move in said first set of holes and have conical ends that protrude into said keyway and on which the key is meant to act with a coded portion; a second set of holes, equal in number to said first set, which are formed in said body and lie on a radial plane; a plurality of driver pins, which can slide in said second set of holes; a plurality of springs, which are accommodated in said second set of holes and act on said plurality of driver pins; each one of said driver pins being kept in contact with a respective coding pin by said springs;

characterized in that the ends of said coding pins and of said driver pins which are in mutual contact have a smaller diameter than the holes that accommodate them, and in that additional reduced-diameter regions are formed on the remaining portion of at least some of said coding pins and said driver pins, separation collars being formed between said reduced-diameter regions and said ends.

Further characteristics and advantages of the present invention will become apparent from the following detailed description thereof given on the basis of the accompanying drawings, wherein:

figure 1 is a longitudinal sectional view of a cylinder lock according to the present invention;
figure 2 is a sectional view, taken along the plane II-II of figure 1, of the lock in the closed or inactive position, with the coding pins and the driver pins in the plug locking position;
figure 3 is a view, similar to figure 2, in a possible effraction situation;
figure 4 is a view, similar to figure 2, in another possible effraction situation;
figure 5 is a sectional view, taken along the plane V-V, in a possible effraction situation;
figure 6 is a longitudinal sectional view of a different embodiment of the cylinder lock; and finally
figure 7 is a sectional view of a different embodiment of the lock in the inactive or closed position, with the coding pins and the driver pins in the plug locking position.

With reference to figures 1-2, the lock comprises a body 1 which comprises a tubular portion 2 that forms a cylindrical seat 3 for a plug 4.

A bit (not shown) for actuating a bolt or spring latch is rotationally coupled in a known manner to the plug 4.

An expansion 5 protrudes from the tubular portion 2 of the body 1, and a plurality of blind holes 6 is formed in said expansion; said holes lie on a longitudinal plane which passes through the axis of the cylindrical seat 3. The blind holes 6 accommodate a plurality of driver pins which are actuated by springs 7 interposed between their inner ends and the bottom of the blind holes 6. The driver pins are of three kinds. The driver pin designated by the reference numeral 8 is constituted by a simple cylinder. The driver pins designated by the reference numeral 9 are constituted by a cylinder which has, at its opposite ends, narrower portions 10 having a smaller diameter and the same axial length. Finally, the driver pins designated by the reference numeral 11 are constituted by a cylinder in which two collars 12, 13 are formed which comprise, between them, a smaller-diameter region which is hereinafter referenced to as neck 14 for the sake of convenience in description. The driver pins 11, like the driver pins 9, have respective reduced-diameter portions 15 at their opposite ends.

It should be noted that the driver pins 9, 11 are symmetrical with respect to a centerline plane which is perpendicular to their axis. In this manner, they can be inserted in the holes 6 of the expansion 5 without preliminary orientation, since their active part, i.e., the part that contributes to increase the resistance of the lock to effraction attempts, is only the part directed toward the plug 4.

An axial keyway 16 is formed in the plug 4 and intersects a plurality of radial holes 17. The holes 17 are equal in number and diameter to the blind holes 6 and are mutually spaced so that in a given angular position of the plug, which corresponds to the position for the insertion and extraction of the key with respect to the lock, they are aligned with the blind holes 6.

Coding pins 18 are accommodated in the holes 17 and are constituted by small cylinders which have a conical end 19 arranged inside the plug and a reduced-diameter external end 20 which is directed toward the peripheral region of the plug.

The coding pins 18, by cooperating with the driver pins 8, 9 and 11, lock or release the rotation of the plug. The driver pins 8, 9 and 11, when the key is removed, under the thrust of the springs 7, can in fact enter the holes 17 and prevent rotation of the plug. The penetration of the driver pins 8, 9 and 11 in the holes 17 is determined by the abutment of the conical ends 19 against the bottom 21 of the holes 17, which protrude radially into the plug 4. It should be noted that only the innermost driver pin 8, which cooperates with the coding pin 18, does not have a reduced-diameter portion, so as to eliminate any plays of the plug 4 in its seat 3 and ensure the alignment of the remaining coding pins with the respective driver pins and allow them to slide, during the insertion and extraction of the key, without making the coding pins and the driver pins strike against the edges of the holes 6 and 17.

With the described lock, opening occurs in a conventional manner. By inserting the key in the channel 16, the coding pins 18 are in fact shifted according to the code, so that the point of contact 22 between the coding pins 18 and the driver pins 8, 9 and 11 coincides with the shearing plane 23 between the seat 3 and the plug 4, so that the locking action of the driver pins 8, 9 and 11 ceases and the plug 4 can rotate freely and operate the bit that moves the bolt or spring-latch.

The higher effectiveness of the lock against attempted effractions is shown more clearly in figures 3 and 4.

When the lock is in the closed position shown in figure 3, the torsion stress applied fraudulently in the direction of the arrow F on the plug by means of a tool 24 inserted in the keyway 16 causes, for some driver pins 11, the overlap of the collar 12 on the rim formed by the hole 6 with the seat 3. Since the rim of the hole 6 is a mechanical abutment for the collar 12, it is practically impossible to move the coding pin 18 axially, and thus place the point of contact 22 on the shearing plane 23, by acting with a picking tool.

However, particularly expert ill-intentioned persons may interpret this difficulty as an indication that the driver pin on which they are working has a reduced-diameter portion; therefore, by stopping the forcing of the plug 4 and acting again on the coding pin 18 with a picking tool 25, they might be able to make the collar 12 return within the hole 6 for trying to align the contact point 22 on the shearing plane 23. In this situation, shown in figure 4, the pin zone consisting of the reduced-diameter portions 20 and 15 provided at the mutually contacting ends of the coding pins 18 and of the driver pins 11 is located at the shearing plane 23. Accordingly, an additional rotation of the plug is allowed which might induce the ill-intentioned person to assume that he has placed the contact point 22 on the shearing plane 23. However, as shown by figure 4, the contact point 22 is not at all on the shearing plane 23 and the rotation of the plug 4 is in any case prevented.

It is evident that the described improvement allows a significant improvement in the safety of the lock against effraction attempts performed by using the Hobb method.

The same inventive concept can also be applied to the driven pin 9 which does not have collars but has only diametrical reductions 10 at the end in contact with the coding pins 18 (see figure 5).

In an advantageous embodiment of the invention, shown in figure 6, the sum S of the lengths of the coding pins and of the driver pins is constant and so is the sum R of the diametrical reductions 15 and 20. By virtue of these refinements, if the coding pins, together with the corresponding driver pins, are fraudulently pushed against the bottom of the holes 6 of the body 5, since the sum S of the lengths of the coding pins and of the driver pins is constant, the lengths of the coding pins cannot be deduced. Likewise, since the sum R of the diametrical reductions is constant, it is not possible to deduce the position of the contact point between the coding pin and the driver pin, since it is possible to locate only the edges 26, 27 of the coding pins and driver pins, which however are at the same level for all the coding pins and driver pins.

The described invention can also be used in so-called flat-key locks shown in figure 7, where the key code is not formed along an edge of the key but on a lateral face thereof.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A cylinder lock comprising: a body (1); a cylindrical seat (3) formed in said body; a plug (4) which can rotate in said seat; an actuation bit which rotates rigidly with said plug; a keyway (16) for inserting a key, formed axially in said plug; a first set of holes (17), which are formed on a radial plane in said plug and intersect said keyway; a first set of coding pins (18), which can move in said first set of holes and have conical ends (19) that protrude into said keyway and on which the key is meant to act with a coded portion; a second set of holes (6), equal in number to said first set, which are formed in said body and lie on a radial plane; a plurality of driver pins (9, 11), which can slide in said second set of holes; a plurality of springs (7), which are accommodated in said second set of holes and act on said plurality of driver pins; each one of said driver pins (8,9,11) being kept in contact with a respective coding pin (18) by said springs; characterized in that the ends (15, 20) of said coding pins (18) and of said driver pins (9, 11) which are in mutual contact have a smaller diameter than the holes that accommodate them, and in that additional reduced-diameter regions (14) are formed on the remaining portion of at least some of said coding pins and said driver pins, separation collars (12, 13) being formed between said reduced-diameter regions and said ends.

2. A lock according to claim 1, characterized in that said driver pins (9, 11) are symmetrical with respect to a centerline plane which is perpendicular to their axis.

3. A lock according to claim 1 or 2, characterized in that the sum (S) of the lengths of the coding pins (18) and of the respective driver pins (9, 11) and the sum (R) of the reduced-diameter regions (15, 20) between the coding pins and the respective driver pins is constant.

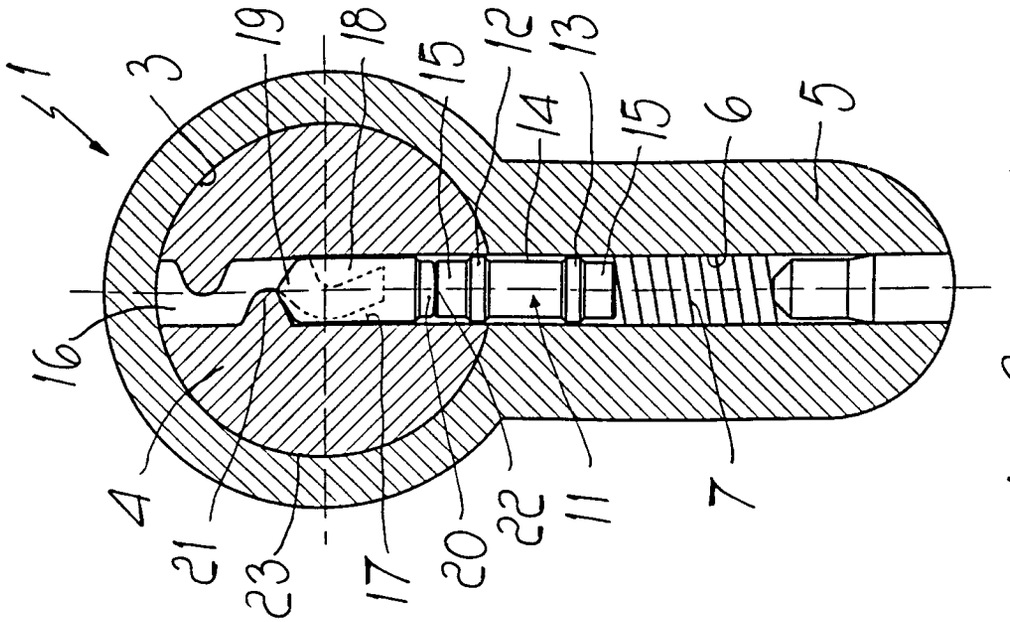
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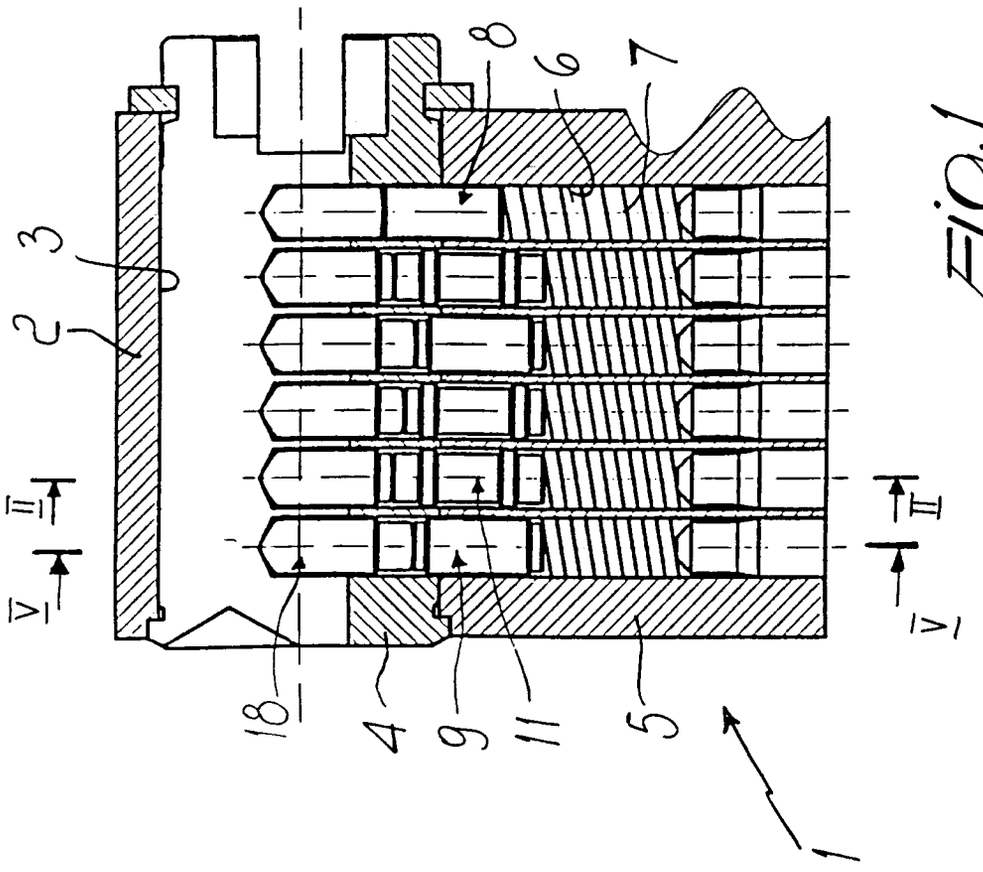
Fig. 2


8
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V
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Fig. 1

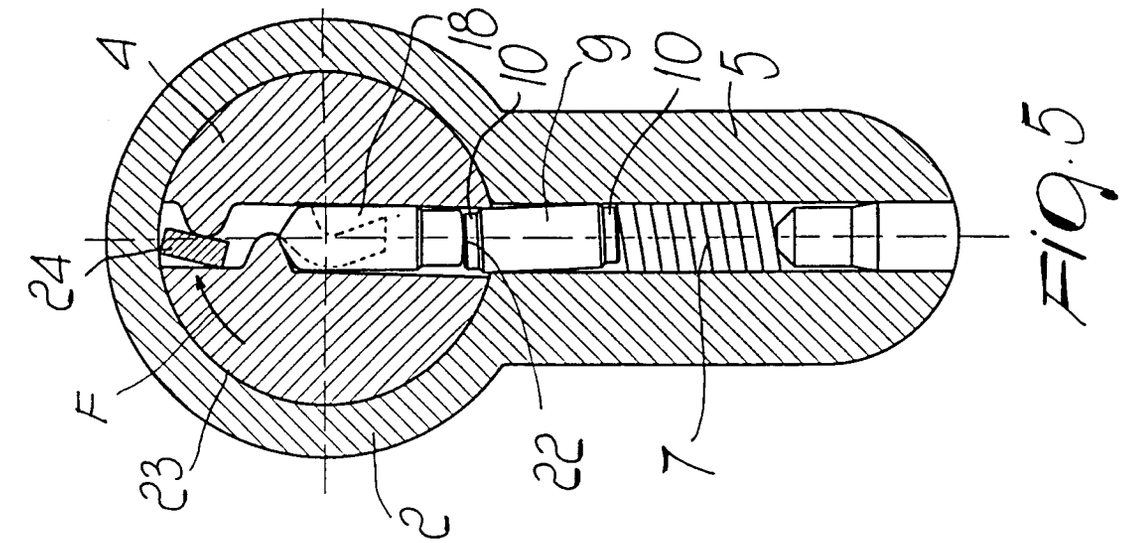

Fig.5

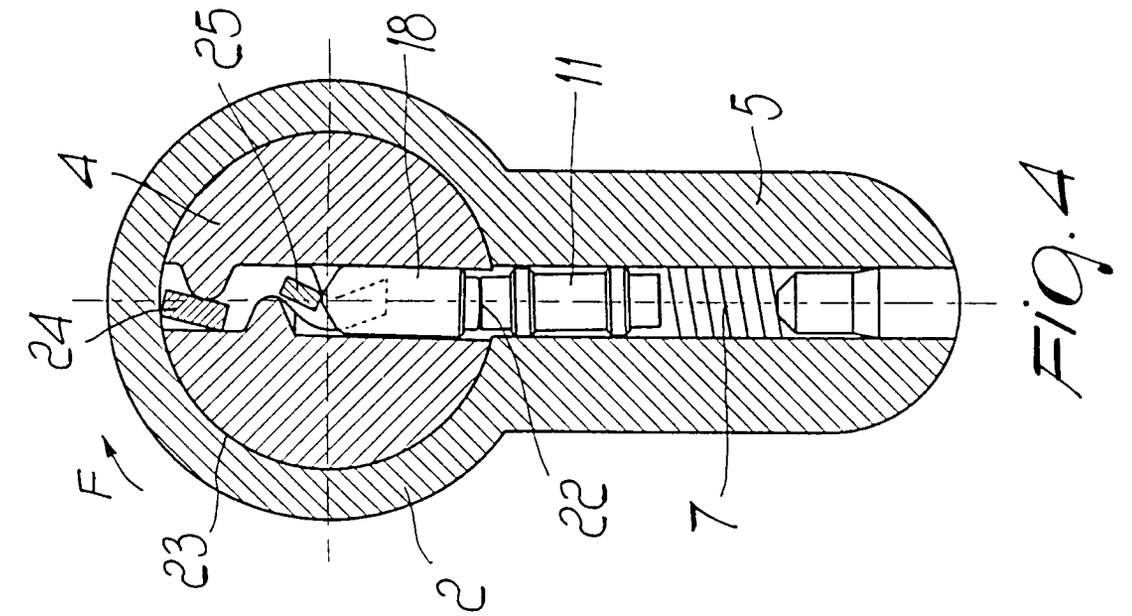

Fig.4

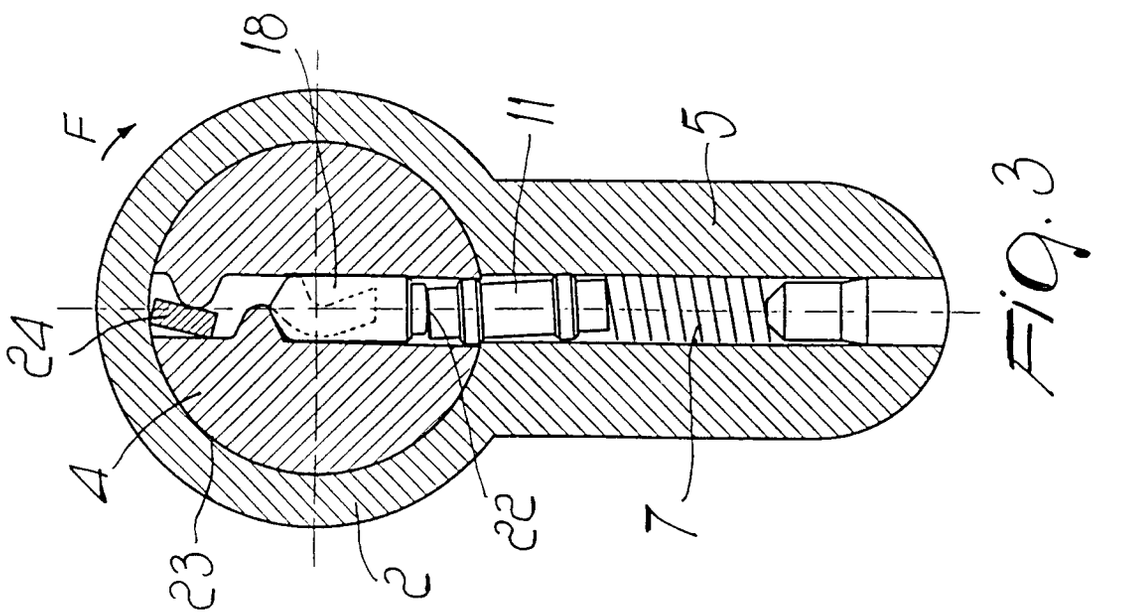

Fig.3

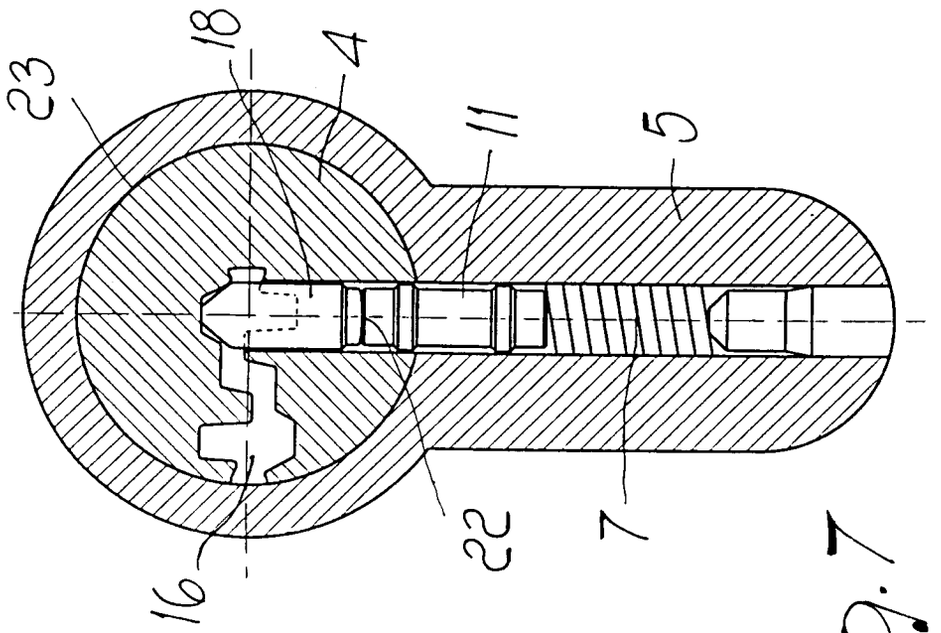

Fig. 7

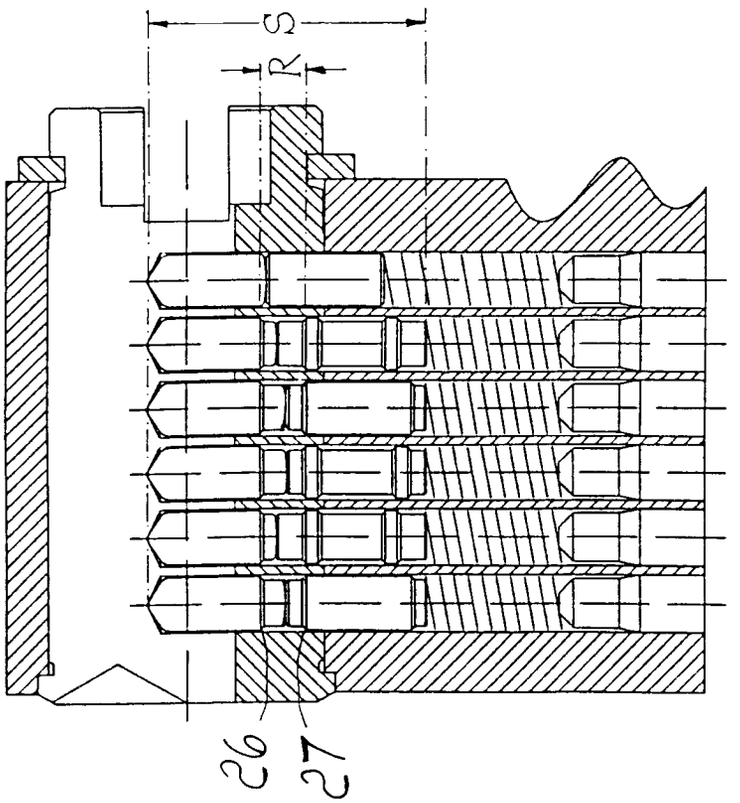

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 12 1142

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,X	EP 0 092 812 A (NEIMAN SA) * the whole document *	1,2	E05B27/00
D,X	US 3 762 193 A (HUCKNALL R) * column 2, line 7 - column 5, line 10 * * column 5, line 26 - line 54; figures *	1	
A	US 2 687 640 A (MIR ET.AL.) * the whole document *	1,3	
A	US 2 051 772 A (TURRELL) * the whole document *	1	
D,A	US 1 593 513 A (STONE) * the whole document *	1	
A	US 3 656 328 A (HUGHES BENJAMIN F) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 March 1998	Henkes, R

CATEGORY OF CITED DOCUMENTS

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