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(54) A tubular lock

(57) A tubular lock (10) comprises a body (11) in which a rotor (12) is rotatable in order to operate a latch. A series of longitudinal through-holes (24), each housing a respective front pin (25), is formed in the rotor (12) and, correspondingly, a series of longitudinal blind holes (26), each housing a rear pin (27) and a spring (28) acting thereon, is formed in the body (11). In the rest position of the lock, each through-hole (24) is aligned with a respective blind hole (26) and the rear pins (27) are urged against the front pins (25) by the springs (28) and are partially housed in the through-holes (24), locking the rotor (12). The pins (25, 27) are moved by a suitable tubular key (13) in a manner such that each is housed entirely in its own hole (24, 26), releasing the rotor (12). To prevent tampering, the blind holes (26) have enlarged mouths (29).

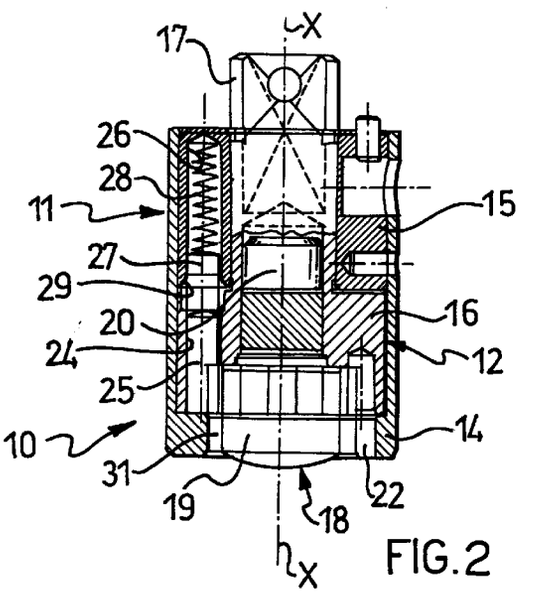

FIG.2

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Description

[0001] The subject of the present invention is a tubular lock.

[0002] Tubular locks of the type comprising a cylindrical body in which a rotor is rotatable in order to operate a latch are known. At the front, between the body and the rotor, the lock comprises an annular lock frame into which the tubular key is fitted. An annular series of through-holes, parallel to the axis of the rotor, is formed in the rotor adjacent the frame, each through-hole housing a respective slidable front pin. An annular series comprising the same number of blind holes, parallel to the axis of the rotor and having the same diameter as the through-holes of the rotor, is correspondingly formed inside the body; each blind hole houses a respective slidable rear pin on which a spring acts, urging the pin out of the hole. In the rest position, each through-hole of the rotor is aligned and in communication with a respective blind hole of the body and each rear pin is held resiliently by the respective spring against a respective front pin and is partially housed in the hole of the front pin so as to prevent the rotor from rotating.

[0003] The front pins differ from one another in length, whereas the rear pins are of equal length. Each front pin and the respective rear pin form a pair of pins.

[0004] This lock is operated with the use of a key having a tubular shank the end of which has an outer, annular series of recesses, the number of recesses being equal to the number of pairs of pins, and the recesses being of different and suitable lengths. If the key is inserted in the annular frame in an appropriate position defined by suitable matching elements, each recess of the shank of the key engages a portion of a respective front pin and the movement of the key into the frame urges the pins towards the base of the lock against the action of the springs until, at the end of the key's travel, by virtue of the different lengths of the recesses, the rear pins are housed entirely in their holes and the rotor can thus rotate freely in order to operate the latch.

[0005] As is known, this lock is very resistant to forcing since, unlike cylinder locks, the front portion can be made of very hard material.

[0006] However, a skilled prospective intruder can operate the lock in a short time with a suitable tool without having a copy of the key and without forcing the lock. The tool comprises a head and a shank with a tubular end portion on which a series of rods is mounted for sliding with friction along the shank. The intruder inserts the end portion of the shank of the tool into the frame and, by suitable movements of the tool, finds, by means of the rods which interact with the pins, the position in which the pins are housed entirely in the respective holes. The intruder can thus release the rotor for rotation relative to the body of the lock and move the latch.

[0007] The object of the present invention is to remedy this weak point of the aforementioned tubular locks.

[0008] To achieve this object, in a lock of the type described above, the mouth of each blind hole is enlarged in comparison with the rest of the hole. By virtue of this characteristic, it is difficult for an intruder to identify the position in which the two pins of each pair are housed entirely in their respective holes.

[0009] For a better understanding, an embodiment of the invention is described by way of non-limiting example below and illustrated in the appended drawings, in which:

Figure 1 is an exploded, perspective view of a tubular lock according to the invention, and of the respective key,

Figure 2 is a longitudinal section of the lock of Figure 1 in the assembled condition, taken on the line II-II of Figure 3,

Figure 3 is a front view of the lock,

Figures 4, 5 and 6 are three different partial longitudinal sections of the lock which show elements of the lock in the rest position,

Figures 7, 8 and 9 show the elements of Figures 4, 5, and 6, respectively, in the operative position of the lock,

Figures 10, 11 and 12 show the elements of Figures 4, 5 and 6, respectively, in the opposite position to the rest position.

[0010] With reference to Figures 1, 2 and 3, the tubular lock shown, generally indicated 10, comprises a body 11 housing for rotation a rotor 12 which can be connected to a latch, not shown. As is known, the rotor 12 is locked in the body 11 of the lock and is released and rotated in order to operate the latch by means of a suitable tubular key 13.

[0011] The body 11 is constituted by a container 14 and by a bush 15 fixed in the container 14. The rotor 12 comprises a head 16 and a shank 17; the head 16 is locked axially between an internal shoulder of the container 14 and the bush 15; the shank 17, on the other hand, slides in the bush 15 and projects from the body 11 at the rear in order to be connected to the latch, not shown.

[0012] The rotor 12 also comprises an axial pin 18 constituted by a head 19 and a shank 20. The head 19 of the pin 18 projects from the front of the head 16 of the rotor 12; the shank 20 of the pin 18 is force fitted in the head 16 and the shank 17 of the rotor.

[0013] An annular frame 31 for housing the tubular shank 21 of the key 13 is formed at the front, between the container 14 and the head 19 of the pin 18 of the rotor 12. Moreover, a recess 22 for coupling with consecutive longitudinal projections 23 of the shank 21 of

the key 13 is formed in the annular frame 31.

[0014] An annular series of through-holes 24 is formed in the head 16 of the rotor 12, parallel to the axis X thereof. The through-holes 24 are disposed adjacent the frame 31 and in communication therewith. Each through-hole 24 houses a respective slidable front pin 25. The front pins 25 differ from one another in length.

[0015] Correspondingly, an annular series of blind holes 26 is formed in the bush 15, the number of blind holes 26 being equal to the number of through-holes 24 of the rotor, and the blind holes 26 being parallel to the axis X of the rotor 12 and having the same diameter as the through-holes 24. Each blind hole 26 houses for sliding a respective rear pin 27 on which a spring 28 acts, urging the pin out of the hole 26. The mouth 29 of each blind hole 26 is flared. The rear pins 27 also differ from one another in length. Moreover, some of the springs 28 differ from the others in stiffness.

[0016] In the rest position of the lock, shown in Figure 2, each through-hole 24 of the rotor 12 is aligned and in communication with a respective blind hole 26 of the bush 15 and each rear pin 27 is kept resiliently against the respective front pin 25 by the respective spring 28 and is housed partially in the hole 24 of the front pin. Since all of the rear pins 27 are engaged between the bush 15 and the rotor 12, the rotor 12 is thus prevented from rotating.

[0017] In the embodiment described, seven pairs of pins, each formed by a front pin 25 and by the respective rear pin 27, are used and seven holes 24 and seven holes 26 are correspondingly provided.

[0018] Figures 4, 5 and 6 show three of these pairs of pins 25, 27 in the rest position.

[0019] As is known, in order to operate the lock, the tubular key 13 has, at the end of its tubular shank 21, an annular series of recesses 30, the number of recesses being equal to the number of pairs of pins 25, 27 and hence being seven, and the recesses having a number of suitable, different lengths equal to the number of pairs of pins 25, 27. The shank 21 of the key 13 is inserted in the frame 31, the projections 23 being aligned with the recess 22 and, at a certain point during the movement of the key into the frame, each recess 30 of the shank of the key engages a portion of a respective front pin 25; the coupling between the recess 22 and the projections 23 ensures that this engagement is correct. If the key 13 is moved further into the frame 31, all of the pairs of pins 25, 27 are urged towards the base of the lock, against the action of the springs 28 until, when the key reaches the end of its travel, because of the different lengths of the recesses 30 of the shank 21 of the key, the rear pins 27 are housed entirely in their holes 26 in the bush 15, whilst the front pins 25 remain housed entirely in their holes 24 in the rotor 12. Figures 7, 8 and 9 show this operative position of the three pairs of pins 25, 27 of Figures 4, 5, and 6. At this point, since there is no longer any pin interposed between the rotor 12 and the bush 15, the rotor is released for rotation and can thus be rotated freely, consequently operating the latch. During the rotation of the rotor 12, the pairs of pins 25, 27 are disconnected. If the rotor 12 is rotated in the opposite direction back to the starting position, the latch correspondingly moves in the opposite direction and the pairs of pins 25, 27 are coupled again; if the key 13 is removed from the frame 31, the rear pins 27 are returned by the action of the springs 28 so as to be fitted partially in the holes 24, locking the rotor, and the lock is returned to the rest position.

[0020] The lock 10 described and illustrated is very difficult to tamper with.

[0021] In fact a prospective intruder with the tool described in the introduction, or with another tool, cannot identify the position in which the front pins 25 and the rear pins 27 are housed entirely in their own holes 24 and 26 (Figure 2 and Figures 7, 8, and 9) in order then to rotate the rotor 12 and move the latch.

[0022] This is due, first of all, to the flared mouths 29 of the blind holes 26. In fact, in the known tubular locks described in the introduction, in which the mouth of each blind hole has the same diameter as the rest of the hole, it is possible for a prospective intruder, by combining small rotary movements of the rotor permitted by its internal play with longitudinal movements of the front pin, to succeed in feeling the striking of the front pin against the edge of the blind hole and hence to identify the release position of the rotor. The flare of the mouth 29, however, means that the diameter of the mouth is larger than the diameter of the rest of the blind hole 26 and hence that it is not possible, by the small rotations which the rotor 12 is allowed, to succeed in striking the front pin 25 against the edge of the blind hole in order to identify the release position of the rotor; the front pin 25 does, however, strike against the internal wall of the mouth 29, thus deceiving the prospective intruder.

[0023] A further factor which helps to prevent tampering is that both the front pins 25 and the rear pins 27 differ from one another in length. If the pairs of pins 25, 27 are pushed fully home until the springs 28 are fully compressed as shown in Figures 10, 11 and 12, the rearward travel in order to bring the pairs of pins to the position in which the rotor is released is different for each pair of pins so that the release position of the rotor cannot be identified. In the known tubular locks described in the introduction, on the other hand, the rear pins are of equal length and the rearward travel of the pairs of pins from the travel-limit position is therefore equal for all of the pairs of pins, naturally facilitating the identification of the release position of the rotor.

[0024] A further factor which helps to prevent tampering is the different stiffnesses of the springs 28. In fact, in the same position of the pairs of pins 25, 27, the springs 28 exert different resilient forces on the various pairs of pins and it is thus not possible for the prospective intruder to rely on the resilient force to identify the release position of the rotor. In the known tubular locks described in the introduction, in which the springs have

the same stiffness, the resilient forces exerted by the springs are the same and this naturally favours the prospective intruder.

[0025] Naturally variants and/or additions to the above-described lock are possible.

[0026] Instead of the flare, any enlargement of the mouth of the blinds holes may be provided. For example, a cylindrical enlargement of larger diameter than the rest of the hole may be formed.

[0027] With regard to the different lengths of the pins, in general, both for the front pins and for the rear pins, it is possible to consider making at least one pin of a different length from the others. For example, it is possible to make a certain number of pins of equal length and to make the rest of the pins the same length as one another but a different length from the previous pins or to make the rest of the pins a different length from one another and from the previous pins.

[0028] The same considerations apply to the stiffness of the springs, that is, at least one spring should have a different stiffness from the other springs. It may be structurally advantageous to make a certain number of springs of a certain stiffness and the rest of the springs of another stiffness.

[0029] The body and the rotor of the lock may have structures different from that shown, provided that they perform the same functions.

Claims

1. A tubular lock (10) comprising a body (11), a rotor (12) rotatable in the body (11) in order to operate a latch, an annular frame (31) which is disposed between the body (11) and the rotor (12) and in which a tubular key (13) is fitted in order to release and rotate the rotor (12), an annular series of through-holes (24) in the rotor (12), parallel to an axis (X) thereof and each housing a respective slidable front pin (25), an annular series of blind holes (26) in the body (11), parallel to the axis (X) of the rotor (12) and each housing a respective slidable rear pin (27) and a spring (28) which urges the rear pin (27) out of the hole (26); in a rest position, each through-hole (24) being aligned and in communication with a respective blind hole (26) and each rear pin (27) being kept resiliently, by the respective spring (28), against a respective front pin (25) and being partially housed in the hole (24) of the front pin (25) so as to prevent the rotation of the rotor (12), the key (13) being shaped in a manner such as to engage the front pins (25) and such that, in a travel-limit position in the frame (31), the key brings the front pins (25) and the rear pins (27) to a position such that the front pins (25) and the rear pins (27) are housed entirely in their respective holes (24, 26) in order to release the rotor (12), characterized in that the mouth (29) of each blind hole (26) is enlarged in comparison with the rest of the hole.

2. A tubular lock according to Claim 1, in which the mouth (29) is flared.

3. A tubular lock according to Claim 1 or Claim 2, in which at least one of the rear pins (27) has a different length from the other rear pins (27).

4. A tubular lock according to Claim 3, in which the rear pins (27) differ from one another in length.

5. A tubular lock according to any one of the preceding claims, in which at least one of the front pins (25) has a different length from the other front pins (25).

6. A tubular lock according to Claim 5, in which the front pins (25) differ from one another in length.

7. A tubular lock according to any one of the preceding claims, in which at least one of the springs (28) has a different stiffness from the other springs (28).

8. A tubular lock according to Claim 7, in which the springs (28) differ from one another in stiffness.

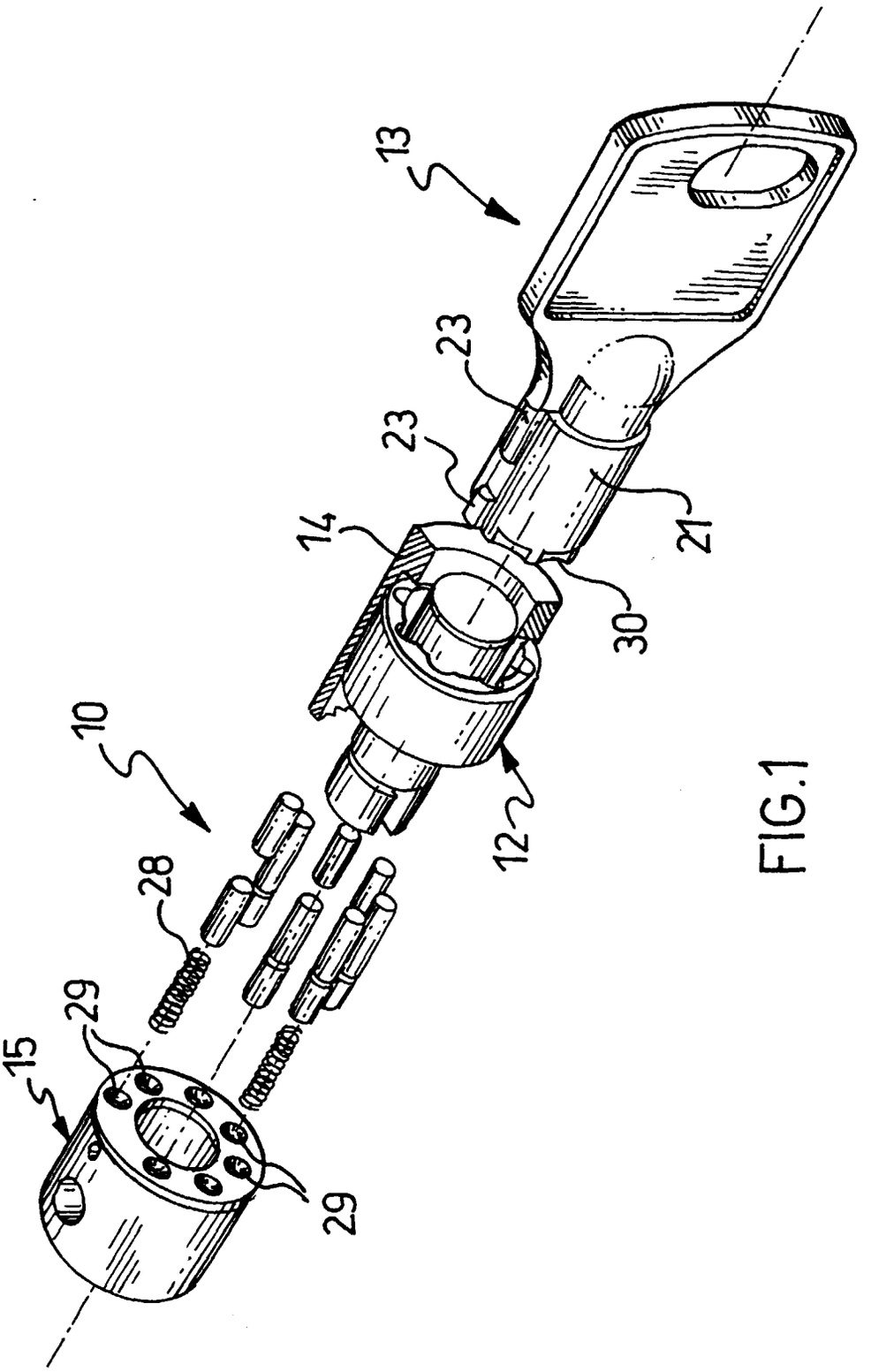

FIG.1

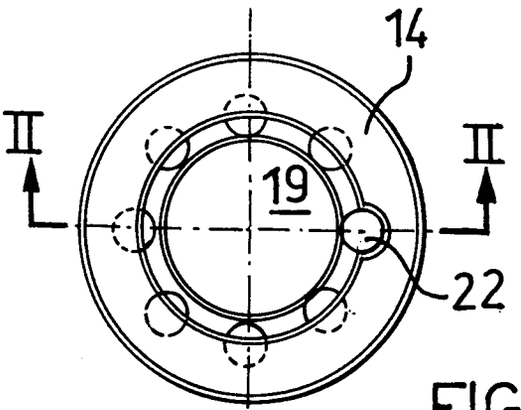

FIG.3

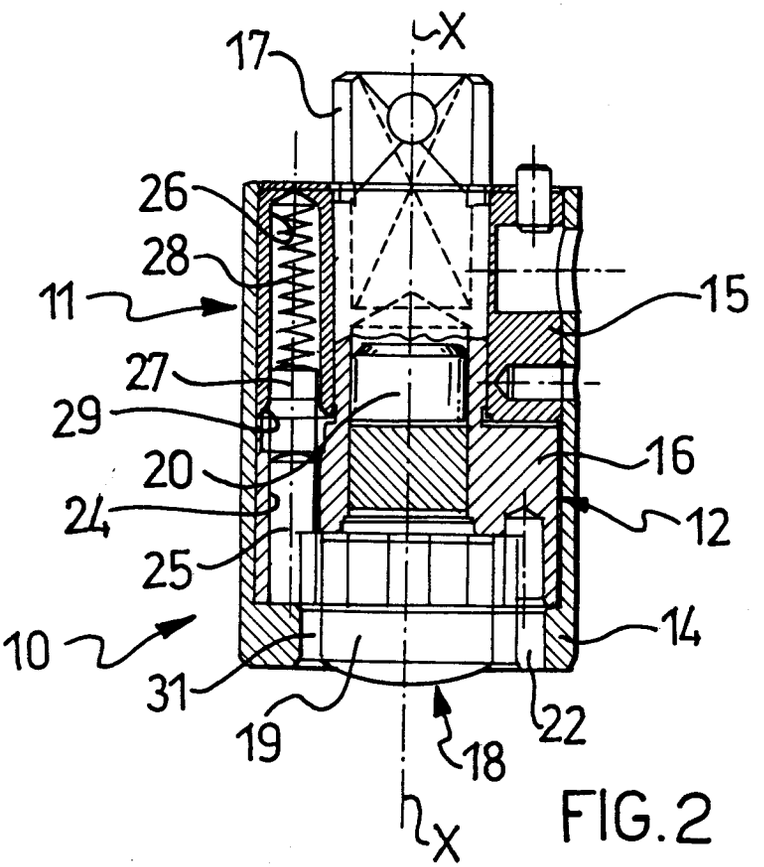

FIG.2

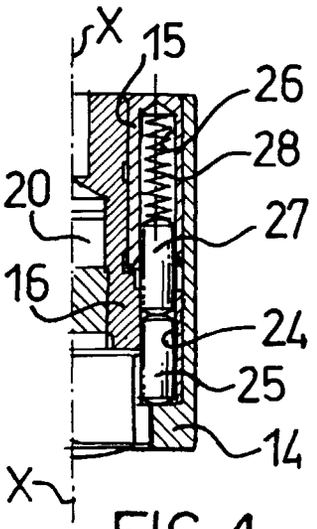

FIG.4

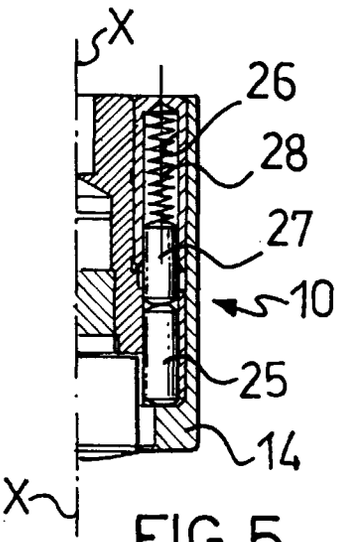

FIG.5

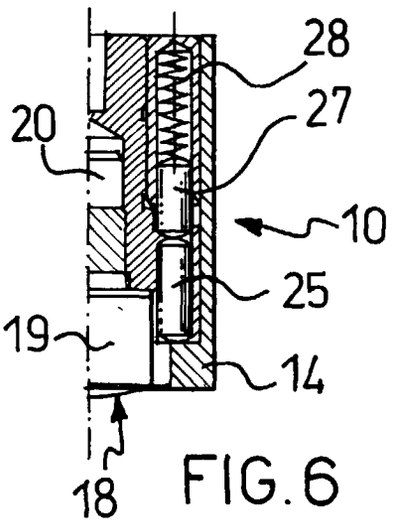

FIG.6

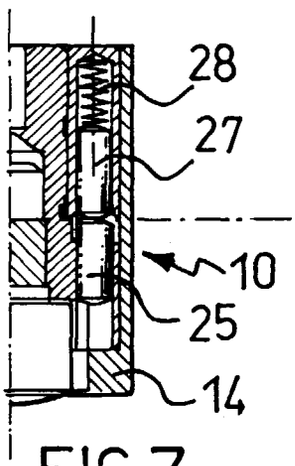

FIG.7

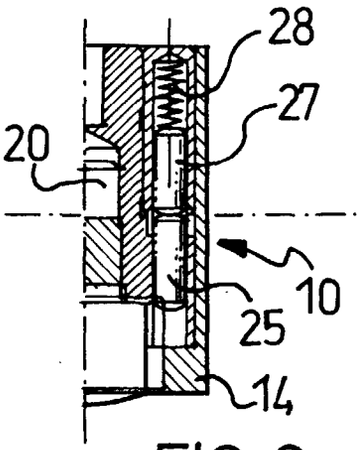

FIG.8

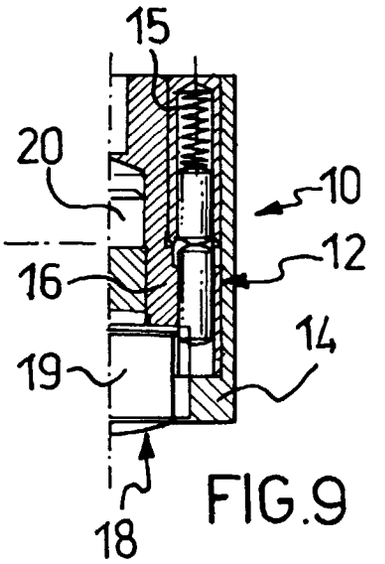

FIG.9

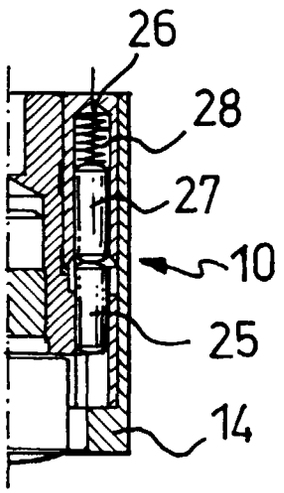

FIG.10

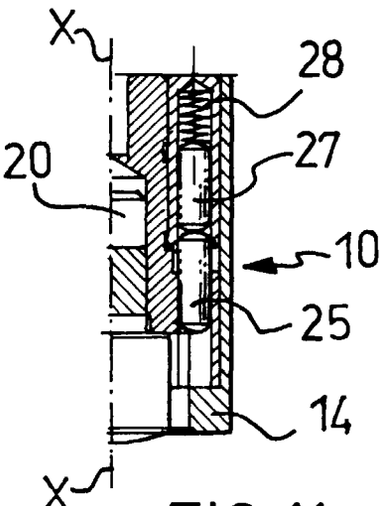

FIG.11

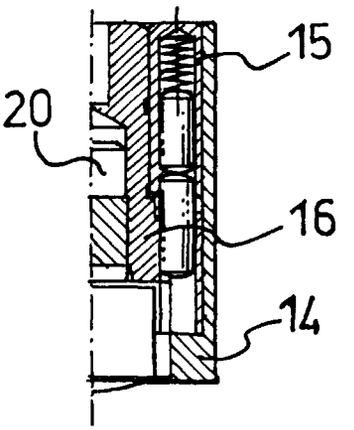

FIG.12

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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0354

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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X	EP 0 139 796 A (HWANG, SHIH-MING) 8 May 1985 * page 5, line 11-13; figures 1-4,6-8 *	1	
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A	DE 29 49 643 A (CHICAGO LOCK) 19 June 1980 * page 15, paragraph 2 - page 16, paragraph 1; figures 5,6 *	1,3-8	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	28 October 1998	Krabel, A

CATEGORY OF CITED DOCUMENTS

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