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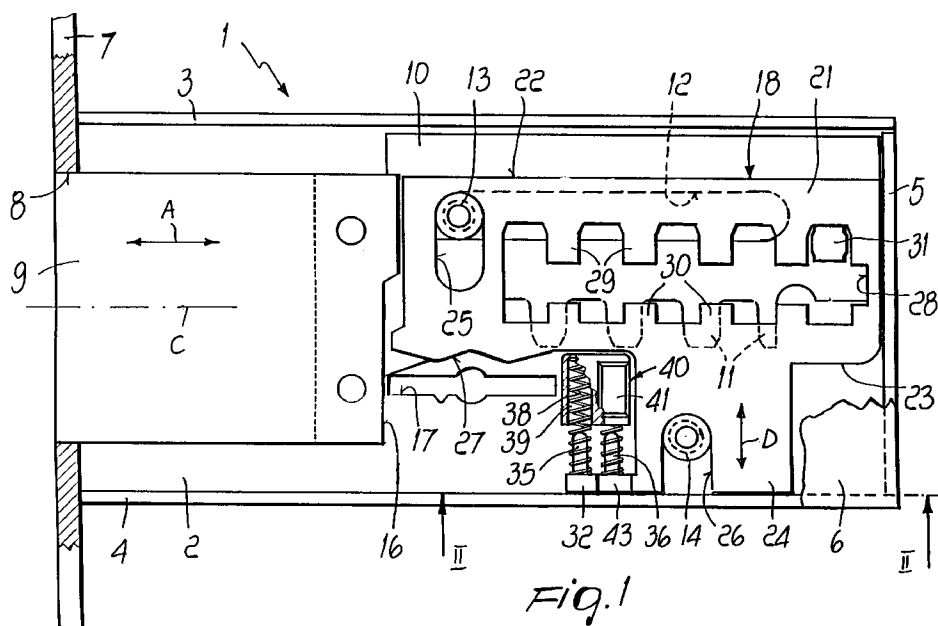
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(54) Lock with flat tumblers

(57) A lock with flat tumblers, comprising a box-shaped body (1) wherein a bolt (9) is slidingly accommodated, the bolt (9) having a tang (10) which is provided with a set of teeth (11) for moving the bolt (9) by means of a double-pattern actuation key and with a locking pin (31) engaging into openings (28) of tumblers (18-20) which are elongated in the bolt sliding direction and have, along their longitudinal edges, mutually opposite teeth (29, 30) forming passages wherethrough the pin (31) advances by successive stops, the tumblers

(18-20) being movable at right angles to the tang (10) in contrast with elastic return elements constituted by cylindrical helical springs (38), the tumblers (18-20) being provided with respective expanded portions (24) which protrude from the key engagement edge and have abutment tabs (32-34) for the springs (38), the springs being arranged at right angles to the bolt sliding direction between the tabs (32-34) and a supporting element (40) adjacent to the edge.



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Description

The present invention relates to a lock with flat tumblers.

These locks comprise a box-shaped body which slidably accommodates a bolt having a tang provided with a set of teeth for moving the bolt by means of a double-pattern actuation key and with a locking pin engaging into openings of tumblers which are elongated in the bolt sliding direction and have, along their longitudinal edges, mutually opposite teeth which form passages wherethrough said pin advances by successive stops.

By actuating the key by means of the cut patterns, the tumblers are placed in such a mutual position that, through the subsequent rotation of the key, it is possible to make the locking pin slide between the mutually opposite teeth to allow the expulsion or retraction of the bolt from the box-shaped body. The tumblers perform their return stroke, and are kept in their inactive position, i.e., in the position for blocking the transverse pin, by means of elastic return elements.

In conventional locks, the tumblers engagement on the pin is provided by means of leaf-type springs which act between a peripheral wall of the box-shaped body of the lock and one side of the tumbler and are arranged in the plane of said tumbler. Since the tumblers are arranged side by side, so as to form a sort of pack, the springs cannot be thicker than said tumblers, and therefore manufacturers are already subjected to limitations.

The worst problem, however, resides in the difficulty in anchoring the ends of the springs to the tumblers. The commonest method is currently to form a notch on the edge of the tumbler where to the spring must be coupled, to insert the end of the spring in said notch, and to compress the edge of the notch so as to achieve anchoring of the spring. This system has been found to be disadvantageous for two substantial reasons: first of all, the compression of the edge of the notch damages the spring, since the tough structure of the spring remains more or less severely cracked and secondly, the continuous actuation of the spring weakens the anchoring point.

In other locks, all the tumblers rest on a single return spring. When the key is operated, the spring acts on the tumbler that performs the longest stroke because of the intended combination of the locks. The tumblers return to their initial position by gravity and because of the entrainment caused by mutual friction among the tumblers.

In order to obviate the above drawbacks, the Applicant proposed, with Italian patent no. 931728 dated July 14, 1971, a lock wherein the tumblers arranged on each side of the bolt have tabs which are folded on the plane of one of the tumblers and act as a guide for elastic return elements, constituted by cylindrical helical springs, which act at right angles to the bolt sliding direction.

This lock, however, has the drawback of an excessive bulk in a vertical direction, i.e., above and below the

bolt, and therefore the use of the lock is limited to situations wherein enough space is available to accommodate it.

A principal aim of the present invention is therefore to provide a flat-tumbler lock in which the elastic return elements are constituted by cylindrical helical springs and which has a structure with a limited vertical bulk.

Within the scope of this aim, an object of the present invention is to provide a lock which is structurally simple and easier to assemble than conventional locks.

This aim and this object are achieved by a lock with flat tumblers, comprising a box-shaped body wherein a bolt is slidably accommodated, said bolt having a tang which is provided with a set of teeth for moving the bolt by means of a double-pattern actuation key and with a locking pin engaging into openings of tumblers which are elongated in the bolt sliding direction and have, along their longitudinal edges, mutually opposite teeth which form passages wherethrough said pin advances by successive stops, said tumblers being movable at right angles to said tang in contrast with elastic return elements constituted by cylindrical helical springs, characterized in that said tumblers are provided with respective expanded portions which protrude from the key engagement edge and have abutment tabs for said springs.

Further characteristics and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a sectional side view of the lock according to the invention;

figure 2 is a sectional view, taken along the plane II-II of figure 1; and

figure 3 is an enlarged-scale view of a detail of figure 2.

With reference to the above figures, the lock comprises a box-shaped body 1 which is composed of a bottom 2 surrounded by a peripheral wall composed of two longitudinal walls 3 and 4 and a transverse wall 5. The walls 3, 4, and 5, with reference to the drawing, are termed upper, lower, and rear walls respectively for the sake of convenience in description. The reference numeral 6 designates the cover which closes the box-shaped body.

The box-shaped body 1 is associated, for example through spot welds, to a front faceplate 7 wherein there is provided the rectangular opening 8 wherethrough the bolt 9 of the lock protrudes externally and is slideable in the direction A. The bolt 9 continues inside the box-shaped body with the tang 10. The tang 10 is constituted by a flat bar which is not as thick as the bolt 9 and lies on the centerline plane that is co-planar to the bolt.

The upper edge of the tang 10 is adjacent to the upper wall 3 and has, along the lower edge, a set of

teeth 11 shaped like a rack.

A slot 12 is formed in the tang 10 and is elongated in the direction A; an internally threaded bush 13 engages said slot and rises from the bottom 2 of the box-shaped body whereto it is fixed. The bush 13 allows to guide the tang 10 during the extraction and retraction strokes of the bolt 9 relative to the box-shaped body, and together with another bush 14 acts as an engagement element for the screws 15 by means of which the cover 6 is fixed so as to close the box-shaped body of the lock.

As shown in figure 1, the set of teeth 11 is approximately aligned with the centerline plane C of the bolt 9, so that the rear edge 16 of the bolt and the set of teeth 11 delimit a recess whereat the opening 17 is provided for the insertion of the double-pattern key for the actuation of the lock. An opening which is mirror-symmetrical with respect to the opening 17 is also provided in the cover 6.

Laterally to the tang 10 there are provided two groups of flat tumblers, each composed of three mutually adjacent tumblers 18, 19, and 20, wherein the tumblers 18 and 20 are mirror-symmetrically identical to each other.

Each tumbler is composed of a substantially rectangular part 21, with an upper edge 22 and a lower edge 23 wherefrom an expanded portion 24 protrudes towards the lower wall 4.

The rectangular part 21 and the expanded portion 24 have respective slots 25 and 26 which are elongated in the direction D at right angles to the direction A and are engaged by the bushes 13 and 14 which, together with the rear wall 5, guide the tumblers in the direction D. At the opening 17 for the key, the lower edge 23 of the rectangular part 21 has a profile 27 which is shaped so that it can be engaged by the double-pattern key inserted in the opening 17 of the bottom 2 or of the cover 6.

A cutout 28 is formed in the part 21 of each tumbler and is elongated in the direction A; a set of teeth 29 protrudes from the upper longitudinal edge of said cutout and is arranged opposite to a second set of teeth 30 which protrudes from the lower edge of the cutout 28.

The teeth 29 form squared tooth spaces which allow to insert, between them, a locking pin 31 which has a squared cross-section and extends on both sides of the tang 10 whereto it is rigidly coupled.

The height of the teeth 29 of each tumbler is alternately the same, but it differs according to a preset cut with respect to the height of the teeth of the adjacent tumbler. Moreover, the opposite ends of the upper teeth 29 and of the lower teeth 30 delimit a passage which is slightly higher than the pin 31, so as to allow said pin to pass between the mutually opposite teeth when the tumblers 18, 19, and 20 are actuated by the key.

Respective tabs 32, 33, and 34 protrude from the ends of the expanded portions 24 towards the front faceplate 7, and respective rods 35, 36, and 37 protrude from said tabs towards the wall 21 and at right angles to

the direction A.

The lateral tabs 32 and 34, comprising the tab 33 between them, have the same length but are longer than the intermediate tab 33.

The rods 35-37 act as guiding and retention elements for cylindrical helical springs 38 which rest on the tabs 32-34 with one end. The cylindrical springs 38 are inserted in respective recesses 39 of a supporting element 40 constituted by a prism-shaped block, which is arranged between the opening 17 and the expanded portions 24 of the tumblers.

The element 40 has, on two opposite faces, rectangular raised portions 41 and 42 which are adapted to engage in complementary slots of the bottom 2 and of the cover 6 in order to anchor the element 40 inside the box-shaped body of the lock.

It should be noted that the springs 38 have a diameter which is greater than the thickness of the tumblers 18-20; therefore, in order to prevent the spring 38 fitted on the rod 36 of the intermediate tab 33 from interfering with the lateral tabs 32 and 34 during the actuation of the tumblers 18-20, said lateral tabs have curves 43 and 44 which are opposite to each other.

Operation of the described lock is fully identical to that of conventional locks. Assuming that the lock is in the open condition of figure 1 and that one intends to actuate it in the closed position, by inserting the double-pattern key in the opening 17 and turning said key counterclockwise, the tumblers 18-20 are aligned so that the passage formed by the mutually opposite teeth 29 and 30 is arranged to the left of the pin 31, and therefore the pin 31 can shift to the left and engage the next tooth space, wherefrom it then moves into the next one at every half-turn of the key. When the bolt 9 has been fully extracted from the lock, the pin is at the opposite end of the opening 28.

The outward advancement of the bolt 9 is caused by the key itself which, after aligning the tumblers as desired, acts on the set of teeth 11 of the tang 10.

The tumblers 18-20 are retained in the position for intercepting the pin 31 and therefore the bolt 9 by means of the cylindrical helical springs 38, which return the tumblers to their lower abutment at every stop, i.e., every time the key performs a half-turn.

It is evident that the described lock perfectly achieves the intended aim and object.

In particular, the reduced height of the tang 10 allows to form a space wherein it is possible to accommodate, in a longitudinal direction, the opening 17 for the lock actuation key and the tumbler return springs 38. In this way, the height of the lock decreases considerably, since there are no mechanical parts which require space above and below the bolt, as instead required in conventional locks to allow to place the springs and move the tumblers, as well as to allow rotation of the key.

A substantial advantage of the described lock resides in the fact that only three kinds of tumbler, corresponding to those that compose each one of the two

groups provided on each side of the tang 10, are required to provide the lock. In an equivalent lock, six different tumblers would instead be required, since each group is composed of three different tumblers which are mirror-symmetrical with respect to those of the other group.

It should also be noted that the springs 38 are partially guided by the rods 35-37 and partially in the recesses 39. In this manner, the rods 35-37, by entering the recesses 39, require a reduced space for their movement.

Numerous modifications and variations are possible in the practical embodiment of the invention, and all are within the scope of the same inventive concept. For example, the tabs 32-34, the springs 38, and the element 40 can be arranged on the opposite side of the expanded portions 24, i.e., between the expanded portions 24 and the wall 5.

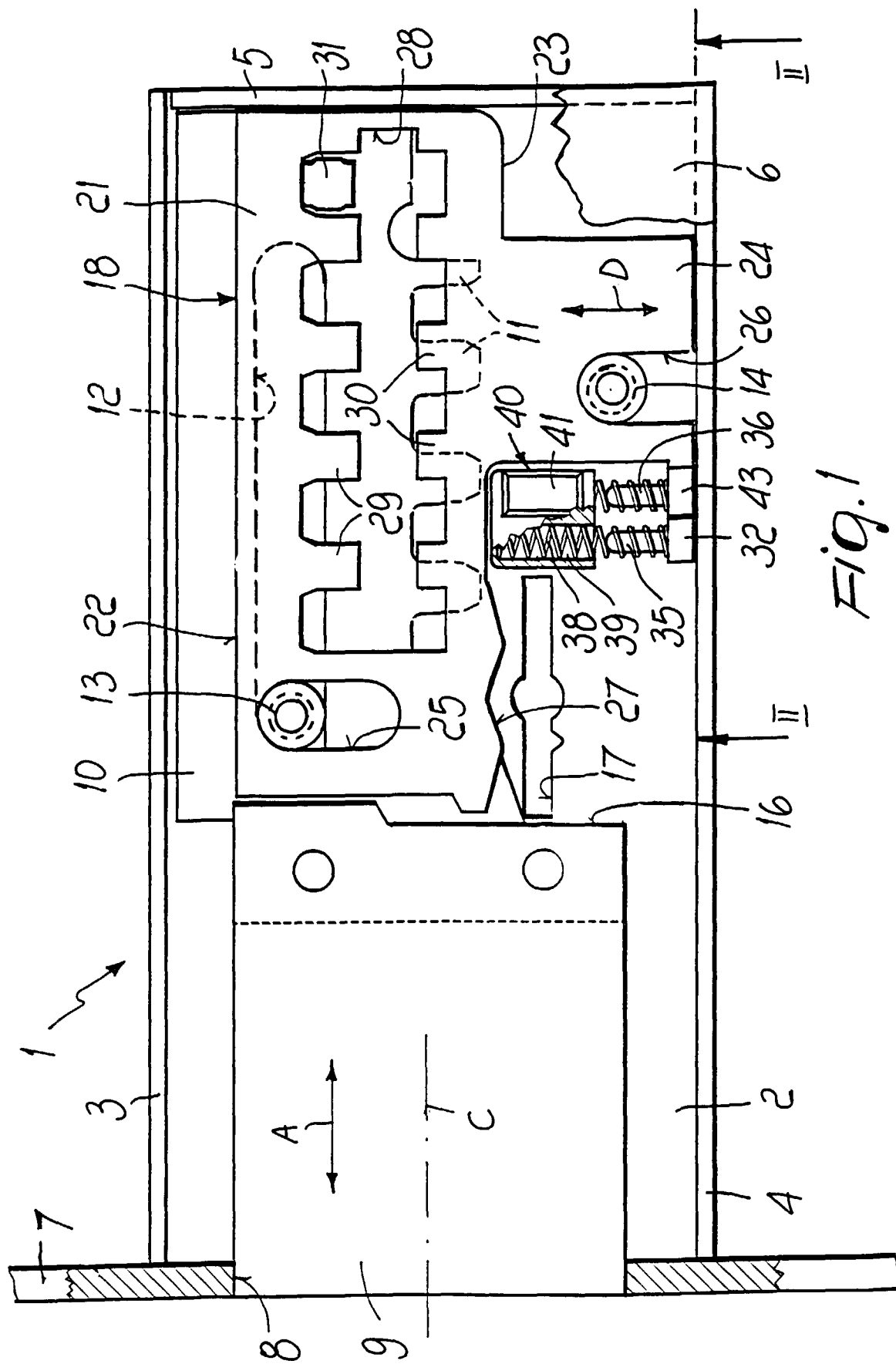
In any case, it is constructively possible to maintain the vertical bulk of the tumblers and their movement within the space occupied by the bolt.

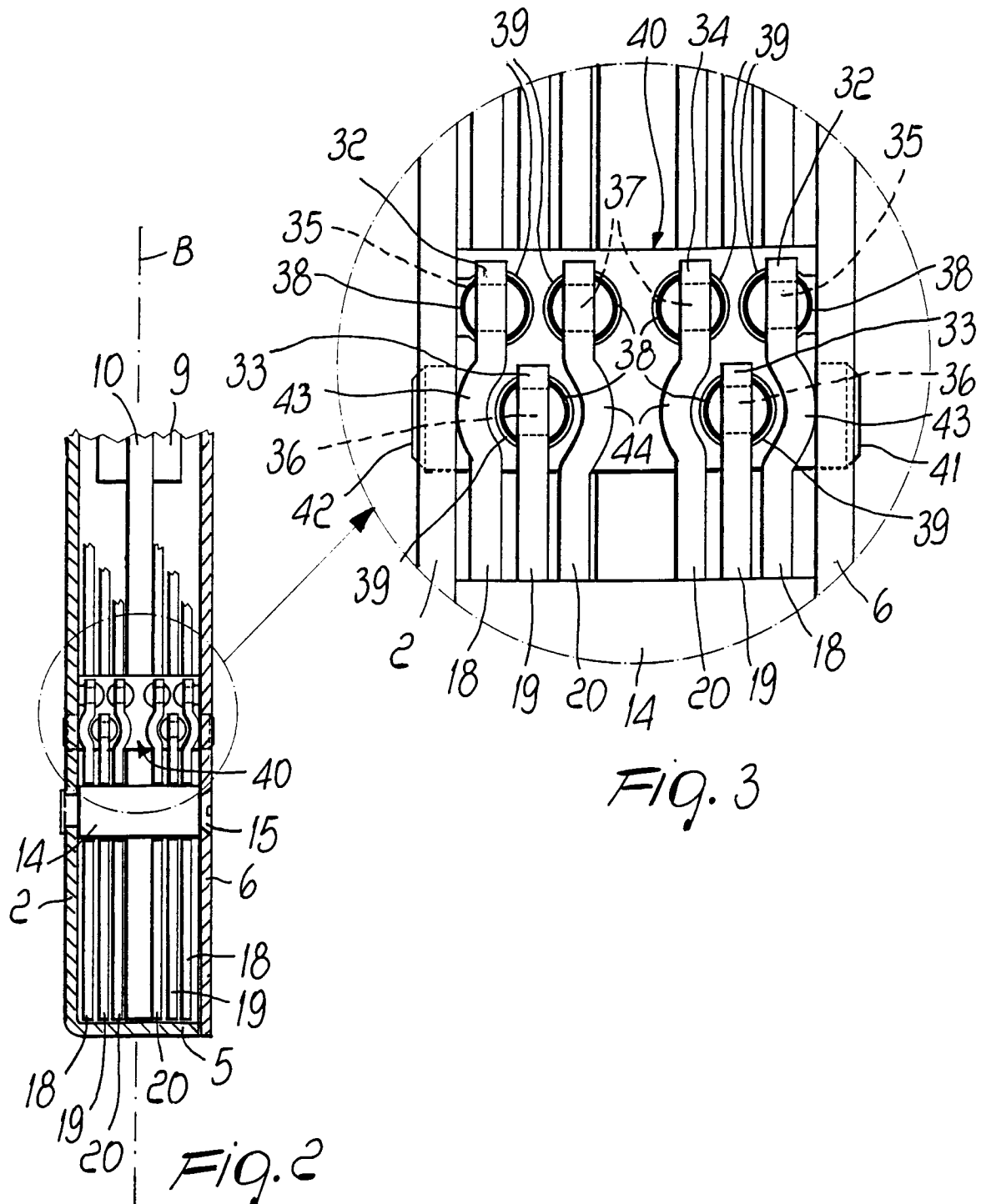
Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified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

Claims

1. Lock with flat tumblers, comprising a box-shaped body (1) in which a bolt (9) is slidably accommodated, said bolt having a tang (10) provided with a set of teeth (11) for moving the bolt by means of a double-pattern actuation key and with a locking pin (31) engaging into openings (28) of tumblers (18-20) which are elongated in the bolt sliding direction and have, along their longitudinal edges, mutually opposite teeth (29, 30) which form passages wherethrough said pin (31) advances by successive stops, said tumblers (18-20) being movable at right angles to said tang (10) in contrast with elastic return elements constituted by cylindrical helical springs (38), characterized in that said tumblers (18-20) are provided with respective expanded portions (24) which protrude from the key engagement edge (27) and have abutment tabs (32-34) for said springs (38), said springs (38) being arranged at right angles to the bolt sliding direction between said tabs (32-34) and a supporting element (40) which is adjacent to said edge.
2. Lock according to claim 1, characterized in that the set of teeth (11) of said tang (10) forms, together with the rear edge (16) of the bolt and said expanded portions (24), a recess whereat the opening (17) for inserting the double-pattern key is provided.

3. Lock according to claim 2, characterized in that said supporting element (40) is fixed in said body (1) between said key opening (17) and said expanded portions (24).
4. Lock according to claim 2, characterized in that said supporting element (40) is fixed in said body (1) on the side of said expanded portions (24) that lies opposite to the side adjacent to said key opening (17).
5. Lock according to one of the preceding claims, characterized in that said supporting element (40) comprises a block which is provided with recesses (39) for partially accommodating said springs (38), and in that said tabs (32-34) are provided with respective rods (35-37) which act as guiding and retention elements for said springs (38), said rods (35-37) being adapted to fit in said recesses (39) during the movement of the tumblers (18-20) produced by the actuation of the key.
6. Lock according to claim 5, characterized in that said tabs (32-34) have curved portions (43, 44) to prevent interferences with the springs (38) that act on adjacent tabs during the movement of the tumblers.







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EUROPEAN SEARCH REPORT

Application Number
EP 96 12 0079

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)
X	US 3 653 238 A (BRUGEMANN HANS) 4 April 1972	1-4	E05B63/00 E05B21/00
Y	* column 3, line 38 - column 8, line 15; figures *	5,6	

X	DE 102 769 C (HALT) * the whole document *	1-4	

X	EP 0 562 539 A (CISA SPA) 29 September 1993	1,2	
A	* column 2, line 15 - column 3, line 43; figures *	5,6	

Y	GB 2 143 574 A (HARDWARE & SYSTEMS PATENTS LTD) 13 February 1985	5,6	
A	* page 1, line 118 - page 3, line 6; figures *	1,2	

A	US 5 267 457 A (SORENSEN BIRK ET AL) 7 December 1993 * column 3, line 12 - column 8, line 30; figures *	1,2,5,6	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E05B

A	EP 0 651 116 A (VACHETTE SA) 3 May 1995 * column 3, line 53 - column 15, line 58; figures *	1,2,5	

A	FR 2 110 096 A (CISA) 26 May 1972 * the whole document *	1,2	

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 1 April 1997	Examiner Henkes, R
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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