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

(11) EP 3 015 628 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.05.2016 Bulletin 2016/18

(51) Int Cl.:
E05B 19/00 *(2006.01)* ***E05B 29/00*** *(2006.01)*
E05B 27/00 *(2006.01)*

(21) Application number: **14382419.1**

(22) Date of filing: **27.10.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) Cylinder device for a lock with combined pin tumblers

(57) The present invention relates to a cylinder device for a lock the purpose of which is to hinder the fraudulent unlocking thereof by third parties, basically comprising a barrel (1) and a plug (2) coupled to one another; where the plug (2) has a cavity (9) for housing a key (3) and where the barrel (1) comprises a pair of counter-pin tumblers (5) and combined pin tumbler (6) coupled to one another, and where the portion of the key (3) to be inserted into the cavity (8) of the plug (2) has two faces (3b, 3c) and two sides (3a), where said sides (3a) comprise at least one cavity (8) having at least one pair of housings (3d, 3e) joined to one another by a channel (3f), and where said cavity (8) is configured to house and push the combined pin tumbler (6) towards the corresponding counter-pin tumblers (5).

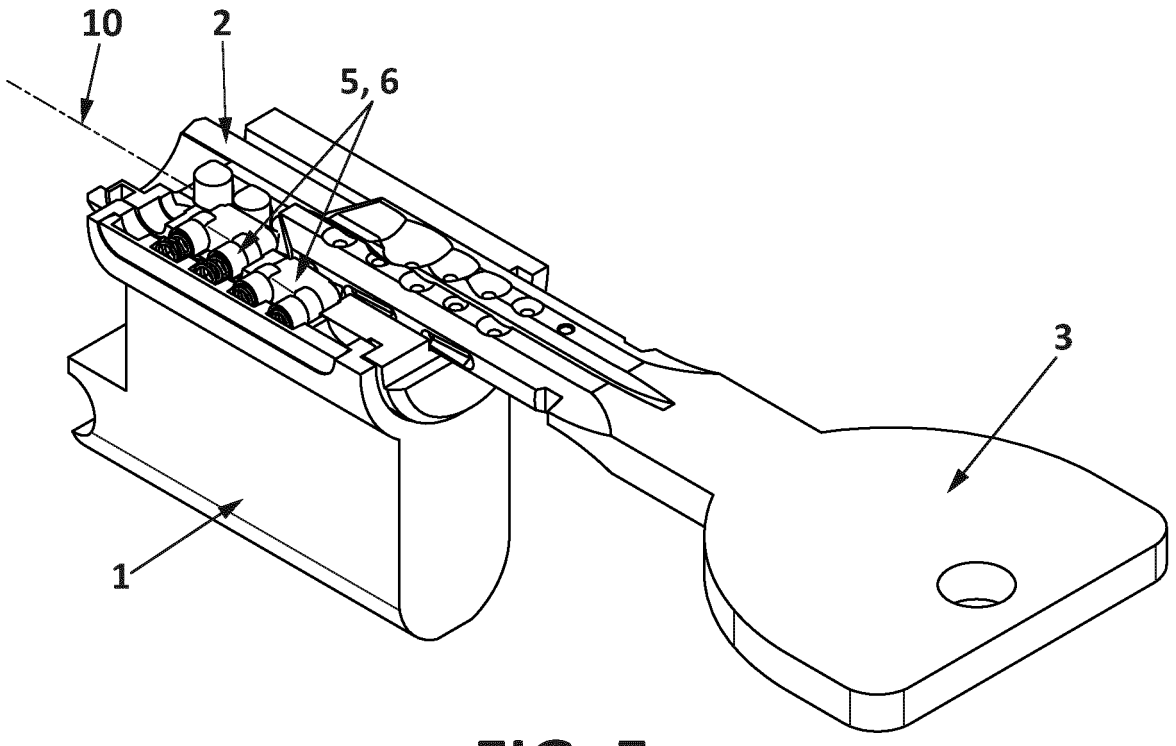

FIG. 5

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Description

Technical Field of the Invention

[0001] The present invention relates to a cylinder device for a lock, having an application in the lock industry, and more specifically in the field of locks for doors or accesses, and also in industry in general in its application for activating other devices.

[0002] The main purpose of this device for cylinders object of the invention is to maximally hinder the fraudulent unlocking of the cylinder by third parties by means of fraudulent manipulation, in addition to hindering the fraudulent reproduction of the keys of the system by preventing their cutting by unauthorized third parties.

Background of the Invention

[0003] By way of introduction, many locking devices for doors or windows in general are known, the most widely used being barrel locks, which have, among other elements, a fixed body known as a barrel coupled directly to the lock, and a rotating cylinder or plug housed axially within the barrel, such that the rotational movement of the plug allows unlocking and locking the lock or activating other mechanisms.

[0004] Such lock cylinders are configured by a barrel and a plug rotating inside the barrel, in which the body of a key which operates an eccentric or cam or the operating element of the cylinder is inserted. Therefore, the blocking/unblocking elements of the barrel are arranged between the rotor and the barrel, said elements being:

- pin tumblers placed in the plug and shifted by the indentations of the key; and
- counter-pin tumblers placed between the plug and the barrel which always remain in contact with the pin tumblers due to the action of springs, both the counter-pin tumblers and the pin tumblers being the elements preventing rotation of the plug in the barrel when they are located in the plane of rotation when there is no key inserted or when the key is not the right key.

[0005] The user is therefore responsible for freeing the rotation of the plug by inserting the right key into it. In this context, and for the purpose of being able to block said rotational movement of the cylinder at the user's will, the rotating cylinder has a series of radial through holes going through the entire thickness of the plug and at any angle; and in correspondence with said holes, the barrel has a series of pin tumblers and counter-pin tumblers aided by springs, such that the pin tumblers have freedom of movement in the direction that is radial to the plug, because the holes of said cylinder are located in correspondence with the position of each of the pin tumblers and counter-pin tumblers of the barrel.

[0006] Each of the pin tumblers preferably has a different length, such that when they are placed in a certain position, all the junction planes between the pin tumblers and counter-pin tumblers correspond with the junction plane between the barrel and the plug, allowing the rotational movement of the plug with respect to the barrel.

[0007] To enable placing each of the pin tumblers in said specific position, it is necessary to insert a key having a stepped geometry, where each of the valleys defines a depth corresponding with the length and the exact position of each of the pin tumblers to be housed in respective valleys, and therefore defining a unique unlocking code for each type of lock.

[0008] This solution is well known in the state of the art; see, for example, international patent application with publication number WO 03/060261, in which a plurality of pin tumblers are configured to be positioned in a series of locations predefined by the geometry of the key, where said key has a chamfered side in correspondence with the pin tumblers, this being a solution used in simple locks but having the drawback of being readily manipulated by third parties as the geometry thereof can be reproduced with suitable tools, such as deformable keys or wires.

[0009] To solve that drawback, keys are known to have notches on their larger faces in correspondence with the pin tumblers of the body of the lock, such that these notches are preferably located on both larger faces, and therefore hinder fraudulent unlocking as there are more combinations for the unblocking thereof; however, since use thereof is widespread, it is possible to identify the code as it can be copied in standard keys with notches in accordance with the position of the pin tumblers.

[0010] Additionally, a technique for unlocking locks known as bumping should be pointed out. In this technique, a key in which all the valleys are machined to maximum depth is used. In this context, said key is inserted into the body of the lock, and at the same time as turning the key in the unlocking direction, the head of the key is hit with an object such that said impact is transmitted to the counter-pin tumblers, being able to line up at a certain moment all the pin tumblers and counter-pin tumblers in the common generatrix of the barrel and plug, since pressure is being applied to the key in the direction of rotation, the rotation of the plug and the subsequent fraudulent unlocking occur.

[0011] For this reason, in view of the drawbacks described and linked to the ease of unlocking locks from the state of the art, a new cylinder device for a lock capable of improving the security of the lock with respect to methods such as picking and bumping, in addition to hindering the manipulation of keys by third parties, is necessary. All this is possible with a device formed by simple entities, the manufacture of which does not substantially increase the cost of the lock device object of the invention.

Description of the Invention

[0012] The present invention relates to a device for lock

cylinders comprising a barrel and plug coupled to one another; where the plug has a cavity configured to allow at least partially housing a key responsible for blocking or unblocking relative movement between said plug and the barrel; where the barrel comprises at least one pair of counter-pin tumblers and a combined pin tumbler coupled to one another through two elastic elements, the plug having at least one hollow consistent with the location of said at least one pair of combined pin tumbler and its counter-pin tumblers, and allowing contact between the key and said at least one combined pin tumbler aided by said elastic elements. Additionally, the portion of the key to be inserted into the cavity of the plug has two larger faces and two sides, where said sides comprise at least one cavity having at least one pair of housings joined to one another by a channel, where said cavity is configured to house, position and push said at least one combined pin tumbler towards the corresponding counter-pin tumblers, where said combined pin tumbler has at least two protuberances joined to one another by a chord the specific shape of which corresponds with the specific geometry of said cavity of the key; defining a specific spatial position between respective combined pin tumbler and counter-pin tumblers which allows relative movement between the barrel and the plug as it is aligned with the junction plane between both.

[0013] It can therefore be seen that the lock device has two main entities:

- On one hand, one entity is the assembly formed by the barrel and plug, which is preferably housed in a lock which is in turn preferably placed in a door, window or similar object, coupled to a frame, case or fixed part.
- On the other hand, the other entity is a key responsible for unlocking and locking the door or window with respect to the frame, case or fixed part, or for activating another device.

[0014] Such entities are known in the state of the art according to the background described above, but it can be seen that as a novel feature, the key has on its sides at least one specific cavity located in correspondence with the at least one combined pin tumbler belonging to the assembly formed by the barrel and the plug; therefore when the key is housed inside the plug, the cavity of the key acts like an envelopment with respect to the combined pin tumbler and places it in a certain position with respect to the counter-pin tumblers, applying compression on said at least one elastic element responsible for elastically joining the combined pin tumbler with its respective counter-pin tumblers. Said certain position defines a specific code and corresponds with the junction plane between the barrel and the plug, such that the user can rotate the plug with respect to the barrel in order to operate the lock or the associated device.

[0015] It can additionally be seen that there is implicitly a technical effect that is very advantageous and linked to the particular geometry of the pin tumbler and the cavity of the key, because it is described that each pin tumbler has at least two protuberances in correspondence with said pair of housings of the key in the respective specific cavity; these technical features allow said pin tumbler to have the possibility of swinging with respect to an axis parallel to the plane of contact between said combined pin tumbler and its counter-pin tumblers, such that if a third party tries to force it open by means of bumping and hits the key to shift the counter-pin tumblers, or by means of picking and makes them vibrate, said counter-pin tumblers do not all shift together because the combined pin tumbler has said at least two protuberances of different height, thereby preventing the forced unlocking in a very effective and simple manner that has been unknown in the state of the art.

[0016] The concept of a cavity on the sides, which is different from stepping on the side of the key, should be pointed out, where said stepping is known in the state of the art of other simpler cylinders for a lock. Since said at least one cavity assures that the combined pin tumbler must be positioned both in height and in depth along the entire length thereof with respect to said at least one cavity of the key, safety against third parties is assured.

[0017] Additionally, if a third party inserts a non-authentic key into the cavity of the plug, the combined pin tumbler will be placed in an arbitrary position with respect to the counter-pin tumblers and it does not have to coincide with the junction plane between the barrel and the plug, preventing relative rotation of the plug with respect to the barrel, and therefore making it impossible to unlock the lock.

[0018] In relation to the design and geometric configuration of the combined pin tumbler, said at least one combined pin tumbler is described as having said at least two protuberances joined to one another by a chord, and where the side of the key has a pair of housings joined to one another by a channel, in correspondence with said pair of protuberances and said chord of said at least one combined pin tumbler, respectively.

[0019] The inviolability of the lock device is thus substantially increased because the combined pin tumbler has two protuberances which therefore define two cavities in the corresponding key, unlike pin tumblers known today formed by simple cylinders, which are easier to manipulate making it easier to unlock the lock.

[0020] The preferred design option in which said at least one combined pin tumbler and the counter-pin tumblers can be joined through two elastic elements configured to allow swinging between said combined pin tumbler with respect to its corresponding counter-pin tumblers is contemplated, thereby improving the swinging of the combined pin tumbler with respect to the corresponding counter-pin tumblers, being a simple and effective solution with respect to possible lock violations by techniques such as bumping and/or picking.

[0021] In this sense, and as a preferred embodiment, each of the protuberances of said at least one combined

pin tumbler is described as having dimensions differing from one another, and where each of the housings configured to contain said protuberances is described as having dimensions differing from one another, respectively. This does not prevent the passage of the key through the inside of the plug because the elastic elements for joining the combined pin tumbler and the counter-pin tumblers are compressed and expand according to the projections and cavities of the key, and again, said preferred design increases safety against third parties that want to unblock the lock device object of the invention without the corresponding key.

[0022] The method of unlocking associated with the lock device object of the invention is also described, where said method comprises the following steps:

a) inserting the key through the cavity of the plug;
b) the elastic element of said at least one pair of combined pin tumbler and counter-pin tumblers being compressed and expanding;
c) housing said at least one combined pin tumbler in said at least one corresponding cavity of the side of the key; defining a specific spatial position for joining respective combined pin tumbler and counter-pin tumblers; and
d) producing relative rotation of the plug with respect to the barrel due to the correspondence of the specific spatial position for joining respective combined pin tumbler and counter-pin tumblers with the junction plane between the barrel and the plug.

[0023] For the purpose of increasing the number of pairs of combined pin tumblers and counter-pin tumblers, it is observed that the side has a surface in which it can house longitudinally and in both orientations a limited number of combined pin tumblers. For this reason, a preferred option is described in which the barrel comprises a plurality of pairs of counter-pin tumblers and combined pin tumblers located orthogonally with respect to said at least one pair of combined pin tumbler and counter-pin tumblers to be coupled to the side of the key, and where said key has on at least one of its faces a plurality of cavities in correspondence with the number and corresponding geometry of the plurality of pairs of combined pin tumblers and counter-pin tumblers.

[0024] The key therefore has cavities both on its larger faces and on its sides, and as a result safety of the device is improved, hindering its inviolability against forced unlocking methods such as picking or bumping. This gives rise to a hybrid between safer, conventional keys and the new key with special cavities on its sides, and the barrel and plug also have combined pin tumblers and counter-pin tumblers located orthogonally with respect to one another, in correspondence with the respective cavities of the key.

[0025] In relation to how relative movement between the barrel and plug is carried out, a design option is described in which the plug has a cylindrical geometry and the barrel has a cylindrical cavity configured for the coupling of said plug, allowing relative movement between respective bodies through the axis of revolution of the cylindrical geometry of the plug. This is a simple and extremely reliable solution because the plug can be rotated through the cylindrical contact between said plug and the barrel, assuring sliding contact and a suitable surface finishing that prevents unwanted blocking.

[0026] Finally and in relation to the possibility of using the plurality of pairs of combined pin tumbler and their counter-pin tumblers, orthogonal to said at least one combined pin tumbler to be coupled to the side of the key, the option in which each combined pin tumbler has a height differing from the rest of the pin tumblers is contemplated, configuring an unlocking and locking code which allows or blocks relative movement between the barrel and the plug. Each combined pin tumbler can also be located in different positions along the side of the key aligned by the cavities of the plug and of the barrel; there is also another option in which each combined pin tumbler can be facing the inside or the outside of the plug, again configuring an unlocking and locking code which allows or blocks relative movement of the barrel and the plug.

[0027] Therefore, according to the described invention the cylinder device for a lock according to the invention is an important novelty because it allows obtaining safe blocking of any type of physical entity susceptible of being locked, such that it maximally hinders forced unlocking of such physical entities by third parties, and all this by means of a device having a simple configuration.

Description of the Drawings

[0028] To complement the description being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a series of drawings is attached as an integral part of said description where the following has been depicted with an illustrative and non-limiting character:

Figure 1 shows a three-dimensional view of a preferred embodiment of the cylinder device for a lock object of the invention.
Figure 2 shows a three-dimensional view similar to the view shown in Figure 1, where the barrel and plug are transparent to enable observing the location of the pin tumblers and counter-pin tumblers.
Figure 3 shows a two-dimensional section view similar to the view shown in Figure 2, with the key housed in the plug of the cylinder device for a lock object of the invention.
Figure 4 shows a three-dimensional section view similar to the view shown in Figures 2 and 3, with the key housed in the plug of the cylinder device for a lock object of the invention.
Figure 5 shows a three-dimensional view of a cross section of the cylinder device for a lock object of the

invention, in which the key is in the process of being inserted into the plug.

Figure 6 shows a two-dimensional detail of a cross section of the cylinder device for a lock object of the invention similar to the view shown in Figure 5, in which the key is in the process of being inserted into the plug.

Figure 7 shows a three-dimensional view of the key belonging to the cylinder device for a lock object of the invention, a pair of cavities for housing the combined pin tumblers being seen.

Figure 8 shows a series of two-dimensional views of the combined pin tumblers of the cylinder device for a lock object of the invention.

Preferred Embodiment of the Invention

[0029] In view of Figures 1 to 6, it can be seen how the lock device object of the invention comprises:

- A barrel (1) and plug (2) pair coupled respectively to one another; there being an intermediate blocking element that can be independently released by unblocking the first barrel (1) and rotor (2) pair.
- Each plug (2) has a cylindrical geometry, and each barrel (1) has a cylindrical cavity configured to couple said plug (2) to the inside of said barrel (1), allowing relative movement between respective bodies through the axis of revolution (10) of the cylindrical geometry of the plug (2).
- Each plug (2) also has a cavity (9) configured to allow partially housing a key (3) responsible for blocking or unblocking relative rotation between said barrel (1) and plug (2).
- Each barrel (1) has at least one pair of combined pin tumbler (6) and counter-pin tumblers (5) coupled to one another through respective elastic elements (4), the plug (2) having at least one pair of hollows consistent with the location of said pairs of combined pin tumbler (6) and counter-pin tumblers (5), and allowing contact between each key (3) and said combined pin tumblers (6) aided by respective elastic elements (4).
- In relation to Figures 1 and 7, it can be seen that the portion of the key (3) to be inserted into the respective cavity (8) of the plug (2) has two larger faces (3b, 3c) and a side (3a), where said side (3a) comprises at least one pair of cavities (8) configured to house and push said pair of combined pin tumblers (6) towards respective corresponding counter-pin tumblers (5), defining a specific spatial position for joining respective combined pin tumbler (6) and counter-pin tumblers (5), which allows relative movement between said barrel (1) and the plug (2) as it corresponds with the junction plane between the barrel (1) and the plug (2).
- In relation to Figures 1 to 6, it can also be seen how each barrel (1) comprises a plurality of pairs of counter-pin tumblers (11) and pin tumblers (12) located orthogonally with respect to said two pairs of combined pin tumbler (6) and counter-pin tumblers (5) to be coupled to the side (3a) of the key (3), and where said key (3) has on both larger faces a plurality of cavities (13) in correspondence with the number and corresponding geometry of the plurality of pairs of pin tumblers (12) and counter-pin tumblers (11).

[0030] Additionally, and in view of Figure 8, it can be seen how each combined pin tumbler (6) to be coupled to the side (3a) of the key (3) has two protuberances (6a, 6b) joined to one another by a chord (6c), and in view of Figure 7, it can be seen how the side (3a) of the key (3) has a pair of housings (3d, 3e) joined to one another by a channel (3f), in correspondence with said pair of protuberances (6a, 6b) and said chord (6c) of said combined pin tumbler (6), respectively.

[0031] Each combined pin tumbler (6) also has a height differing from the rest of the combined pin tumblers, configuring an unlocking and locking code which allows or blocks relative movement between the barrel (1) and the plug (2) of the lock.

[0032] Therefore, each of the protuberances (6a, 6b) of the at least one combined pin tumbler (6) to be coupled to the side (3a) of each key (3) has dimensions (A, B) differing from one another, and where each of the housings (3d, 3e) configured to contain said protuberances (6a, 6b) have dimensions differing from one another, respectively. The distance (E) between both protuberances (6a, 6b) is variable according to the design of the channel (3f) of each key (3).

[0033] In view of this description and set of drawings, the person skilled in the art will understand that the embodiments of the invention that have been described can be combined in many ways within the object of the invention. The invention has been described according to several preferred embodiments thereof, but it will be evident for the person skilled in the art that many variations can be introduced in said preferred embodiments without exceeding the object of the claimed invention.

Claims

1. Cylinder device for a lock comprising a barrel (1) and a plug (2) coupled to one another; where the plug (2) has a cavity (9) configured to allow at least partially housing a key (3) responsible for blocking or unblocking relative rotation between said barrel (1) and plug (2); where the barrel (1) comprises at least one pair of counter-pin tumblers (5) and combined pin tumbler (6) coupled to one another through at least two elastic elements (4), the plug (2) having at least one hollow (7) consistent with the location of said at least one pair of combined pin tumbler (6) and counter-pin tumblers (5), and allowing contact between the key (3) and said at least one combined

pin tumbler (6) aided by said elastic elements (4); and the device being **characterized in that** the portion of the key (3) to be inserted into the cavity (8) of the plug (2) has two faces (3b, 3c) and two sides (3a), where said sides (3a) comprise at least one cavity (8) having at least one pair of housings (3d, 3e) joined to one another through a channel (3f), where said cavity (8) is configured to house and push said at least one combined pin tumbler (6) towards the corresponding counter-pin tumblers (5), where said combined pin tumbler (6) has at least two protuberances (6a, 6b) joined to one another by a chord (6c) in correspondence with the geometry of said cavity (8) of the key (3); defining a specific spatial position for joining respective combined pin tumbler (6) and counter-pin tumblers (5) which allows relative movement between said barrel (1) and the plug (2) as it corresponds with the junction plane between the barrel (1) and the plug (2).

2. Cylinder device for a lock according to claim 1, **characterized in that** each of the protuberances (6a, 6b) have dimensions (A, B) differing from one another; and where each of the housings (3d, 3e) configured to contain said protuberances (6a, 6b) have dimensions differing from one another, respectively.

3. Cylinder device for a lock according to any of the preceding claims, **characterized in that** the barrel (1) comprises a plurality of pairs of counter-pin tumblers (11) and pin tumblers (12) located orthogonally with respect to said at least one pair of combined pin tumbler (6) and counter-pin tumblers (5) to be coupled to the side (3a) of the key (3); and where said key (3) has on at least one of its faces a plurality of cavities (13) in correspondence with the number and corresponding geometry of the plurality of pairs of pin tumblers (12) and counter-pin tumblers (11).

4. Cylinder device for a lock according to any of the preceding claims, **characterized in that** the plug (2) has a cylindrical geometry and the barrel (1) has a cylindrical cavity (8) configured to couple said plug (2) to the inside of said barrel (1), allowing relative movement between respective bodies through the axis of revolution (10) of the cylindrical geometry of the plug (2).

5. Cylinder device for a lock according to any of the preceding claims, **characterized in that** it has a plurality of pairs of combined pin tumbler (6) and counter-pin tumblers (5); where each combined pin tumbler (6) has a different height with respect to the rest of the pin tumblers, configuring an unlocking and locking code which allows or blocks relative movement of the barrel (1) and the plug (2).

6. Cylinder device for a lock according to any of the preceding claims, **characterized in that** it has a plurality of pairs of combined pin tumbler (6) and counter-pin tumblers (5); where each combined pin tumbler (6) is located in different positions along the side (3a) of the key (3) aligned by the cavities of the plug (2) and of the barrel (1), configuring an unlocking and locking code which allows or blocks relative movement of the barrel (1) and the plug (2).

7. Cylinder device for a lock according to any of the preceding claims, **characterized in that** it has a plurality of pairs of combined pin tumbler (6) and counter-pin tumblers (5); where each combined pin tumbler (6) is facing the inside or the outside of the plug (2), configuring an unlocking and locking code which allows or blocks relative movement of the barrel (1) and the plug (2).

8. Cylinder key (3) for a lock having two faces (3b, 3c) and two sides (3a), **characterized in that** said sides (3a) comprise at least one cavity (8) having at least one pair of housings (3d, 3e) joined to one another by a channel (3f) having a specific geometry, where said cavities (8) are configured to house at least one combined pin tumbler (6).

9. Lock key (3) according to claim 8, **characterized in that** each of the housings (3d, 3e) of said cavity (8) have different dimensions between respective housings (3d, 3e), respectively.

10. Lock key (3) according to claims 8 and 9, **characterized in that** the channel (3f) joining said at least one pair of housings (3d, 3e) has a notched section having a variable area.

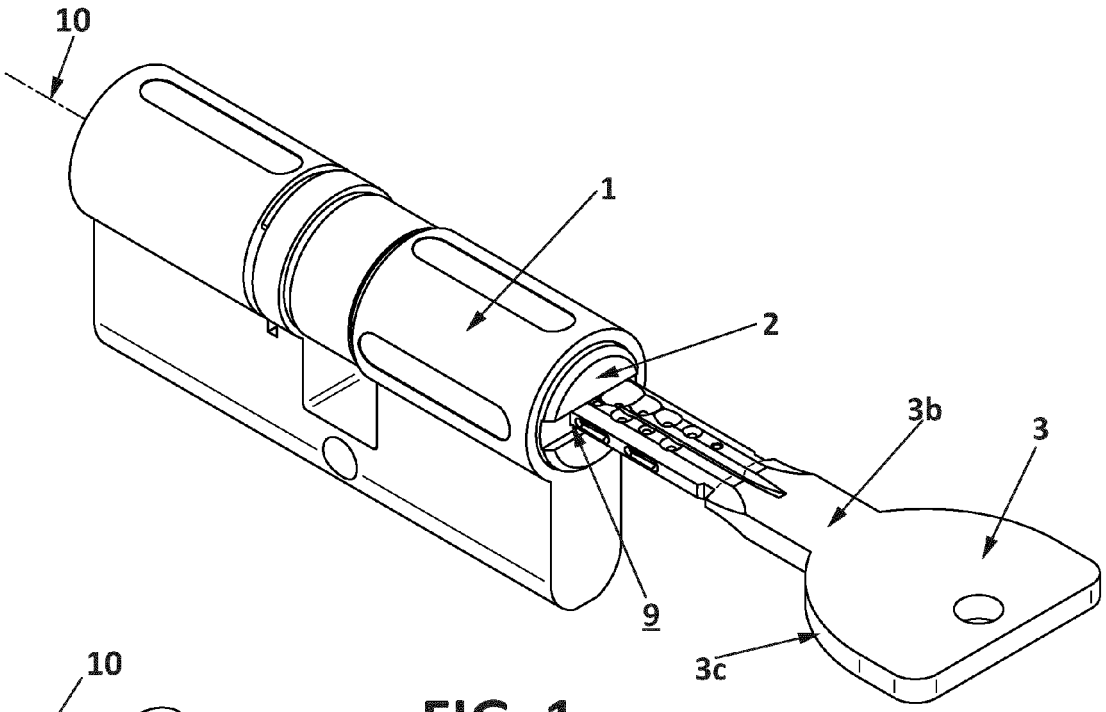

FIG. 1

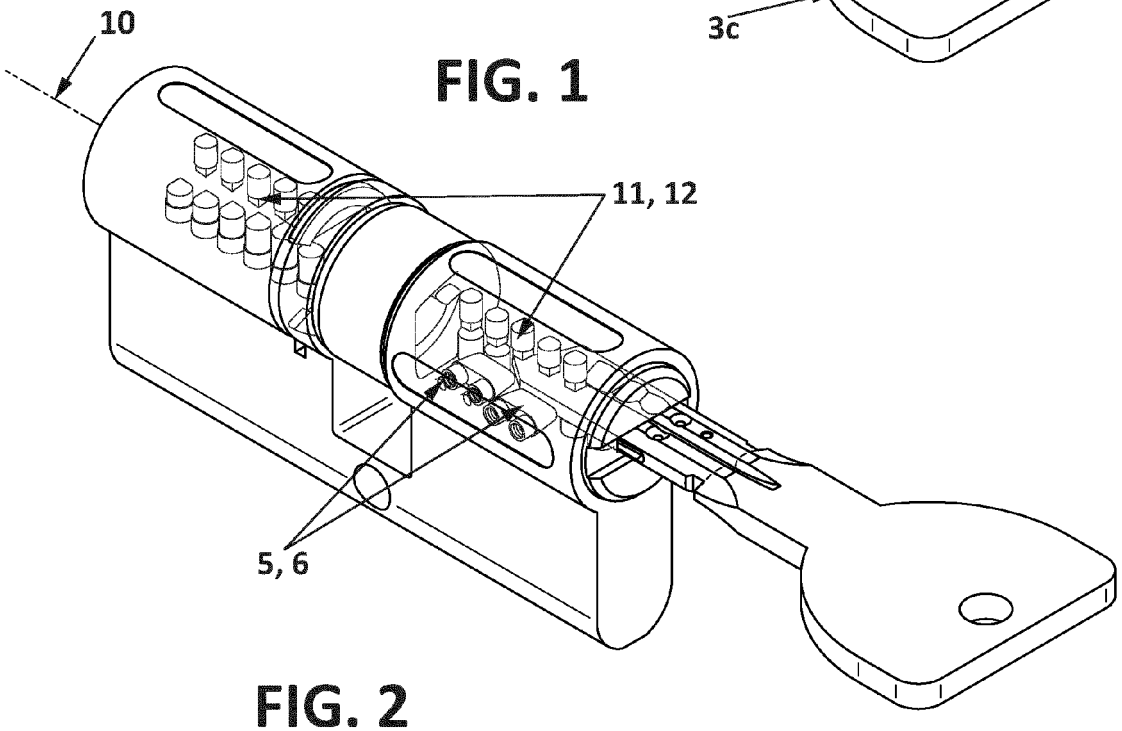

FIG. 2

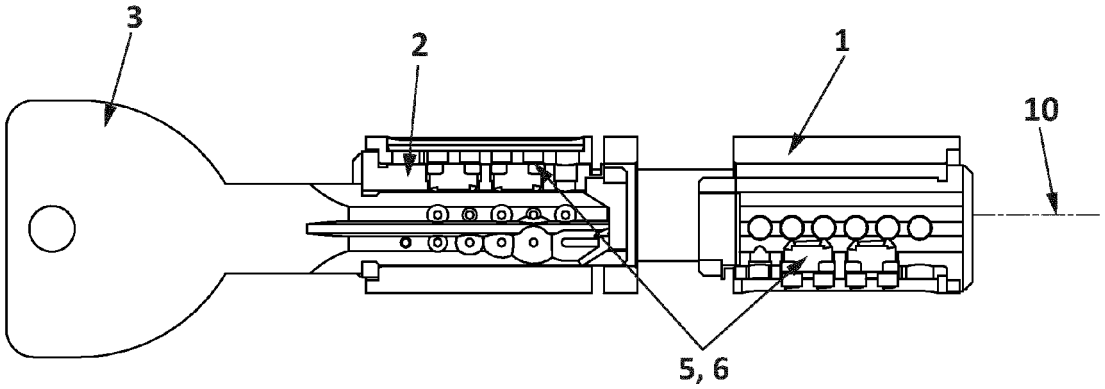

FIG. 3

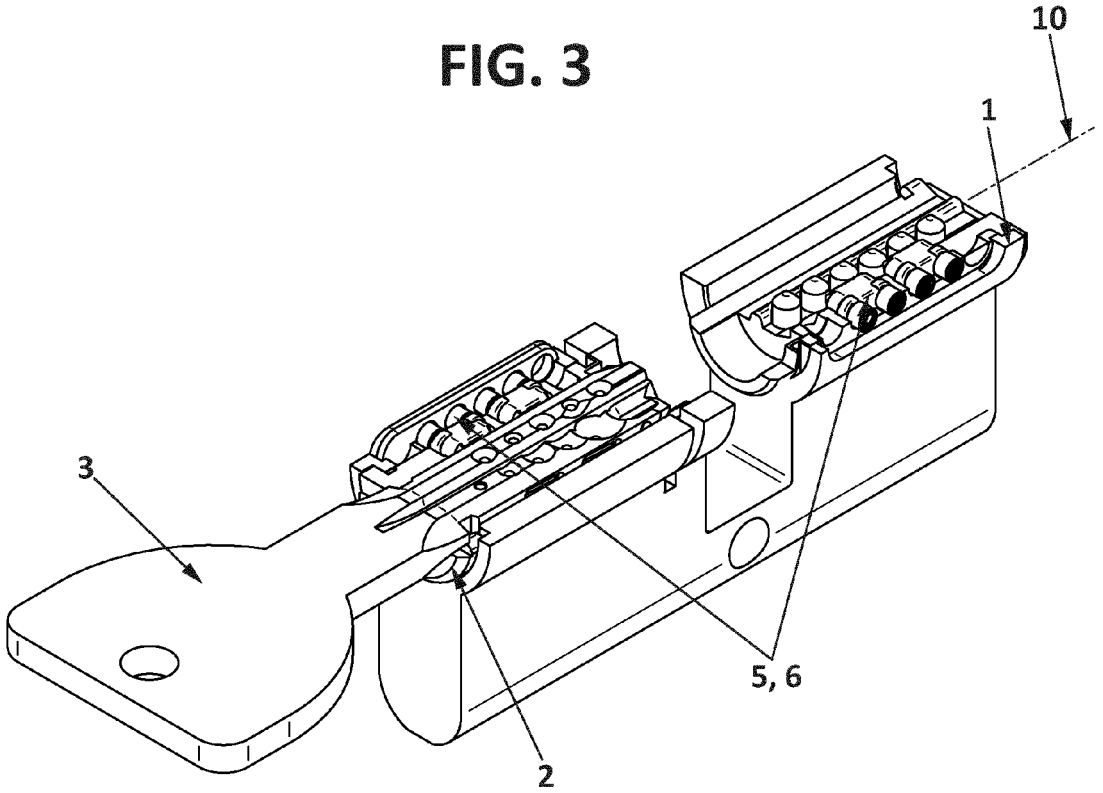

FIG. 4

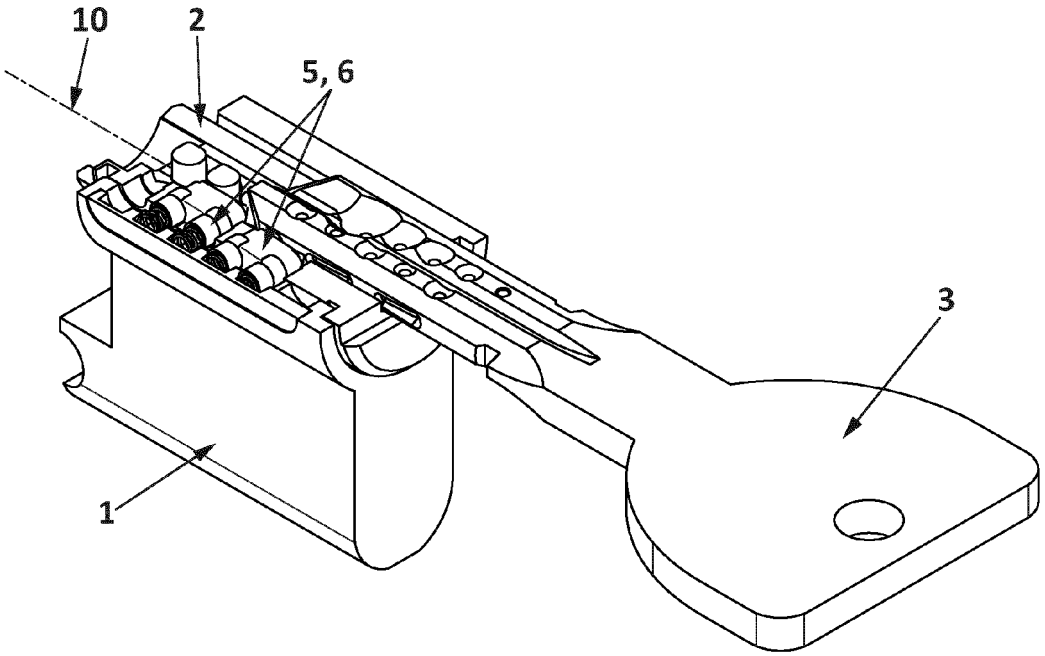

FIG. 5

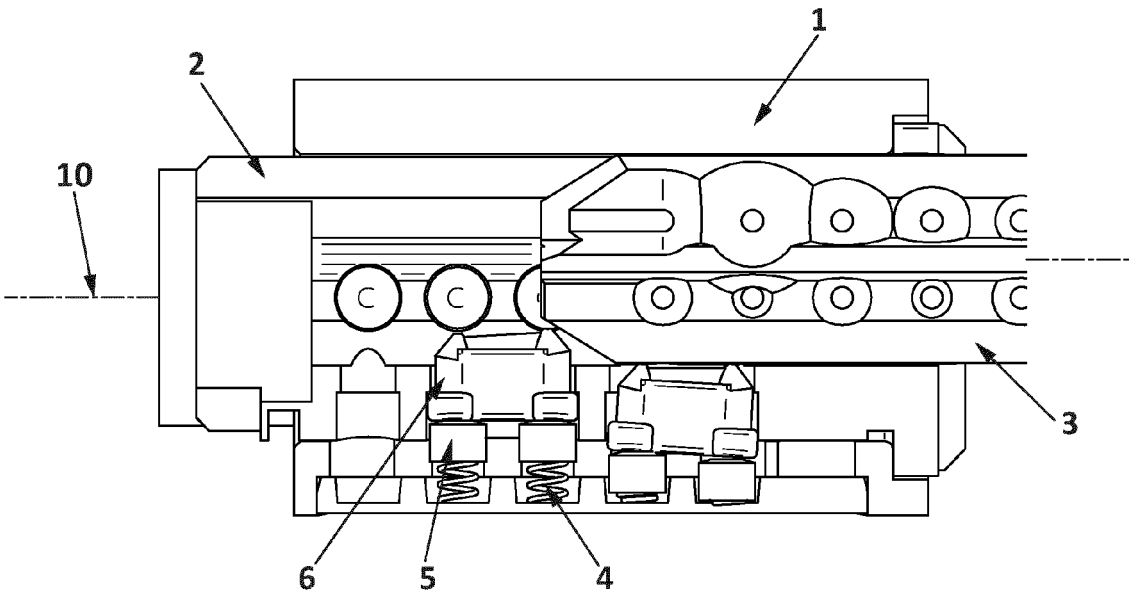

FIG. 6

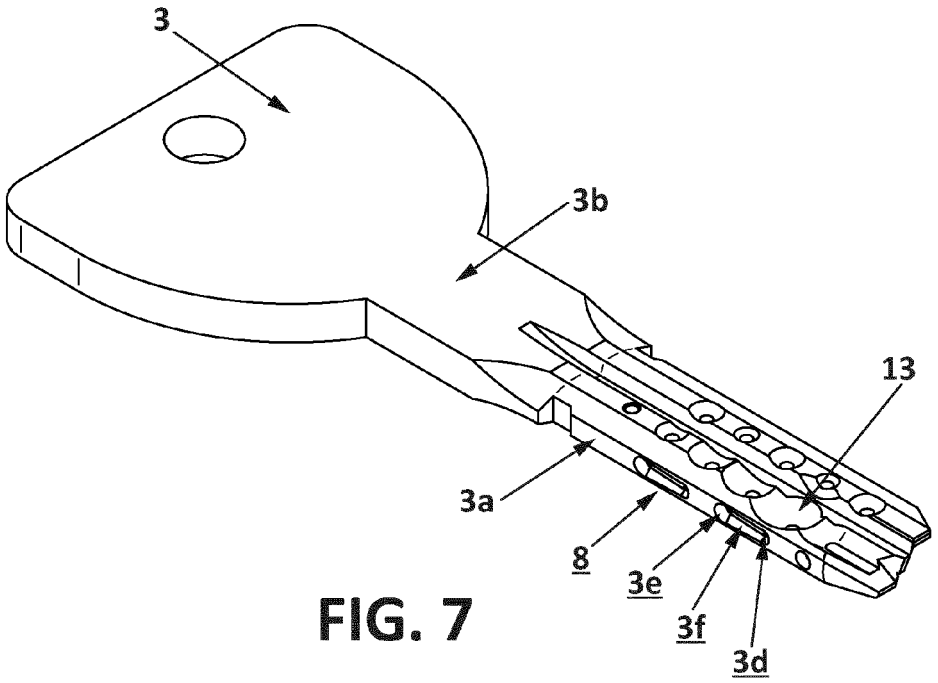

FIG. 7

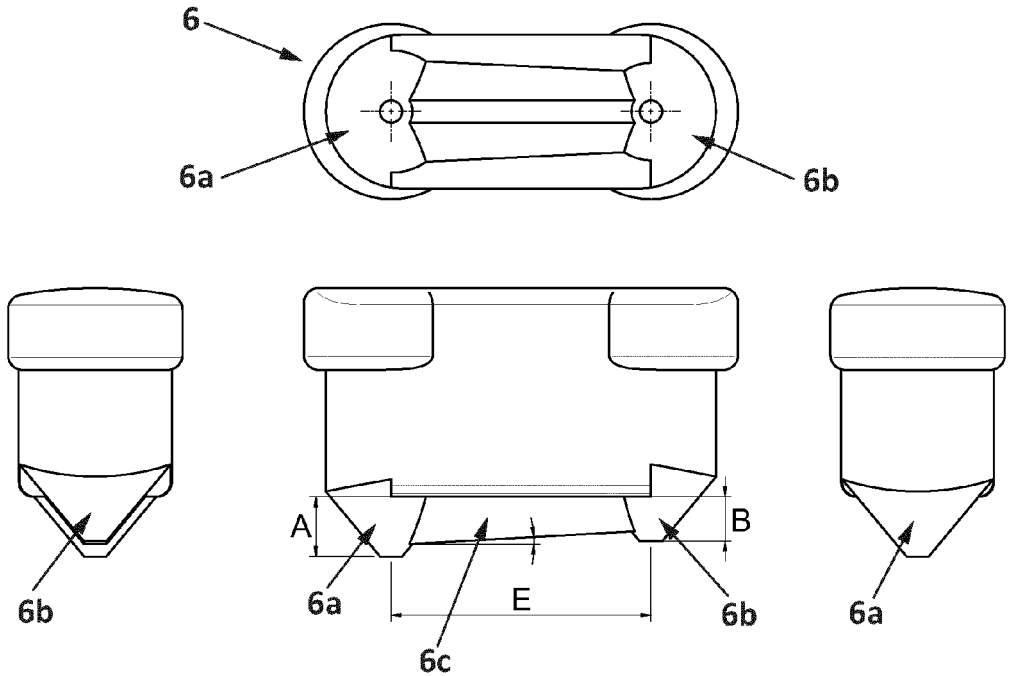

FIG. 8

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 14 38 2419

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	WO 2013/055877 A2 (DOLEV MOSHE [IL]; KLEIN DAVID [IL]) 18 April 2013 (2013-04-18) * page 12 - page 13; figures 9,9A11,11A *	1,2,4-10 3	INV. E05B19/00 E05B29/00 E05B27/00
X A	EP 2 090 726 A2 (TALLERES ESCORIAZA SA [ES]) 19 August 2009 (2009-08-19) * figures 12-16,30,48 *	8-10 1	
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