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(54) **Cylinder lock arrangement**

(57) A lock cylinder arrangement for fixation to a lock casing and for control of a lock mechanism arranged in the lock casing. The arrangement comprises a cylinder housing (2c) having a first axial end (2a) arranged to be positioned distal to the lock casing and a second axial end (2b) being opposite to the first axial end and arranged to be positioned proximal to the lock casing.

A cylinder core (2d) is rotatably accommodated in the cylinder housing. A cylinder ring (21) is mountable coaxially around the cylinder housing. A cylinder cap (22) is mountable coaxially around the cylinder housing, radially inside of the cylinder ring. The cylinder ring comprises a radially inwardly projecting stop (21c), which, in cooperation with a locking ring (23) received in a locking groove (24) arranged in the envelope surface of the cylinder housing, limits axial displacement of the cylinder ring towards the first axial end of the cylinder housing. The cylinder housing and the cylinder cap are provided with interacting locking means (22a, 22b, 22c, 201, 202) which are arranged to limit axial displacement of the cylinder cap toward the first axial end of the cylinder housing, when the cylinder ring surrounds said locking means.

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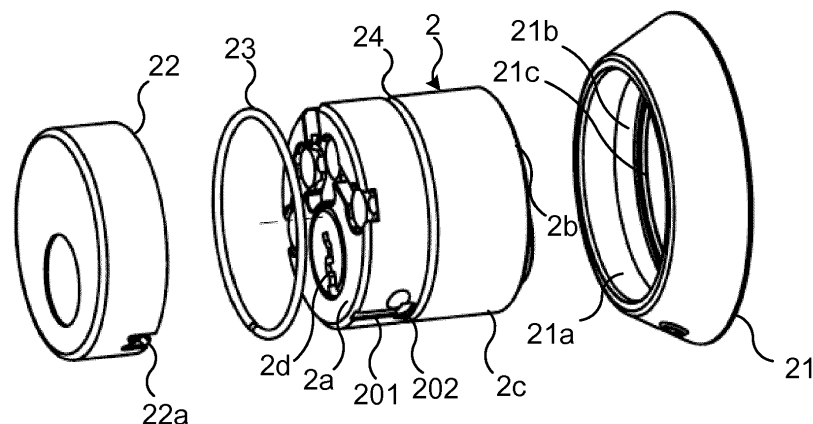


Fig. 3a

Description

TECHNICAL FIELD

[0001] The invention relates to a lock cylinder arrangement intended and arranged for being fixed to a lock casing and for control of a lock mechanism arranged in the lock casing. The invention also relates to a lock arrangement comprising such a lock cylinder arrangement.

BACKGROUND

[0002] Locks for doors, windows, gates and the like are often designed as mortise locks. Such mortise locks comprise a lock case which forms a housing for a lock mechanism and which, when mounted to the door or the like is recessed or mortised into a cavity arranged in the door blade. The lock mechanism comprises movable parts such as cylinder followers and link arrangements which are mechanically connected to one or several bolts e.g. a latch bolt and/or a dead bolt, which bolts may be arranged inside or outside of the lock case. In order to manoeuvre the bolts, a lock cylinder may be fixed to the lock case and connected to the lock mechanism. The lock cylinder comprises a cylinder housing and a cylinder core, sometimes called cylinder plug, which is rotatably accommodated in an axial bore of the cylinder housing. The cylinder housing may also be referred to as a stator and the core may be referred to as a rotor. When the lock cylinder is mounted to the lock case, the core is connected to the lock mechanism such that the bolt or bolts may be manoeuvred by rotation of the core. The core may e.g. be connected to a cylinder follower arranged in the lock case by means of a tailpiece which is fixed to that axial end of cylinder core which lies proximal to the lock case, when mounted. In some locks, movement of the bolts is achieved by manoeuvring of a special manoeuvring device, such as a handle, a knob or an electrical arrangement. In such cases the cylinder core is connected to blocking means comprised in the lock mechanism. The blocking means is arranged to selectively allow and prevent manoeuvring of the bolt and may be controlled by means of rotating the cylinder core.

[0003] In order to control access through the door or the like, the lock cylinder may be arranged such that an authorisation is required for admitting manoeuvring of the bolts. Such an authorization may be accomplished in many different ways, e.g. mechanically, electrically or by a combination of electrical and mechanical means.

[0004] In a traditional key operated lock, authorisation is accomplished mechanically. The lock cylinder is normally then provided with a set of pin tumblers which are displaceably received in pin tumbler chambers arranged in the cylinder housing and in the core. The cylinder core exhibits an axially arranged key channel into which a mechanical key with a code surface may be inserted. Upon insertion of the key, the code surface acts as a cam and displaces or lifts the pin tumblers. If a correct or author-

ized key is inserted the pin tumblers are displaced to positions such that no pin tumbler extends between the pin tumbler chambers arranged in the cylinder housing and the cylinder core. Thereby the core is allowed to be rotated in order to manoeuvre the lock mechanism. If no key or an incorrect, unauthorized key is inserted into the key channel, at least one pin tumbler will be simultaneously received in a respective pin tumbler channel in both the housing and the core. Thereby rotation of the core is prevented. Other examples of mechanical lock cylinders are the disc cylinders.

[0005] In electrical and electro-mechanical locks the lock cylinder may be provided with electronic authorization control means, such as a key pad for entering a code or an RFID reader for detecting a code transmitted from an RFID transmitter worn by the user. Also such lock cylinders may be arranged to prevent rotation of the core relative to the housing if no authorized code has been presented. The manoeuvring of the lock mechanism by means of rotating the core, may however also be selectively allowed and prevented by other means. For example, the core may be connected to the tail piece by means of a coupling device which selectively connects and disconnects the core with the tail piece in response to whether or not an authorized code has been presented. If no authorized code has been presented the core is disconnected from the tail piece such that rotation of the core is not transmitted to the tail piece or the lock mechanism, whereby the lock mechanism may not be manoeuvred or controlled by rotating the core.

[0006] The cylinder core may comprise various different means for bringing about rotation. Instead of being provided with a key channel for insertion of a key which is used for rotating the core, it may comprise or be connected to a knob, a thumb turn, a handle or any electrical means such as a motor or a solenoid for rotating the core.

[0007] The present invention is applicable to all the above mentioned exemplifying variations and uses of a lock cylinder arrangement.

PRIOR ART

[0008] Fig. 0 illustrates a previously known door lock of the above described type which comprises a lock cylinder arrangement. The known lock comprises a lock case 100 that is recessed in a door leaf which has a high security outside 101 and an inside 102, which forms a lower security or convenient side of the door. A first lock cylinder 103a is fixed to the inside of the lock case and a second cylinder 103b is fixed to the outside of the lock case. The two lock cylinders each have a cylinder housing and a core 104 which is rotatable in the cylinder housing. The core has a key channel. When a correct key is inserted into the key channel, the core can be rotated relative to the cylinder housing by turning the key. The core's rotational movement is transferred to a cylinder follower in the lock case 100 by means of a tail piece 105 which is fixed to the end portion of the core 104, which

end faces the lock case 100. Rotation of the cylinder follower in turn affects a locking mechanism in the lock case for actuating a bolt 106 and a latch 107.

[0009] At the traditional lock cylinders, such as the above illustrated, the two cylinders are fixed to the lock housing using screws 108 which are inserted from the inside through the inner cylinder 103a and the lock housing 100 and which, from the inside, are screwed into threaded holes arranged in the outer cylinder 103b. EP 0 072 803 B1 describes another example of such an arrangement. These arrangements have the advantage of that the mounting screws are not accessible from the outside of the door, which outside should exhibit a high degree of security. The arrangements, however, have the serious disadvantage in that a specific cylinder cannot be used both on the outside and on the inside. They are thus not, what in the industry is known as reversible. Instead, the cylinders must be designed either as outside cylinders with threaded non through holes or as internal cylinders with through holes which are provided with internal stops for axial support of the mounting screw heads.

[0010] There are also reversible cylinders which are designed as the above described interior cylinder (103a). The exterior and the interior cylinders are then fixed to the lock housing by means of the respective sets of mounting screws being inserted through each cylinder from the end facing away from the lock case and screwed into threaded holes arranged in the lock case. By this means the cylinder is made reversible whereby one and the same cylinder can be used on both the outside and the inside of the door. The arrangement has however the disadvantage that the mounting screws are accessible from the outside of the door, which seriously reduces the security.

[0011] US 6,860,129 discloses another lock arrangement comprising an outer and an inner lock cylinder and a lock core. The outer lock cylinder is secured to the lock core by means of an outer sleeve, an outer collar provided with locking notches and a locking pin. A head of the locking pin is received in the locking notches and the pin extends through the lock core such that an end of the pin is in contact with an inner collar of the lock arrangement.

[0012] At lock cylinders of the type illustrated in fig. 0, it is known to provide so-called drill protection. Such drill protection normally consists of plates and / or rods which are formed in a high strength material and which are introduced in various particularly sensitive parts of the lock cylinder to prevent these parts, through drilling in the lock cylinder, from being removed or destroyed in order to force the lock.

[0013] US 6,301,942 discloses a lock cylinder provided with drilling protection organs.

[0014] A problem with prior art drilling protection is that it is complicated and space-consuming to obtain a good fixation of the drilling protection parts in the lock cylinder.

[0015] At the lock cylinders illustrated in fig 0, a decorative cylinder ring 109a, 109b is arranged around the

cylinder 103a, 103b on the outside of the door. The cylinder ring 109 may be internally threaded and secured to the cylinder by being threaded onto an external thread provided on the envelope surface of the lock cylinder. Alternatively, and as indicated in fig. 1, the cylinder ring 109 may be fixed to the cylinder by being slipped onto the outside and fixed in position with a radially disposed small fixing screw which is screwed into contact with envelope surface of the lock cylinder. The function of the cylinder ring 109 is to cover the hole in the door through which the cylinder protrudes and thus to provide a neat installation.

[0016] To further enhance the appearance of the installed lock, a decorative cover or cap 110a, 110b can be applied around the cylinder, radially inside cylinder ring, so that the entire lock cylinder, apart from the key channel mouth is concealed under cover. The cap 110a, 110b can be fixed by means of the cylinder ring fixing screw extending through a slot in the cap 110 or by a simple resilient snap element which is snapped into a designated recess in the envelope surface of the lock cylinder. By choosing different materials and designs for the cylinder ring 109a, 109b and the cap 110a, 110b, is it possible to give the entire lock different appearances to match various other accessories and fittings on the door or interior decoration in general.

[0017] US 7,389,660 discloses another known arrangement for fixation of a cylinder ring to a lock cylinder

[0018] In recent years it has proved to be a problem that the decorative details of the lock are attractive to thieves, and that they are stolen, for example from lock installations in public buildings.

[0019] At prior art lock cylinder arrangements it is also known to arrange so called screw protection means.

Such means are arranged for preventing unauthorized persons from removing the lock cylinder from the lock casing and/or the door. The screw protection means may comprise a plug or the like which covers at least one mounting screw by which the lock cylinder is fixed to the lock casing. The plug is arranged at that end of the screw which is used for inserting a screw driver or any other tool for screwing the mounting screw when mounting and dismounting the lock cylinder. The lock cylinder may further be provided with plug locking means which prevent removal of the plug when the cylinder core is in a locked state and which allow removal of the plug when the core has been rotated to an unlocked state. By this means, access to the mounting screw is allowed only for person that are in the possession of a correct key or any other authorization means that allow operation of the lock arrangement.

[0020] EP 0 072 803 B1 discloses a previously known screw protection means comprising a plug of the above described type, which plug is provided with a waist portion. A radially displaceable pin is arranged in a radial bore of the lock housing. A corresponding radial bore is arranged in the lock core. An outward end of the pin may be brought in and out of engagement with the waist por-

tion of the plug to thereby respectively prevent and allow removal of the plug. The pin is displaceable out of engagement with the waist portion only when the cylinder core has been rotated, by means of an authorized key, such that the two radial bores are in register with each other.

[0021] This known screw protection arrangement thus provides for that only persons being in possession of an authorized key are able to remove the plug and to dismount the mounting screws. The known arrangement however exhibits some disadvantages in that it is comparatively complicated to manufacture a cylinder housing and a core with said radial bores. The pin and bores further requires comparatively large space within the cylinder housing and the core and the arrangement requires a comparatively large number of movable parts.

SUMMARY

[0022] It is therefore an object of the present invention to provide an enhanced lock cylinder arrangement.

[0023] Another object to provide such a lock cylinder arrangement with an enhanced fixation of a decorative cylinder ring and cylinder cap.

[0024] It is a further object to provide such a lock cylinder arrangement which prevents unauthorized removal of the cylinder ring and the cap.

[0025] A still further object is to provide such a lock cylinder arrangement at which the cylinder ring and cylinder cap being arranged at an outer lock cylinder can be removed only after gaining access to the inside of the door.

[0026] Yet another object is to provide such a lock cylinder arrangement at which requires dismounting of the lock cylinder from the lock casing for allowing removal of the cylinder ring and the cap.

[0027] It is another object to provide such a lock cylinder arrangement at which the cylinder ring and cap may be readily mounted to the lock cylinder.

[0028] According to the invention the lock cylinder arrangement is intended for fixation to a lock casing and for control of a lock mechanism arranged in the lock casing. The lock cylinder arrangement comprises a cylinder housing having a first axial end arranged to be positioned distal to the lock casing and a second axial end being opposite to the first axial end and arranged to be positioned proximal to the lock casing. A cylinder core is rotatably accommodated in the cylinder housing. A cylinder ring is mountable coaxially around the cylinder housing. A cylinder cap is mountable coaxially around the cylinder housing, radially inside of the cylinder ring. The cylinder ring comprises a radially inwardly projecting stop which, in cooperation with a locking ring received in a locking groove arranged in the envelope surface of the cylinder housing, limits axial displacement of the cylinder ring towards the first axial end of the cylinder housing. The cylinder housing and the cylinder cap are provided with interacting locking means which are arranged to limit axial

displacement of the cylinder cap toward the first axial end of the cylinder housing, when the cylinder ring surrounds said locking means.

[0029] Hereby the cylinder ring and the cap may be easily mounted to the lock cylinder before the lock cylinder has been fixed to a lock casing. Theft of the cylinder ring and the cap is however prevented in an efficient manner, since removal of the cylinder ring and cap requires that the lock cylinder is detached from the lock casing. Such removal of the lock cylinder may only be accomplished after having gained access to the inside of the door or the like.

[0030] The locking means may comprise a radially inwardly projecting snap hook and a radially outwardly projecting locking tab arranged on the cylinder cap and a snap recess arranged in the envelope surface of the cylinder housing, which snap recess is arranged to receive the snap hook.

[0031] The snap hook and the locking tab may be arranged on a resilient tongue of the cylinder cap.

[0032] An axial groove may be arranged in the envelope surface of the cylinder housing, which groove extends from the first axial end surface of the cylinder housing and opens to the snap recess.

[0033] The cylinder cap may be formed of a sheet metal or polymer material.

[0034] The cylinder ring may comprise a front axial portion arranged to lie proximal to the first axial end of the cylinder housing, an intermediate portion and a rear axial portion arranged to lie distal to the first axial end of the cylinder housing. The front axial portion then exhibits a first inner diameter; the intermediate axial portion exhibits a second inner diameter which is larger than the first diameter and the rear axial portion exhibits a third inner diameter, which is smaller than the first and the second diameters.

[0035] The locking ring may exhibit an outer diameter which is smaller than the first and the second inner diameters and larger than the third inner diameter of the cylinder ring, when the locking ring is received in the locking groove.

[0036] The intermediate portion may be arranged to abut the lock tab for pressing the snap hook into the snap recess when the cylinder is positioned around the cylinder cap and cylinder housing.

[0037] The intermediate portion may be conical and exhibit the second inner diameter at an axial end of said intermediate portion being distal to the front axial portion.

[0038] Alternatively, the intermediate portion may exhibit a circumferential recess which defines the second inner diameter.

[0039] The locking ring may be resilient for allowing releasable snap fixation in the locking groove.

[0040] Further objects and advantages of the invention will be apparent from the following detailed description of embodiments and from the appended claims.

[0041] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the

technical field, unless explicitly defined otherwise herein. All references to "a/an/the element, apparatus, component, means, step, etc." are to be interpreted openly as referring to at least one instance of the element, apparatus, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] The invention is now described, by way of example, with reference to the accompanying drawings, in which:

Fig. 0 is an exploded view in perspective illustrating a previously known lock arrangement comprising two lock cylinders.

Fig 1a is an exploded view in perspective illustrating a lock cylinder arrangement comprising two reversible lock cylinders.

Fig 1b is a partly exploded view in perspective illustrating an outer lock cylinder of the arrangement shown in fig. 1a.

Fig. 2a is an exploded view in perspective illustrating a lock cylinder arrangement comprising drill protection members.

Fig. 2b is a cross section of the lock cylinder arrangement shown in fig. 2a.

Fig. 2c is a an exploded view similar to the one in fig. 2a, illustrating the same lock cylinder arrangement with some of the drilling protection members inserted into the cylinder housing.

Figs. 3a-c are perspective views of a lock cylinder arrangement comprising a cylinder ring and a decorative cylinder cap and shows the arrangement during different steps of assembling.

Fig. 3d is a longitudinal section in enlarged scale of a portion of the lock cylinder arrangement shown in figs 3a-c, when assembled.

Figs. 4a and 4b are perspective views illustrating a lock cylinder arrangement comprising means for screw protection.

Fig. 4c is an exploded perspective view of a cover member forming part of the lock cylinder arrangement shown in figs 4a and 4b.

Figs. 4d-4f are front elevation views of the lock cylinder arrangement shown in figs. 4a-4b and shows

components thereof in different operational positions.

DETAILED DESCRIPTION OF EXAMPLIFYING EMBODIMENTS

[0043] The invention will now be described more fully hereinafter with reference to the accompanying drawings, in which certain embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided by way of example so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout the description.

[0044] Figs. 1a and 1b illustrates a cylinder lock arrangement comprising two identical reversible lock cylinders. Fig. 1a, shows an inner lock cylinder 1 and an outer lock cylinder 2. The figure does not show the intermediate lock case arranged between the cylinders, to which lock case the cylinders are fixed. The two cylinders 1, 2 are identical. They exhibit a respective first axial end 1a, 2a which is intended to be located distal to the lock case and a respective second end 1b, 2b arranged opposite to the first end and intended to be arranged proximal to the lock case. Each lock cylinder 1, 2 comprises a cylinder housing 1c, 2c and a core 1d, 2d, which is rotatably accommodated in the cylinder housing 1c, 2c. For fixing of the two cylinders 1, 2, to each other and to the lock case a set of fixation devices 3, 4 are provided. In the example illustrated, four fixation devices are used. Each fixation device comprises a first fixation member 3 being stationary and a second fixation member 4 being rotary. The two fixation members of each fixation device have cooperating engagement parts for fixing engagement. In the example shown, the first fixation member 3 consists of a nut bushing with an internal thread and the second fixation member 4 consists of a screw with external thread. It is also possible that the first fixation member has an external thread and the second fixation member an internal thread. It is also possible that the engagement between the first fixation member and the second fixation member is achieved by means of a bayonet-engagement or the like.

[0045] The cylinders 1, 2, exhibit a number of axial through bores 5, 6 extending through the respective cylinder housing 1c, 2c, which number corresponds to the number fixation devices 3, 4. As seen in Figure 1b, each bore comprises a main portion 5 and a mouth portion 6. The main portion 5 extends from the second cylinder end 1b, 2b to the mouth portion 6 which is arranged adjacent the first cylinder end 1a, 2a. In the illustrated example, the mouth portion 6 is axially divided into an inner mouth portion 6a, being arranged proximal to the main portion 5 and an outer mouth portion 6b being arranged adjacent the first end 2a och the cylinder housing 2. The outer

mouth portion 6b extends a small distance, approx. 5 mm, from the first cylinder end 1a, 2a to the inner mouth portion 6a. The inner mouth portion extends approx. 20 mm from the outer mouth portion 6b to the main portion 5. The main portion 5 has a circular cross section with a first diameter D1.

[0046] The outer mouth portion 6b has a polygonal cross section with a larger cross sectional area than the inner mouth portion 6a and than the main portion 5. In this way, a first axial stop 7 having a generally annular abutment surface is arranged at an inner bottom of the outer mouth portion 6b. The first axial stop 7 is substantially parallel to both cylinder end faces. The first axial stop 7 has a circular inner edge and a polygonal outer edge. The outer mouth portion 6b is thus defined by the first axial stop 7 and by a wall which is arranged perpendicular to the first axial stop 7 and which comprises a number of planar wall segments 8.

[0047] The inner mouth portion 6a has a circular cross section with a second diameter D2 and a cross sectional area that is smaller than the cross sectional area of the outer mouth portion 6b but larger than the main portion 5. In this way, a second axial stop 9a having a generally annular abutment surface is arranged at an inner bottom of the inner mouth portion 6a. The second axial stop 9a is substantially parallel to both cylinder end faces. The second axial stop 9a has a circular inner edge and a circular outer edge. The inner mouth portion 6a is thus defined by the second axial stop 9a and by a cylindrical wall 9b which is arranged perpendicular to the second axial stop 9a and which extends to the first axial stop 7.

[0048] Each first fixation member 3 comprises an internally threaded cylindrical sleeve portion 3a and a first head portion 3b. The sleeve portion 3a has an outer diameter which is slightly smaller than the inner mouth portion's 6a inner diameter D2, so that the sleeve portion 3a can be inserted in the inner mouth portion 6a and therein threadedly receive an externally threaded end 4a (see Figure 1a) of the second fixation member 4. First head portion 3b has a cross sectional area which is larger than the sleeve portion's 3a cross-sectional area and the cross sectional area of the inner mouth portion 6a. The first head portion 3b can thus not be inserted into the inner mouth portion 6a. The cross section of the first head portion 3b is further polygonal with a shape corresponding to the outer mouth portion's 6b polygonal cross section, so that the first fixation member 3 is prevented from rotating relative to the cylinder 1, 2, by means of form locking between the first head portion 3b and the wall segments 8 of the outer mouth portion 6b.

[0049] The rotatable second fixation members 4 each have a cylindrical second head portion 4b. The end surface of the second head portion 4b is provided with a groove (not shown) for engagement by a screwdriver or the like. The second head portion 4b has a diameter that is larger than the diameter D1 of the bore's main portion 5, but smaller than the diameter D2 of the inner mouth portion 6a. When the second fixation member 4 is insert-

ed into the bore 5, 6 from the first cylinder end 1a, 2a, the second head portion 4b can therefore be inserted through outer mouth portion 6b and into the inner mouth portion 6a, where it is allowed to rotate relative to the cylinders 1, 2. By contrast, the second axial stop 9 of the inner mouth portion 6a prevents the second head portion 4b from passing into the main portion 5 of the bore.

[0050] During mounting to a lock case, a first cylinder 1 is placed at the inner convenient side of the lock case and a second cylinder 2 at the high security outside of the lock case. As shown in Figure 1a, the second fixation members 4 are inserted into the first, inner cylinder 1 from the first side 1b. The second fixation members 4 are further pushed such that their threaded portions 4a are passed through corresponding mounting holes (not shown) arranged in the lock casing (not shown) and into the main portion 5 and the inner mouth portion 6a of the second cylinder 2. The first fixation members 3 are introduced into the second, outer cylinder 2 from the first side 2a so that the first head portions 3b are anti-rotationally engaged with the wall segments 8 of the outer mouth portions 6b. The second fixation members 4 are thereafter screwed into threaded engagement with the first fixation members 3.

[0051] It will be appreciated that the first axial stops 7 of the second cylinder 2 prevents the first fixation members 3 from being displaced towards the first cylinder 1. Correspondingly, the second axial stops 9 of the first cylinder 1 will prevent the second fixation members 4a from being displaced towards the second cylinder 2. When the second fixation members 4 are tightened into engagement with the first fixation members 3, an axial contractive force is thus achieved, which forces the first 1 and second 2 cylinder to secure abutment against the intermediate lock case (not shown). At the same time, the form locking between the wall segments 8 and the first fixation member's 3 first head portions 3b prevents the first fixation members 3 from being unscrewed from the outside of the door. The two identical and therefore reversible cylinders 1, 2 may thus be dismantled only from the inside of the door.

[0052] The first head portion 3b of the first fixation members 3 are further provided with an outwardly convex end surface, which renders it difficult to remove the first fixation members 3 by drilling from the outside of the door.

[0053] The fixation devices and the bores may be varied in a number of different ways within the scope of the appended claims. It is e.g. possible to arrange the mouth portion as a single mouth portion having a constant cross section over its entire axial length. In such a case, the arrangement comprises a single axial stop which is arranged at the bottom of the mouth portion. The head portions of both the first and the second fixation members then has a cross sectional area which is larger than the bore's main portion but smaller or equal to the cross sectional area of the mouth portion. Thus, the single axial stop then prevents the head portions of both the first and the second fixation members from being axially displaced

into the bore's main portion.

[0054] The first fixation members may be formed with a constant cross section over its entire axial length. In such case the entire first fixation member constitutes a first head portion.

[0055] Irrespective of whether or not the first head portion constitutes the entire first fixation member or an axial portion thereof, relative rotation between the first fixation member and the cylinder may be achieved by other means than by corresponding polygonal cross sections. The mouth portions and the first head portions may e.g. exhibit corresponding non-circular cross sections other than polygonal, such as oval, elliptic or other rounded non-circular shapes.

[0056] The first head portion and the mouth portion may even be provided with corresponding circular cross sections. In such a case, relative rotation between the first fixation member and the cylinder may be provided by means of friction locking between the first head portion and the mouth portion. Such a friction locking may be achieved by means of press fitting, force fitting, tight fitting and the like of the first head portion in the mouth portion. The friction between the first head portion and the mouth portion may be increased by means of knurling or other friction increasing means being provided to the first head portion and/or the walls of the mouth portion. Relative rotation between the first head portion and the cylinder may also be achieved by means of interacting form locking and/or friction locking means arranged at an axial end surface of the first head portion and/or on the axial stop arranged at the bottom of the mouth portion.

[0057] Additionally, the second fixation members may comprise more than one component. For example, at least one second fixation member may comprise a rod which at least at its end portions exhibits an external thread and a sleeve or the like which is threaded onto one end of the rod. The sleeve then may form the second head portion. A recess, a protrusion or the like for engaging a tool may be provided, e.g. at an end surface of the sleeve, such that the sleeve and the rod may be jointly screwed by means of a screw driver or the like for bringing the other end of the rod into engagement with a first fixation member. In a simple embodiment, the fixation device may thus comprise an externally threaded rod and two internally threaded sleeves, ring nuts, nuts or the like.

[0058] In the illustrated embodiments, the lock cylinder arrangement is provided with four axial bores arranged in each lock cylinder and four fixation devices. It is however possible to vary the number of bores and corresponding fixation devices. At the type of lock cylinder exhibiting an oval cross section it has been proven suitable to provide each cylinder with only two bores and the lock arrangement with two corresponding fixation devices.

[0059] Upon mounting two cylinders at a respective side of a lock case it may, at some applications, be advantageous to insert some of the first fixation devices from a first side of the lock case and some of the first

fixation devices from a second side of the lock case. A corresponding number second fixation devices are then inserted from the respective opposite side of the lock case. At the so mounted lock arrangement, the mouth portions of each lock cylinder will accommodate both first and second head portions.

[0060] Figs. 2a-c illustrate an exemplifying embodiment of a lock cylinder arrangement provided with drill protection means. In the Figs 2a-c, an outer cylinder 2 of the type described above is shown. As seen in fig. 2a, the lock cylinder 2 comprises four different types of drilling protection means:

[0061] A first drill protection means is constituted by the first fixation members 3. As described above the first fixation members 3 are provided with an outwardly convex end surface which renders it difficult to position and maintain a drill or a drill bit for damaging or removing the first fixation member through a drilling operation. A second drill protection means is constituted by a drill protection plate 14, which is disposed in an outwardly open recess 2d which is formed in the outer end face 2b of the lock cylinder 2. A third drill protection means is formed by two pins 13 which are inserted into channels 15 which extend from the lock cylinder's 2 envelope surface, in a cross sectional plane near the outer end of the cylinder and parallel to the pin tumbler chambers 12. A fourth drill protection means is formed of two cylindrical rods 11 which are inserted into channels 16 running axially along and on both sides of the lock cylinder's pin tumbler chambers 12.

[0062] The drilling protection plate 14 covers the channels 16 in which the rods 11 are occupied and thus prevents removal of the rods 11. Drill protection plate 14 is further configured and arranged so that it is secured to the lock cylinder by two 3' of the first fixing members 3', 3" described above, which first fixing members 3', 3" constitute fixing means for fixing the lock cylinder 2 to a lock case. For this purpose, the recess 2c in which the drilling protection plate 14 is received, is arranged to extend into the two central outer mouth portions 6'b of the bores in which the fixing members 3, 4 are occupied. When the plate 14 is positioned in the recess 2c, its outwardly facing surface is arranged in the same plane as the first axial stop 7' defined by the outer mouth portions 6'b. When the lock cylinder 2 is fixed by the fixing members 3, 4, the first head portions 3'b of the central first fixation members 3' will thus abut the plate 14 and prevent removal of the plate 14.

[0063] The channels 15 in which the drill protection pins 13 are received extend partially through the inner mouth portion 6"a of the outer two bores for the fixation members 3". Each pin 13 further comprises a narrowed waist portion 13a which, in the inserted state is arranged in level with inner mouth portion 6"a. When the first fixation members 3" are inserted in the two outer mouth portions 6", the sleeve portions 3"a of the stationary members 3", extend past the waist portions 13a and thereby secure, by form locking, the pins 13 in their respective

channels 15.

[0064] Thus the existing first fixation members 3', 3" on the one hand, per se form drill protection members and, on the other hand, are used for fixing and securing of all drill protection members 11, 13, 14.

[0065] Figs. 3a-d illustrate an exemplifying embodiment of a lock cylinder arrangement provided with a cylinder ring and a decorative cylinder cap. Figs. 3a-d show a lock cylinder 2 which is intended to be mounted to the high security outside of a door. The cylinder arrangement further comprises a cylinder ring 21, a cap 22 and a locking ring 23 of a resilient material, such as steel. The cap 22 is provided for decorative purposes and may be formed of a number of different materials and exhibiting different colours and surface roughness depending on the field of application. The locking ring 23, cylinder ring 21 and the cap 22 are mounted on the lock cylinder 2 before the lock cylinder 2 is fixed to the lock case as described above. First, the locking ring 23 is applied to the lock cylinder 2, so that it snaps into a designated slot 24 which is arranged in the envelope surface of the lock cylinder 2 and extends in the circumferential direction.

[0066] A central bore of the cylinder ring 21 has a front cylindrical portion 21a, an intermediate rearwardly radially flared portion 21b and a rear inwardly projecting stop 21c. The front portion 21a has a constant inner diameter d1 which is slightly larger than the outer diameter of the cap 22 and than the outer diameter of the locking ring 23, when mounted in the slot 24. The diameter of the intermediate portion 21b increases gradually backward from diameter d1 to a larger inner diameter d2, so that this portion is conical. The inwardly projecting stop 21c is cylindrical with a diameter d3, that is smaller than d1, and than the outer diameter of locking ring 23 when the locking ring is mounted. The cylinder ring 21 can thus be threaded onto the lock cylinder in the forward direction until the inwardly projecting stop 21c comes in contact with the locking ring 23.

[0067] The cap 22 is slipped onto the lock cylinder 2 in the direction from the front. The cap 22 has on its circumferential surface, at the rear end, a resilient tongue 22a with a radially inwardly projecting snap hook 22b and a radially outwardly projecting locking tab 22c. The lock cylinder 2 has on its circumferential surface an axial groove 201 which, at its rear end opens into a snap recess 202, whose depth is larger than that of the groove 201. At the illustrated embodiment the snap hook 22b is spoon shaped such as to increase the rigidity of the snap hook 22b to thereby achieve a secure snap engagement with the snap recess 202. The snap hook may however have any suitable shape as long as it may be brought into snap engagement with a corresponding snap recess.

[0068] When the cap 22 is slipped onto the lock cylinder 2, the snap hook 22b runs in the slot 201 until the cap is fully slipped onto the cylinder, whereby snap hook 22b snaps into the snap recess 202. Thereafter, the cylinder ring 21 is slipped onto the cylinder 2 from the rear end, in the forward direction. The front cylindrical portion 21

then passes over the locking tab 22c. The cylinder ring 21 may now be positioned at any desired axial position along the cylinder 2, as long as the locking tab 22c is arranged along and radially inside the cylindrical portion 21a or the intermediate conical portion 21b of the cylinder ring 21.

[0069] When the cylinder is thereafter mounted to the lock case, it is not possible to remove the cylinder ring 21 thanks to the locking ring's 23 blocking interaction with the inwardly projecting stop 21c of the cylinder ring 21. Nor is it possible to pull off the cap 22 as the cylinder ring's 21 cylindrical portion 21a, in contact with locking tab 22c presses the tab 22b to engage the snap recess 202.

[0070] In order to remove the cylinder ring and/or the cap, it is necessary to first remove the lock cylinder from the lock case, which is possible only for those who have access to the inside of the door, as described above.

[0071] The intermediate portion of the cylinder ring may, instead of being conical, comprise a circumferential recess which defines the second inner diameter. Such a recess may be formed such that the transition between the first inner diameter to the second inner diameter forms a step. The recess may also be curved such that the transition between the first inner diameter and the second inner diameter is continuous.

[0072] Figs. 1a and 4a-4f illustrates a lock cylinder arrangement comprising a screw protection means for preventing access to the mounting screws by which the lock cylinder is fixed to a lock case. The screw protection means is applied to a lock cylinder 1, which is intended to be mounted to the inner convenient side of a door. The lock cylinder 1 comprises a cylinder housing 1c which has a first axial end 1a which is arranged to be positioned distal to the lock case (not shown) and a second axial end 1b which is arranged opposite to the first axial end 1a and intended to be positioned proximal to the lock case. A cylinder core 1d is rotatably accommodated in the cylinder housing 1c.

[0073] The lock cylinder 1 exhibits four fixation bores 5, 6 which extends axially through the cylinder housing 1c. Each fixation bore comprise a main portion 5 and a widened mouth portion 6 arranged at the first axial end 1a. Each mouth portion 6 is axially divided into an inner mouth portion 6a and an outer mouth portion 6b. The inner mouth portion 6a defines an axial stop. A fixation member 4 is inserted in each fixation bore 5, 6. Each fixation member 4 comprises a head portion 4b which is able to be seated in the mouth portion 6 and to be axially supported by the axial stop. Each fixation member 4 also comprise a threaded end portion 4a by means of which the lock cylinder 1 may be fixed to a lock casing and/or a corresponding outer lock cylinder as described above.

[0074] The first axial end 1a of the cylinder housing 1c is provided with a recess 1e. The recess 1e is identical with the recess 2e described above with references to fig. 2a and when the cylinder 1 is used as an outer cylinder, the recess 1e may accommodate a drill protection

plate similar to the plate 14 described above. However, when the cylinder 1 is used as an inner cylinder as illustrated in figs 1 and 4a-4f the recess 1e is arranged to receive a cover device 30. The cover device 30 comprises a base member 31 which may be inserted into the recess 1e. A locking member 32 is attached to the base member 31. The locking member 32 is formed as a disc which is rotatably attached to the base member 31 and received in the recess 1e. The base member exhibits 31 an axially extending dowel 37 which is received in a central through opening 38 in the locking member and which defines a rotational axis for the locking member. A spring biased snap pin 39a is arranged at the base member 31. The locking member 32 exhibits two corresponding snap holes 39b, 39c. The snap pin 39a is arranged to snap engage the snap holes 39b, 39c at a respective rotational position of the locking member, corresponding to a release position and a locking position respectively of the locking member 32.

[0075] The cover device 30 further comprises two leg members 35 which are attached to the base member 31. Each leg member 35 comprises two axially protruding plugs 36. Each plug 36 comprises a first axial plug portion which is insertable into an inner mouth portion 6a of the cylinder housing 1c and a second plug portion 36b which is insertable in the outer mouth portion 6b.

[0076] When the cover device 30 is inserted into recess 1e, the plugs 36 are received in a respective mouth portion 6 such as to cover a head portion 4b of a fixation member 4 received in each mouth portion 6.

[0077] The cylinder housing 1c is provided with a stop 33 which is formed as two under cut portions of the recess 1e. The locking member 32 exhibits a peripheral edge 34 which exhibits two indentations 34a. The indentations 34a are arranged at an angular distance which corresponds to the distance between the two under cut portions 33 of the recess. The locking member 32 may thus be rotated to a release position at which the two indentations 34a are aligned with the under cut portions 33, such that the locking member 32 and the base member 31 may be axially inserted into and removed from the recess 1e. When the locking member 32 and the base member 31 has been received in the recess 1e, the locking member may be rotated to a locking position, wherein the first indentations 34a are brought out of alignment with the under cut portions 33. At the locking position, a portion of the peripheral edge 34 not forming the first indentations engages the under cut portions 33 such that removal of the locking member 32 and the base member is prevented.

[0078] The cylinder core 1d is provided with a radial cut out 41 which is arranged in the generally cylindrical outer envelope surface 40 of the core 1d. The peripheral edge 34 of the locking member further exhibits a first 34b and a second 34c concave cam surface. The curvature of both concave cam surfaces 34b, 34c correspond to the radius of the cylindrical outer envelope surface 40 of the core. Thus, when the locking member 32 has been ro-

tated such that either of the concave cam surfaces 34b, 34c is enclosing a portion of the cylindrical envelope surface 40 of the core 1d, it is possible to rotate the core 1d, e.g. by means of a correct key being inserted into a key channel of the core.

[0079] The first concave cam surface 34b is arranged such that it encloses the envelope surface of the core 1d when the locking member 32 has been rotated to its locking position as shown in fig. 4d. In fig 4d, the core 1d is in a first rotational position at which it is required to insert an authorized key into the key channel in order to be able to rotate the core 1d. The first concave cam surface 34b encloses a portion of the outer envelope surface 40 of the core, such that it is not possible to rotate the locking member 32. In this locking position the indentations 34a are brought out of alignment with the under cut portions 33, such that it is not possible to remove the locking member 32 or the base member 31 from the recess 1e. In this position the head portions 4b of the fixation members 4 are thus covered by a respective plug 36 inserted in the mouth portion 6 of the cylinder housing. Thereby the head portions 4b are not accessible for dismounting of the lock cylinder 1.

[0080] In order to allow access to the head portions 4b, it is required to first insert an authorized key into the key channel of the core 1d and to rotate the core 1d, to a predetermined position in which the radial cut out 41 of the core 1d is arranged in register with the locking member 32. This predetermined rotational position of the core is shown in figs. 4e and 4f. At this predetermined rotational position of the core 1d it is possible to rotate the locking member 32 toward its release position, as shown in fig. 4e. During such rotation of the locking member 32, the entire edge 34 of the locking member 32, may pass the cylinder core 1d, since the radial cut out 41 allows also radially outmost portions of the edge 34 to pass through the cut out portion 41. In fig 4e, the locking member 32 has been rotated counterclockwise about half the way from the locking position shown in fig 4d, towards the release position shown in fig. 4f. By completing the rotation of the locking member 32 to the release position shown in fig. 4f, the two indentations are brought into alignment with a respective under cut portion 33. It is thereby possible to remove the cover device 30 such that the mouth portions 6 and the fixation member's 4 head portions are made accessible for removal. At the same time the second concave cam surface 34c has been rotated such that it is arranged in proximity to the core 1d. The core 1d may thereby be rotated back to the position shown in fig. 4d to thereby allow removal of the key.

[0081] At an embodiment which is not illustrated in the drawings, the locking member may be linearly movable between a locking position and a release position. Additionally, the stop arranged in the cylinder housing may be formed by other means than an under cut portion of a recess. E.g. the stop may be formed as a stud which extends axially from the first end of the cylinder housing. The stud may at the free end be provided with an enlarge-

head portion. A linearly displaceable locking member may be provided with a keyhole shaped through opening with a widened portion which may be brought in register with the enlarged head portion for allowing removal of the locking member and a narrower portion which in register with the head portion prevents removal of the locking member. The cover device may comprise any number of plugs or other covering means, which in register with at least one mouth portion for a fixation member prevents access to at least one fixation member.

[0082] The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims. Especially features of the various embodiments of the lock cylinder arrangement may be combined in any desirable manner depending on the application and needs.

Claims

1. A lock cylinder arrangement for fixation to a lock casing and for control of a lock mechanism arranged in the lock casing, said arrangement comprising;
 - a cylinder housing (2c) having a first axial end (2a) arranged to be positioned distal to the lock casing and a second axial end (2b) being opposite to the first axial end and arranged to be positioned proximal to the lock casing;
 - a cylinder core (2d) which is rotatably accommodated in the cylinder housing;
 - a cylinder ring (21) which is mountable coaxially around the cylinder housing and
 - a cylinder cap (22) which is mountable coaxially around the cylinder housing, radially inside of the cylinder ring, **characterized in that**
 - the cylinder ring comprises a radially inwardly projecting stop (21c), which, in cooperation with a locking ring (23) received in a locking groove (24) arranged in the envelope surface of the cylinder housing, limits axial displacement of the cylinder ring towards the first axial end of the cylinder housing; and **in that**
 - the cylinder housing and the cylinder cap are provided with interacting locking means (22a, 22b, 22c, 201, 202) which are arranged to limit axial displacement of the cylinder cap toward the first axial end of the cylinder housing, when the cylinder ring surrounds said locking means.
2. A lock cylinder arrangement according to claim 1, wherein the locking means comprises a radially inwardly projecting snap hook (22b) and a radially outwardly projecting locking tab (22c) arranged on the cylinder cap (22) and a snap recess (202) arranged

in the envelope surface of the cylinder housing (2c), which snap recess is arranged to receive the snap hook.

3. A lock cylinder arrangement according to claim 2, wherein the snap hook (22b) and the locking tab (22c) are arranged on a resilient tongue (22a) of the cylinder cap (22).
4. A lock cylinder arrangement according to claim 2 or 3, wherein an axial groove (201) is arranged in the envelope surface of the cylinder housing (2c), which groove extends from the first axial end (2a) surface of the cylinder housing and opens to the snap recess (202).
5. A lock cylinder arrangement according to any of claims 1-5, wherein the cylinder cap (22) is formed of a sheet metal or polymer material.
6. A lock cylinder arrangement according to any of claims 1-5, wherein the cylinder ring (21) comprises a front axial (21a) portion arranged to lie proximal to the first axial end (2a) of the cylinder housing, an intermediate portion (21b) and a rear axial portion (21c) arranged to lie distal to the first axial end of the cylinder housing and wherein the front axial portion exhibits a first inner diameter, (d1); the intermediate axial portion exhibits a second inner diameter (d2) which is larger than the first diameter (d1) and the rear axial portion exhibits a third inner diameter (d3), which is smaller than the first (d1) and the second (d2) diameters.
7. A lock cylinder arrangement according to claim 6, wherein the locking ring (23) exhibits an outer diameter (d4), which is smaller than the first (d1) and the second (d2) inner diameters and larger than the third inner diameter (d3) of the cylinder ring (21), when the locking ring is received in the circumferential locking groove.
8. A lock cylinder arrangement according to claim 6 or 7, wherein the intermediate portion (21b) is arranged to abut the lock tab (22c) for pressing the snap hook (22b) into the snap recess (202) when the cylinder ring (21) is positioned around the cylinder cap (22) and cylinder housing (2c).
9. A lock cylinder arrangement according to any of claims 6-8, wherein the intermediate portion (21c) is conical and exhibits the second inner diameter (d2) at an axial end of said intermediate portion being distal to the front axial portion.
10. A lock cylinder arrangement according to any of claims 6-8, wherein the intermediate portion exhibits a circumferential recess which defines the second

inner diameter.

11. A lock cylinder arrangement according to any of claims 1-10, wherein the locking ring (23) is resilient for allowing releasable snap fixation in the locking groove (24). 5

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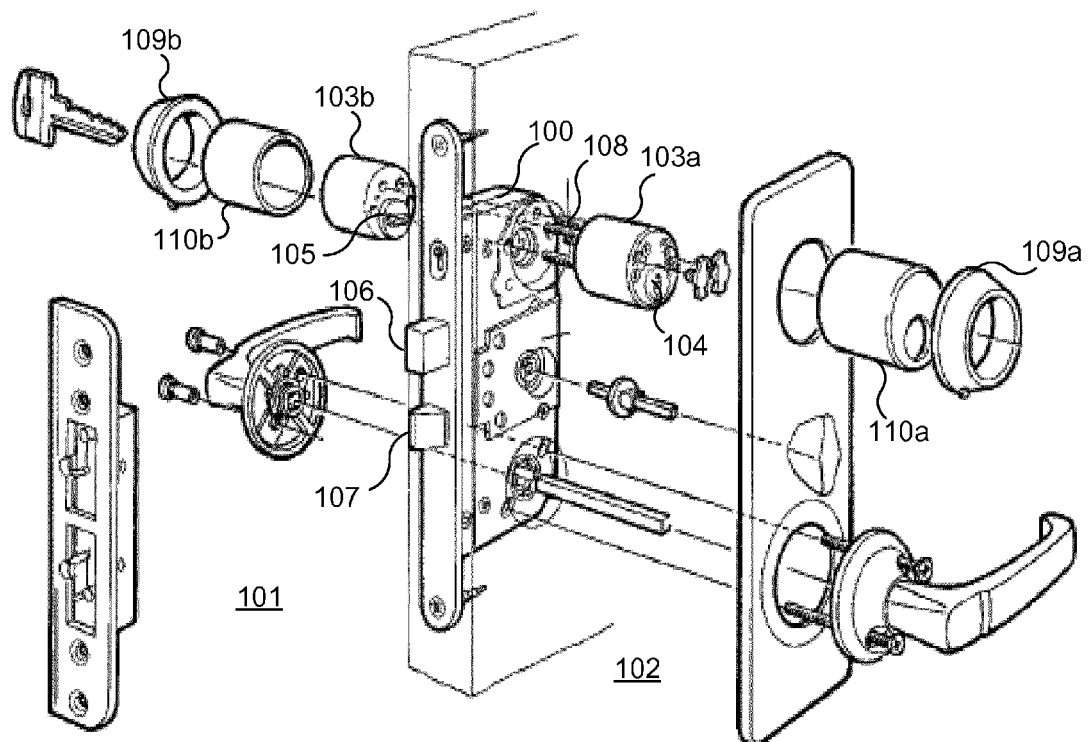


Fig. 0

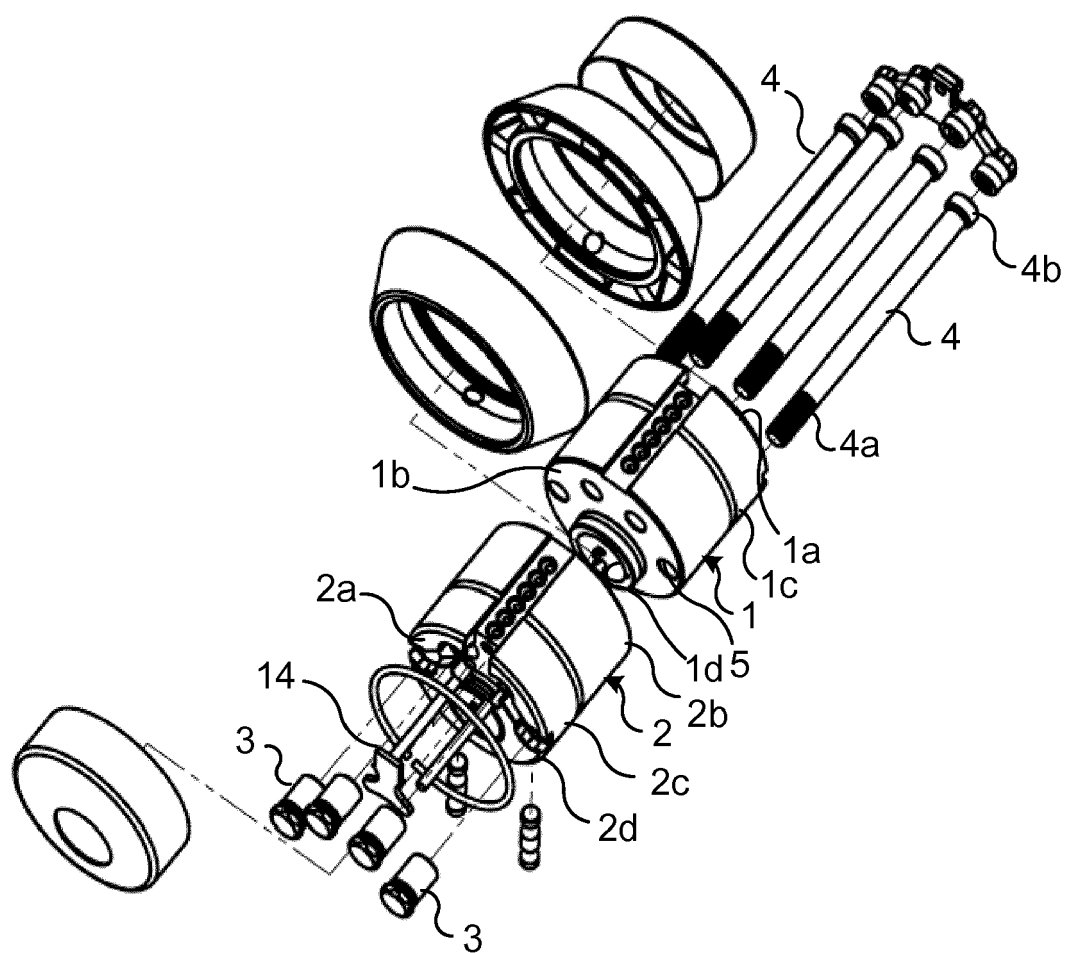


Fig. 1a

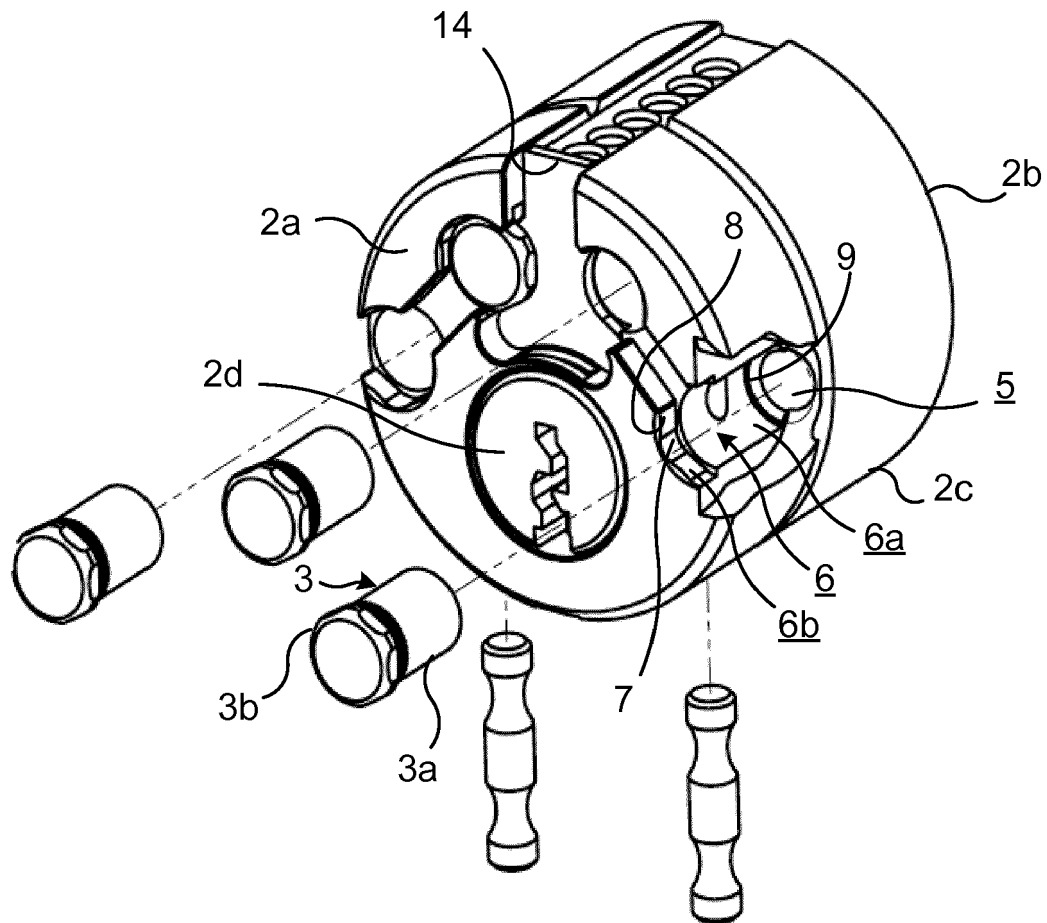


Fig. 1b

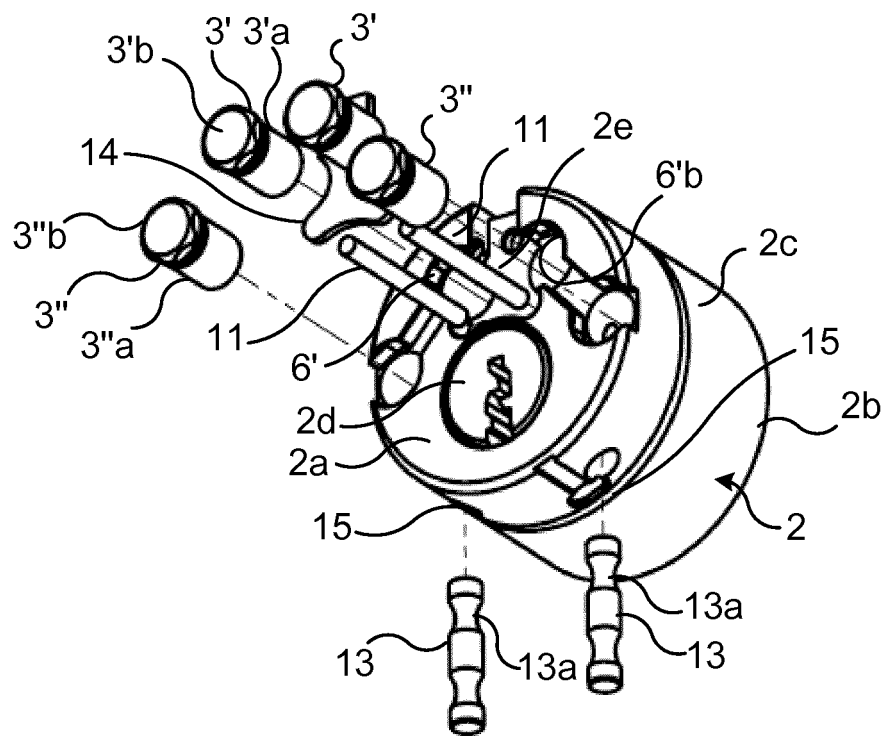


Fig. 2a

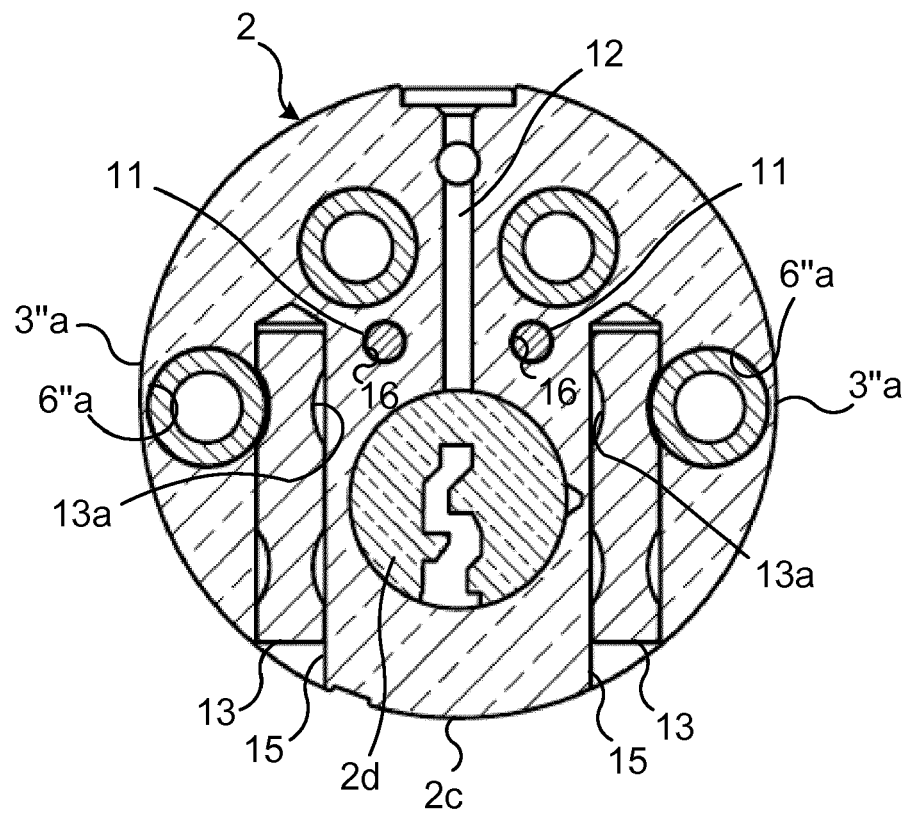


Fig. 2b

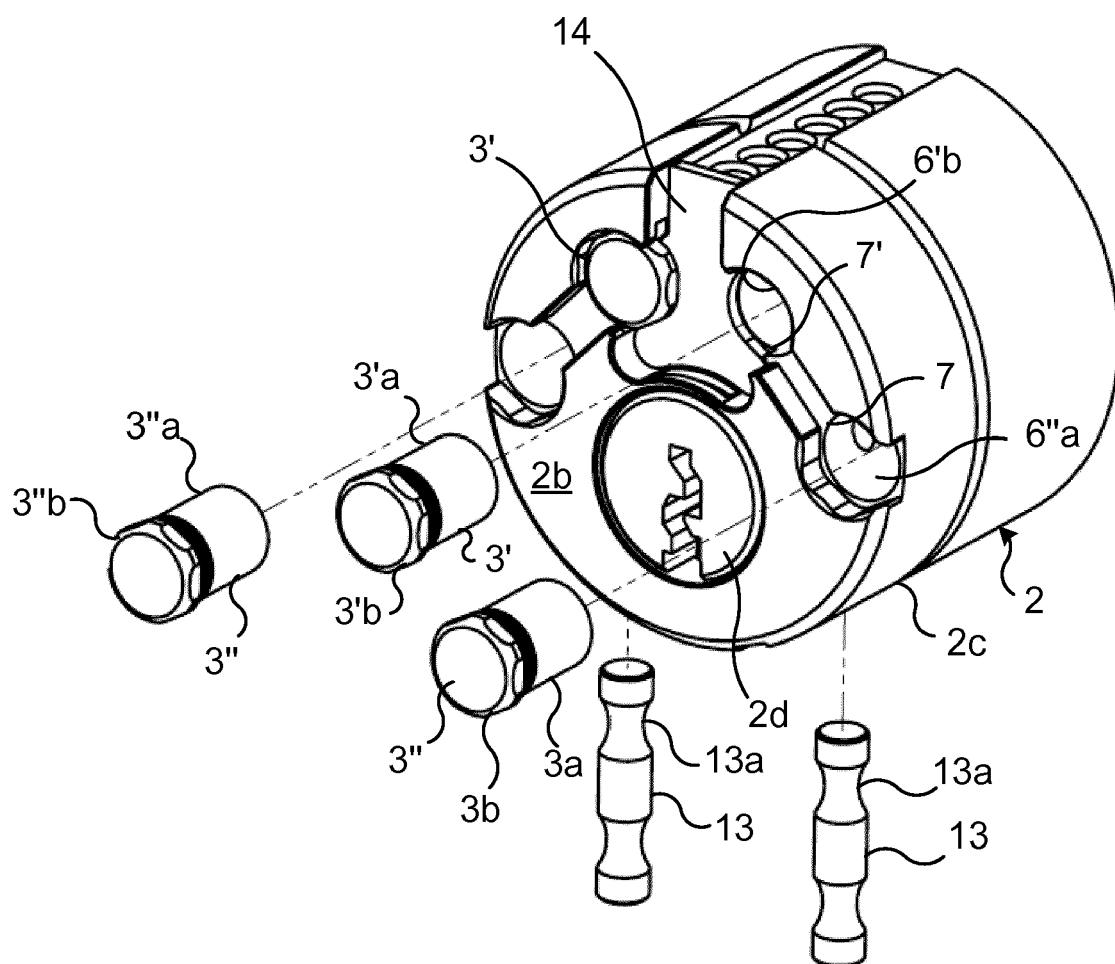


Fig. 2c

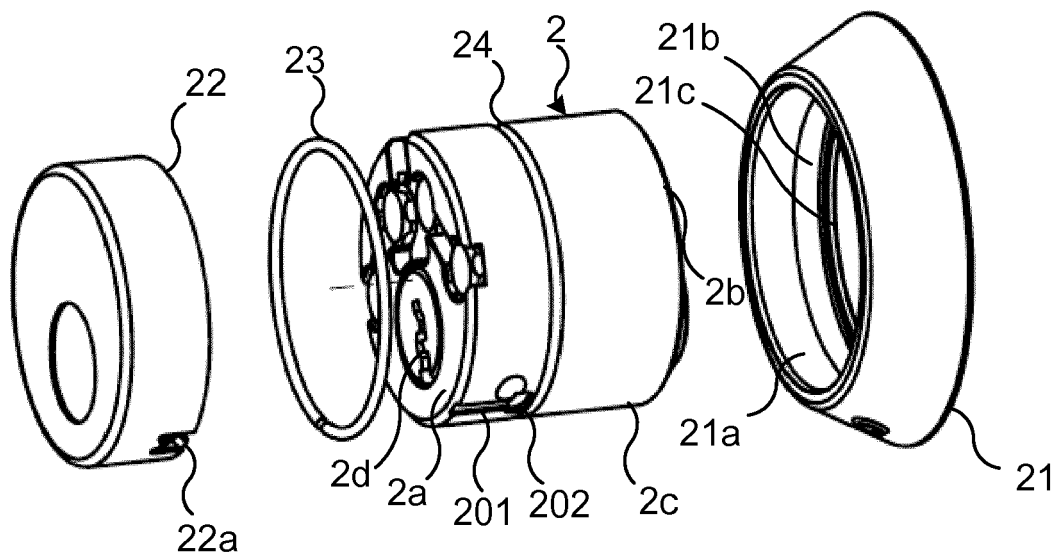


Fig. 3a

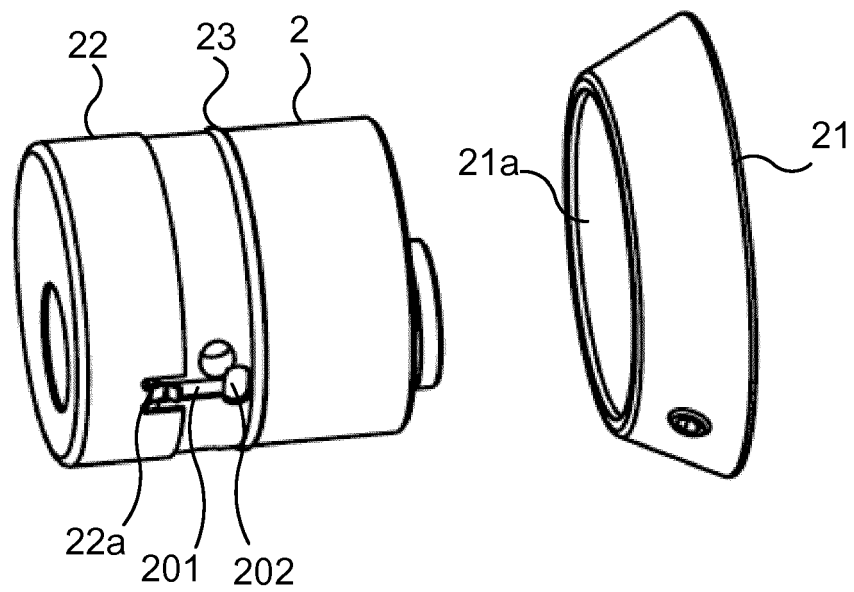


Fig. 3b

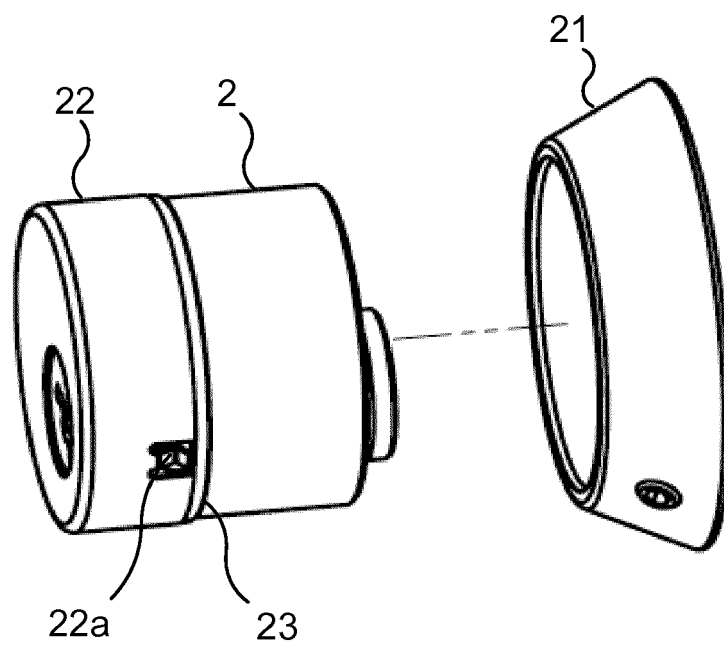


Fig. 3c

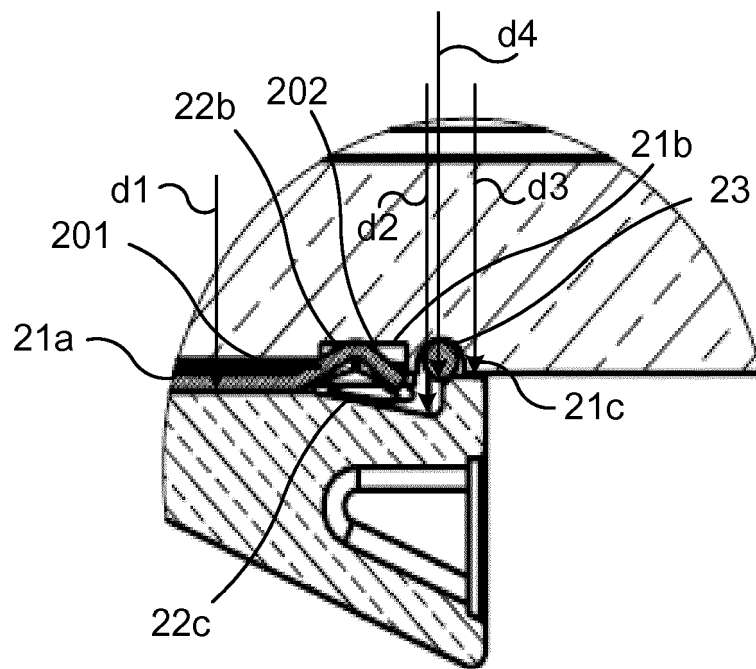


Fig. 3d

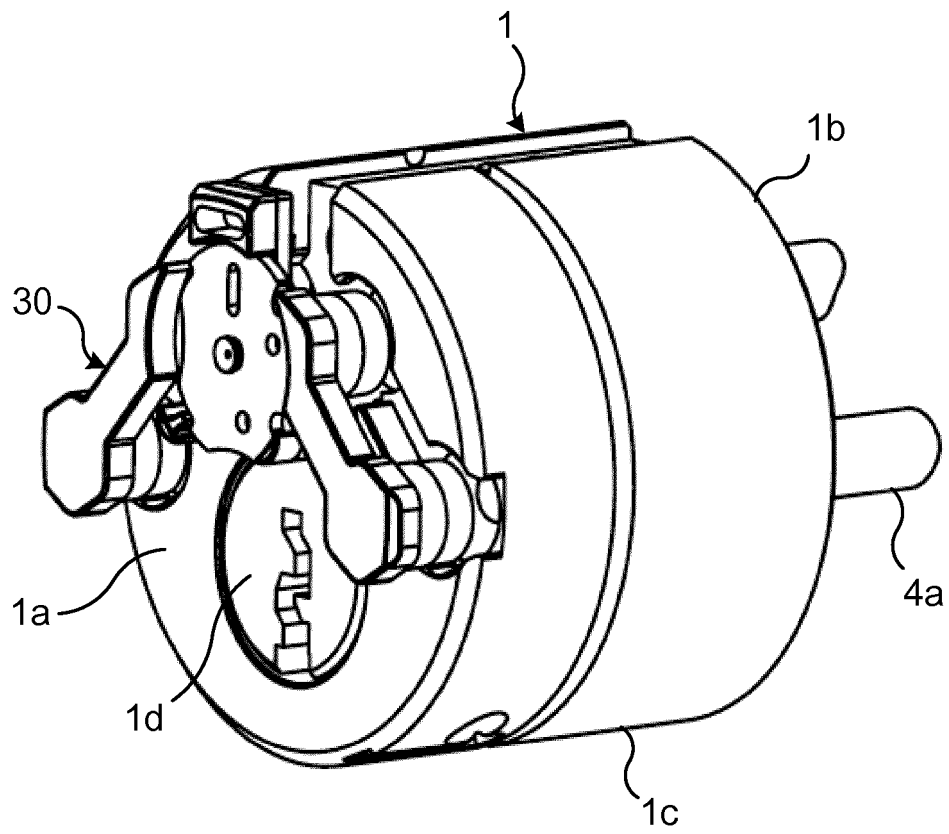


Fig. 4a

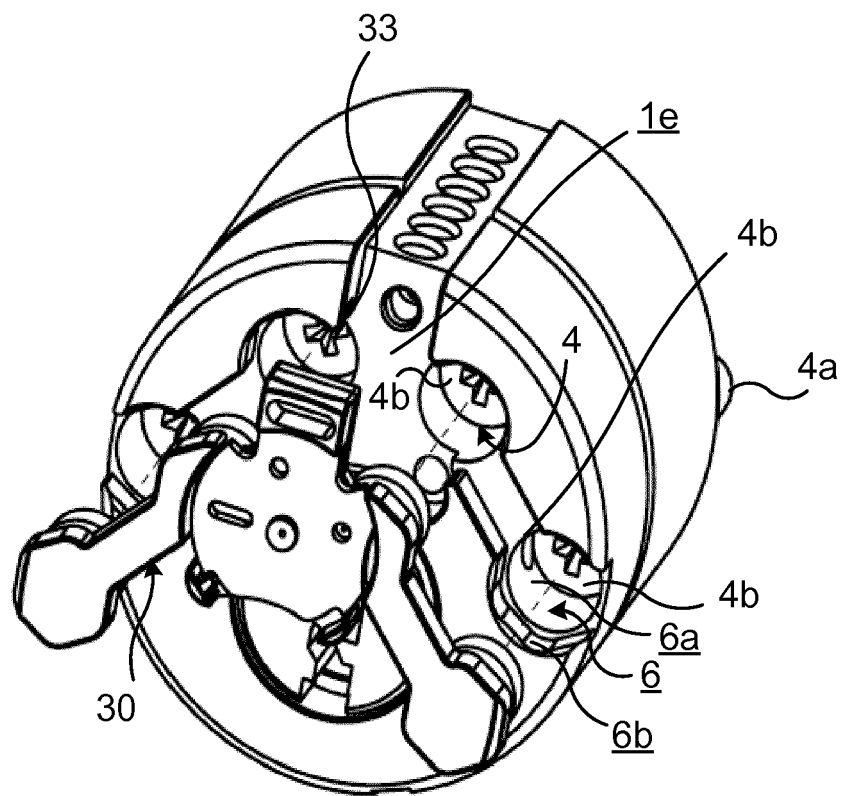


Fig. 4b

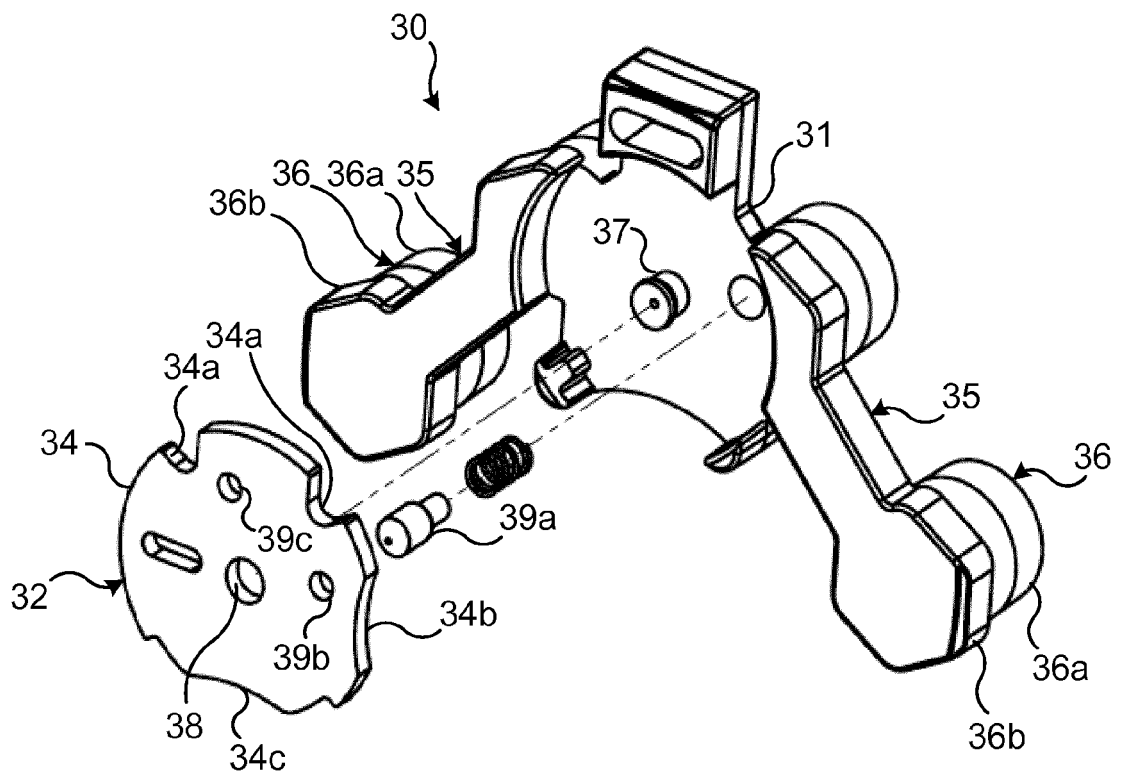


Fig. 4c

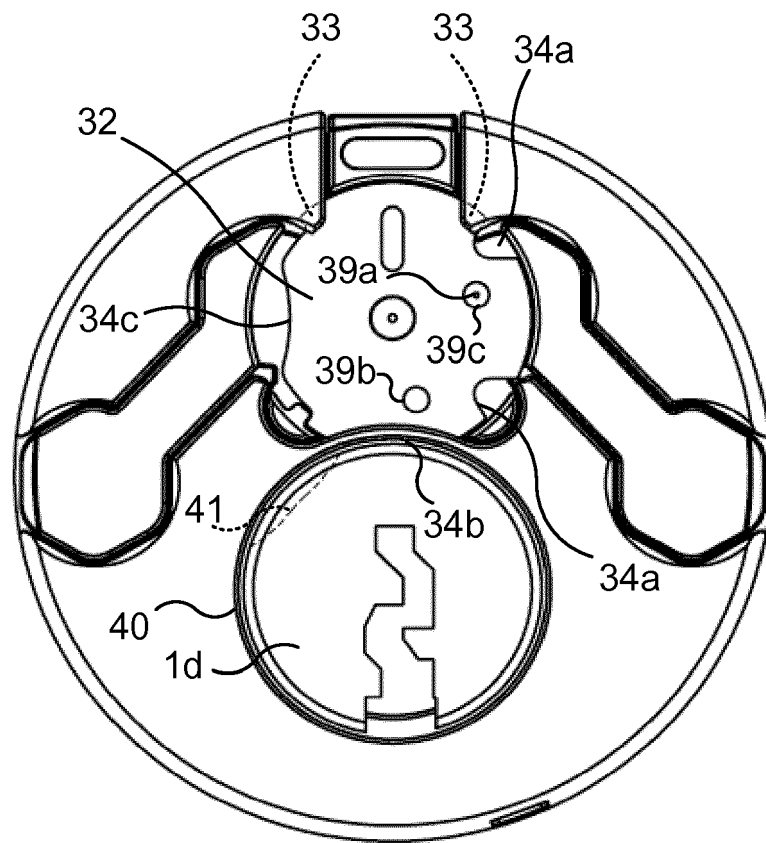


Fig. 4d

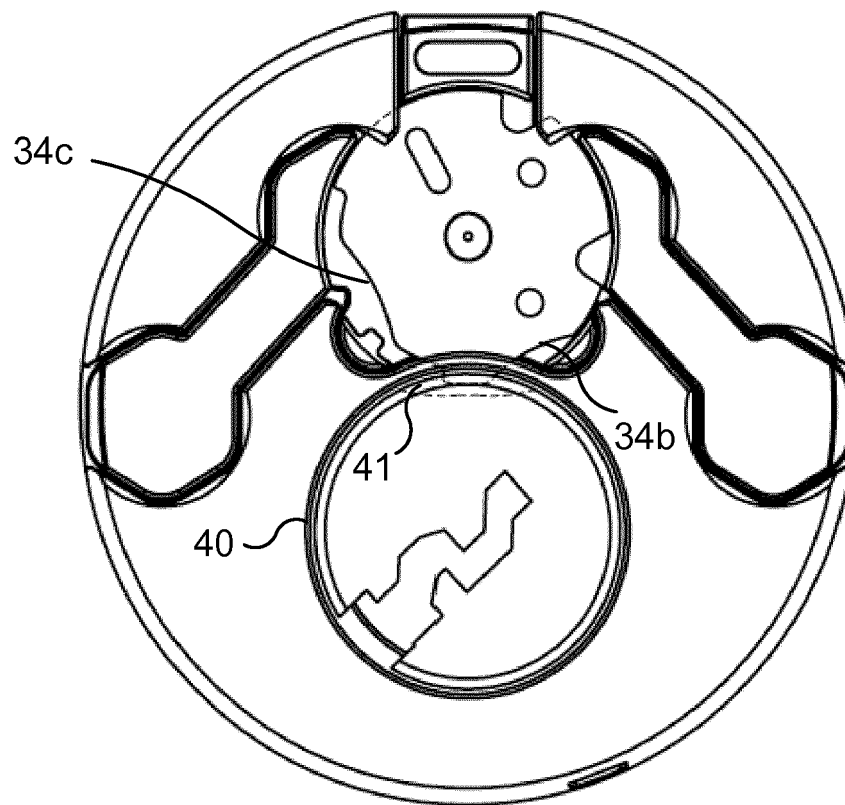


Fig. 4e

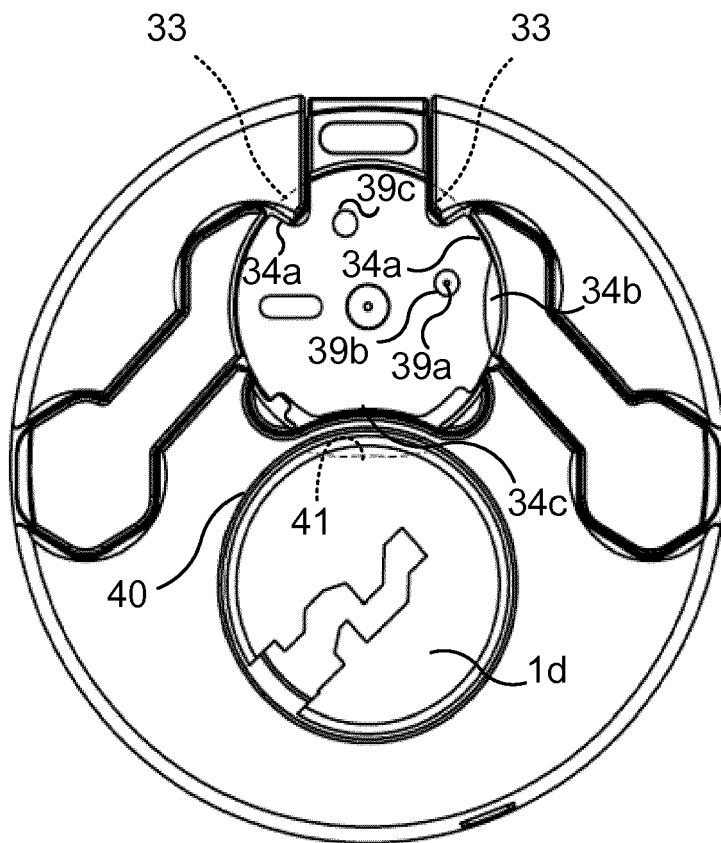


Fig. 4f



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Application Number
EP 13 19 0058

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A	EP 1 688 565 A1 (VALENTE MASSIMO [FR]) 9 August 2006 (2006-08-09) * the whole document *	1	
A	EP 2 479 361 A1 (OLIANA PIER LUIGI [IT]) 25 July 2012 (2012-07-25) * the whole document *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) E05B
Place of search The Hague		Date of completion of the search 22 July 2014	Examiner Geerts, Arnold
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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EP 2479361	A1	25-07-2012	NONE		

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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