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(54) **LOCKING SYSTEM COMPRISING CYLINDER LOCK AND A PUNCHED CONTROL KEY**

SCHLIESSSYSTEM UMFASSEND EIN ZYLINDERSCHLOSS UND EINEN GESTANZTEN SCHLÜSSEL

SYSTÈME DE VERROUILLAGE COMPRENANT UNE SERRURE À BARILLET ET UNE CLÉ DE COMMANDE POINÇONNÉE

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Description

[0001] The present invention relates to a locking system comprising a cylinder lock and a punched control key.

[0002] Also disclosed but not forming part of the invention is a method for making a blank for duplicating a punched control key and a method for duplicating a punched control key.

[0003] The term cylinder lock is intended as a type of lock in which a cylindrical drive rotor of the latch is rotatably housed in a stator and has a slit for receiving a punched control key. This key has flared punchings, which, following an elastic thrusting action, abut against control heads of pistons housed in the lock.

[0004] The depth and position of the punchings constitute the cuts of the key that corresponds to the position of the pistons adapted to allow the rotation of the rotor. In fact, when the control key corresponding to the lock is inserted into the slit and the pistons abut in their respective punching, the opposite ends of the pistons align on the sliding surface between the rotor and stator, allowing the rotation of the rotor itself.

[0005] One known method of opening this type of lock is called "key bumping", which consists in preparing a "bumping key" provided with punchings having the maximum depth obtainable in the thickness of the key itself. The bumping key can be inserted in the slit of the lock at a length greater than the control key. In general, the bumping key is made starting from a blank or untreated key, adapted to create a duplicate of the control key of the lock, providing thereon maximum-depth punchings and filing the typical stop abutments of the control key.

[0006] By inserting the bumping key in the slit, all the pistons arrange at their maximum height. By hitting the key to push it further into the slit, the pistons are subjected to an impact in a radial direction, making the rotation of the rotor possible.

[0007] DE4036158 discloses a key blank provided with a pre-cut punching and a chute. US6105404 discloses a system in which a plurality of different keys that operate different locks can be used to operate a common lock. EP2281985 discloses a cylinder lock in which the distances of the contact surfaces of the pins are different. This arrangement is achieved changing the position of at least one pin with respect to the others or providing at least a pin with a diameter larger than the others. EP2108767 discloses a cylinder lock with at least one pusher which defines a safety position for at least one first pin in which the first pin is spaced from the wall even when no key is inserted in the slot. EP2108767 discloses a cylinder lock comprising an asymmetrically shaped head.

[0008] In this context, the technical task underlying the present invention is to propose a locking system, in particular a cylinder lock and a punched control key, able to resist such an opening method.

[0009] The stated technical task and the aims specified are substantially achieved by a locking system compris-

ing a cylinder lock and a punched control key and by a blank for making a duplicate of the punched control key, each comprising the technical features described in one or more of the accompanying claims.

[0010] In particular, the present invention relates to a locking system comprising a cylinder lock and a punched control key according to claim 1.

[0011] The present invention may additionally comprise one or more of the characteristics set forth in the dependent claims, incorporated here for reference, each corresponding to a possible embodiment.

[0012] Additional features and advantages of the present invention will become more apparent from the indicative, and thus non-limiting description that follows.

This description is provided herein below with reference to the attached drawings, which are provided solely for purpose of providing approximate and thus non-limiting examples, of which:

- figure 1 is a schematic, longitudinal section view of a first embodiment of a cylinder lock associated with a respective punched control key;
- figure 2 is an enlarged view of detail II in figure 1;
- figure 3 is a sectional view according to track III-III in figure 1;
- figure 4 is a schematic, longitudinal section view of the cylinder lock of figure 1 associated with a bumping key;
- figure 5 is an enlarged view of detail V in figure 4;
- figure 6 is an enlarged view of detail VI in figure 3;
- figure 7 is a schematic, longitudinal section view of a second embodiment of a cylinder lock associated with a respective punched control key;
- figure 8 is an enlarged view of detail VIII in figure 7;
- figure 9 is a sectional view according to track IX-IX in figure 7;
- figure 10 is a schematic, longitudinal section view of the cylinder lock of figure 7 associated with a bumping key;
- figure 11 is an enlarged view of detail XI in figure 10;
- figure 12 is a schematic perspective view of a blank for making a duplicate of a punched control key adapted to be used in a cylinder lock;
- figure 13 is a schematic plan view of a punched control key adapted to be used in a cylinder lock.

[0013] With reference to the accompanying figures, the number 1 comprehensively denotes a cylinder lock, the number 100 denotes a punched control key adapted to control the unlocking and locking of the cylinder lock 1 and the number 200 denotes a blank or untreated key for making a copy of the punched control key 100.

[0014] Referring for example to figures 1, 7 and 13, the punched control key 100 comprises a grip 101 and a plate-like body 102 that mainly extends along a longitudinal direction "A" from the grip 101 toward a free end 103. In other words the punched control key 100, in particular the plate-like body 102, has a longitudinal dimen-

sion greater than the transverse dimensions, with reference to the longitudinal direction "A". In turn, a transverse direction of the plate-like body 102 is greater than the other one so as to define two major side surfaces 102a and two minor side surfaces 102b.

[0015] At least one major side surface 102a of the plate-like body 102 has a longitudinal trail 104, a first longitudinal track 105 on which active punchings 100a, 100b are made and a second longitudinal track 106 on which passive punchings 100c can be made. Preferably, the punched control key 100 is reversible, i.e. the two major side surfaces 102a of the plate-like body 102 are identical as a result of a 180° rotation of the punched control key around the longitudinal direction "A".

[0016] Further passive punchings 100d can possibly be provided on a minor side surface 102b of the plate-like body 102.

[0017] The active punchings have a flared shape, for example conical, with varying depths in relation to the cuts of the punched control key 100. Among the active punchings, the punched control key 100 comprises an active anti-burglary punching 100b formed in a proximal position with respect to the free end 103.

[0018] Preferably, the active anti-burglary punching 100b has a basic footprint 107 having an elongated shape in a direction perpendicular to the longitudinal direction "A" of the plate-like body 102. Even more preferably, the active anti-burglary punching 100b has two planar surfaces 108 that extend from the basic footprint 107 connected by substantially truncated-conical side surfaces 109. The overall active anti-burglary punching 100b has a flared shape, both at the planar surfaces 108 and at the side surfaces 109. A planar surface 108 extends toward the free end 103, forming a rear planar surface 108. The other planar surface 108 extends toward the grip 101, forming a front planar surface 108.

[0019] The active anti-burglary punching 100b has a width at the base equal to 0.5 mm, length equal to 1.7 mm and depth equal to 1.5 mm.

[0020] In general, the term "front" is used to indicate a portion and/or an element arranged and/or facing toward the grip 101, with reference to the punched control key 100, or toward an insertion area of the punched control key 100 in the cylinder lock 1, with reference to the lock itself. Similarly, the term "rear" is used to indicate a portion and/or an element arranged and/or facing toward the free end 103, with reference to the punched control key 100 or toward the part opposite the insertion area of the punched control key 100 in the cylinder lock 1, with reference to the lock itself.

[0021] The major side surface of the plate-like body 102 also has a chute 110 that extends between the active anti-burglary punching 100b and the free end 103.

[0022] Along the longitudinal direction "A" of the punched control key 100, an abutment portion 111 is provided, preferably two abutment portions 111, which in the use of the punched control key 100 abuts against a corresponding abutment portion of the cylinder lock 1

such that the punched control key 100 has a predefined longitudinal dimension of insertion "H" and the active punchings are arranged in respective predefined longitudinal positions within the cylinder lock. By way of example the basic footprint of the active anti-burglary punching 100b is arranged at a position longitudinally placed at a distance H1 equal to 18.5 mm from the abutment portion in the case that will be described in reference to figure 1 and equal to 17.9 mm in the case that will be described in reference to figure 7.

[0023] To make a duplicate of the punched control key 100, use of the blank 200 or an untreated key is envisaged, for which figure 12 constitutes a possible non-limiting exemplary embodiment. The blank 200 has certain features in common with the punched control key 100 that have been indicated in figure 12 with the same reference number. In fact, the blank 200 comprises the grip 101 and the plate-like body 102 with at least one major side surface 102a provided with the longitudinal trail 104. The first longitudinal track 105 is adapted to receive the active punchings 100a of the control key 100 and the second longitudinal track 106 is adapted to receive the passive punchings 100c of the control key 100.

[0024] The first longitudinal track 105 already has the active anti-burglary punching 100b formed in a proximal position with respect to the free end 103, and the chute 110 that extends between the active anti-burglary punching 100b and the free end 103.

[0025] In other words, the creation of the active anti-burglary punching 100b is envisaged directly on the same blank, as well as duplicating a punched control key 100 starting from this blank, by completing the active punchings 100a on the first longitudinal track 105.

[0026] Figures 1-6 illustrate a first embodiment of the cylinder lock 1.

[0027] The cylinder lock 1 comprises a stator 2 and at least one cylindrical rotor 3. In the illustrated examples, two rotors 3 are provided, arranged symmetrically so as to terminate at the respective inner and outer surfaces of a door or a window.

[0028] The stator 2 has a cylindrical seat 4 which extends longitudinally between a front portion 2a and a rear portion 2b. "X" is used to indicate a longitudinal axis of the cylindrical seat 4.

[0029] The stator 2 further has a plurality of radial holes 5 terminating in the cylindrical seat 4. The radial holes 5 have respective central axes arranged radially with respect to the longitudinal axis "X" and lying in the same plane containing the longitudinal axis "X". Preferably the radial holes 5 pass through the entire thickness of the stator 2 and, on the opposite side of the cylindrical seat 4, are closed by respective closure elements 6. The rotor 3 is housed in the cylindrical seat 4 such to be able to rotate around the longitudinal axis "X" in multiple angular positions. The surface that delimits the cylindrical seat 4 defines a sliding surface between the rotor 3 and the stator 2.

[0030] The rotor 3 has a front opening 7 which provides

access to a slit 8 that extends between the front opening 7 and a rear portion of the rotor and which therefore has a longitudinal extension which coincides with the longitudinal axis "X". The front opening 7 and the slit 8 are adapted to the insertion of the punched control key 100 i.e., with respect to the longitudinal axis "X", they have a transverse counter-shaped profile with respect to the transverse section of the punched control key 100.

[0031] The rotor 3 has a plurality of radial holes 9 that terminate in the slit 8 and radially pass through the entire thickness of the rotor itself. The radial holes 9 of the rotor 3 have respective central axes arranged radially with respect to the longitudinal axis "X" and lying in the same plane containing the longitudinal axis "X".

[0032] In the angular position of the rotor 3 shown in figure 1, corresponding to an angular alignment position, the radial holes 5 of the stator 2 and the radial holes 9 of the rotor 3 are aligned to form a plurality of radial recesses that extend along the respective central axes comprehensively indicated with the letter "Y".

[0033] The cylinder lock 1 comprises a plurality of pistons, among which a plurality of locking pistons 10a are provided, each adapted to abut in an active punching 100a of the punched control key 100, and at least one anti-burglary piston 10b suited to abut in the active anti-burglary punching 100b of the punched control key 100. Preferably, the anti-burglary piston 10b is the piston farthest from the front opening 7, therefore arranged in the rear portion of the rotor 3.

[0034] Each piston 10a, 10b is housed in a radial hole 9 of the rotor 3 and is slidable along the central axis "Y".

[0035] Each piston 10a, 10b comprises a control head 11 having an apex 12 protruding inside the slit 8 and a control surface 13a configured to come into contact with the punched control key 100 at an active punching 100a, 100b of the control key itself.

[0036] Each piston is associated with a respective counter-piston 14, arranged in line with the piston itself along the central axis "Y" and in contact with it at the respective abutment ends, and an elastic element 15, arranged in line with the piston and the counter-piston along the central axis "Y" and in contact with the latter. Each counter-piston 14 is therefore interposed between an elastic element 15 and a piston 10a, 10b.

[0037] Each elastic element 15 is housed in a radial hole 5 of the stator 2 and is thrustingly active on the respective counter-piston 14 to push the set constituted by the counter-piston and piston toward the slit 8. In the remainder of the present description, this movement will also be defined as lifting, independent of the fact that the pistons and counter-pistons are oriented vertically or in different angles.

[0038] In addition, the set constituted by the piston and counter-piston is movable in opposition to the respective elastic element 15 as a result of the interaction between the control head 11 of the piston 10a, 10b and the punched control key 100. In the remainder of the present description, this movement will be also be defined as

lowering, independent of the fact that the pistons and counter-pistons are oriented vertically or in different angles.

[0039] In use, when the rotor 3 is in the angular alignment position and the punched control key 100 is outside the slit 8, the counter-pistons 14 are free to rise in their respective radial seats, pushed by the elastic elements 15, and to straddle between the rotor 3 and the stator 2, preventing the rotation of the rotor around the longitudinal axis "X".

[0040] To free the rotation of the rotor 3, the punched control key 100 having the correct cuts is inserted into the slit 8, when the rotor 3 is in the angular alignment position. Finding abutment in the respective active punchings 100a, 100b, the pistons 10a, 10b and consequently the counter-pistons 14 are lowered and compress the elastic elements 15. The abutment ends of the pistons and counter-pistons are aligned along the sliding surface between the rotor 3 and the stator 2. Using the punched control key 100, the rotor 3 is placed in rotation around the longitudinal axis "X", dragging the pistons with itself while the counter-pistons and the elastic elements remain housed in the stator 2.

[0041] In the case of locking pistons 10a, the relative control head 11 has a substantially conical or slightly truncated-conical shape, with the apex 12 lying on the central axis "Y". To free the rotation of the rotor 3, the control head 11 abuts against and comes into contact with a respective active punching 100a having a substantially conical or slightly truncated-conical shape, complementary shaped to the control head itself. The control surface 13a of the control head 11 is for example constituted by a top surface of the locking piston 10a, i.e. the apex 12.

[0042] In the case of an anti-burglary piston 10b, the relative control head 11 is shaped asymmetrically with respect to the central axis "Y", having the apex 12 lying on the opposite side of the front opening 7 with respect to the central axis "Y", i.e. at a rear portion of the anti-burglary piston 10b. Preferably the control head 11 of the anti-burglary piston 10b comprises a front surface 13b arranged toward the front opening 7, terminating at the apex 12 and intersecting the central axis "Y" of the radial hole 9 of the rotor 3 in which the anti-burglary piston 10b is housed. The front surface 13b is preferably inclined toward the apex 12 with respect to the central axis "Y".

[0043] Preferably, the control surface 13a of the control head 11 of the anti-burglary piston 10b is inclined toward the apex 12 with respect to the central axis "Y" and is arranged on the part opposite the front opening 7 with respect to the central axis "Y" at the rear portion of the anti-burglary piston 10b. To free the rotation of the rotor 3, the control surface 13a abuts against and preferably only comes into contact with a rear portion of the active anti-burglary punching 100b.

[0044] In one possible embodiment for which the accompanying drawings constitute a non-limiting example, the control head 11 of the anti-burglary piston 10b has a chisel shape with the front surface 13b and the control

surface 13a having a planar shape and converging in the apex 12. The apex 12 thus has a linear shape and is preferably arranged in a direction perpendicular to the central axis "Y" and to the longitudinal extension of the slit 8, i.e. the longitudinal axis "X".

[0045] In one possible embodiment for which the accompanying drawings constitute a non-limiting example, the apex 12 having a linear shape has a length L1 which is smaller than the diameter "D" of the radial seat and of the body of the anti-burglary piston 10b and is preferably offset with respect to the central axis "Y" along a direction perpendicular to the longitudinal extension of the slit 8 (figure 3 and figure 6).

[0046] In one possible embodiment for which the accompanying drawings constitute a non-limiting example, the anti-burglary piston 10b comprises an anti-rotation device 16 configured to keep the angular position of the anti-burglary piston 10b fixed around the central axis "Y". Preferably, the anti-rotation device 16 comprises a tab 17 of the anti-burglary piston 10b that extends transversely with respect to the central axis "Y" to be inserted in a guide 18 of the rotor 3 parallel to the central axis "Y". The guide 18 is configured to allow the translation of the tab 17 along the central axis "Y" and to prevent rotation about the central axis "Y".

[0047] In use, to free the rotation of the rotor 3, the locking pistons 10a abut in the respective active punchings 100a of the punched control key 100 while the anti-burglary piston 10b abuts in the active anti-burglary punching 100b in mutual contact only at the respective rear portions. Figure 1 illustrates the angular alignment position of the rotor 3 with the punched control key 100 inserted into the slit 8 and correctly interacting with the pistons 10a, 10b such to allow the rotation of the rotor 3 around the longitudinal axis "X". It can be noted that the active punchings 100a of the punched control key 100 are arranged along the longitudinal direction "A" such to be arranged symmetrically on the respective central axis "Y" of the cylinder lock and to circumferentially wind around the control head 11 at least to the depth that characterises them.

[0048] Preferably, the active anti-burglary punching 100b is also arranged along the longitudinal direction "A" such to be arranged symmetrically on the respective central axis "Y". The active anti-burglary punching 100b defines in its interior a volume greater than the volume occupied by the control head 11 of the anti-burglary piston 10b that is arranged in the rear portion of this volume. In other words, in the interaction between the control head 11 of the anti-burglary piston 10b and active anti-burglary punching 100b, the control surface 13a comes into contact with the rear planar surface 108 of the active anti-burglary punching 100b and generates a gap 19 between the front surface 13b of the anti-burglary piston 10b and the front portion of the active anti-burglary punching 100b. The gap 19 is adapted to prevent burglary attempts using bumping keys, as will be described later. In other words, the active anti-burglary punching 100b already

formed on the blank 200, and therefore also present on the punched control key 100, is configured and/or arranged to receive an anti-burglary piston 10b of the cylinder lock 1 resting on the rear planar surface 108, i.e. that which extends toward the free end 103, in a coupling condition between the punched control key 100 obtained from the blank 200 and the cylinder lock itself.

[0049] The blocking of the rotation of the rotor 3 is performed in a manner similar to the locking pistons 10a and the anti-burglary piston 10b by extracting the punched control key 100.

[0050] Figures 4 and 5 illustrate a burglary attempt that exploits the method known as "key bumping", wherein a "bumping key" 300 is inserted into the slit 8 and hit from the outside to force the lowering of the pistons.

[0051] The bumping key 300 is obtained starting from the blank 200, comprising the active anti-burglary punching 100b, wherein further punchings 300a are made having an identical depth equal to the maximum obtainable depth on the blank 200. When the bumping key 300 is inserted into the slit 8 all the locking pistons 10a abut against their maximum height at the further punching 300a. In the interaction between the control head 11 of the anti-burglary piston 10b and the active anti-burglary punching 100b of the bumping key 300, a gap 19 is however created between the front surface 13b of the anti-burglary piston 10b and the front portion of the active anti-burglary punching 100b. The percussion exerted on the bumping key 300 from the outside is not able to cancel the gap 19 and therefore cause the lowering of the anti-burglary piston 10b. Any further action on the active anti-burglary punching 100b would lead to an increase in the gap 19, thereby increasing the security of the cylinder lock.

[0052] Figures 7-11 illustrate a second embodiment of the cylinder lock 1. The elements which are shared with the first embodiment have been indicated with the same reference number. In this case, a particular shape of the anti-burglary piston 10b is not provided, as it has a control head 11, which is structurally and functionally similar to those of the locking pistons 10a. Its anti-burglary function is determined by its position, which leads it to abut in the active anti-burglary punching 100b of the punched control key 100.

[0053] The blank 200 and the punched control key 100 comprise the active anti-burglary punching 100b, whose shape is preferably similar to that described previously.

[0054] The active anti-burglary punching 100b is formed in a proximal position with respect to the free end 103 and the chute 110 that extends between the active anti-burglary punching 100b and the free end 103. The active anti-burglary punching 100b is arranged along the longitudinal direction "A" such to be positioned offset along the longitudinal axis "X", toward the front opening 7 of the cylinder lock 1, with respect to the apex 12 of the anti-burglary piston 10b and the central axis "Y", in a coupling condition between the control key 100 obtained from the blank 200 and the cylinder lock 1. In figure 8 the

letter "S" is used to indicate the distance between the basic footprint 107 of the active anti-burglary punching 100b and the apex 12 of the anti-burglary piston 10b. This staggered arrangement can also be envisaged in the first embodiment.

[0055] In use, to free the rotation of the rotor 3, the locking pistons 10a abut in the respective active punchings 100a of the punched control key while the anti-burglary piston 10b abuts in the active anti-burglary punching 100b in mutual contact at the respective rear portions. Figure 7 illustrates the angular alignment position of the rotor 3 with the punched control key 100 inserted into the slit 8 and correctly interacting with the pistons 10a, 10b such to allow the rotation of the rotor 3 around the longitudinal axis "X". It can be noted that the active punchings 100a of the punched control key 100 are arranged along the longitudinal direction "A" such to be arranged symmetrically on the respective central axis "Y" and to circumferentially wind around the control head 11 at least to the depth that characterises them. The active anti-burglary punching 100b is arranged along the longitudinal direction "A" such to be arranged offset along the longitudinal axis "X" toward the front portion of the rotor 3, with respect to the central axis "Y".

[0056] Also in this case, the active anti-burglary punching 100b defines in its interior a volume greater than the volume occupied by the control head 11 of the anti-burglary piston 10b that abuts in the rear portion of this volume. In other words, in the interaction between the control head 11 of the anti-burglary piston 10b and active anti-burglary punching 100b, the control head 11 comes into contact with the rear planar surface 108 of the active anti-burglary punching 100b and generates a gap 19 between the control head 11 of the anti-burglary piston 10b and the front portion of the active anti-burglary punching 100b.

[0057] In other words, the active anti-burglary punching 100b of the blank 200 is configured and/or arranged to receive an anti-burglary piston 10b of the cylinder lock 1 resting on the rear planar surface 108, i.e. that which extends toward the free end 103, in a coupling condition between the punched control key 100 obtained from the blank 200 and the cylinder lock itself.

[0058] The rotation of the rotor 3 is blocked in a similar manner to the locking pistons 10a and the anti-burglary piston 10b by extracting the anti-burglary control key.

[0059] Figures 10 and 11 illustrate a burglary attempt that exploits the method known as "key bumping", wherein a "bumping key" 300 is inserted into the slit 8 and hit from the outside to force the lowering of the pistons. As previously described, the percussion exerted on the bumping key 300 from the outside is not able to cancel the gap 19 and therefore cause the lowering of the anti-burglary piston 10b. Any further action on the active anti-burglary punching 100b would lead to an increase in the gap 19, thereby increasing the security of the cylinder lock.

[0060] In general terms, the cylinder lock 1 and/or the

blank 200 for making a copy of the punched control key 100 define a locking system.

[0061] The cylinder lock 1 comprises an anti-burglary piston 10b housed in a respective radial hole 9 of the rotor 3 and comprising a control head 11 configured to abut at the active anti-burglary punching 100b of the punched control key 100.

[0062] The blank 200 already has the active anti-burglary punching 100b and the chute 110 that extends between the active anti-burglary punching 100b and the free end 103.

[0063] The active anti-burglary punching 100b and/or the anti-burglary piston 10b are shaped and/or arranged in such a way that, in a coupling condition between the punched control key obtained from the blank 200 and the cylinder lock 1, the anti-burglary piston 10b abuts in the active anti-burglary punching 100b at a respective rear portion and that a front portion of the active anti-burglary punching 100b is arranged at a longitudinal distance "Z" from a front portion of the anti-burglary piston 10b in order to generate the gap 19.

[0064] The longitudinal distance "Z" is greater than 1.7 mm, i.e. has a possible further longitudinal excursion obtainable on a bumping key 300, filing the abutment portion 111.

[0065] The configuration and/or shape of the active anti-burglary punching 100b is uniquely associated to a given cylinder lock such to define a volume inside the active anti-burglary punching 100b which is greater than a volume occupied by the control head of the anti-burglary piston 10b.

Claims

1. A locking system comprising a cylinder lock (1) and a punched control key (100), wherein the cylinder lock (1) comprises:

- a stator (2) having a cylindrical seat (4), which extends along a longitudinal axis (X) between a front portion (2a) and a rear portion (2b), and a plurality of radial holes (5) terminating in said cylindrical seat (4),

- at least one rotating cylindrical rotor (3) housed in said cylindrical seat (4) and having a front opening (7) which grants access to a slit (8) having a longitudinal extension coinciding with the longitudinal axis (X) and adapted to receive said punched control key (100), wherein said rotor (3) has a plurality of radial holes (9) that terminate in said slit (8) and that, in an angular alignment position of said rotor (3), are aligned with the radial holes (5) of the stator (2) to form a plurality of radial seats that extend along respective central axes (Y),

- a plurality of pistons (10a, 10b), each piston being housed in a radial hole (9) of the rotor (3),

slidable along said central axis (Y) and comprising a control head (11) having an apex (12) projecting inside the slit (8) and configured to abut at an active punching (100a, 100b) of the punched control key (100),

- a plurality of elastic elements (15), each elastic element being housed in a radial hole (5) of the stator (2),

- a plurality of counter-pistons (14), each counter-piston being interposed between an elastic element (15) and a piston (10a, 10b),

wherein each elastic element (15) is thrustingly active on the respective counter-piston (14) to push said counter-piston and said piston toward said slit (8) and wherein said piston and said counter-piston are movable in opposition to the respective elastic element (15) as a result of the interaction between the control head (11) and the punched control key (100),

characterised in that said plurality of pistons comprises an anti-burglary piston (10b),

wherein the punched control key (100) comprises an active anti-burglary punching (100b) formed in a proximal position with respect to a free end (103) and a chute (110) that extends between said active anti-burglary punching (100b) and said free end (103),

and wherein in a coupling condition between the punched control key (100) obtained from a blank (200) and the cylinder lock (1), the anti-burglary piston (10b) abuts in the active anti-burglary punching (100b) at a respective rear portion and that a front portion of the active anti-burglary punching (100b) is arranged at a longitudinal distance (Z) from a front portion of the anti-burglary piston (10b) in order to generate the gap (19) adapted to prevent burglary attempts using bumping keys.

2. The locking system according to claim 1, wherein said anti-burglary piston (10b) comprises said control head (11) shaped asymmetrically with respect to said central axis (Y), with said apex (12) arranged on the opposite side of the front opening (7) with respect to said central axis (Y), at a rear portion of said anti-burglary piston (10b)

3. The locking system according to claim 2, wherein said control head (11) of said anti-burglary piston (10b) comprises a front surface (13b) arranged toward said front opening (7), terminating at said apex (12) and intersecting said central axis (Y).

4. The locking system according to claim 3, wherein said front surface (13b) is inclined toward said apex (12) with respect to said central axis (Y).

5. The locking system according to one or more of the preceding claims 2-4, wherein said control head (11) of said anti-burglary piston (10b) comprises a control surface (13a) inclined toward said apex (12) with respect to said central axis (Y) and arranged on the opposite side of said front opening (7) with respect to said central axis (Y) at the rear portion of the anti-burglary piston (10b).

6. The locking system according to one or more of the preceding claims 2-5, wherein said control head (11) of said anti-burglary piston (10b) has a chisel shape with a front surface (13b), and a control surface (13a) having a planar shape converging in said apex (12) having a linear shape.

7. The locking system according to claim 6, wherein said apex (12) having a linear shape is arranged in a direction perpendicular to said central axis (Y) and to said longitudinal axis (X).

8. The locking system according to claim 7, wherein said apex (12) having a linear shape has a length (L1) smaller than the diameter (D) of said radial hole (9) of the rotor (3) and is preferably offset with respect to said central axis (Y) along a direction perpendicular to said longitudinal axis (X).

9. The locking system according to one or more of the preceding claims, wherein said anti-burglary piston (10b) is the piston which is most distant from the front opening (7), arranged in the rear portion of the rotor (3).

10. The locking system according to one or more of the preceding claims 2-8, wherein said anti-burglary piston (10b) comprises an anti-rotation device (16) configured to maintain the angular position of the anti-burglary piston constant around the central axis (Y).

11. The locking system according to one or more of the preceding claims, wherein said active anti-burglary punching (100b) and/or said control head (11) of the anti-burglary piston (10b) are shaped and/or arranged in such a way that, in the coupling condition, said control head (11) abuts in said active anti-burglary punching (100b) and is arranged in the rear portion of the internal volume of the active anti-burglary punching (100b), leaving a gap (19) between the control head (11) of the anti-burglary piston (10b) and a front portion of the active anti-burglary punching (100b), said gap (19) being adapted to prevent burglary attempts using bumping keys.

12. The locking system according to one or more of the preceding claims, wherein the active anti-burglary punching (100b) defines in its interior a volume greater than the volume occupied by the control head (11) of the anti-burglary piston (10b) that, in the coupling condition, is arranged in the rear portion of this volume. 5
13. The locking system according to claim 11 or 12, wherein the plurality of pistons of the cylinder lock (1) comprises a plurality of locking pistons (10a) each adapted to abut in an active punching (100a) of the punched control key (100) and wherein the anti-burglary piston (10b) has a control head (11) which is structurally and functionally similar to those of the locking pistons (10a). 10 15
14. The locking system according to one or more of claim 11-13, wherein the active anti-burglary punching (100b) is arranged along a longitudinal direction (A) of the punched control key (100) such to be positioned offset along the longitudinal axis (X), toward the front opening (7) of the cylinder lock (1), with respect to the apex (12) of the anti-burglary piston (10b), in the coupling condition, the basic footprint (107) of the active anti-burglary punching (100b) being disposed at a distance (S) from the apex (12) of the anti-burglary piston (10b). 20 25

Patentansprüche

1. Schließsystem, umfassend ein Zylinderschloss (1) und einen gestanzten Steuerkeil (100), wobei das Zylinderschloss (1) umfasst: 30 35
- einen Stator (2) mit einem zylindrischen Sitz (4), der entlang einer Längsachse (X) zwischen einem vorderen Abschnitt (2a) und einem hinteren Abschnitt (2b) verläuft, und mehreren radialen Löchern (5), die im zylindrischen Sitz (4) enden, 40
 - zumindest einen drehenden zylindrischen Rotor (3), der im zylindrischen Sitz (4) eingefasst ist und eine vordere Öffnung (7) aufweist, welche Zugang zu einem Schlitz (8) gewährt, der eine Längserstreckung aufweist, welche mit der Längsachse (X) zusammenfällt, und zum Aufnehmen des gestanzten Steuerkeils (100) geeignet ist, wobei der Rotor (3) mehrere radiale Löcher (9) aufweist, die im Schlitz (8) enden und die, in einer winkligen Ausrichtungsposition des Rotors (3), an den radialen Löchern (5) des Stators (2) ausgerichtet sind, um mehrere radiale Sitze auszubilden, die entlang jeweiliger Mittelachsen (Y) verlaufen, 45 50
 - mehrere Kolben (10a, 10b), wobei jeder Kolben in einem radialen Loch (9) des Rotors (3) ein-

gefasst ist, entlang der Mittelachse (Y) gleitbar ist und einen Steuerkopf (11) mit einem Scheitel (12) umfasst, der in den Schlitz (8) hinein vorsteht und zum Angrenzen an eine aktive Ausstanzung (100a, 100b) des gestanzten Steuerkeils (100) konfiguriert ist, 5

- mehrere elastische Elemente (15), wobei jedes elastische Element in einem radialen Loch (5) des Stators (2) eingefasst ist, 10
- mehrere Gegenkolben (14), wobei jeder Gegenkolben zwischen einem elastischen Element (15) und einem Kolben (10a, 10b) eingeschoben ist, 15

wobei jedes elastische Element (15) schiebend auf den jeweiligen Gegenkolben (14) aktiv ist, um den Gegenkolben und den Kolben zum Schlitz (8) hin zu schieben, und wobei der Kolben und der Gegenkolben im Widerstand zu dem jeweiligen elastischen Element (15) infolge der Wechselwirkung zwischen dem Steuerkopf (11) und dem gestanzten Steuerkeil (100) beweglich sind, **dadurch gekennzeichnet, dass** die mehreren Kolben einen Einbruchschutzkolben (10b) umfassen, 20

wobei der gestanzte Steuerkeil (100) eine aktive Einbruchschutzausstanzung (100b), die in einer proximalen Position bezüglich eines freien Endes (103) ausgebildet ist, und eine Rampe (110) umfasst, die zwischen der aktiven Einbruchschutzausstanzung (100b) und dem freien Ende (103) verläuft, 25 30

und wobei in einem Kupplungszustand zwischen dem gestanzten Steuerkeil (100), der aus einem Rohling (200) erhalten ist, und dem Zylinderschloss (1) der Diebstahlenschutzkolben (10b) in der aktiven Diebstahlenschutzausstanzung (100b) an einen jeweiligen hinteren Abschnitt angrenzt, und wobei ein vorderer Abschnitt der aktiven Diebstahlenschutzausstanzung (100b) in einem Längsabstand (Z) zu einem vorderen Abschnitt des Diebstahlschutzkolbens (10b) angeordnet ist, um den Spalt (19) zu erzeugen, der zum Verhindern von Einbruchversuchen unter Benutzung von Schlagschlüsseln geeignet ist. 35 40 45 50

2. Schließsystem nach Anspruch 1, wobei der Einbruchschutzkolben (10b) den Steuerkopf (11) umfasst, der asymmetrisch bezüglich der Mittelachse (Y) ausgebildet ist, wobei der Scheitel (12) auf der gegenüberliegenden Seite der vorderen Öffnung (7) bezüglich der Mittelachse (Y) an einem hinteren Abschnitt des Einbruchschutzkolbens (10b) angeordnet ist. 55

3. Schließsystem nach Anspruch 2, wobei der Steuerkopf (11) des Einbruchschutzkolbens (10b) eine Vorderfläche (13b) umfasst, die zur vorderen Öffnung (7) hin angeordnet ist, am Scheitel (12) endet und die Mittelachse (Y) schneidet.
4. Schließsystem nach Anspruch 3, wobei die Vorderfläche (13b) zum Scheitel (12) hin bezüglich der Mittelachse (Y) geneigt ist.
5. Schließsystem nach einem oder mehreren der vorhergehenden Ansprüche 2 bis 4, wobei der Steuerkopf (11) des Einbruchschutzkolbens (10b) eine Steuerfläche (13a) umfasst, die zum Scheitel (12) hin bezüglich der Mittelachse (Y) geneigt ist und auf der gegenüberliegenden Seite der vorderen Öffnung (7) bezüglich der Mittelachse (Y) am hinteren Abschnitt des Einbruchschutzkolbens (10b) angeordnet ist.
6. Schließsystem nach einem oder mehreren der vorhergehenden Ansprüche 2 bis 5, wobei der Steuerkopf (11) des Einbruchschutzkolbens (10b) eine Meißelform mit einer Vorderfläche (13b) und einer Steuerfläche (13a) mit einer planen Form aufweist, die im Scheitel (12) mit einer linearen Form konvergieren.
7. Schließsystem nach Anspruch 6, wobei der Scheitel (12) mit einer linearen Form in einer senkrecht zur Mittelachse (Y) und zur Längsachse (X) verlaufenden Richtung angeordnet ist.
8. Schließsystem nach Anspruch 7, wobei der Scheitel (12) mit einer linearen Form eine Länge (L1) aufweist, die geringer als der Durchmesser (D) des radialen Lochs (9) des Rotors (3) ist, und vorzugsweise bezüglich der Mittelachse (Y) entlang einer senkrecht zur Längsachse (X) verlaufenden Richtung versetzt ist.
9. Schließsystem nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Einbruchschutzkolben (10b) der Kolben ist, der im größten Abstand zur vorderen Öffnung (7) gelegen ist, welche im hinteren Abschnitt des Rotors (3) angeordnet ist.
10. Schließsystem nach einem oder mehreren der vorhergehenden Ansprüche 2 bis 8, wobei der Einbruchschutzkolben (10b) eine Drehschutzvorrichtung (16) umfasst, die zum Konstanthalten der Winkelposition des Einbruchschutzkolbens um die Mittelachse (Y) konfiguriert ist.
11. Schließsystem nach einem oder mehreren der vorhergehenden Ansprüche, wobei die aktive Diebstahlschutzausstanzung (100b) und/oder der Steuerkopf (11) des Einbruchschutzkolbens (10b) derart geformt und/oder angeordnet sind, dass, im Kupplungszustand, der Steuerkopf (11) in der aktiven Diebstahlschutzausstanzung (100b) angrenzt und im hinteren Abschnitt des Innenvolumens der aktiven Diebstahlschutzausstanzung (100b) angeordnet ist, wobei ein Spalt (19) zwischen dem Steuerkopf (11) des Diebstahlschutzkolbens (10b) und einem vorderen Abschnitt der aktiven Diebstahlschutzausstanzung (100b) belassen ist, wobei der Spalt (19) zum Verhindern von Einbruchversuchen unter Benutzung von Schlagschlüsseln geeignet ist.
12. Schließsystem nach einem oder mehreren der vorhergehenden Ansprüche, wobei die aktive Diebstahlschutzausstanzung (100b) in ihrem Inneren ein Volumen definiert, das größer als das Volumen ist, welches durch den Steuerkopf (11) des Diebstahlschutzkolbens (10b) belegt ist, der, im Kupplungszustand, im hinteren Abschnitt dieses Volumens angeordnet ist.
13. Schließvorrichtung nach Anspruch 11 oder 12, wobei die mehreren Kolben des Zylinderschlosses (1) mehrere Sperrkoben (10a) umfassen, die jeder zum Angrenzen in einer aktiven Ausstanzung (100a) des gestanzten Steuerkeils (100) geeignet sind, und wobei der Diebstahlschutzkolben (10b) einen Steuerkopf (11) aufweist, der strukturell und funktionell jenen der Sperrkolben (10a) ähnelt.
14. Schließsystem nach einem oder mehreren der Ansprüche 11 bis 13, wobei die aktive Diebstahlschutzausstanzung (100b) entlang einer Längsrichtung (A) des gestanzten Steuerkeils (100) angeordnet ist, sodass sie versetzt entlang der Längsachse (X) zur vorderen Öffnung (7) des Zylinderschlosses (1) hin bezüglich des Scheitels (12) des Diebstahlschutzkolbens (10b) im Kupplungszustand positioniert sein soll, wobei die Basisstellfläche (107) der aktiven Diebstahlschutzausstanzung (100b) in einem Abstand (S) zum Scheitel (12) des Diebstahlschutzkolbens (10b) angeordnet ist.

Revendications

1. Système de verrouillage comprenant une serrure à barillet (1) et une clé de commande poinçonnée (100), dans lequel la serrure à barillet (1) comprend
- un stator (2) ayant un siège cylindrique (4), qui s'étend le long d'un axe longitudinal (X) entre une partie avant (2a) et une partie arrière (2b), et une pluralité de trous radiaux (5) se terminant dans ledit siège cylindrique (4),
 - au moins un rotor cylindrique rotatif (3) logé dans ledit siège cylindrique (4) et ayant une

ouverture avant (7) qui donne accès à une fente (8) ayant une extension longitudinale coïncidant avec l'axe longitudinal (X) et adaptée pour recevoir ladite clé de commande poinçonnée (100), dans lequel ledit rotor (3) a une pluralité de trous radiaux (9) qui se terminent dans ladite fente (8) et qui, dans une position d'alignement angulaire dudit rotor (3), sont alignés avec les trous radiaux (5) du stator (2) pour former une pluralité de sièges radiaux qui s'étendent le long d'axes centraux respectifs (Y),

- une pluralité de pistons (10a, 10b), chaque piston étant logé dans un trou radial (9) du rotor (3), pouvant coulisser le long dudit axe central (Y) et comprenant une tête de commande (11) ayant un sommet (12) faisant saillie à l'intérieur de la fente (8) et configurée pour venir en butée contre un poinçon actif (100a, 100b) de la clé de commande poinçonnée (100),
- une pluralité d'éléments élastiques (15), chaque élément élastique étant logé dans un trou radial (5) du stator (2),
- une pluralité de contre-pistons (14), chaque contre-piston étant interposé entre un élément élastique (15) et un piston (10a, 10b),

dans lequel chaque élément élastique (15) est actif en poussant sur le contre-piston respectif (14) pour pousser ledit contre-piston et ledit piston vers ladite fente (8) et dans lequel ledit piston et ledit contre-piston sont mobiles en opposition à l'élément élastique respectif (15) en conséquence de l'interaction entre la tête de commande (11) et la clé de commande poinçonnée (100),

caractérisé en ce que ladite pluralité de pistons comprend un piston anti-effraction (10b),

dans lequel la clé de commande poinçonnée (100) comprend un poinçon anti-effraction actif (100b) formé dans une position proximale par rapport à une extrémité libre (103) et une goulotte (110) qui s'étend entre ledit poinçon anti-effraction actif (100b) et ladite extrémité libre (103),

et dans lequel, dans une condition d'accouplement entre la clé de commande poinçonnée (100) obtenue à partir d'une ébauche (200) et la serrure à barillet (1), le piston anti-effraction (10b) vient en butée dans le poinçon anti-effraction actif (100b) au niveau d'une partie arrière respective et **en ce qu'** une partie avant du poinçon anti-effraction actif (100b) est agencée à une distance longitudinale (Z) d'une partie avant du piston anti-effraction (10b) afin de générer l'espace (19) adapté pour empêcher les tentatives de cambriolage en utilisant des clés à

frapper.

2. Système de verrouillage selon la revendication 1, dans lequel ledit piston anti-effraction (10b) comprend ladite tête de commande (11) de forme asymétrique par rapport audit axe central (Y), avec ledit sommet (12) disposé du côté opposé de l'ouverture avant (7) par rapport audit axe central (Y), au niveau d'une partie arrière dudit piston anti-effraction (10b).
3. Système de verrouillage selon la revendication 2, dans lequel ladite tête de commande (11) dudit piston anti-effraction (10b) comprend une surface avant (13b) disposée vers ladite ouverture avant (7), se terminant au niveau dudit sommet (12) et coupant ledit axe central (Y).
4. Système de verrouillage selon la revendication 3, dans lequel ladite surface avant (13b) est inclinée vers ledit sommet (12) par rapport audit axe central (Y).
5. Système de verrouillage selon une ou plusieurs des revendications précédentes 2 à 4, dans lequel ladite tête de commande (11) dudit piston anti-effraction (10b) comprend une surface de commande (13a) inclinée vers ledit sommet (12) par rapport audit axe central (Y) et disposée du côté opposé de ladite ouverture avant (7) par rapport audit axe central (Y) au niveau de la partie arrière du piston anti-effraction (10b).
6. Système de verrouillage selon une ou plusieurs des revendications précédentes 2-5, dans lequel ladite tête de commande (11) dudit piston anti-effraction (10b) a une forme de ciseau avec une surface avant (13b), et une surface de commande (13a) ayant une forme plane convergeant dans ledit sommet (12) ayant une forme linéaire.
7. Système de verrouillage selon la revendication 6, dans lequel ledit sommet (12) ayant une forme linéaire est disposé dans une direction perpendiculaire audit axe central (Y) et audit axe longitudinal (X).
8. Système de verrouillage selon la revendication 7, dans lequel ledit sommet (12) de forme linéaire a une longueur (L1) inférieure au diamètre (D) dudit trou radial (9) du rotor (3) et est de préférence décalé par rapport audit axe central (Y) selon une direction perpendiculaire audit axe longitudinal (X).
9. Système de verrouillage selon une ou plusieurs des revendications précédentes, dans lequel ledit piston anti-effraction (10b) est le piston le plus éloigné de l'ouverture avant (7), disposé dans la partie arrière du rotor (3).

10. Système de verrouillage selon une ou plusieurs des revendications précédentes 2 à 8, dans lequel ledit piston anti-effraction (10b) comprend un dispositif anti-rotation (16) configuré pour maintenir constante la position angulaire du piston anti-effraction autour de l'axe central (Y). 5
11. Système de verrouillage selon une ou plusieurs des revendications précédentes, dans lequel ledit poinçon anti-effraction actif (100b) et/ou ladite tête de commande (11) du piston anti-effraction (10b) sont conformés et/ou disposés de telle sorte que, à l'état d'accouplement, ladite tête de commande (11) bute dans ledit poinçon anti-effraction actif (100b) et est disposée dans la partie arrière du volume interne du poinçon anti-effraction actif (100b), laissant un espace (19) entre la tête de commande (11) du piston anti-effraction (10b) et une partie avant du poinçon anti-effraction actif (100b), ledit espace (19) étant adapté pour empêcher les tentatives d'effraction à l'aide de clés à frapper. 10
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12. Système de verrouillage selon une ou plusieurs des revendications précédentes, dans lequel le poinçon anti-effraction actif (100b) définit en son sein un volume supérieur au volume occupé par la tête de commande (11) du piston anti-effraction (10b) qui, à l'état d'accouplement, est disposée dans la partie arrière de ce volume. 25
30
13. Système de verrouillage selon la revendication 11 ou 12, dans lequel la pluralité de pistons de la serrure à barillet (1) comprend une pluralité de pistons de verrouillage (10a) adaptés chacun pour venir en butée dans un poinçonnage actif (100a) de la clé de commande poinçonnée (100) et dans lequel le piston anti-effraction (10b) a une tête de commande (11) qui est structurellement et fonctionnellement similaire à celles des pistons de verrouillage (10a). 35
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14. Système de verrouillage selon une ou plusieurs des revendications 11-13, dans lequel le poinçon anti-effraction actif (100b) est disposé le long d'une direction longitudinale (A) de la clé de commande poinçonnée (100) de manière à être positionné de manière décalée le long de l'axe longitudinal (X), vers l'ouverture avant (7) de la serrure à barillet (1), par rapport au sommet (12) du piston anti-effraction (10b), dans la condition d'accouplement, l'empreinte de base (107) du poinçon anti-effraction actif (100b) étant disposée à une distance (S) du sommet (12) du piston anti-effraction (10b). 45
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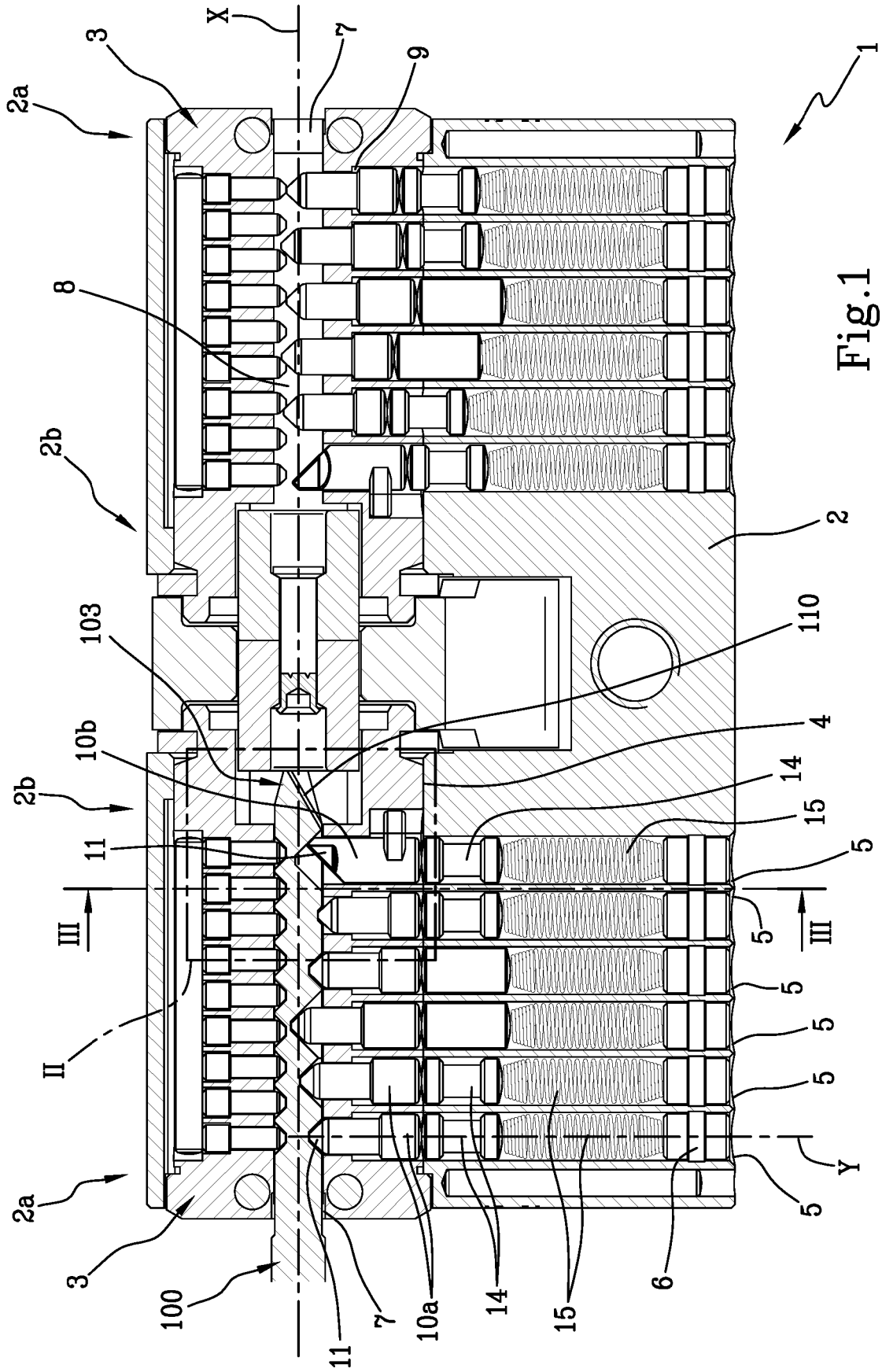


Fig.1

Fig.2

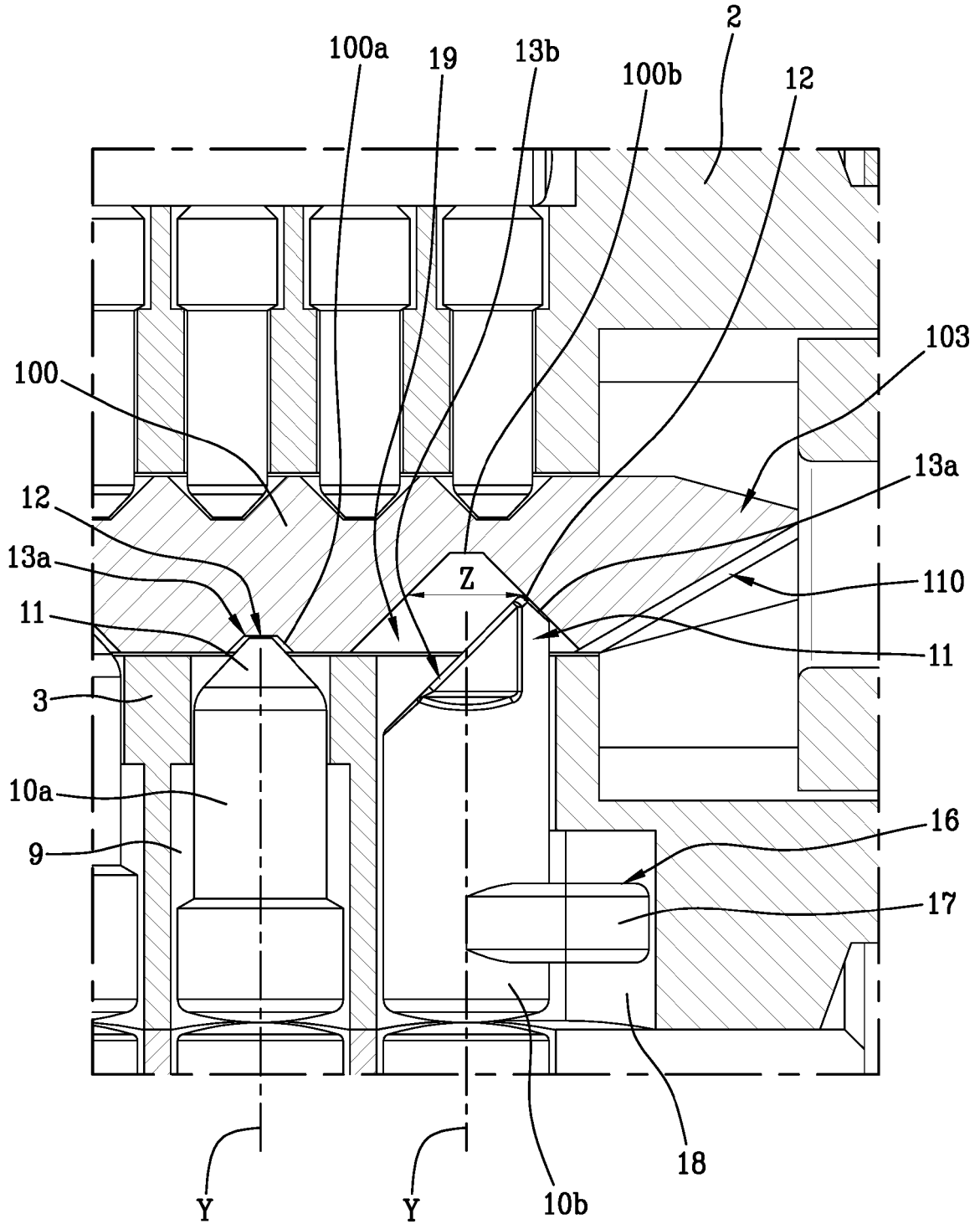
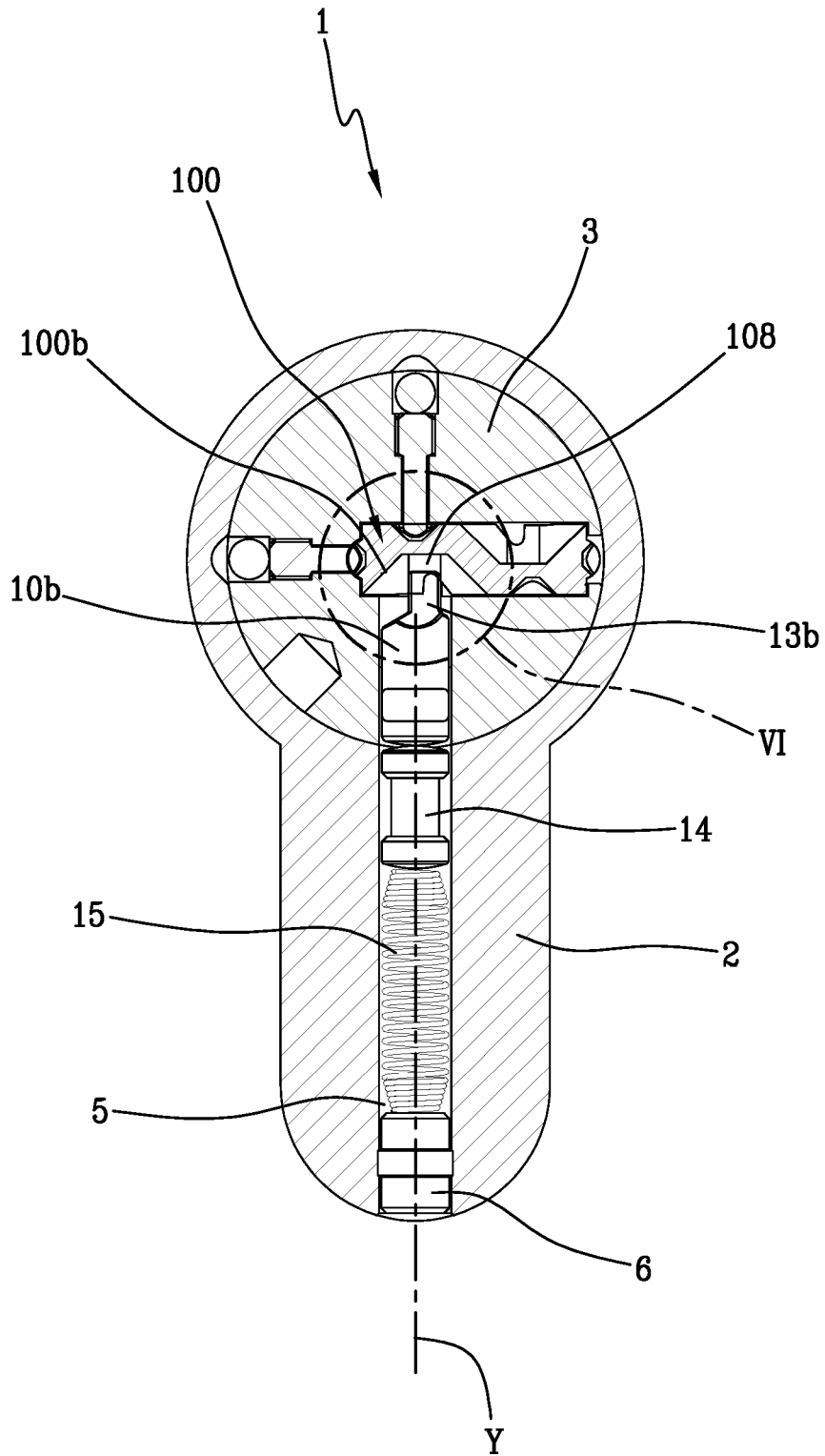


Fig.3



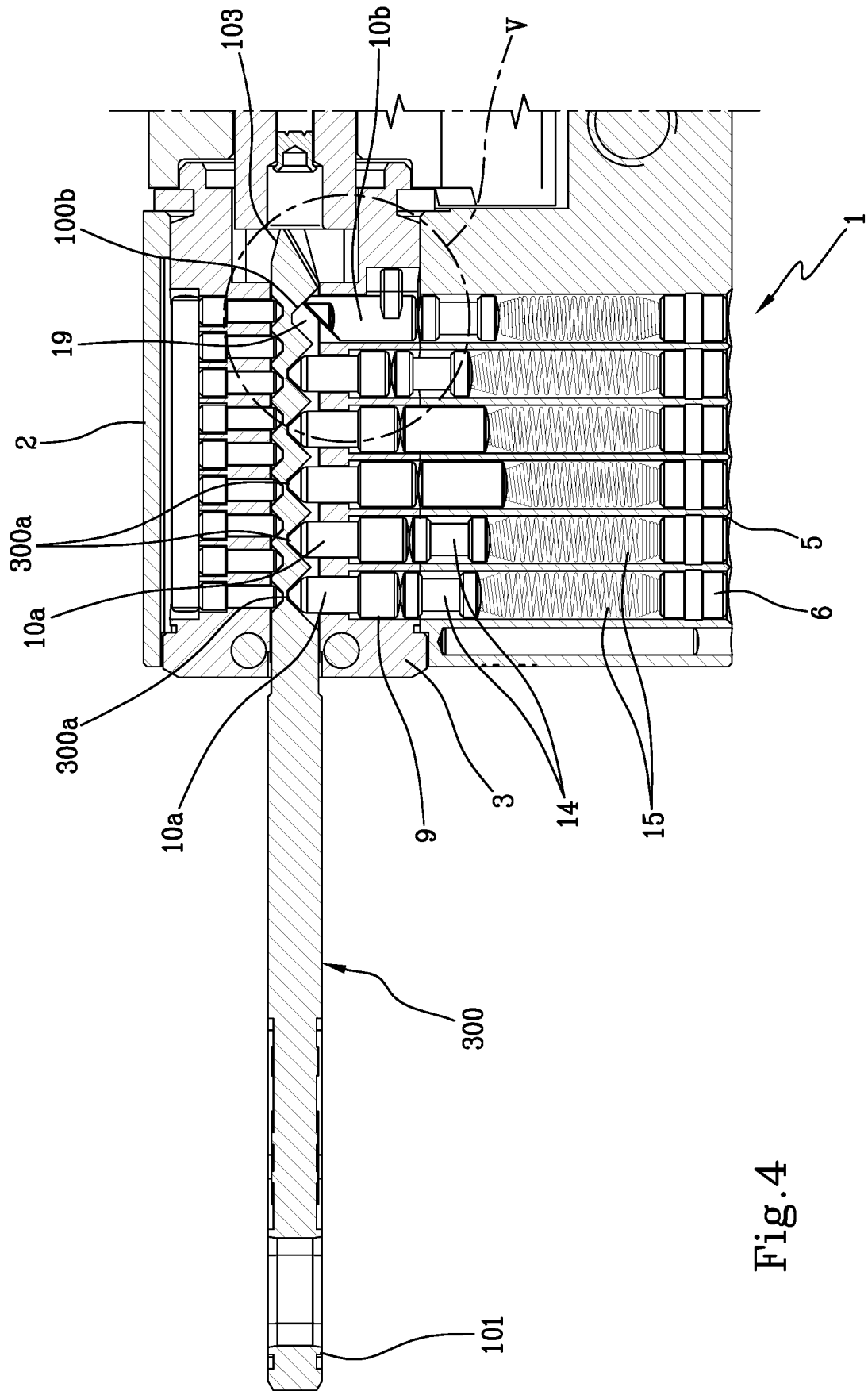


Fig. 4

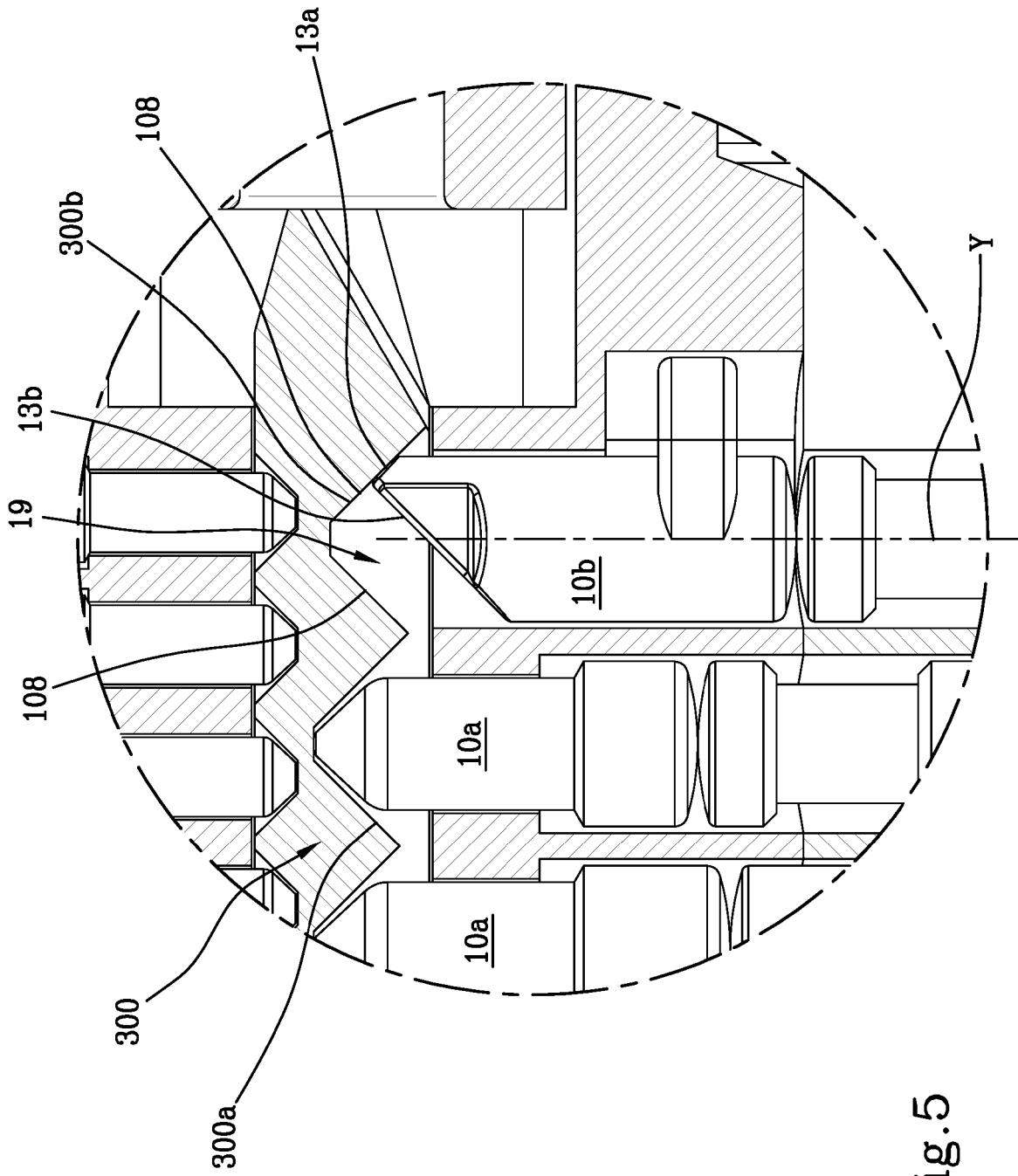


Fig. 5

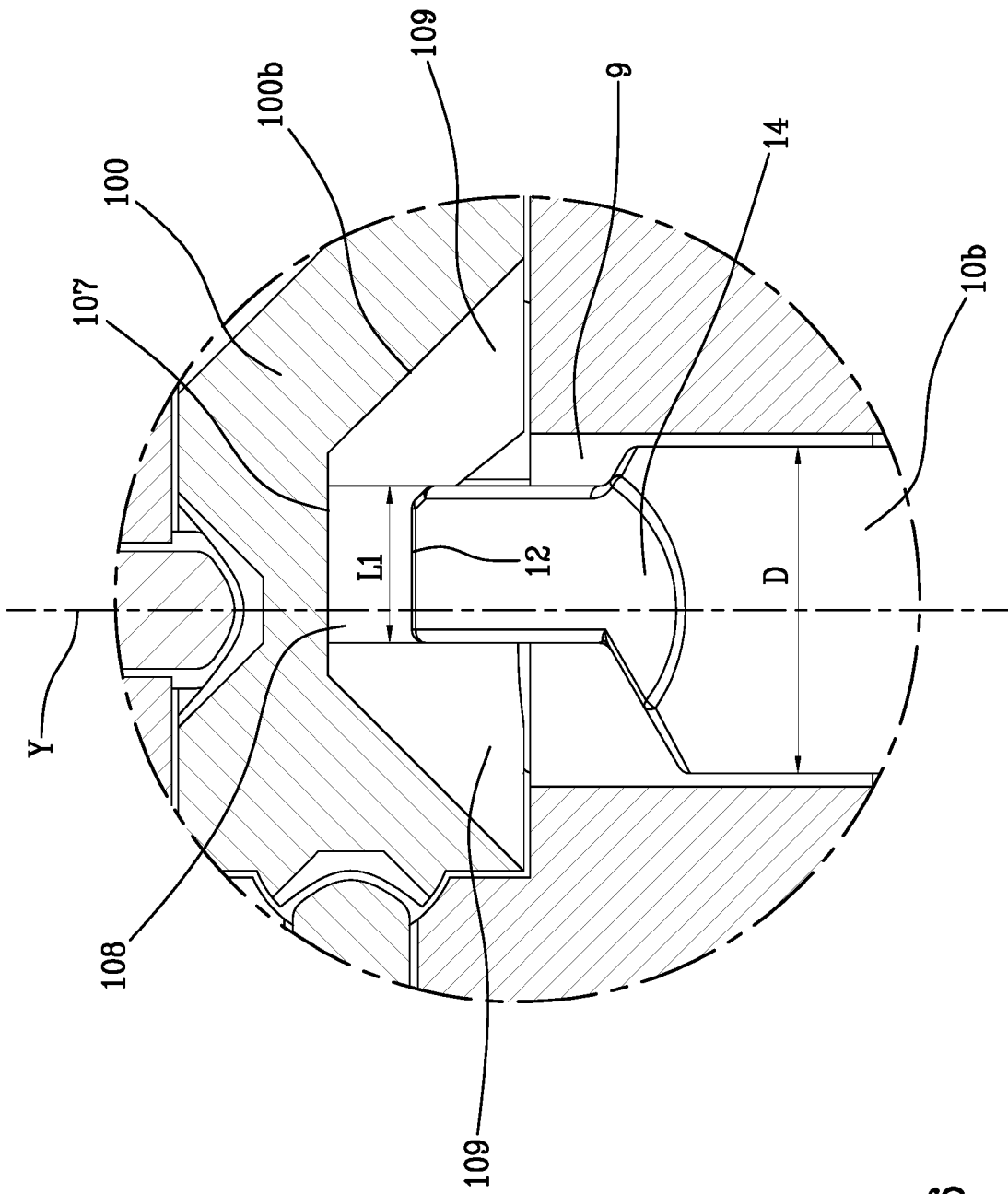


Fig. 6

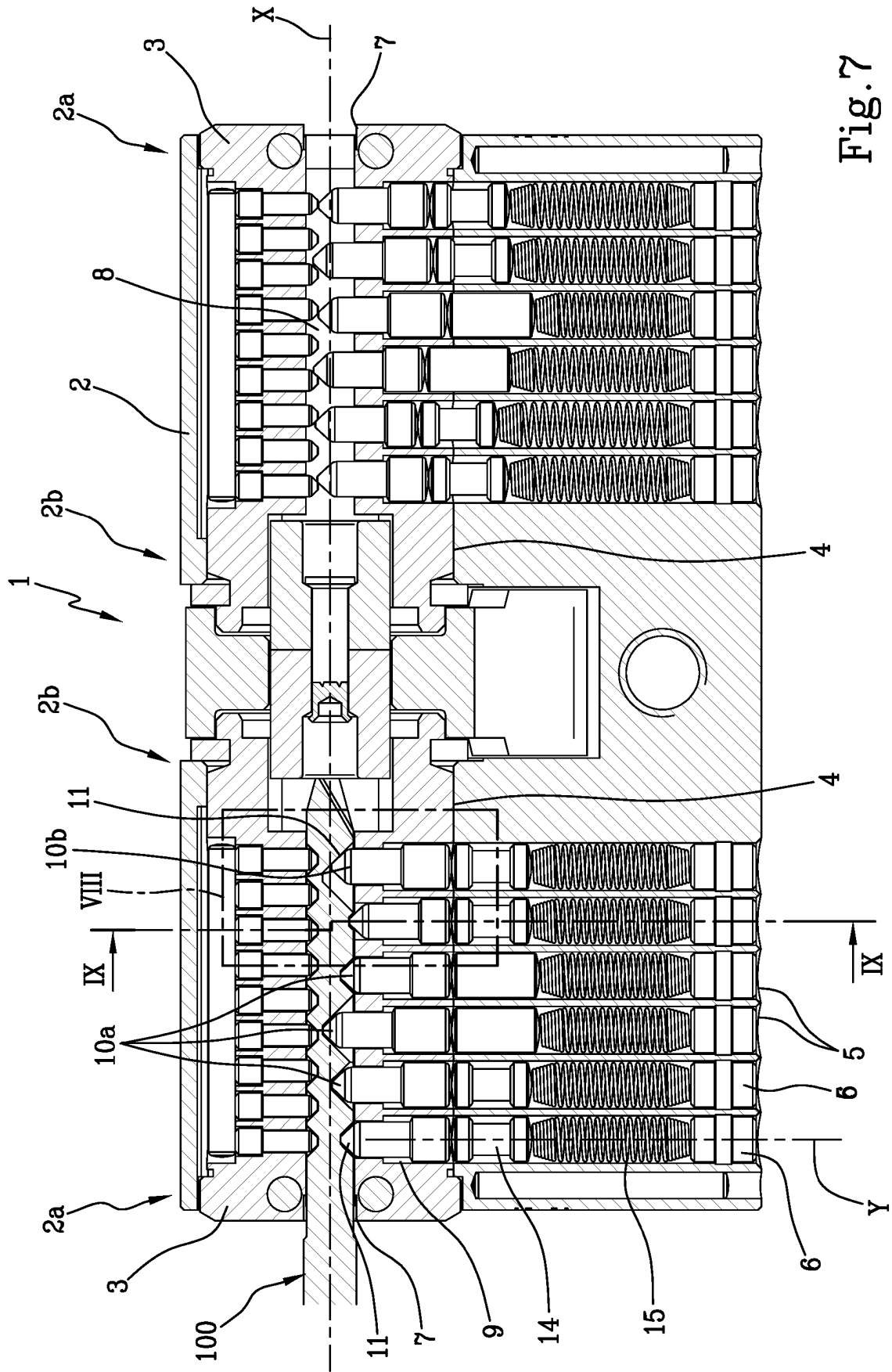


Fig. 7

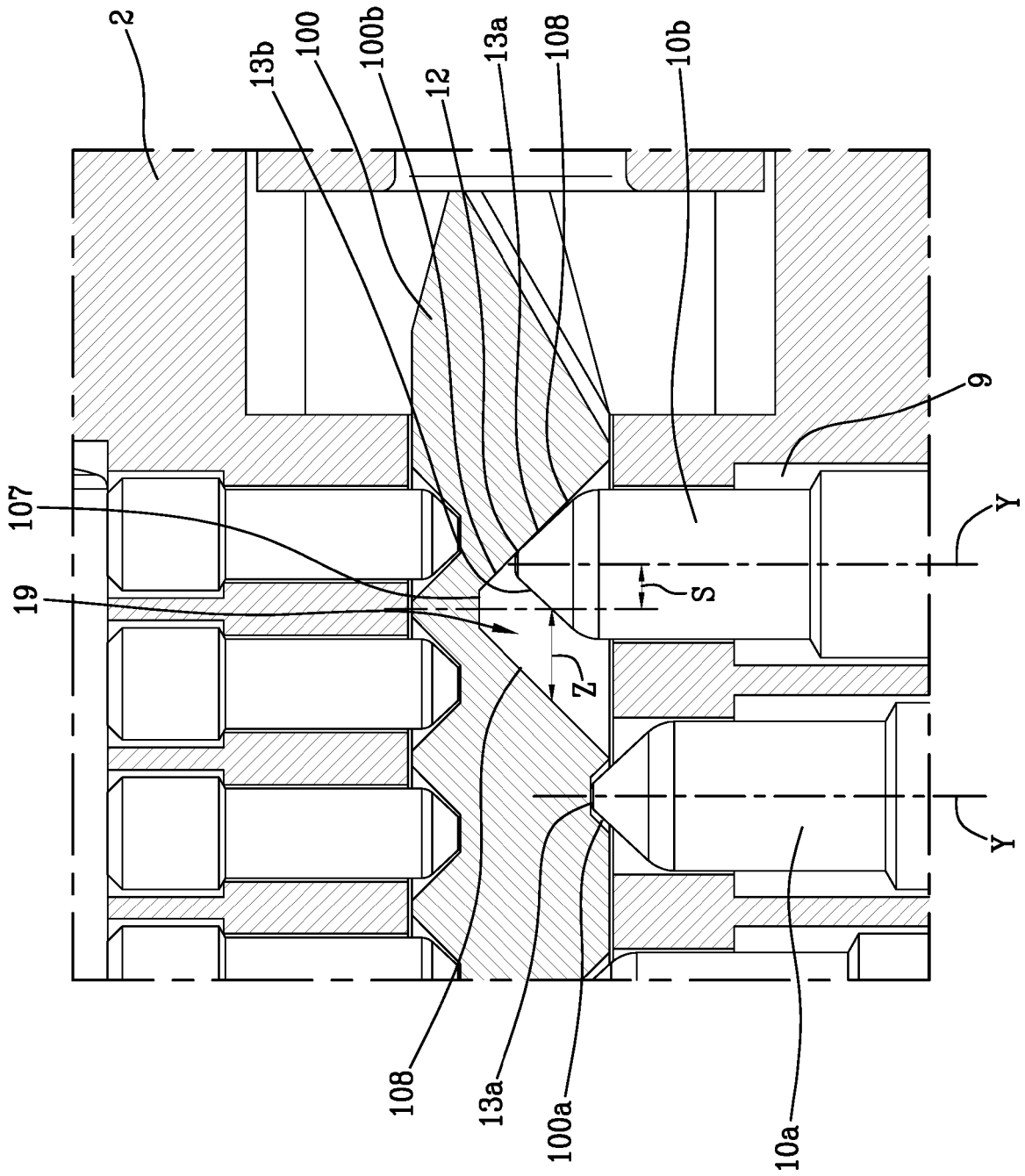
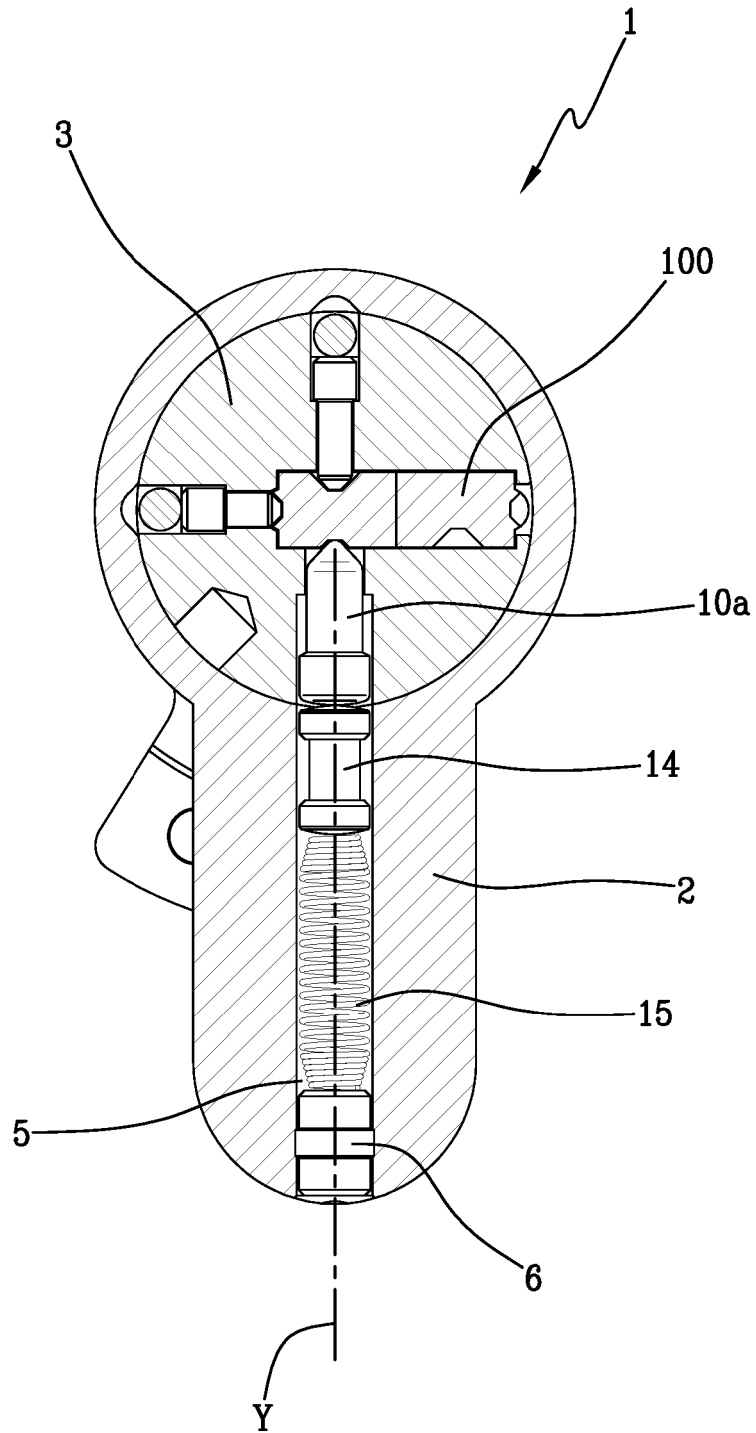


Fig. 8

Fig.9



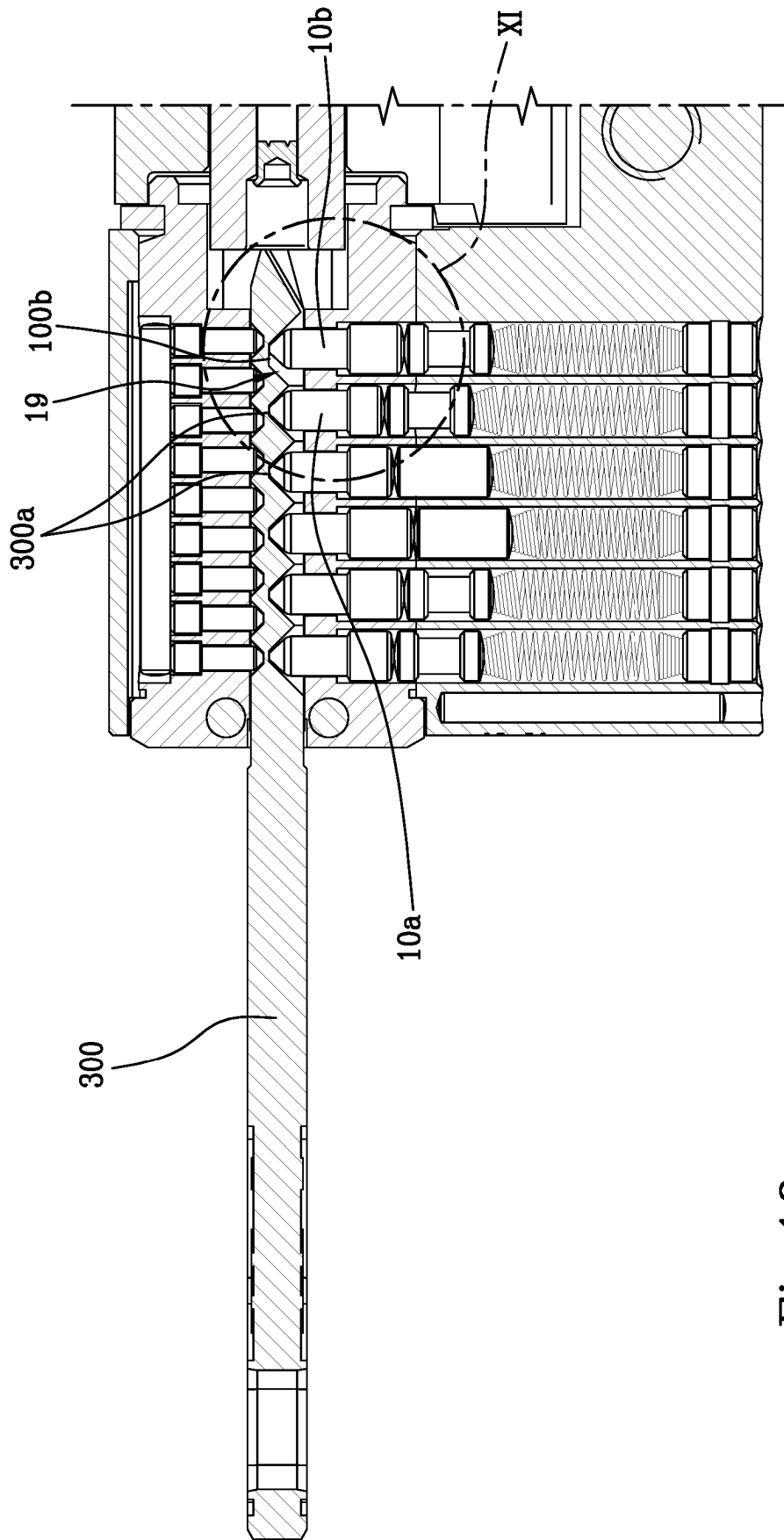


Fig.10

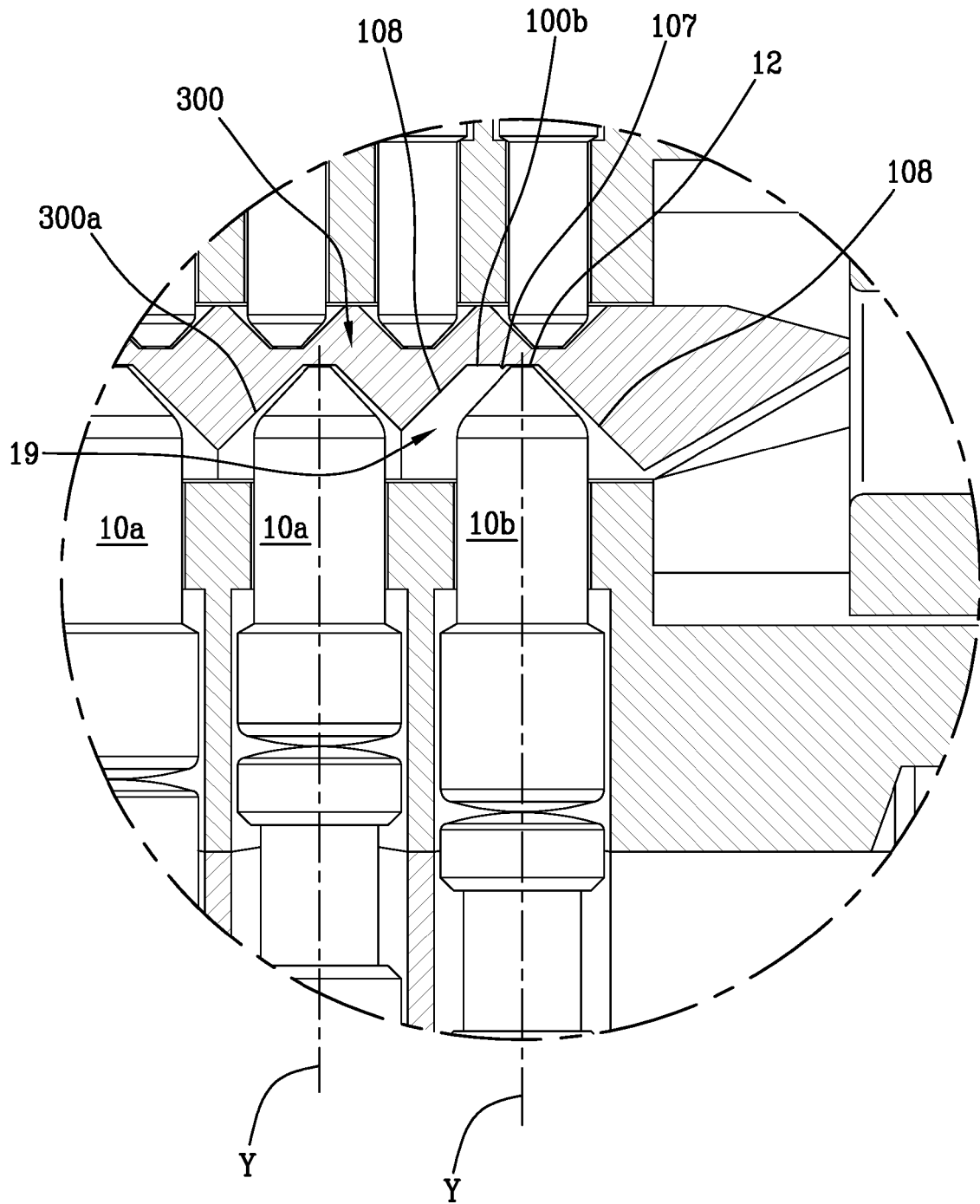


Fig.11

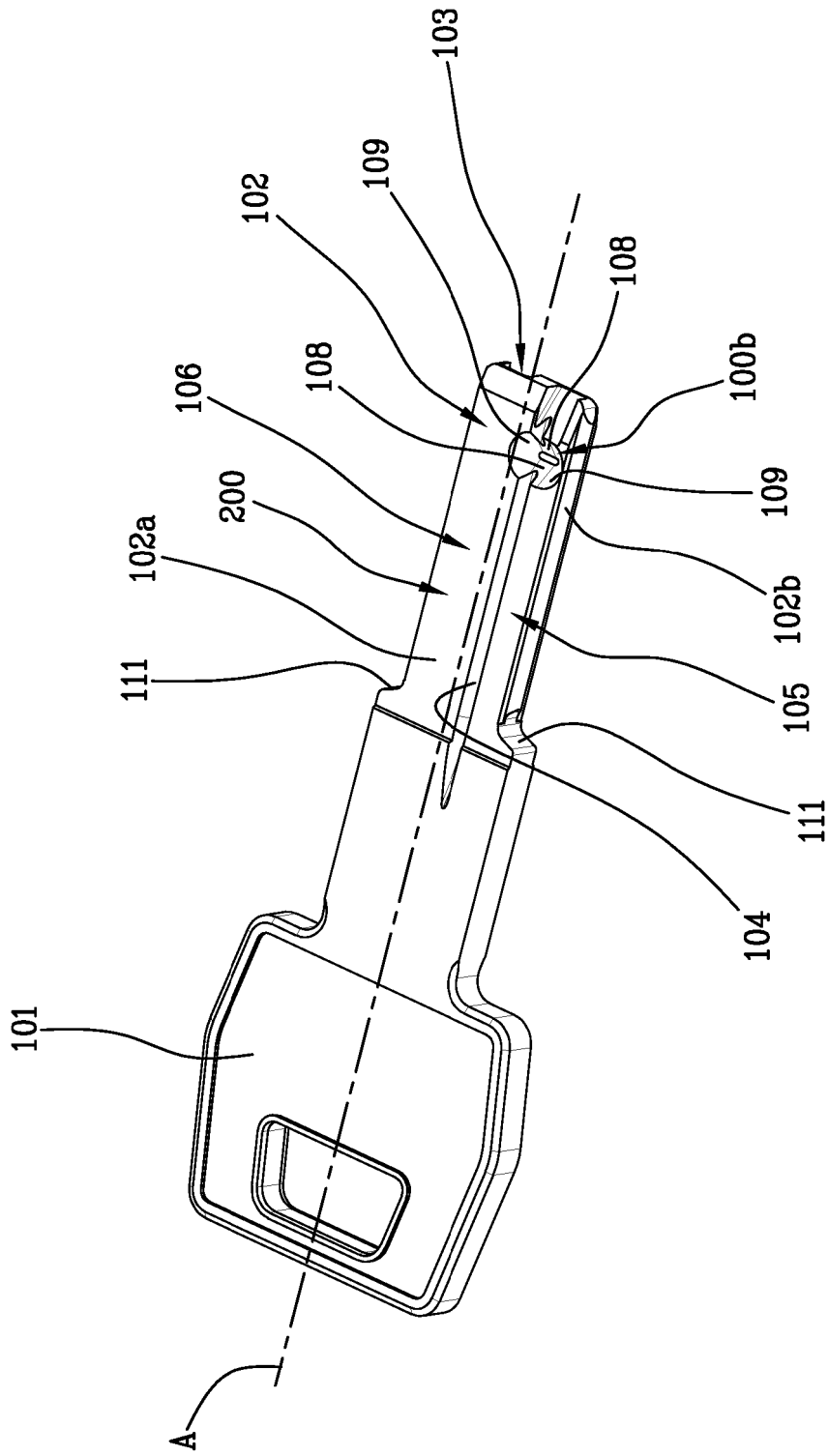
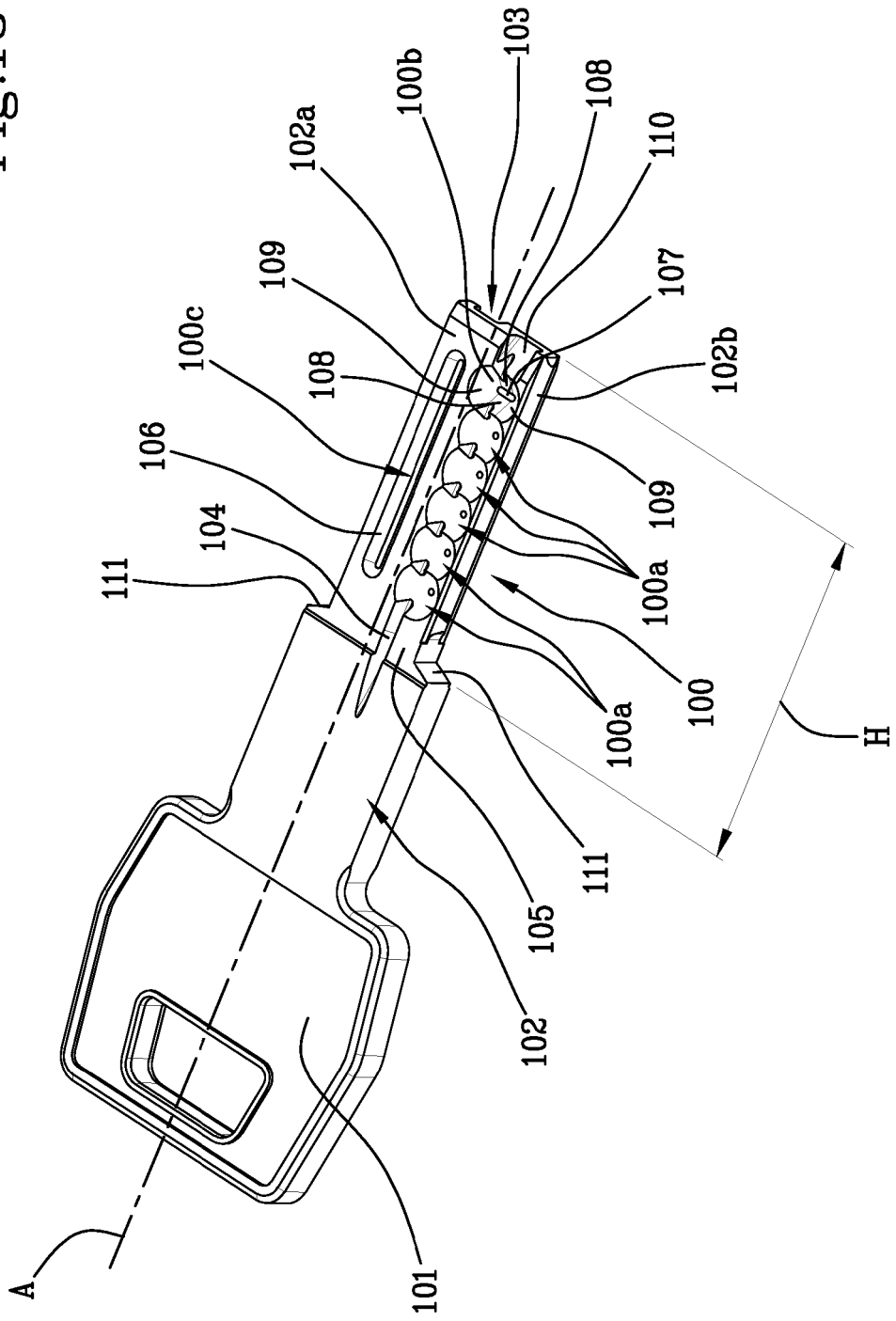


Fig.12

Fig.13



REFERENCES CITED IN THE DESCRIPTION

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