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(54) **COMPACT LOCK FOR INTERNAL DOORS AND LOCK ASSEMBLY**

(57) Lock (100, 200) for internal doors comprising: a case (110, 210); a first pawl (105, 205) and a second pawl (106, 206) provided with at least one tooth (106', 206'), said second pawl (106, 206) being configured in order to be rotated by a second handle and said second pawl (106, 206) being able to rotate independently from said first pawl (105, 205); a latch (107, 207) configured to translate from an opening position to a closure position and vice versa; an interface element (111, 211) configured to co-operate with the latch (107, 207), with the first pawl (105, 205) and with the second pawl (106, 206) in such a way that, when any one of said pawls (105, 205, 106, 206) is rotated in a first direction, from a rest position to a first position of functioning, said interface element (111, 211) performs a translation from a first position to a second position, causing, in turn, the translation of the latch (107, 207) from the closure position to the opening position; a spring (112, 212) connected with the interface element (111, 211), said spring (112, 212) being configured to co-operate with said pawls (105, 205, 106, 206), in such a way that, when any one of the pawls (105, 205) is rotated in a second direction opposite to said first direction, from the rest position to a second position of functioning, the translation of the interface element (111, 211), from the first to the second position, is prevented or permitted if the other of the pawls (106, 206) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment above or below a threshold, respectively.

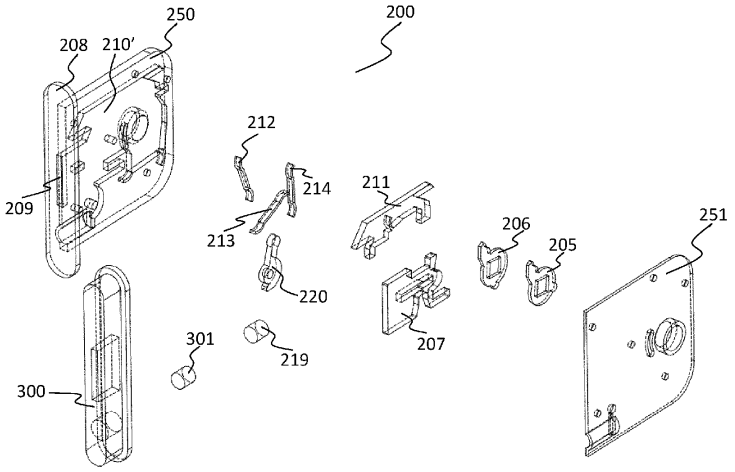

Fig.2

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a compact lock for internal doors, provided with mechanisms for opening/closing the lock and blocking and releasing the lock itself in the closure configuration without the use of keys. The lock that is the subject of the present description is not, therefore, equipped with a through panel, but is of the so-said "split panel" type and can be made using both purely mechanical mechanisms and mechanisms based on the use of magnets. The present invention also relates to a lock assembly comprising a lock provided with a magnet and a counter-plate, or staple, also provided with a magnet capable of co-operating with that of the lock.

STATE OF THE ART

[0002] At the present state of the art, the most common locks for internal doors are equipped with mechanisms that allow them to be opened by means of a handle and with mechanisms that allow blocking in the closure configuration by means of the use of a key. The latter can then be used to unblock the lock itself and thus enable it to be opened by means of a handle. Traditional locks for internal doors are therefore of the so-said "through-panel" type, i.e. they are equipped with a single handle panel, and, consequently, with a single pawl, for both sides of the lock. This single pawl is controlled by one handle per side and can be blocked from both sides by means of a key. Locks shaped in this way have the characteristic of creating a certain encumbrance on both sides of the door due to the presence of the keys, in that the latter are elements protruding from the lock. This encumbrance, in addition to being aesthetically displeasing, can give rise to safety problems, especially in those environments where children live, as they can accidentally bump such keys and, having a stature comparable to that of the height at which the lock is mounted in the door, the bumps can cause even serious damage to the face and to the eyes. Furthermore, should the lock be accidentally blocked, with a key, by a user who is no longer able to reopen it, such as a child or also a person with a disability, or a person who, suddenly and temporarily taken ill, is not in full possession of their physical and/or mental faculties, and should this key should remain blocked inside the lock, it is not always easy and immediate to succeed in opening the lock for those who find themselves on the other side of the door, even if they have another key. For this reason, it is desirable to have locks that can be blocked in their closure configuration, without the use of keys, but by means of mechanisms inside the lock itself that allow at the same time blocking (known in the sector as the "privacy function") and releasing of the block (known in the sector as the "emergency function") on the opposite side of the door with respect to the side where the block has been enabled. In this context, locks with a split handle panel have been introduced in the sector, allowing two users who are on the two sides of the door to act completely independently, and to block the lock by preventing opening by the user who may be on the other side of the door. In such locks, however, the "privacy" function is performed by elements, such as, for example, pegs, or small pins, provided with a tooth configured to co-operate with a handle pawl usually equipped with a special recess. Once a peg is inserted, when the pawl is actuated by an external handle, the tooth of the peg engages in the pawl, preventing the lock from opening (by means of rotation or thrust inwards depending on the models). These pins, or pegs, protrude from the door surface and, although they are less bulky than keys, they do not allow perfect coplanarity between door and lock. In the locks of the state of the art, moreover, the "emergency" function is often performed by a tool external to the lock, such as for example a small screwdriver, with which the "privacy" element can be pushed into the lock release position by means of a small hole usually formed in the handle rosette. It is intuitable that, as in the case of an emergency, releasing the lock in this way may not be completely immediate or, in any case, not practicable with the necessary timeliness in certain dangerous situations.

OBJECTS AND SUMMARY OF THE INVENTION

[0003] The object of the present invention is, therefore, to provide a lock for internal doors that can be blocked in its closure configuration by means of mechanisms inside the lock itself so that there are no elements protruding from the same lock (e.g. keys, pins, pegs), beyond the optional handle.

[0004] A second object is, moreover, to provide a lock for internal doors that, once blocked, can be unblocked immediately and extremely easily in the event of an emergency. This object is achieved by a lock comprising:

- a case;
- a front provided with at least one hole;
- a first pawl provided with at least one tooth, said first pawl being configured to be rotated by means of a first handle;
- a second pawl provided with at least one tooth, said second pawl being configured to be rotated by means of a second handle and said second pawl being able to rotate independently from said first pawl;
- a latch configured to traverse the hole of the front, performing a translation from a position of opening wherein said latch is retracted inside the case to a position of closure wherein said latch is projected outside of the case, and vice versa;
- an interface element configured to co-operate with the latch, with the tooth of the first pawl and with the tooth of the second pawl in such a way that, when the first pawl, or the second pawl, is rotated in a first

direction, from a rest position to a first position of functioning, said interface element performs a translation from a first position to a second position, the translation of the interface element causing, in turn, the translation of the latch from the position of closure to the position of opening;

- a spring, preferably a ribbon spring, connected to the interface element, said spring being configured to co-operate with

  - the tooth of the first pawl, when the first pawl is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, such as to:

    o prevent the translation of the interface element from the first to the second position, when the second pawl is made to rotate, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
    o permit the translation of the interface element from the first to the second position when the second pawl is rotated, in the first direction, from the rest position to the first position of functioning with a mechanical moment above said threshold; and/or

  - the tooth of the second pawl, when the second pawl is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to:

    o prevent the translation of the interface element from the first to the second position, when the first pawl is rotated in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
    o permit the translation of the interface element from the first to the second position when the first pawl is rotated, in the first direction, from the rest position to the first position of functioning with a mechanical moment above said threshold.

[0005] When a user wants to open the door, by means of the first or the second handle they can rotate the first pawl or the second pawl respectively in a first direction, making them move from the rest position to a first position of functioning, wherein the tooth of that which, of the two pawls, has been made to rotate, comes into contact with the interface element causing the interface element to translate from its first position to its second position. The translation of the interface element in turn causes the latch to retract inside the case, i.e. the translation of the latch from the closure position to the opening position.

[0006] As far as the "privacy" function is concerned, when a user wishes to block the opening of the lock, to another user who may be on the other side of the door, again by means of the first or the second handle, the user can rotate the first or the second pawl, respectively, in a second direction opposite to said first direction, so as to pass from the rest position to a second position of functioning, wherein the tooth of the one which, of the two pawls, has been made to rotate in the second direction, comes into contact with the ribbon spring connected to the interface element. In this way, if a user, who is on the other side of the door, tries to open the lock by rotating the other of the two pawls in the first direction, from the rest position to the first position of functioning, they fail in their intent, because the translation of the interface element from the first to the second position and, therefore, the retraction of the latch is prevented by the second pawl which is in the second position of functioning.

[0007] As far as the "emergency" function is concerned, the user who manoeuvres the handle on the other side of the door with respect to the one where the user is who has enabled the block, can unblock the lock by applying a greater force so that the tooth of the pawl controlled by the handle on the other side of the door pushes the interface element up to the point where it translates the interface element from its first to its second position and, then, opening the lock. In this way, in the event of danger, the block can be unblocked quickly and easily, ensuring maximum safety also for those users who, due to age or disability, may not be able to unblock the block themselves.

[0008] Thanks to the particular mechanism provided, which provides for the co-operation of the three elements, spring, interface element and pawl, the blocking function, or "privacy" function, and the releasing function, or "emergency" function, are exercised by means of the same handle with which the normal opening of the lock is performed. Blocking and releasing the lock, therefore, become possible without any element protruding from the lock case other than the handle itself, improving the safety and the aesthetics of the whole. If, then, flat handles are fitted on the lock of the present invention, such as those described by way of an example here below in the present description, the complete coplanarity of the lock with the door is guaranteed. The simple use of flat handles in traditional locks would not allow this coplanarity to be obtained, due to the presence of keys or in general of protruding "privacy" elements. Only the combination of flat handles with the lock of the present invention allows this feature to be obtained, which is useful and aesthetically pleasing at the same time.

[0009] A third object that the present invention proposes to achieve is, therefore, the perfect coplanarity of the lock plus handle with the door.

[0010] The possibility of using a lock plus handle assembly perfectly coplanar with the door makes it easier to mount the lock on very thin doors, such as, for example,

those made in glass, in that it eliminates the need to make the so-called "shims" (i.e. increases in the thickness of the door) at the lock. These shims are, instead, necessary in the case of traditional locks, due to the greater thickness of the latter with respect to what a glass internal door normally has. With traditional locks, therefore, the designer of frames must always foresee that there is enough space inside the door to accommodate the lock.

[0011] A fourth object of the present invention is, therefore, to obtain greater design freedom for the manufacturer of frames, as regards shapes and thickness of the doors.

[0012] Even in wooden doors, with traditional locks, it is in any case necessary to form an adequate space in the wing of the door, removing, consequently, a not inconsiderable amount of material. This weakens the actual structure of the door and makes longer and more complex assembly operations necessary.

[0013] A fifth object of the present invention is, therefore, to allow easier and faster assembly of locks.

[0014] Finally, the lock of the present invention can also be made either by means of mechanical components alone, or by means of magnetic components. In particular, the latch of the lock described here can be either a traditional slide latch or, a latch connected to a rocker arm which, in turn, co-operates with a magnet also mounted in the lock. This magnet co-operates with a magnet having a magnetic polarization which is opposite with respect to a magnet contained in the staple mounted in the door jamb. As the door approaches the door jamb, the magnet mounted in the lock is repelled by the magnet mounted in the staple towards the inside of the lock and the rocker arm performs a rotation which, in turn, causes the passage of the latch from the opening position to the closure position.

[0015] In this way, the lock of the present invention makes it possible to achieve a fourth object which is to obtain all the advantages described above together with the fluidity and robustness typical of magnetic locks. Furthermore, the special feature of basing the closure mechanism not on the attraction of two magnets as, instead, occurs in the magnetic locks of the state of the art (utility model application no. 202007901498200 and patent applications nos. 102009901700267, 102006901431400, 102003901154929 and 102001900943841), allows exploiting of the advantages of fluidity linked to magnetism not only for the movement of the latch but also for the activation of other mechanisms that can be connected thereto such as, for example, anti-seismic systems, such as those provided for in patent application no. 102016000103226.

[0016] This and further objects of the present invention will be made clearer by the reading of the following detailed description of some preferred embodiments of the present invention, to be understood as a non-limiting example of the more general concepts claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The following description refers to the accompanying drawings, in which:

- Figure 1 is a blown-up view of a first embodiment of a lock according to the present invention;
- Figure 2 is a blown-up view of a lock assembly comprising a second embodiment of a lock according to the present invention and a counter-plate;
- Figure 3a is a frontal view of a first embodiment of the lock of the present invention without cover plate, in the closure configuration;
- Figure 3b is a frontal view of a first embodiment of the lock of the present invention without cover plate, in the opening configuration;
- Figure 4 is a frontal view of a first embodiment of the lock of the present invention without cover plate, during the opening of said lock by handle;
- Figure 5a is a frontal view of a first embodiment of the lock of the present invention without cover plate, in the blocking configuration;
- Figure 5b is a frontal view of a first embodiment of the lock of the present invention without cover plate, during the forcing of the block;
- Figure 6a is a frontal view of the assembly comprising the counter-plate and a second embodiment of the lock of the present invention without cover plate and in the opening configuration;
- Figure 6b is a frontal view of the assembly comprising the counter-plate and a second embodiment of the lock of the present invention without cover plate and in the opening configuration;
- Figure 7 is a frontal view comprising the counter-plate and a second embodiment of the lock of the present invention without cover plate and during the opening of said lock by means of a handle;
- Figure 8a is a frontal view of the assembly comprising the counter-plate and a second embodiment of the lock of the present invention without cover plate and in the blocking configuration;
- Figure 8b is a frontal view of the assembly comprising the counter-plate and a second embodiment of the lock of the present invention without cover plate and during the forcing of the block;
- Figure 9a is a detail of a first embodiment of the lock of the present invention, relative to the interface element;
- Figure 9b is a detail of a second embodiment of the lock of the present invention, relative to the interface element;
- Figure 10a is a sectioned view of a flat rotary type handle which can be mounted on the lock of the present invention; and
- Figure 10b is a detail of a sectioned view of a flat rotary type handle which can be mounted on the lock of the present invention, said detail corresponding to the area comprised in the dotted rectangle of Fig-

ure 10a.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring to Figures 1, 3a, 3b, 4, 5a, 5b and 9a, a first embodiment of the lock (100) of the present invention comprises:

- a case (110);
- a front (108) provided with at least one hole (109);
- a first pawl (105) provided with at least one tooth (105') and a protuberance (105"), said first pawl (105) being configured to be rotated by means of a first handle;
- a second pawl (106) provided with at least one tooth (106') and a protuberance (106"), said second pawl (106) being configured to be rotated by means of a second handle and said second pawl (106) being able to rotate independently from said first pawl (105);
- a slide latch (107) configured to traverse the hole (109) of the front (108), performing a translation from an opening position wherein said latch (107) is retracted inside the case (110) to a closure position wherein said latch (107) has exited outside the case (110) and vice versa; and
- an interface element (111) configured to co-operate with the latch (107), with the tooth (105') of the first pawl (105) and with the tooth (106') of the second pawl (106) in such a way that when the first pawl (105), or the second pawl (106), are made to rotate in a first direction, from a rest position to a first position of functioning, said interface element (111) performs a translation from a first position to a second position, the translation of the interface element (111) causing, in turn, the translation of the latch (107) from the closure position to the opening position.

[0019] The case (110) can comprise a base (150) and a cover plate (151). The base (150) can be delimited by at least one bottom surface (140) preferably parallel to the front (108) of the lock (100) and by two surfaces (141, 142) parallel one to the other and perpendicular to the bottom surface (140). The case (110) can also be formed integrally with the front (108). The base (150) is a plate consisting of a full solid provided with a recess (110') shaped in such a way as to accommodate in its interior the latch (107), the interface element (111), the first pawl (105) and the second pawl (106) and to allow the translation of the latch (107), the interface element (111) and the rotation of the first pawl (105) and the second pawl (106). The interface element (111) is preferably equipped with a central body (132), with a first tooth (130), or front tooth, which protrudes from said central body (132), said first tooth (130) being placed between the front (108) of the lock (100) and the central body (132) of the interface element (111), and with a second tooth (131), or rear tooth, that protrudes from said central body (132), said second tooth (131) being placed between the central body (132) of the interface element (111) and the bottom surface (140). The interface element (111) is translatable from a first position wherein only the front tooth (130) abuts on the profile of the recess (110') to a second position wherein only the rear tooth (131) abuts on the profile of the recess (110'). The interface element (111) is then equipped with a third tooth (133), or central tooth, placed between the first tooth (130) and the second tooth (131), and with a fourth tooth (134) placed between the first tooth (130) and the third tooth (133). As will be explained in greater detail here below, the third tooth (133) is configured to co-operate with the tooth (105') of the first pawl (105) and with the tooth (106') of the second pawl (106), to make the lock (100) move from the closure position to the opening position, when the first pawl (105) or the second pawl (106) is turned by handle. The fourth tooth (134) is configured to co-operate with the latch (107) in such a way that when the interface element (111) moves from its first position to its second position, its fourth tooth (134) drags the latch (107) inside the case (110) of the lock (100), making it move from the closure position to the opening position, thus causing the opening of the same lock (100).

[0020] Referring to Figures 3a, 3b and 9a, when the lock (100) is in its rest configuration, or closure configuration, the latch (107) has exited outside the case (110), the interface element (111) is in its first position and both the first pawl (105) and the second pawl (106) are in a rest configuration.

[0021] In this situation, the spontaneous rotation of the first pawl (105) is prevented by a first spring (113) configured to co-operate with the protuberance (105") of said first pawl (105). Thanks to the presence of this first spring (113), maintaining of the first pawl (105) in its rest configuration is therefore guaranteed. Similarly, the spontaneous rotation of the second pawl (106) is prevented by a second spring (114) configured to co-operate with the protuberance (106") of said second pawl (106), guaranteeing the maintaining of the second pawl (106) in its rest configuration. Both the first spring (113) and the second spring (114) are, preferably, ribbon springs. The spontaneous translation of the interface element (111) from the first to the second position is prevented by a pair of permanent magnets (117, 118) consisting of a first magnet (117) mounted in the case (110) and a second magnet (118) mounted on the interface element (111), said first (117) and second (118) magnet having the same magnetic polarization and being aligned to the direction of translation of the interface element (111). The same function performed by the pair of magnets (117, 118) which hold the interface element (111) immobile in its first position can, alternatively, be performed by a spring, not shown in the drawings, which restrains the front tooth (130) of the interface element (111) abutting on the profile of the recess (110') of the case (110). The translation of the latch (107) from the closure position to the opening

position is also prevented by a pair of permanent magnets (115, 116) consisting of a first magnet (115) mounted in the case (110) and a second magnet (116) mounted in the latch (107), said first (115) and second (116) magnet having the same magnetic polarization and being aligned to the direction of translation of the latch (107). In this case too, the function performed by the pair of permanent magnets (115, 116) which hold the latch (107) immobile in the rest position can be performed by a spring.

[0022] When the door on which the lock (100) is mounted is brought closer to the jamb, the latch (107), at contact with the jamb, is pushed into the case (110) to then exit again, returning to its rest or closure position, when the door is aligned with the jamb. The latch (107) thus entering the housing provided, which is normally provided for accommodating the latch (107) in common staples or counter-plates.

[0023] Referring to Figures 4 and 9a, when a user wants to open the door, by means of a first handle, they can rotate the first pawl (105) in a first direction (clockwise for an observer of Figure 4) making it move from the rest position to a first position of functioning wherein the tooth (105') of said first pawl (105) comes into contact with the central tooth (133) of the interface element (111). The force exerted by the tooth (105') of the first pawl (105) on the central tooth (133) of the interface element (111) causes the translation of the interface element from its first position to its second position. The translation of the interface element (111), thanks to the interaction of the fourth tooth (134) of the interface element (111) with the latch (107), causes, in turn, the slide latch (107) to retract inside the case (110), i.e. the translation of the latch (107) from the closure position to the opening position.

[0024] The opening of the lock (100), or rather the transition from the closing to the opening configuration, can also be performed with the second handle, i.e. with the rotation of the second pawl (106) in a manner wholly similar to what has already been described for the first pawl (106). In this case, therefore, when the user rotates the second pawl (106) by means of the second handle, the tooth (106') of the second pawl (106) comes into contact with the central tooth (133) of the interface element (111) and causes the translation of the latter from its first to its second position, thus causing the latch (107) to retract into the case (110) and, therefore, the opening of the lock (100).

[0025] Referring to Figures 5a, 5b and 9a, the first embodiment of the lock (100) of the present invention also comprises a spring (112) connected to the interface element (111). Said spring (112) is also preferably a ribbon spring (112) and is configured to co-operate with the tooth (105') of the first pawl (105), and/or with the tooth (106') of the second pawl (106) in order to block the lock (100) in its closure position.

[0026] When the lock (100) is in its closure configuration, the first pawl (105) can be rotated in a second direction (anticlockwise direction for an observer of Figures 5a and 5b), said second direction being opposite said first direction, so as to pass from the rest position to a second position of functioning, in which the tooth (105') of the first pawl (105) comes into contact with the ribbon spring (112) connected to the interface element (111). In this way, the lock (100) enters a blocking configuration, since if a user, who were to be found on the other side of the door on which the lock (100) is mounted (i.e. the user who manoeuvres the second handle), were to try to open the lock (100) by rotating the second pawl (106), in the first direction, from the rest position to the first position of functioning, they would not succeed in their intent because the translation of the interface element (111) from the first to the second position, and therefore the retracting of the latch (107), are prevented. However, the user who manoeuvres the second handle and thus the second pawl (106) can unblock the lock (100) by applying a greater force so that the tooth (106') of the second pawl pushes the central tooth (133) of the interface element (111) to the extent of making the interface element (111) translate from its first to its second position. The translation of the interface element (111) then, thanks to the interaction of the tooth (134) of the interface element (111) with the latch (107), causes the translation of the latch (107) itself and, therefore, the opening of the lock (100). In other words, the spring (112) connected with the interface element is configured to co-operate with the tooth (105') of the first pawl (105), when the first pawl (105) is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to:

- prevent the translation of the interface element (111) from the first to the second position, when the second pawl (106) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
- allow the translation of the interface element (111) from the first to the second position when the second pawl (106) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment above said threshold.

[0027] In a wholly similar manner, the second pawl (106) can optionally also be used to make the lock (100) enter the blocking configuration.

[0028] When the lock (100) is in its closure configuration, in fact, the second pawl (106) can be rotated in a second direction (anticlockwise direction for an observer of Figures 5a and 5b), said second direction being opposite to said first direction, so as to pass from the rest position to a second position of functioning, in which the tooth (106') of the second pawl (106) comes into contact with the ribbon spring (112) connected to the interface element (111). In this way, the lock (100) enters a blocking configuration, because if a user were to try to open the lock (100) by rotating the first pawl (105), in the first direction, from the rest position to the first position of functioning, they would not succeed in their intent because

the translation of the interface element (111) from the first to the second position, and therefore the retracting of the latch (107), are prevented. The user who manoeuvres the first handle and, therefore, the first pawl (105) can, however, unblock the lock (100) by applying greater force so that the tooth (105') of the first pawl pushes the central tooth (133) of the interface element (111) to the extent where it makes the interface element (111) translate from its first to its second position. The translation of the interface element (111) then causes, thanks to the interaction of the tooth (134) of the interface element (111) with the latch (107), the translation of the latch (107) itself, and, therefore, the opening of the lock (100). Summing up, the spring (112) connected with the interface element is configured to co-operate with the tooth (106') of the second pawl (106), when the second pawl (106) is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to:

- prevent the translation of the interface element (111) from the first to the second position, when the first pawl (105) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
- allow the translation of the interface element (111) from the first to the second position, when the first pawl (105) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment above said threshold.

[0029] Referring to Figures 2, 6a, 6b, 7, 8a, 8b and 9b, a second embodiment of the lock (200) of the present invention comprises:

- a case (210);
- a front (208) provided with at least one hole (209);
- a first pawl (205) provided with at least one tooth (205') and a protuberance (205"), said first pawl (205) being configured in order to be rotated by means of a first handle;
- a second pawl (206) provided with at least one tooth (206') and a protuberance (206"), said second pawl (206) being configured in order to be rotated by a second handle and said second pawl (206) being able to rotate independently from said first pawl (205);
- a latch (207) configured in order to traverse the hole (209) of the front (208), performing a translation from an opening position wherein said latch (207) is retracted inside the case (210) to a closure position wherein said latch (207) has exited outside the case (210), and vice versa;
- an interface element (211) configured in order to co-operate with the latch (207), with the tooth (205') of the first pawl (205) and with the tooth (206') of the second pawl (206) in such a way that, when the first pawl (205), or the second pawl (206), are rotated in a first direction, from a rest position to a first position of functioning, said interface element (211) performs a translation from a first position to a second position, the translation of the interface element (211) causing, in turn, the translation of the latch (207) from the closure position to the opening position;
- a magnet (219) being aligned to the direction of translation of the latch (207); and
- a rocker arm (220) configured to co-operate with said magnet (219) and with the latch (207).

[0030] As in the first embodiment, also in the second embodiment the case (210) can be formed integrally with the front (208) and comprises a cover plate (251) and a base (250). The latter is a plate consisting of a full solid provided with a recess (210') shaped in such a way as to accommodate in its interior the latch (207), the magnet (219), the rocker arm (220), the interface element (211), the first pawl (205) and the second pawl (206). Said recess (210') is also shaped in such a way as to allow the translation of the latch (207), of the interface element (211) and of the magnet (219), as well as the rotation of the first pawl (205), of the second pawl (206) and of the rocker arm (220). Also in the second embodiment, the interface element (211) is provided with a central body (232), with a first tooth (230), or front tooth, a second tooth (231), or rear tooth and with a third tooth (233), or central tooth, placed between the first tooth (230) and the second tooth (231) and a fourth tooth (234) placed between the first tooth (230) and the second tooth (231). The interface element (211) can be translated from a first position wherein the front tooth (230) abuts on the profile of the recess (210') to a second position wherein the rear tooth (231) abuts on the profile of the recess (210'). The third tooth (233) is then configured to co-operate with the tooth (205') of the first pawl (205) and with the tooth (206') of the second pawl (206), when the latter are rotated by means of a handle to move the lock (200) from the closure to the opening position. The fourth tooth (234) is configured to co-operate with the latch (207) in such a way that, when the interface element (211) moves from its first position to its second position, its fourth tooth (234) drags the latch (207) inside the case (210) of the lock (200), making it move from the closure to the opening position, thus causing the lock (200) itself to open. Referring to Figures 6a, 6b and 9b, when the lock (200) is in its rest configuration, or opening configuration, the latch (207) is retracted inside the case (210), the interface element (211) is in the first position, and both the first pawl (205) and the second pawl (206) are in a rest configuration.

[0031] The spontaneous rotation of the first pawl (205) is prevented by a first ribbon spring (213) configured to co-operate with the protuberance (205") of said first pawl (205), ensuring the maintaining of the first pawl (205) in its rest configuration. Similarly, the spontaneous rotation of the second pawl (206) is prevented by a second ribbon spring (214) configured to co-operate with the protuberance (206") of said second pawl (206), ensuring the main-

taining of the second pawl (206) in its rest configuration. The spontaneous translation of the interface element (211) from the first to the second position is prevented by a pair of permanent magnets (217, 218) consisting of a first magnet (217) mounted in the case (210) and a second magnet (218) mounted on the interface element (211), said first (217) and second (218) magnet having opposite magnetic polarization and being aligned to the direction of translation of the interface element (211). The same function performed by the pair of magnets (217, 218) which hold the interface element (211) immobile in its first position can, alternatively, be performed by a spring, not shown in the drawings, which holds the rear tooth (231) of the interface element (211) away from the profile of the recess (210'). The translation of the latch (207) from the opening position to the closure position is prevented by a pair of permanent magnets (215, 216) consisting of a first magnet (215) mounted in the case (210) and a second magnet (216) mounted in the latch (207), said first (215) and second (116) magnet having opposite magnetic polarization and being aligned to the direction of translation of the latch (207). In this case too, the function performed by the pair of permanent magnets (215, 216) which holds the latch (207) immobile in the rest position can be performed by a spring.

[0032] In order to be able to function, the second embodiment of the lock (200) of the present invention must be coupled to a counter-plate (300) comprising a permanent magnet (301), or an electromagnet, having opposite magnetic polarization with respect to that of the magnet (219) of the lock (200).

[0033] When the door on which the lock (200) is mounted is brought closer to the jamb, the front (208) of the lock (200) and the front of the counter-plate, or staple, (300) are aligned and the magnet (219) mounted in the lock (200) is thus repelled by the magnet (301) mounted in the staple. This repulsion causes the translation of the magnet (219) mounted in the lock (200) towards the interior of the case (210), and, that is to say, the moving away of the magnet (219) mounted on the lock (200) from the front (208). As mentioned above, the recess (210') of the case (210) is shaped in such a way as to allow this translation. The rocker arm (220) is configured to co-operate with the magnet (219) mounted in the lock (200) in such a way that, when said magnet (219) translates inside the case (210), moving away from the front (208), the rocker arm (220) performs a rotation, the rotation of the rocker arm (220) causing, in turn, the move of the latch (207) from the opening position to the closure position. The retracting of the magnet (219) mounted in the lock (200) therefore makes the rocker arm (220) rotate in anticlockwise direction for the observer of Figures 6a and 6b and, by rotating, pushes the latch (207) towards the exterior of the case (210), causing the lock (200) to close. The magnet (219) mounted in the lock (200) can be either a permanent magnet or an electromagnet.

[0034] Referring to Figures 7 and 9b, the opening of the lock (200) in its second embodiment can be performed by a user using a handle connected to the first (205) or to the second pawl (206) as already described above in relation to the first embodiment of the present invention. When a user wants to open the door, by means of a handle, they can rotate the first pawl (205), or the second pawl (206), in a first direction (clockwise for an observer of Figure 7), making them move from the rest position to a first position of functioning wherein their tooth (205', 206') comes into contact with the central tooth (233) of the interface element (211). The force exerted by the tooth (205') of the first pawl (205), or the tooth (206') of the second pawl (206), on the central tooth (233) of the interface element (211), causes the translation of the interface element from its first position to its second position. The translation of the interface element (211), thanks to the interaction of the fourth tooth (234) of the interface element (211) with the latch (207), causes, in turn, the retracting of the latch (207) inside the case (207) with the consequent opening of the lock (200).

[0035] Referring to Figures 8a, 8b and 9b, the second embodiment of the lock (200) of the present invention also comprises a ribbon spring (212) connected with the interface element (211) which exercises the function of blocking of the lock (200), together with the pawls (205, 206), said ribbon spring (212) being able to co-operate with the teeth (205', 206') of the pawls (205, 206) in order to block the lock (200) in its closure position. When the lock (200) is in its closure configuration, in fact, the first pawl (205) can be rotated in a second direction (anticlockwise direction for an observer of Figures 8a and 8b), said second direction being opposite to said first direction, so as to move from the rest position to a second position of functioning, wherein the tooth (205') of the first pawl (205) comes into contact with the ribbon spring (212) connected with the interface element (211). In this way, the lock (200) enters a blocking configuration, since if a user, on the other side of the door on which the lock (200) is mounted (i.e. the user who manoeuvres the second handle), were to try to open the lock (200) by rotating the second pawl (206), in the first direction, from the rest position to the first position of functioning, they would not succeed in their intent, since the translation of the interface element (211) from the first to the second position, and therefore the retracting of the latch (207), are prevented. However, the user who manoeuvres the second handle, and thus the second pawl (206), can unblock the lock (200) by applying a greater force so that the tooth (206') of the second pawl pushes the central tooth (233) of the interface element (211) to the extent of making the interface element (211) translate from its first to its second position. The translation of the interface element (211) then causes, thanks to the interaction of the fourth tooth (234) of the interface element (211) with the latch (207), the opening of the lock (200).

[0036] In other words, the spring (212) connected with the interface element is configured to co-operate with the tooth (205') of the first pawl (205) when the first pawl (205) is rotated in a second direction, said second direc-

tion being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to:

- prevent the translation of the interface element (211) from the first to the second position when the second pawl (206) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
- allow the translation of the interface element (211) from the first to the second position when the second pawl (206) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment above said threshold.

[0037] In a wholly similar manner, the second pawl (206) can optionally also be used to make the lock (200) enter the blocking configuration. In this case, obviously the releasing by means of the first pawl (205) can take place by applying a greater force so that the tooth (205') of the first pawl (205) pushes the interface element (211) to the extent of making it translate from its first to its second position, thus opening the lock (200).

[0038] The spring (212) connected with the interface element is, therefore, further configured to co-operate with the tooth (206') of the second pawl (206), when the second pawl (206) is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to

- prevent the translation of the interface element (211) from the first to the second position, when the first pawl (205) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
- allow the translation of the interface element (211) from the first to the second position when the first pawl (205) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment above said threshold.

[0039] Referring to Figures 2, 6a, 6b, 7, 8a, 8b and 9b, and, in addition to what is described above, a lock assembly (200, 300) comprising the second embodiment of the present invention (200) and a counter-plate (300) is also the subject of the present invention. The counter-plate (300), in turn, comprises a magnet (301) having opposite magnetic polarization with respect to that of the magnet (219) of the lock (200). This magnet (301) can be a permanent magnet (301) or an electromagnet, configured to co-operate with both a permanent magnet (219) and with an electromagnet mounted in the lock (200). The lock assembly (200, 300) can therefore be implemented in four different embodiments. The first embodiment of the assembly (200, 300) provides for the presence of two permanent magnets (219, 301) of which one (219) in the lock (200) and the other (301) in the counter-plate (300). The second embodiment provides, instead, for the two electromagnets to be mounted, one in the lock (200) and the other in the counter-plate (300). The third and the fourth embodiments then provide for the combination of a permanent magnet (219) in the lock (200) and an electromagnet in the counter-plate (300) and the combination of an electromagnet in the lock (200) and a permanent magnet (301) in the counter-plate (300), respectively.

[0040] Finally, referring to Figures 10a and 10b, on the lock (100, 200) of the present invention it is possible to mount any handle of the state of the art comprising a flat handle, such as, for example, a rotary handle (400). This handle (400) comprises: a fixed handle body, a movable ring or flange (402) and a knob (403). The handle body comprises: a hollow cylindrical solid (404) derived from the difference of two solid cylinders (an inner cylinder and an outer cylinder) and an upper plate (404') in the form of a circular crown whose inner circumference coincides with the outer base circumference of the hollow cylinder (404). The handle body is intended to be mounted in the door and on the lock (100, 200) in such a way that the hollow cylinder (404') is mounted in the thickness of the door and the upper plate (404') abuts on the door surface so as to become flush with it. The movable flange (402) too comprises an upper surface having a shape of a circular crown and is configured to be mounted inside the hollow cylindrical solid (404) of the handle body and to slide inside it. The movable flange (402) is, moreover, connected to the bottom (401) of the handle body by means of two springs (501, 502). The knob (403) is mounted inside the movable flange (402) and screwed to one of the pawls (105, 106, 205, 206). The knob (403) is also provided with an underframe (403') configured to enter in abutment with a tooth (402') in the movable flange (402). When a user wants to open the lock (100, 200), or block it, or unblock it, they must push the movable element (402) towards the door, overcoming the force of the springs (501, 502) and making it retract into the hollow cylinder (404) of the handle body, and then they must rotate the knob (403) and, therefore, the pawl (105, 106, 205, 206) in the desired direction, said direction varying according to whether it is an opening, blocking or releasing operation.

Claims

1. Lock (100, 200) for internal doors comprising:

- a case (110, 210);
- a front (108, 208) provided with at least one hole (109, 209);
- a first pawl (105, 205) provided with at least one tooth (105', 205'), said first pawl (105, 205) being configured to be rotated by means of a first handle;
- a second pawl (106, 206) provided with at least

one tooth (106', 206'), said second pawl (106, 206) being configured to be rotated by means of a second handle and said second pawl (106, 206) being able to rotate independently from said first pawl (105, 205);
- a latch (107, 207) configured to traverse the hole (109, 209) of the front (108, 208), performing a translation from an opening position wherein said latch (107, 207) is retracted inside the case (110, 210) to a closure position wherein said latch (107, 207) has exited outside the case (110, 210) and vice versa; and
- an interface element (111, 211) configured to co-operate with the latch (107, 207), with the tooth (105', 205') of the first pawl (105, 205) and with the tooth (106', 206') of the second pawl (106, 206) in such a way that, when the first pawl (105, 205), or the second pawl (106, 206), are rotated in a first direction, from a rest position to a first position of functioning, said interface element (111, 211) performs a translation from a first position to a second position, the translation of the interface element (111, 211) causing, in turn, the translation of the latch (107, 207) from the closure position to the opening position;

said lock (100, 200) being **characterised in that** it comprises a spring (112, 212) connected to the interface element (111, 211), said spring (112, 212) being configured to co-operate with

- the tooth (105', 205') of the first pawl (105, 205), when the first pawl (105, 205) is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to:

  • prevent the translation of the interface element (111, 211) from the first to the second position, when the second pawl (106, 206) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
  • allow the translation of the interface element (111, 211) from the first to the second position, when the second pawl (106, 206) is rotated, in the first direction, from the rest position to the first position of functioning with a mechanical moment above said threshold; and/or

- the tooth (106', 206') of the second pawl (106, 206), when the second pawl (106, 206) is rotated in a second direction, said second direction being opposite to said first direction, from the rest position to a second position of functioning, in such a way as to:

  • prevent the translation of the interface element (111, 211) from the first to the second position, when the first pawl (106, 206) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment below a threshold; and
  • allow the translation of the interface element (111, 211) from the first to the second position, when the first pawl (105, 205) is rotated, in the first direction, from the rest position to the first position of functioning, with a mechanical moment above said threshold.

2. Lock (100, 200) according to claim 1, wherein the first pawl (105) comprises a protuberance (105", 205') different from the tooth (105', 205') of the first pawl (105, 205) and the second pawl (106, 206) comprises a protuberance (106", 206") different from the tooth (106', 206') of the second pawl (106, 206).

3. Lock (100, 200) according to the preceding claim, wherein said lock (100, 200) comprises: a first spring (113, 213) and a second spring (114, 214), different from the spring (112, 212) connected with the interface element, said first spring (113, 213) being configured to co-operate with the protuberance (105", 205") of the first pawl (105, 205) so as to prevent the spontaneous rotation of the first pawl (105, 205) in the second direction, when said first pawl (105, 205) is in the rest position and said second spring (114, 214) being configured to co-operate with the protuberance (106", 206") of the second pawl (106, 206) in such a way as to prevent the spontaneous rotation of the second pawl (106, 206) in the second direction, when said second pawl (106, 206) is in the rest position.

4. Lock (100, 200) according to any one of the preceding claims, wherein the case (110, 210) comprises a plate consisting of a full solid provided with a recess (110', 210') shaped in such a way as to accommodate in its interior the latch (107, 207), the interface element (111, 211), the first pawl (105, 205) and the second pawl (106, 206) and to allow the translation of the latch (107, 207), of the interface element (111, 211) and the rotation of the first pawl (105, 205) and of the second pawl (106, 206).

5. Lock (100, 200) according to the preceding claim, wherein said recess (110', 210') is shaped in such a way that when the first pawl (105, 205), or the second pawl (106, 206), are in the second position of functioning, their teeth (105', 205', 106', 206') abut against the profile of said recess (110', 210').

6. Lock (100, 200) according to any one of claims 3 to 5, wherein the spring (112, 212) connected to the interface element (111, 211) and/or the first spring (113, 213) and/or the second spring (114, 214) are ribbon springs.

7. Lock (100) according to any one of the preceding claims, wherein the latch (107) is a slide latch.

8. Lock (100) according to the preceding claim, wherein the spontaneous translation of the latch (107) from the closure position to the opening position is prevented by a spring or by a pair of permanent magnets (115, 116) consisting of a first magnet (115) mounted in the case (110) and a second magnet (116) mounted in the latch (107), said first (115) and second (116) magnet having the same magnetic polarization and being aligned to the direction of translation of the interface element (111).

9. Lock (200) according to any one of claims 1 to 7, wherein said lock (200) comprises:

- a magnet (219) aligned to the direction of translation of the latch (207
- a rocker arm (220) configured to co-operate with said magnet (219) and with the latch (207), in such a way that, when said magnet (219) translates inside the case (210), moving away from the front (208), said rocker arm (220) performs a rotation, the rotation of the rocker arm (220) causing, in turn, the movement of the latch (207) from the opening position to the closure position.

10. Lock (200) according to the preceding claim, wherein the magnet (219) is a permanent magnet.

11. Lock (200) according to claim 10, wherein the magnet (219) is an electromagnet.

12. Lock (200) according to claim 10 or 11 or 12, wherein the case (210) is a full solid provided with a recess (210') shaped in such a way as to accommodate in its interior the magnet (219) and the rocker arm (220), and in such a way as to allow the translation of the magnet (219) and the rotation of the rocker arm (220).

13. Lock (200) according to any one of claims 9 to 12, wherein the translation of the latch (207) from the opening position to the closure position is prevented by a spring or by a pair of permanent magnets (215, 216) consisting of a first magnet (215) mounted in the case (210) and a second magnet (216) mounted in the latch (207), said first (215) and second (216) magnet having opposite magnetic polarization and being aligned to the direction of translation of the latch (207).

14. Lock (100, 200) according to any one of the preceding claims, wherein the spontaneous translation of the interface element (111, 211) from the first to the second position is prevented by a spring or by a pair of permanent magnets (117, 118, 217, 218) consisting of a first magnet (117, 217) mounted in the case (110, 210) and a second magnet (118, 218) mounted on the interface element (111, 211), said first (117, 217) and second (118, 218) magnet being aligned to the direction of translation of the interface element (111, 211).

15. Lock assembly (200, 300) comprising:

- a lock (200) according to any one of claims 9 to 14; and
- a counter-plate (300) comprising a permanent magnet (301) or an electromagnet having opposite magnetic polarization with respect to that of the magnet (219) of the lock (200).

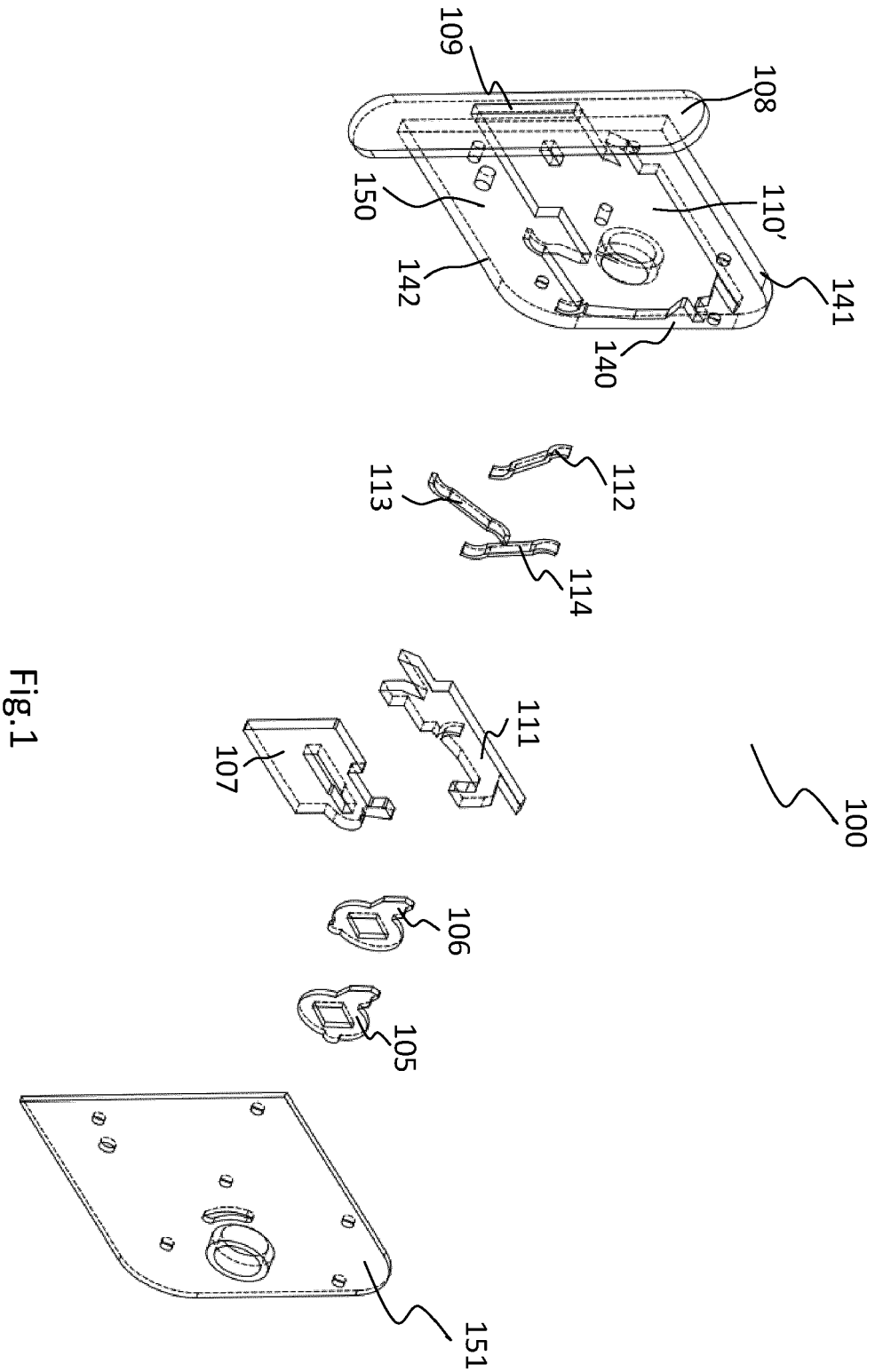
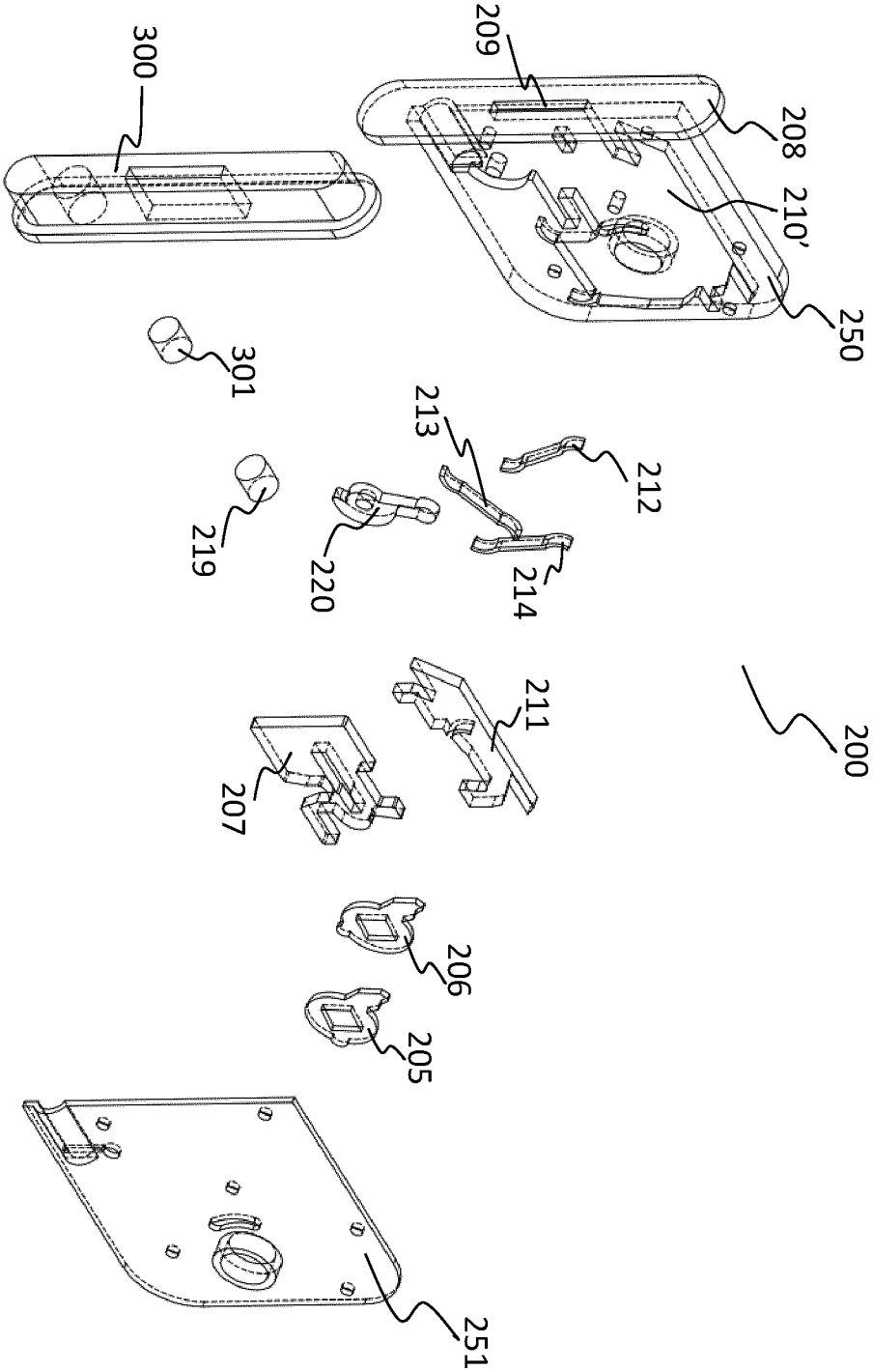


Fig.1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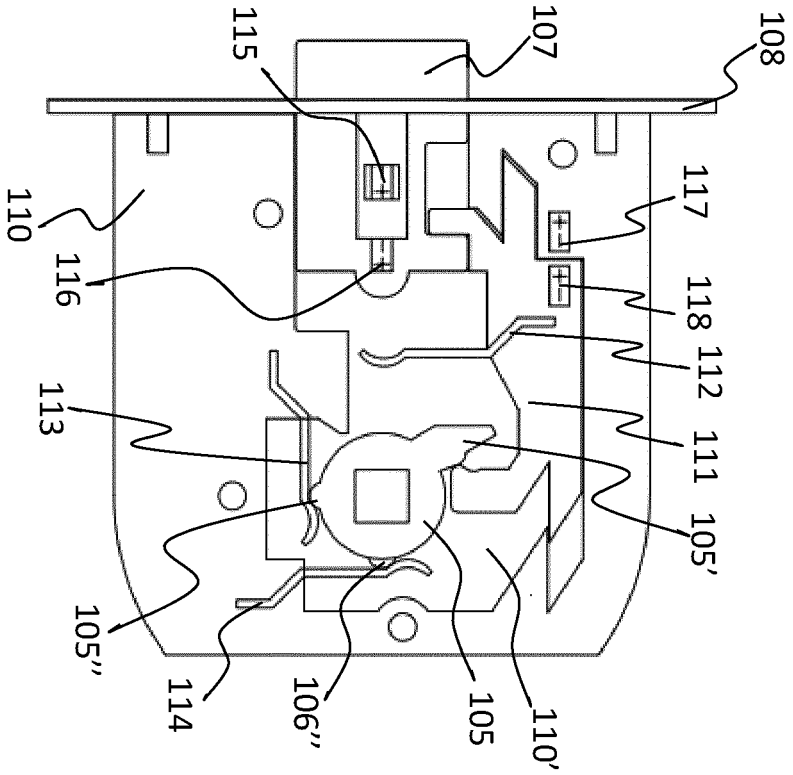
251

Fig.2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110'

Fig.3a

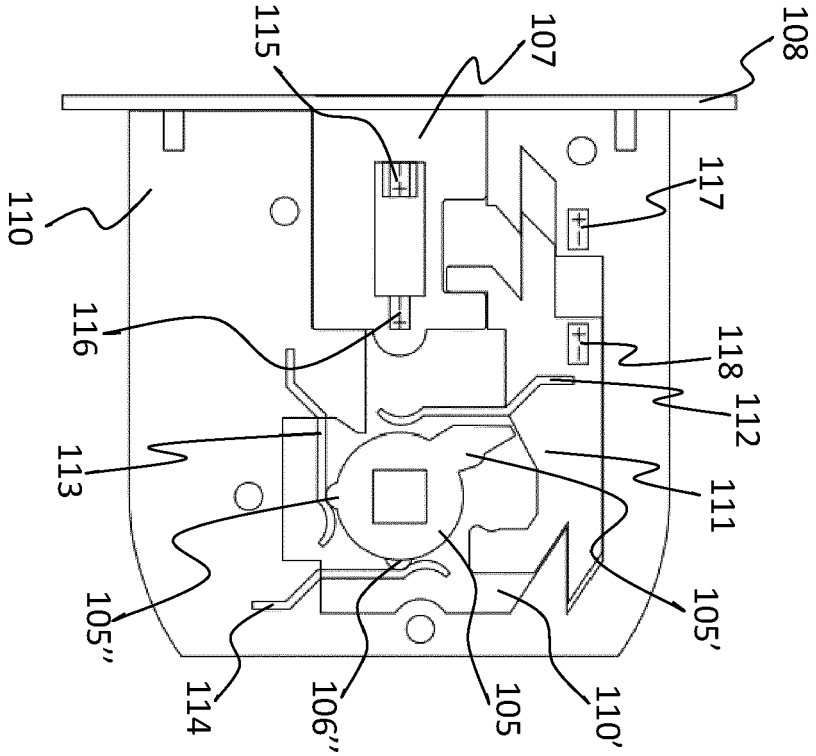
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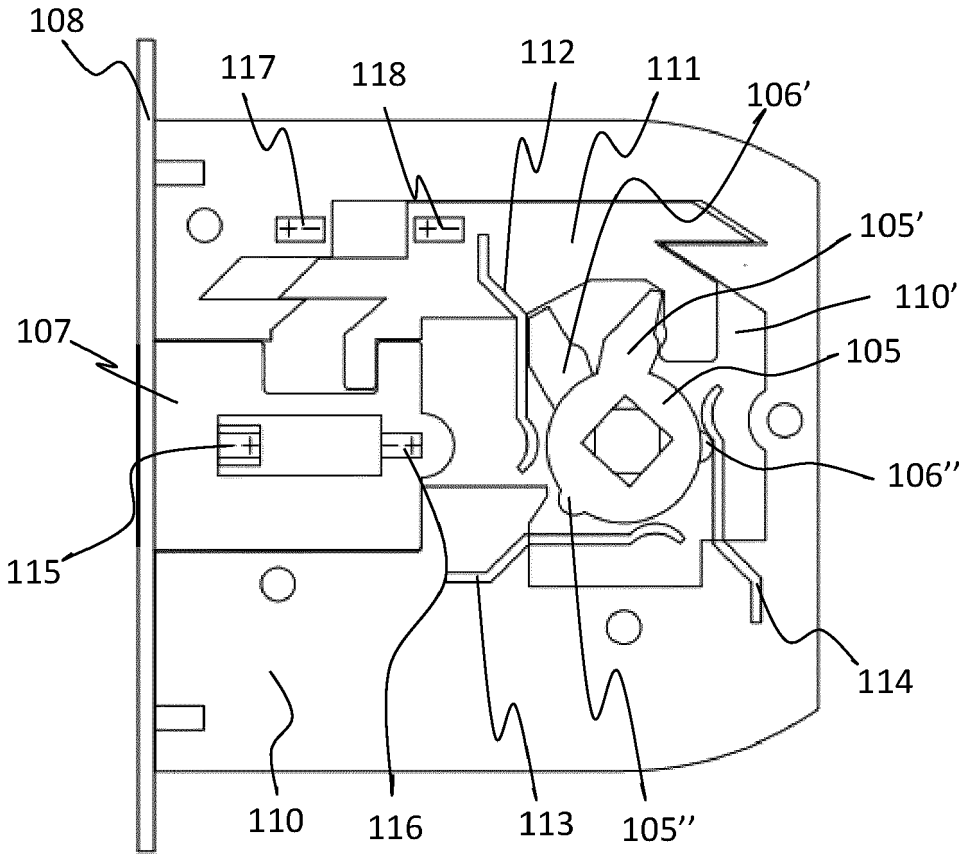
Fig.3b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116
113
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Fig.4

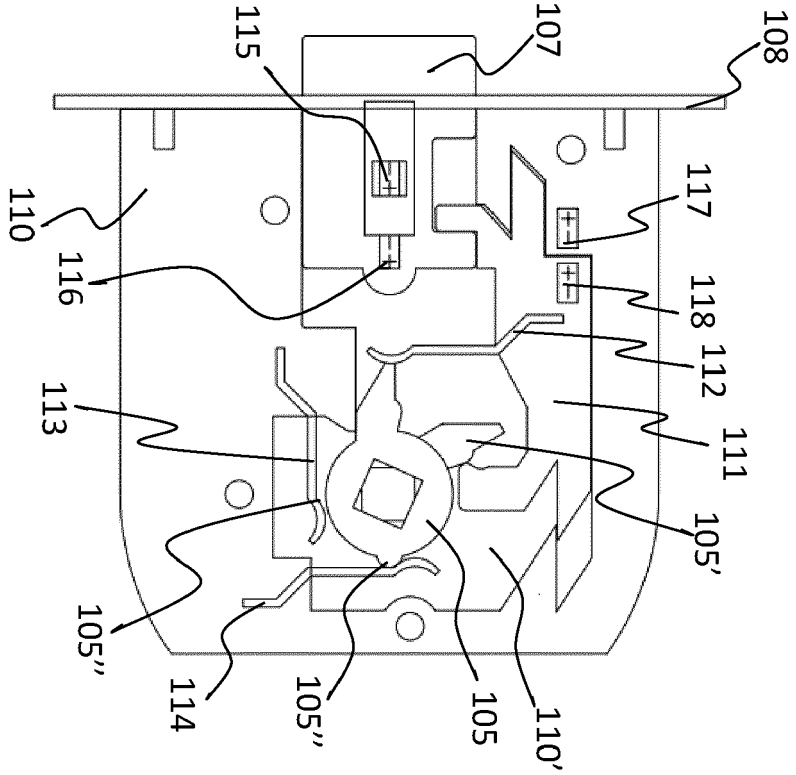
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Fig.5a

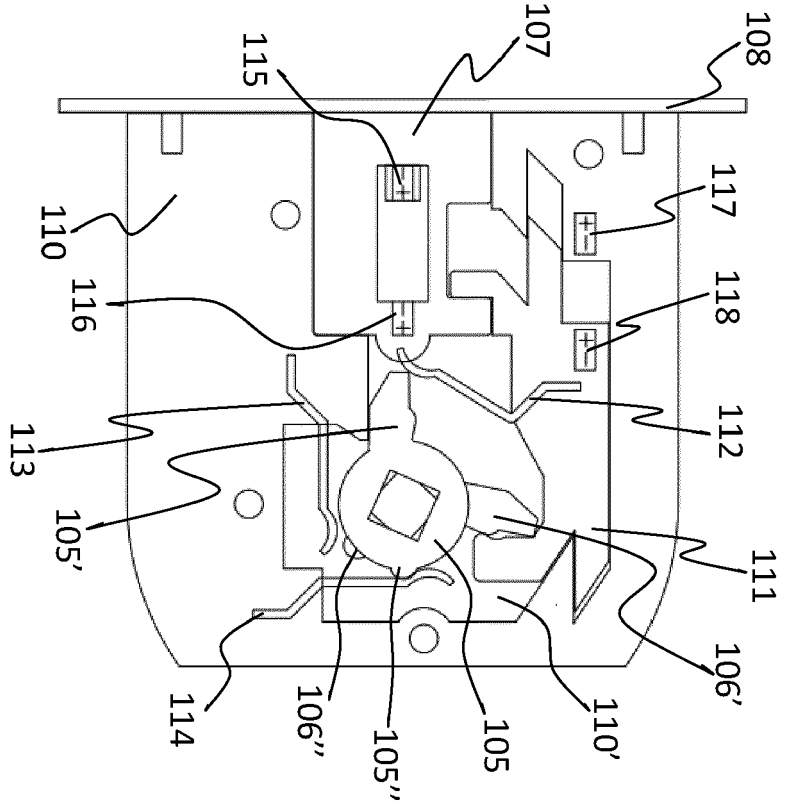
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Fig.5b

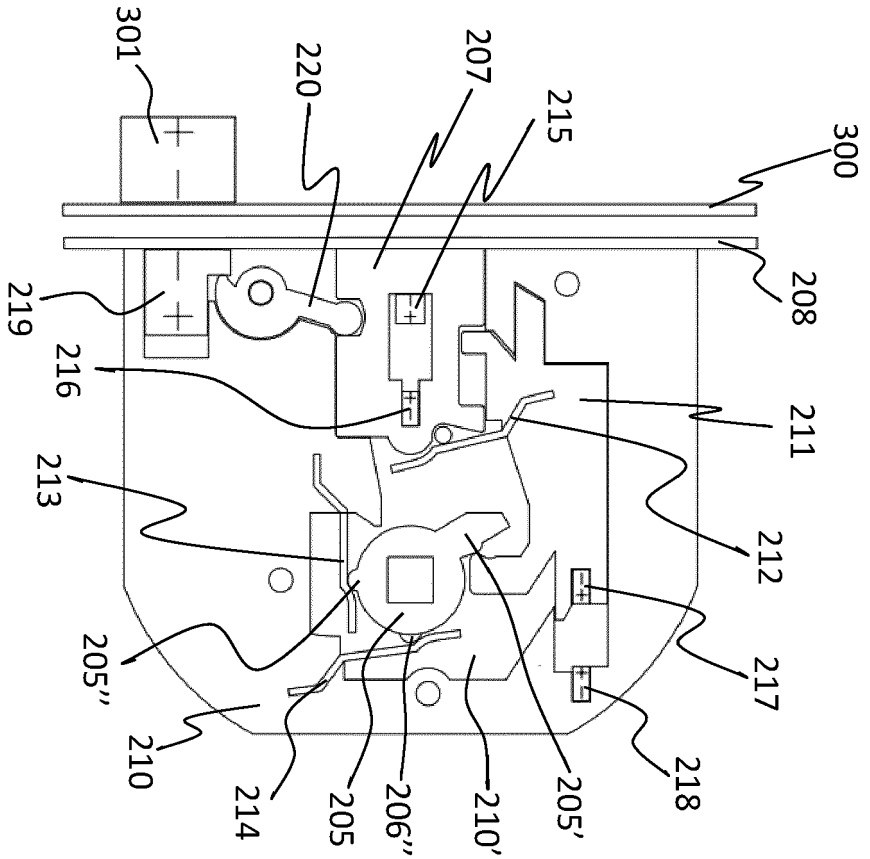
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Fig.6a

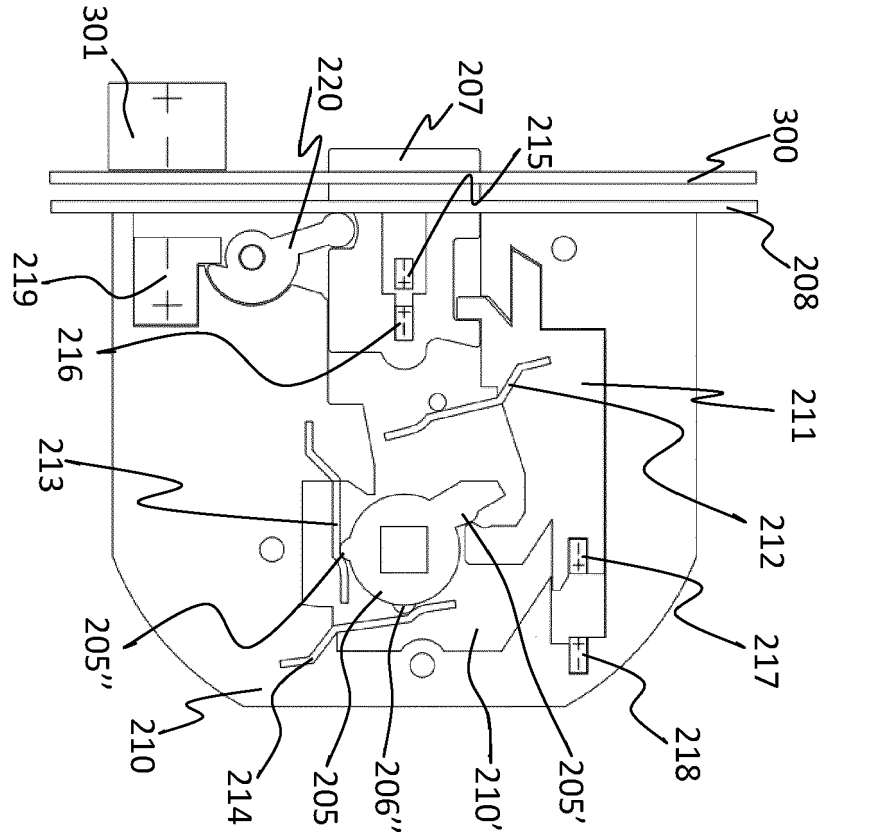
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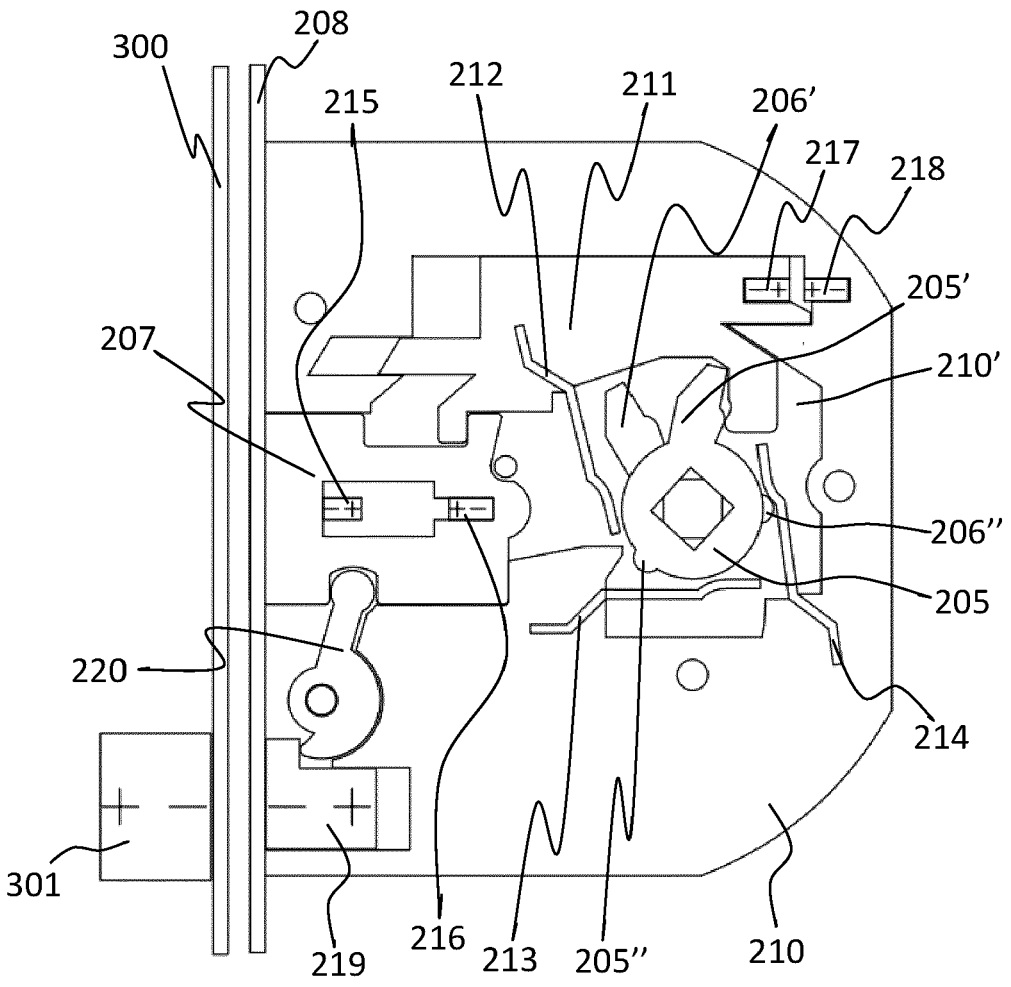
Fig.6b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210

Fig.7

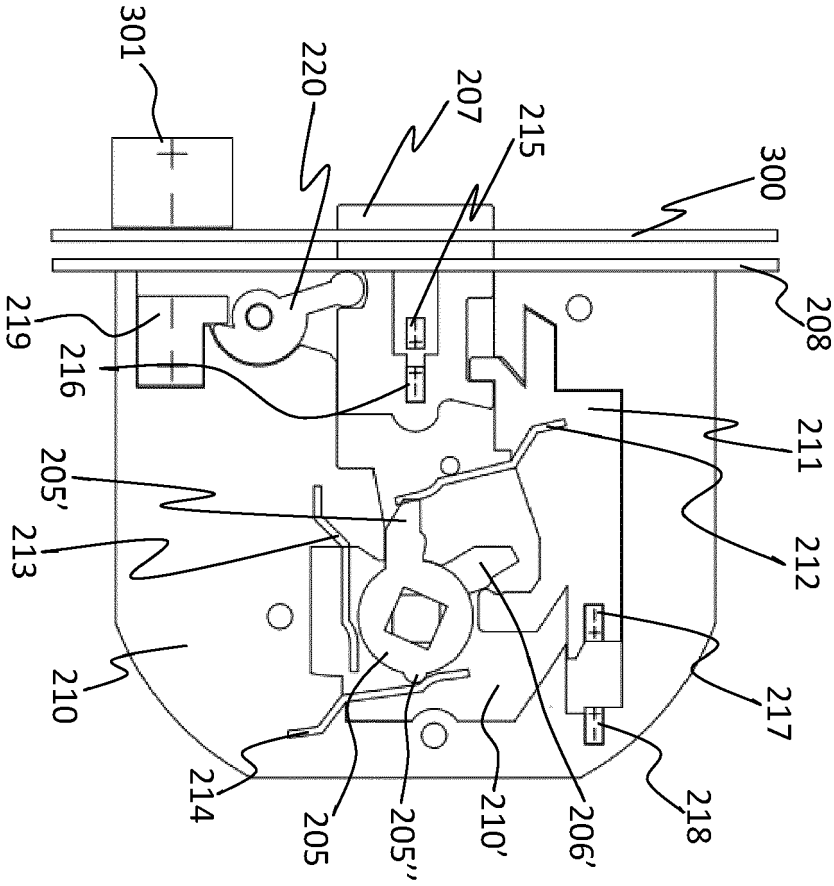
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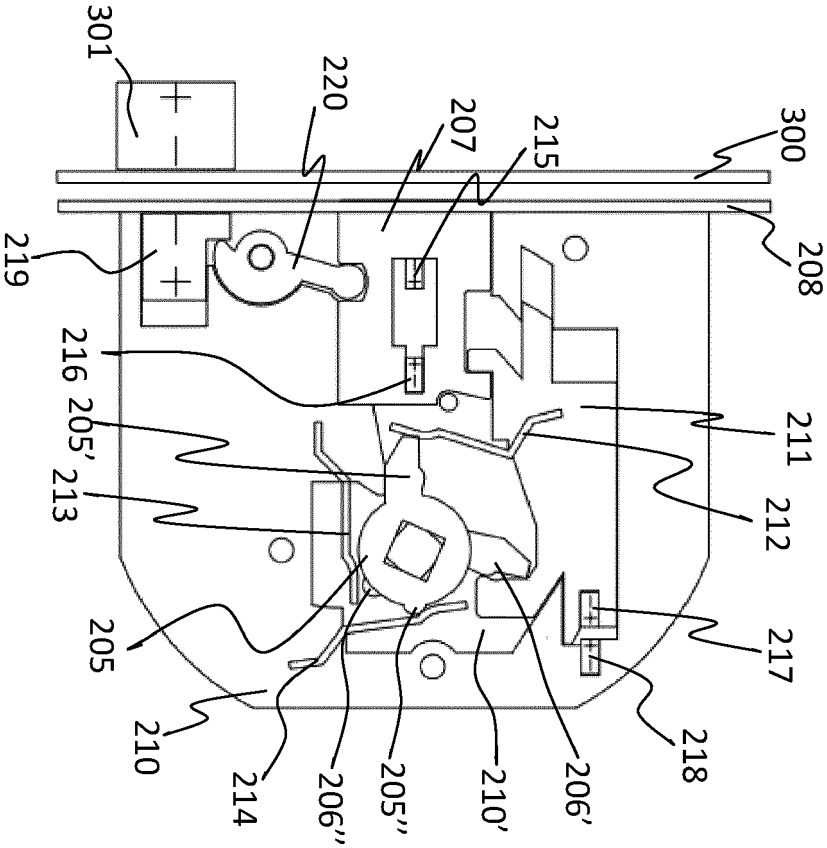
Fig.8a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218

Fig.8b

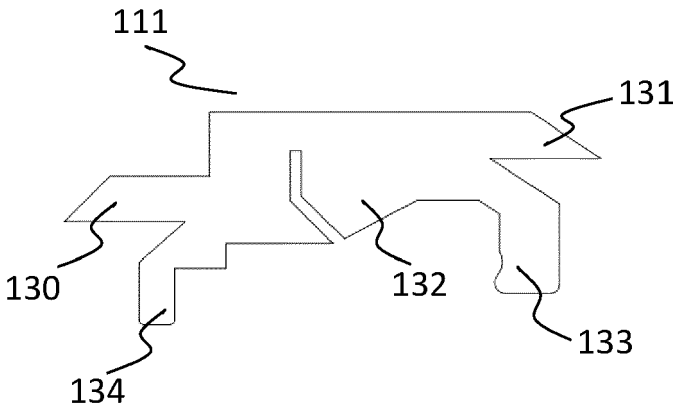

Fig.9a

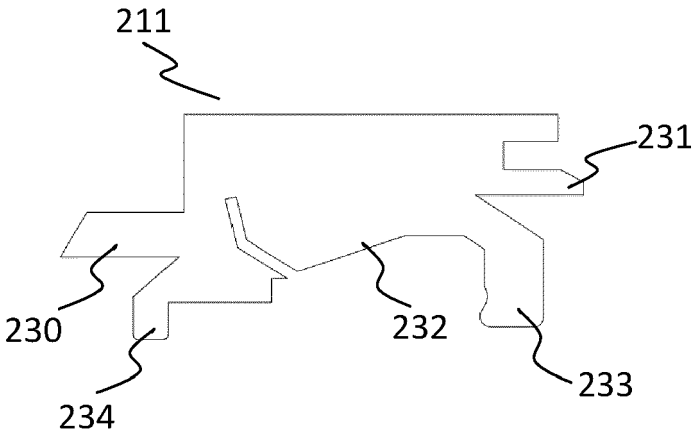

Fig.9b

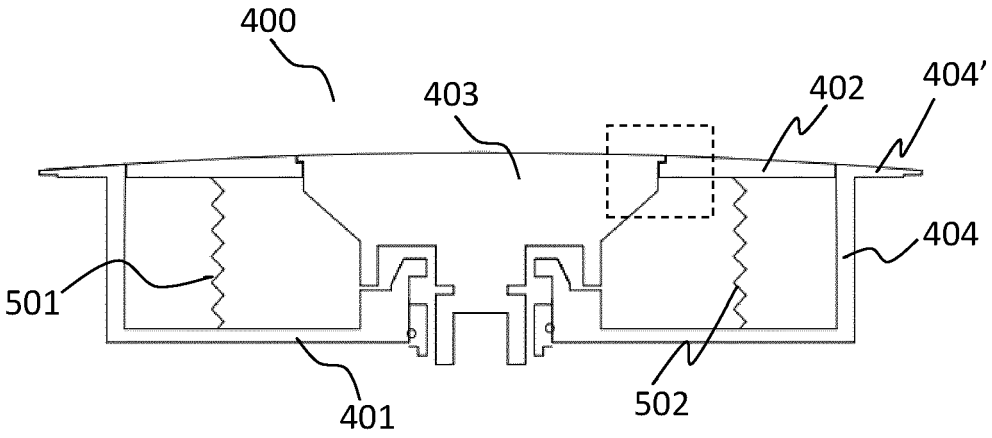

Fig.10a

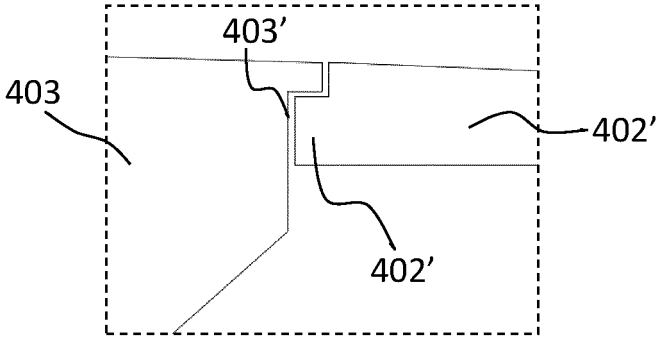

Fig.10b

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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 7343

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 September 2020	Robelin, Fabrice

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