



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.02.2024 Bulletin 2024/09

(21) Application number: **22191811.3**

(22) Date of filing: **23.08.2022**

(51) International Patent Classification (IPC):
E05B 47/02 ^(2006.01) **E05B 63/00** ^(2006.01)
E05B 65/00 ^(2006.01) **E05B 15/16** ^(2006.01)
E05B 17/04 ^(2006.01) **E05B 9/02** ^(2006.01)
E05B 47/00 ^(2006.01)

(52) Cooperative Patent Classification (CPC):
E05B 47/026; E05B 9/02; E05B 15/1614;
E05B 63/0073; E05B 65/0007; E05B 17/04;
E05B 2047/0086; E05B 2047/0087;
E05B 2063/0039

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

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(54) **AN ELECTRICALLY OPERABLE LOCKING DEVICE FOR THE LOCKING OF A GATE WING**

(57) An electrically operable locking device configured for the locking of a gate wing (402), by electrically extending a drop bolt from a base part (300), the locking device comprising:

- a frame arranged for being fixed to the gate wing,
- the base part supported on the frame, wherein the base part is arranged mechanically movable with respect to the frame in a length direction between an extended position, and a retracted position whereby if the drop bolt (302) is extended from the base part, the drop bolt is disengaged from the fixed bolt reception element and the gate wing is released, and
- a shell (100) arranged mechanically movable in the length direction with respect to the base part between an applied position and a removed position, wherein the locking device further comprises a mechanical locking mechanism fixed in the shell and provided for locking the shell to the frame, and wherein the shell and the base part are releasably interconnected by means of a releasable connection member.

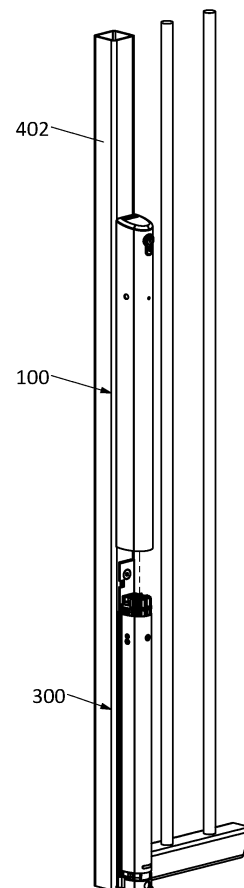


Fig. 8

Description

Technical field

[0001] The present invention relates to electrical locks which are used in entry and exit passages or other access controlled areas. The invention is particularly concerned with the allowance of emergency passage through such exterior entry points under the condition of a power failure.

Background

[0002] Electrically controlled bolt locks are commonly used in many security applications. The flexibility provided by an electric lock assembly allows the opening and closing of the lock to be remotely controlled from a guard station to allow limited access to a facility.

[0003] An important drawback of the electrically operated locking devices is that in case of an error in the activation system of the extended electrically controlled bolt the access through the passage remains blocked. There is thus no emergency opening possibility provided in case of an internal failure or an external power failure. Usually, in case of power failure, the locking device needs to be physically removed from the gate wing it closes off in order to allow entrance, an operation which is time consuming and requires a relatively high skill level and specialised training, which is not necessarily widespread under emergency rescue personnel.

[0004] There is therefore a need for an electric locking device arranged for the remote controlled opening of gate wings, wherein the locking device is easy to access and to be unlocked by emergency services or authorized persons. Such an electric locking device is known from patent publication EP2749720. This patent publication discloses an electrically operable locking device for the locking of a gate wing wherein the locking device is provided for locking the gate wing by electrically extending a drop bolt from a base part, therein referred to as a housing which comprises such a base part, into an extended configuration and engaging the drop bolt with a fixed bolt reception element, and for releasing the gate wing by electrically retracting the drop bolt into the base part into a retracted configuration and disengaging the drop bolt from the fixed bolt reception element, the locking device comprising:

- a frame for fixing the locking device to the gate wing,
- the frame supporting the base part, wherein the base part is at least partly enclosed by a base part sidewall extending in a length direction wherein the sidewall comprises a concave inner surface and a convex outer surface, wherein the base part is arranged mechanically movable with respect to the frame in the length direction between an extended position of the base part, whereby, if the drop bolt is extended from

the base part, the drop bolt is engaging with the fixed bolt reception element and the gate wing is locked, and a retracted position of the base part whereby, if the drop bolt is extended from the base part, the drop bolt is disengaged from the fixed bolt reception element and the gate wing is released, and

- a mechanical locking mechanism provided for locking the base part to the frame in the extended position and with the release of the mechanical locking mechanism allowing the mechanical movement of the base part from the extended position of the base part into the retracted position of the base part, the mechanical locking mechanism comprising a key-operated lock cylinder to lock or unlock the base part to the frame thereby bringing the mechanical locking mechanism in respectively the locked and unlocked configuration.

[0005] A problem with the electrical locking device from the prior art publication EP2749720 is that it is often required to access the inner mechanism of the base part for repairs or maintenance. In the prior art this requires the removal of the base part from the frame, which is a time consuming process. This in particular makes it cumbersome to provide an electrical locking device that is at least partly battery operated wherein the batteries are provided within the base part of the locking device, because the access to the batteries, for example for servicing the batteries, would require the removal of the entire base part from the frame. It is also cumbersome to provide the electrical locking device with a processor within the base part, wherein the access to the processor enables to change settings of the operation of the electrical locking device. An example setting is the speed by which the drop bolt moves between the extended and retracted configurations, or the depth by which the drop bolt extends in the extended configuration.

Description of the invention

[0006] The present invention aims to provide an electrical locking device similar to the electrical locking device of prior art publication EP2749720 wherein the above mentioned disadvantages are overcome.

[0007] To that end, the present invention provides an electrical locking device according to the first claim. The electrically operable locking device is configured for the locking of a gate wing. Preferably, the gate wing controls access through a passage. The locking device is in particular provided for locking the gate wing by electrically extending a drop bolt from a base part into an extended configuration and engaging the drop bolt with a fixed bolt reception element. The locking device is in particular provided for releasing the gate wing by electrically retracting the drop bolt into the base part into a retracted configuration and disengaging the drop bolt from the fixed bolt reception element. The locking device therefore comprises

es a frame, preferably a metallic frame, preferably arranged as a rail, arranged for being fixed to the gate wing. The locking device further comprises the above mentioned base part which is supported on said frame. The base part is arranged mechanically movable with respect to the frame in a length direction between an extended position of the base part, whereby, if the drop bolt is extended from the base part, the drop bolt is engaging with the fixed bolt reception element and the gate wing is locked, and a retracted position of the base part whereby, if the drop bolt is extended from the base part, the drop bolt is disengaged from the fixed bolt reception element and the gate wing is released. Preferably, the frame extends along said length direction such as to enable movement of the base part over said frame in the length direction. Preferably, the drop bolt has a throw length relative to the base part of at least 50 mm, preferably at least 90mm. The base part thus preferably moves along the length direction between the extended position and the retracted position by at least said throw length of the drop bolt. This movement of the base part allows a privileged user such as a rescue worker, to unlock the gate wing mechanically if the need would arise. To that end, the base part must however be enabled to move from the extended position to the retracted position. To that end, a locking mechanism, as will be described below, has to be unlocked. Preferably, the base part comprises a base part sidewall extending in the length direction, wherein the sidewall comprises a concave inner surface and a convex outer surface. In other words, preferably the base part sidewall forms a tube extending in the length direction. The tube preferably has an upper opening through which elements such as batteries can be inserted into the tube.

[0008] The locking device further comprises a shell comprising a sidewall extending in the length direction. Preferably the shell sidewall comprises a concave inner surface and a convex outer surface. In other words, preferably the shell sidewall forms a tube extending in the length direction. The tube preferably has a lower opening through which the base part can be inserted, for example such that the concave inner surface of the shell tube at least partly overlaps with the convex outer surface of the base part tube. The shell is arranged mechanically movable in the length direction with respect to the base part between an applied position wherein the shell sidewall encloses at least a part of the base part, and a removed position wherein the shell is removed from the base part. Preferably, in the applied position the shell prevents access to elements provided in the base part such as batteries. Preferably, in the applied position, the shell encloses the upper opening of the base part tube thereby preventing access to elements provided within the base part, such as the batteries. Preferably, the shell tube encloses substantially the entire base part tube.

[0009] The locking device further comprises a mechanical locking mechanism provided for locking the shell to the frame at least when the shell is in the applied po-

sition and the base part is in the extended position. The mechanical locking mechanism comprises a holding body configured for holding a key-operated lock cylinder to lock or unlock the shell to the frame thereby bringing the mechanical locking mechanism in respectively the locked and unlocked configuration. Preferably, the mechanical locking mechanism comprises said key-operated lock cylinder. Typically however, the locking device is sold without the key-operated lock cylinder. The user, prior to installation of the locking device on the gate wing, buys a separate key-operated lock cylinder, and inserts it into the holding body. The mechanical locking mechanism is fixed within the shell such that the mechanical locking mechanism moves together with the shell between the applied and removed positions of the shell.

[0010] The shell sidewall and the base part, preferably the base part sidewall, are releasably interconnected by means of a releasable connection member such as a screw extending through the shell sidewall and the base part sidewall or a spring biased pin provided on the base part sidewall extending into an opening in the shell sidewall. The connection is such that:

- if the connection member is released (for example the screw is unscrewed or the pin is pushed out of the opening in the shell sidewall) and if the mechanical locking mechanism is in the unlocked configuration, the shell can be brought from the applied position to the removed position,
- if the connection member is not released and if the mechanical locking mechanism is in the unlocked configuration, the shell and the base part can be moved together between the extended and retracted positions of the base part, and
- if the mechanical locking mechanism is in the locked configuration independent of the state of the connection member, the shell prevents the base part from being brought from the extended position into the retracted position.

[0011] The locking device as described above thus normally locks and unlocks a gate wing by respectively extending or retracting the drop bolt with respect to the base part, and can additionally, in particular in cases of emergency, unlock the gate wing by moving the base part from the extended position to the retracted position, for which the mechanical locking mechanism has to be brought from the locked to the unlocked configuration. Furthermore, access to the inside of the base part is secured by means of said mechanical locking mechanism by intermediary of the shell. The inside of the base part could for example comprise batteries or processors. Furthermore, as will be described further in the embodiments below, the same mechanical locking mechanism secures access to the fixation bolts which fix the frame to the gate wing, as well as access to the internal components of the shell such as the fixation screw. Finally, the same mechanical locking mechanism enables a user to remove

the shell from the base part which allows the user to powder coat the shell in a different color without having to remove the base part from the frame. This makes production of the locking device more economical, because all locking devices can be manufactured in one color and the user can subsequently powder coat the shell separately without having to remove the base part from the frame. Powder coating the shell is after all a process which has to be performed at a remote location with a dedicated powder coating furnace. This is particularly advantageous in embodiments wherein the shell encloses a large part of the base part, for example substantially the entire base part. In these embodiments, the color of the base part is after all barely or not visible to the user during regular use of the locking device.

[0012] According to an embodiment of the present invention, the locking device comprises one or more fixation bolts to attach the frame, in particular the rail of the frame, to the gate wing. Preferably the frame comprises a top fixation bolt which is only accessible to the user when the shell is in the removed position and when the base part is in the extended position. The locking mechanism thus secures access to the top fixation bolt.

[0013] According to an embodiment of the present invention, in the applied position the shell sidewall overlaps with the base part along a region which extends in the length direction. The overlapping region can be small portion of the base part, for example only a few centimeters from the top of the base part along the length direction. The overlapping region can also be large, for example substantially the entire base part for example such that in the applied position the shell sidewall prevents access to the base part along a direction perpendicular to the length direction. Preferably, the releasable connection member interconnects the shell sidewall and the base part in the overlapping region. Preferably, the releasable connection member transversely interconnects the shell sidewall and the base part in the overlapping region. Preferably the releasable connection member comprises an interconnection element such as a screw or a spring loaded pin, wherein in the applied position said interconnection element extends through the shell sidewall along a direction comprising a component perpendicular to the length direction, for example a direction substantially perpendicular to the length direction. Preferably, the interconnection member is accessible to the user without having to remove the base part from the frame and/or without having to bring the base part in the retracted position. This makes it easier to switch the shell between the removed and applied positions. Furthermore, preferably the releasable interconnection member can be removed from the shell sidewall without losing the integrity of the remainder of the locking device i.e. the releasable interconnection member only has the purpose of interconnecting the shell sidewall and the base part.

[0014] According to an embodiment of the present invention, the locking device further comprises a primary power source comprising an electric power cable in op-

eration connected to an electric utility network, and a secondary power source comprising batteries, preferably primary batteries. The electrical actuation of the drop bolt is energized by one of the primary power source and the secondary power source. The batteries are provided within the base part, for example enclosed by the base part tube and accessible through the upper opening in the base part tube. The batteries are accessible when the shell is in the removed position, for example such that the upper opening of the base part tube is accessible. In other words, in the applied position the shell preferably prevents access to the batteries.

[0015] According to an embodiment of the present invention, the locking device further comprises a processor, the processor being arranged to instruct, depending on a set of conditions, the primary or secondary power source to energize the electrical actuation of the drop bolt. Preferably the processor is provided within the base part, for example enclosed by the base part sidewall. Preferably, the processor is arranged to receive user instructions for example by means of a wireless signal, indicating the desire of a user to open or close the gate wing by means of the electrical actuation of the drop bolt. The processor is arranged for instructing the primary power source to electrically actuate the drop bolt upon receipt of such a user instruction. According to an embodiment of the present invention the processor is arranged for instructing the secondary power source to electrically actuate the drop bolt towards the retracted configuration upon detecting that the primary power source has failed. Failure of the primary power source for example occurs when the electrical grid is down. This could for example be done on purpose by a rescue team such as firefighters. In order to ensure that those firefighters can still use the gate wing, the gate wing is automatically unlocked by retracting the drop bolt by means of the secondary power source. Given that the secondary power source will be rarely used, e.g. only in situations of emergency, the batteries are preferably primary batteries. According to an embodiment of the present invention, the processor is arranged for instructing the primary power source to electrically actuate the drop bolt to the retracted configuration when the charged state of the secondary power source is below a threshold value. This ensures that the correct operation of the safety measure of retracting the drop bolt with the secondary power source in case of primary power source failure (as described above) can be guaranteed. Also when no batteries are inserted into the locking device, the locking device will detect that the secondary power source is below a threshold value. According to an embodiment of the present invention, access to the processor enables to change settings of the operation of the electrical locking device. An example setting is the speed by which the drop bolt moves between the extended and retracted configurations, or the depth by which the drop bolt extends in the extended configuration.

[0016] According to an embodiment of the present in-

vention, the base part comprises a base part sidewall as discussed above. According to an embodiment of the present invention the base part sidewall and/or the shell sidewall are sidewalls extruded along the length direction. Preferably the base part sidewall and/or the shell sidewall is a metallic sidewall, preferably made of aluminum. According to an embodiment of the present invention, in the applied position the shell sidewall overlaps at least partly with the base part sidewall, preferably such that the concave inner surface of the shell sidewall lies adjacent to a portion of the convex outer surface of the base part sidewall. Preferably, in the applied position, the shell sidewall overlaps with substantially the entire base part sidewall preferably such that the concave inner surface of the shell sidewall lies adjacent to the entire convex outer surface of the base part sidewall. This embodiment ensures that the shell sidewall is stably positioned onto the base part, making it more difficult to forcefully remove the shell sidewall from the base part.

[0017] According to an embodiment of the present invention the base part, preferably the base part sidewall comprises a first coupling means such as a guide groove and the shell sidewall comprises a complementary coupling means such as a guide protrusion arranged to be received in the first coupling means of the base part such as to enable translation of the shell sidewall over the base part along the length direction. Preferably, the cooperation of the first and second coupling means also prevent the rotation along an axis in the length direction of the shell with respect to the base part.

[0018] According to an embodiment of the present invention, the frame comprises a notch in the frame and said mechanical locking mechanism comprises a projecting member which is arranged to move in and out of said notch of said frame to lock and to unlock said shell to the frame. According to an embodiment of the present invention, the mechanical locking mechanism further comprises a reinforcing plate attached to the holding body, wherein the reinforcing plate comprises a notch, and wherein the projecting member is arranged to move in and out said notch. The reinforcing plate has the advantage of shielding the holding body from high stresses which could occur when someone tries to forcefully open the locking device. Preferably the reinforcing plate is made of metal, and the holding body is made of plastic such as polyamide. Preferably the reinforcing plate is a flat plate i.e. an unbended plate. Providing an unbended plate improves the production tolerances of the mechanical locking mechanism. Preferably, the flat reinforcing plate lies substantially parallel to the frame. Preferably, the reinforcing plate lies adjacent to the frame.

[0019] According to an embodiment of the present invention, the mechanical locking mechanism comprises an intermediary locking element which is rotatably mounted in the holding body. The projecting member is provided on said intermediary locking element and the intermediary locking element is arranged such that rotation of said intermediary locking element moves said pro-

jecting member in and out of said the notch of the frame (as well as the notch of the reinforcing plate if present). The mechanical locking mechanism preferably further comprises a spring arranged to press said projecting member of said intermediary locking element into said notch of the frame. Preferably the intermediary locking element is rotatable about an axis in the length direction and the key-operated lock cylinder has an axis of rotation substantially perpendicular to said length direction. As is known, a lock cylinder has a pin which is rotated along the axis of rotation of the lock cylinder upon rotation of the appropriate key in the lock cylinder. Upon rotation of the pin of the lock cylinder, the pin abuts the intermediary locking element causing the intermediary locking element to rotate along the axis in the length direction, in turn retracting the projecting member out of the notch (against the action of the spring if present) and pushing the projecting member into the notch (by means of the action of the spring if present). According to an embodiment of the present invention, the projecting member is a metallic plate, preferably a flat metallic plate i.e. an unbended metallic plate. Preferably the intermediary locking element is made from plastic such as polyamide. Making the intermediary locking element out of plastic enables to pour the plastic such as to obtain an intermediary locking element with improved production tolerances, for example as opposed to making the intermediary locking element out of a bended metallic plate. This enables to accurately and reproducibly position the pivot points of the intermediary locking element, for example to accurately and reproducibly manufacture the pivot parts as described next. According to an embodiment of the present invention, the intermediary locking element comprises a pivot part by means of which the intermediary locking element is connected to the holding body in such a manner as to enable rotation of the intermediary locking element along an axis extending in the length direction. Preferably, the pivot part of the intermediary locking element is located closer to the contact area with said pin of the lock cylinder than to said notch in the frame.

[0020] According to an embodiment of the present invention, the pin of the lock cylinder lies outside of the lock cylinder main body when the key is removed from the lock cylinder. The pin is then for example rotated under an angle of about 30 degrees. This prevents from being able to remove the lock cylinder from the holding body whenever the key is removed from the lock cylinder. Preferably the lock cylinder is further anchored to the holding body by means of a lateral bolt extending perpendicular to the extension direction of the lock cylinder (i.e. the direction along which the pin of the lock cylinder rotates).

[0021] According to an embodiment of the present invention, the mechanical locking mechanism is fixed to the shell sidewall at least by means of the key-operated lock cylinder which extends from within the holding body through an opening in the shell sidewall.

[0022] According to an embodiment of the present invention, the shell further comprises a lid arranged on top

of the shell sidewall. Preferably, the lid is attached to the holding body of the mechanical locking mechanism by means of a fixation screw. Preferably, the head of the fixation screw lies within the holding body. The fixation screw is thus only accessible to the user after having brought the shell into the removed position. The mechanical locking mechanism thus secures the access to the fixation screw. More in general, not per se linked to the present embodiment, the mechanical locking mechanism preferably secures the access to the inner components of the shell such as the above mentioned fixation screw.

[0023] According to an embodiment, the mechanical locking mechanism can be removed from the shell. In other words, preferably the mechanical locking mechanism is releasably mounted within the shell. The user for example has to remove the above mentioned screw connecting the holding body with the lid and the above mentioned lateral bolt, and has to use the key to bring the pin of the lock cylinder out of the above mentioned rotated position. Being able to remove the mechanical locking mechanism from the shell has the advantage that the shell can be powder coated without damaging the mechanical locking mechanism. As described above and further below, the mechanical locking mechanism after all preferably comprises plastic components which could be damaged, for example molten, when applying the powder coat procedure. The latter after all comprises heating the shell in a dedicated furnace, which heat could damage, for example melt, the plastic components of the mechanical locking mechanism.

[0024] According to an embodiment of the present invention, the base part comprises a reinforced plug end and said frame comprises a reinforced annular foot. Said reinforced plug end is arranged to enter into the annular opening in said annular foot when said base part is in the extended position such that the plug end is embedded in said reinforced foot. This prevents the forceful opening of the locking device. Preferably, the reinforced plug end is made from plastic. Preferably, the plug end serves as a sliding guide for the drop bolt when moving between the extended and retracted configuration. The drop bolt, being made from metal, easily slides over the plastic plug end. Preferably the reinforced annular foot is made from metal. This makes it more difficult to break the foot. Preferably, the reinforced foot is attached to the frame, in particular to the rail of the frame, by means of a fixation bolt used to attach the rail of the frame to the gate wing. This fixation bolt is preferably a bottom fixation bolt, preferably in addition to the above mentioned top fixation bolt. Preferably, the bottom fixation bolt is only accessible to the user when the base part is brought in the retracted position. In the retracted position, the annular foot is no longer filled with the plug end. Preferably the annular foot comprises a fixation bolt access opening through which a user can insert a screw driver such as to manipulate the fixation bolt. Access to the bottom fixation bolt is thus secured by means of the mechanical locking mechanism.

According to an embodiment of the present invention, in the applied position the shell sidewall extends in the length direction up to the reinforced plug end of the base part.

[0025] According to an embodiment of the present invention, one of the base part and the frame is provided with at least one protrusion and the other one of the base part and the frame is provided with at least one guide for accepting the protrusion. The cooperation of the protrusion and the guide is arranged to guide relative movement of the base part with respect to the frame. Preferably, the holding body of the mechanical locking mechanism comprises a similar protrusion or guide as the base part such as to enable a cooperation thereof with the protrusion or guide of the frame. Said cooperation being arranged to guide relative movement of the shell with respect to the frame.

[0026] The invention further provides a method of use of the locking device as described above. The use preferably comprises bringing the shell to the removed position, for example prior to the construction of the locking device or for example after construction of the locking device by bringing the shell from the applied position to the removed position, subsequently removing the mechanical locking mechanism from the shell, and subsequently powder coating the shell. As described above, it is indeed an advantage of the present invention that the shell can be removed from the base part such that the shell can be separately powder coated. Furthermore, by removing the mechanical locking mechanism from the shell, any plastic components from the mechanical locking mechanism would not be damaged by the high temperatures occurring during the powder coating process.

[0027] It is a further, i.e. second, object of the present invention to provide a novel mechanical locking mechanism as described above, i.e. independent of the provision of the removable shell as described above. The novel locking mechanism could for example be implemented in the locking device of patent publication EP2749720 which is therefore incorporated herein by reference. The present invention for example also relates to an electrically operable locking device configured for the locking of a gate wing, the device being provided for locking the gate wing by electrically extending a drop bolt from a housing into an extended configuration and engaging the drop bolt with a fixed bolt reception element, and for releasing the gate wing by electrically retracting the drop bolt into the housing into a retracted configuration and disengaging the drop bolt from the fixed bolt reception element. The housing could for example comprise a base part and a separate removable shell as described above in the present patent application, or could for example comprise an integrally connected base part and shell as is known from patent publication EP2749720. The locking device comprising:

- a frame arranged for being fixed to the gate wing,

- the housing supported on the frame, wherein the housing is arranged mechanically movable with respect to the frame in a length direction between an extended position of the housing, whereby, if the drop bolt is extended from the housing, the drop bolt is engaging with the fixed bolt reception element and the gate wing is locked, and a retracted position of the housing whereby, if the drop bolt is extended from the housing, the drop bolt is disengaged from the fixed bolt reception element and the gate wing is released,

wherein the locking device further comprises a mechanical locking mechanism, preferably the locking mechanism as described in the present patent application under the preceding object of the invention. The mechanical locking mechanism is provided for locking the housing to the frame at least when the housing is in the extended position, the mechanical locking mechanism comprising a holding body configured for holding a key-operated lock cylinder to lock or unlock the housing to the frame thereby bringing the mechanical locking mechanism in respectively the locked and unlocked configuration. Preferably, the mechanical locking mechanism comprises said key-operated lock cylinder. Typically however, the locking device is sold without the key-operated lock cylinder. The user, prior to installation of the locking device on the gate wing, buys a separate key-operated lock cylinder, and inserts it into the holding body.

[0028] According to an embodiment of the second object of present invention, the frame comprises a notch in the frame and said mechanical locking mechanism comprises a projecting member which is arranged to move in and out of said notch of said frame to lock and to unlock said shell to the frame. According to an embodiment of the present invention, the mechanical locking mechanism further comprises a reinforcing plate attached to the holding body, wherein the reinforcing plate comprises a notch, and wherein the projecting member is arranged to move in and out said notch. The reinforcing plate has the advantage of shielding the holding body from high stresses which could occur when someone tries to forcefully open the locking device. Preferably the reinforcing plate is made of metal, and the holding body is made of plastic such as polyamide. Preferably the reinforcing plate is a flat plate i.e. an unbended plate. Providing an unbended plate improves the production tolerances of the mechanical locking mechanism. Preferably, the flat reinforcing plate lies substantially parallel to the frame. Preferably, the reinforcing plate lies adjacent to the frame.

[0029] According to an embodiment of the second object of the present invention, the mechanical locking mechanism comprises an intermediary locking element which is rotatably mounted in the holding body. The projecting member is provided on said intermediary locking element and the intermediary locking element is arranged such that rotation of said intermediary locking el-

ement moves said projecting member in and out of said the notch of the frame (as well as the notch of the reinforcing plate if present). The mechanical locking mechanism preferably further comprises a spring arranged to press said projecting member of said intermediary locking element into said notch of the frame. Preferably the intermediary locking element is rotatable about an axis in the length direction and the key-operated lock cylinder has an axis of rotation substantially perpendicular to said length direction. As is known, a lock cylinder has a pin which is rotated along the axis of rotation of the lock cylinder upon rotation of the appropriate key in the lock cylinder. Upon rotation of the pin of the lock cylinder, the pin abuts the intermediary locking element causing the intermediary locking element to rotate along the axis in the length direction, in turn retracting the projecting member out of the notch (against the action of the spring if present) and pushing the projecting member into the notch (by means of the action of the spring if present). According to an embodiment of the present invention, the projecting member is a metallic plate, preferably a flat metallic plate, i.e. an unbended metallic plate. Preferably the intermediary locking element is made from plastic such as polyamide. Making the intermediary locking element out of plastic enables to pour the plastic such as to obtain an intermediary locking element with improved production tolerances, for example as opposed to making the intermediary locking element out of a bended metallic plate. This enables to accurately and reproducibly position the pivot points of the intermediary locking element, for example to accurately and reproducibly manufacture the pivot parts as described next. According to an embodiment of the present invention, the intermediary locking element comprises a pivot part by means of which the intermediary locking element is connected to the holding body in such a manner as to enable rotation of the intermediary locking element along an axis extending in the length direction. Preferably, the pivot part of the intermediary locking element is located closer to the contact area with said pin of the lock cylinder than to said notch in the frame.

[0030] In the present second object of the invention, the locking device preferably comprises a primary power source comprising an electric power cable in operation connected to an electric utility network, and a secondary power source comprising batteries, wherein the electrical actuation of the drop bolt is energized by one of the primary power source and the secondary power source, and wherein the batteries are provided within the housing.

Figures

[0031] Figure 1 is a perspective view of an embodiment of the locking device according to the present invention attached to a gate wing, wherein the base part of the locking device is in the extended position, wherein the shell is in the applied position, and wherein the drop bolt

is the extended configuration, thereby locking the gate wing.

[0032] Figure 2 is a perspective view of the locking device shown in figure 1, wherein the base part of the locking device is in the retracted position, wherein the shell is in the applied position, and wherein the drop bolt is the extended configuration, thereby unlocking the gate wing.

[0033] Figure 3 shows a sideview of the locking device of in figures 1 and 2, in different configurations with the shell always in the applied position. Figure 3a shows, similar to figure 1, the base part in the extended position and the drop bolt in the extended position. Figure 3b shows, similar to figure 2, the base part in the retracted position and the drop bolt in the extended position. Figure 3c shows the base part in the extended position and the drop bolt in the retracted position.

[0034] Figure 4 is a perspective view of the locking device of figure 1 wherein the shell has been removed and wherein the annular foot of the frame is not shown. The base part is shown in the extended position.

[0035] Figure 5 is an exploded view of the locking device shown in figure 4.

[0036] Figure 6a and 6b respectively show a front perspective view and a back perspective view of the shell of the locking device shown in figure 1.

[0037] Figure 7a and 7b respectively show an exploded view of the shell shown in figure 6a and in figure 6b.

[0038] Figure 8 shows how the shell shown in figures 6 and 7 is in the removed position and is being applied over the base part such as to obtain the locking device shown in figure 1.

[0039] Figure 9 shows the shell and the base part of figure 8 wherein the shell is brought into the applied position and wherein the releasable connection member is being applied.

[0040] Figure 10 shows a cross-section sideview of the locking device in the configuration as shown figure 3a.

[0041] Figure 11 shows a cross-section sideview of the locking device in the configuration as shown figure 3b.

[0042] Figure 12 is a perspective detail of parts of the locking mechanism which is provided in the shell of the locking device of figure 1, wherein the cooperation of the locking mechanism with the frame is shown. Figures 12a and 12b show the detail from opposing sides.

[0043] Figure 13 shows the detail of figure 12 in a plane view. Figure 13a, 13b and 13c respectively show a front view, a back view and a top view.

[0044] Figure 14 shows in more detail parts of the locking mechanism shown in figure 12. Figure 14a and 14b respectively show an assembled perspective view and an exploded perspective view.

[0045] Figure 15 is a perspective back view of a top part of the locking device of figure 1.

[0046] Figure 16a shows a top view of the locking device of figure 1 with a cross section indication. Figure 16b shows a cross sectional view of the locking device according to axis BB indicated in figure 16a.

[0047] Figure 17 shows a side view of the locking device of figure 1 with cross-section indications.

[0048] Figures 18a, 18b, 18c, 18d and 18e show a cross section of the locking device of figure 1 along a plane perpendicular to the length direction respectively according to the axis BB, CC, DD, FF and GG indicated in figure 17.

[0049] Figure 19 shows a perspective view of the bottom part of the locking device of figure 1 wherein the base part is in the retracted position and wherein the drop bolt is in the retracted configuration. Figures 19a and 19b show the bottom part from different angles.

Brief description of the figures

[0050] Figures 1, 2 and 3 show a locking device 400 according to an embodiment of the present invention which is mounted to a gate wing 402 which may be a hinged closing member or a sliding closing member. The locking device comprises a housing and a frame 200. The housing in turn comprises a base part 300 which is for example shown in figures 4 and 5, and further comprises a shell 100 which is for example shown in figures 6 and 7. The base part 300 comprises a base part sidewall 320 extending in the length direction as indicated by the arrow with reference sign "L". The base part sidewall 320 comprises a concave inner surface and a convex outer surface. In other words, the base part sidewall 320 forms a tube extending in the length direction. The tube is made of metal which is extruded along the length direction. The tube has an upper opening 380 through which elements such as batteries can be inserted into the tube. The shell 100 comprises a shell sidewall 120 having a concave inner surface and a convex outer surface, and a lid 110, together forming a lower opening 181 and a lateral opening 180 as is shown in figure 6. The shell sidewall 120 forms a tube. The shell sidewall 120 is made of metal which is extruded along the length direction. The lower opening 181 enables the insertion of the base part 300 into the shell. The lateral opening 180 is covered by the frame 200 when the shell is brought in an applied position wherein the base part 300 is substantially entirely inserted into the shell 100. In the applied position as shown in the present figures, the concave inner surface of the shell tube overlaps with the convex outer surface of the base part tube. Figures 1, 2 and 3 for example show the shell in the applied position. Figure 8 shows the shell 100 in the removed position wherein it is in the process of being brought into the applied position as in shown in figure 9.

[0051] The locking device 400 is in particular provided for releasing the gate wing 402 by electrically retracting a drop bolt 302 into the base part 300 into a retracted configuration and disengaging the drop bolt 302 from the fixed bolt reception element 401, in particular out of the opening 403 formed in the bolt reception element 401. The locking device 400 therefore comprises a metallic frame 200 formed as a rail extending in the length direction L. The frame 200 is arranged for being fixed to the

gate wing 402. To that end, the frame 200 comprises fixation bolts 203 which are further described in the patent publication EP2749720 which is incorporated herein. The frame 200 is therefore provided with openings 217a and 217b. The base part 300 is supported on said frame 200 in such a manner that it is mechanically movable with respect to the frame 200 in the length direction "L" between an extended position as is shown in the figures 1, 3a and 3c, whereby, if the drop bolt 302 is extended from the base part 300 as is shown in figures 1 and 3a, the drop bolt 302 is engaging with the fixed bolt reception element 401 and the gate wing is locked, and a retracted position as is shown in figures 2 and 3b whereby, if the drop bolt 302 is extended from the base part as is shown in figures 1 and 3b, the drop bolt 302 is disengaged from the fixed bolt reception element 401 and the gate wing is released.

[0052] The locking device 400 further comprises a primary power source comprising an electric power cable 209 in operation connected to an electric utility network, and a secondary power source comprising batteries 326. Both of the primary and secondary power sources are arranged to power an electromotor 322 which rotates a spindle 327 by intermediary of a coupling piece 325 arranged to absorb shocks from the spindle such as to protect the electromotor. The rotation of the spindle 327 entrains a transformation element 370 along the length direction, i.e. the transformation element 370 translates along the length direction upon rotation of the spindle. To that end, the transformation element comprises a threaded interior which cooperates with the spindle, similar to a nut and bolt cooperation. The transformation element is positioned in the base part sidewall 320 such that it cannot rotate along an axis in the length direction, thereby transforming the rotation of the spindle into a translation of the transformation element. The drop bolt 302 is connected to the transformation element 370 such as to translate along the length direction together with the transformation element. Both the primary power source and the secondary power source provide power to the electromotor 322 through a processor 324. The processor 324 is provided within the base part 300 and is anchored thereto by means of screw 319. Access to the processor 324 is hindered by the batteries 326 which are provided between the processor 324 and the upper opening 380 in the base part tube. The batteries are also provided within the base part 300 and are accessible through the upper opening 380 in the base part tube when the shell 100 is in the removed position, such that the upper opening 380 of the base part tube is accessible. The batteries are provided in a liquid tight battery housing 371a, 371b which comprises two halve housings interconnected by a seal 396. When the shell 100 is in the removed position, the batteries 326 can be removed from the base part 300 by unscrewing the fixation screws 328. The power cable 309 connects to the frame 200 at a lower part of the frame and moves up along the frame up to the processor 324. As is particularly visible in figures

13c and 15, the frame 200 thereto comprises rearward guide means 225 formed as projections between which a plastic cover 221 is applied as is particularly visible in figures 13c and 18. Figure 18b, 18c, 18d and 18e show that the plastic cover 221 comprises a channel receiving the power cable 209. This way, the power cable 209 is not easily accessible by the user. In order to prevent damage to the power cable 209 upon moving the base part 300 between the extended and retracted positions, a flexible cable guide 312 is provided to connect the power cable to the processor. The electrical actuation of the drop bolt 302 is energized by one of the primary power source and the secondary power source. The processor 324 is arranged to instruct, depending on a set of conditions, the primary or secondary power source to energize the electrical actuation of the drop bolt 302. The processor 324 is arranged to receive user instructions by means of a wireless signal, indicating the desire of a user to open or close the gate wing 402 by means of the electrical actuation of the drop bolt 302. The processor 324 is by default arranged for instructing the primary power source to electrically actuate the drop bolt 302 upon receipt of such a user instruction. The processor 324 is arranged for instructing the secondary power source to electrically actuate the drop bolt 302 towards the retracted configuration upon detecting that the primary power source has failed. Given that the secondary power source will be rarely used, e.g. only in situations of emergency, the batteries 326 are primary batteries. The processor 324 is further arranged for instructing the primary power source to electrically actuate the drop bolt 302 to the retracted configuration when the charged state of the secondary power source is below a threshold value. This ensures that the correct operation of the safety measure of retracting the drop bolt with the secondary power source in case of primary power source failure (as described above) can be guaranteed.

[0053] As is particularly shown in figures 8 and 9, the shell sidewall 120 is arranged mechanically movable in the length direction with respect to the base part 300 between an applied position wherein the shell sidewall encloses the base part 300, and a removed position wherein the shell is removed from the base part. In the applied position the shell 100 prevents access to elements provided in the base part such as batteries 326. In the applied position, the shell 100 in particular encloses the upper opening 380 of the base part tube thereby preventing access to elements provided within the base part, such as the batteries. As is particularly shown in figures 4, 6, 18d and 18e, the base part sidewall 320 comprises a first coupling means 377 formed as a guide groove and the shell sidewall 120 comprises a complementary coupling means 107 formed as a guide protrusion arranged to be received in the first coupling means 377 of the base part 300 such as to enable translation of the shell sidewall 120 over the base part sidewall 320 along the length direction. The cooperation of the first and second coupling means also prevent the rotation along an axis in the

length direction of the shell 100 with respect to the base part 300.

[0054] The locking device 400 further comprises a mechanical locking mechanism 101 provided for locking the shell 100 to the frame 200 when the shell 100 is in the applied position and the base part 300 is in the extended position. As is particularly shown in figures 6 and 7, the mechanical locking mechanism 101 comprises a plastic holding body 112 holding a lock cylinder 103 operated by means of a key 104 to lock or unlock the shell 100 to the frame 200 thereby bringing the mechanical locking mechanism 101 in respectively the locked and unlocked configuration. The mechanical locking mechanism 101 is fixed within the shell 101 such that the mechanical locking mechanism moves together with the shell between the applied and removed positions of the shell. The mechanical locking mechanism 101 is fixed to the shell sidewall 120 by means of the key-operated lock cylinder 103 which extends from within the holding body 112 through an opening in the shell sidewall through a plastic reinforcing part 111. Furthermore, the lid 110 is attached to the holding body 112 by means of a fixation screw 113. The head of the fixation screw 113 lies within the holding body 112. The lid 110 can be integrally fixed, for example welded to the shell sidewall 120 in which case the fixation screw 113 additionally fixes the holding body 112 to the shell sidewall 120. Alternatively, the lid 110 is releasably mounted to the shell sidewall 120 by means of coupling the lid 110 to the holding body 112 with the fixation screw 113 and by fixing the holding body 112 to the shell sidewall 120 by means of the lock cylinder 103. The lock cylinder 103 is further anchored to the holding body 112 and the shell sidewall 120 by means of a lateral bolt 102 extending perpendicular to the extension direction of the lock cylinder 103 (i.e. the direction along which the pin of the lock cylinder rotates). The lateral bolt 102 is however accessible from the outside to anyone. Therefore, the pin 130 of the lock cylinder 103 lies outside of the lock cylinder main body when the key is removed from the lock cylinder. The pin is then for example rotated under an angle of about 30 degrees. This prevents from being able to remove the lock cylinder 103 from the holding body 112 whenever the key is removed from the lock cylinder. As is shown in figures 18a, 18b and 18c, the holding body 112 is furthermore fixed in the shell 100 by providing tight fit between the holding body 112 and the shell sidewall 120. As discussed above, the shell sidewall 120 comprises a coupling means 107. The holding body 112 comprises a complementary coupling means 177, similar to the first coupling means 377 of the base part sidewall 320, such that the holding body 112 can be slid out of the shell 100 along the length direction after liberation of the holding body 112, i.e. after removal of the lateral bolt 102, after removal of the fixation screw 113 and after removal of the lock cylinder 103.

[0055] As is particularly shown in figures 8 and 9, the shell sidewall 120 and the base part sidewall 320 are releasably interconnected by means of a releasable con-

nection member implemented as a screw 122 extending through an opening 106 in the shell sidewall and an opening in the base part sidewall 322. The connection is such that:

- if the connection member is released (i.e. the screw 122 is unscrewed out of the opening 106 in the shell sidewall) and if the mechanical locking mechanism 101 is in the unlocked configuration, the shell 100 can be brought from the applied position to the removed position,
- if the connection member is not released and if the mechanical locking mechanism 101 is in the unlocked configuration, the shell 100 and the base part 300 can be moved together between the extended and retracted positions of the base part 300, and
- if the mechanical locking mechanism 101 is in the locked configuration independent of the state of the connection member, the shell 100 prevents the base part 300 from being brought from the extended position into the retracted position. In this situation, the base part 300 is trapped between the fixed bolt reception element 401 and the mechanical locking mechanism 101.

[0056] As is particularly visible in figures 4, 5, 12, 13, 15 and 16, the frame 200 comprises a notch 206. The mechanical locking mechanism 101 comprises a projecting member 117 which is arranged to move in and out of said notch 206 to lock and to unlock said shell 100 to the frame 200. The mechanical locking mechanism 301 further comprises a flat metallic reinforcing plate 114 attached to the holding body 112. The reinforcing plate 114 also comprises a notch 136 wherein the projecting member 114 is arranged to move in and out said notch 136 when locking and unlocking the shell 100 to the frame 200. The reinforcing plate 114 has the advantage of shielding the more vulnerable plastic holding body 112 from high stresses which could occur when someone tries to forcefully open the locking device 400. The flat reinforcing plate 114 lies substantially parallel and adjacent to the frame 200.

[0057] As is particularly shown in figures 12, 13 and 14, the mechanical locking mechanism 301 comprises a plastic intermediary locking element 116 which is rotatably mounted in the holding body 112. The intermediary locking element 116 comprises a first plate 134 and a second plate 132 substantially perpendicular to one another. The projecting member 117 is provided on the first plate 134 of said intermediary locking element 116 by means of screws 119 and nuts 135. The intermediary locking element 116 is arranged such that rotation of said intermediary locking element along an axis in the length direction at the intersection of the first and second plates moves said projecting member 117 in and out of said the notch 206 of the frame as well as in and out of the notch 136 of the reinforcing plate 114. The mechanical locking mechanism 101 further comprises a spring 121 posi-

tioned between said first plate 134 of the intermediary locking element 116 and a dedicated receptacle formed in the holding body 112. The spring 121 is arranged to press said projecting member of said intermediary locking element into said notch of the frame. The intermediary locking element is rotatable about an axis in the length direction and the key-operated lock cylinder 103 has an axis of rotation substantially perpendicular to said length direction. As is known, a lock cylinder has a pin 130 which is rotated along the axis of rotation of the lock cylinder 101 upon rotation of the appropriate key 104 in the lock cylinder 103. Upon rotation of the pin 130 of the lock cylinder 103, depending on the clockwise or counter-clockwise rotation of the key 104, the pin 130 abuts on or retracts from the second plate 132 of the intermediary locking element 116 causing the intermediary locking element to rotate along the axis in the length direction, in turn retracting the projecting member 117 out of the notch 206 against the action of the spring or pushing the projecting member into the notch 206 by means of the action of the spring 121. The intermediary locking element 116 comprises a pivot part 133 by means of which the intermediary locking element 116 is connected to the holding body 112 in such a manner as to enable rotation of the intermediary locking element 116 along an axis extending in the length direction. The pivot part 133 of the intermediary locking element 116 is located closer to the contact area with said pin 130 of the lock cylinder 103 than to said notch 206 in the frame 200. This results in a great projecting distance of the projecting member 117 despite a short range of movement of the pin 130.

[0058] As is particularly shown in figure 19, the base part 300 comprises a plastic reinforced plug end 318 and said frame 200 comprises a metallic reinforced annular foot 201. Said reinforced plug end 318 is arranged to enter into the annular opening in said annular foot 201 when said base part 300 is in the extended position such that the plug end 318 is embedded in said reinforced foot 201. This prevents the forceful opening of the locking device. The reinforced foot 201 comprises an opening 202 enabling the removal or insertion of the fixation bolt 203 when the base part 300 is in the retracted position. The reinforced plug end 318 is attached to the base part sidewall 320 by means of a protrusion 334 on the reinforced plug end 318 which clicks into a groove 333 in the base part sidewall 320, as well as by means of screws 330. The reinforced foot 201 is attached to the frame 200, in particular to the longitudinally extending rail of the frame, by means of the fixation bolt 203.

[0059] As is particularly shown in figures 18d and 118e, the frame 200 is provided with a protrusion 222 extending along the length direction, and the base part sidewall 320 is provided with a guide 337 for accepting the protrusion 222. The cooperation of the protrusion 222 and the guide 337 is arranged to guide relative movement of the base part 300 with respect to the frame 200. As is particularly shown in figures 18a, 18b and 18c, the holding body 112 of the mechanical locking mechanism 101 comprises a

similar guide 137 as the base part 300 such as to enable a cooperation thereof with the protrusion 222 of the frame 200. Said cooperation is arranged to guide relative movement of the shell 100 with respect to the frame 200.

Claims

1. An electrically operable locking device (400) configured for the locking of a gate wing (402), the device (400) being provided for locking the gate wing (402) by electrically extending a drop bolt (302) from a base part (300) into an extended configuration and engaging the drop bolt (302) with a fixed bolt reception element (401), and for releasing the gate wing (402) by electrically retracting the drop bolt (302) into the base part (300) into a retracted configuration and disengaging the drop bolt (302) from the fixed bolt reception element (401), the locking device (400) comprising:

- a frame (200) arranged for being fixed to the gate wing (402),
- the base part (300) supported on the frame, wherein the base part is arranged mechanically movable with respect to the frame (200) in a length direction between an extended position of the base part (300), whereby, if the drop bolt (302) is extended from the base part (300), the drop bolt (302) is engaging with the fixed bolt reception element (401) and the gate wing (402) is locked, and a retracted position of the base part (300) whereby, if the drop bolt (302) is extended from the base part (300), the drop bolt (302) is disengaged from the fixed bolt reception element (401) and the gate wing (402) is released,

characterized in that

the locking device (400) further comprises a shell (100) comprising a sidewall (120) extending in the length direction, wherein the shell is arranged mechanically movable in the length direction with respect to the base part between an applied position wherein the shell sidewall encloses at least a part of the base part, and a removed position wherein the shell is removed from the base part,

and in that the locking device further comprises a mechanical locking mechanism (101) provided for locking the shell (100) to the frame (200) at least when the shell is in the applied position and the base part is in the extended position, the mechanical locking mechanism (101) comprising a holding body (112) holding a key-operated lock cylinder (103) to lock or unlock the shell to the

frame (200) thereby bringing the mechanical locking mechanism (101) in respectively the locked and unlocked configuration, and wherein the mechanical locking mechanism (101) is fixed within the shell such that the mechanical locking mechanism moves together with the shell between the applied and removed positions of the shell, and **in that** the shell (100) sidewall and the base part are releasably interconnected by means of a releasable connection member (122), such that

- if the connection member is released and if the mechanical locking mechanism (101) is in the unlocked configuration, the shell can be brought from the applied position to the removed position,
 - if the connection member is not released and if the mechanical locking mechanism (101) is in the unlocked configuration, the shell and the base part can be moved together between the extended and retracted positions of the base part, and
 - if the mechanical locking mechanism (101) is in the locked configuration independent of the state of the connection member, the shell prevents the base part from being brought from the extended position into the retracted position.
2. The locking device according to the preceding claim wherein in the applied position the shell sidewall (120) overlaps with the base part (300) along a region which extends in the length direction, and wherein the releasable connection member (122) transversely interconnects the shell sidewall and the base part in the overlapping region.
 3. The locking device according to any one of the preceding claims wherein the locking device comprises a primary power source comprising an electric power cable (209) in operation connected to an electric utility network, and a secondary power source comprising batteries (326), and wherein the electrical actuation of the drop bolt is energized by one of the primary power source and the secondary power source, wherein the batteries are provided within the base part, and wherein the batteries are accessible when the shell (100) is in the removed position.
 4. The locking device according to the preceding claim wherein the locking device further comprises a processor (324), the processor being arranged to instruct, depending on a set of conditions, the primary or secondary power source to energize the electrical actuation of the drop bolt, wherein the processor is arranged to receive user instructions indicating the desire of a user to open or close the gate wing by

means of the electrical actuation of the drop bolt, and wherein the processor is arranged for instructing the primary power source to electrically actuate the drop bolt upon receipt of such a user instruction.

5. The locking device according to the preceding claim wherein the processor is arranged for instructing the secondary power source to electrically actuate the drop bolt towards the retracted configuration upon detecting that the primary power source has failed.
6. The locking device according to any one of the preceding claims 4 to 5 wherein the processor is arranged for instructing the primary power source to electrically actuate the drop bolt to the retracted configuration when the charged state of the secondary power source is below a threshold value.
7. The locking device according to any one of the preceding claims wherein the base part comprises a base part sidewall, and wherein the base part sidewall and the shell sidewall are both sidewalls extruded along the length direction, wherein preferably both sidewalls are metallic sidewalls, preferably aluminum sidewalls.
8. The locking device according to the preceding claim wherein in the applied position the shell sidewall overlaps with substantially the entire base part sidewall.
9. The locking device according to any one of the preceding claims wherein the base part comprises a first coupling means (377) and wherein the shell sidewall comprises a complementary coupling means (107) arranged to be received in the first coupling means of the base part such as to enable translation of the shell sidewall over the base part along the length direction.
10. The locking device according to any one of the preceding claims in which the frame (200) comprises a notch (206) in the frame (200) and said mechanical locking mechanism (101) comprises a projecting member (117) which is arranged to move in and out of said notch (206) of said frame (200) to lock and to unlock said shell to the frame (200), and wherein the mechanical locking mechanism (101) further comprises a reinforcing plate (114) attached to the holding body (112), wherein the reinforcing plate comprises a notch (136), and wherein the projecting member (117) is arranged to move in and out said notch (136), wherein the reinforcing plate is made of metal, and wherein the holding body (112) is made of plastic.
11. The locking device (400) according to claim 10 or 10, wherein said mechanical locking mechanism

- (101) comprises an intermediary locking element (116) which is rotatably mounted in the holding body (112), wherein said projecting member (117) is provided on said intermediary locking element (116) and wherein the intermediary locking element is arranged such that rotation of said intermediary locking element moves said projecting member in and out of said the notch (206) of the frame (200), and wherein said mechanical locking mechanism (101) comprises a spring (121) arranged to press said projecting member (117) of said intermediary locking element (116) into said notch (206) of the frame (200), and wherein said intermediary locking element (116) is rotatable about an axis in the length direction and wherein said key-operated lock cylinder (103) has an axis of rotation substantially perpendicular to said length direction, and wherein preferably the projecting member (117) is a metallic plate, and preferably wherein the intermediary locking element (116) is made from plastic.
12. The locking device according to any one of the preceding claims wherein the mechanical locking mechanism (101) is releasably mounted within the shell (100).
13. The locking device (400) according to any of the preceding claims, wherein said base part (300) comprises a reinforced plug end (318) and said frame (200) comprises a reinforced annular foot (201), and wherein said reinforced plug end (318) is arranged to enter into the annular opening in said annular foot (201) when said base part (300) is in the extended position such that the plug end (318) is embedded in said reinforced foot (201).
14. The locking device (400) according to any of the preceding claims, wherein one of the base part (300) and the frame (200) is provided with at least one protrusion (222) and the other one of the base part (300) and the frame (200) is provided with at least one guide (337) for accepting the protrusion (222), and wherein the cooperation of the protrusion and the guide is arranged to guide relative movement of the base part (300) with respect to the frame (200), and wherein the holding body (112) of the mechanical locking mechanism (101) comprises a similar protrusion or guide (137) as the base part (300) such as to enable a cooperation thereof with the protrusion (222) or guide of the frame (200), said cooperation being arranged to guide relative movement of the shell (100) with respect to the frame (200).
15. Method of use of the locking device (400) according to claim 12, wherein the use comprises bringing the shell (100) to the removed position, subsequently removing the mechanical locking mechanism (101) from the shell, and subsequently powder coating the shell.
16. An electrically operable locking device (400) configured for the locking of a gate wing (402), the device (400) being provided for locking the gate wing (402) by electrically extending a drop bolt (302) from a housing (100, 300) into an extended configuration and engaging the drop bolt (302) with a fixed bolt reception element (401), and for releasing the gate wing (402) by electrically retracting the drop bolt (302) into the housing (100, 300) into a retracted configuration and disengaging the drop bolt (302) from the fixed bolt reception element (401), the locking device (400) comprising:
- a frame (200) arranged for being fixed to the gate wing (402),
 - the housing (100, 300) supported on the frame, wherein the housing is arranged mechanically movable with respect to the frame (200) in a length direction between an extended position of the housing, whereby, if the drop bolt (302) is extended from the housing, the drop bolt (302) is engaging with the fixed bolt reception element (401) and the gate wing (402) is locked, and a retracted position of the housing whereby, if the drop bolt (302) is extended from the housing, the drop bolt (302) is disengaged from the fixed bolt reception element (401) and the gate wing (402) is released,
 - a mechanical locking mechanism (101) provided for locking the housing to the frame (200) at least when the housing (100, 300) is in the extended position, the mechanical locking mechanism (101) comprising a holding body (112) holding a key-operated lock cylinder (103) to lock or unlock the shell to the frame (200) thereby bringing the mechanical locking mechanism (101) in respectively the locked and unlocked configuration, wherein the frame (200) comprises a notch (206) in the frame (200) and said mechanical locking mechanism (101) comprises a projecting member (117) which is arranged to move in and out of said notch (206) of said frame (200) to lock and to unlock said housing (100, 300) to the frame (200), wherein the mechanical locking mechanism (101) further comprises a reinforcing plate (114) attached to the holding body (112), wherein the reinforcing plate comprises a notch (136), and wherein the projecting member (117) is arranged to move in and out said notch (136), wherein the reinforcing plate is made of metal, and wherein the holding body (112) is made of plastic, wherein said mechanical locking mechanism (101) comprises an intermediary locking element

ment (116) which is rotatably mounted in the holding body (112), wherein said projecting member (117) is provided on said intermediary locking element (116) and wherein the intermediary locking element is arranged such that rotation of said intermediary locking element moves said projecting member in and out of said the notch (206) of the frame (200), and wherein said mechanical locking mechanism (101) comprises a spring (121) arranged to press said projecting member (117) of said intermediary locking element (116) into said notch (206) of the frame (200), and wherein said intermediary locking element (116) is rotatable about an axis in the length direction and wherein said key-operated lock cylinder (103) has an axis of rotation substantially perpendicular to said length direction, and wherein the projecting member (117) is a metallic plate, and preferably wherein the intermediary locking element (116) is made from plastic.

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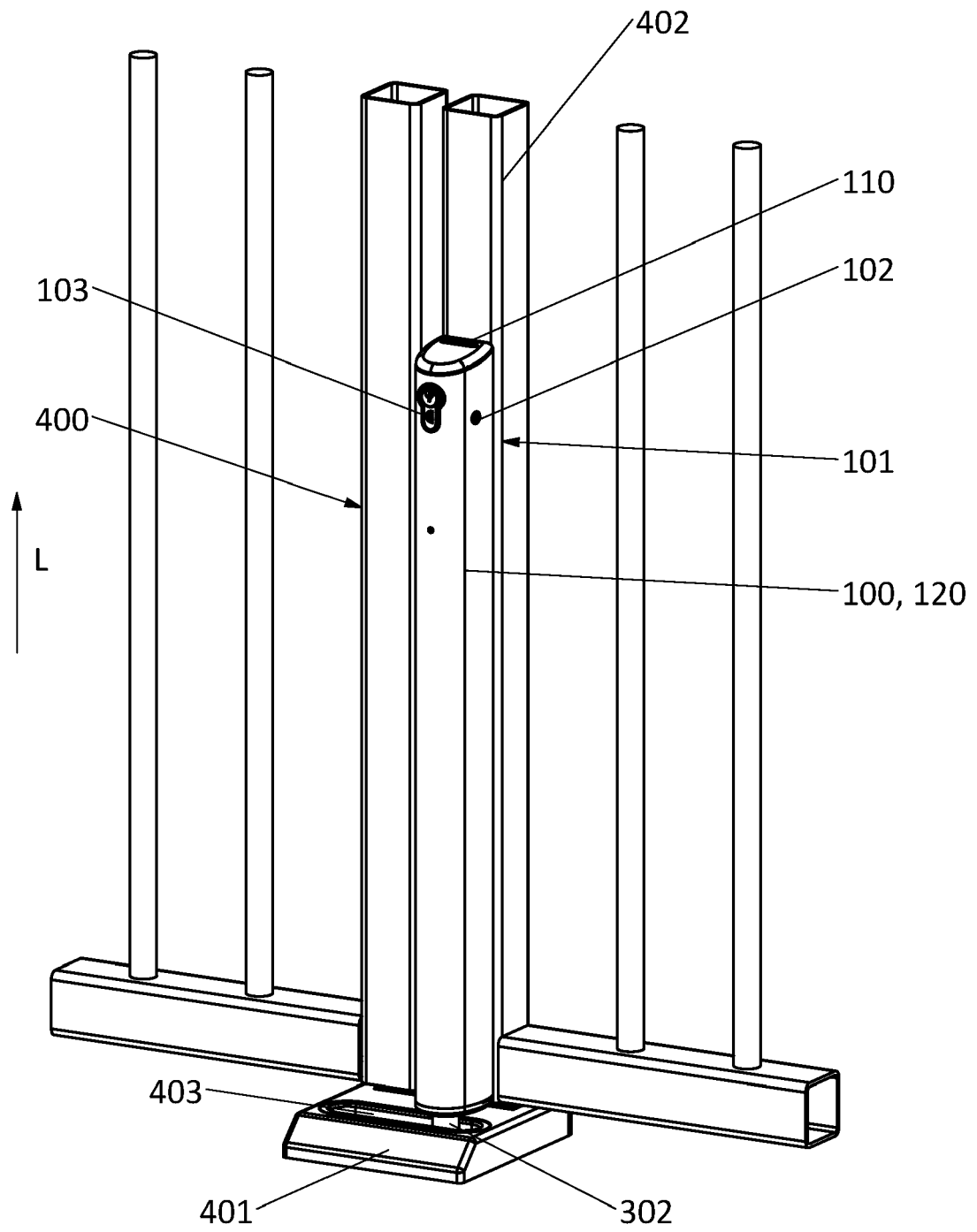


Fig. 1

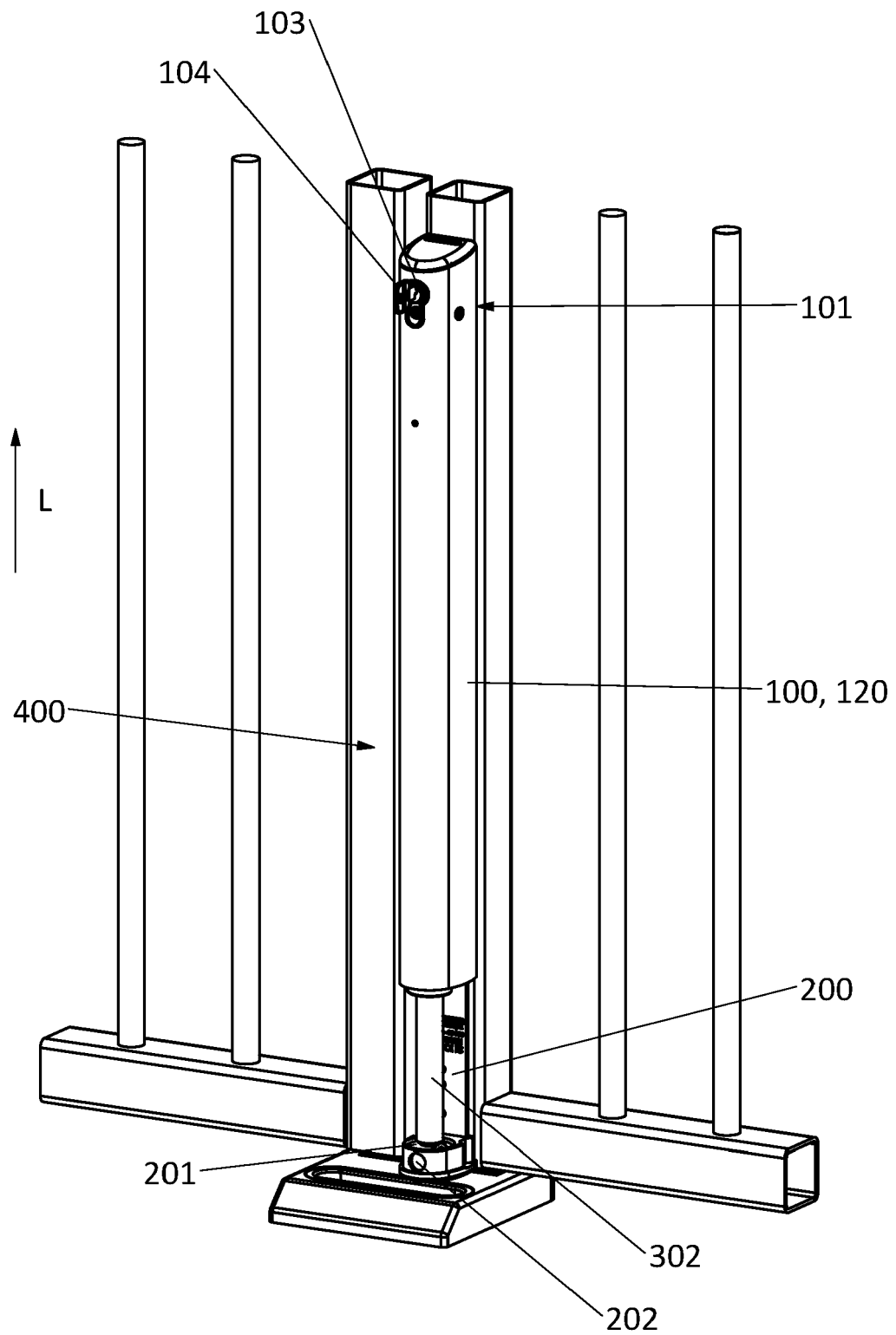


Fig. 2

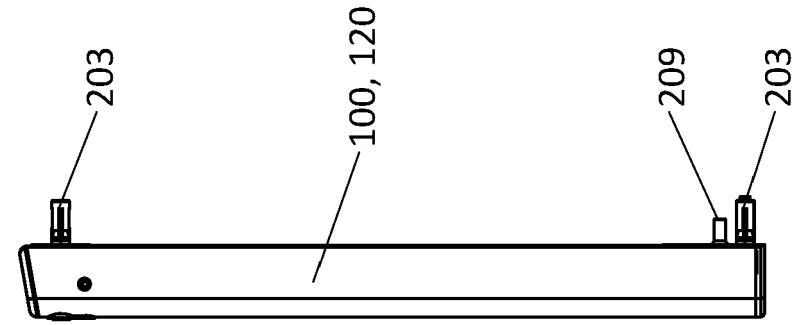


Fig. 3c

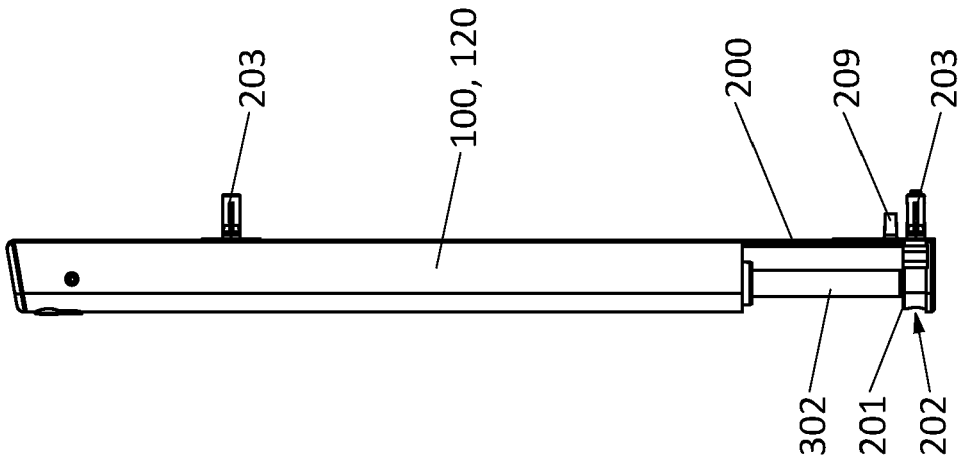


Fig. 3b

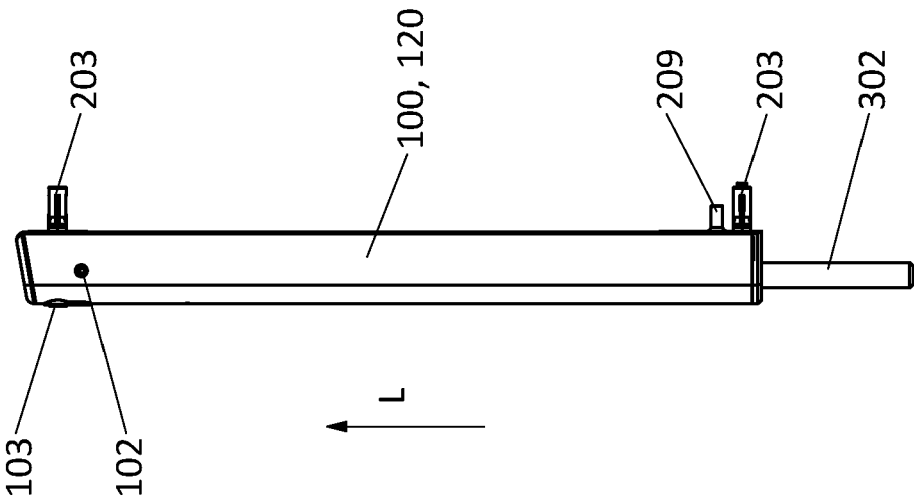


Fig. 3a

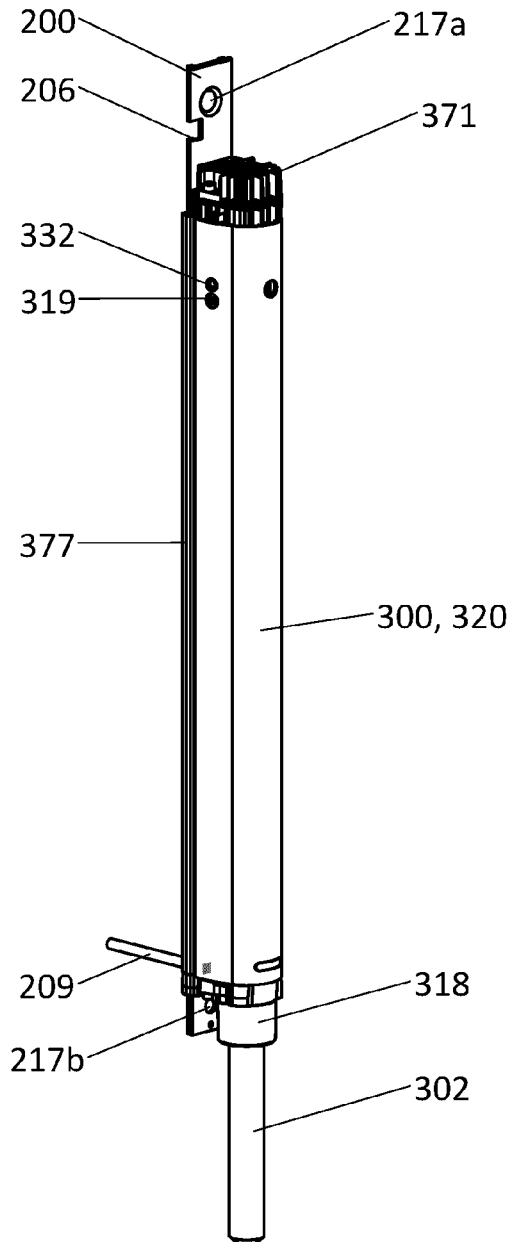


Fig. 4

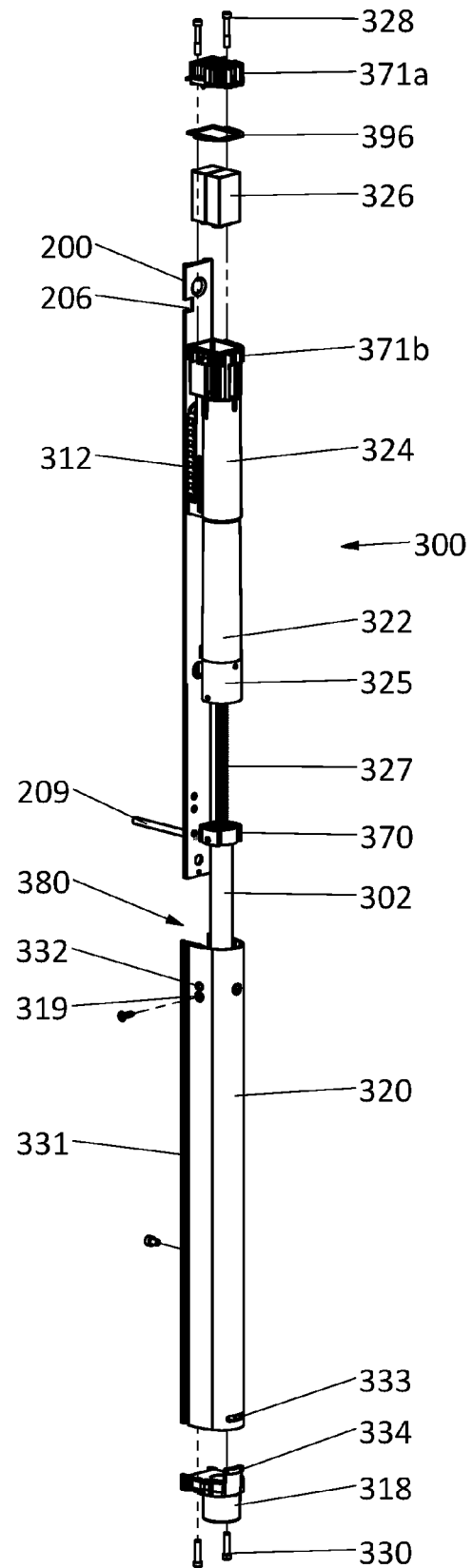


Fig. 5

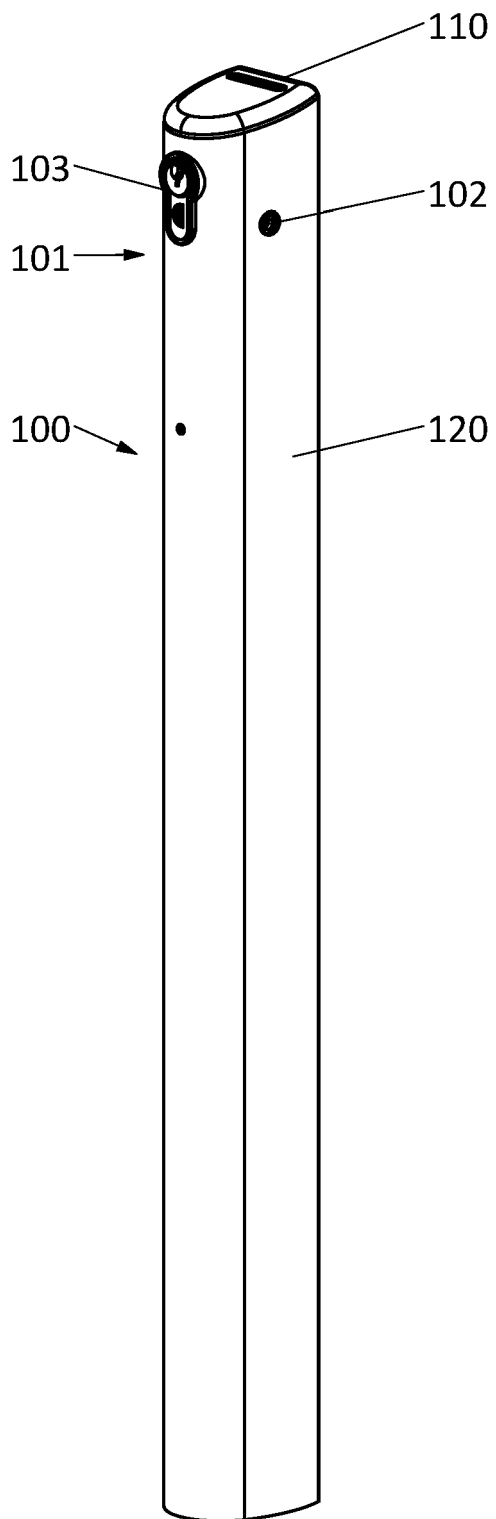


Fig. 6a

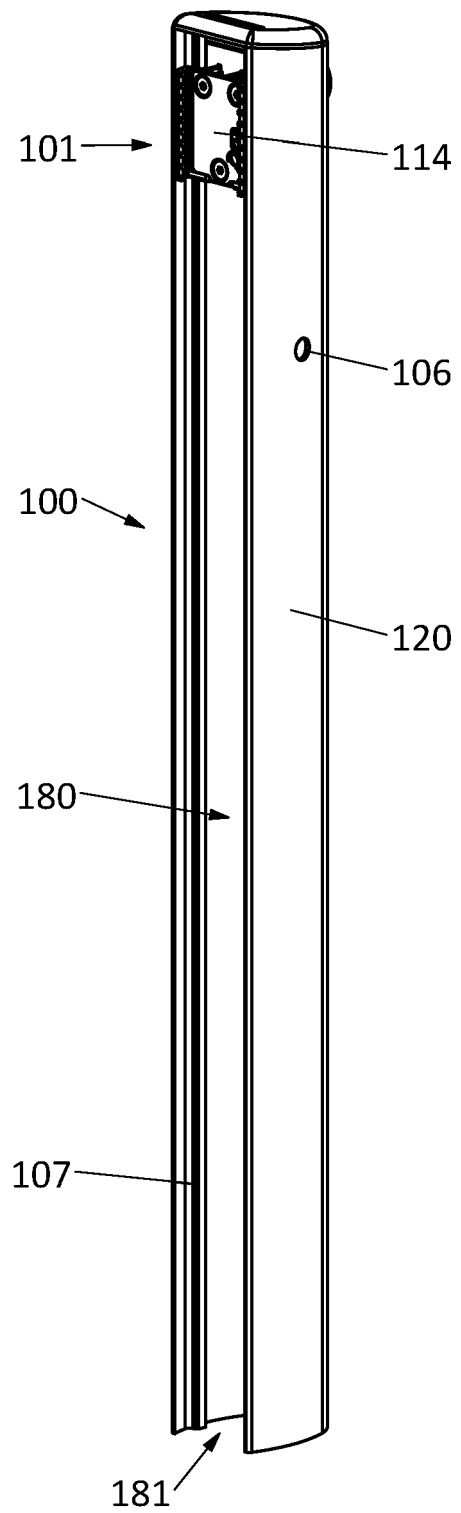


Fig. 6b

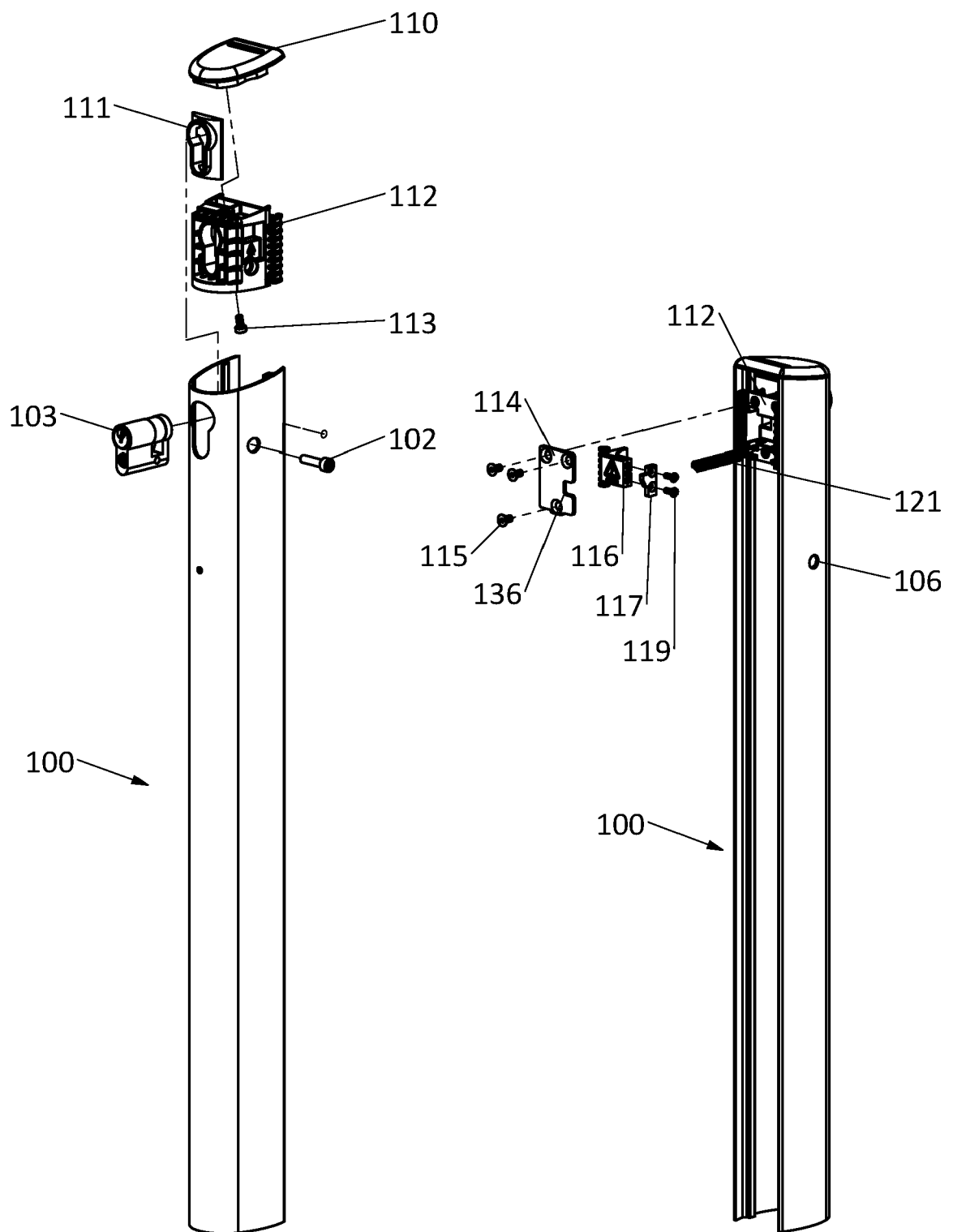


Fig. 7a

Fig. 7b

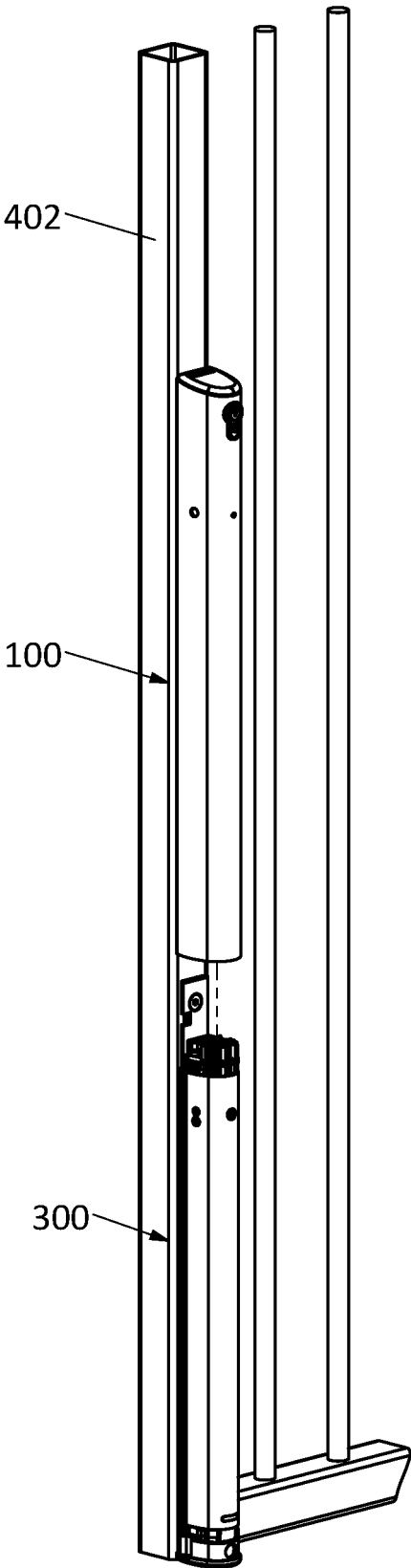


Fig. 8

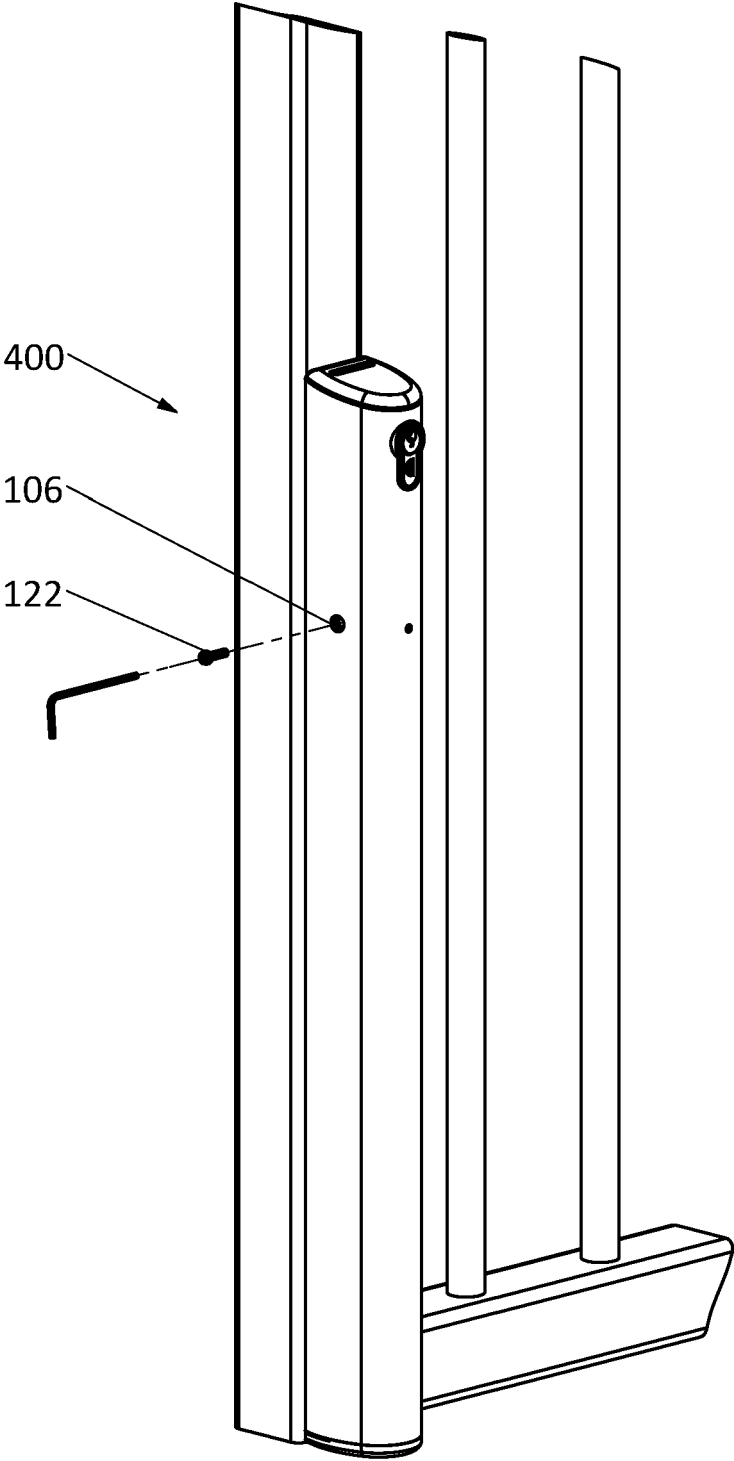


Fig. 9

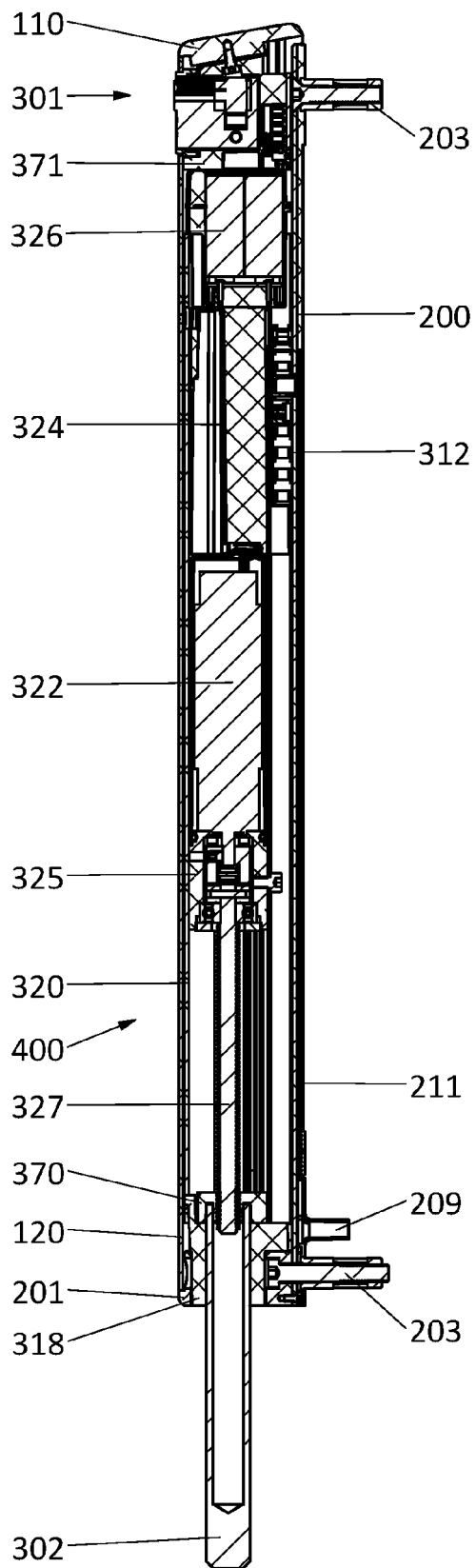


Fig. 10

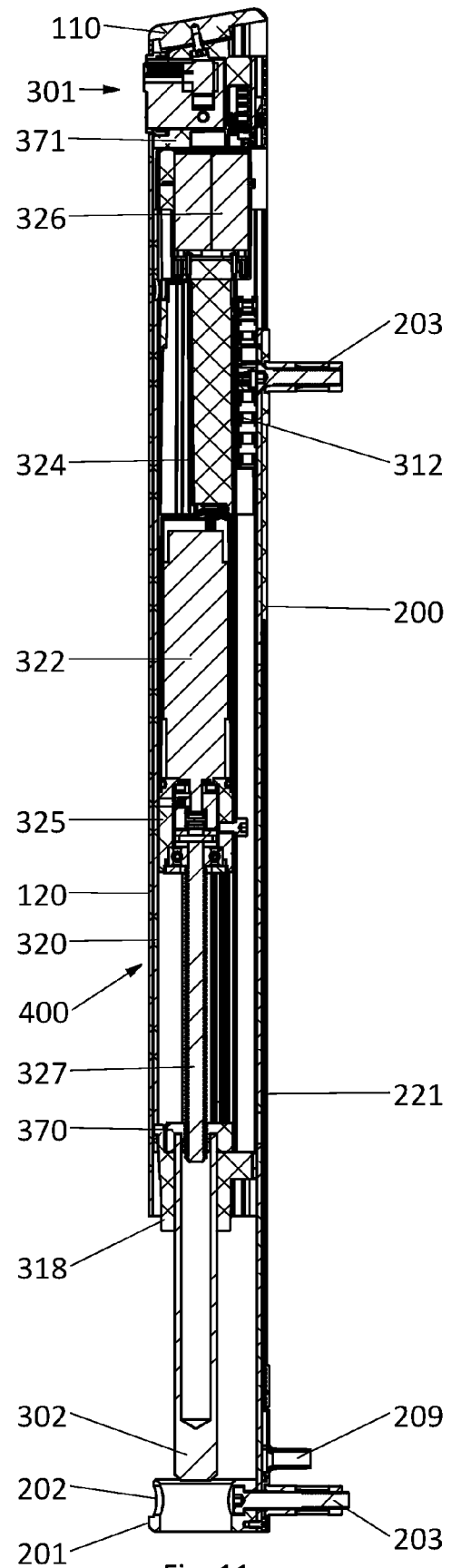


Fig. 11

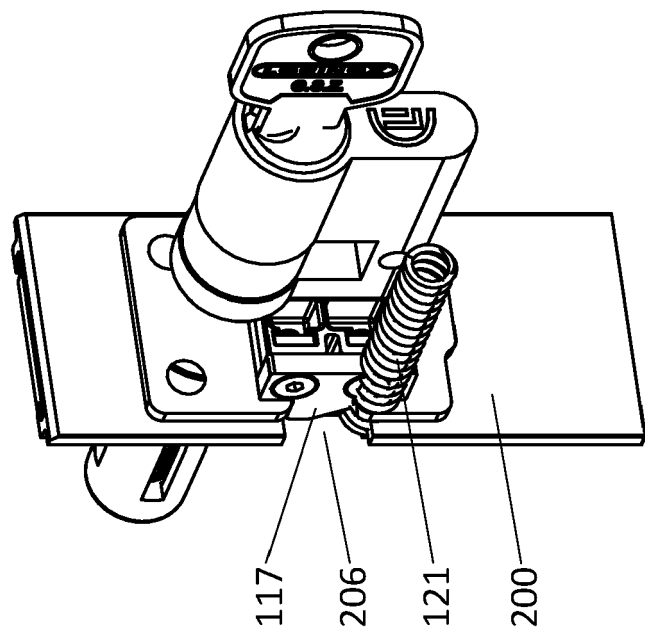


Fig. 12b

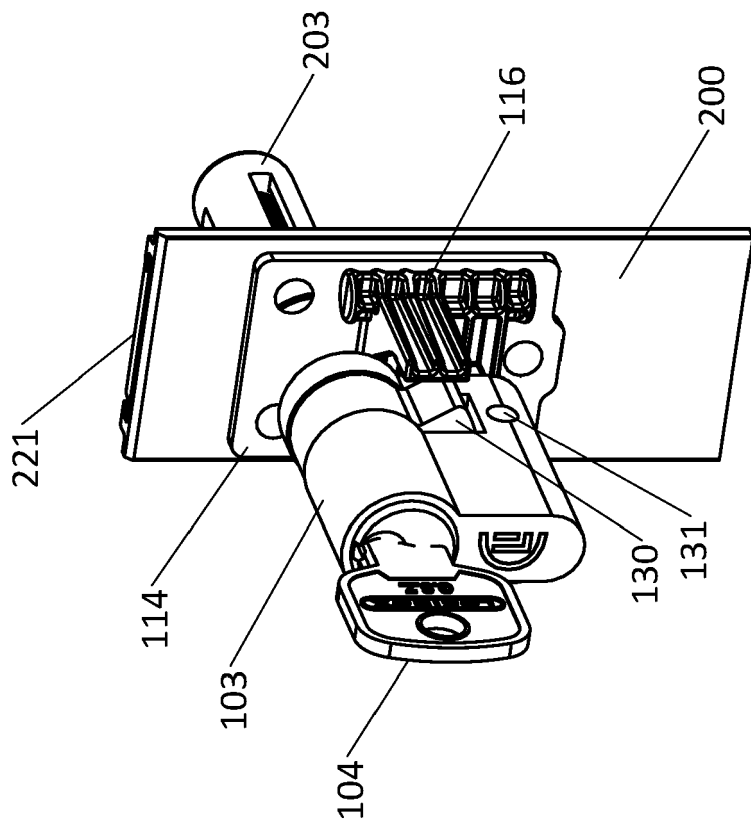


Fig. 12a

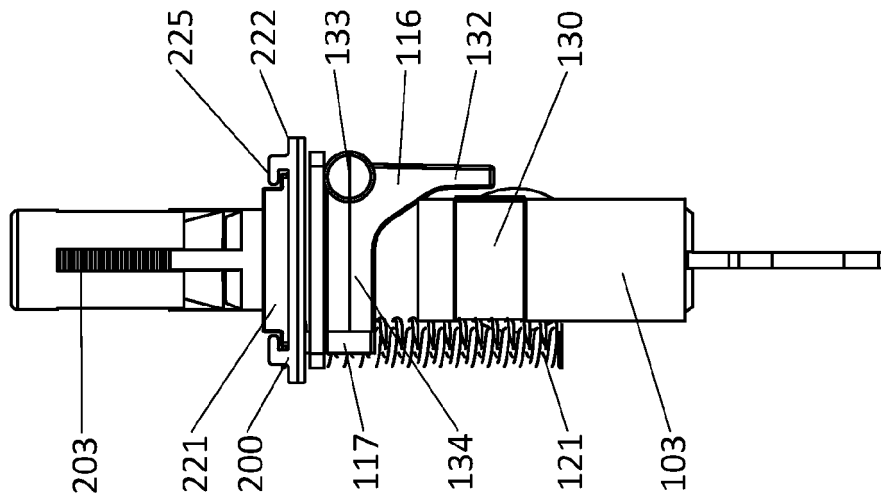


Fig. 13c

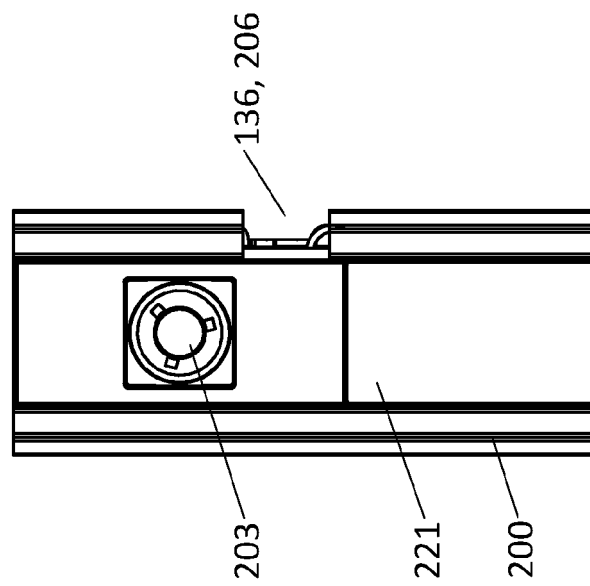


Fig. 13b

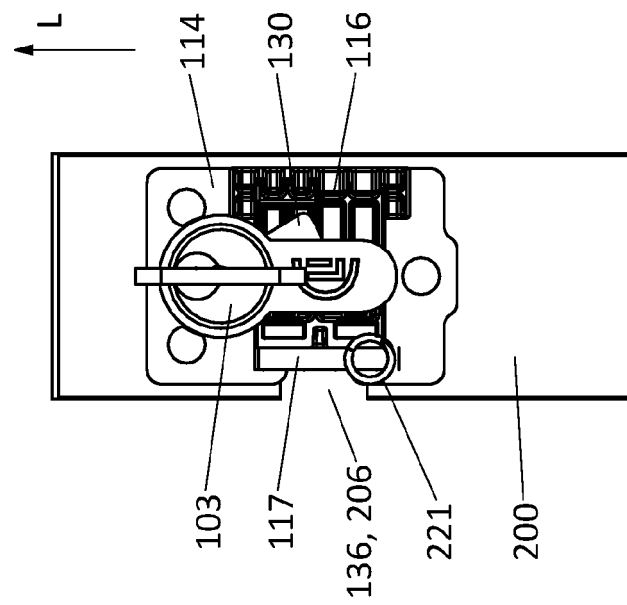


Fig. 13a

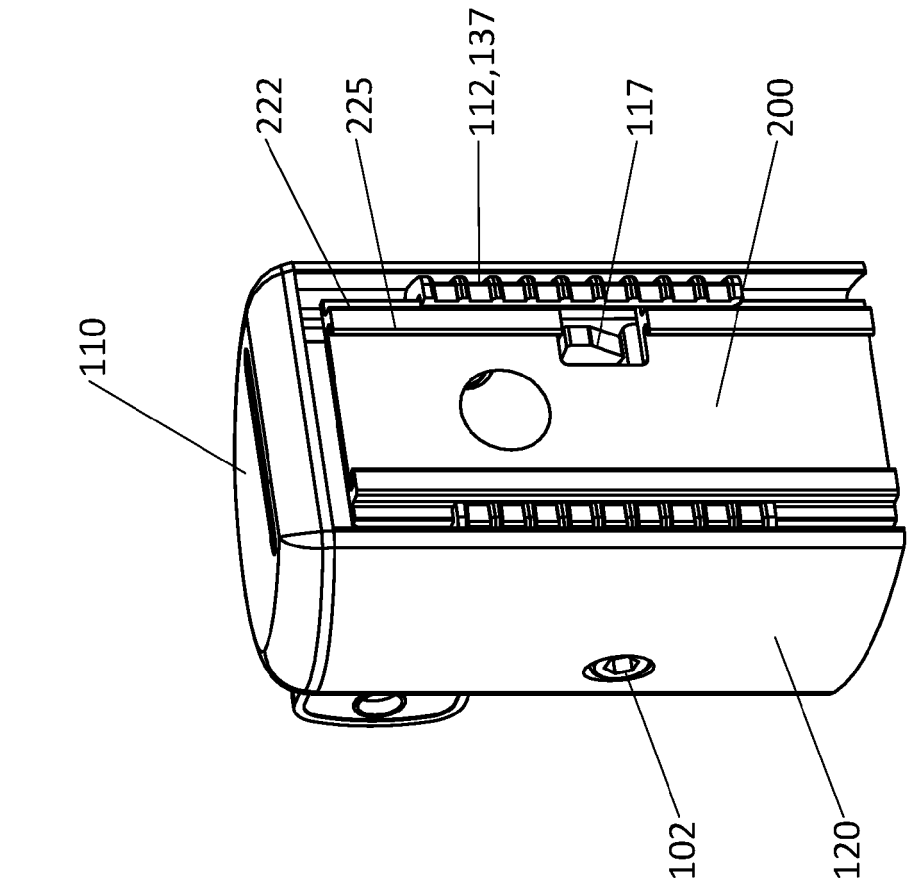


Fig. 15

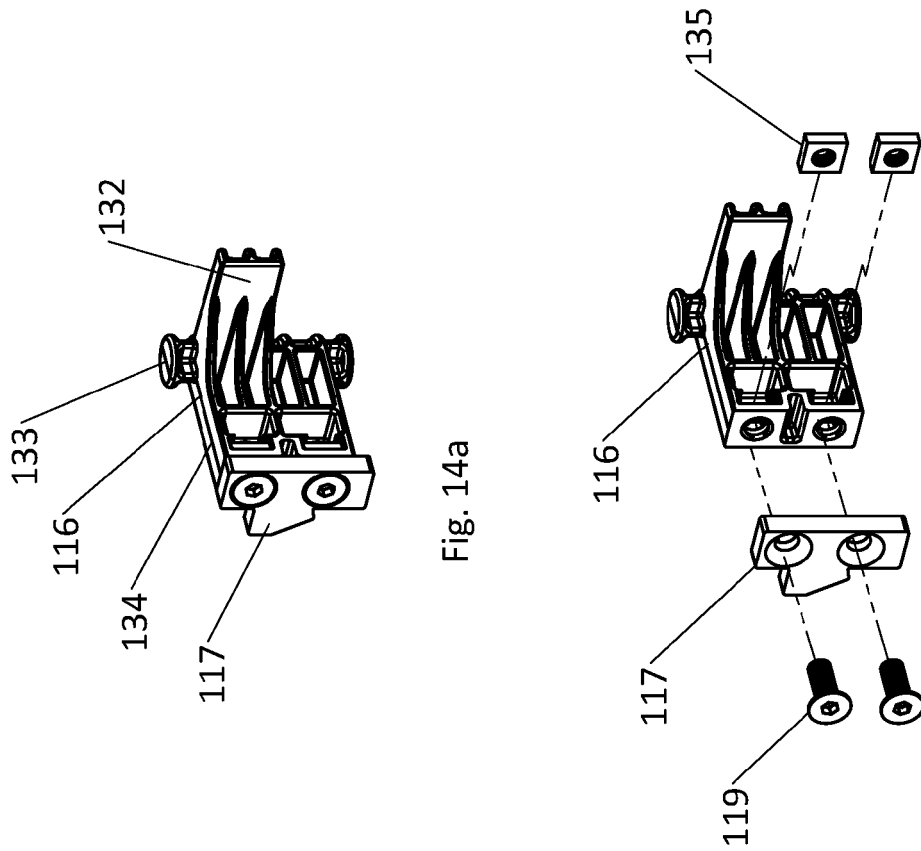
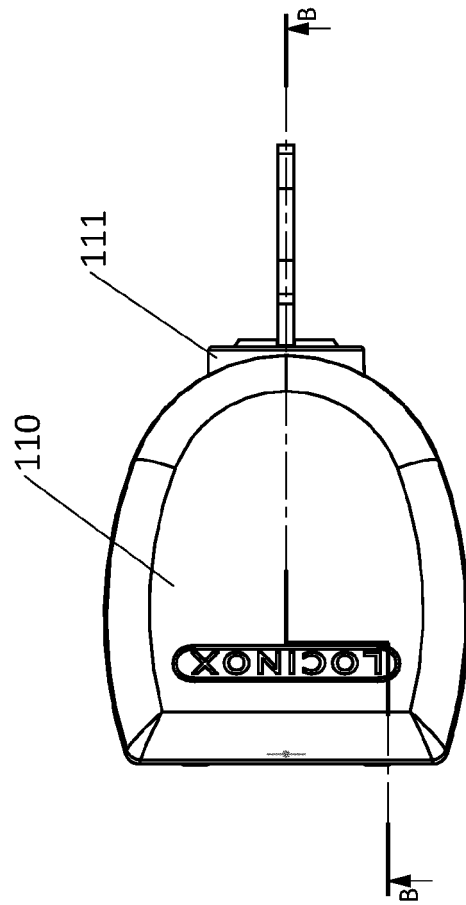
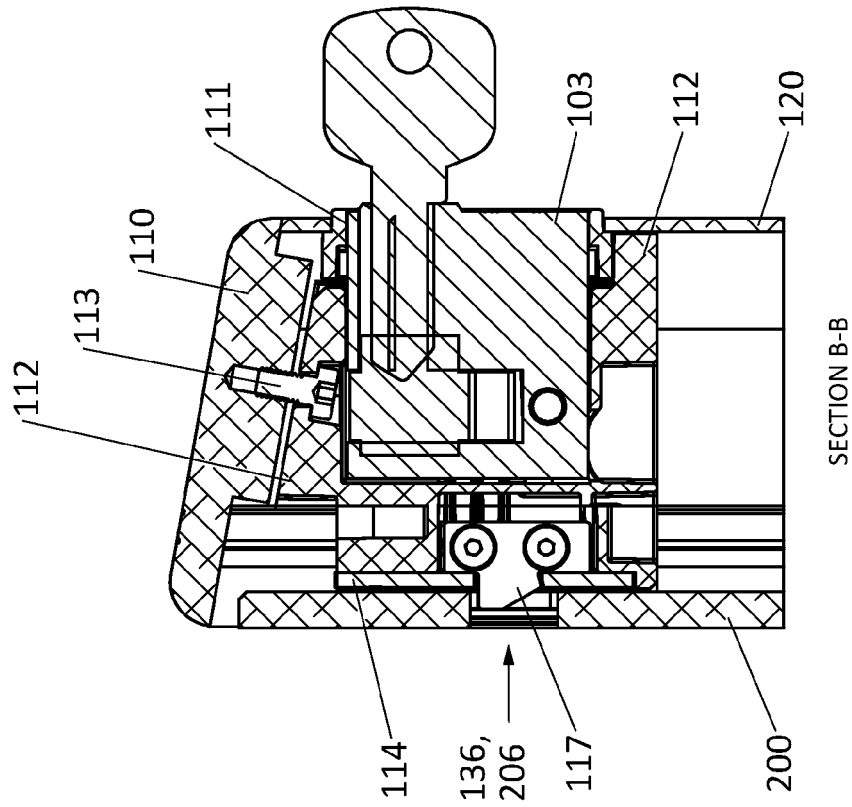


Fig. 14a

Fig. 14b



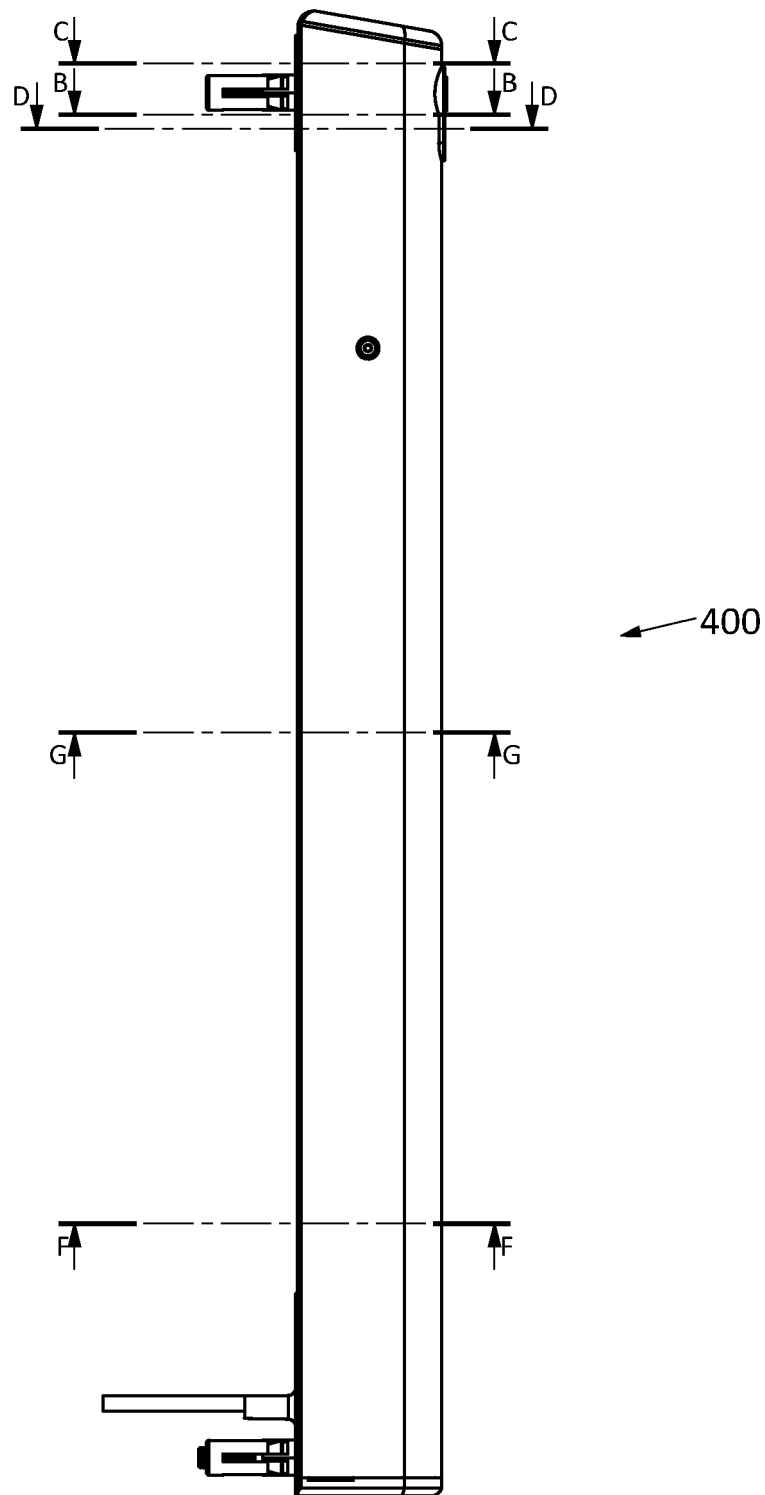


Fig. 17

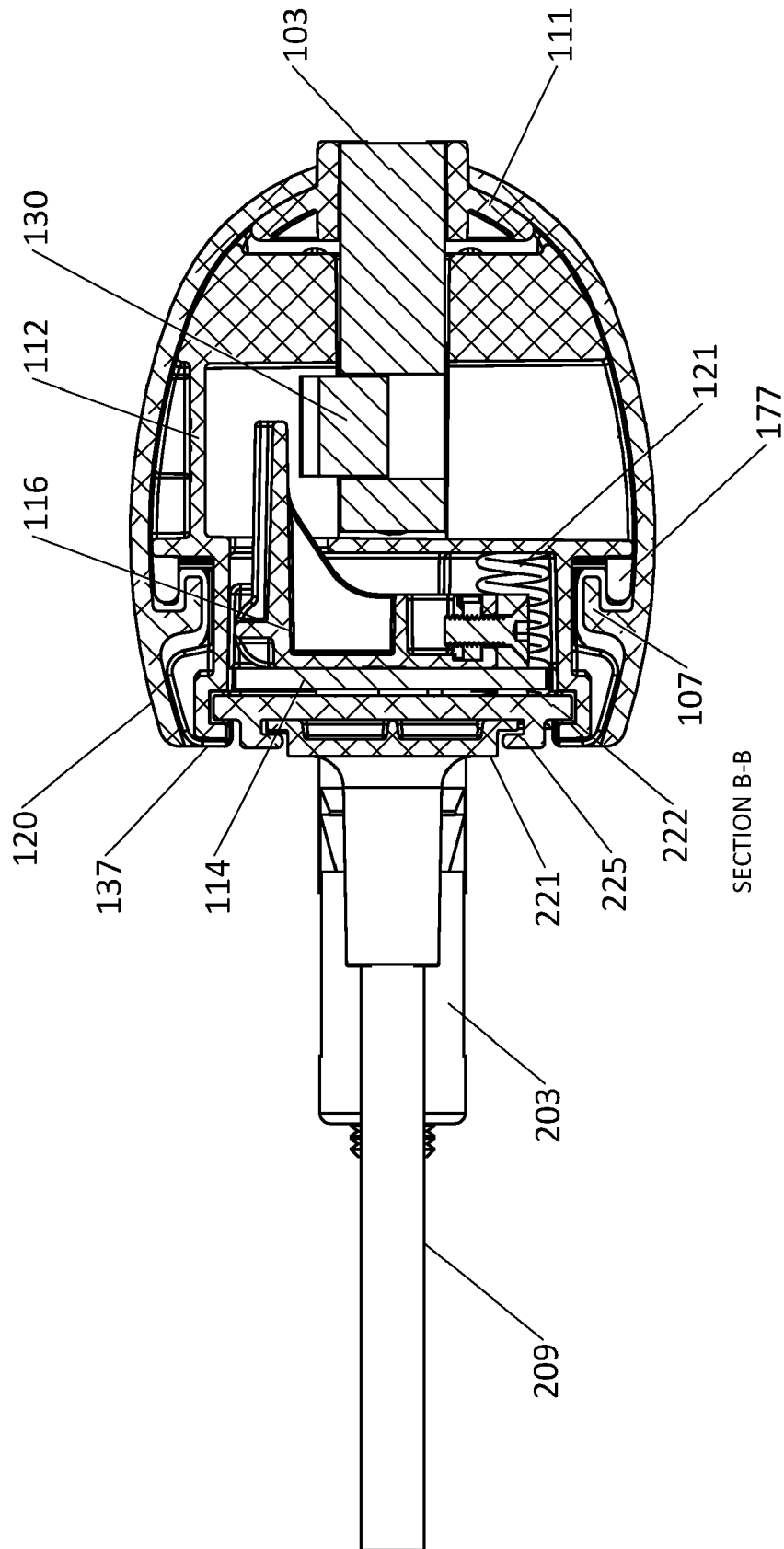


Fig. 18a

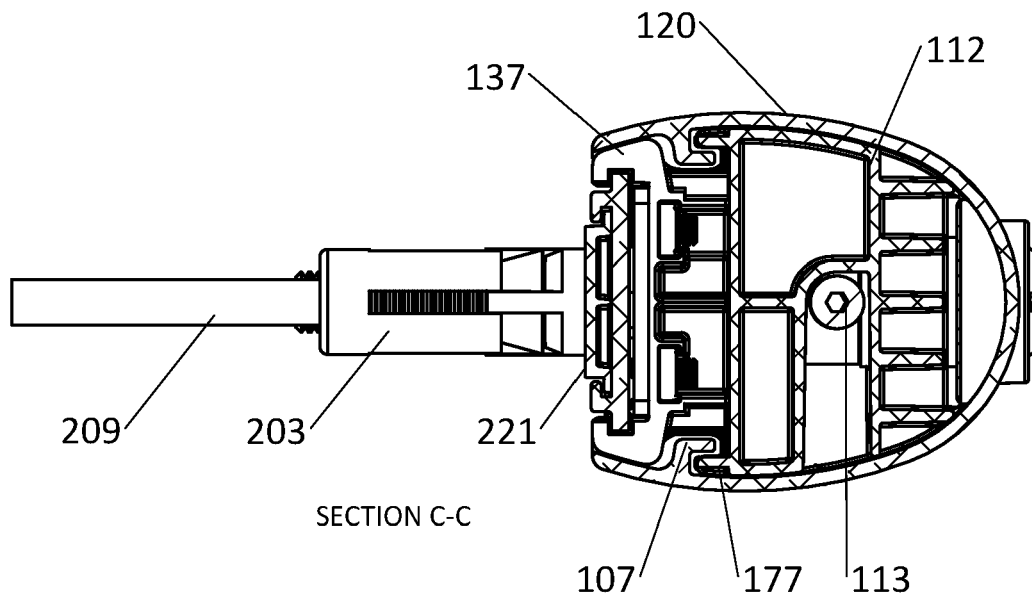


Fig. 18b

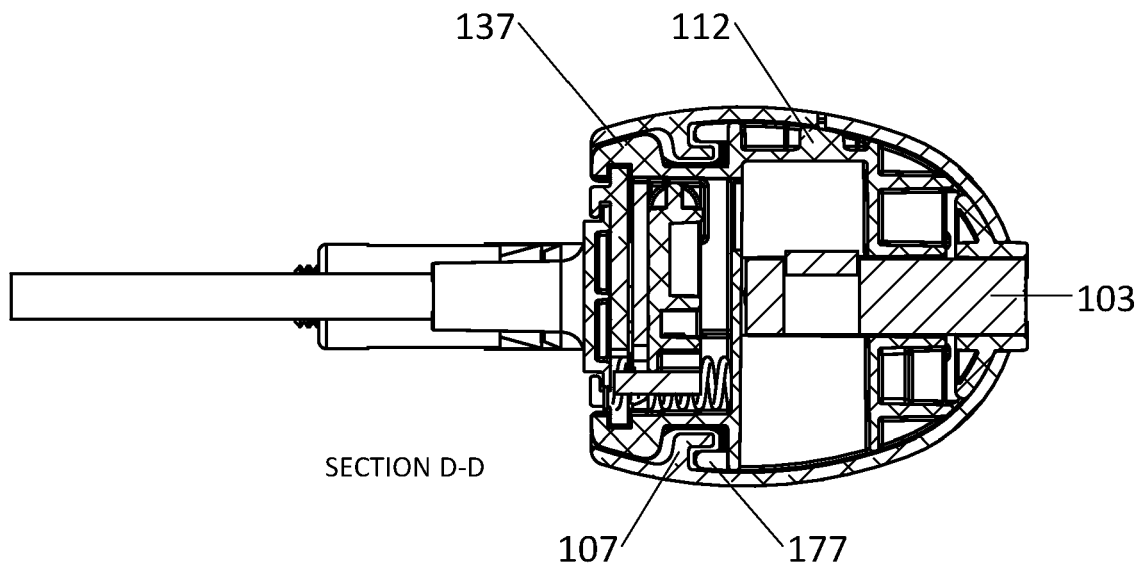


Fig. 18c

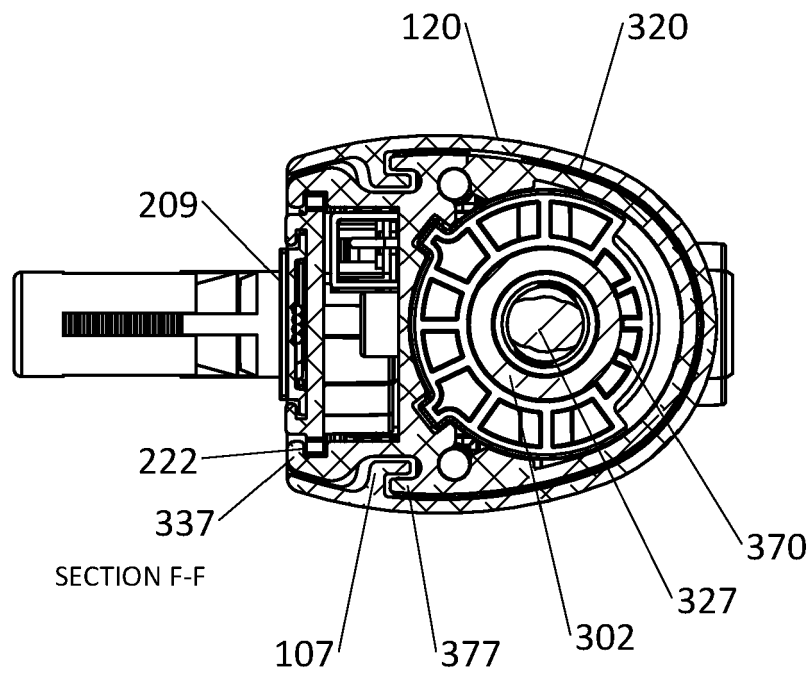


Fig. 18d

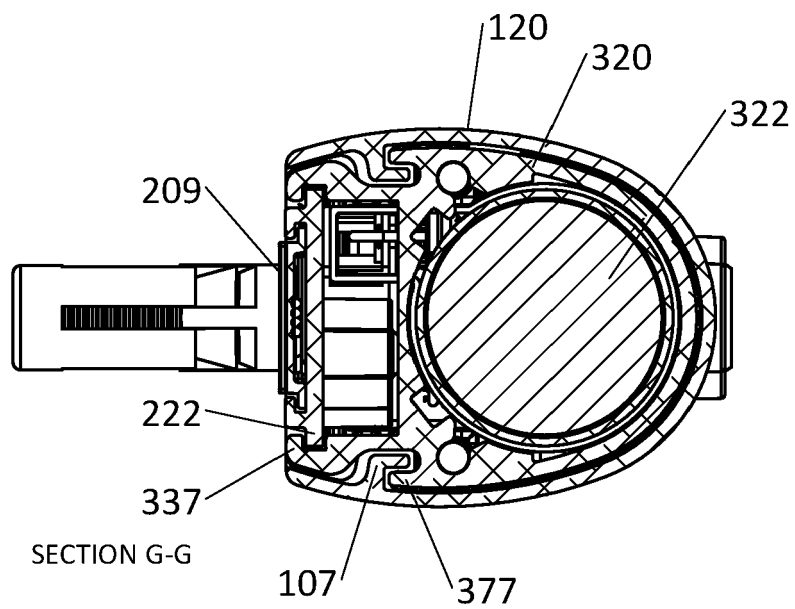


Fig. 18e

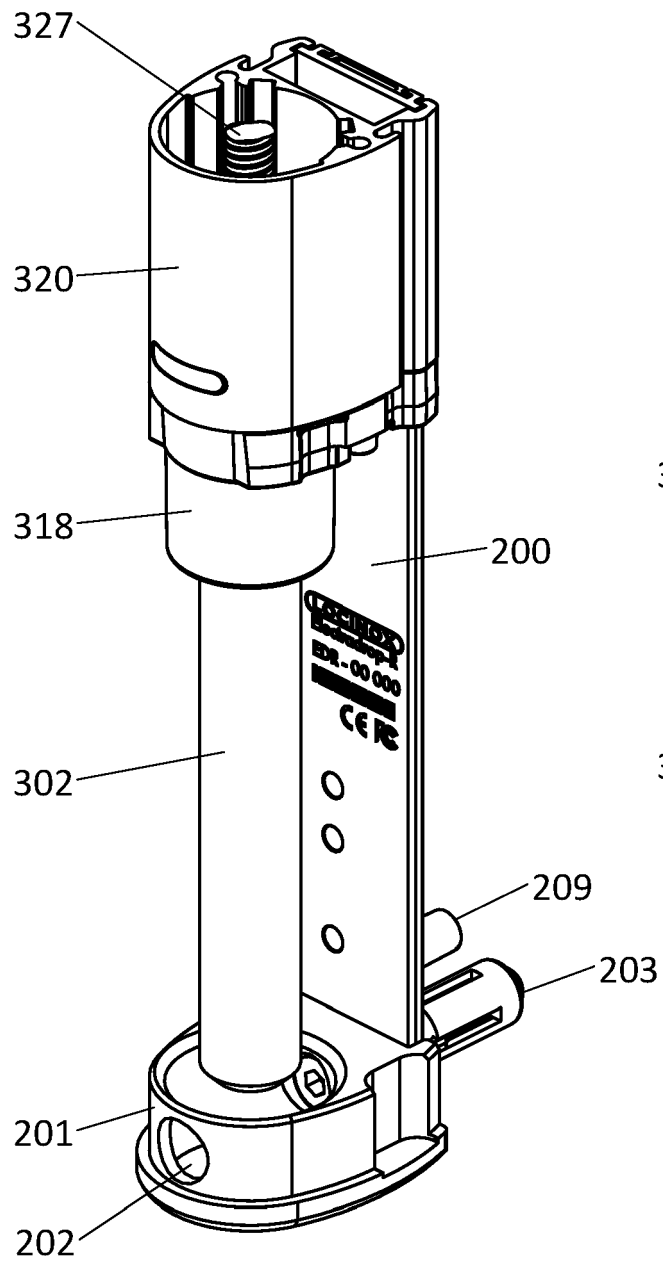


Fig. 19a

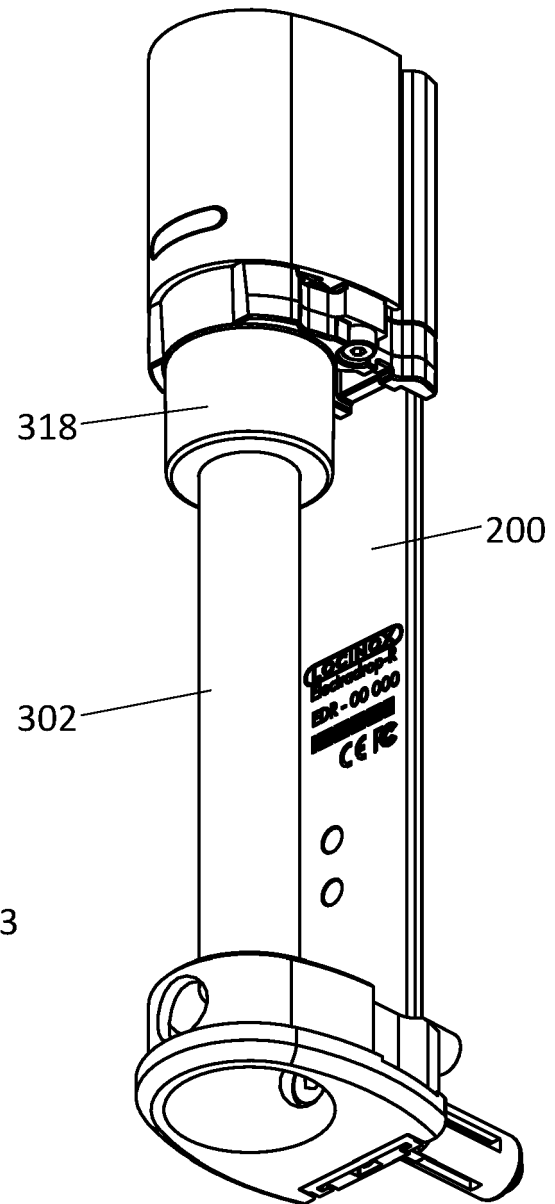


Fig. 19b



EUROPEAN SEARCH REPORT

Application Number

EP 22 19 1811

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EPO FORM 1503 03.82 (P04C01)

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A	EP 0 021 670 A1 (LYNG BJOERN [ES]; HAMRE INGUALD [ES]; DREYER NILS T [ES]) 7 January 1981 (1981-01-07) * figures 5-7 *	1	
A	DE 197 53 013 A1 (PERCIC MLADEN [DE]) 2 June 1999 (1999-06-02) * the whole document *	16	
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 March 2023	Examiner Ansel, Yannick
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-15

An electrically operable locking device configured for the locking of a gate wing comprising a shell mounted in an applied position for manual unlocking or a removed position for maintenance.

2. claim: 16

An electrically operable locking device configured for the locking of a gate wing comprising a reinforcing plate made of metal.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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