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(54) LOCKING DEVICE FOR COMPRESSED CLOSING OF A DOOR

(57) A locking device (100) for a door arrangement (200), comprising: a frame member (20) configured to be arranged to a door frame (220); a housing (10) configured to be arranged to a door (210); a cam unit (30) rotatably coupled to the housing (10) to rotate about a rotational axis (R) between a primary locking position in which the cam unit (30) is engaged with the frame member (20), and a releasing position in which it is released from the frame member (20); the cam unit (30) being rotatable to a secondary locking position between said primary locking position and said releasing position, in which position it is also engaged with the frame member (20), wherein the frame member (20) is configured to bias the cam unit (30) toward a mounting side of the frame member (20) with a greater biasing force (F) in the primary locking position than in the secondary locking position.

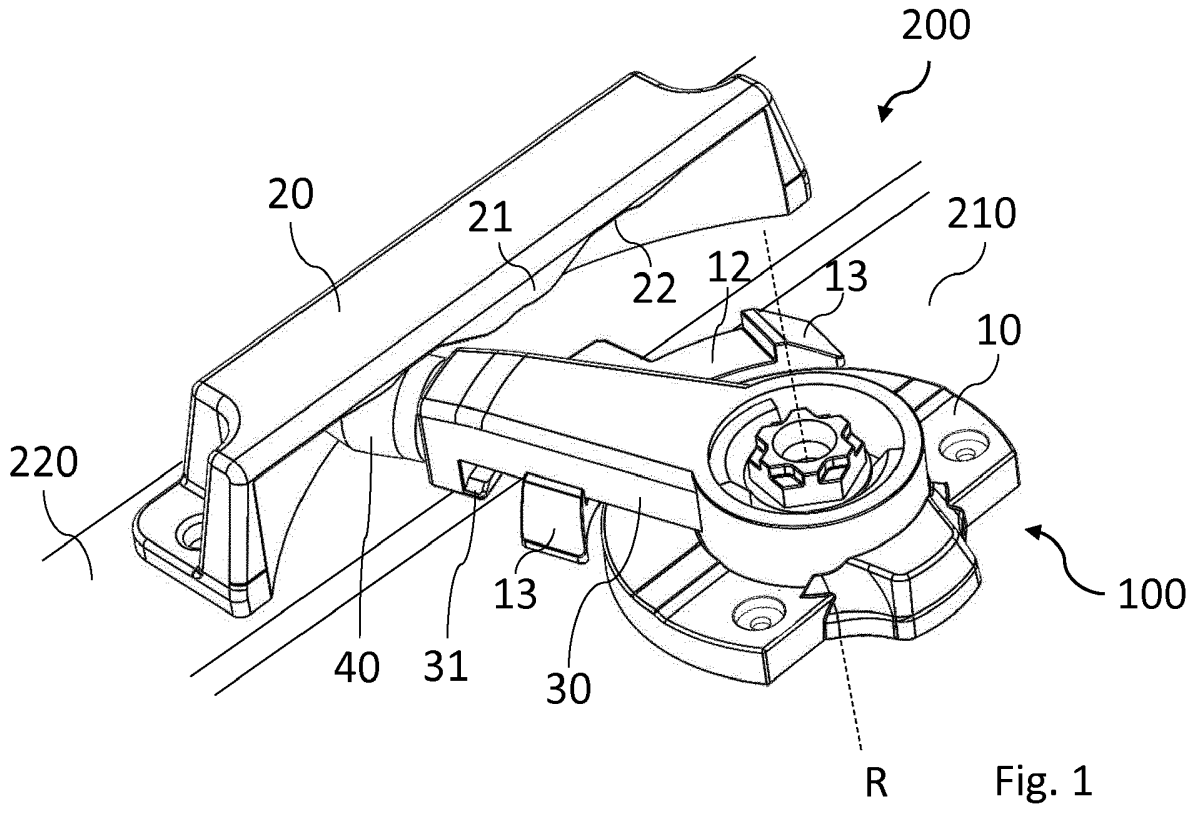

Fig. 1

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Description

Technical Field

[0001] The present disclosure relates to a locking device for arrangement to a locker, pressurized hatch or the like, and in particular to a locking device providing a safe unlocking procedure.

Background

[0002] It is known that containers filled with a pressurized medium can crack, so that the pressurized medium leaks to an exterior. This introduces a risk whenever storing such containers. In some cases, multiple containers are stored in the same place in a small compartment, such as a locker. Hence, the compartment itself may become pressurized relative the exterior of the locker. In such situations, a user may be potentially hurt when attempting to open the locker door, as there is a risk that the locker door is flung open into the user.

[0003] Additionally, pressurized hatches may also be prone to be flung open when opened due to the pressure difference between a compartment, into which the hatch opens, and the exterior of the compartment. Further, ventilation installations may also be subjected to pressure differences, for instance in case of a fire, in which case hatches may become pressurized and be flung open when opened, thereby potentially hurting a user attempting to open the hatch.

[0004] Another aspect is that the locker, the hatch or the like will be subjected to unnecessary wear and tear over time if flung open excessively. The life expectancy is thereby reduced.

[0005] In view of the above, there is a need for a solution which alleviates the above problems.

Summary

[0006] It is an object of the present invention to provide an improved solution that alleviates the problems of the prior art. Furthermore, it is an object to provide an arrangement for securing a door to a door frame.

[0007] The invention is defined by the appended independent claims, with embodiments being set forth in the appended dependent claims, in the following description and in the drawings.

[0008] According to a first aspect of the invention, a locking device for a door arrangement is provided. The locking device may comprise a frame member configured to be arranged to a door frame. The locking device may comprise a housing configured to be arranged to a door. The locking device may comprise a cam unit rotatably coupled to the housing to rotate about a rotational axis between a primary locking position in which the cam unit is engaged with the frame member, and a releasing position in which it is released from the frame member. The cam unit may also be rotatable to a secondary locking position between said primary locking position and said releasing position, in which position it may also engage with the frame member. The frame member may be configured to bias the cam unit toward the door frame when in use with a greater biasing force in the primary locking position than in the secondary locking position.

[0009] In the following, words such as the door arrangement may refer to any such arrangement that has an openable element moveable between an open and a closed state relative a frame to expose an opening therebetween. Such an openable element may for instance be a door, a locker door, a hatch, a window, or the like. Further, words such as "top" or "higher" side/surface of the locking device refers to the side/surface intended to generally face away from the door arrangement when arranged thereto. Likewise, words such as "bottom", "lower", or "mounting" side/surface of the locking device refers to the side/surface intended to generally face toward the door arrangement when arranged thereto.

[0010] A first advantage of the looking device may be sequential locking/unlocking of the locking device, in particular a two-step locking/unlocking procedure. Assuming that the locking device is arranged to a door arrangement, and that the locking device is initially securely locking the door to the door frame, the cam unit may in a first step be rotated from the primary locking position to the secondary locking position, and when it is safe to open the door, the cam unit may in a second step be rotated further from the secondary locking position to the releasing position. The biasing force may be sufficiently strong so that the cam unit is displaced transversally toward the mounting side of the frame member, thereby toward the door frame when in use, as the cam unit is rotated from the secondary locking position to the primary locking position. Consequently, the door is more tightly closed when the cam unit is in the primary locking position as compared to the case when the cam unit is in the secondary locking position. The closing of the door is thereby compressed to provide a tight sealed closing of the door.

[0011] In a preferred use of the locking device, it is configured to be arranged to a door arrangement fluidly connecting two space volumes, a first space volume and a second space volume, between which two space volumes a pressure difference may exist. The locking device may be arranged to the door arrangement on the side of the first space volume. The second space volume may have a greater pressure than the first space volume. The second space volume may have a lesser pressure than the first space volume. In either case, by rotating the cam unit from the primary locking position to the secondary locking position, the door may be slightly relieved from the tightly shut position. A gap may thus form between the door and the door frame. The gap between the door and the door frame may allow for the pressure to equalize between the first and second space volume. Hence, while the cam unit is in the secondary locking position, pressure equalization between the first and second space volumes may occur. The cam unit may be rotated further to the

releasing position when a sufficient pressure equalization has been established. This ensures that the door is not flung open, but opened in a controlled manner. Alternatively, this two-step unlocking facilitates opening of the door in the case where the pressure of the first space volume exceeds the pressure of the second space volume. The frame member may be configured to displace the cam unit away from the mounting side of the door frame, i.e. away from the door frame when in use, as the cam unit is moved from the primary locking position to the secondary locking position.

[0012] In the following, a more detailed description regarding the locking device is provided. The housing of the locking device may have a substantially flat shape. The housing may be substantially disc-shaped. It may be provided with fastening means so that it may be securely arranged to a door or the like. The fastening means may be screws configured to be placed in through holes in the housing. The housing may be provided with a flat mounting surface configured to abut the door when the housing is arranged thereto. The housing may have a flat top surface. The cam unit may move adjacently to the flat top surface as the cam unit rotates about the rotational axis. The housing may be configured so that the cam unit may rotate about 90 degrees in at least one direction from the primary locking position. The housing may be configured so that the cam unit may rotate about 90 degrees in either direction from the primary locking position. The housing may be configured so that the cam unit may rotate in at least one direction, preferably in either direction, between 0 - 100 degrees, between 0 - 110 degrees, between 0 - 120 degrees, between 0 - 130 degrees, between 0 - 150 degrees, between 0 - 170 degrees, or between 0 - 180 degrees. The housing may be designed so that it does not limit the rotation of the cam unit, thereby allowing the cam unit to rotate freely about the rotational axis.

[0013] The cam unit of the locking device may comprise a substantially elongated shape. The cam unit may be rotationally coupled to the housing in one end of the elongated shape of the cam unit. The cam unit may have a bottom side configured to face the flat top side of the housing, when rotationally coupled to the housing. The cam unit may be rotationally coupled to the housing by means of a connecting member. The cam unit may have a through-hole, through which the connecting member is placed to rotationally couple the cam unit to the housing. The connecting member may comprise a pin which has a threaded end, which end is configured to receive a screw-nut. The connecting member may comprise a screw configured to engage in a threaded hole in the housing. The connecting member may comprise a distance unit configured to press onto the cam unit, so that it is held in place. The screw or the screw-nut may be configured to tighten the distance unit to the cam unit to adjust the friction between the two. The distance unit may have a slanted surface, and the through-hole of the cam unit may have slanted inner walls corresponding to the angle of the slanted surface of the distance unit. The cam unit may have an engaging portion arranged on the opposing end of the elongated end relative the end rotationally coupled to the housing. The cam unit may comprise engaging means configured to engage with the frame member.

[0014] The frame member of the locking device may have a mounting plate configured to abut the door frame when the frame member is arranged thereto. The mounting side of the mounting plate may be substantially flat. The frame member may comprise fastening means so that it may be securely arranged to the door frame. The mounting plate may have through-holes configured to receive screws there-through for fastening the frame member to the door frame. The frame member may have a front plate transversally displaced from the mounting plate. The frame member may comprise connecting walls connecting the front plate to the mounting plate. The mounting plate, the front plate and the connecting walls may together form a receiving recess configured to receive the cam unit. When the cam unit is in either the primary or secondary locking position, it may be located in said receiving recess. The receiving recess may be formed so that it can adequately engage with the cam unit in the primary locking position, thereby impairing the movement of the cam unit thereabout. The biasing force may result from the frame member and the cam unit making contact with each other, either directly or indirectly. The biasing force may consequently impair the rotational movement of the cam unit so that its rotational movement is impaired, thereby retaining it in the primary locking position. The biasing force may be sufficiently strong so that the cam unit may be prevented from being displaced from the primary locking position by natural means, such as gravity.

[0015] According to one embodiment, the frame member may comprise a primary support portion and a secondary support portion, each support portion generally displaced transversally from a mounting side of the frame member, wherein the primary support portion is displaced transversally closer to the mounting side than the secondary support portion. The cam unit may be placed adjacent to the primary support portion when in the primary locking position. The cam unit may be placed adjacent to the secondary support portion when in the secondary locking position. The cam unit may be configured to abut the primary support portion when in the primary locking position. The cam unit may be configured to abut the secondary support portion when in the secondary locking position. Due to the primary support portion and the secondary support portion being arranged generally at different transversal distances as measured from the mounting side, wherein the primary support portion is arranged closer, the cam unit may be subjected to a greater biasing force when in the primary locking position than in the secondary locking position. The cam unit may be free from any biasing force when in the secondary position. The locking device may be arranged so that the

cam unit is subject to a biasing force from the primary support portion when in the primary locking position, but subject to a weaker biasing force or no biasing force at all from the secondary support portion when in the secondary locking position. Hence, the locking device may securely keep a door closed. The primary and secondary support portions may each be arranged to, when in use, face the door frame onto which the frame member is arranged.

[0016] According to one further embodiment, any of the primary support portion and the secondary support portion may be provided with a groove configured to receive the cam unit. The primary support portion and any secondary support portion may each be provided with a groove to receive the cam unit. Any such groove may be arranged so that a portion of the cam unit resides in said groove when in either the primary locking position or the secondary locking position. Any such groove may have an elongated cut-out portion. Any such groove may extend in parallel radially from the rotational axis of the cam unit. Any such groove may have a cut portion corresponding to the shape of the portion of the cam unit being received. Any such groove may thus facilitate retaining the cam unit in either the primary locking position or the secondary locking position. Any such groove may be sufficiently deep so that the cam unit may not be moved by means of gravity. Thereby, the cam unit may only be moved between the primary locking position and the secondary locking position by means of a user.

[0017] According to one further embodiment, receiving surfaces of the primary support portion and the secondary support portion may be smoothly interconnected. This may facilitate the cam unit to be moved between the primary locking position and the secondary locking positions.

[0018] According to one further embodiment, the cam unit may comprise an arm of which one end is rotatably coupled to the housing, and the opposite end is configured to engage with the frame member. The cam unit arm may be provided with an elongated shape. The cam unit arm may be provided with a flat top surface. The cam unit arm may be provided with a flat bottom surface. The top surface and the bottom surface of the cam unit arm may be substantially parallel. The cam unit arm may comprise engaging means configured to engage with the frame member when the cam unit is moved to either the primary or secondary locking position. The engaging means may be located at one end of the cam unit arm. By having a cam unit arm, the cam unit may more easily engage with and disengage from the frame member.

[0019] According to one further embodiment, the biasing force may be provided by a deformable member. The deformable member may store mechanic energy when being deformed from a resting position, so that it may exert the biasing force when being deformed. The deformable member may be arranged to the frame member. The deformable member may be configured to be deformed by the cam unit when the cam unit is moved to the primary locking position. The biasing force exerted by the deformable member may displace the cam unit toward the mounting side of the frame member, thereby tightly shutting the door to the door frame. The deformable member may be configured such that the biasing force resulted from the mechanic energy stored in the deformed deformable member overcomes the resulting force due to the pressure acting on the door. The cam unit may be configured to be in direct contact with the deformable member. A deformable member may be arranged to be deformed by the cam unit when the cam unit is moved to the primary locking position. Alternatively, the deformable member may be arranged to the cam unit. The primary support portion and the secondary support portion may be configured to receive the deformable member when the cam unit is rotated to either respective support portion. The groove on each respective support portion may be configured to receive the deformable member. The deformable member may be a spring, a flexible distance portion, or the like. The deformable member may thus provide a reliable way of providing the biasing force. The deformable member may be durable so that it can be deformed a plurality of times. The deformable member may be provided in a material that does not deteriorate significantly over time. Further, by having said deformable member, it may be conveniently replaced if damaged. This reduces the cost of repairing the locking device, since only a single component needs to be replaced. The deformable member may be easily accessible when the cam unit is in the releasing position, thereby removing the need to fully remove the locking device from the door arrangement if the deformable member needs to be replaced. This may thus reduce cost associated with repairing the locking device.

[0020] According to one further embodiment, the cam unit may comprise an engaging means configured to be in contact with the frame member when the cam unit is in the primary or secondary locking position. The engaging means may share similar characteristics as the deformable member. The engaging means may be a deformable member. The engaging means may be relatively stiff while being somewhat deformable. Alternatively, the engaging means is substantially stiff and/or rigid. The engaging means may have a cylindrical surface. Any of the primary or secondary support portion may be provided with a groove for receiving said engaging means. Any such groove may have a shape corresponding to the cylindrical shape of the engaging means. By having an engaging means, the cam unit may more easily engage with the frame member.

[0021] According to one further embodiment, the engaging means is a roller rotatably arranged at an end of the arm of the cam unit to rotate about a longitudinal axis of the arm of the cam unit. By having the roller, the roller may rotatably engage with and disengage from a groove in the frame member. Further, by having the roller, the cam unit may more easily be rotated between the primary locking position and the second locking position. The roll-

er may rotatably move along the receiving surfaces of the primary support portion and the secondary support portion as the cam unit rotates between the primary locking position and the secondary locking position.

[0022] According to one further embodiment, the locking device comprises retaining means configured to prevent the cam unit from being rotated from the secondary locking position to the releasing position. The retaining means may be frictional in nature. The retaining means may be geometric structures. The retaining means may be associated with either the frame member, the cam unit, or the housing. The retaining means may be protrusions. The retaining means may be arranged to the housing. The retaining members may protrude a pre-determined height from the top side of the housing. The retaining members may prevent the cam unit from rotating between the secondary locking position to the releasing position by blocking the cam unit. The retaining means may be symmetrically placed, so that the cam unit may rotate about the same angle from the primary locking position. The retaining means may be arranged to the housing so that the cam unit may rotate between 0-20 degrees from the primary locking position in at least one direction, preferably in either direction. The secondary locking position may be defined as the position where the cam unit abuts either of the retaining means. In the case where the cam unit may only rotate in one direction from the primary locking position, the locking device may comprise one such protrusion arranged so that it is placed in the way. Hence, the locking device may be configured to have one primary locking position, while having two secondary locking positions. The locking device may be configured to provide more than two secondary locking position to the cam unit, for instance 3, 4, 5, 6, 7, 8, etc. The locking device may be configured so that the cam unit is in the primary locking position extends perpendicular over an interface between the door frame and the door. The locking device may be configured so that the cam unit in the primary locking position extends perpendicular to a rotational axis of the door arrangement. Hence, the locking device may be more adept at managing forces applied to the door, thereby being able to withstand forces of greater magnitude.

[0023] According to one further embodiment, the retaining means may be arranged on a flexible portion of the housing, which flexible portion may be displaceable in a direction perpendicular to a rotational plane of the cam unit to such a degree that the retaining means are displaced so that it no longer prevents the cam unit from being rotated between the secondary locking position and the releasing position. The flexible portion may be two, arranged symmetrically about the rotational axis. The flexible portions may be curved. By having the retaining means arranged on flexible portions, the retaining means may be displaced so that the cam unit may freely rotate between the secondary locking position and the releasing position. The retaining means may be exposed to an exterior of the housing so that a user may readily interact with said retaining means and simply push them away so that the cam unit may rotate between the secondary locking position and the releasing position.

[0024] According to one further embodiment, the retaining means may be provided with a slanted top surface. The retaining means may be ramp-like in shape, with the sharp walls facing towards the in-between region in which the cam unit would reside in a locking position. By having these ram-like retaining means, the cam unit may more easily be rotated there-in-between when being rotated from the releasing position to one of the locking positions.

[0025] According to one further embodiment, the cam unit may comprise a support latch configured to engage with the housing when the cam unit is in the primary locking position. The support latch may be hook shaped, e. g. by protruding in a first direction out from cam unit, and then in a direction perpendicular to the first direction, thereby forming a gap between the support latch and a main body of the cam unit. The gap may be sufficiently wide to receive a protruding end portion of the housing. The support latch may thus provide means to prevent the cam unit from being bent away from the housing. For instance, the support latch protects the cam unit when a user attempts to close a door when the cam unit is not in a releasing position. As a result, the locking device may be more durable.

[0026] According to one further embodiment, the locking device may comprise a handle coupled to the cam unit. The handle may be arranged to the connecting member. The handle may be arranged on the top side of the housing. Alternatively, the handle may be configured to be arranged on an opposite side of a door as the cam unit. In such a case, the connecting member may be configured to extend through the door to expose an end to which the handle may be securely arranged. By having the handle, the cam unit may be more easily operated to rotate about the rotational axis, between the primary locking position, the secondary locking position, and the releasing position.

[0027] According to one embodiment, the locking device may further be arranged so that the cam unit is displaceable along the rotational axis relative the housing. By having the cam unit being displaceable along the rotational axis, an alternate means of moving the cam unit passed the retaining means is provided. Releasing means may be coupled to the cam unit so that when the releasing means are being activated, the cam unit is displaced. The flat top surface may be provided with at least one slanted ridge, so that when the cam unit moves along the flat top surface, it will be slightly displaced along the rotational axis when making contact with said at least one slanted ridge. This may facilitate the cam unit to move passed the retaining means, either from the releasing position to the secondary locking position, in the opposite direction, or in either direction. The slanted ridge may be correspondingly arranged to the housing relative the retaining means to facilitate the cam unit to be displaced

as previously explained.

[0028] According to one further embodiment, the releasing means may be coupled to the retaining means. Hence, when the releasing means are being activated, the retaining means may be moved out of the way so that the cam unit may rotate further between the secondary locking position and the releasing position.

[0029] According to one further embodiment, the housing may comprise a support body which, when the locking device is arranged to a door arrangement, resides between the frame member and the door. The support body may extend the flat top surface so that it extends along a portion of the cam unit when being in the primary locking position. The support body may provide a larger supporting interface between the cam unit and the housing. This may ensure that the housing presses onto the cam unit not only at one end of the cam unit but along a larger portion of the cam unit, preferably along a majority of the portion of the cam unit when in the primary and/or secondary locking position. This may distribute forces between the cam unit and the housing more effectively. By having this support body, excessive bending of the cam unit may be prevented. For instance, if the pressure in the second space volume is greater than the pressure in the first space volume, the door will be pushed away from the door frame. However, the support body may distribute this pushing force along a greater portion of the cam unit more evenly, thereby reducing that the cam unit breaks.

[0030] According to a further aspect of the present invention, a handle arrangement for arrangement to a door arrangement is provided. The handle arrangement comprises a locking device in accordance with any of the previous embodiments, and a handle coupled to the cam unit for operatively rotating the cam unit between the primary locking position, the secondary locking position, and the releasing position.

[0031] According to one further aspect of the invention, a locker is provided. The locker comprises a locker frame, and a locker door rotatably coupled to the locker frame, and a locking device according to any above embodiments is arranged so that the frame member is arranged to the locker frame and the housing is arranged to the locker door, so that the locker door may be fully secured to the locker frame when the cam unit is in the primary locking position.

Brief Description of the Drawings

[0032] The invention will in the following be described in more detail with reference to the enclosed drawings, wherein:

Fig. 1 shows a perspective view of the locking device when arranged to a door arrangement, according to one embodiment of the invention;

Fig. 2 shows a schematic view of the frame member according to one embodiment of the invention;

Fig. 3 shows a perspective view of the cam unit and the housing according to one embodiment of the invention;

Fig. 4 shows a perspective view of the cam unit and the housing according to one embodiment of the invention;

Fig. 5 shows a perspective view of the cam unit, the housing and the frame member according to one embodiment of the invention;

Fig. 6 shows a perspective view of the cam unit, the housing and a handle according to one embodiment of the invention;

Fig. 7 shows a perspective view of the locking device according to one embodiment of the invention;

Fig. 8a shows a perspective view of the locking device when the cam unit is in a locking position, according to one embodiment of the invention;

Fig. 8b shows a perspective view of the locking device when the cam unit is in a releasing position, according to one embodiment of the invention.

Description of Embodiments

[0033] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements.

[0034] Fig. 1 shows a perspective view of the locking device 100 when arranged to a door arrangement 200. The locking device 100 comprises a housing 10, a cam unit 30, and a frame member 20. The housing 10 comprises a flat, disc-shaped portion. When the housing is arranged to a door, a bottom side of the flat, disc-shaped portion abuts the door 210. The top side of the flat, disc-shaped portion faces away from the door, when the housing 10 is arranged to the door 210. The frame member 20 is configured to be arranged to the door frame 220, so that a gap is formed between the frame member 20 and the door frame 220.

[0035] The cam unit 30 comprises an elongated shape, an arm, wherein one end of the arm is provided with a through-hole. A connecting member 15 is inserted in said through-hole to rotatably couple the cam unit 30 to the housing 10. The cam unit 30 is rotatably coupled to the housing 10 to rotate about a rotational axis R. The cam unit 30 is configured to rotate between a releasing position in which it is released from the frame member 20, and a primary locking position in which it engages with the frame member 20. The cam unit 30 is also rotatable into a secondary locking position between the primary locking position and the releasing position. As can be seen in Figs. 1 and 2, there are two secondary locking position, one along each rotational direction of the cam

unit from the primary locking position. As the cam unit rotates between the primary locking position to a releasing position, in either direction, the cam unit 30 moves along the flat top surface of the housing 10 towards one of the secondary locking positions. The cam unit 30 comprises a roller 40 configured to be subjected to a biasing force F from the frame member when the cam unit 30 is moved to the primary locking position. When the cam unit 30 engages with the frame member 20 in the primary locking position, the roller 40 is placed in the frame member gap.

[0036] The frame member 20 comprises a primary support portion 21 and two secondary support portions 22, as shown in Fig. 2. Each of the primary support portion 21 and the secondary support portions 22 are arranged in the frame member gap. The primary support portion 21 and the secondary support portions 22 extend from one side of the gap towards the other, towards a mounting plane M of the frame member 20, which mounting plane M coincides with the mounting side of the frame member intended to abut the door frame 220 when the frame member 20 is arranged thereto. In other words, the primary support portion 21 and the secondary support portions 22 are generally displaced transversally from the mounting plane, wherein the primary support portion 21 is arranged closer to the mounting plane than the secondary support portions 22. Each support portions are configured to receive the roller 40 along a continuous receiving surface. The cam unit 30 is rotatable in a locking position between a primary locking position P, in which the roller 40 is placed adjacent to the primary support portion 21, and secondary locking positions I, in which the roller 40 is placed adjacent to either secondary support portions 22. Due to the offset between the primary support portion 21 and the secondary support portions 22, the roller 40 (indicated by dashed lines) is displaced when the cam unit 30 is in the primary locking position P, thereby subjected to a biasing force F between the cam unit 30 and the primary support portion 21. As a consequence, the movement of the cam unit 30 is impaired thereabout the primary locking position P. Further, the primary support portion 21, and each secondary support portion 22, are provided with a groove for receiving the roller 40. The groove provides that a force needs to be applied on the cam unit 30 in direction to move the cam unit 30 towards or from the secondary locking position, in order to move the roller 40 passed the shoulder next to the groove.

[0037] Further, as shown in Fig. 3, the housing 10 comprises a support body 11 extending in a radial direction from the flat, disc-shaped portion of the housing 10. The support body 11 comprises two flexible portions 12 extending away from the support body 11 from opposite sides. The flexible portions 12 are curved so as to form arcs extending along the circumference of a circle with its origin coinciding with the rotational axis R. The flexible portions 12 are also provided with flat surfaces, which flat surfaces are extensions of the flat top surface of the housing 10. On top of each flexible portion, at each respective end of the flexible portions 12, retaining means 13 are arranged. The retaining means 13 protrude out of each flexible portion 12 on the same side as the flat top surface of the housing 10. The retaining means 13 have a ramp-like structure, whereby the height of each retaining means 13 decreases continuously towards the end of each flexible portion 12. The retaining means 13 define a region between the two in which the cam unit may rotate about the rotational axis R. When the cam unit 30 is in the secondary locking position I, the cam unit 30 is placed adjacent to the retaining means 13, thereby being prevented from being rotated beyond these retaining means 13. The cam unit 30 may be rotated passed the retaining means when the retaining means have been pushed toward the door, for instance by a user.

[0038] Fig. 4 shows yet another perspective view of the cam unit 30 and the housing 10. As can be seen in Fig. 4, the cam unit 30 comprises a support latch 31. The support latch 31 is configured to engage with the support body 11 when the cam unit 30 is in the primary locking position P. The support latch 31 protrudes in a first direction out from cam unit 30, and then in a direction perpendicular to the first direction, so that a gap is formed between the support latch 31 and a main body of the cam unit 30. The width of the gap corresponds to the thickness of a protruding portion of the support body 11. When the cam unit 30 is in the primary locking position, the protruding portion of the support body 11 is received in the gap between the support latch 31 and the main body of the cam unit 30. The support latch 31 thereby reduces the risk of the cam unit 30 from being bent, for instance in the case where one attempts to shut the door arrangement 200 when the cam unit 30 is not in a releasing position, as shown in Fig. 5. In another embodiment, the support body 11 may be shaped to engage with the support latch 31 also when the cam unit 30 is in the secondary locking position, and/or the releasing position.

[0039] A handle 50 may be coupled to the cam unit 30. In one embodiment, the handle 50 is arranged to the connecting member 15, as is shown in Fig. 6. Hence, by rotating the handle 50, the cam unit 30 is rotated by the same angle. The handle 50 is in one embodiment configured to be arranged to the locking device 100 on the same side as the cam unit 30 is arranged. In an alternate embodiment, the handle 50 is configured to be arranged on an opposite side of a door 210. Alternatively, the locking device 100 is provided with means for fastening the handle on an opposite side of the door as the cam unit, as shown in Figs. 7, 8a, 8b. In such a case, the connecting member 15 extends through the door 210 to expose an end to which the handle may be securely arranged. By having the handle 50 being operable on an opposite site, the locking device 100 may be arranged to an inside of the door arrangement. The handle 50 may thus be operated to rotate the cam unit 30 between the primary locking position P as shown in Fig. 8a to the releasing position shown in Fig. 8b. While Figs. 8a and 8b illustrate

the functionality of the alternate embodiment where the handle 50 is configured to be arranged on an opposite side of a door 210, the embodiment where the handle is configured to be arranged on the same side as the housing may work similarly. The mobility and functionality of the cam unit 30 is not dependent on which side the handle 50 is configured to be arranged.

[0040] What has been said above and illustrated in the drawings regarding the two secondary support portions 22 of the frame member 20 and the cam unit's 30 engagement therewith in either of the two described secondary locking positions is equally applicable to an embodiment wherein the frame member 20 only provides one secondary support portion 22 and thereby enables one secondary locking position for the cam unit 30.

[0041] In the drawings and specification, there have been disclosed preferred embodiments and examples of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation, the scope of the invention being set forth in the following claims.

Claims

1. A locking device (100) for a door arrangement (200), comprising:

   a frame member (20) configured to be arranged to a door frame (220);
   a housing (10) configured to be arranged to a door (210);
   a cam unit (30) rotatably coupled to the housing (10) to rotate about a rotational axis (R) between a primary locking position in which the cam unit (30) is engaged with the frame member (20), and a releasing position in which it is released from the frame member (20);
   the cam unit (30) being rotatable to a secondary locking position between said primary locking position and said releasing position, in which position it is also engaged with the frame member (20),
   wherein the frame member (20) is configured to bias the cam unit (30) toward the door frame when in use with a greater biasing force (F) in the primary locking position than in the secondary locking position.

2. The locking device according to any of claims 1, wherein the frame member (20) comprises a primary support portion (21) and a secondary support portion (22), each support portion (21, 22) generally displaced transversally from the mounting side of the frame member (20), wherein the primary support portion (21) is displaced transversally closer to the mounting side than the secondary support portion (22).

3. The locking device according to claim 2, wherein any of the primary support portion (21) and the secondary support portion (22) is provided with a groove configured to receive the cam unit (30).

4. The locking device according to any of claims 2 - 3, wherein the receiving surfaces of the primary support portion (21) and the secondary support portion (22) are smoothly interconnected.

5. The locking device according to any preceding claims, wherein the cam unit (30) comprises an arm of which one end is rotatably coupled to the housing (10), and the opposite end is configured to engage with the frame member (20).

6. The locking device according to any of preceding claims, wherein the cam unit (30) comprises an engaging means (40) configured to be in contact with the frame member when the cam unit (30) is in the primary or secondary locking position.

7. The locking device according to claim 6, when dependent on claims 5, wherein the engaging means is a roller (40) rotatably arranged at an end of the arm of the cam unit (30) to rotate about a longitudinal axis (L) of the arm of the cam unit (30).

8. The locking device according to any of preceding claims, wherein the locking device comprises retaining means (13) configured to prevent the cam unit (30) from being rotated from the secondary locking position to the releasing position.

9. The locking device according to claim 8, wherein the retaining means (13) are arranged on a flexible portion (12) of the housing (10), which flexible portion is displaceable in a direction perpendicular to a rotational plane of the cam unit to such a degree that the retaining means (13) is displaced so that it no longer prevents the cam unit (30) from being rotated between the secondary locking position and the releasing position.

10. The locking device according to claim 9, wherein a retaining means (13) is provided with a slanted top surface.

11. The locking device according to any preceding claims, wherein the cam unit (30) comprises a support latch (31) configured to engage with the housing (10) when the cam unit (30) is in the primary locking position.

12. The locking device according to claim 12, when dependent on claim 5, wherein the support latch (31) is arranged on the arm of the cam unit (30).

13. The locking device according to any preceding claims, wherein the housing (10) comprises a support body (11) which, when the locking device (100) is arranged to a door arrangement (200), resides between the frame member (20) and the door (210).

14. The locking device according to any preceding claims, comprising a handle (50) coupled to the cam unit (30).

15. A locker (200) comprising a locker frame (220), and a locker door (210) rotatably coupled to the locker frame (220), and a locking device (100) according to any preceding claims arranged so that the frame member (20) is arranged to the locker frame and the housing (10) is arranged to the locker door (210), so that the locker door (210) may be fully secured to the locker frame (220) when the cam unit (30) is in the primary locking position.

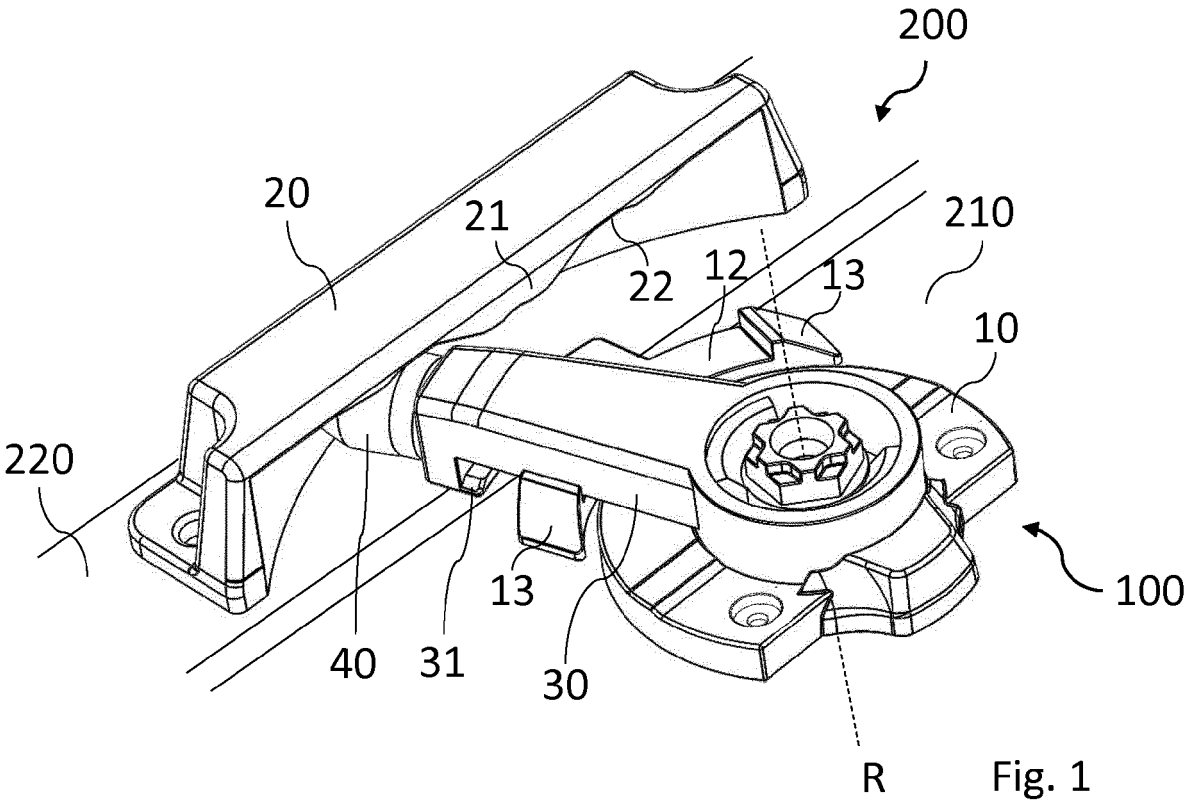


Fig. 1

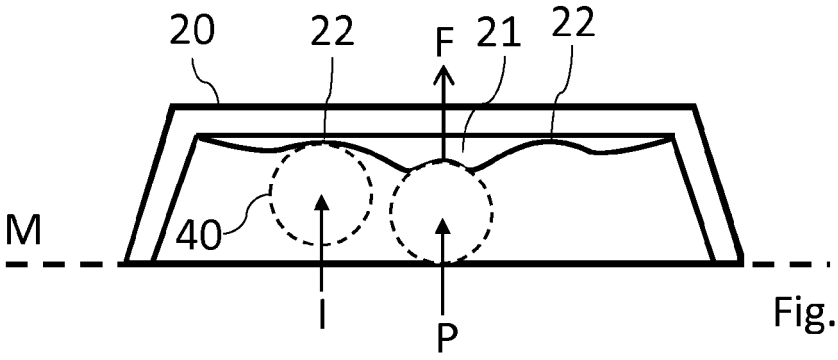


Fig. 2

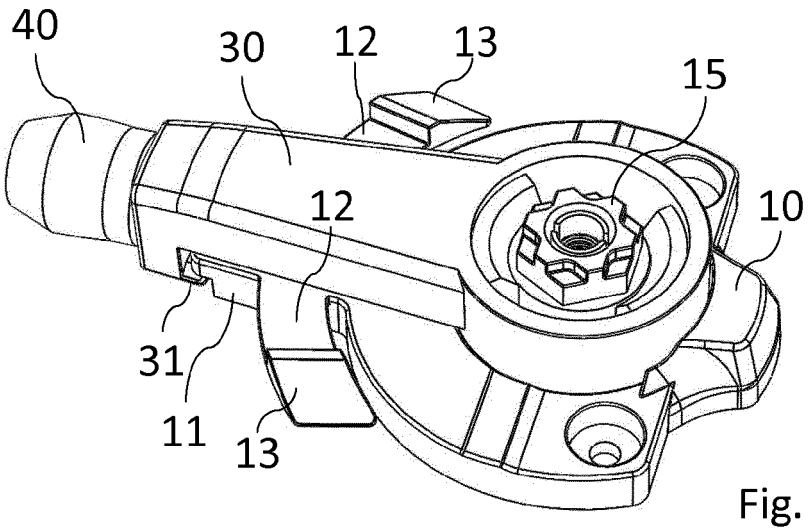


Fig. 3

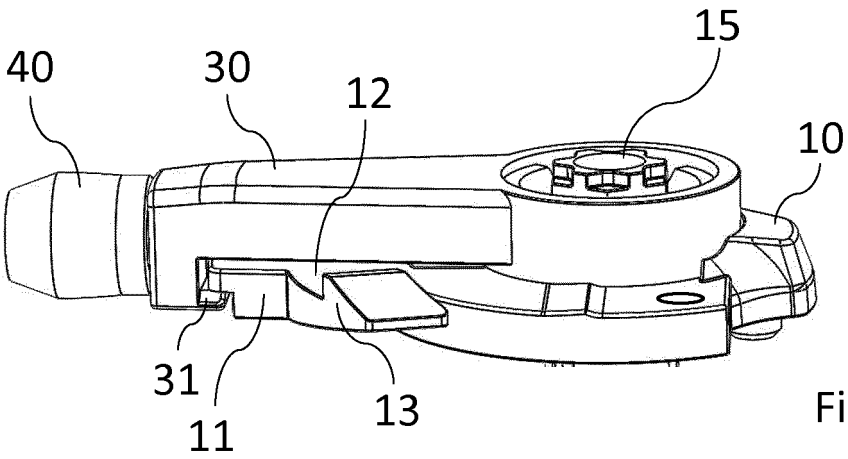


Fig. 4

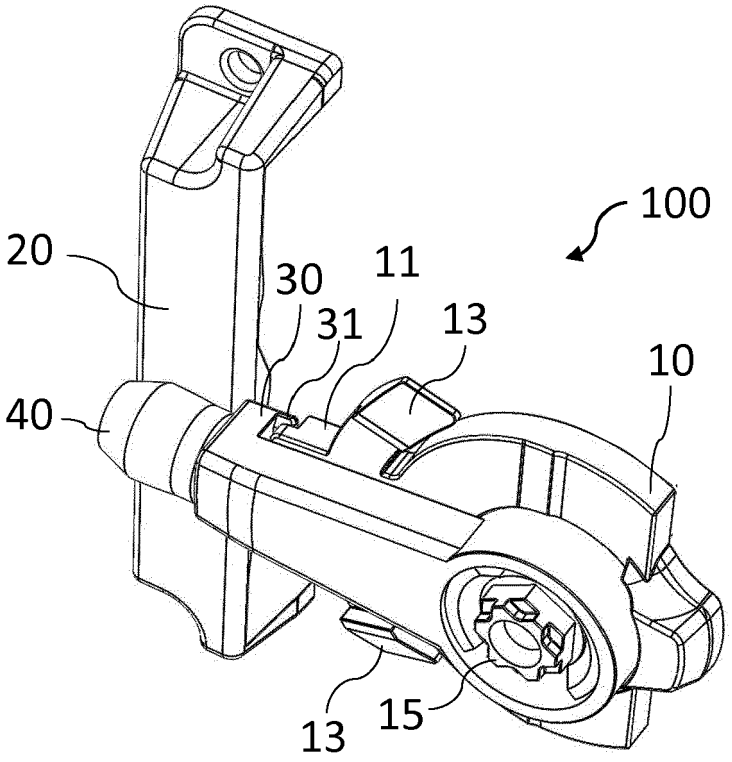


Fig. 5

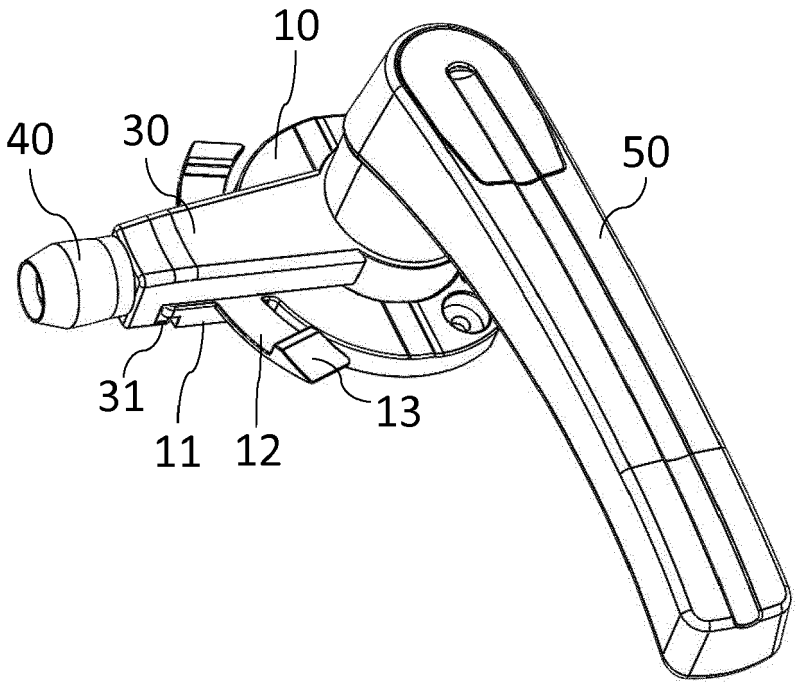


Fig. 6

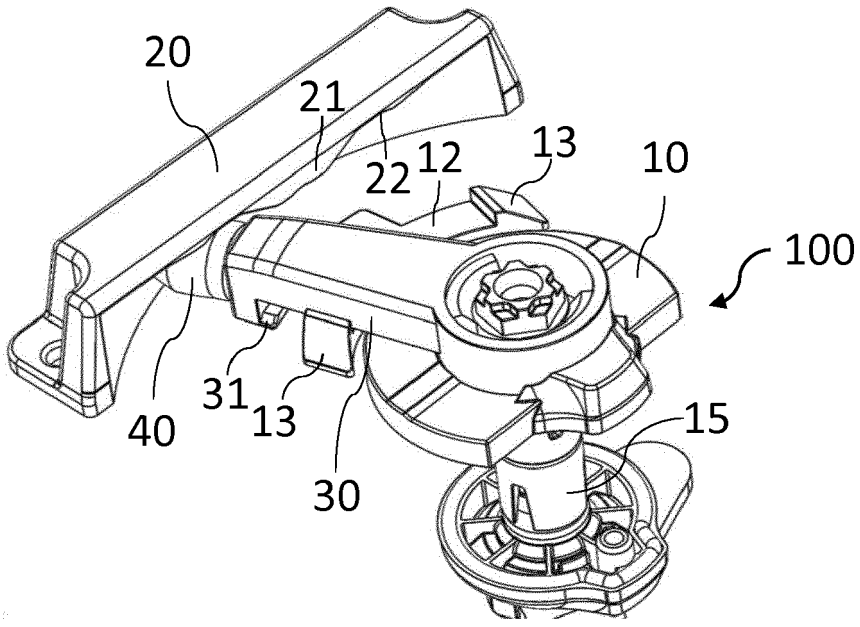
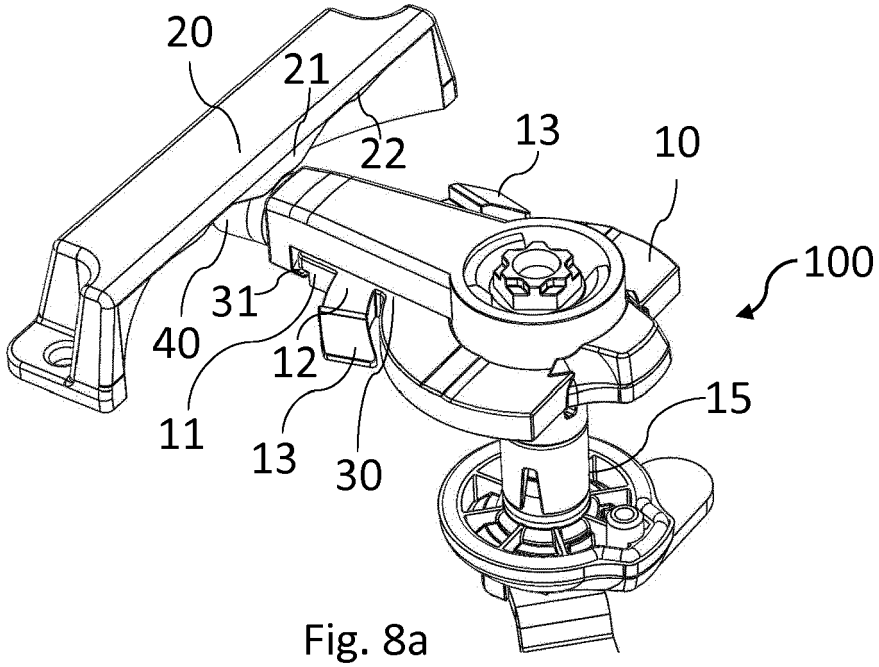


Fig. 7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21
22
13
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100
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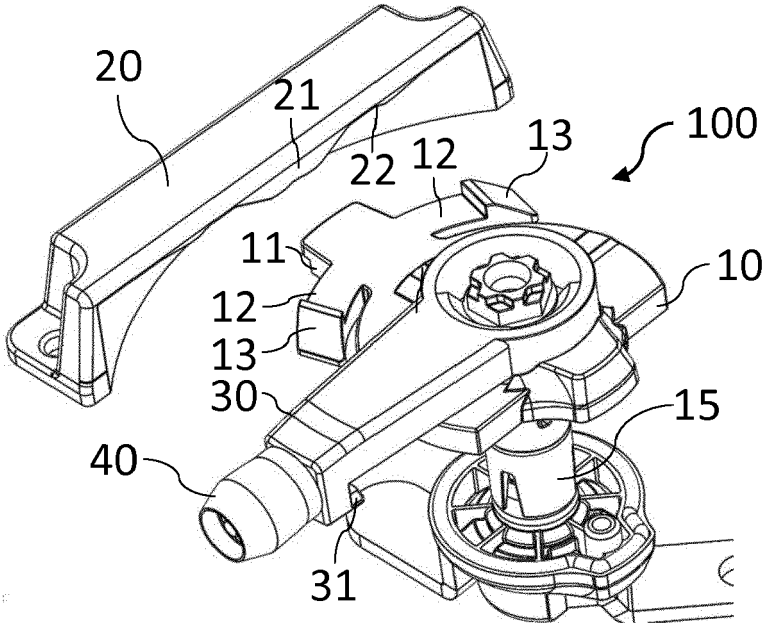
Fig. 8a


20
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12
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100
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13
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40
31

Fig. 8b

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 6914

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