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(54) **LAUNDRY DRYING MACHINE**

(57) A laundry drying machine (1) comprising a cabinet (2) housing a chamber (3) for treating laundry having a rotation axis (RR), a porthole (8, 108) for providing access to and tightly closing the chamber (3), a hinge (11) to pivot the porthole (8, 108) to the cabinet (2), a lock (12) of a kind that allows opening of the porthole during operation of the laundry drying machine, the lock (12) comprising a first member (13, 113) on the porthole (8, 108) and a matching member (14) on the cabinet (2), and a grip-only handle (15, 15a, 15b, 15c, 115), wherein said porthole (8) comprises a frame assembly comprising at least one frame (30, 30a, 31, 130, 131), wherein said lock (12) is configured to be released by applying a force beyond a threshold onto the porthole (8) away from the cabinet (2), and wherein said grip-only handle (15, 15a, 15b, 15c, 115) and said first member (13, 113) of said lock (12) are arranged in such a way that, when the porthole (8, 108) is closed, the center of mass (C15, C15a, C15b, C15c, C115) of said grip-only handle (15, 15a, 15b, 15c, 115) and the center of mass (C12, C112) of said first member (13, 113) of said lock (12) are located, with respect to the rotation axis (RR), at different angular positions.

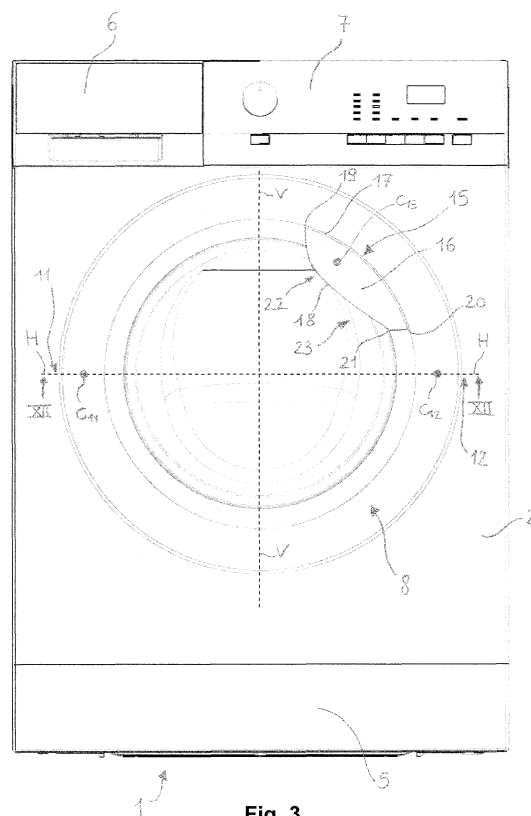


Fig. 3

Description

[0001] The present invention relates to a laundry dryer machine (also called a dryer) for drying laundry.

[0002] A laundry drying machine is a laundry treatment machine which can dry goods or laundry. Other known laundry treatment machines -to which the present invention is not directed- include laundry washing machines (or simply washing machines) and laundry washing-drying machines (or simply washer/dryers).

[0003] A laundry treatment machine typically includes a cabinet wherein the processing chamber for housing the laundry to be treated is housed, and a door or porthole for providing access to and tightly closing the chamber. In the case of a washing machine or a washer/dryer, the chamber is usually a drum, rotatably mounted within a washing tub. In the case of a dryer, the chamber is usually a rotatable drum, there being air circulation ducts, a heater, and a blower for circulating heated air in the ducts and in the chamber.

[0004] A kind of porthole for laundry treatment machines which is of interest herein comprises a frame assembly that comprises at least one frame. The frame assembly usually further comprises a bowl. Sometimes, the frame assembly comprises an outer frame, an inner frame, and a bowl sandwiched between the outer and inner frames. In the case of a circular porthole, the inner and outer frames are generally annular.

[0005] As used in the present description and in the attached claims, terms "outer" and "inner", and "outwards" and "inwards" refer to the cabinet or the laundry treatment machine, and in the closed condition as far as the porthole is concerned.

[0006] Terms "radial", "radially inner", "radially inwards", "radially outer" and "radially outwards" refer to the axis of rotation of the processing chamber, when the porthole is closed.

[0007] The bowl is generally cup-shaped, having a flange retained between the frames, and protruding towards the inner of the laundry machine. An essentially disc shaped cap, e.g. made of transparent or non-transparent plastics, and/or a finishing rim may also be provided.

[0008] The porthole is typically hinged to the cabinet, so as to rotate (usually about a vertical axis), the hinge being usually arranged across a horizontal centerline or median plane of the porthole.

[0009] The porthole usually has a handle to be gripped by a user.

[0010] The porthole usually has a lock.

[0011] In a washing machine or a washer dryer, in order to avoid leakage of water and the correlated dangers of short circuit and electric shock, the lock is an electromechanical lock, namely a lock that is configured to avoid opening of the porthole during operation of the machine; and to possibly avoid operation of the machine with the porthole open, by issuing a consent signal to an electronic control unit of the machine only when the porthole is

closed and/or to delay opening of the porthole after the end of an operation cycle.

[0012] As opposed thereto, in a dryer the lock is of a kind that allows opening of the porthole during operation of the machine, i.e. during a laundry drying operation cycle. A sensor of the open/closed state of the porthole may be provided-externally of or embedded within the lock - to issue a state signal to an electronic control unit of the dryer, which in turn may at least stop the rotation of the drum once the porthole is sensed to be opened.

[0013] There are two major classes of door (or porthole) opening systems. In a first class, the porthole is provided with a hook that is moved by pivoting the handle with respect to the porthole, and the cabinet is provided with an opening that is engaged by the hook on the porthole in a closed condition, not engaged in an open or released condition. In other cases, the porthole is provided with a latch, and the cabinet is provided with a push button or similar manual control provided on a user interface to operate a mechanism, mounted within the cabinet, that engages/disengages the latch. The portholes of this type suffer from the important drawback that they cannot be opened from inside the processing chamber (for example by a child who has entered the chamber and has closed the door), since their opening requires pivoting the handle or acting on a manual control provided in a user interface which can be clearly made only from outside the processing chamber.

[0014] US 2011/0023316 A1, and similarly US 2011/0023561 A1, discloses a household appliance comprising: a housing having an opening for accessing an interior of the housing; a tub disposed inside the housing, the tub having a rotating drum therein for receiving laundry through the opening; and a door assembly having a see-through portion for viewing into the tub, the door assembly being pivotably coupled to the housing and movable between an open position for accessing the opening of the housing and a closed position for closing the opening of the housing, wherein the door assembly includes: a door frame; and a front ring coupled directly or indirectly to the door frame, wherein the front ring includes a front face having an outside edge and an inside edge, wherein the inside edge defines an opening in the front face that substantially corresponds to the see-through portion of the door; and a recessed rear face on an opposite side of the front ring from the front face, wherein the recessed rear face includes a handle portion extending around at least a portion of the front ring. The handle portion extends around at least a 180° portion of the front ring, and is centered about a door hook.

[0015] In the second class of door opening systems, to which the invention is directed, and which may be named "pull-to-open type" door opening system, the porthole is provided with a latch, and the cabinet is provided with a latch retaining mechanism that includes a mobile part which is configured to be movable between a retaining position, in which it engages the latch so as to retain the porthole in a closed condition, and an opening posi-

tion in which it releases the latch so as to allow the opening of the porthole. The mobile part of the latch retaining mechanism typically interacts with an elastic element, for example a spring, which allows the releasing of the latch when a releasing force is applied which is greater than a threshold force. The porthole is therefore opened by pulling it outwards with enough force, and can also be opened by pushing it from the inside of the drum, e.g. by a caught child.

[0016] Alternatively, the latch may be provided in the cabinet and the pull-to-open type latch retaining mechanism may be provided in the porthole.

[0017] Generally, in such second class of door opening systems, latch and latch retaining mechanism are not provided with electric parts or electric connections that interact with the mechanical arrangements of the latch and/or latch retaining mechanism to promote and/or prevent the door opening/closing. Electric/electronic arrangements, however, may be provided in the latch and/or latch retaining mechanism to sense the opened/closed status of the porthole.

[0018] In the case of this second class, the handle of the porthole has only the function of providing a grip to the user, it is fixed to the porthole, usually to the outer frame of the porthole, and it is typically symmetrical with respect to the latch.

[0019] The object of the invention is to improve a grip-only handle of a porthole of a laundry drying machine having a pull-to-open door opening system.

[0020] Applicant found that the above object is achieved by arranging the lock and the grip-only handle at different positions with respect to at least a door frame to which a bowl of the door is secured.

[0021] European application number 13182529.1, still unpublished at the filing date/priority date of the present application, discloses a laundry machine comprising a cabinet housing a chamber for treating laundry having a rotation axis, a porthole for providing access to and tightly closing the chamber, a hinge to pivot the porthole to the cabinet, an electromechanical lock comprising a first member on the porthole and a matching member on the cabinet, and a grip-only handle, wherein said porthole comprises at least one frame and a glass secured to the at least one frame, wherein said electromechanical lock is configured to be released by applying a force beyond a threshold onto the porthole away from the cabinet, and wherein said grip-only handle and said first member of said electromechanical lock are arranged in such a way that, when the porthole is closed, a center of mass of said grip-only handle and a center of mass of said first member of said electromechanical lock are located, with respect to the rotation axis, at different angular positions.

[0022] In a first aspect, the invention relates to a laundry drying machine comprising a cabinet housing a chamber for treating laundry having a rotation axis, a porthole for providing access to and tightly closing the chamber, a hinge to pivot the porthole to the cabinet, a lock of a kind that allows opening of the porthole during

operation of the laundry drying machine, the lock comprising a first member on the porthole and a matching member on the cabinet, and a grip-only handle, wherein said porthole comprises a frame assembly comprising at least one frame,

wherein said lock is configured to be released by applying a force beyond a threshold onto the porthole away from the cabinet,

wherein said grip-only handle and said first member of said lock are arranged in such a way that, when the porthole is closed, the center of mass of said grip-only handle and the center of mass of said first member of said lock are located, with respect to the rotation axis, at different angular positions.

[0023] In the present description and in the attached claims, the "angular position" refers to the rotation axis of the chamber for treating laundry.

[0024] In the present description and in the attached claims, the expression that the centers of mass are "located at different angular positions" means that the centers of mass belong to different half planes each starting from the rotation axis.

[0025] Preferably said frame assembly comprises a bowl secured to the at least one frame.

[0026] More preferably said frame assembly comprises an outer frame and an inner frame, and a bowl is sandwiched between the outer frame and the inner one frame.

[0027] In the present description and in the attached claims, "bowl" has to be read as a protective element supported by at least one frame of the frame assembly of the porthole and having the function, together with the rest of the porthole, of tightly closing the processing chamber of the machine and, preferably (if this bowl is transparent or partially transparent), to at least partially allow to see the internal of the chamber for treating laundry when the porthole is closed; therefore the bowl may be made of glass, but also of different material (e.g. plastic material), and it may be transparent, opaque, or partially transparent.

[0028] The described arrangement allows increasing the degree of freedom in designing the grip-only handle by relieving the constraints that would be imposed by the presence, at the frame of the porthole, of the first member of the lock at the same position as the handle.

[0029] Preferably said hinge is arranged in such a way that, when the porthole is closed, its center of mass is located, with respect to the rotation axis, at a diametrically opposite angular position with respect to the center of mass of said first member of said lock.

[0030] In the present description and in the attached claims, the expression that the centers of mass are "located at diametrically opposite angular positions" means that the centers of mass belong to a same plane containing also the rotation axis, and are located on the two different half planes thereof starting from the rotation axis.

[0031] The arrangement of the lock diametrically opposite the hinge provides a uniform distribution of the

forces, including the weight of the porthole. The tightness of the chamber when closed by the porthole is also maximized by the arrangement of the lock diametrically opposite the hinge.

[0032] Preferably said grip-only handle and said first member of said lock are arranged in such a way that, when the porthole is closed, their centers of mass are located, with respect to the rotation axis, at angular positions that are reciprocally spaced by less than 90°.

[0033] This means that said grip-only handle is arranged in the half of the porthole about the lock. This reduces the effort of the user to pull open the porthole.

[0034] Preferably when the laundry drying machine is arranged on a horizontal supporting plane, the hinge and lock are each located across and preferably centered across a horizontal median plane of the porthole, and are diametrically opposite to each other with respect to the rotation axis when the porthole is closed, and the grip-only handle is located outside of the horizontal median plane.

[0035] This is ergonomically the best position for the user, who reaches the handle from above or respectively from below, depending on whether the laundry drying machine is mounted on the floor or arranged on top of another equipment or piece of furniture, like in the case of a dryer arranged on top of a washing machine.

[0036] Preferably the grip-only handle is configured to be alternatively positionable in one of at least two prefixed positions, more preferably alternatively in one of four prefixed positions, with respect to at least one frame of the frame assembly.

[0037] This allows the handle to be always in the more ergonomic position, depending e.g. on whether the laundry drying machine is mounted on the floor or arranged on top of another equipment or piece of furniture, like in the case of a dryer arranged on top of a washing machine, and/or on whether the porthole is hinged at the left or at the right, the porthole being possibly reversible in its opening direction.

[0038] In embodiments, said grip-only handle is configured to be alternatively positionable in one of at least two prefixed positions with respect to the whole frame assembly.

[0039] Preferably said at least two prefixed positions are such that in any one of these prefixed positions said grip-only handle, when the porthole is closed, has a different angular position with respect to said rotation axis.

[0040] In an advantageous embodiment, the grip-only handle is one piece with the at least one frame.

[0041] In an advantageous embodiment, the grip-only handle is one piece with an annular handle support, that can be mounted in at least two different angular positions with respect to said at least one frame, so that said grip-only handle is positionable in said at least two prefixed positions by mounting said annular handle support in one of these at least two different angular positions.

[0042] The support is preferably rotatably mounted with respect to said at least one frame.

[0043] In an advantageous embodiment, the grip-only handle is provided with one or more coupling elements and the frame assembly is provided with a matching coupling element(s), preferably with a plurality of matching coupling elements so that the grip-only handle can be mounted in at least two different prefixed positions with respect to said at least one frame.

[0044] Preferably, at least one cover having one or more coupling elements similar to that/those of the grip-only handle is further provided, wherein when the grip-only handle is mounted in a preselected one of said at least two prefixed positions, the at least one cover is provided at the other one(s) of at least two prefixed positions.

[0045] Preferably, the matching coupling elements of the frame assembly comprise bushings that are also used to assemble said at least one frame of said frame assembly.

[0046] Preferably the grip-only handle extends through a wall forming the outer edge of said at least one frame of the frame assembly.

[0047] Preferably a wall forming the outer edge of the at least one frame of the frame assembly comprises a slot for receiving the grip-only handle or a cover.

[0048] Preferably, the grip-only handle is arranged in such a way to be individually separable from said frame assembly.

[0049] Preferably the grip-only handle comprises a body portion that protrudes radially inwardly or radially outwardly from the at least one frame, and further preferably, it extends along an arc of a circumference.

[0050] In embodiments, the grip-only handle comprises a body portion that protrudes radially inwardly from the at least one frame, and further preferably, it extends along an arc of a circumference, there being a wall of the handle or of the at least one frame crossing the body portion at an intermediate zone of the body portion, and a plurality of reinforcing ribs extending from the body portion and the wall.

[0051] More preferably the body portion of the grip-only handle is generally flat.

[0052] In the present description and in the attached claims, "generally" or "substantially" or "essentially" means in disregard of specific instances and with regard to an overall picture.

[0053] Thus, "generally flat" means that the handle may depart slightly or locally from a flat configuration, still being prevalently flat or essentially two-dimensional. In particular the grip-only handle may be slightly curved.

[0054] Preferably, the ribs are generally L-shaped bodies arranged at a corner between the wall and the body portion, on the inner side of the grip-only handle facing, when the porthole is closed, the chamber and/or the cabinet.

[0055] Preferably, the ribs are generally flat.

[0056] Preferably, each rib includes a long edge adjoining an inner side of the body portion from the wall towards a free edge of the body portion, more preferably up to the free edge, and a short edge adjoining at least

part of the wall.

[0057] Preferably, the ribs extend parallel to each other. Alternatively, each rib extends in a radial plane.

[0058] In order to provide a particularly ergonomic handle, it may advantageously protrude radially inwardly from the at least one frame and extend along an arc of a circumference, the radial extent of the handle being not constant along said arc of a circumference and the handle comprising a zone having a first radial extent, and a zone adjacent thereto having a second radial extent smaller than the first radial extent, so that when the handle is gripped by a user, the zone having the first radial extent is gripped by the index finger and the medium finger, and the zone having the second radial extent is gripped by the ring finger and the little finger.

[0059] Preferably the grip-only handle comprises a body portion having a first edge that is an arc of circumference and adjoins the at least one frame and a free edge that: contacts the first edge at a first end of the handle, is then curved, having a radially inner convexity so that the radial extent of the handle increases to a maximum and then decreases again to a minimum greater than zero at a corner near a second end of the handle, and after the corner is straight along an almost radial direction, until it contacts the first edge at the second end of the handle.

[0060] Preferably the grip-only handle protrudes radially inwards from said at least one frame, i.e. protrudes towards the axis of rotation of the processing chamber. Preferably the grip-only handle does not protrude outwards of said at least one frame.

[0061] Alternatively, the grip-only handle protrudes radially outwards from the at least one frame, i.e. protrudes in a direction radially departing from the axis of rotation of the processing chamber.

[0062] Preferably, in this case the grip-only handle protrudes outwards of said at least one frame.

[0063] Preferably the hinge is located on a left side of said porthole, as seen from the outside of said laundry drying machine having the porthole in front of the viewer.

[0064] In an advantageous embodiment the grip-only handle is arranged in such a way as to be individually separable from said frame assembly. "Individually" means that the grip-only handle can be separated as a single-body from the rest of the frame assembly, i.e. a separation of other parts of the frame assembly is not required (with the possible exception of screws or other fixing devices) in order to separate the grip-only handle from the frame assembly. In this way, if user needs changing the position of the handle since, for example, the handle belongs to the porthole of a laundry drying machine which has to be moved over a washing machine, it is not necessary to completely dismantle the frame assembly (for example separating the inner from outer frame), but it is sufficient to separate the handle from the frame assembly, and moving it to the suitable prefixed position.

[0065] In an advantageous embodiment the frame as-

sembly comprises an outer frame, an inner frame, and a bowl supported by the outer frame and the inner frame, and the grip-only handle is preferably arranged in such a way to be individually separable from the outer frame and/or inner frame for allowing to change its position among said at least two prefixed positions. In other words in this advantageous embodiment the grip-only handle can be separated from and attached to the inner and/or outer frame as a single body, which is a much easier operation than, for example rotating a whole outer frame (in case for example the handle is a single body with the latter) with respect to an inner frame.

[0066] In one aspect of the invention, the laundry processing chamber is supported by one or more rollers rotatably mounted on a supporting structure connected to the cabinet.

[0067] The Applicant also found that the above object is achieved by providing a grip-only handle that is reinforced against flexural stress.

[0068] In an aspect, the invention relates to a laundry drying machine comprising a cabinet housing a chamber for treating laundry having a rotation axis, a porthole for providing access to and tightly closing the chamber, a hinge to pivot the porthole to the cabinet, a lock of a kind that allows opening of the porthole during operation of the laundry drying machine, the lock comprising a first member on the porthole and a matching member on the cabinet, and a grip-only handle, wherein said lock is configured to be released by applying a force beyond a threshold onto the porthole away from the cabinet,

wherein said porthole comprises a frame assembly comprising at least one frame, and

wherein said grip-only handle comprises a body portion that protrudes radially inwardly from the at least one frame and extends along an arc of a circumference, there being a wall of the handle or of the at least one frame crossing the body portion at an intermediate zone of the body portion, and a plurality of reinforcing ribs extending from the body portion and the wall.

[0069] Preferably the ribs are generally L-shaped bodies arranged at a corner between the wall and the body portion, on the inner side of the grip-only handle facing, when the porthole is closed, the chamber.

[0070] Preferably, each rib includes a long edge adjoining an inner side of the body portion from the wall towards a free edge of the body portion, and a short edge adjoining at least part of the wall.

[0071] Preferably, the ribs extend parallel to each other. Alternatively, each rib extends in a radial plane.

[0072] Further features of the laundry machine of this aspect are detailed above with respect to the first aspect of the invention.

[0073] The Applicant also found that the above object is achieved by providing an ergonomic grip-only handle.

[0074] In an aspect, the invention relates to a laundry drying machine comprising a cabinet housing a chamber for treating laundry having a rotation axis, a porthole for

providing access to and tightly closing the chamber, a hinge to pivot the porthole to the cabinet, a lock of a kind that allows opening of the porthole during operation of the laundry drying machine, the lock comprising a first member on the porthole and a matching member on the cabinet, and a grip-only handle, wherein said lock is configured to be released by applying a force beyond a threshold onto the porthole away from the cabinet, wherein said porthole comprises a frame assembly comprising at least one frame, wherein said grip-only handle protrudes radially inwardly from the at least one frame and extends along an arc of a circumference, the radial extent of the handle being not constant along said arc of a circumference and the handle comprising a zone having a first radial extent, and a zone adjacent thereto having a second radial extent smaller than the first radial extent, so that the when the handle is gripped by a user, the zone having the first radial extent is gripped by the index finger and the medium finger, and the zone having the second radial extent is gripped by the ring finger and the little finger.

[0075] Preferably the grip-only handle comprises a body portion having a first edge that is an arc of circumference and adjoins the at least one frame and a free edge that: contacts the first edge at a first end of the handle, is then curved, having a radially inner convexity so that the radial extent of the handle increases to a maximum and then decreases again to a minimum greater than zero at a corner near a second end of the handle, and after the corner is straight along an almost radial direction, until it contacts the first edge at the second end of the handle.

[0076] In one aspect of the invention, the laundry processing chamber is supported by one or more rollers rotatably mounted on a supporting structure connected to the cabinet.

[0077] In one embodiment of the invention, the laundry processing chamber is supported by a shaft arranged at a rear portion of the chamber, i.e. opposite to the laundry loading/unloading opening.

[0078] Further features of the laundry machine of this aspect are detailed above with respect to the first aspect of the invention.

[0079] Features and advantages of the present invention will be more readily understood from the following detailed description of some advantageous embodiments thereof, which is provided below by way of non-limiting example with reference to the accompanying drawings, wherein:

- FIG. 1 shows a perspective view of a laundry drying machine according to the invention, wherein a porthole of the laundry machine is closed;
- FIG. 2 shows a perspective view of the laundry drying machine of FIG. 1, wherein the porthole is open;

- FIG. 3 shows a front view of the laundry drying machine of FIG. 1, wherein the porthole is closed;
- FIGs. 4-8 diagrammatically show different shapes and positions of a handle of the laundry drying machine according to the invention;
- FIGs. 9 and 10 show two perspective exploded views of the porthole of the laundry drying machine of FIG. 1, respectively from the outside and from the inside thereof;
- FIG. 11 shows a rear view of an outer frame of the porthole of FIGs. 9, 10, with one piece handle;
- FIG. 12 shows a sectional view of the porthole of FIGs. 9, 10 and of its hinge, taken along line XII-XII of FIG. 3;
- FIGs. 13 and 13a show an enlarged detail of the handle of the porthole of FIGs. 9, 10, in perspective from the inner side thereof and in cross section, taken along line XIII-XIII of FIG. 11, respectively;
- FIG. 14 shows a front view of an outer frame of a porthole and handle according to another embodiment of the invention, having a removable handle;
- FIG. 15 shows a sectional view taken along line XV-XV of FIG. 14;
- FIG. 16 shows a diagrammatic view, from the inside, of the frame and handle of FIG. 14; and
- FIG. 17 shows a front view of an outer frame of a porthole and handle according to another embodiment of the invention, having a handle support,
- FIGs. 18, 19 and 20 show three different perspective exploded views of a porthole, a grip-only handle and further components of another embodiment of a laundry drying machine according to the invention;
- FIGs. 21-24 show perspective views of the porthole shown in FIGs. 18-20 with a grip-only handle and a cover attached thereto in different positions;
- FIG. 25 shows the grip-only handle shown in FIGs. 18-20 in perspective from the inner side thereof, and the outer frame partially broken away;
- FIG. 26 shows a rear view of the porthole shown in FIG. 18-20, with the grip-only handle attached thereto;
- FIG. 27 shows a rear view of an outer frame of the porthole shown in FIG. 18-20, with the grip-only handle attached thereto;

- FIGs. 28 and 29 show sectional views respectively taken along lines A-A and B-B of FIG. 26; and
- FIGs. 30 and 31 show sectional views respectively taken along lines C-C and D-D of FIG. 27.

[0080] Like elements are denoted by like reference signs throughout the figures.

[0081] In FIGs. 1, 2, and 3 a laundry drying machine 1 is shown in perspective and front views.

[0082] The laundry drying machine 1 comprises a parallelepiped cabinet (or housing) 2. The cabinet 2 may be advantageously made of a frame covered by a metal sheet, e.g. a steel sheet.

[0083] Cabinet 2 houses a chamber 3 for treating laundry. The chamber 3 is a drum 4 rotatably mounted about a rotation axis RR. Drum 4 may be supported by one or more rollers rotatably mounted on a supporting structure connected to the cabinet 2. Said one or more rollers can be provided either on one or both drum end regions, and are preferably idle rollers, i.e. rollers that rotate due to the rotation of the drum 4 which is applied by a driving arrangement, such as an electrical motor and a transmission belt connecting the motor to the drum. In one embodiment of the invention the drum is supported by rollers in a front end thereof and by a shaft mounted in a rear end of the drum, the front end of the drum being the end where the laundry loading/unloading opening is formed. In the advantageous example shown in the attached figures, rotation axis RR is, when the machine is installed on the floor, in an operative position, like in the example shown in FIGs. 1 and 2, substantially horizontal, but in a different advantageous embodiment this axis RR can be inclined. As shown, the cabinet 2 of the laundry machine 1 may advantageously include a pull-out condensate collecting tank 6, as well as a control panel 7. These components may be missing and/or other components may be present on the cabinet 2. In particular, cabinet 2 will further house -in a manner known *per se*- air circulation ducts, a heater, a drying air moisture condenser, and a blower for circulating heated air in the ducts and in the chamber 3, besides an electronic control unit. A panel 5 may be movable from the front of cabinet 2 to provide access to a part of said components. An aperture 10 of one of the air circulating ducts is further visible in FIG. 2, and is provided for exhausting drying air from the chamber 3 and directing it towards the drying air moisture condenser-in the case of a back-to-front air flow within chamber 3. A fluff removing filter (not shown in the drawings) can be received into the aperture 10.

[0084] A porthole 8 for providing access to and tightly closing the chamber 3 is provided at the front wall of the cabinet 2, specifically at an opening 9 of the cabinet 2 and at an opening 3a of the chamber 3.

[0085] A hinge 11 is provided to pivot the porthole 8 to the cabinet 2 so that it can be opened by rotating it about a vertical axis XX, as shown in FIG. 2. The hinge 11 is arranged in such a way that, when the porthole 8 is

closed, its center of mass C11 (see e.g. FIG. 3) is located, with respect to the rotation axis RR, at a first angular position.

[0086] Preferably, hinge 11 is arranged across, and more preferably centered across, a horizontal median plane HH of the porthole 8.

[0087] Hinge 11 may be any conventional hinge, preferably of the type that is not visible when the porthole 8 is closed. In the embodiment shown in the figures, hinge 11 comprises a portion 11 a (FIG. 2, 12) fixed to the cabinet 2, a seat 11 b (FIGs. 9, 10, 12) for housing it provided in the porthole 8, and a hinge pin (not shown in FIGs 1 to 17) extending in holes of the portion 11 a and of the seat 11 b, wherein holes 11c of the seat 11 b are visible in FIGs. 9 and 12. Reference shall also be made to FIGs. 18-20 described in detail hereinafter.

[0088] A lock 12 is provided between the porthole 8 and the cabinet 2. The lock 12 comprises a portion or member fixed to the cabinet 2 and a portion or matching member fixed to the porthole 8 that cooperate with each other. The portion or member fixed to the porthole 8 will sometimes be referred to as first member hereinafter, and the portion or matching member fixed to the cabinet 2 will sometimes be referred to as second member hereinafter.

[0089] The lock 12 is configured to allow opening of the porthole during operation of the machine, i.e. during a laundry drying operation cycle. A sensor of the open/closed state of the porthole may be provided - externally of or embedded within the lock 12 - to issue a state signal to the electronic control unit of the dryer 1, which in turn may at least stop the rotation of the drum 4 once the porthole is sensed to be opened.. In this connection, reference shall also be made to FIGs. 18-20 described in detail hereinafter.

[0090] Advantageously the first member of lock 12 comprises a latch 13 protruding from the porthole 8 towards the cabinet 2 -visible in FIGs. 2, 9, 10 and 12-, and the second member comprises a latch retaining mechanism 14 for receiving the latch 13, positioned at the cabinet 2.

[0091] The latch 13 is shown as a protrusion having an aperture 13a. The entire latch retaining mechanism 14 is not visible in the figures, only a seat for receiving the latch 13 is visible. The latch retaining mechanism 14 preferably includes, in a manner known *per se*, a mobile part which is configured to be movable between a retaining position, in which it engages the latch 13 so as to retain the porthole 8 in a closed condition, and an opening position in which it releases the latch 13 so as to allow the opening of the porthole 8. The mobile part of the latch retaining mechanism 14 at the cabinet 2 preferably interacts with an elastic element, for example a spring, which allows the releasing of the latch 13 when a releasing force is applied which is greater than a threshold force. In the mounted condition, the latch 13 cannot move with respect to the porthole 8, and the latch retaining mechanism 14 is not operated by any push button or similar manual

control. The porthole 8 is therefore of the "pull-to-open type", opened by applying a force beyond a threshold onto the porthole 8 away from the cabinet 2.

[0092] The lock 12 is preferably arranged across, and more preferably centered across, the horizontal median plane HH of the porthole 8.

[0093] The first member 13 of lock 12 is arranged in such a way that, when the porthole 8 is closed, its center of mass C12 (see e.g. FIG. 3) is located, with respect to the rotation axis RR, at a different angular position than the center of mass C11 of the hinge 11, preferably at a diametrically opposite angular position with respect to hinge 11.

[0094] A grip-only handle 15 is provided at the porthole 8, to be gripped by a user for applying a pulling force onto the porthole 8 away from the cabinet 2.

[0095] The porthole 8 is usually opened by pulling it outwards with enough force through the handle 15, but it can also be opened by pushing it from the inside of the drum 4, e.g. by a caught child thanks to its "pull-to-open type" construction.

[0096] A grip-only handle 15 in connection with a "pull-to-open" porthole or lock has several advantages. It is easier and less expensive to manufacture than a pivotal handle operating a movable hook at the porthole, especially when it is one piece with a frame of the porthole 8 as discussed below. Moreover it is more robust than a pivotal handle.

[0097] The grip-only handle 15 protrudes radially inwardly from the frame of the porthole 8, specifically from the inner circumferential edge of an outer frame 30 thereof (see below). Thus, when the porthole 8 is viewed from the outside in a direction along rotation axis RR, the grip-only handle 15 is clearly visible, rather than being hidden by the frame of the porthole 8. However, the above statement is not to be narrowly construed in the sense that the grip-only handle 15 is attached to or forms one single piece with the outer frame of the porthole 8: it may be attached to one or more different parts of the porthole 8.

[0098] The grip-only handle 15 is provided at a position which is not aligned or not corresponding with the position of the lock 12. The grip-only handle 15 is arranged such that, when the porthole 8 is closed, its center of mass C15 is located, with respect to the rotation axis RR, at a different angular position than the center of mass C12 of the first member 13 of the lock 12.

[0099] The grip-only handle 15 is preferably located or arranged outside the horizontal median plane HH of the porthole 8. The grip-only handle 15 is thus offset with respect to horizontal median plane HH and the lock 12. In case of a large extent of the handle 15 and/or of the lock 12, the two might however overlap in part.

[0100] In the case shown, wherein the porthole 8 is circular and it is hinged at its left (as viewed from the front of the laundry machine 1 when the porthole is closed), the hinge 11 is advantageously centered across a position at 9 o'clock or 180° in a conventional angular reference system, and the lock 12 is across a position at 3

o'clock or 0°. Thus the centers of mass C11 and C12 of hinge 11 and the first member 13 of lock 12 lie on the median plane HH when they are symmetric.

[0101] In FIGs. 1 to 3, the grip-only handle 15 is shown arranged in the first quadrant, i.e. between 0° and 90°. A vertical centerline VV of the porthole 8 is also indicated in FIG. 3 to easily identify the quadrants. Advantageously the grip-only handle 15 extends for an arc or circumference lying in the generally central portion of the first quadrant.

[0102] In case the laundry drying machine 1 is to be arranged on top of another equipment or piece of furniture, like in the case of a dryer machine arranged on top of a washing machine, the grip-only handle 15 may be arranged in the fourth quadrant, i.e. between 270° and 360°, as shown in FIG. 4.

[0103] In case the laundry drying machine 1 is hinged at its right, and arranged on the floor, then the grip-only handle 15 may be arranged in the second quadrant, i.e. between 90° and 180° as shown in FIG. 5.

[0104] Finally, in case the laundry drying machine 1 is hinged at its right, and arranged on top of another equipment or piece of furniture, as shown in FIG. 6, then the grip-only handle 15 may be arranged in the third quadrant, i.e. between 180° and 270°.

[0105] It is immediately recognized that in all four cases, even if the position of the centers of mass C11, C12, C15 is just estimated in the drawings, the grip-only handle 15 and the first member 13 of lock 12 are arranged in such a way that, when the porthole 8 is closed, their centers of mass C15 and C12 are located, with respect to the rotation axis RR, at different angular positions.

[0106] Moreover, in all four cases, the hinge 11 is arranged in such a way that, when the porthole 8 is closed, its center of mass C11 is located, with respect to the rotation axis RR, at a diametrically opposite angular position with respect to the center of mass C12 of the first member 13 of the lock 12.

[0107] Moreover, in all four cases the grip-only handle 15 and the first member 13 of the lock 12 are arranged such that, when the porthole is closed, their centers of mass C15, C12 are located, with respect to the rotation axis, at angular positions that are reciprocally spaced by less than 90°.

[0108] Thus, the grip-only handle 15 is preferably arranged in the half of the porthole about the lock 12.

[0109] In FIGs. 4-6 only an outer frame 30 of the porthole 8 is shown. A bowl 32 of the porthole 8 is not shown. The construction of the porthole 8 is better disclosed below with reference to FIGs. 9, 10. Moreover, in those figures the position of the hinge 11 and of the lock 12 is indicated with the same reference numbers, even if the two are not visible.

[0110] In FIG. 3-6 an identical handle 15 is shown in all four prefixed positions with respect to the frame 30. The handle 15 can be one piece with the frame 30 or positionable with respect to it. Before discussing how this can be achieved, it is noted that a handle 15a having a

shape that is for example the mirror image of that of handle 15 may be provided in the case of porthole 8 hinged at its right, as shown in FIG. 7 and in FIG. 8.

[0111] By the possibility of assembling a plurality of differently-shaped handles to a same porthole 8, the handle may always be configured with an ergonomic shape, as shown by the handle 15 in FIGs. 3, 4 and the handle 15a in FIGs. 7, 8.

[0112] Such handle 15, 15a as shown in FIGs. 3, 4, 7, 8 has a body part 16, 16a cantilever or protruding radially inward from the outer frame 30 of the porthole 8—within the above broad meaning —, and extending along an arc of a circumference, e.g. of about 40-55°. The body part 16 is preferably generally flat, as defined above. Preferably, the body part 16, 16a has a first edge 17, 17a that is an arc of circumference and adjoins the inner circumference of a slanted wall 35 (see below) of the outer frame 30 of the porthole 8. Preferably, the body part 16, 16a has a second or free edge 18, 18a cantilevered from the outer frame 30 of the porthole 8. Preferably the body part 16, 16a has a radial extent defined between the first edge 17, 17a and the free edge 18, 18a.

[0113] The radial extent of the handle 15, 15a is preferably not constant. The free edge 18, 18a preferably adjoins or contacts the first edge 17, 17a at a first end 19, 19a of the handle 15, 15a that is upper in the mounted condition of the handle 15, 15a shown in FIGs. 3, 4, 7, 8, so that the radial extent of the handle 15, 15a at first end 19, 19a is zero. Moving towards a second end 20, 20a of the handle 15, 15a, opposite the first end 19, 19a and lower in the mounted condition of the handle 15, 15a shown in FIGs. 3, 4, 7, 8, the free edge 18, 18a is preferably first curved, having a radially inner convexity so that the radial extent of the handle 15, 15a increases to a maximum and then decreases again to a minimum greater than zero at a corner 21, 21a near the second end 20, 20a of the handle 15, 15a; after the corner 21, 21a the free edge 18, 18a is straight along an almost radial direction, until it adjoins or contacts the first edge 17, 17a at the second end 20, 20a of the handle 15, 15a.

[0114] The handle 15, 15a thus preferably comprises a zone 22, 22a having a first or comparatively large radial extent, and a zone 23, 23a adjacent thereto having a second or comparatively small radial extent, smaller than the first radial extent, so that when the handle 15, 15a is gripped by a user, the zone 22, 22a having the first or comparatively large radial extent is gripped by the index finger and the medium finger, and the zone 23, 23a having the second or comparatively small radial extent is gripped by the ring finger and the little finger.

[0115] The handle 15, 15a is therefore ergonomic when in the positions of FIGs. 3, 4, 7, 8, what helps the user to easily apply the required force to pull open the porthole 8.

[0116] It is noted that usually dryer machines have a reversible porthole (left/right hinge). This may be obtained by interchanging the hinge portion 11a and the latch retaining mechanism 14 on the cabinet, and by ro-

tating by 180° the porthole 8 or at least a frame assembly thereof.

[0117] As discussed in the introductory part of the disclosure, the described arrangement of lock 12 and handle 15 provides several advantages.

[0118] An advantageous embodiment of the porthole 8 is now better disclosed with reference to FIGs. 9-12.

[0119] The porthole 8 comprises a frame assembly comprising, in the illustrated case, an outer frame 30, and an inner frame 31; a bowl 32 is advantageously sandwiched between the outer frame 30 and the inner frame 31.

[0120] The latch 13 is also shown in an exploded condition in FIGs. 9, 10.

[0121] The outer frame 30 is a preferably generally annular member, having an outer circumferential edge 33 and a preferably beveled inner circumferential edge 34. Between the outer circumferential edge 33 and the inner circumferential edge 34, the outer frame 30 has a preferably slanted wall 35. The slanted wall 35 is preferably closer to the cabinet 2 at the outer circumferential edge 33 than at the inner circumferential edge 34, with reference to the closed condition of the porthole 8 (see FIG. 12).

[0122] The inner frame 31 is also a preferably generally annular member, having a preferably tapered outer circumferential edge 36 and an inner circumferential edge 37. Preferably, between the outer circumferential edge 36 and the inner circumferential edge 37, the inner frame 31 has a flat wall 38.

[0123] On the sides coupling with each other, i.e. looking from the outside of the laundry drying machine 1 the inner side of outer frame 30 and the outer side of inner frame 31, the outer frame 30 and the inner frame 31 are preferably generally concave and advantageously they have a plurality of reinforcing ribs 39, 40, respectively. The outer frame 30 and the inner frame 31 have preferably also a matching system for coupling to each other, with the interposition of the bowl 32 and the latch 13. In the embodiment shown, the outer frame 30 has advantageously a plurality of internally threaded bushings 41 and the inner frame 31 advantageously has a plurality of holes 42 in corresponding prefixed positions, for receiving a plurality of screws or bolts (not shown, but reference may be made to the embodiment shown in FIGs. 18-20 and described hereinbelow). The ribs 39, 40 preferably extend about the bushings 41 and about the holes 42, respectively.

[0124] Any other matching system may be suitable, such as snap pins, welding, glueing and similar.

[0125] The seat 11b for the hinge 11 is advantageously made in the inner frame 31 and partly in the outer frame 30. Advantageously, in the inner frame 31, preferably diametrically opposite the centerline of the seat 11b for the hinge 11, there is an apertured seat 44 for the passage of the latch 13.

[0126] Advantageously the inner side of the outer frame 30 has a protruding spacer 45 for abutting the latch

13 and keeping it out of the apertured seat 44 in inner frame 31.

[0127] The bowl 32 is preferably generally convex towards the inside of the laundry drying machine 1, protruding inwards from the inner frame 31. The shape of the bowl 32 can depart from that shown.

[0128] The bowl 32 has preferably a circumferential rim 46 that is sandwiched between the outer frame 30 and the inner frame 31.

[0129] Preferably, circumferential rim 46 has two diametrically opposite triangular protrusions 47. Advantageously, the inner frame 31 has, on its inner circumferential edge 37, notches 48 for housing the triangular protrusions 47 of the bowl 32. Advantageously, the outer frame 30 has, on its inner side, triangular protrusions 49 defining seats for the triangular protrusions 47 of the bowl 32. Thus, the rotational position of the bowl 32 is well defined.

[0130] Advantageously, further matching lugs 50 and recesses 51 are provided on the inner and outer frames 30, 31, respectively, to define the rotational mutual position thereof.

[0131] Advantageously, the inner frame 31 has, on its inner circumferential edge 37, elastic retainers 51 a defining the axial position of bowl 32.

[0132] The handle 15 is preferably one piece with the outer frame 30 and radially protrudes inward, cantilever from the inner circumferential edge 34. It is noted that in FIG. 10 the protruding portion of the handle 15 is hidden by the outer frame 30. As visible in FIG. 13a, the body part 16 of handle 15 is, advantageously, slightly recessed with respect to the slanted wall 35 of the outer frame 30 near its circumferential inner edge, and ends, at its free edge 18, flush with the slanted wall 35 of the outer frame 30 so as not to protrude from the outer frame 30 outwards, i.e. away from the cabinet 2 in the closed condition of the porthole 8.

[0133] As visible in FIGs. 10-13 and 13A, the beveled inner circumferential edge 34 of the outer frame 30 is, advantageously, interrupted at the handle 15 by a wall 52 extending along part of a cylindrical surface flush with the radially inner edge of the beveled inner circumferential edge 34. Radially outer part 53 of the body portion 16 and lateral walls 54 advantageously fill the gap between the wall 52 and the beveled inner circumferential edge 34. Between the body portion 16 of the handle 15 and the inner circumferential edge 34 of the outer frame 30 there are also lateral walls 54a.

[0134] The body portion 16 of the handle 15 is thus crossed by the wall 52 at an intermediate zone of the body portion 16. This enhances the strength of the handle 15.

[0135] A plurality of reinforcing ribs 55 advantageously extend from the body portion 16. Advantageously, the ribs 55 are generally L-shaped bodies arranged at the corner between the wall 52 and the body portion 16, on the inner side of handle 15 facing, when the porthole 8 is closed, the chamber 3 and/or the cabinet 2.

[0136] Reinforcing ribs 55 are preferably generally flat.

[0137] Each rib 55 includes a long edge 56 adjoining the inner side of the body portion 16 from the wall 52 towards and preferably up to the free edge 18, and a short edge 57 adjoining at least part of the wall 52.

[0138] The reinforcing ribs 55 may also extend shorter along the body portion 16 and/or longer along wall 52 (even up to its free edge) than shown.

[0139] When molding the outer frame 30 with the handle 15 and its reinforcing ribs 55 in plastics, the material flowing in the ribs 55 would tend to make depressions on the opposite side (outer side) of the flat body 16 of the handle 15. In order to avoid these depressions to be seen from the front of the laundry machine 1, the ribs 55 should be made enough thin. On the other hand, the ribs 55 should be made enough thick and/or close to each other as to provide enough reinforcement against the flexural stress during opening of the porthole 8. A skilled in the art will find a proper compromise between the two opposite requirements without the exercise of inventive skills.

[0140] Preferably, but not necessarily, the reinforcing ribs 55 may have a thickness, e.g. of 1.2 mm, that is at most 40% of the thickness of the body portion 15, the latter being e.g. of 3 mm; the distance between reinforcing ribs 55 may be shorter than or equal to 2.8 mm. With those figures, there are about 25 reinforcing ribs 55 in 100 mm of length of the body portion 16.

[0141] The ribs 55 may extend parallel to each other as shown, or each rib 55 can extend in a radial plane.

[0142] The reinforcing ribs 55 also improve the grip on the handle 15 because they avoid slipping of the hand, especially a wet hand as may well occur when dealing with washing laundry.

[0143] The handle 15, 15a can be made one piece with the outer frame 30 - or generally speaking with the porthole 8 - as shown thus far. To have the handle 15, 15a mounted in the various prefixed positions disclosed in connection with FIGs. 3-8, however, two different outer frames 30 for a same handle 15 as shown in FIGs. 3-6 have to be manufactured, four different outer frames 30 for an always ergonomic handle 15, 15a as shown in FIGs. 3, 4, 7, 8. However, a handle 15, 15a made one piece with the outer frame 30, such as co-molded therewith, is very strong, inexpensive and neat.

[0144] In order to avoid having to manufacture and store different outer frames 30 with one piece handle 15, 15a, it is also possible to provide for a modified outer frame 30a and a detachable handle 15b, as shown in FIG. 14-16. FIG. 16 is schematic, and does not show several details as shown in FIGs. 9-11.

[0145] Besides the possibility of changing the position of the handle, this would also bring about other advantages, such as the possibility of easily changing the layout of the handle for different models of laundry machine 1 without having to provide different molds of the entire outer frame.

[0146] Outer frame 30a corresponds to the outer frame 30 already disclosed apart from what disclosed below.

[0147] Handle 15b advantageously includes a body portion 16b similar to body portion 16 of handle 15, advantageously including a zone 22b having a comparatively large radial extent and a zone 23b having a comparatively small radial extent, as well as a wall 52b extending along part of a cylindrical surface and lateral walls 54b one piece therewith, similar to walls 52, 54 just described. Wall 52b crosses body portion 16b at an intermediate zone thereof. The generally flat body portion 16b includes an arc of circumference edge 17b and a free edge 18b having the shape described above. The other parts of handle 15b are labeled similarly to the corresponding parts of handle 15, with a "b" suffix.

[0148] From the wall 52b extending along part of a cylindrical surface, a pair of bushings 59 advantageously protrudes, preferably generally radially, outwards, but extending parallel to each other and parallel to a median radial plane of the handle 15b. In the mounted condition of the handle 15b, the bushings 59 advantageously insert into bushings 60 having holes 61 that extend from the beveled inner circumferential edge 34a of outer frame 30a. Bushings 60 also advantageously protrude preferably generally radially outwards, but extending parallel to each other and parallel to a median radial plane defined centrally of the two bushings 60. Screws 62 or bolts advantageously retain the handle 15b to the outer frame 30a by passing through holes 61 and engaging bushings 59.

[0149] Outer frame 30a may include two or four series of holed bushings 60 as shown in FIGs. 14, 16 for mounting the handle 15b (or a handle having a mirror-image shape similar to that shown in FIGs. 7, 8).

[0150] The holes 61 that are not used for mounting the handle 15b may be advantageously covered with a cap. Alternatively, all the holes 61 may be covered by a thin membrane having a preferential rupture circumference, and during installation of the laundry machine 1, the membrane is removed only at the two holes 61 being actually used for mounting the handle 15b.

[0151] In the handles 15, 15a, 15b, the free edge 18, 18a, 18b of the body portion 16, 16a, 16b can have a thickening 58, 58b, preferably rounded, on the inner side of the handles 15, 15a, 15b.

[0152] The handle of the porthole can also be fixed, instead of with screws and threaded holes as just described, with snap action pins, or any other suitable system, in particular suitable coupling element(s) and matching coupling element(s).

[0153] With reference to FIG. 17, showing a different advantageous embodiment of the invention, the position of the handle 15c may also be changed through a rotation of an annular handle support 63, which is part of the frame assembly, to which handle 15c is fixed (for example handle 15c and annular handle support 63 may be a single body or one piece); in this case annular handle support 63 is advantageously sandwiched between the outer and inner frames 30, 30a, 31, and it is arranged in such a way that it can be mounted in at least two different angular

positions with respect to the rest of the frame assembly, and in particular to the outer frame 30, so that handle 15c is positionable in at least two prefixed positions by mounting annular handle support 63 in one of these at least two different angular positions. The other parts of handle 15c are labeled similarly to the corresponding parts of handle 15, with a "c" suffix.

[0154] Thus, the grip-only handle 15b, 15c is configured to be alternatively positionable in one of at least two prefixed positions with respect to the frame(s) 30, 30a, 31.

[0155] Moreover, said at least two prefixed positions are such that in any one of these prefixed positions, said grip-only handle 15b, 15c, when the porthole 8 is closed, has a different angular position with respect to the rotation axis RR.

[0156] Preferably, the prefixed positions of the grip-only handle 15b, 15c correspond to those described above with reference to grip-only handles 15, 15a.

[0157] In a further embodiment, the annular handle support 63, carrying or being a single body or one integral piece with the handle 15c, may be arranged in such a way to be individually separable from the porthole frame assembly.

[0158] Another advantageous embodiment of a porthole and detachable grip-only handle is now disclosed with reference to FIGs. 18-31, wherein like parts are labeled similarly to the corresponding parts of the previously described embodiments, with reference numerals increased by 100. For details not disclosed below, reference may be made to the previously disclosed embodiments.

[0159] In this embodiment, the porthole may be hinged at the left or at the right, and is thus reversible. In FIGs. 18-20, the porthole is shown hinged at the left.

[0160] More precisely, in FIGs. 18-20 a porthole 108, a hinge portion 111 d of a hinge provided to pivot porthole 108 to the cabinet 2 of the laundry drying machine 1 (see FIGs. 1-3), a first member of a lock, or latch 113 -fixed with screws 113b-, and a detachable grip-only handle 115 are shown in an exploded perspective view. Moreover, a cover 170 used in combination with detachable grip-only handle 115 and further discussed below is shown in FIGs. 18-20.

[0161] Furthermore, a member 180 of a sensor of the open/closed state of the porthole 108 is shown. Member 180 cooperates with a switch (not shown) provided at cabinet 2 to issue a state signal to the electronic control unit of the laundry drying machine 1, which in turn may at least stop the rotation of the drum 4 once the porthole is sensed to be opened. Member 180 is sandwiched between the outer frame 130 and the inner frame 131, and protrudes inwards from a slot 181 provided on the wall 138 of inner frame 131.

[0162] Porthole 108 comprises indeed a frame assembly that, similarly to the above embodiments, preferably comprises outer frame 130 and inner frame 131; a bowl 132 is conveniently sandwiched between the outer frame

130 and the inner frame 131.

[0163] Outer frame 130 is fastened to inner frame 131, e.g. through a plurality of screws 143 passing through holes 142 of the inner frame 131 and engaging into internally threaded bushings 141 of outer frame 130. Any other fastening means may be used, e.g. as those stated above in connection with the previous embodiment.

[0164] In this embodiment, an essentially disc shaped cap 182, e.g. made of transparent plastic, is also conveniently sandwiched between the outer frame 130 and the inner frame 131, more precisely outwards of bowl 132. This component avoids that a user may touch bowl 132, that might be hot during operation of the laundry drying machine 1. It may also play an aesthetic role. Disc shaped cap 182 is preferably only slightly curved or essentially flat, and preferably has a thickened circumferential peripheral edge 183. A plurality of holes or passages 184 are distributed around circumferential peripheral edge 183 for the passage of further screws not shown in the drawings. Disc shaped cap 182 may also have a triangular protrusion 185 to define its rotational position by engagement with a triangular protrusion (not visible) of slanted wall 135 of the outer frame 130 or of wall 138 of inner frame 131.

[0165] Furthermore, a lint filter cover 186 is also conveniently sandwiched between the outer frame 130 and the inner frame 131, more precisely between the bowl 132 and the disc shaped cap 182, at a bottom position thereof. Lint filter cover 186 has the shape of a circular segment and is usually made of an opaque material, in order to hide from view a lint filter (not shown) arranged in the aperture 10 of one of the air circulating ducts (See Fig. 2). A plurality (two in the case shown) of holes or passages 187 are provided at the circular edge of lint filter cover 185 for the passage of screws.

[0166] In the case shown, due to the configuration of the hinge portion 111 d, a seat or slots 111e and 111f is/are provided in inner frame 131 and outer frame 130, respectively, instead of the single hinge seat 11 b of the previously discussed embodiment. Also shown is a hinge pin 111g and bushings 111h for being interposed between the pin 111 g and the holes 111i of hinge portion 111 d.

[0167] Bowl 132 has four elongated lugs 147 instead of the triangular protrusions 47 of the first embodiment, and the outer frame 130 has corresponding elongated seats 149 for engagement of the four elongated lugs 147.

[0168] Finally, a finishing ring 199 is shown (see also FIGs. 28-31), attached to the slanted wall 135 of outer frame 130. Finishing ring 199 is provided to enhance the aesthetical appearance of the front side of the porthole 108.

[0169] As stated, porthole 108 is advantageously reversible. In order to change from the illustrated configuration wherein the porthole 108 is hinged at the left, the inner frame 131 and the outer frame 130 are rotated by 180°, the positions of the hinge portion 111 d and the latch 113 remaining the same with respect to the inner

frame 130 and outer frame 131, turning out to be conversely interchanged with respect to the cabinet 2. The position of bowl 132, disc shaped cap 182 and lint filter cover 186 is conversely not be changed. See also FIGs 21-24.

[0170] A second slot 181 a is provided in inner frame 131 diametrically opposite slot 181, to be used for the passage of sensor member 180 when the porthole 108 is hinged at the right upon turning the inner frame 131 by 180°, so that sensor member 180 may face the switch (not shown) provided at the cabinet 2.

[0171] The detachable grip-only handle 115 is advantageously arranged in such a way as to be separable from the frame assembly of porthole 108. Thus, its layout may be easily changed.

[0172] Moreover, the grip-only handle 115 is preferably provided with one or more coupling elements and the frame assembly is provided with a matching coupling element, and more preferably a plurality of matching coupling elements, so that the handle 115 can be mounted in at least two different prefixed positions with respect to the frame assembly.

[0173] In the case shown in the drawings, this is achieved by providing two seats 171 a and 171b made in the frame assembly, in particular in outer frame 130, for alternatively receiving the handle 115.

[0174] Before discussing in detail the coupling elements and matching coupling elements, it is noted that, as far as the positions of the seats 171 a, 171 b and thus the prefixed positions of the grip-only handle 115 are concerned, preferably all what has been stated with reference to the above described embodiments of the invention holds true.

[0175] Thus, seats 171 a, 171b are such that in any of them, the grip-only handle 115, when the porthole 108 is closed, has a different angular position with respect to the drum rotation axis RR (FIGs. 1-2).

[0176] The seats 171 a, 171b are preferably symmetrical with respect to the horizontal median plane HH of the porthole 108.

[0177] Each seat 171 a, 171 b is preferably located at an angular position that is spaced by more than 90° from the location of hinge 11, notably from seat 111f.

[0178] As seen in FIGs. 21-24, in the mounted condition of the porthole 108, each seat 171 a, 171 b is preferably offset with respect to the latch 113 of lock 12. More in particular, each seat 171 a, 171 b is located at an angular position that is spaced by less than 90° from the latch 113 of lock 12, and in the half of the porthole 108 about the latch 113. When the grip-only handle 115 is installed in seat 171 a (FIGs. 21 and 24) or respectively 171b (FIGs. 22 and 23), when the porthole 108 is closed, the center of mass C115 of the handle 115 and the center of mass C12 of lock 12 are thus located, with respect to the rotation axis RR (FIG. 1-2), at different angular positions, preferably at angular positions that are reciprocally spaced by less than 90°.

[0179] Turning back to FIGs. 18-20, each seat 171 a,

171 b comprises a slot 172a, 172b in the outer circumferential edge 133 of outer frame 130, and advantageously exploits the bushings 141 of the outer frame 130 already provided for the screws 143, as matching coupling elements for coupling elements at the handle 115, in particular snapping coupling elements better described below. The outer circumferential edge 133 of outer frame 130 is formed by a wall extending along the direction of the rotation axis RR, once the porthole is mounted on the machine cabinet.

[0180] As best seen in FIGs. 25-27, the grip-only handle 115 advantageously comprises a body part 116 that, when the handle 115 is attached to the frame assembly of porthole 108, at one of the seats 171 a, 171 b, protrudes radially outwards from the frame assembly, in particular from the outer frame 130, and more in particular from the outer circumferential edge 133 of the outer frame 130. Thus, when the porthole 108 is viewed from the outside in a direction along rotation axis RR, the grip-only handle 115 is clearly visible, rather than being hidden by the frame of the porthole 108. Preferably, the body-part 116 slants outwardly relative to the cabinet 2 front wall so as to be easily grasped by user fingers.

[0181] Grip-only handle 115 further comprises a wall 152 that, when the handle 115 is attached to the frame assembly of porthole 108 at one of the seats 171 a, 171b, matches the radially outer shape of the outer circumferential edge 133 of outer frame 130 and closes the slot 172a, 172b.

[0182] Grip-only handle 115 further comprises an attachment portion 190 that, when the handle 115 is attached to the frame assembly of porthole 108 at one of the seats 171 a, 171b, protrudes radially inwards from the outer circumferential edge 133 of outer frame 130, within the concavity of the inner side of outer frame 130 itself. Preferably, the grip-only handle 115 extends through the wall forming the outer circumferential edge 133 of outer frame 130.

[0183] The body part 116 of the grip-only handle 115 has a first, radially inner edge 117 that is an arc of circumference and adjoins -in a mounted condition- the outer circumference of slanted wall 135 of outer frame 130, a second or free edge 118 cantilevered from the outer frame 130, and lateral edges 119, 119a. The free edge 118 of grip-only handle 115 is slightly shorter than the first edge 117, so that the lateral edges 119 and 119a slightly converge from the first edge 117 towards the free edge 118.

[0184] The first edge 117 and the free edge 118 of the grip-only handle 115 are advantageously defined by two arcs of circumference concentric with one another and with the circumferential edges 133, 134 of the outer frame 130

[0185] The radial extent of handle 115 is constant along the majority of the handle 115. This has the advantage of providing a universal handle for the four prefixed positions shown in FIGs. 21-24.

[0186] A plurality of reinforcing ribs 155 advantageously

ly extends from the inner side of the grip-only handle 115. The ribs 155 are generally flat bodies arranged parallel to each other or in a radial plane. Ribs 155 of handle 115 preferably extend for the entire radial extent of body part 116. Differently from ribs 55 of handle 15, ribs 155 of handle 115 however extend for the entire extent of body part 116 along cylindrical wall 152.

[0187] As best seen in FIG. 25, 29 and 30, the body part 116 of grip-only handle 115 is advantageously slightly slanted, in such a way that the free edge 118 of the grip-only handle 115 protrudes outwards with respect to the first edge 117 of the grip-only handle 115. Moreover, the body part 116 of handle 115 is, differently from the previous embodiment, only slightly recessed with respect to the slanted wall 135 of the outer frame 130 near its circumferential outer edge 133, but ends, at its free edge 118, protruding outwards from the outer frame 130, i.e. away from the cabinet 2 in the closed condition of the porthole 108. By these provisions, also grip-only handle 115 provides an ergonomic grip to the user.

[0188] Attachment portion 190 of grip-only handle 115 comprises a wall 191 generally protruding radially inwards from the wall 152, and has reinforcing ribs 192. Attachment portion 190 further has, centrally, a pair of seats 193 one of which engages, if desired in a snapping action, one of the bushings 141 of outer frame 130. Attachment portion 190 further has, at its longitudinal ends, a pair of half-seats 194 for receiving another of the bushings 141 of outer frame 130.

[0189] Attachment portion 190 of grip-only handle 115 preferably further has seats 195 for receiving fixing elements, such as screws (not shown), engaging in further bushings 196 of the outer frame 130, so as to securely fix the handle to the outer frame 130.

[0190] As briefly stated above, detachable grip-only handle 115 is preferably used in combination with cover 170. Cover 170 is advantageously provided to close the slot 171 a or 171b that is not occupied by the grip-only handle 115. Thus, when grip-only handle 115 is attached at seat 171 a, cover 170 is attached at seat 171 b, and vice versa.

[0191] As best seen in FIGs. 28 and 31, cover 170, similarly to the grip-only handle 115, has coupling element(s) that allow it to be attached to the outer frame 130 at the selected seat 171 a, 171b of the outer frame 130, through the same matching coupling element(s) provided for handle 115.

[0192] Advantageously, cover 170 is quite similar to grip-only handle 115, in that it comprises a wall 152a similar to wall 152 of handle 115, and an attachment portion 190a similar to and preferably identical with attachment portion 190 of handle 115. Attachment portion 190a is not disclosed in detail, but its parts are labeled similarly to the corresponding parts of handle 115, with an "a" suffix.

[0193] However, cover 170 lacks a protruding body portion similar to body portion 116 of handle 115. On the contrary, the external surface of the cover 170 is such

as to be flush, when installed, with the outer circumferential edge 133 of the outer frame 130. In this way, the appearance of the outer frame 130 is not impaired by the provision of the additional seat for the detachable grip-only handle 115.

[0194] Advantageously, the reciprocal position of the grip-only handle 115 and of the cover 170 is reversible by the user by removing the outer frame 130 from the frame assembly. The grip-only handle 115 and cover 170 are easily removable from their seats 171 a, 171 b provided in the outer frame 130 especially when fixing screws are not used through seats 195. By providing for this reversibility, the grip-only handle 115 can always be placed in the position deemed optimal by the user as a function of the arrangement and location of the laundry drying machine 1 (see FIGs. 21-24). In this way, porthole 108 can be easily opened/closed independently on whether the porthole 108 has to be right-hand or left-hand openable or whether the laundry drying machine rests on a floor or on a laundry washing machine.

[0195] FIGs. 28-31 further show a finishing ring 199 fitted in a dedicated recess 200 located in the outer side of the slanted wall 135 of the outer frame 130. Such finishing ring 199 may be adhesively attached to the outer frame 130.

[0196] More than two seats 171 a, 171 b, and correspondingly more than one cover 170, may be provided.

[0197] In other embodiments, the grip-only handle may protrude radially inwards from the frame assembly similarly to the embodiment of FIGs. 1-17, or radially outwards from the frame assembly similarly to the embodiment of FIGs. 18-31, still being attached to one or more components of the porthole 108 different from outer frame 130, or being one piece with one or more different components of the porthole 108, so that, when the porthole 108 is viewed from the outside in a direction along rotation axis RR, the grip-only handle is clearly visible, rather than being hidden by the frame of the porthole.

[0198] The porthole can comprise only a single frame and a bowl suitably fixed thereto, or even no bowl and be one transparent or non-transparent part.

[0199] The various disclosed features may be present individually or in any combination in a laundry drying machine according to the invention.

Claims

1. A laundry drying machine (1) comprising a cabinet (2) housing a chamber (3) for treating laundry having a rotation axis (RR), a porthole (8, 108) for providing access to and tightly closing the chamber (3), a hinge (11) to pivot the porthole (8, 108) to the cabinet (2), a lock (12) of a kind that allows opening of the porthole during operation of the laundry drying machine, the lock (12) comprising a first member (13, 113) on the porthole (8, 108) and a matching member (14) on the cabinet (2), and a grip-only handle (15, 15a,

15b, 15c, 115),

wherein said porthole (8, 108) comprises a frame assembly comprising at least one frame (30, 30a, 31, 130, 131),

wherein said lock (12) is configured to be released by applying a force beyond a threshold onto the porthole (8, 108) away from the cabinet (2),

characterized in that

said grip-only handle (15, 15a, 15b, 15c, 115) and said first member (13, 113) of said lock (12) are arranged in such a way that, when the porthole (8, 108) is closed, a center of mass (C15, C15a, C15b, C15c, C115) of said grip-only handle (15, 15a, 15b, 15c, 115) and a center of mass (C12, C112) of said first member (13, 113) of said lock (12) are located, with respect to the rotation axis (RR), at different angular positions.

2. The laundry machine (1) of claim 1, wherein said hinge (11) is arranged in such a way that, when the porthole (8, 108) is closed, its center of mass (C11, C111) is located, with respect to the rotation axis (RR), at a diametrically opposite angular position with respect to the center of mass (C12, C112) of said first member (13, 113) of said lock (12).
3. The laundry machine (1) of claim 1 or 2, wherein said grip-only handle (15, 15a, 15b, 15c, 115) and said first member (13, 113) of said lock (12) are arranged in such a way that, when the porthole (8, 108) is closed, their centers of mass (C15, C15a, C15b, C15c, C115; C12, C112) are located, with respect to the rotation axis (RR), at angular positions that are reciprocally spaced by less than 90°.
4. The laundry machine (1) of one or more of previous claims, wherein said grip-only handle (15, 15b, 15c, 115) is configured to be alternatively positionable in one of at least two prefixed positions with respect to said at least one frame (30, 30a, 31, 130, 131) of the frame assembly.
5. The laundry machine (1) of claim 4, wherein said grip-only handle (15b, 115) is provided with one or more coupling elements (59, 190, 193-195) and said frame assembly is provided with a plurality of matching coupling elements (60, 62, 171 a, 171b, 141, 196) so that said grip-only handle (15b, 115) can be mounted in at least two prefixed positions.
6. The laundry drying machine (1) of claim 5, wherein at least one cover (170) having one or more coupling elements (190a, 193a-195a) similar to that/those of the grip-only handle (115) is further provided, and wherein when the grip-only handle (115) is mounted in a preselected one of said at least two prefixed positions, the at least one cover (170) is provided at the other one(s) of at least two prefixed positions.

7. The laundry drying machine (1) of claims 5 or 6, wherein said matching coupling elements (171 a, 171 b, 141, 196) of said frame assembly comprise bushings (141) that are also used to assemble said at least one frame (130, 131) of said frame assembly. 5
8. The laundry drying machine (1) of one or more of the previous claims, wherein the grip-only handle (115) extends through a wall forming the outer edge (133) of said at least one frame (130) of the frame assembly. 10
9. The laundry drying machine (1) of one or more of the previous claims, wherein a wall forming the outer edge (133) of said at least one frame (130) of the frame assembly comprises a slot (172a, 172b) for receiving the grip-only handle (115) or a cover (170). 15
10. The laundry drying machine (1) of one or more claims 1 to 5, wherein said grip-only handle (15, 15a) is one piece with said at least one frame (30, 30a, 31). 20
11. The laundry drying machine (1) of claim 1, wherein said grip-only handle (15c) is one piece with an annular handle support (63) that can be mounted in at least two different angular positions with respect to said at least one frame (30, 30a, 31), so that said grip-only handle (15c) is positionable in said at least two prefixed positions by mounting said annular handle support (63) in one of these at least two different angular positions. 25 30
12. The laundry machine (1) of one or more of the claims 1 to 5 or 11 wherein said grip-only handle (15b, 15c) is arranged in such a way to be individually separable from said frame assembly. 35
13. The laundry drying machine (1) of one or more of the previous claims, wherein said grip-only handle (15, 15a, 15b, 15c, 115) comprises a body portion (16, 16a, 16b, 16c, 116) that protrudes radially inwardly or radially outwardly from the at least one frame (30, 30a, 130, 31, 131). 40
14. The laundry machine (1) of claim 13, wherein there is a wall (52, 52b) of the handle (15b, 15c) or of the at least one frame (30, 30a, 31) crossing the body portion (16b, 16c) at an intermediate zone of the body portion (16b, 16c), and a plurality of reinforcing ribs (55) extending from the body portion (16b, 16c) and the wall (52, 52b), and wherein the ribs (55) are generally L-shaped bodies arranged at a corner between the wall (52, 52b) and the body portion (16, 16a, 16b, 16c), on the inner side of the grip-only handle (15, 15a, 15b, 15c) facing, when the porthole (8) is closed, said chamber (3) and/or said cabinet (2). 45 50 55
15. The laundry machine (1) of claim 14, wherein each

rib (55) includes a long edge (56) adjoining an inner side of the body portion (16, 16a, 16b, 16c) from the wall (52, 52b) towards a free edge (18, 18a, 18b, 18c) of the body portion (16, 16a, 16b, 16c), and a short edge (57) adjoining at least part of the wall (52, 52b).

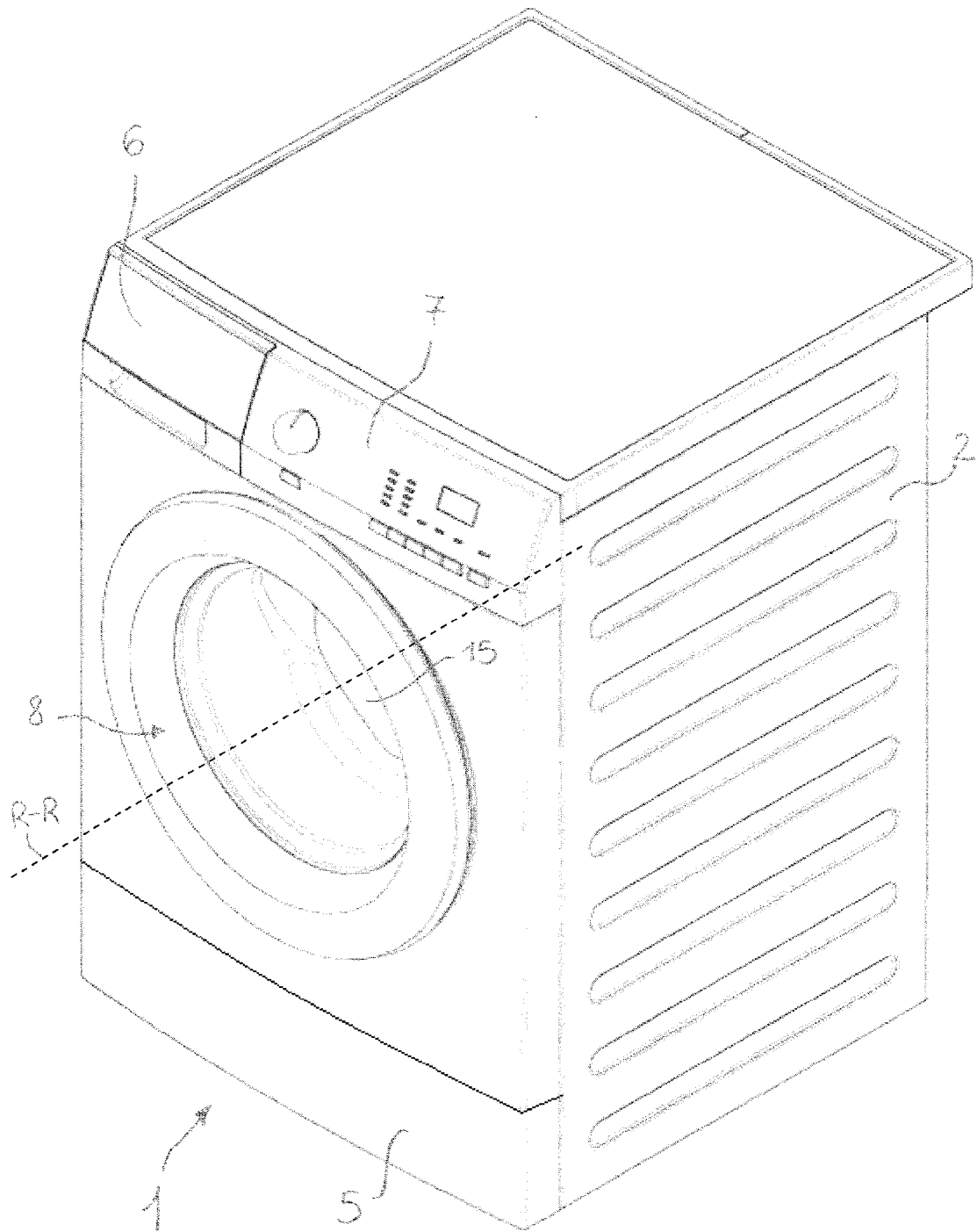


Fig. 1

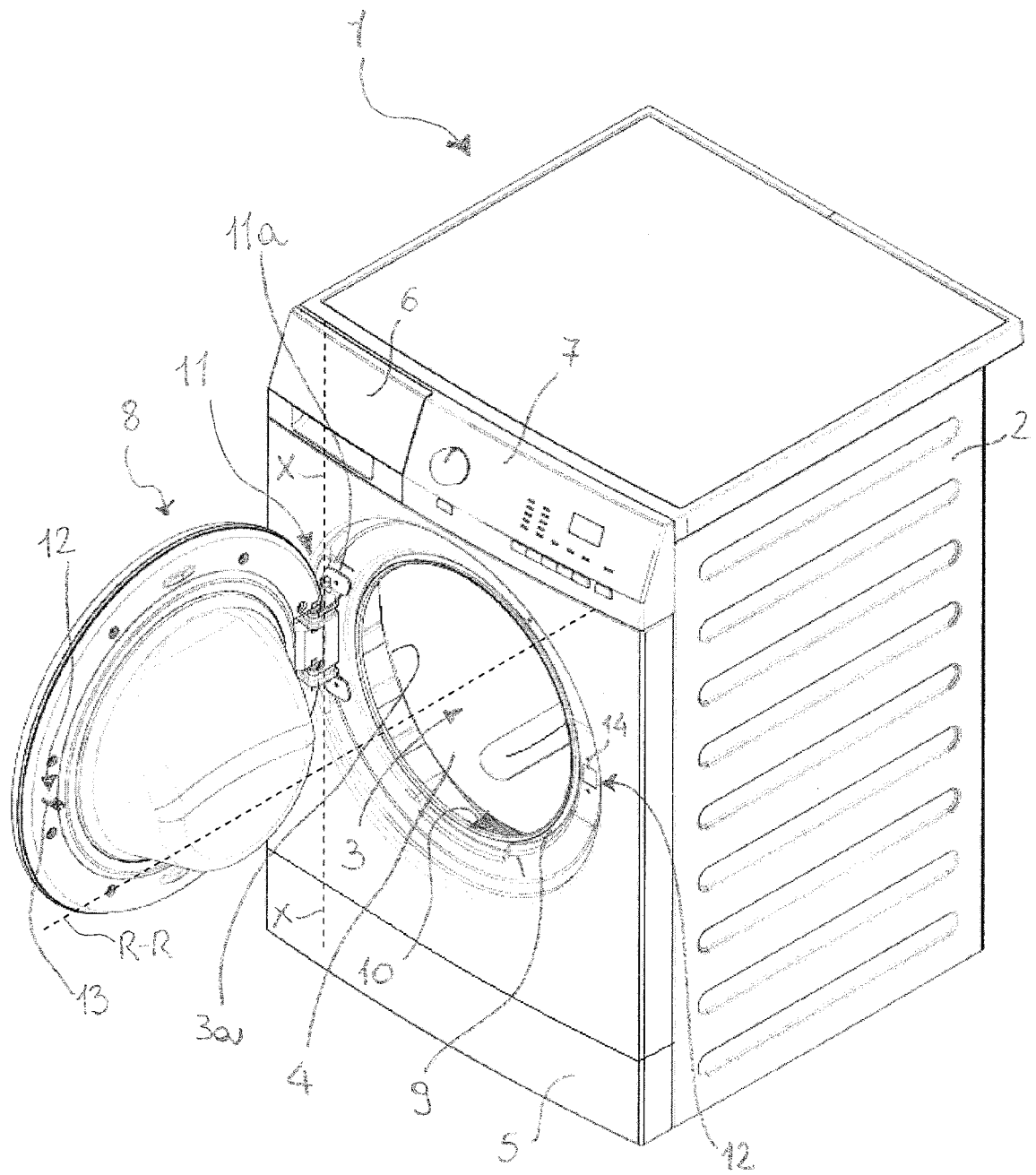


Fig. 2

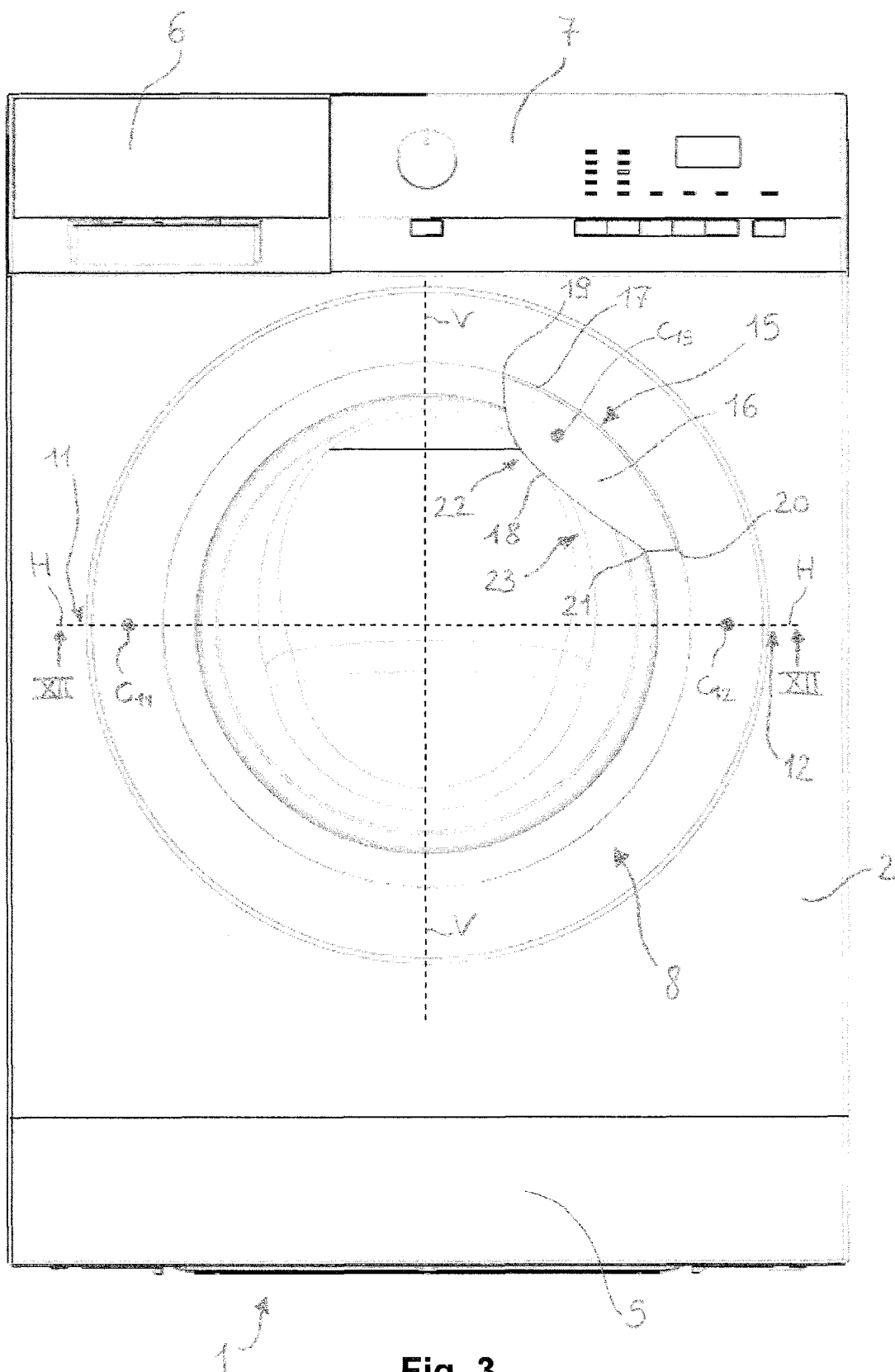


Fig. 3

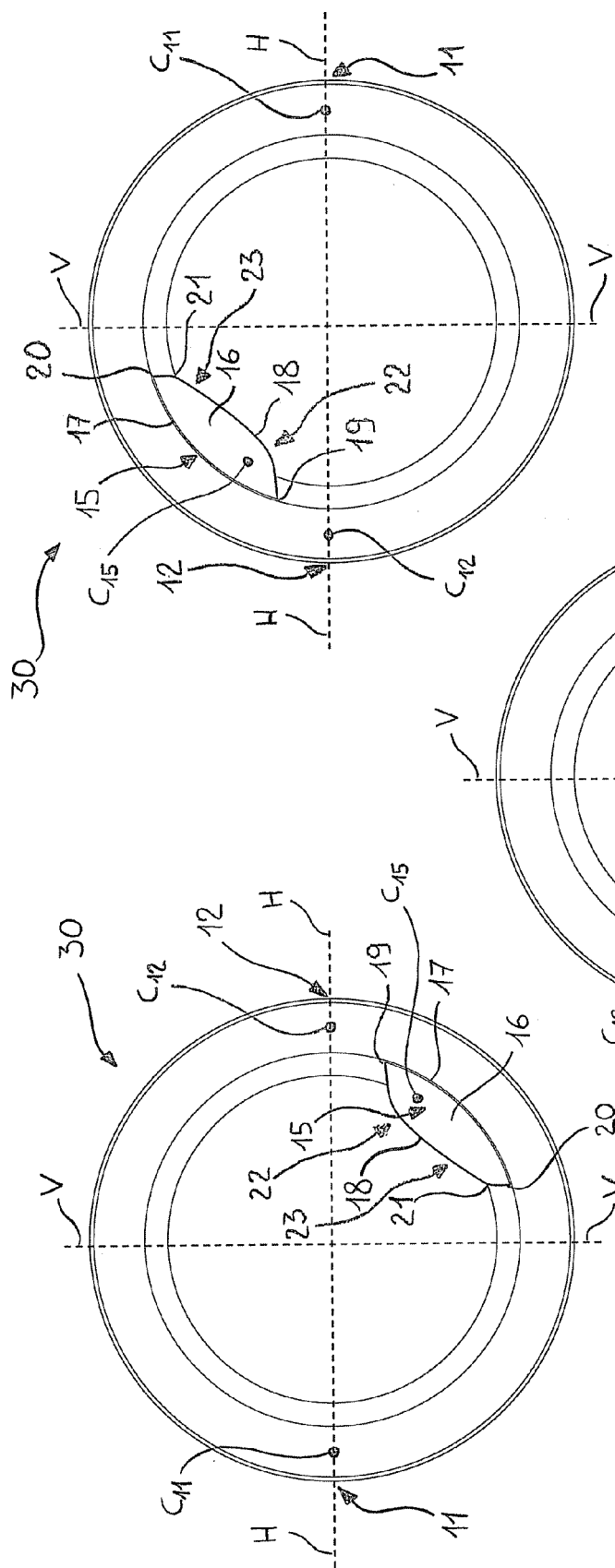


Fig. 4

Fig. 5

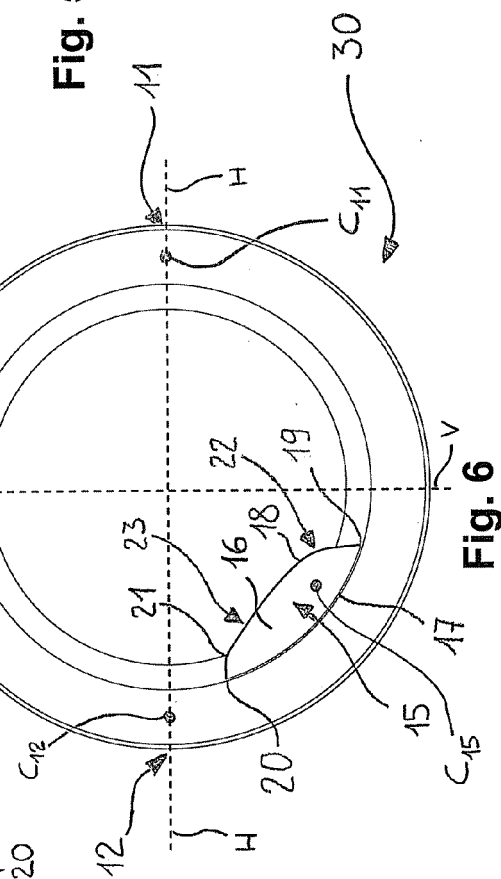
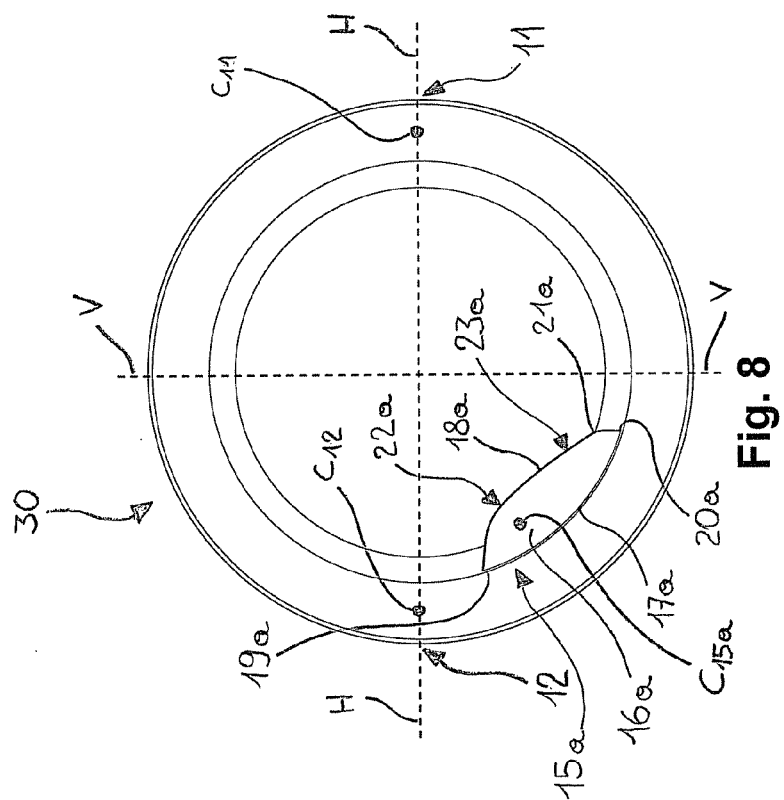
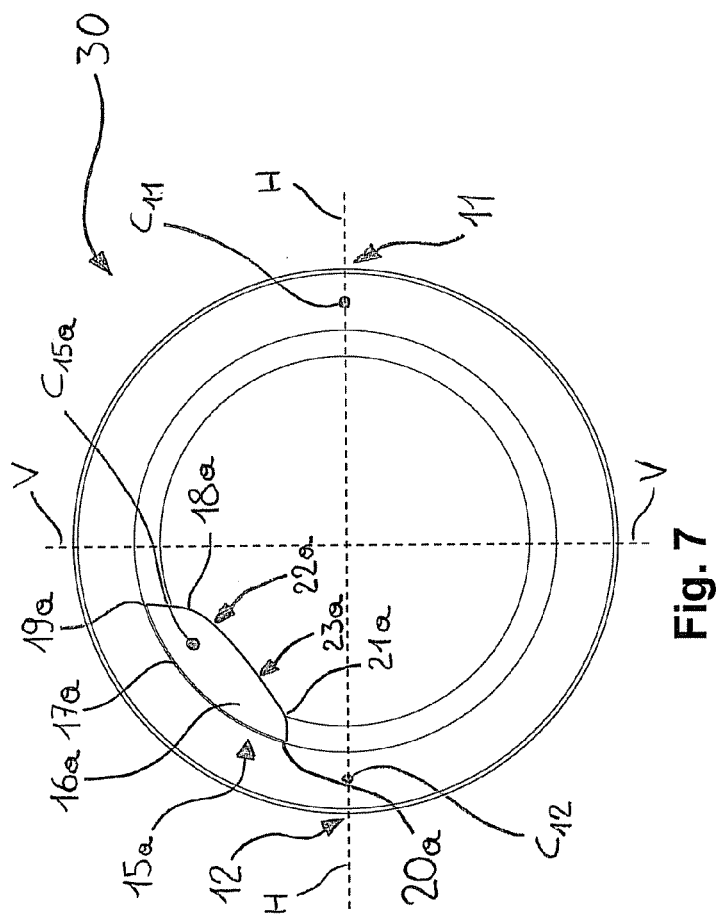


Fig. 6



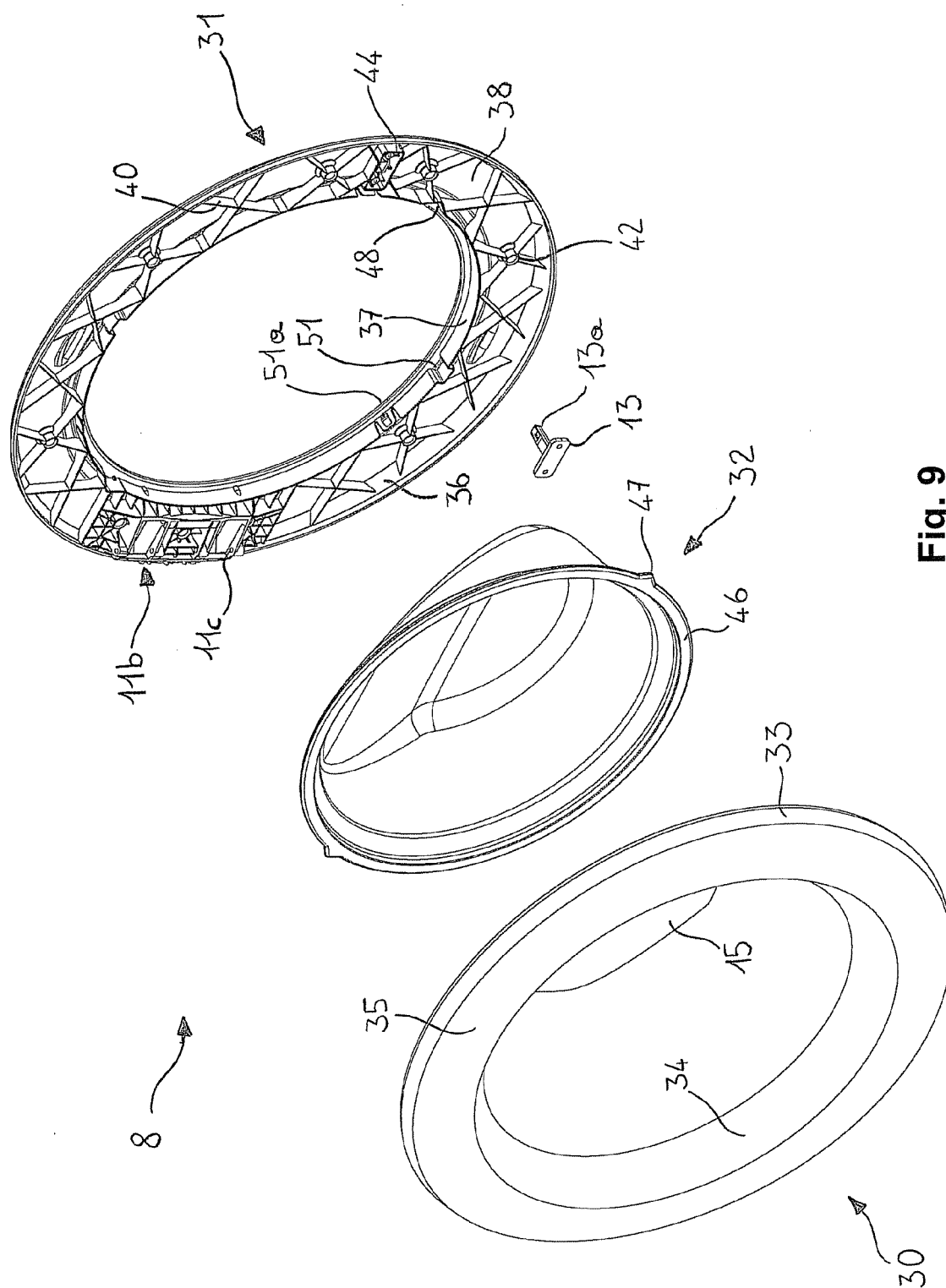


Fig. 9

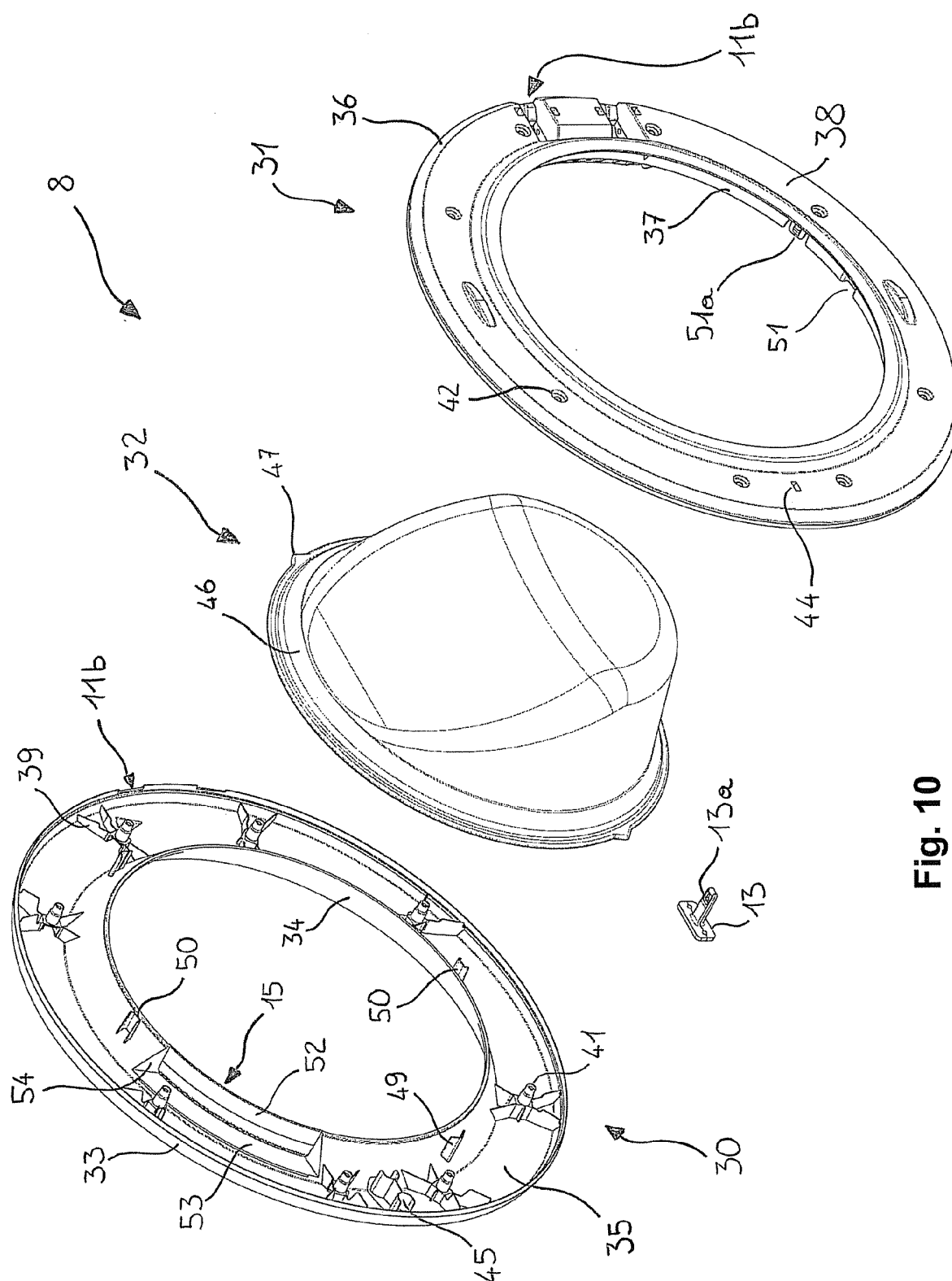


Fig. 10

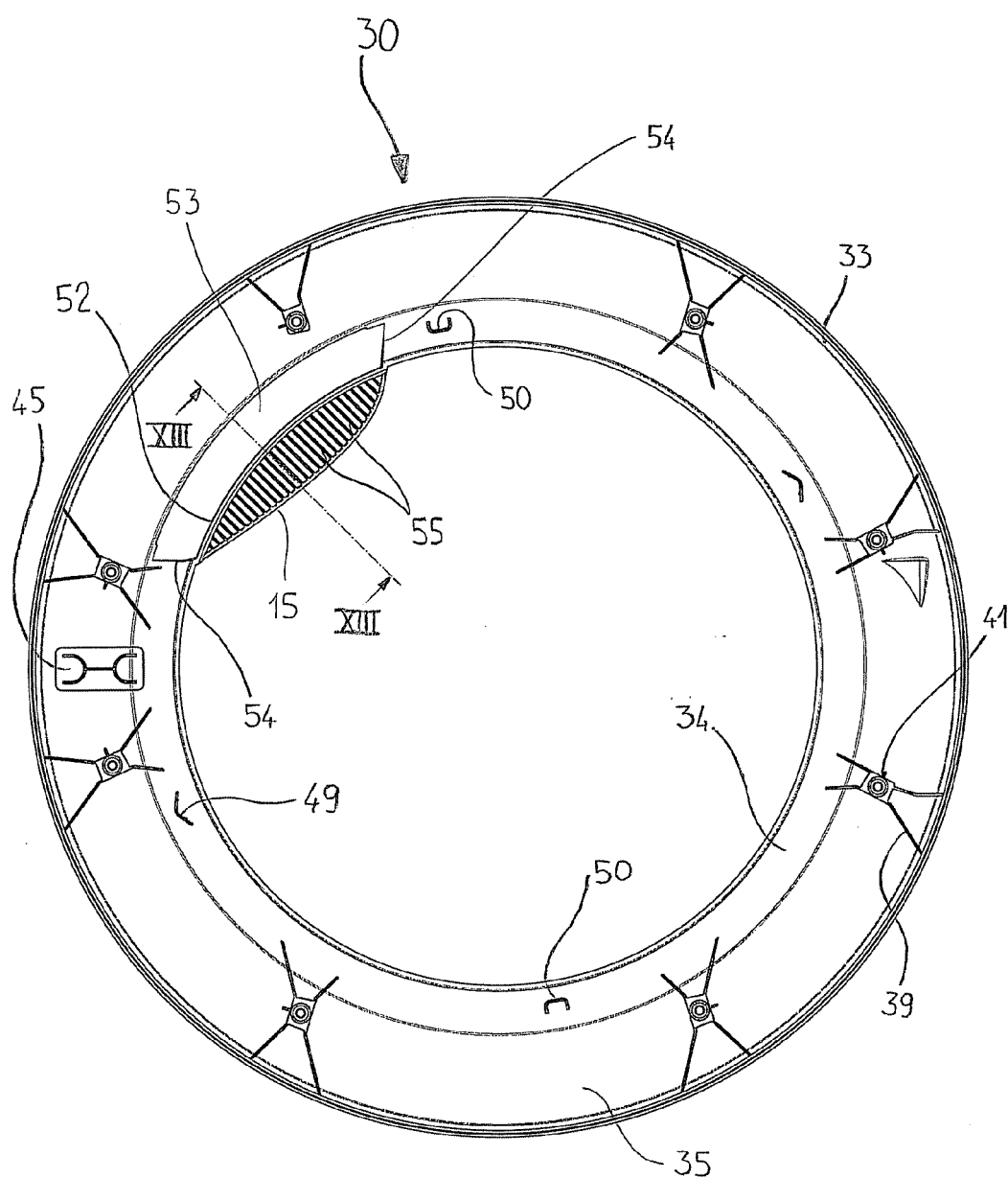


Fig. 11

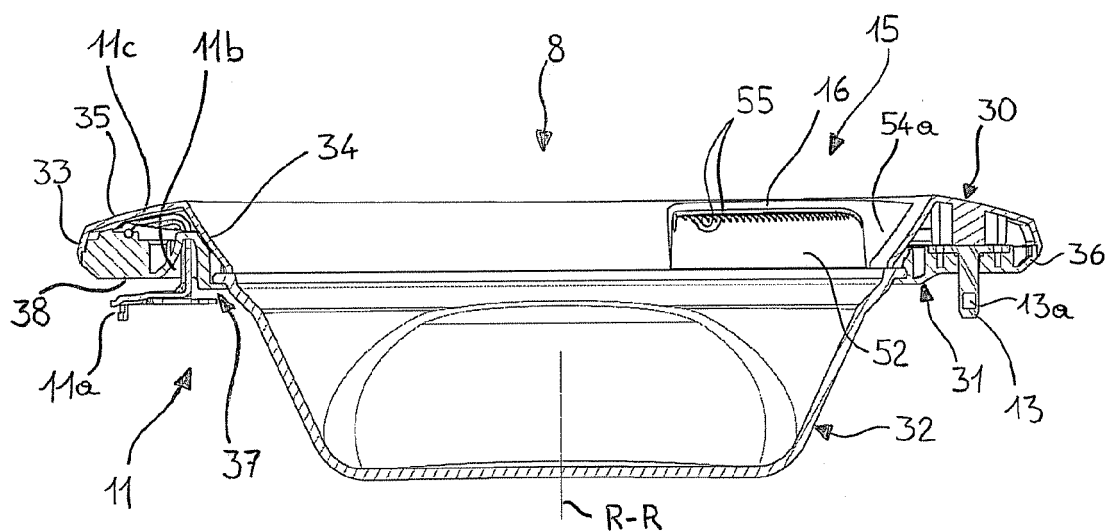


Fig. 12

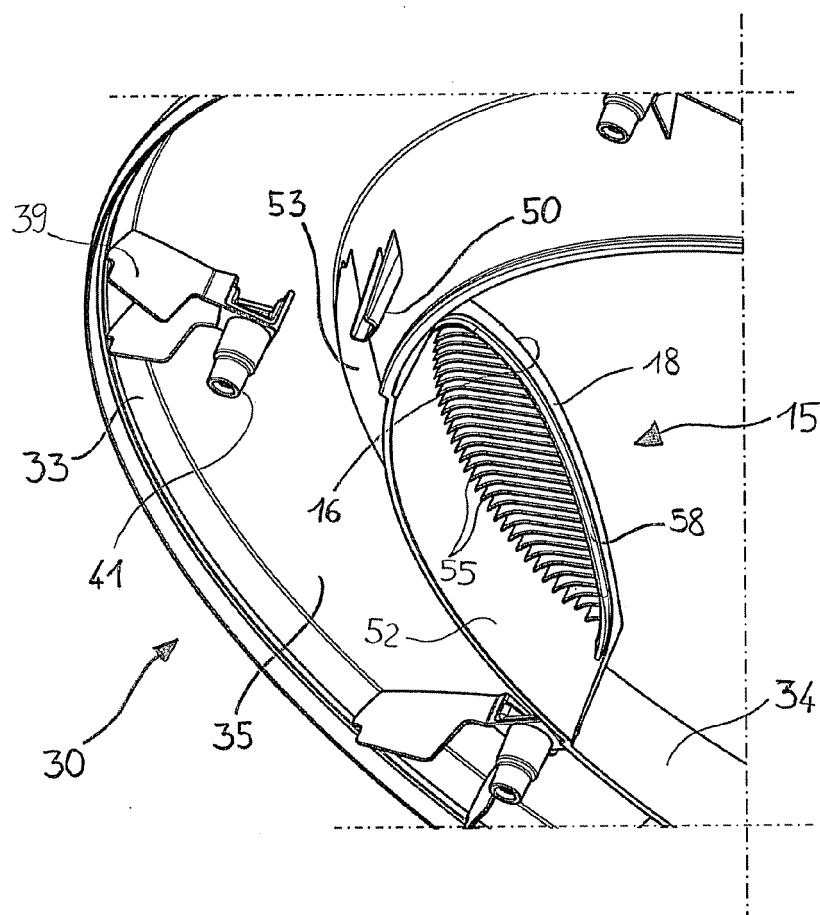


Fig. 13

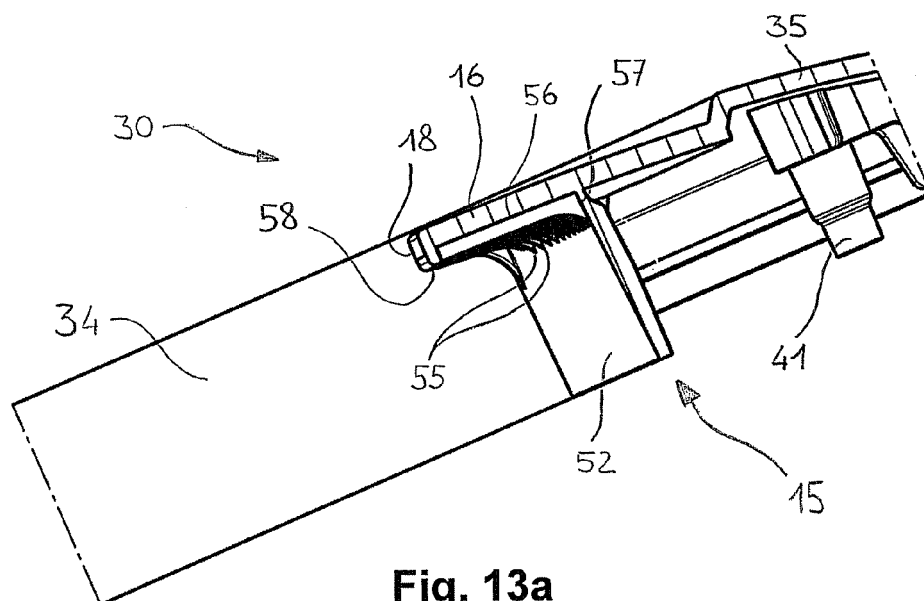


Fig. 13a

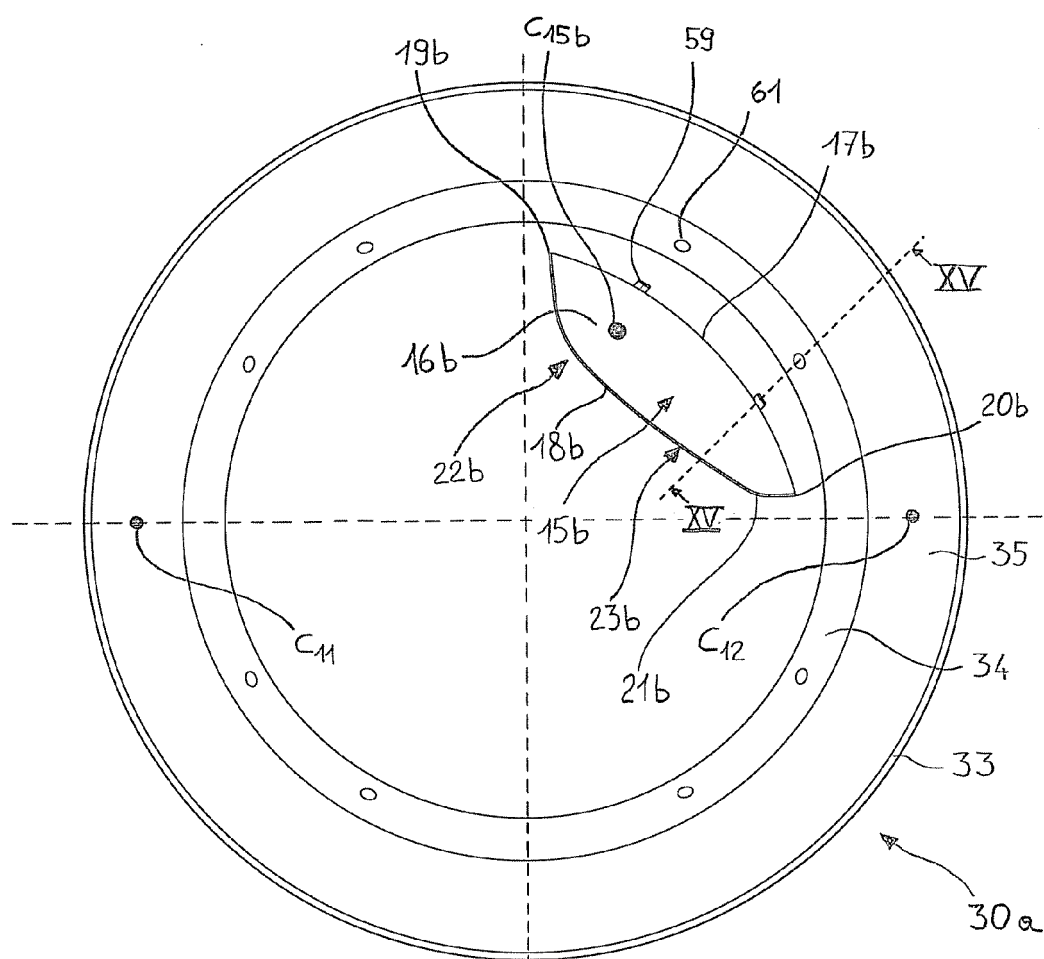


Fig. 14

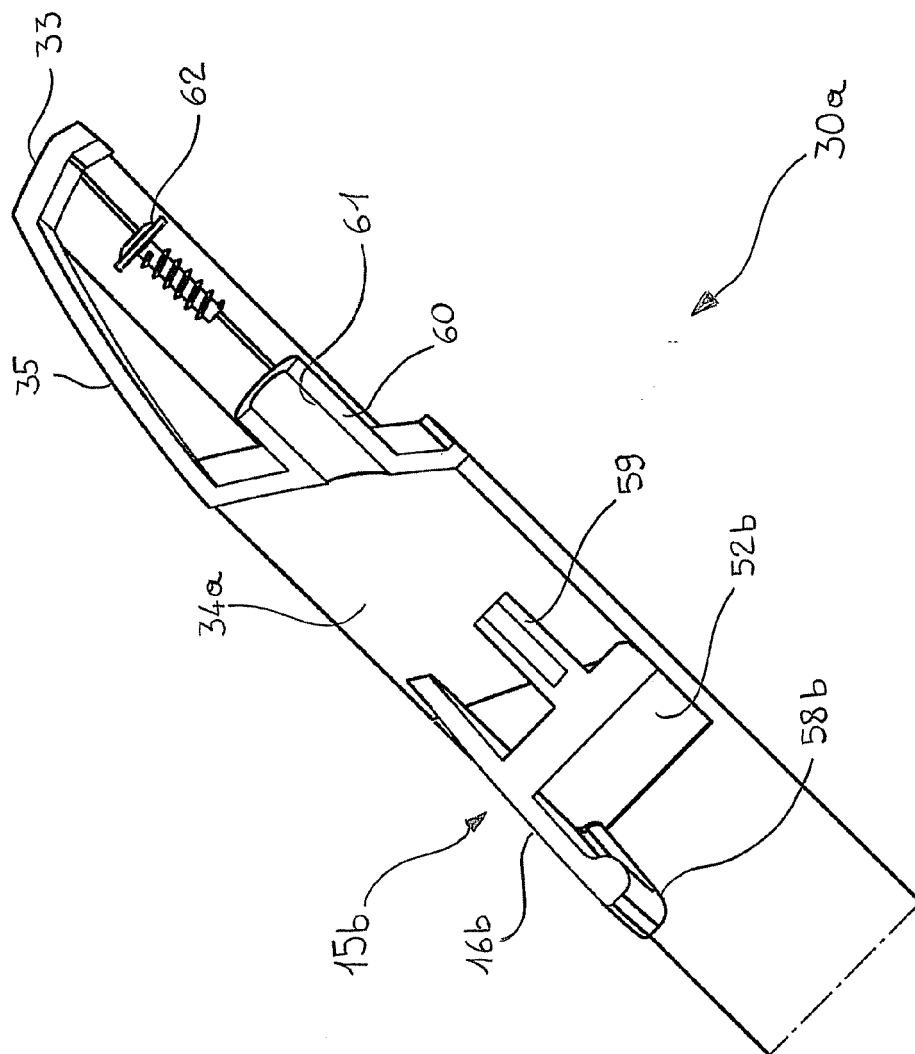


Fig. 15

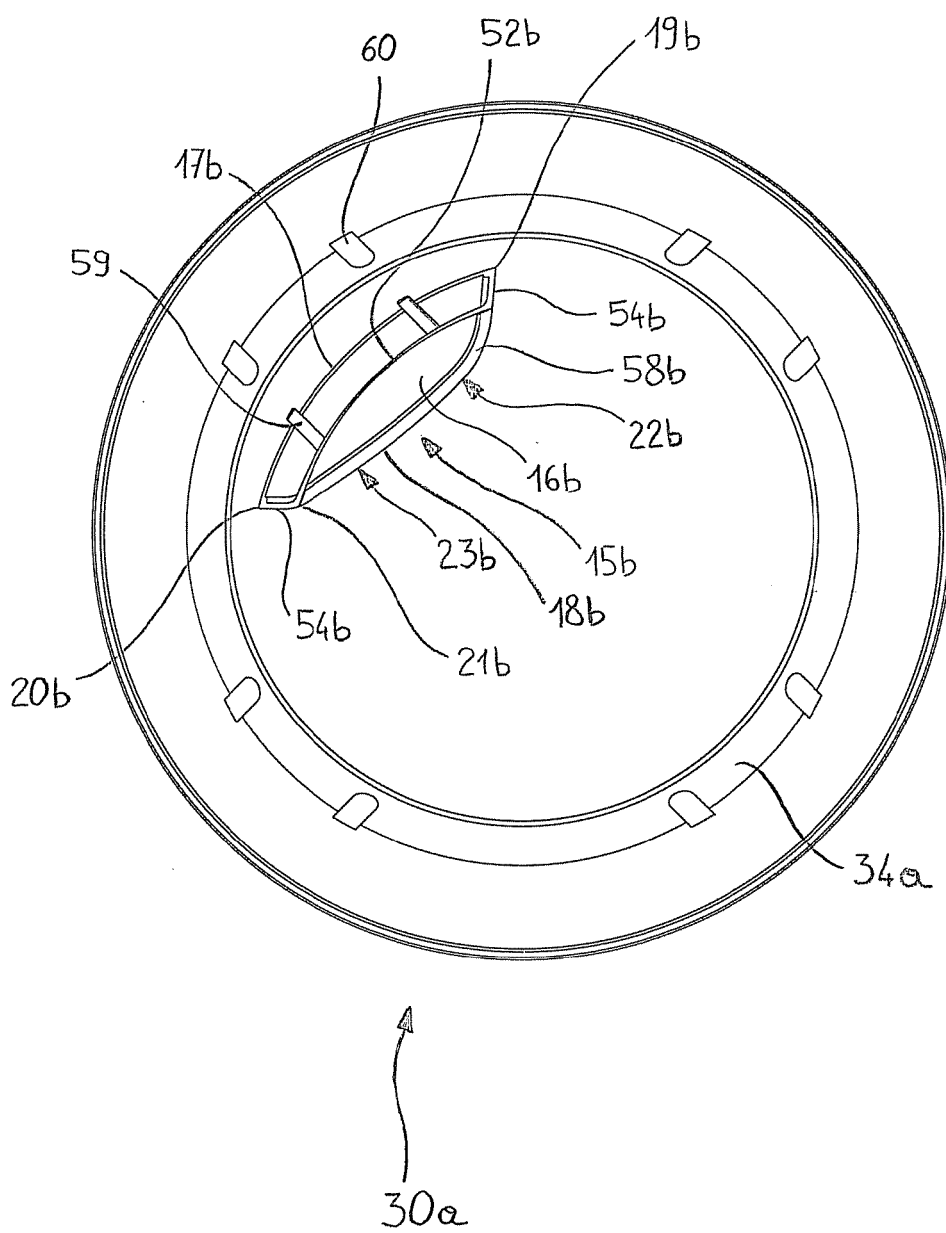


Fig. 16

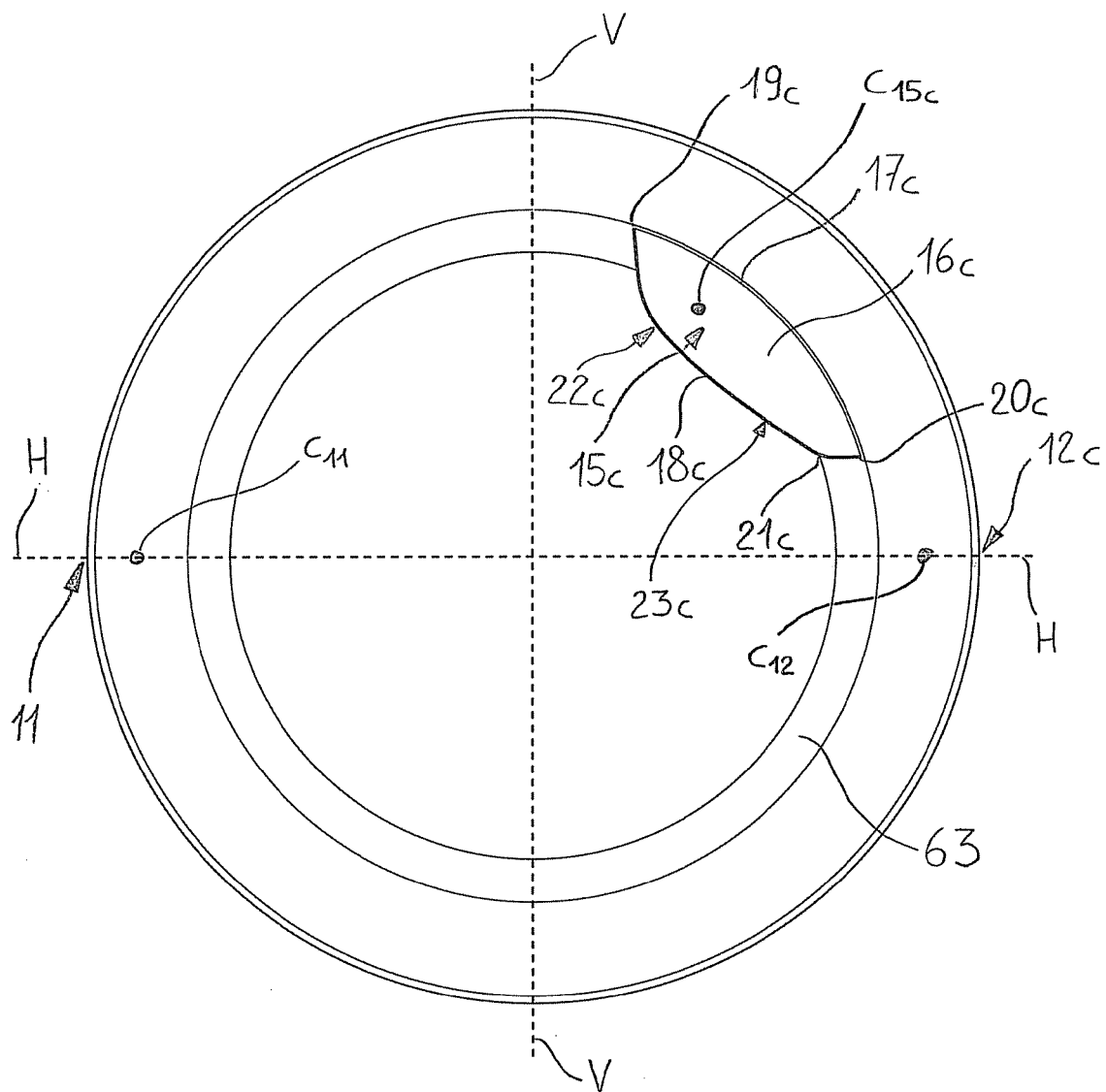


Fig. 17

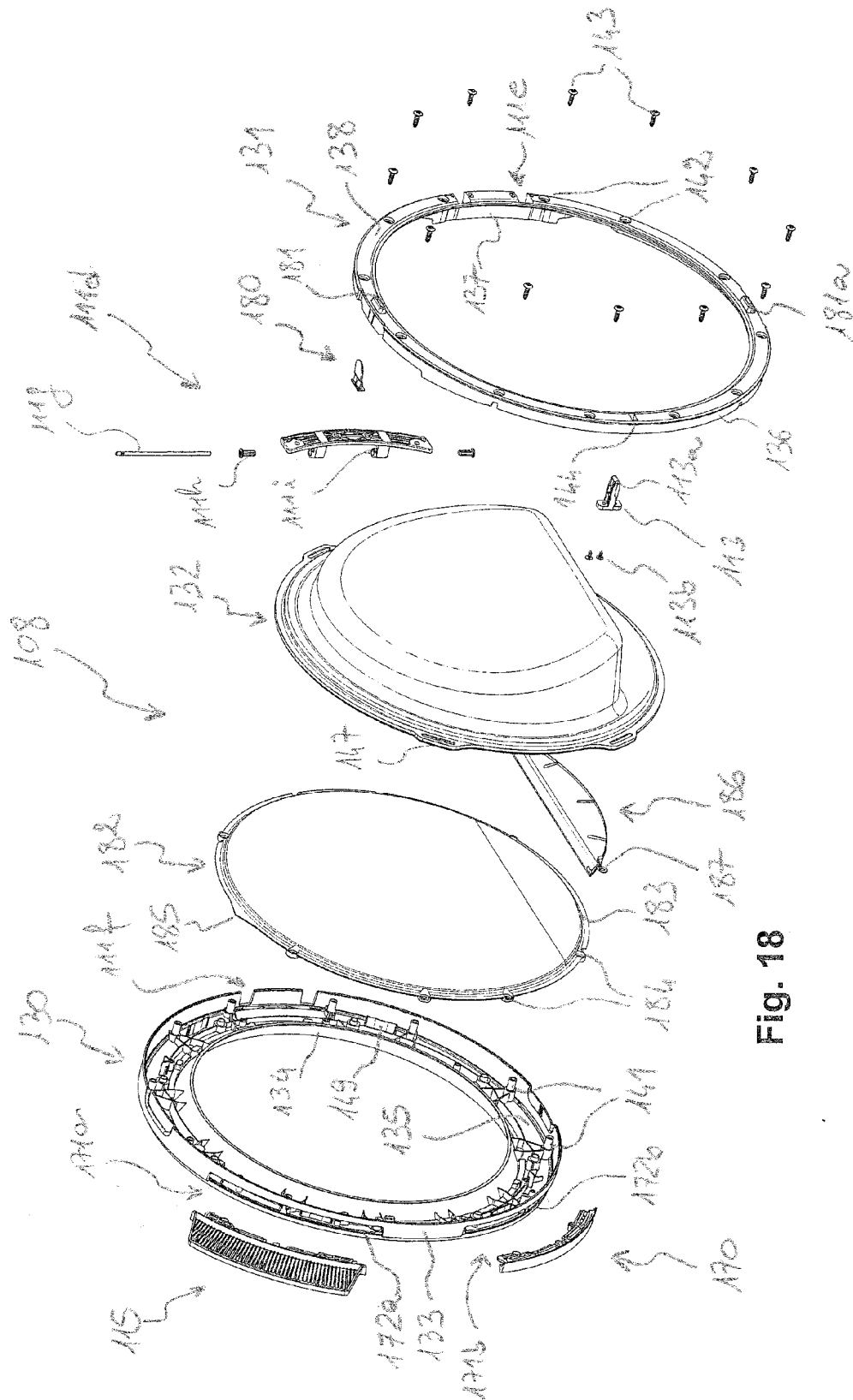


Fig. 18

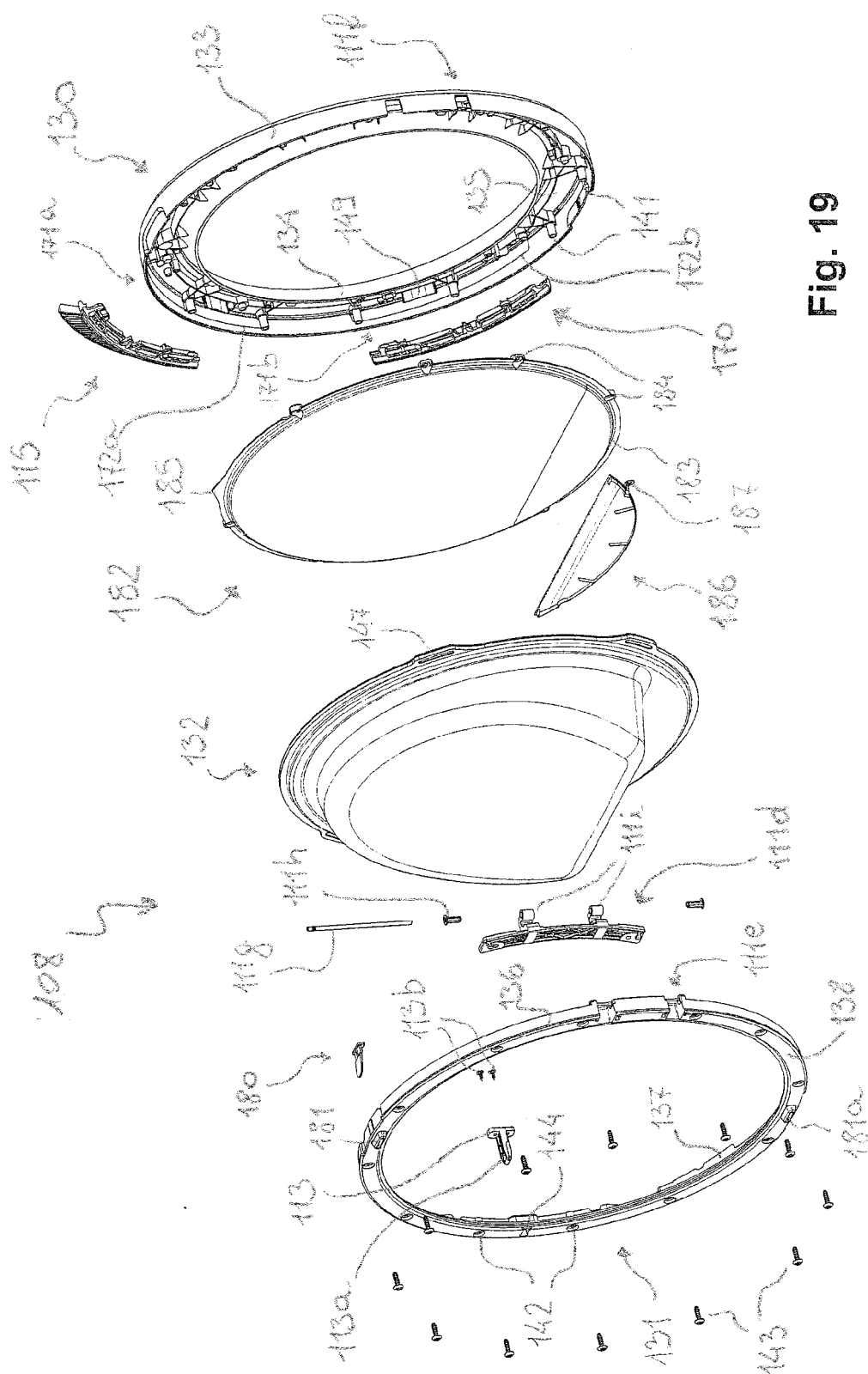


Fig. 19

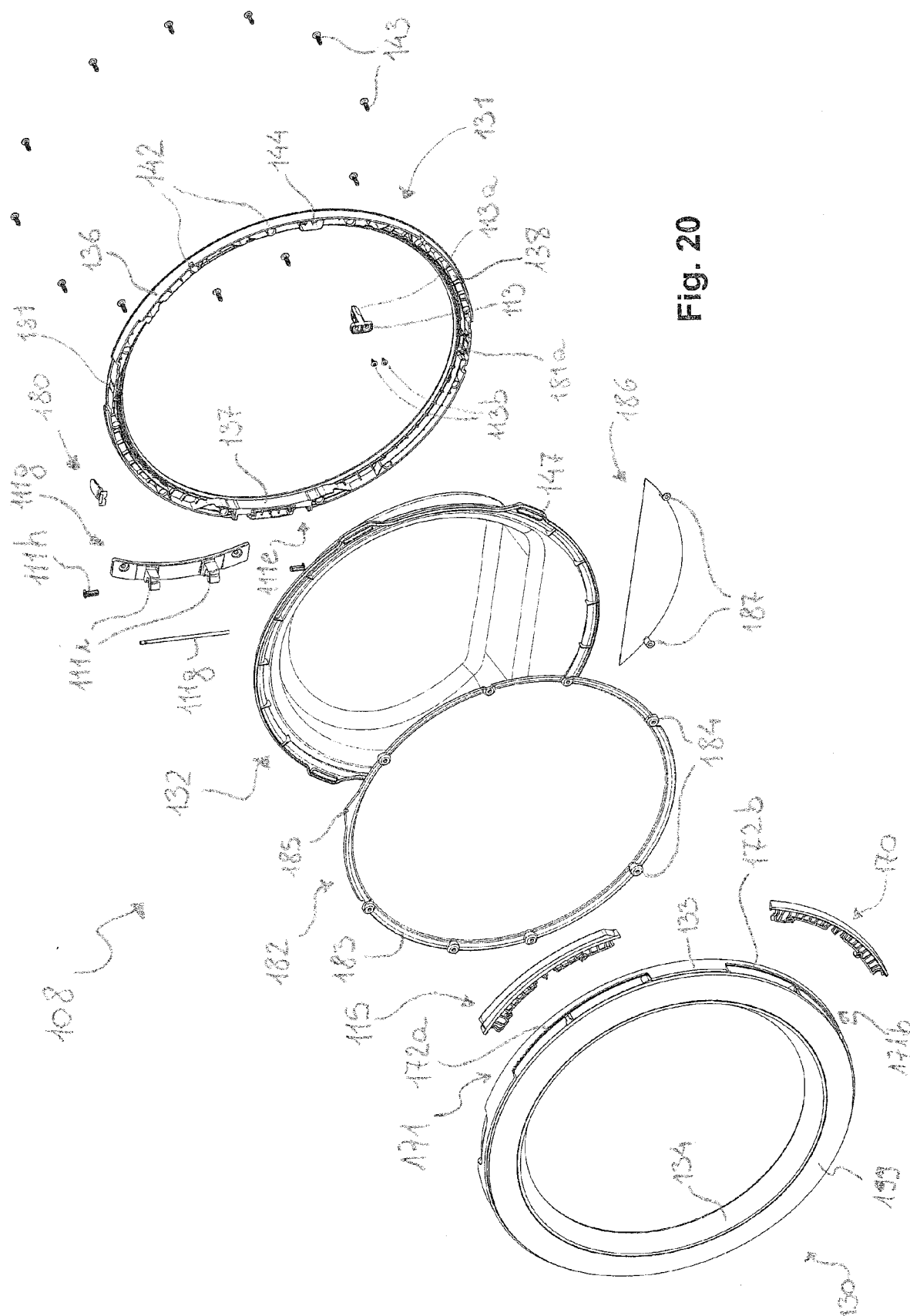


Fig. 20

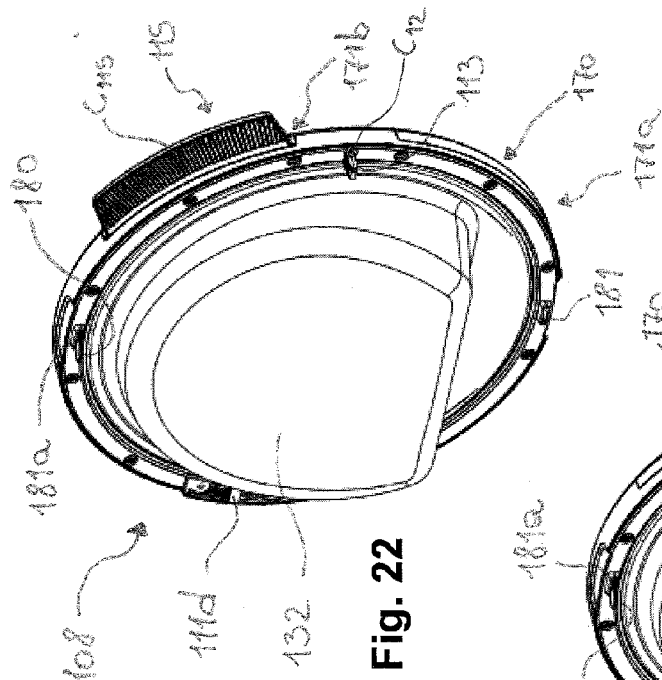


Fig. 22

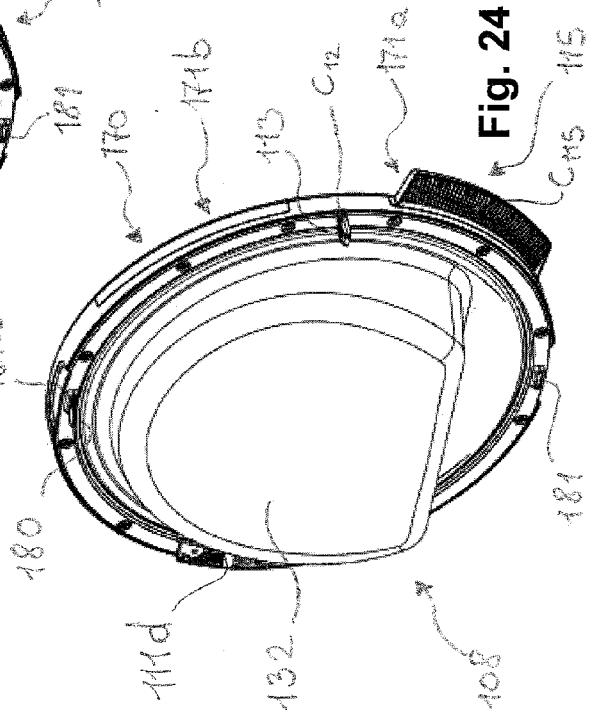


Fig. 24

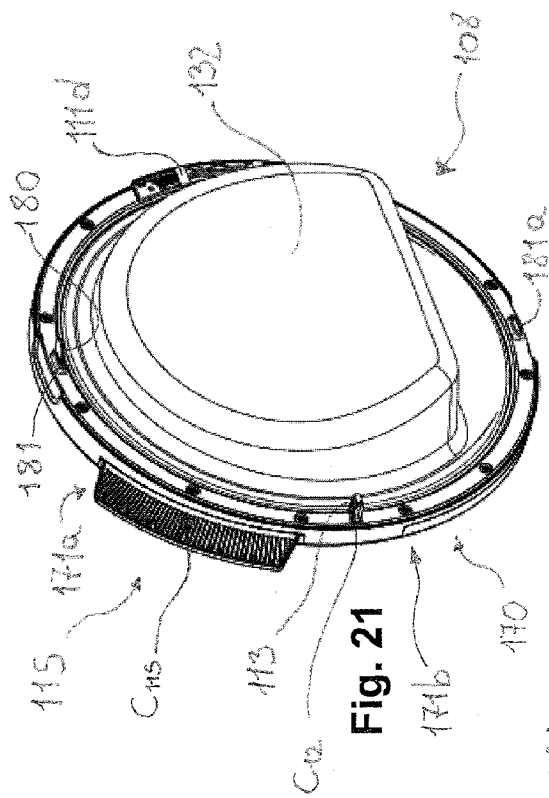


Fig. 21

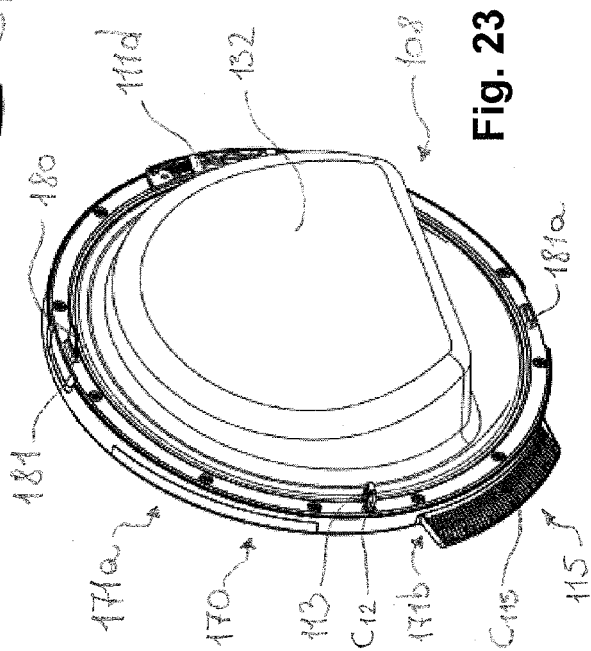


Fig. 23

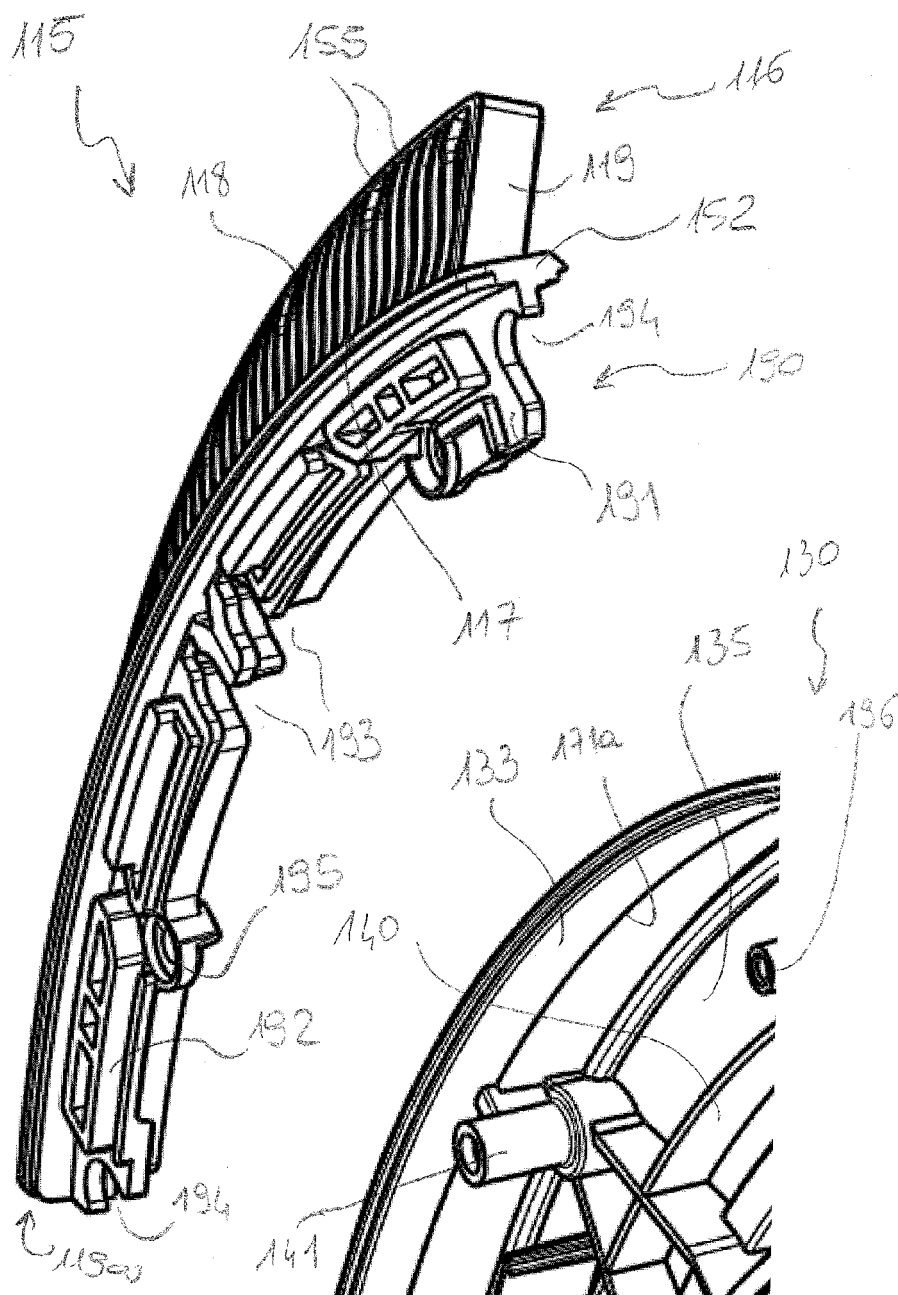


Fig. 25

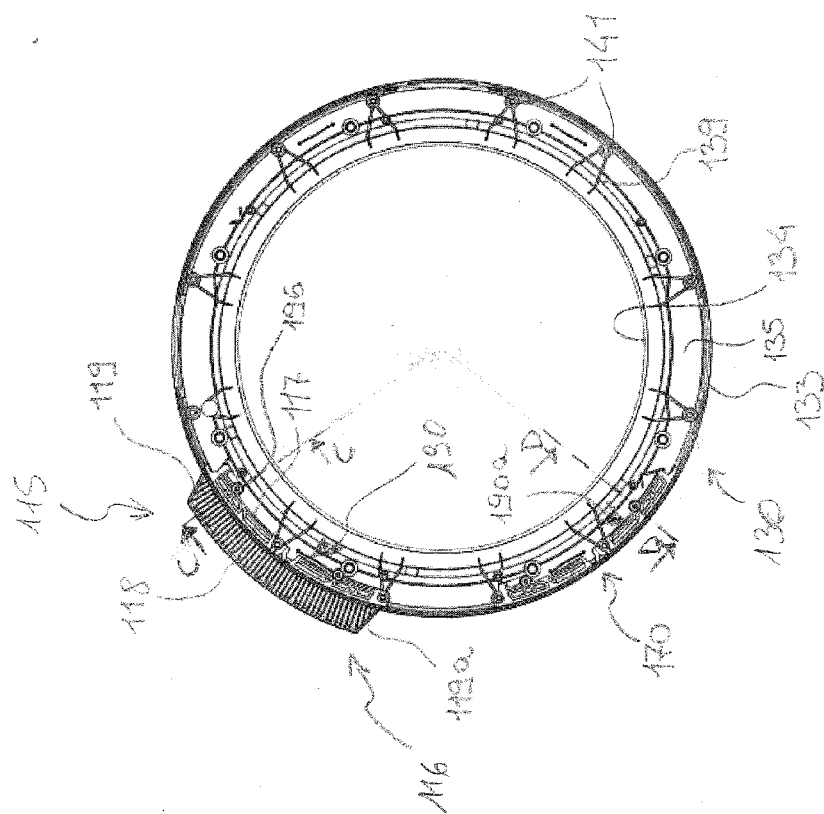


Fig. 26

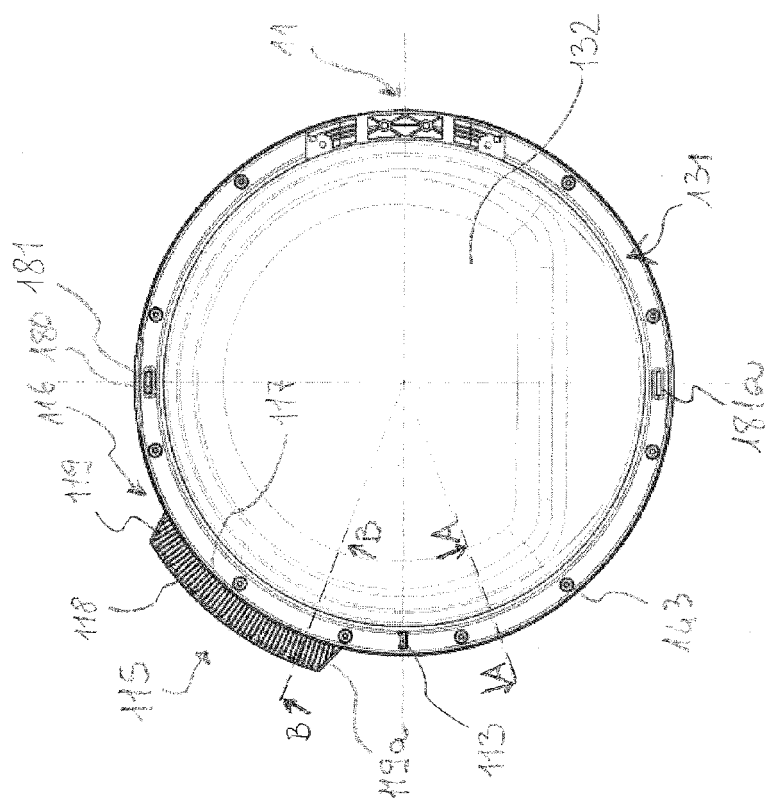


Fig. 27

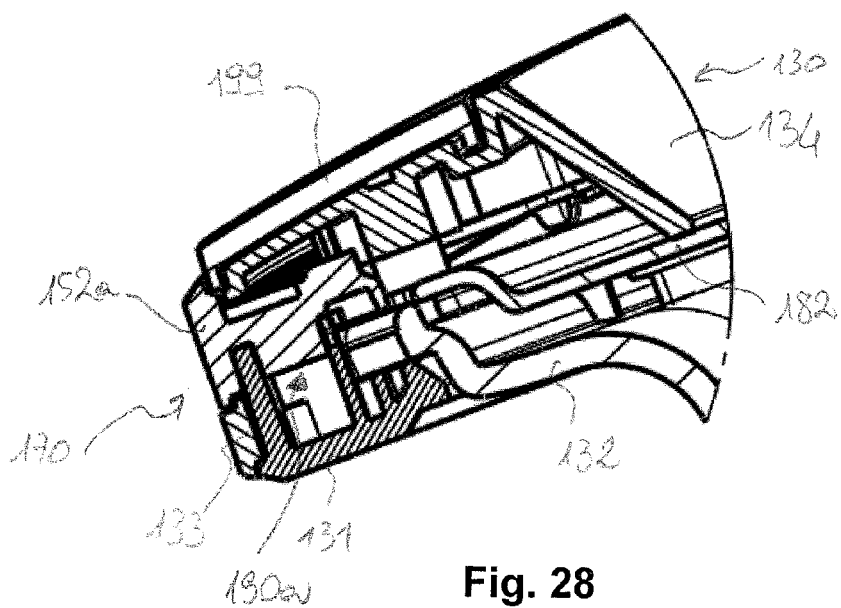


Fig. 28

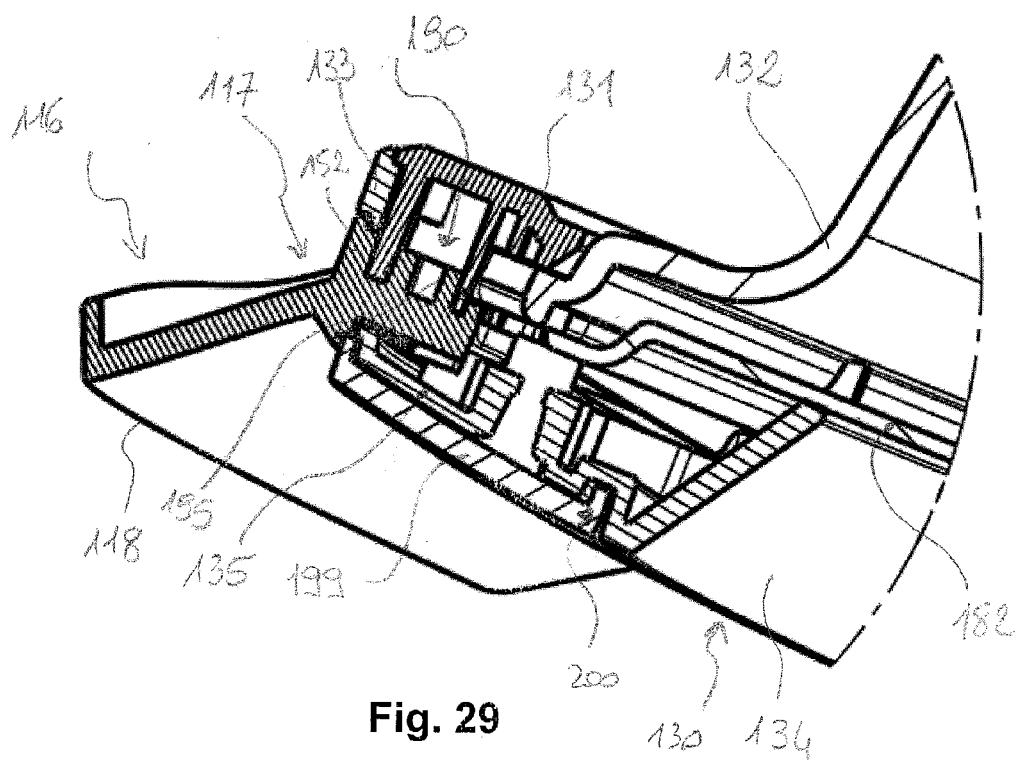
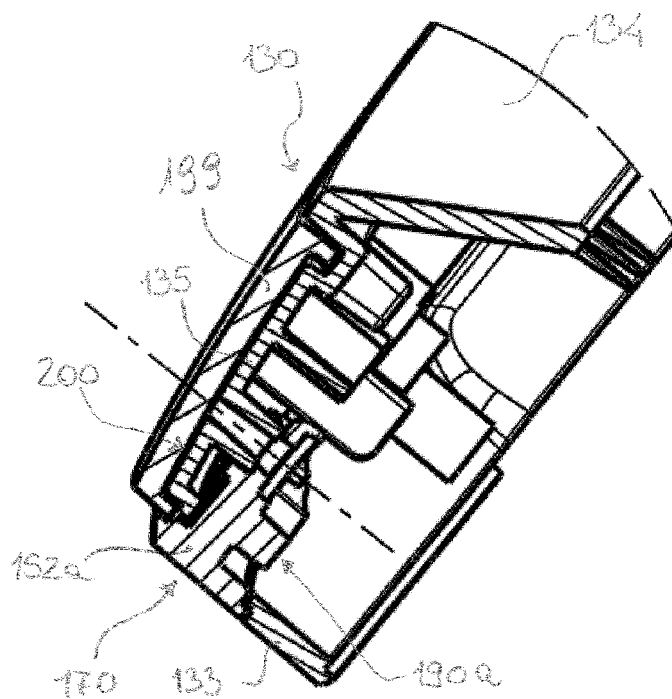
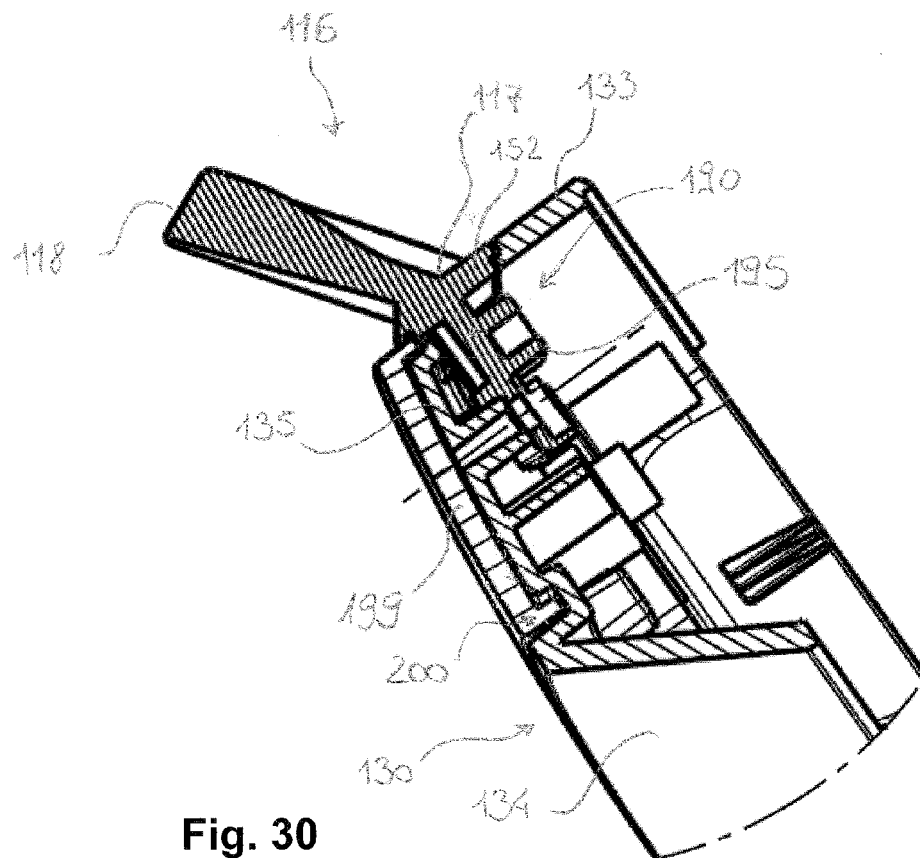


Fig. 29





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Application Number
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Place of search Munich		Date of completion of the search 18 June 2015	Examiner Weinberg, Ekkehard
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