

(19)



(11)

**EP 2 977 499 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**01.02.2017 Bulletin 2017/05**

(51) Int Cl.:  
**D06F 39/10** <sup>(2006.01)</sup> *D06F 39/12* <sup>(2006.01)</sup>  
**D06F 58/22** <sup>(2006.01)</sup>

(21) Application number: **14178110.4**

(22) Date of filing: **23.07.2014**

(54) **Laundry washing machine**

Waschmaschine

Machine à laver le linge

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

(43) Date of publication of application:  
**27.01.2016 Bulletin 2016/04**

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## Description

**[0001]** The invention relates to a laundry washing machine, in particular a laundry washing machine having a filter opening for accessing a filter unit.

**[0002]** Nowadays laundry washing machines generally comprise an external casing, or cabinet, provided with a loading/unloading door which allows the access to a washing tub containing a perforated rotatable drum in which the laundry to be washed can be loaded.

**[0003]** Known washing machines comprise a water load system adapted for feeding water and washing/rinsing products (i.e. detergent, softener, etc.) into the tub.

**[0004]** Known washing machines also comprise a discharge system typically comprising a drain pump and some draining pipes, adapted for discharging waste washing liquid (i.e. water and water mixed with washing and/or rinsing products) outside the washing machine.

**[0005]** The discharge system typically comprises a filter unit, placed between the bottom of the tub and the drain pump, adapted to retain all undesirable bodies (for example buttons came off from the laundry, coins erroneously introduced into the washing machine, etc.) passed through the holes located on the periphery of the drum, or fell to the bottom of the tub by passing between the drum and the tub, which could damage or obstruct the drain pump.

**[0006]** The most common of these filter units comprise a filter receiving body, positioned inside the cabinet, and accessible via a filter opening provided in the cabinet; a filter element is removably positioned into the filter receiving body, and a removable closing element, or cover, is provided for selectively closing the filter opening, so as to selectively allowing or impeding the access to the filter receiving body

**[0007]** Patent Application published as No. US 2004/0148974 discloses a filter cover assembly of a washing machine including a cover fitted to a filter hole provided at a cabinet of the washing machine for loading/unloading a filter.

**[0008]** When the filter is to be extracted from the inside of the washing machine, for example for cleaning or replacing purposes, such a cover is completely removed and detached from the washing machine. Then, when the filter, for example after it has been cleaned or replaced, is to be repositioned in its working position inside the filter hole, the filter cover is to be repositioned too in order to cover fit the filter hole. However, sometimes, during the cleaning or replacing filter actions, such a filter cover may be lost or moved away from the washing machine, making difficult its recovery or usage, resulting in a delay in repositioning the cover in order to restore the working conditions.

**[0009]** Thus, there is the need to have always the filter cover at the user's fingertips so it can be quickly repositioned to close the filter unit once the filter, cleaned or replaced, has been reinserted back into the filter unit which houses it.

**[0010]** Therefore the object of the invention is providing a laundry washing machine with a filter unit having a cover which may be completely separated from the filter opening of the machine for allowing an easy removal/reinsertion of the filter, and which may be promptly repositioned, for example after the filter has been reinserted in the filter unit, without the risk or loosing such a cover while it is separated from the filter opening.

## 10 DISCLOSURE OF INVENTION

**[0011]** The applicant has found that, by connecting a removable closing element, which closes/open a filter opening in a laundry washing machine for the removal/insertion of a filter element, to a portion of the laundry washing machine by means of a flexible connecting device, the risk of losing the closing element, or not promptly having it at the user fingertips when the filter opening is to be closed by such a closing element, is eliminated.

**[0012]** In compliance with the above aims, according to the present invention there is provided a laundry washing machine as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

**[0013]** Therefore, such a laundry washing machine comprises:

- a cabinet containing a washing tub, in which washing liquid may be loaded,
- a rotatable drum, rotatably accommodated in the washing tub for containing the laundry to be washed,
- a water load system for conveying washing water into the washing tub,
- a discharge system for discharging waste washing liquid outside the laundry washing machine.

**[0014]** Furthermore, the discharge system comprises a filter unit which comprises:

- a filter receiving body, positioned inside the cabinet and accessible via a filter opening provided in the cabinet;
- a filter element removably positioned into the filter receiving body;
- a removable closing element for selectively closing the filter opening, so as to selectively allowing or impeding the access to the filter receiving body.

**[0015]** Furthermore, the laundry washing machine further comprises a flexible connecting device connecting the removable closing element to a portion of the laundry washing machine.

**[0016]** The flexible connecting device allows the removable closing element to be always connected to a

portion of the laundry washing machine. Thus, the risk that such a removable closing element may be lost or moved away from the laundry washing machine when it is temporarily removed for allowing the removal/insertion of the filter, is eliminated. Accordingly, there is no delay in repositioning the removable closing element in the position in which it closes the filter opening due to not promptly having it when needed, as it occurs in the conventional laundry washing machines.

**[0017]** The flexible connecting device allows the removable closing element to be completely separated from the filter opening; the only connection between removable closing element and washing machine is provided by the flexible connecting device which can be highly deformed and moved, and therefore its presence in practice does not obstruct (or only minimally obstructs) the filter opening, thus allowing an easy manual handling of the filter during its removal/insertion from/into the filter receiving body.

**[0018]** Furthermore and preferably, said removable closing element is movable from a closed position wherein it closes the filter opening to a removed position in which the filter opening is left open, the flexible connecting device connecting the removable closing element to the laundry washing machine in both said closed position and said removed position and also in each intermediate position between said closed and removed position.

**[0019]** In this way the removable closing element is permanently connected to the laundry washing machine, whichever its position is.

**[0020]** Furthermore and preferably, though not necessarily, the flexible connecting device has an elongated shape.

**[0021]** Furthermore and preferably, though not necessarily, the flexible connecting device is a rope or a string or a flexible band.

**[0022]** In this way, the flexible connecting device has a limited thickness and, as such, occupies a limited space, allowing the user to still have large free spaces for accessing the filter opening.

**[0023]** Furthermore and preferably, though not necessarily, the flexible connecting device has a first end and a second end opposed to said first end.

**[0024]** Preferably, the first end is removably fixed to the removable closing element.

**[0025]** Preferably the second end is removably fixed to a portion of the laundry washing machine.

**[0026]** Furthermore and preferably, though not necessarily, each of said first and second ends of the flexible connecting device has an arrow shaped tip, preferably with two flexible lateral fins arranged in a symmetrical manner with respect to the tip.

**[0027]** In this way, being in particular flexible the two lateral fins, they are allowed to be first compressed and deformed to occupy a reduced space and then allowed to regain their original shape.

**[0028]** Furthermore and preferably, though not necessarily, the first end of the flexible connecting device is

removably fixed to a first fixing support placed onto the inner side of the removable closing element.

**[0029]** Furthermore and preferably, though not necessarily, the second end of the flexible connecting device is removably fixed to a second fixing support placed in a portion of the filter unit or in a portion of the laundry washing machine, preferably adjacent to the filter unit.

**[0030]** Furthermore and preferably, though not necessarily, the said first and second fixing supports are any rigid support, such a bar, a wing, a protuberance, or any rigid body firmly fixed, respectively, to the inner side of the removable closing element and to the filter unit or to a portion of the laundry washing machine adjacent to said filter unit.

**[0031]** Furthermore and preferably, though not necessarily, the first fixing support is made in metal or plastic and may be integrated with the inner side of the removable closing element.

**[0032]** Furthermore and preferably, though not necessarily, the second fixing support is made of metal or plastic and may preferably be integrated with a portion of the filter unit or a portion of the laundry washing machine, preferably adjacent to the filter unit.

**[0033]** Furthermore and preferably, though not necessarily, the fixing elements, provided on the first and second fixing supports, are identical one another.

**[0034]** Furthermore and preferably, though not necessarily, the fixing elements comprise a rigid structure having a hole or cavity at its inside, such, as for example for allowing the passage through this hole or cavity of the first/second end of the flexible connecting device and, then, the clamping of this first/second end of the flexible connecting device on such a rigid structure of the fixing elements.

**[0035]** In fact, being flexible the two lateral fins of the first/second end of the flexible connecting device, they can be easily deformed and allowed to pass through the corresponding hole or cavity provided on the fixing elements. Then, once they have passed on the other side of the hole or cavity, they are allowed to regain their original shape and to abut against the rigid structure of the fixing elements in order to clamp therein. In such a way each of the first and second end of the flexible connecting element is firmly fixed to the corresponding fixing element and it will be not allowed to be accidentally removed from said position. In fact, the only way to remove the flexible connecting device from the fixing element, for example for replacement purposes, is to deform again the flexible lateral fins and force them to disengage from the rigid structure in order to let them pass back again through the hole or cavity and be freely disconnected from the corresponding fixing element.

**[0036]** In such a way, the first and second ends of the flexible connecting device are firmly fixed, respectively, to the inner side of the removable closing element and to a portion of the inside of the laundry washing machine. Thus, in particular, even if the user exerts a relevant force for removing the removable closing element when it has

to occupy the removed position, the removable closing element will remain tightly fixed to the laundry washing machine due to the fact that the second end of the flexible connecting device is securely fixed to the laundry washing machine.

**[0037]** Furthermore and preferably, though not necessarily, said flexible connecting device further comprise, preferably for each of its first and second ends, a blocking adjuvant element being preferably positioned in close proximity of the terminal portions of such lateral fins, on the opposite side of the arrow shaped tip with respect to the lateral fins. Such a blocking adjuvant element is allowed to cover the hole or cavity of the fixing elements once the first and/or second end have passed there-through and fixed to the corresponding fixing elements.

**[0038]** In another advantageous embodiment, the first and second ends of the flexible connecting device may be fixed to said fixing elements by other fixing techniques; for example, they may be fixed through screw elements, threaded holes, and the like, or by welding, glueing, over injection, etc..

**[0039]** Furthermore and preferably, though not necessarily, said flexible connecting device is as long as to be accommodated in an empty space between the inner side of said removable closing element and said filter unit when said removable closing element is in said closed position, and as long as to be elongated to allow said removable closing element to be removed in such a way to leave completely unobstructed the filter opening, except for the presence of said flexible connecting device, when said removable closing element is in said removed position.

**[0040]** In this way, the length of the flexible connecting device is the right compromise allowing both to be compressed inside the laundry washing machine without exerting any resistance when the removable closing element is in the closed position (and therefore it does not affect the external aesthetics of the cabinet) and to be extended up to its entire length when the removable closing element is in the removed position without representing an obstruction to the user for accessing the filter opening.

**[0041]** Furthermore and preferably, though not necessarily, said filter opening has a circular shape.

**[0042]** In this way, said circular shape of the filter opening allows an easy removal/insertion of said filter element from/into said filter unit, both the filter element and the filter unit having a substantially a cylindrical shape.

**[0043]** Furthermore and preferably, though not necessarily, said removable closing element has a circular shape, too, and has substantially the same diameter of said filter opening.

**[0044]** In this way, said circular shape of the removable closing element allows it to tight close the filter opening.

**[0045]** Furthermore and preferably, though not necessarily, said removable closing element contains an integrated sliding fixing element protruding from its edge and adapted to engage the border of the filter opening, so as

to allow the removable positioning of the removable closing element into the filter opening.

**[0046]** By moving the sliding fixing element, the removable closing element is removed and the filter opening is allowed to be opened.

**[0047]** Furthermore and preferably, though not necessarily, said integrated sliding fixing element is preferably placed in the bottom portion of the removable closing element, advantageously along its preferably circumferential edge.

**[0048]** In this way, by sliding the integrated sliding fixing element along the circumferential edge of the removable closing element with a circular movement of about 90°, the removable closing element is allowed to be removed starting from its bottom portion and the filter opening is allowed to be opened.

**[0049]** Furthermore and preferably, though not necessarily, said removable closing element comprises a snapping device for removably fixing it to the border of said filter opening.

**[0050]** Furthermore and preferably, though not necessarily, said snapping device is placed along the circumferential edge of the removable closing element on the opposite side with respect to said integrated sliding fixing element.

**[0051]** Furthermore and preferably, though not necessarily, said snapping device engages with the border of the filter opening when the removable closing element is fixed to the latter, providing a snap-fittings connection between the removable closing element and the filter opening; advantageously the snapping device comprises an unlocking element, that can be operated by the user in order to deactivate the snap-connection between the between the removable closing element and the filter opening. Preferably unlocking element is a tab. In order to remove the removable closing element and thus to open the filter opening, it is necessary that the user applies a finger pressure onto said tab to disengage the snapping device from the border of the filter opening.

**[0052]** Furthermore and preferably, though not necessarily, said removable closing element comprises a centring device positioned on the inner side of the removable closing element.

**[0053]** By this way, said centring device prevents the closure of said filter opening if said filter element is inserted in said filter receiving body but not correctly positioned inside it.

**[0054]** Furthermore and preferably, though not necessarily, said centring device comprises one or more wings protruding from the inner side of said removable closing element in such a position to abut against said filter element if the latter is inserted in said filter receiving body but not correctly positioned inside it, so as to impede, in this condition, the closure of said filter opening with said closing element.

**[0055]** It is underlined that the expression "correctly positioned" means that the filter element has been introduced in the filter receiving body in such a way that sub-

stantially all the washing/rinsing liquid (i.e. water or water mixed with washing and/or rinsing products, such as detergents, bleaching, softeners, etc.) has to pass through the filter element, in particular through its filtering surface, before entering the drain pump. When the filter element is correctly positioned into the filter receiving body, therefore, all the foreign bodies which may be contained in the washing/rinsing liquid are trapped in the filter element.

**[0056]** Therefore "not correctly positioned" means that the filter element hasn't been inserted into the filter receiving body in such a way that substantially all the washing/rinsing liquid has to pass through the filter element in order to enter the drain pump.

**[0057]** Furthermore and preferably, though not necessarily, one of said one or more wings of the centring device protruding from the inner side of said removable closing element is allowed to act as a fixing support for the fixing element with which the first end of said flexible connecting element engages.

**[0058]** Furthermore and preferably, though not necessarily, said one wing acting as a fixing support comprises a rigid structure firmly fixed to the inner side of the removable closing element and a fixing element connected to said rigid structure which engages with the first end of said flexible connecting element. For example, such a fixing element comprises a cavity or a hole through which said first end of the flexible connecting element passes through for securely fixing the removable closing element, as discussed above.

**[0059]** Furthermore and preferably, though not necessarily, said a filter unit is positioned at the bottom of the washing tub.

**[0060]** In this way the removal of discharge liquid accumulated by gravity in the lower portion of the laundry washing machine is rendered easier.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0061]** Further characteristics and advantages of the present invention will be highlighted in greater detail in the following detailed description.

**[0062]** A non-limiting embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view of a laundry washing machine realized in accordance with the teachings of the present invention with the removable closing element in the closed position;
- Figure 2 is a lateral schematic view of the laundry washing machine of Figure 1 ;
- Figure 3 is a perspective view of the filter unit of the laundry washing machine of Fig. 1 with the removable closing element in the removed position;
- Figure 4a and Figure 4b are perspective views of,

respectively, the outer side and the inner side of the removable closing element;

- 5 - Figure 5 is a detail of the laundry washing machine of the Figure 1 with the removable closing element in the removed position and the filter unit completely positioned inside the filter body;
- 10 - Figure 6 is a detail of the washing machine of Figure 1 with the removable closing element in the removed position and the filter unit partially removed from the filter body;
- 15 - Figure 7 is a detail of the washing machine of Figure 1 with the removable closing element in the removed position and the filter unit totally removed from the filter body;
- 20 - Figure 8 is a perspective view of the flexible connecting device shown in its maximum extension, with parts of the laundry washing machine removed for clarity;
- 25 - Figure 9 is an enlarged and partially sectioned view of the inner side of the removable closing element according to the invention, showing a first end of the flexible connecting device fixed to it;
- 30 - Figure 10 is an enlarged and partially sectioned view of the a second end of the flexible connecting device fixed to a portion of the filter unit.
- 35 - Figure 11 is a detail of the removable closing element in the closed position;
- Figure 12 is a cross section according to section A-A of Figure 11.

#### DETAILED DESCRIPTION OF THE INVENTION

40 **[0063]** It is underlined that in the present application the expression "laundry washing machine", or simply "washing machine" may as well indicate a "simple" washing machine (i.e. a washing machine which can only wash and rinse the laundry) and a washing-drying machine (i.e. a washing machine which can also dry the laundry).

45 **[0064]** Moreover, even if in the following the present invention will be described, purely by way of example, in relation to a front-loading laundry washing machine, it is clear that the present invention may be applied, substantially without any crucial modification, to a top-loading washing machine.

50 **[0065]** With reference to Figure 1 and Figure 2, an embodiment of a laundry washing machine 1 of the present invention is illustrated; it comprises an external casing or cabinet 2 structured for resting on the floor, containing a washing tub 3 in which washing liquid may be loaded; the washing tub 3 contains a rotatable washing drum 4,

rotatably accommodated in the washing tub 3, where the laundry, not shown, to be treated can be loaded.

**[0066]** The laundry washing machine 1 is advantageously provided with a loading/unloading door 22 which allows access to the drum 4.

**[0067]** The drum 4 is advantageously rotated by an electric motor 50, which preferably transmits the rotating motion to the shaft of the drum 4, advantageously by means of a belt/pulley system 51. In a different advantageous embodiment of the invention, not illustrated, the motor can be directly associated with the shaft of the drum 4.

**[0068]** The laundry washing machine 1 is further provided with a water load system 5 for conveying washing water into the washing tub 3 and with a discharge system 6 for discharging waste washing liquid outside the laundry washing machine 1.

**[0069]** The water load system 5 is preferably arranged in the upper part of the laundry washing machine 1 and is suited to supply water into the tub 3.

**[0070]** The laundry washing machine 1 advantageously comprises a removable drawer 23 preferably provided with various compartments suited to be filled with washing and/or rinsing products (i.e. detergent, softener, etc.).

**[0071]** In a preferred embodiment, the water is supplied into the tub 3 from the water load system 5, advantageously by making it flow through the drawer 23 and then through a supply pipe 24.

**[0072]** The water which reaches the tub 3 can, in this case, selectively contain one of the products contained in the compartments of the drawer 23, or such water can be clean and in this case it may reach the tub 3 directly, for example bypassing the compartments of the drawer 23, or passing through an empty compartment of the drawer 23.

**[0073]** In an alternative advantageous embodiment of the invention, a further separate water supply pipe can be provided, which supplies exclusively clean water into the tub 3.

**[0074]** The water supply circuit 5 also preferably comprises a water flow sensor (not shown), for example a flow meter, which makes it possible to calculate the quantity of water supplied into the tub 3.

**[0075]** With particular reference to the embodiment of the present invention shown in Figure 2 and Figure 3, the discharge system 6 comprises a drain pump 25, a pipe 26, only schematically represented in enclosed figures, connecting the tub 3 to the drain pump 25 and an outlet pipe 27 ending outside the cabinet 2. The discharge system 6 is suited to drain the liquid, i.e. dirty water or water mixed with washing and/or rinsing products, from the tub 3 to the outside.

**[0076]** Activation of the drain pump 25 drains the liquid, i.e. dirty water or water mixed with washing and/or rinsing products, from the tub 3 to the outside.

**[0077]** The discharge system 6 further comprises a filter unit 7 advantageously placed between the bottom of the tub 3 and the drain pump 26 and adapted to retain

all the undesirable bodies (for example buttons that have come off the laundry, coins erroneously introduced into the laundry washing machine, etc.) which could damage or obstruct the drain pump 26.

5 **[0078]** In an embodiment of the invention, the filter unit 7 comprises a filter receiving body 8, positioned inside the cabinet 2 and accessible via a filter opening 9 provided in the cabinet 2; a filter element 10 removably positioned into the filter receiving body 8; and a removable closing element 11 for selectively closing the filter opening 9, so as to selectively allowing or impeding the access to the filter receiving body 8.

10 **[0079]** The filter element 10 is to be periodically removed, and then for example cleaned or replaced, through the filter opening 9 placed advantageously on the front of the cabinet 2 of the laundry washing machine 1, preferably in the bottom portion thereof.

15 **[0080]** The removable closing element 11 is movable from a closed position, shown for example in Figures 1 and 11, wherein it closes the filter opening 9, to a removed position, shown for example in Figures 5 to 7, in which the filter opening 9 is left open.

20 **[0081]** The removable closing element 11 has preferably a circular shape, and it has advantageously substantially the same diameter of said filter opening 9, having preferably a substantially circular shape, too. Thus, such a circular shape of the removable closing element 11 allows it, when it is in the closed position, to tight close the filter opening 9. More in general the removable closing element 11 is preferably counter-shaped to the opening 9, so as to be able to tight close the latter.

25 **[0082]** By this way, such a size and shape correspondence between the removable closing element 11 and the filter opening 9 furthermore contributes to preserve the exterior beauty of the cabinet 2 of the laundry washing machine 1 of the present invention.

30 **[0083]** Preferably the filter opening 9 and the closing element 11 have a substantially circular shape, which improves the removal/insertion operations of the filter element 10 from/into said filter unit 7, since both the filter element 10 and the filter unit 7 have preferably a substantially cylindrical shape.

35 **[0084]** Preferably, the removable closing element 11 contains an integrated sliding fixing element 17, preferably placed in the bottom portion of the removable closing element 11, advantageously along its circumferential edge 31 in case the closing element 11 has a circular shape, and protruding from the edge of the removable closing element 11, so as to allow a removable positioning of the removable closing element 11 into the filter opening 9.

40 **[0085]** The removable closing element 11 further comprises a snapping device 18 for removably fixing it to the border of the filter opening 9, the snapping device 18 being preferably placed in the top portion of the removable closing element 11 (along its circumferential edge 31 in case the closing element 11 has a circular shape), preferably opposite to the a sliding fixing element 17.

Such a snapping device 18 advantageously engages with the border of the filter opening 9 when the removable closing element 11 is fixed to the latter, providing a snap-fittings connection between the removable closing element 11 and the filter opening 9; advantageously the snapping device 18 comprises an unlocking element 32, that can be operated by the user in order to deactivate the snap-connection between the between the removable closing element 11 and the filter opening 9. In the advantageous embodiment of the invention shown in attached figures unlocking element 32 is a tab 32; in order to remove the removable closing element 11 and thus let free access to the filter opening 9, it is necessary a user finger pressure onto the tab 32 to disengage the snapping device 18 from the border of the filter opening 9.

**[0086]** The removable closing element 11 preferably comprises a centring device 19 who prevents the closure of the filter opening 9 if the filter element 10 is inserted in the filter receiving body 8 but it is not correctly positioned inside the latter. Preferably the centring device 19 comprises some wings 20 (for example three wings 20 are shown in Figure 4b), protruding from the inner side 21 of the removable closing element 11 in such a position to abut against the filter element 10 if the latter is inserted in the filter receiving body 8 in a not correctly positioned, so as to impede, in this condition, the closure of the filter opening 9 with the removable closing element 11.

**[0087]** Figures 5 to 7 show the removable closing element 11 in the removed position and the filter element 10 completely inside the filter body 8 (Figure 5), partially removed from the filter body 8 through the filter opening 9 (Figure 6), and completely removed from the filter body 8 (Figure 7).

**[0088]** Thus, being the removable closing element 11 completely separable from the filter opening 9, an easy handling of the filter element 10 during its removal//insertion from/into the filter receiving body 8 is allowed.

**[0089]** On the other hand, Figures 11 and 12 show the removable closing element 11 in the closed position, respectively, in a front view where only the tab 32 where the user has to inset his/her fingers to exercise a pressure on it is visible, and in a lateral view taken along the line A-A of Figure 11, where the sliding fixing element 17 and two wings 20 protruding from the inner side 21 of the removable closing element 11 towards the filter unit (not shown in Figure 12) are visible.

**[0090]** With particular reference to the embodiment of the present invention shown in Figures 3-8, the laundry washing machine 1 is further provided with a flexible connecting device 12 which connects the removable closing element 11 to a portion of the laundry washing machine 1 in whichever position - closed, removed or any intermediate position between the closed and the removed position - is the removable closing element 11.

**[0091]** The flexible connecting device 12 has advantageously an elongated shape, such as a rope or a string or a flexible band.

**[0092]** The flexible connecting device 12 is advanta-

geously as long as to be accommodated in a empty space 16 between the inner side 21 of the removable closing element 11 and the filter unit 7 when the removable closing element 11 is in the closed position, and as long as to be elongated to allow the removable closing element 11 to be removed in such a way to leave completely unobstructed, except for the presence of the flexible connecting device 12, the filter opening 9 when the removable closing element 11 is in the removed position (Figures 3, 5, 6, and 7).

**[0093]** In this way, the flexible connecting device 12 is allowed to be bent and positioned inside the filter unit 7 when the removable closing element 11 is in the closed position, and to be extended up to its entire length when the removable closing element 11 is in the removed position, without representing an obstruction to the user for accessing the filter opening 9, for example, cleaning purposes, water draining and/or for removing something that is clogged therein.

**[0094]** The flexible connecting device 12 has a first end 14 and a second end 15 opposed to the first end 14.

**[0095]** Preferably, one or both the first end 14 and second end 15 are fixed in a removable way respectively to one of the removable closing element 11 and to a portion of the filter unit 7 or to a portion of the laundry washing machine 1. Preferably, as shown in Figures 8-10, each of the first end 14 and the second end 15 of the flexible connecting device 12 has a corresponding arrow shaped tip 28a, 28b having two flexible lateral fins 29 arranged in a symmetrical manner with respect to the tip 28a, 28b. Being flexible, the arrow shaped tip 28a, 28b and the two lateral fins 29 of both the first end 14 and the second end 15 of the flexible connecting device 12 are deformable and may be compressed to pass through narrow holes or cavities and then released to regain the original shape once passed therethrough.

**[0096]** Advantageously, the first end 14 of the flexible connecting device 12 is removably fixed to a first fixing support provided with a first fixing element positioned onto the inner side 21 of the removable closing element 21. In the advantageous embodiment of the present invention shown in Figures 4b and 9, the first end 14 is removably fixed to a fixing support 33 supported by one of the wing 20 of the centring device 19 protruding from the inner side 21 of the removable closing element 21 discussed above. The fixing support 33 is provided with a hole 34 (Figure 4b) wherein the arrow shaped tip 28a of the first end 14 can be introduced. In alternative, the first fixing support may be any suitable rigid support, such a bar, a wing, a protuberance, or any rigid body firmly fixed to the inner side 21 of the removable closing element 11, made in metal or plastic and that may also be integrated with such an inner side 21 of the removable closing element 11.

**[0097]** Thus, the flexible arrow tip 28a and the two lateral fins 29 of the first end 14 of the flexible connecting device 12 are deformed to pass through the hole 34 and, once passed therethrough, regain the original shape and

abut against the fixing support 33 thus allowing the flexible connecting device 12 to be firmly clamped onto the fixing support 33 of the protruding wing 20. Furthermore, a blocking adjuvant element 30a is preferably present in close proximity of the terminal portions of the lateral fins 29 of the first end 14, on the opposite side of the arrow shaped tip 28a with respect to the lateral fins 29. Such a blocking adjuvant element 30a is allowed to cover the hole or cavity 34 once the first end 14 has passed there-through and fixed to the fixing support 33. Thus, the blocking adjuvant element 30a contributes to firmly secure the flexible connecting device 12 to the corresponding fixing support 33.

**[0098]** On the other hand, the second end 15 of the flexible connecting device 12 is advantageously removably fixed to a second fixing support 13, the latter being preferably a rigid body 13 placed in a portion of the filter unit 7 adjacent to the filter opening 9. In alternative advantageous embodiment, the second end 15 of the flexible connecting device 12 may be fixed to any suitable rigid portion of the laundry washing machine 1.

**[0099]** As already discussed above with reference to the first fixing support 33 for the first end 14 of the flexible connecting device 12, also the second fixing support 13 preferably comprises a hole 35. Again, advantageously the second end 15 of the flexible connecting device 12, including the related flexible arrow tip 28b and two lateral fins 29, is deformed to be allowed to pass through the hole 35 and, once passed therethrough, regains the original shape and abuts against the second fixing support 13, thus allowing the flexible connecting device 12 to be firmly clamped onto such a second fixing support 13. Also in this case, a blocking adjuvant element 30b is preferably present in close proximity of the terminal portions of the lateral fins 29 of the second end 15, as discussed above with reference to the blocking adjuvant element 30a of the first end 14, to better fix the reciprocal position of the second end 15 and the fixing support 13.

**[0100]** In such a way, the first end 14 and the second end 15 of the flexible connecting device 12 are firmly secured, respectively, to the inner side 21 of the removable closing element 11 and to a portion of the inside of the laundry washing machine 1.

**[0101]** Thus, the flexible connecting device 12 allows the removable closing element 11 to be always connected to a portion of the laundry washing machine 1. Thus, the risk that the removable closing element 11 may be lost or moved away from the laundry washing machine 1, when it is temporarily removed for allowing the removal/insertion of the filter element 10, is eliminated. Accordingly, there is no delay in repositioning the removable closing element 11 in the position in which it closes the filter opening 9 due to not promptly having it when needed, as it occurs in the conventional laundry washing machines.

**[0102]** In another advantageous embodiment, not illustrated, the first end 14 and the second end 15 of the flexible connecting device 12 may be fixed to correspond-

ing fixing elements by other fixing techniques, such as by screw elements, threaded holes, and similar tools, or by welding, gluing, over injection, etc.

**[0103]** While the present invention has been described with reference to the particular embodiments shown in the figures, it should be noted that the present invention is not limited to the specific embodiments illustrated and described herein; on the contrary, further variants of the embodiments described herein fall within the scope of the present invention, which is defined in the claims.

## Claims

1. Laundry washing machine (1) comprising:

- a cabinet (2) containing a washing tub (3), in which washing liquid may be loaded,
- a rotatable drum (4), rotatably accommodated in the washing tub (3) for containing the laundry to be washed,
- a water load system (5) for conveying washing water into said washing tub (3);
- a discharge system (6) for discharging waste washing liquid outside the laundry washing machine (1), wherein said discharge system (6) comprises a filter unit (7),

wherein said filter unit (7) comprises:

- a filter receiving body (8), positioned inside said cabinet (2) and accessible via a filter opening (9) provided in said cabinet (2);
- a filter element (10) removably positioned into said filter receiving body (8);
- a removable closing element (11) for selectively closing said filter opening (9), so as to selectively allowing or impeding the access to said filter receiving body (8),

### characterized in that

said laundry washing machine (1) further comprises a flexible connecting device (12) connecting said removable closing element (11) to a portion of said laundry washing machine (1).

2. Laundry washing machine (1) according to claim 1, wherein said removable closing element (11) is movable from a closed position, wherein it closes the filter opening (9), to a removed position in which the filter opening (9) is left open, and wherein said flexible connecting device (12) connects said removable closing element (11) to said laundry washing machine (1) in both said closed position and said removed position and in each intermediate position between said closed and removed position.
3. Laundry washing machine (1) according to claim 1

- or 2, wherein said flexible connecting device (12) connects said removable closing element (11) to a portion of said filter unit (7).
4. Laundry washing machine (1) according to claim 1 or 2, wherein said flexible connecting device (12) connects said removable closing element (11) to a fixing element (13) placed in a portion of said laundry washing machine (1) adjacent to said filter unit (7).
5. Laundry washing machine (1) according to any of the previous claims, wherein said flexible connecting device (12) has an elongated shape.
6. Laundry washing machine (1) according to any of the previous claims, wherein said flexible connecting device (12) has a first end (14) and a second end (15), opposed to said first end (14), wherein the first end (14) is removably fixed to said removable closing element (11).
7. Laundry washing machine (1) according to claim 6, wherein said first end (14) of the flexible connecting device (12) is fixed to the inner side of said removable closing element (11).
8. Laundry washing machine (1) according to claim 6 or 7 when not depending on claim 4, wherein said second end (15) of the flexible connecting device (12) is fixed to a portion of said filter unit (7).
9. Laundry washing machine (1) according to claim 2 or to any of claims 3 to 8 when depending on claim 2, wherein said flexible connecting device (12) is as long as to be accommodated in an empty space (16) between the inner side of said removable closing element (11) and said filter unit (7) when said removable closing element (11) is in said closed position, and as long as to be elongated to allow said removable closing element (11) to be removed in such a way to leave completely unobstructed the filter opening (9), except for the presence of said flexible connecting device (12), when said removable closing element (11) is in said removed position.
10. Laundry washing machine (1) according to any of the previous claims, wherein said removable closing element (11) contains an integrated sliding fixing element (17) protruding from its edge and adapted to engage the border of said filter opening (9), so as to allow the removable positioning of said removable closing element (11) into said filter opening (9).
11. Laundry washing machine (1) according to any of the previous claims, wherein said removable closing element (11) comprises a snapping device (18) for removably fixing it to the border of said filter opening (9).

12. Laundry washing machine (1) according to any of the previous claims, wherein said removable closing element (11) comprises a centring device (19) who prevents the closure of said filter opening (9) if said filter element (10) is inserted in said filter receiving body (8) but not correctly positioned inside the latter.
13. Laundry washing machine (1) according to claim 12, wherein said centring device (19) comprises one or more wings (20) protruding from an inner side (21) of said removable closing element (11) in such a position to abut against said filter element (10) if the latter is inserted in said filter receiving body (8) but not correctly positioned inside the latter, so as to impede, in this condition, the closure of said filter opening (9) with said removable closing element (11).
14. Laundry washing machine (1) according to any of the previous claims, wherein said flexible connecting device (12) is a rope or a string or a flexible band.

### Patentansprüche

1. Waschmaschine (1), umfassend:
- ein Gehäuse (2), das eine Waschwanne (3) enthält, in die Waschflüssigkeit geladen werden kann,
  - eine drehbare Trommel (4), die drehbar in der Waschwanne (3) untergebracht ist, um die zu waschende Wäsche zu enthalten,
  - ein Wasserladesystem (5) zum Befördern von Waschwasser in die Waschwanne (3);
  - ein Abgabesystem (6) zum Abgeben von restlicher Waschflüssigkeit aus der Waschmaschine (1), wobei das Abgabesystem (6) eine Filtereinheit (7) umfasst,
- wobei die Filtereinheit (7) umfasst:
- einen Filteraufnahmekörper (8), der innerhalb des Gehäuses (2) angeordnet ist und über eine Filteröffnung (9) zugänglich ist, die in dem Gehäuse (2) bereitgestellt ist;
  - ein Filterelement (10), das entfernbar in dem Filteraufnahmekörper (8) angeordnet ist;
  - ein entfernbares Verschlusselement (11) zum selektiven Schließen der Filteröffnung (9), um selektiv den Zugang zum Filteraufnahmekörper (8) zuzulassen oder zu verhindern,
- dadurch gekennzeichnet, dass** die Waschmaschine (1) ferner eine flexible Verbindungsvorrichtung (12) umfasst, die das entfernbare Verschlusselement (11) mit einem Abschnitt der Waschmaschine (1) verbindet.

2. Waschmaschine (1) nach Anspruch 1, wobei das entfernbare Verschlusselement (11) von einer geschlossenen Position, bei der es die Filteröffnung (9) schließt, zu einer entfernten Position, bei der die Filteröffnung (9) offen bleibt, beweglich ist und wobei die flexible Verbindungsvorrichtung (12) das entfernbare Verschlusselement (11) mit der Waschmaschine (1) in der geschlossenen Position und in der entfernten Position und in jeder Zwischenposition zwischen der geschlossenen und der entfernten Position verbindet.
3. Waschmaschine (1) nach Anspruch 1 oder 2, wobei die flexible Verbindungsvorrichtung (12) das entfernbare Verschlusselement (11) mit einem Abschnitt der Filtereinheit (7) verbindet.
4. Waschmaschine (1) nach Anspruch 1 oder 2, wobei die flexible Verbindungsvorrichtung (12) das entfernbare Verschlusselement (11) mit einem Befestigungselement (13) verbindet, das in einem Abschnitt der Waschmaschine (1) benachbart der Filtereinheit (7) angeordnet ist.
5. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei die flexible Verbindungsvorrichtung (12) eine längliche Form aufweist.
6. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei die flexible Verbindungsvorrichtung (12) ein erstes Ende (14) und ein zweites Ende (15) gegenüber dem ersten Ende (14) aufweist, wobei das erste Ende (14) entferntbar an dem entfernbaren Verschlusselement (11) befestigt ist.
7. Waschmaschine (1) nach Anspruch 6, wobei das erste Ende (14) der flexiblen Verbindungsvorrichtung (12) an der Innenseite des entfernbaren Verschlusselements (11) befestigt ist.
8. Waschmaschine (1) nach Anspruch 6 oder 7, wenn nicht von Anspruch 4 abhängig, wobei das zweite Ende (15) der flexiblen Verbindungsvorrichtung (12) an einem Abschnitt der Filtereinheit (7) befestigt ist.
9. Waschmaschine (1) nach Anspruch 2 oder nach einem der Ansprüche 3 bis 8, wenn abhängig von Anspruch 2, wobei die flexible Verbindungsvorrichtung (12) so lang ist, dass sie in einem leeren Raum (16) zwischen der Innenseite des entfernbaren Verschlusselements (11) und der Filtereinheit (7) untergebracht werden kann, wenn sich das entfernbare Verschlusselement (11) in der geschlossenen Position befindet, und so lang, dass sie gedehnt werden kann, um dem entfernbaren Verschlusselement (11) zu ermöglichen, derart entfernt zu werden, dass die Filteröffnung (9) vollständig freigelassen wird, mit Ausnahme der Gegenwart der flexiblen Verbindungsvorrichtung (12), wenn sich das entfernbare Verschlusselement (11) in der entfernten Position befindet.
10. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei das entfernbare Verschlusselement (11) ein integriertes Schiebebefestigungselement (17) enthält, das von der Kante vorsteht und zum Eingreifen in den Rand der Filteröffnung (9) ausgelegt ist, um das Entfernen des entfernbaren Verschlusselements (11) in der Filteröffnung (9) zu ermöglichen.
11. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei das entfernbare Verschlusselement (11) eine Schnappvorrichtung (18) zum Entfernen Befestigen davon am Rand der Filteröffnung (9) umfasst.
12. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei das entfernbare Verschlusselement (11) eine Zentriervorrichtung (19) umfasst, die das Verschließen der Filteröffnung (9) verhindert, wenn das Filterelement (10) in den Filteraufnahmekörper (8) eingeführt ist, aber nicht korrekt darin positioniert wurde.
13. Waschmaschine (1) nach Anspruch 12, wobei die Zentriervorrichtung (19) einen oder mehrere Flügel (20) umfasst, die von einer Innenseite (21) des entfernbaren Verschlusselements (11) in einer solchen Position vorstehen, um am Filterelement (10) zu lagern, wenn dies in dem Filteraufnahmekörper (8) eingeführt, aber nicht korrekt darin positioniert ist, um unter dieser Bedingung das Verschließen der Filteröffnung (9) mit dem entfernbaren Verschlusselement (11) zu untersagen.
14. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei die flexible Verbindungsvorrichtung (12) ein Seil oder ein Riemen oder ein flexibles Band ist.

#### 45 **Revendications**

1. Machine (1) à laver le linge comprenant :
- une carrosserie (2) contenant une cuve (3) de lavage, dans laquelle on peut charger du liquide de lavage,
  - un tambour rotatif (4), logé en rotation dans la cuve (3) de lavage, destiné à contenir le linge à laver,
  - un système (5) de chargement d'eau pour transporter de l'eau de lavage dans ladite cuve (3) de lavage ;
  - un système (6) de vidange pour évacuer les

déchets liquides de lavage à l'extérieur de la machine (1) à laver le linge, dans laquelle ledit système (6) de vidange comprend une unité de filtre (7),

dans laquelle l'unité de filtre (7) comprend :

- un corps (8) récepteur de filtre, placé à l'intérieur de ladite carrosserie (2) et accessible via une ouverture (9) de filtre aménagée dans ladite carrosserie (2) ;
- une cartouche filtrante (10) placée amovible dans ledit corps (8) récepteur de filtre ;
- un élément de fermeture (11) amovible pour fermer de façon sélective ladite ouverture (9) de filtre, de façon à permettre ou empêcher de façon sélective l'accès audit corps (8) récepteur de filtre,

**caractérisée en ce que** ladite machine (1) à laver le linge comprend en outre un dispositif flexible (12) de raccordement reliant ledit élément de fermeture (11) amovible à une partie de ladite machine (1) à laver le linge.

2. Machine (1) à laver le linge selon la revendication 1, dans laquelle ledit élément de fermeture (11) amovible est mobile d'une position fermée, dans laquelle il ferme l'ouverture (9) de filtre, à une position retirée, dans laquelle l'ouverture (9) de filtre reste ouverte, et dans laquelle ledit dispositif flexible (12) de raccordement relie ledit élément de fermeture (11) amovible à ladite machine (1) à laver le linge tant dans ladite position fermée que dans ladite position retirée et dans chaque position intermédiaire entre lesdites positions fermée et retirée.
3. Machine (1) à laver le linge selon la revendication 1 ou 2, dans laquelle ledit dispositif flexible (12) de raccordement relie ledit élément de fermeture (11) amovible à une partie de ladite unité de filtre (7).
4. Machine (1) à laver le linge selon la revendication 1 ou 2, dans laquelle ledit dispositif flexible (12) de raccordement relie ledit élément de fermeture (11) amovible à un élément de fixation (13) placé dans une partie de ladite machine (1) à laver le linge adjacente à ladite unité de filtre (7).
5. Machine (1) à laver le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit dispositif flexible (12) de raccordement a une forme allongée.
6. Machine (1) à laver le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit dispositif flexible (12) de raccordement comporte une première extrémité (14) et une seconde extré-

mité (15) opposée à ladite première extrémité (14), dans laquelle la première extrémité (14) est fixée amovible audit élément de fermeture (11) amovible.

- 5 7. Machine (1) à laver le linge selon la revendication 6, dans laquelle ladite première extrémité (14) du dispositif flexible (12) de raccordement est fixée au côté intérieur dudit élément de fermeture (11) amovible.
- 10 8. Machine (1) à laver le linge selon la revendication 6 ou 7, quand elle n'est pas subordonnée à la revendication 4, dans laquelle ladite seconde extrémité (15) du dispositif flexible (12) de raccordement est fixée à une partie de ladite unité de filtre (7).
- 15 9. Machine (1) à laver le linge selon la revendication 2 ou selon l'une quelconque des revendications 3 à 8, quand elle n'est pas subordonnée à la revendication 2, dans laquelle ledit dispositif flexible (12) de raccordement est suffisamment long pour se loger dans un espace vide (16) entre le côté intérieur dudit élément de fermeture (11) amovible et ladite unité de filtre (7) quand ledit élément de fermeture (11) amovible est dans ladite position fermée, et suffisamment long pour être allongé afin de permettre de retirer ledit élément de fermeture (11) amovible de façon à laisser complètement dégagée l'ouverture (9) de filtre, si ce n'est la présence dudit dispositif flexible (12) de raccordement, quand ledit élément de fermeture (11) amovible est dans ladite position retirée.
- 20 10. Machine (1) à laver le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit élément de fermeture (11) amovible intègre un élément de fixation (17) coulissant qui dépasse de son bord et est apte à entrer en prise avec le bord de ladite ouverture (9) de filtre, afin de permettre audit élément de fermeture (11) amovible d'entrer dans ladite ouverture (9) de filtre.
- 25 11. Machine (1) à laver le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit élément de fermeture (11) amovible comprend un dispositif à pression (18) pour le fixer amovible au bord de ladite ouverture (9) de filtre.
- 30 12. Machine (1) à laver le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit élément de fermeture (11) amovible comprend un dispositif de centrage (19) qui empêche la fermeture de ladite ouverture (9) de filtre si ladite cartouche filtrante (10) est introduite dans ledit corps (8) récepteur de filtre mais n'est pas en position correcte à l'intérieur de ce dernier.
- 35 13. Machine (1) à laver le linge selon la revendication 12, dans laquelle ledit dispositif de centrage (19) comprend une ou plusieurs ailettes (20) dépassant

du côté intérieur (21) dudit élément de fermeture (11) amovible dans une position telle qu'elles butent contre ladite cartouche filtrante (10) si cette dernière est introduite dans ledit corps (8) récepteur de filtre mais n'est pas en position correcte à l'intérieur de ce dernier, afin d'empêcher, dans cette situation, la fermeture de ladite ouverture (9) de filtre au moyen dudit élément de fermeture (11) amovible.

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- 14.** Machine (1) à laver le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit dispositif flexible (12) de raccordement est une cordelette ou une ficelle ou une bande souple.

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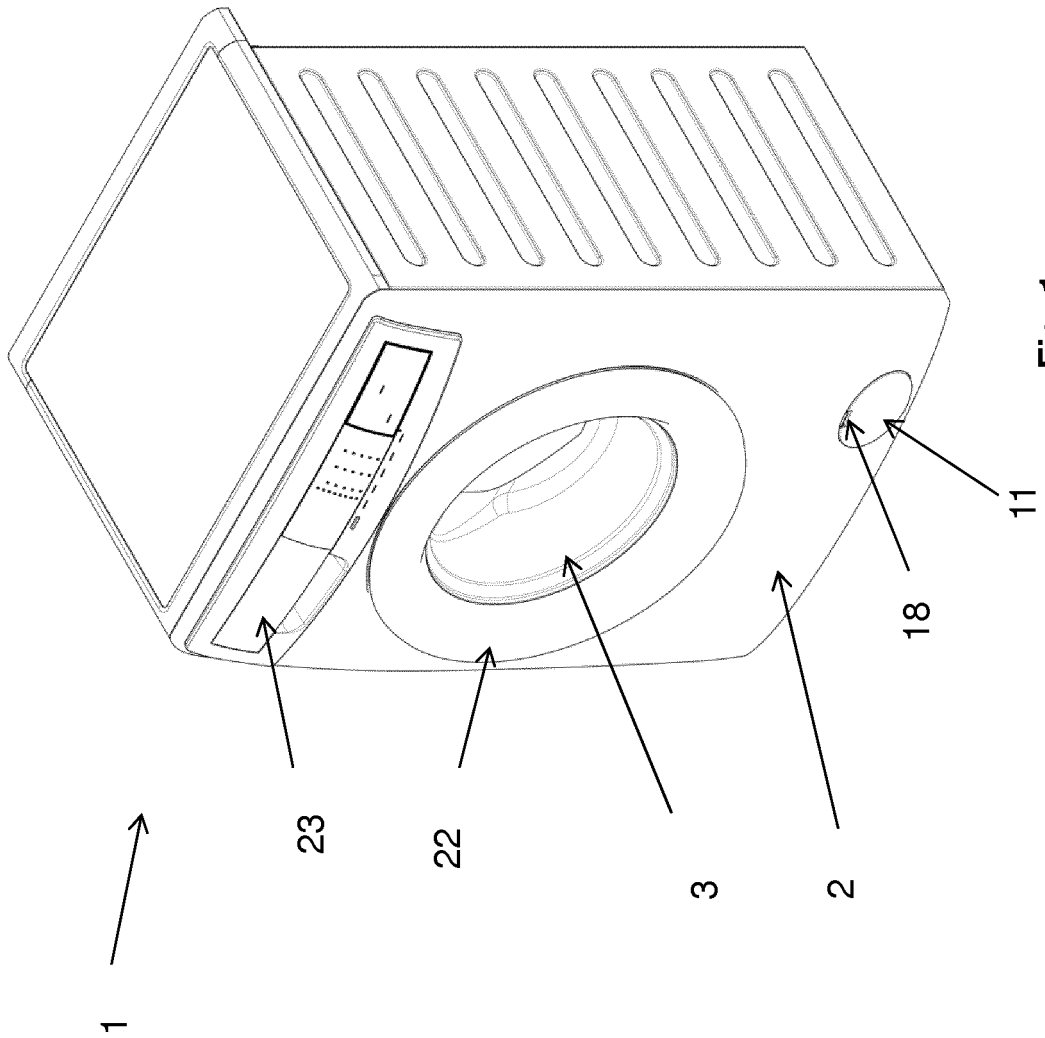


Fig. 1

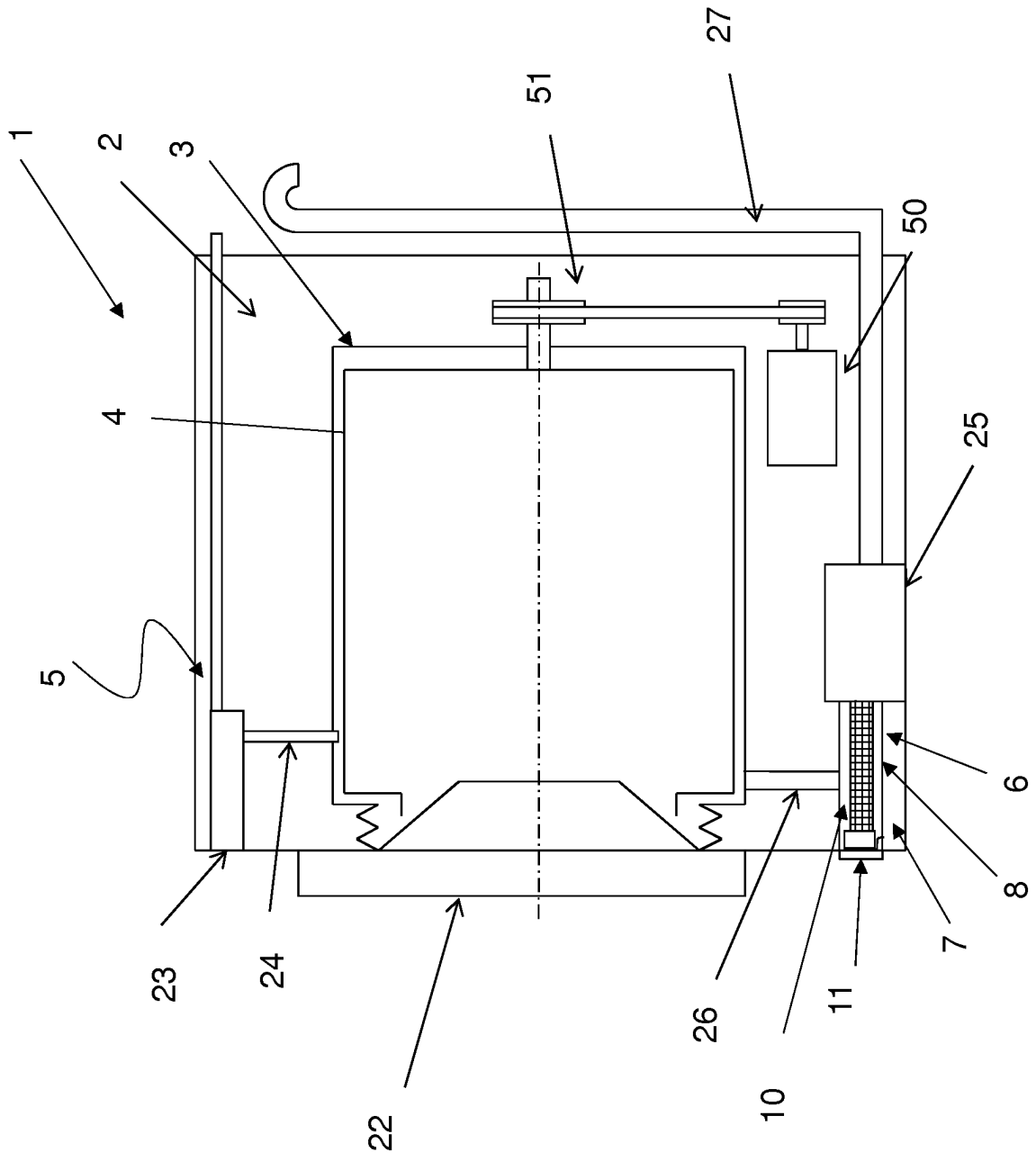


Fig. 2

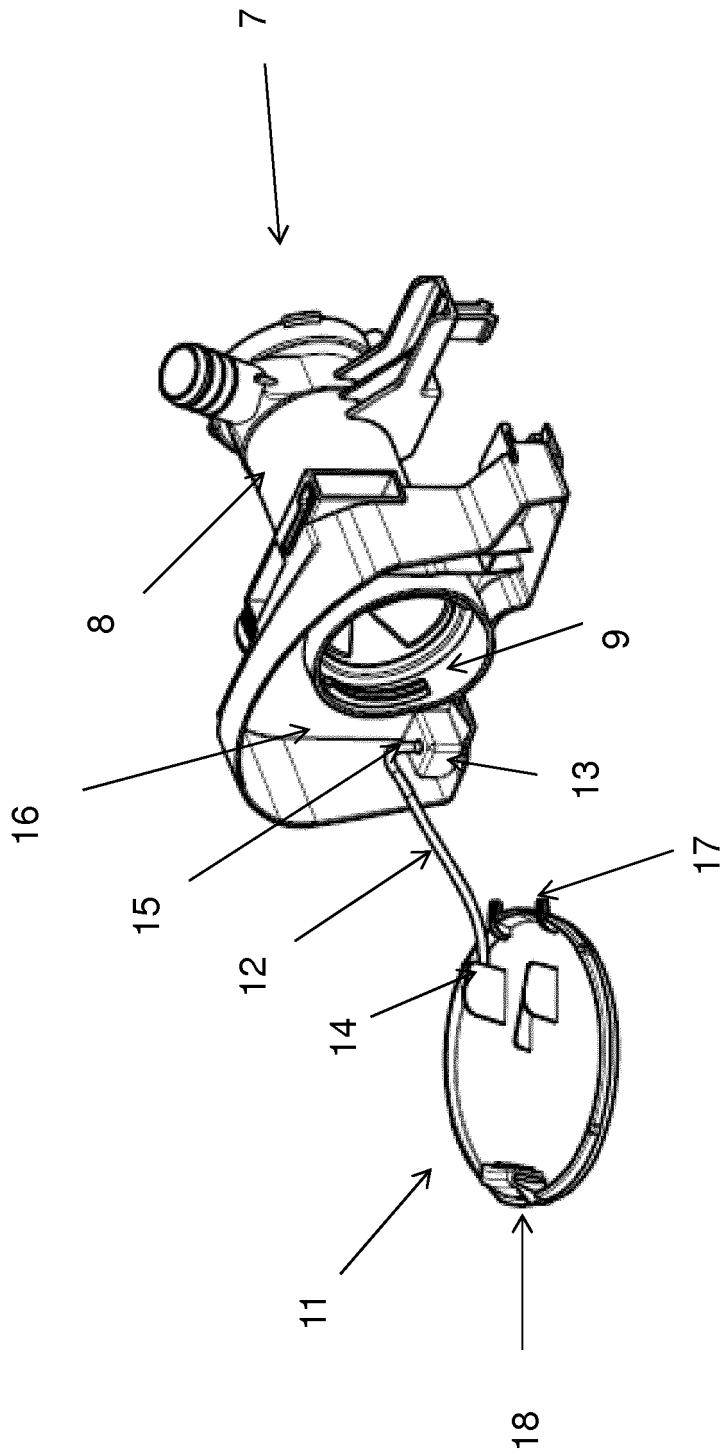


Fig. 3

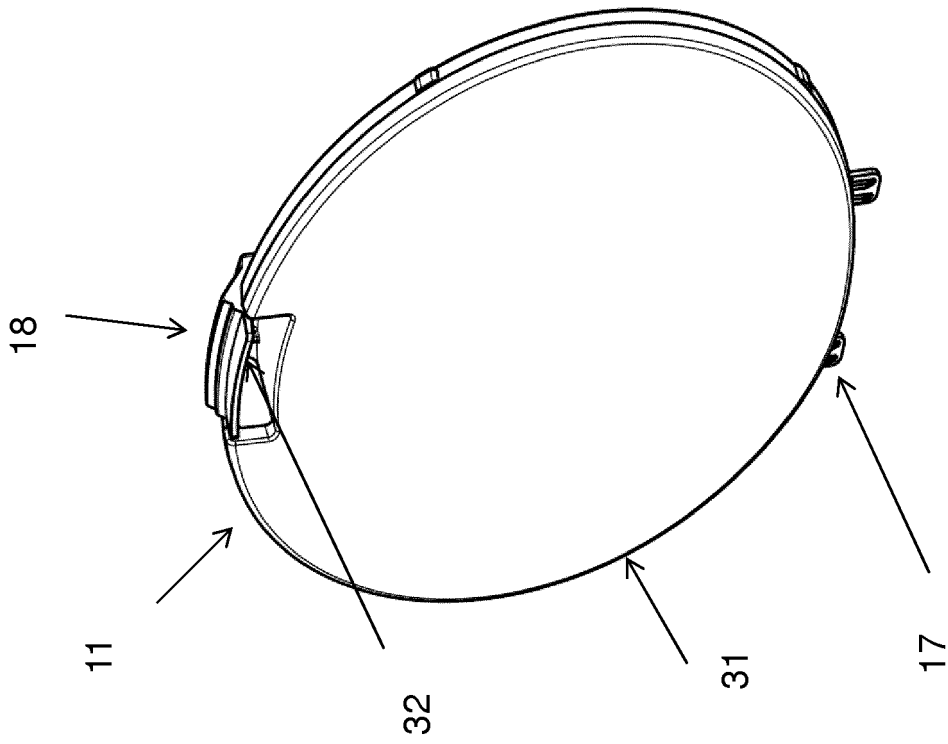


Fig. 4a

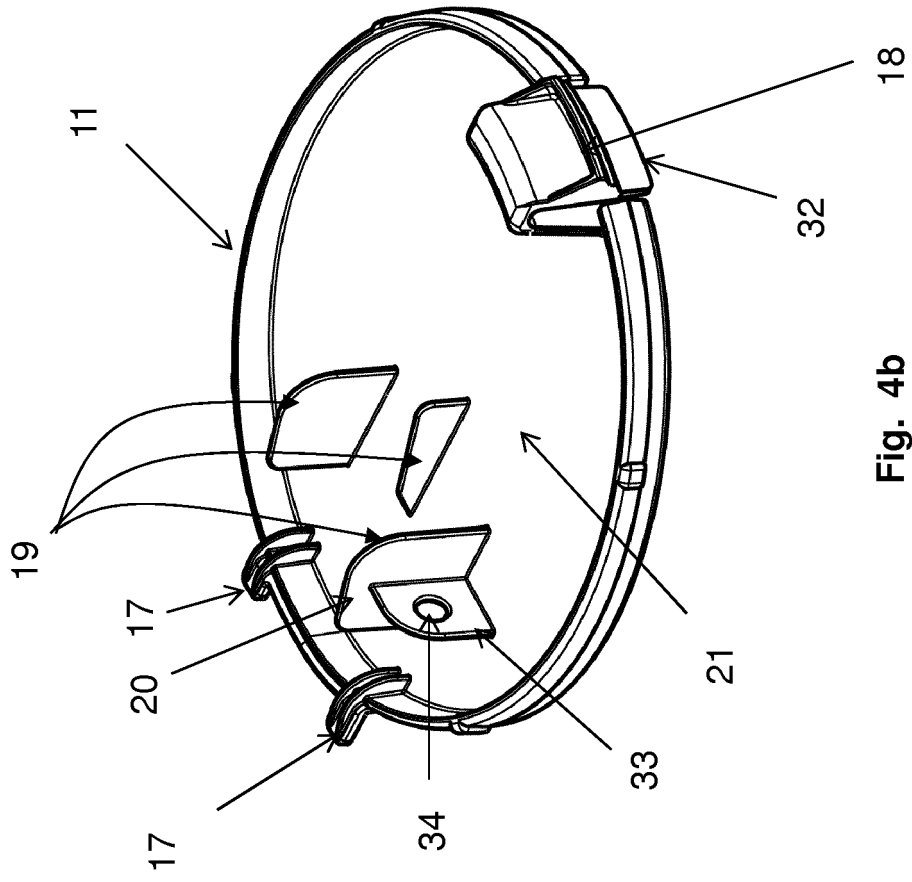


Fig. 4b

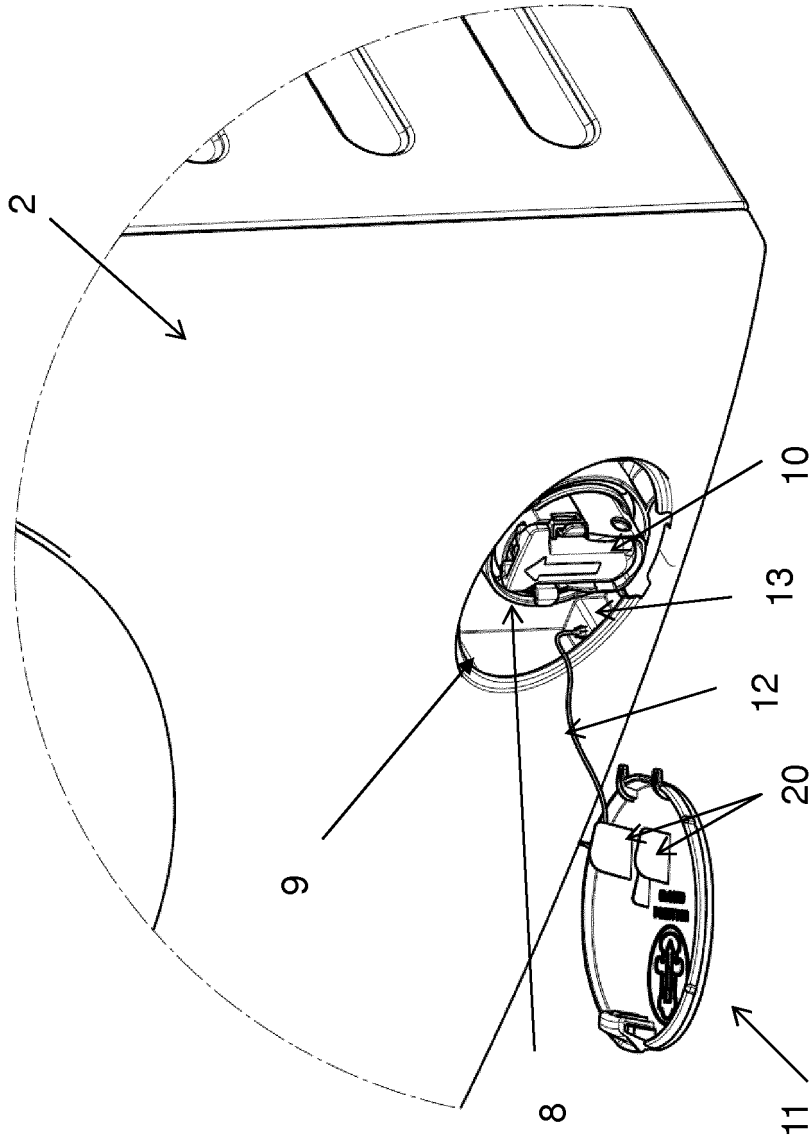


Fig. 5

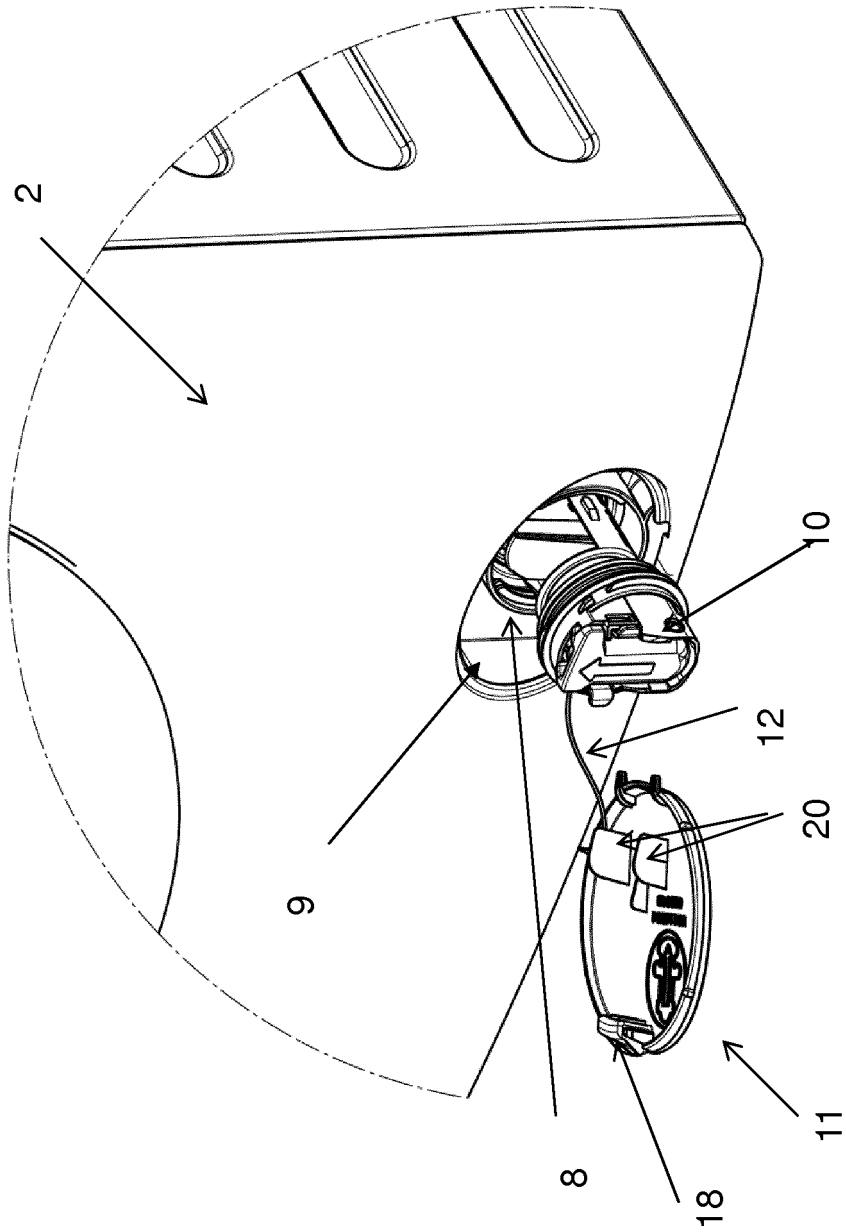


Fig. 6

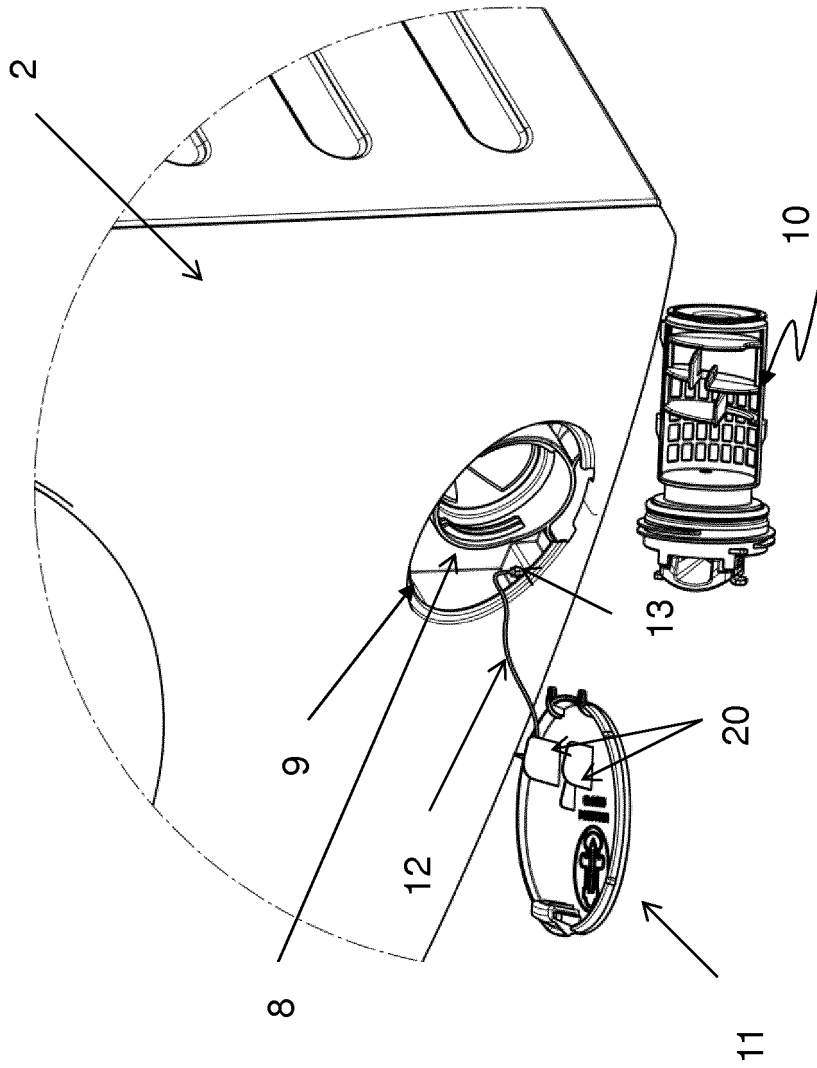


Fig. 7

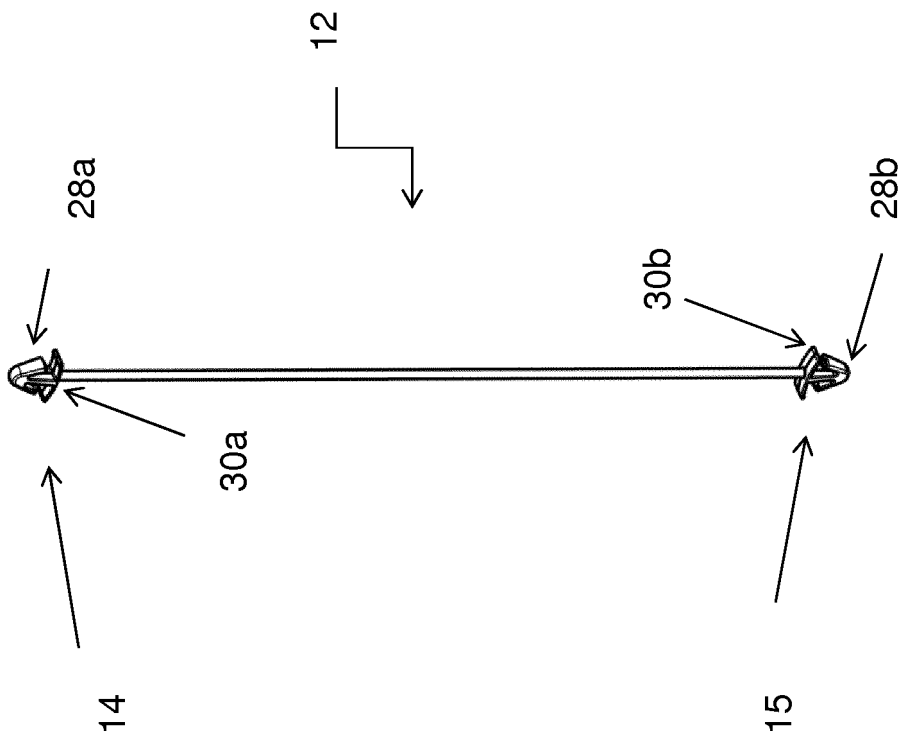


Fig. 8

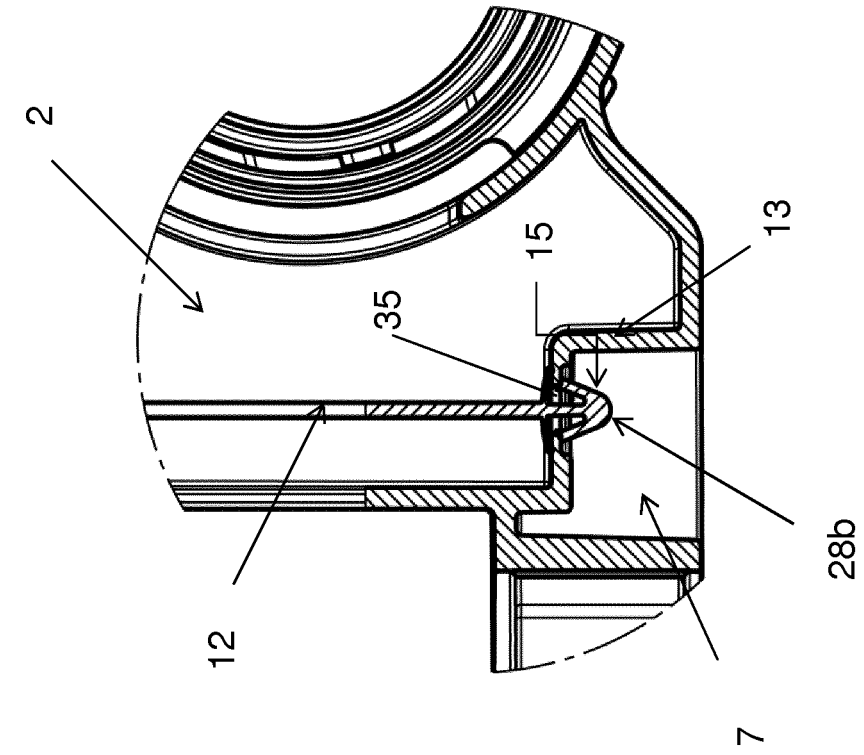


Fig. 9

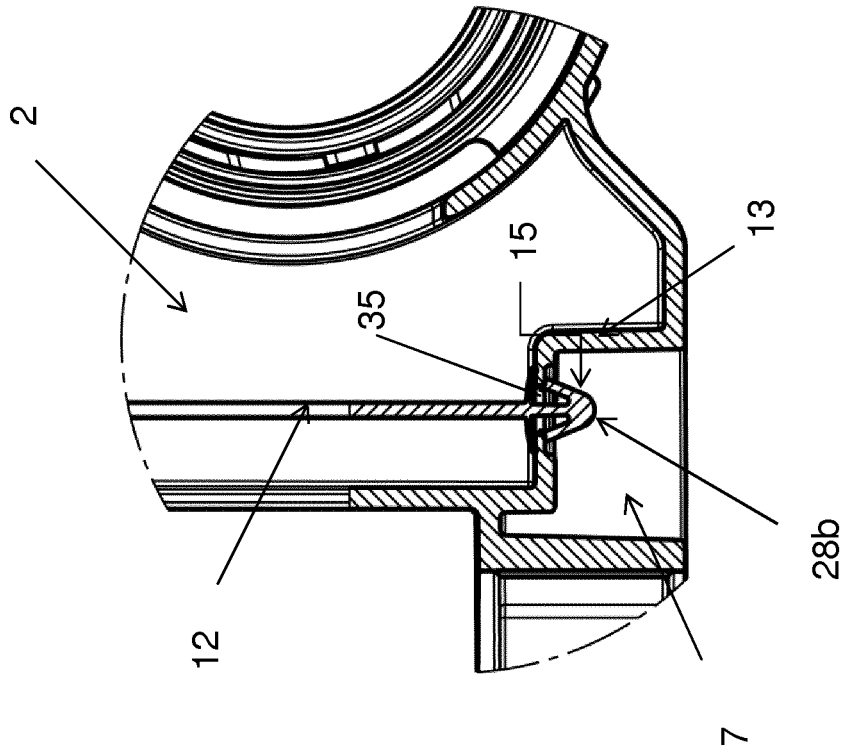


Fig. 10

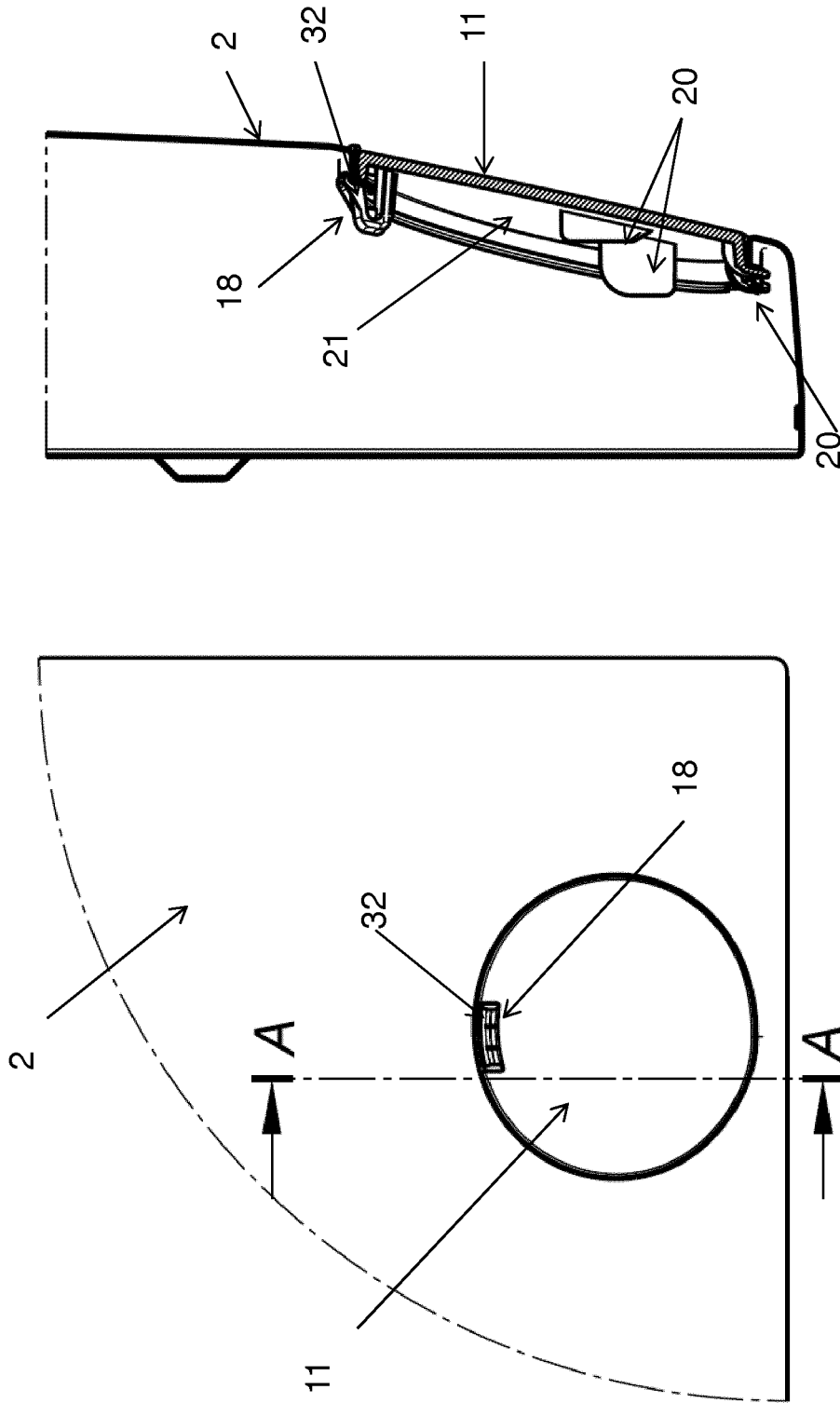


Fig. 12

Fig. 11

**REFERENCES CITED IN THE DESCRIPTION**

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