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(54) **Laundry washing machine comprising a filter assembly**

(57) A laundry washing machine (100) comprises an outer casing (101), a treatment chamber (1) for receiving a load to be washed, a pump unit (4) for discharging water from the treatment chamber, a filter assembly (2) coupled to the pump unit and comprising a filter element (21) removably housed in a filter body (20), wherein the washing machine comprises a connection interface (30) into which an opening (103) is defined and through which the filter element (21) can be inserted into/removed from the filter body (20). The washing machine further comprises a connecting device (3) for connecting the filter body (20) to the connection interface (30), comprising a guide member (31) and a respective engagement portion (32) that match with the guide member (31) such that the filter body (20) and the connection interface (30) are coupled together, and an automatic fastening locking element (33) preventing movement of the engagement portion (32) with respect to the guide member (31) when the engagement portion is at least partially received in the guide member.

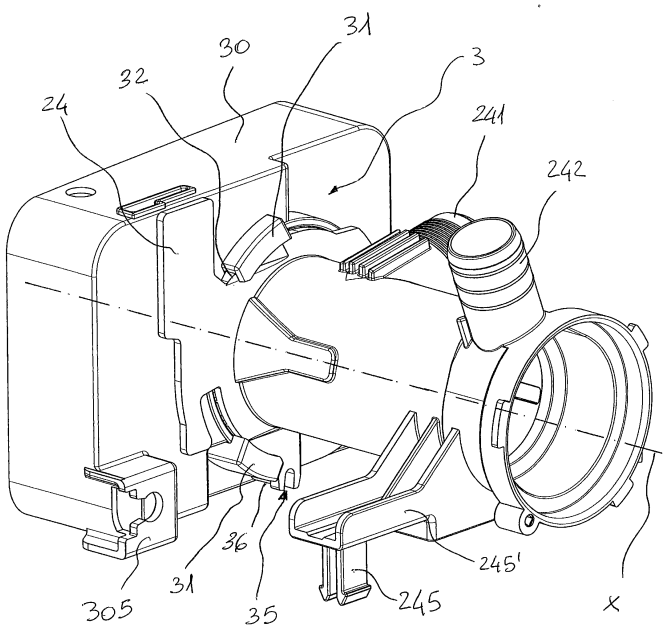

FIG. 6A

EP 2 886 704 A1

Description

Field of the invention

[0001] The present invention relates to a laundry washing machine (called also simply "washing machine") comprising a pump unit for discharging washing/rinsing liquid (e.g. water or water mixed with washing/rinsing products, like detergent, bleach or softener) from a treatment chamber, and a filter assembly for filtering washing/rinsing liquid discharged by the pump unit.

Background of the invention

[0002] Conventionally, laundry washing machines include one or more pumps for draining washing/rinsing liquid from the washing tub and discharging it to an external drainage and/or for recirculating this liquid into the tub.

[0003] In both cases a filter unit is typically provided between the tub and the pump(s), in order to prevent small objects (e.g. coins, buttons, etc.) exiting the washing tub from clogging the pump(s)

[0004] Typically, the filter unit comprises a filter element arranged upstream the pump(s), having an inlet side fluidly connected to the tub for receiving liquid therefrom. An outlet of the pump is then typically connected to a draining conduit (in case of a draining pump) provided for discharging washing/rinsing liquid from the tub to an external drainage, or to a recirculation circuit (in case of a recirculation pump), provided for recirculating washing/rinsing liquid into tub. Washing/rinsing liquid discharged from the tub passes through the filter element before entering the pump(s).

[0005] In some known washing machines a single pump is used both for draining and for recirculating washing/rinsing liquid; in this case a valve is typically provided downstream the pump for connecting it selectively to the draining circuit or to the recirculation circuit.

[0006] A known washing machine having a recirculation circuit and such a filter element is e.g. disclosed in EP 2 455 533.

[0007] A washing machine comprising a drainage pump with a filter element is also disclosed in KR 2008 0102779, relating to a washing machine including a drainage case forming the external appearance of a drainage pump, an impeller provided inside the drainage case, a pump motor supplying the driving force to the impeller, a drainage filter for filtering the foreign material flowing in the drainage case, an anti-vibration member provided on one side of the drainage case, and a fixing cap which is provided to fasten the drainage case to the washing machine. An opening of cylindrical shape is formed on the front side of the drainage case so that the drainage filter is inserted and withdrawn therethrough. A screw thread is formed on the outer circumference of the opening and engages with a screw thread formed on the inner side of the fixing cap.

[0008] The opening for the filter is positioned near the bottom of the front panel of the external casing of the washing machine, such that it can be reached by a user in order to remove the filter for maintenance purposes.

[0009] In order to improve the external appearance of the washing machine, it is also known to position the opening for the filter in a recessed part of front panel, closed by a removable cover which is flush with external surface of the bulkhead.

[0010] In this manner, the handle for removing the filter as well as any visible parts thereof or of the structure supporting it, can be hidden under the cover.

[0011] The recessed part is normally made by a box-shaped portion, formed on a panel defining a front bulkhead of the washing machine.

[0012] It should be noticed that the use of the box-shaped portion makes the connection between the filter unit and the front panel quite difficult since coupling elements, such as the fixing cap described above, cannot be easily handled.

[0013] Accordingly, threaded locking rings or similar connecting elements are used for fixing the filter assembly to the front panel or, more precisely, to the box-shaped portion, thus making the assembling of the washing machine more complex and labour-intensive.

Summary of the invention

[0014] An object of the invention is to provide a laundry washing machine that overcomes the drawbacks of known laundry appliances comprising a pump unit and with a removable filter element.

[0015] A further object is to provide a laundry washing machine in which the filter assembly can be easily assembled.

[0016] Another object of the invention is to provide a laundry washing machine in which a filter assembly con be easily associated or connected to the external casing without requiring tools (e.g. screwdrivers) for operating fixing devices.

[0017] Furthermore, it is also an object of the present invention to provide a laundry washing machine in which the assembly of the filter assembly to the external casing of the washing machine does not require to position any fixing member from outside the external casing, thus permitting an easy assembling of the machine even when the opening for inserting/removing the filter is in a recessed portion of the external casing.

[0018] In addition, an object of the present invention is also to provide reliable and strong connection between the filter assembly and the portion of the laundry washing machine to which the filter assembly is fixed.

[0019] According to the invention it is provided a laundry washing machine comprising:

- an outer casing;
- a treatment chamber for receiving a load to be washed;

- a pump unit for discharging water from the treatment chamber;
- a filter assembly interposed between the treatment chamber and the pump unit for filtering washing/rinsing liquid discharged from the treatment chamber, the filter assembly comprising a filter element and a filter body defining a seat for removably housing the filter element;
  wherein the washing machine comprises a connection interface into which an opening is defined and through which the filter element can be inserted into/removed from the filter body;
  said filter assembly further comprising:
- a connecting device for connecting the filter body to the connection interface such that the seat of the body filter is aligned with the opening;
  wherein the connecting device comprises:

  - a guide member and a respective engagement portion that is shaped for matching with the guide member such that the filter body and the connection interface are coupled together at least along an axis corresponding to the removal and insertion direction of the filter element in the seat,
  - an automatic fastening locking element, automatically fastening the engagement portion to the guide member when the engagement portion reaches a predetermined fastening position into the guide member, so as to prevent movements of the engagement portion with respect to the guide member at least along a withdrawal direction of the engagement portion from the guide member. It is to be understood that the in the laundry washing machine according to the invention, the filter assembly can be connected to the connection interface by moving the engagement portion into the guide member until the automatic fastening locking element locks the engagement portion.

[0020] Accordingly, the connection can be achieved simply by a suitable movement of the filter body with respect to the connection interface, without requiring any tools (e.g. a screwdriver), or other fixing element, fixed after positioning the filter body, such as a threaded locking ring.

[0021] It is also clear that this relative movement between the filter body and the connection interface can be equally performed both when the opening for the filter element is flush with the external casing and when it is defined in a recessed part.

[0022] Also, the shape-coupling between the guide member and the engagement portion warranties a robust and reliable connection between the filter body and the interface.

[0023] According to a preferred embodiment, the connection interface is formed as a distinct body from a panel of the external casing, the connection interface being associated or associable to the external casing. In this manner, the same filter body can be connected by means of the same connecting device to interfaces having different shapes, in order to accommodate the filter assembly in washing machines with differently shaped external casings.

[0024] It is underlined that the connection interface can be advantageously fixed to the external casing, or in a further advantageous embodiment, the connection interface it can be positioned spaced and in a fixed position with respect to the external casing, for example fixed to a supporting structure, like a base of the machine, to which the external casing is connected.

[0025] Preferably, the filter body is cylindrical and the guide member develops as an arc of circumference concentric to the filter body. In this manner the insertion of the engagement portion inside the guide member can be easily achieved by rotating the filter body with respect to the connection interface.

[0026] According to another aspect of the invention, the guide member is formed on the connection interface and comprises a slot into which the engagement portion slides, the slot developing parallel to a plane defined by a mouth of the opening, the engagement portion being preferably formed on the filter body by a projection radially extending from the filter body. According to this aspect, the connecting device can be realized with a very simple and reliable structure that can be easily adapted to different designs of the external casing.

[0027] According to a further preferred embodiment, the filter body comprises a collar in which a mouth of the seat for the filter element is defined and axially extending from the engagement portion, the collar being complementary shaped to the opening and being inserted therein when the engagement portion is aligned with the slot of the guide member. This feature allows simplifying the positioning and thus the assembling of the filter body, since the coupling between the collar and the opening, which can be easily achieved, allows a preliminary positioning of the filter body and of the connection interface.

[0028] According to a preferred embodiment, the connection interface defines a recessed part of the external casing, the guide members projecting from a base surface of the connection interface towards the interior of the washing machine. In this manner no parts of the connecting device requires to be positioned within the recess defined by the connection interface, thus avoiding excessive difficulties when assembling the filter assembly.

[0029] According to another aspect of the invention, the automatic fastening locking element may advantageously be a snap-fit locking element. Preferably, the connecting device comprises a resilient stopping element which is urged away by the snap-fit locking element until the engagement portion matches with the guide member at least up to the predetermined fastening position, the resilient stopping element abutting against an abutment surface of the snap-fit locking element, pre-

venting the movement of the engagement portion with respect to the guide member, when the engagement portion is moved back from the predetermined fastening position. This allows locking the filter body with respect to the connection interface with a simple and reliable structure in which the snap of the locking element automatically occurs as the engagement portion is inserted in the guide member.

[0030] Preferably, the resilient stopping element comprises flap against which the snap-fit locking element urges before reaching the predetermined fastening position, the flap developing along a surface which is tilted with respect to a path followed by an outermost portion of the snap-fit locking element as the engagement portion travels into the guide member, such that the flap is gradually deformed by the urging of the snap-fit locking element. This allows a gradual fitting of the snap-fit element, thus allowing a smooth connection without requiring excessive stresses on the structure of the connecting device.

[0031] Preferably, the laundry washing machine further comprises a supporting structure, to which the external casing of the machine can be advantageously connected, the connection interface and the filter body comprising a respective fixing element to the supporting structure. This allows firstly fixing the connection interface to the supporting structure, then connecting the connection interface to the filter body and finally fixing also the filter body to the structure or vice-versa. In this manner assembling of the washing machine can be further simplified.

[0032] According to a preferred embodiment, the fixing element of the filter body is a snap-fix element, snapping in a respective seat of the supporting structure when the engagement portion matches with the guide member. Accordingly, the fixing of the filter body to the supporting structure can occur by means of the same operation performed in order to couple the filter body to the connection interface.

[0033] Preferably, the snap-fix element is positioned at an end of an arm extending radially from the filter body. In this manner, the snap-fixing of the filter body to the supporting structure can be achieved more easily and with less effort when the filter body is connected by rotation to the connection interface.

[0034] Preferably, the guide member comprises a stopping end delimiting the stroke of the engagement portion into the guide member, thus allowing delimiting the movement of the engagement portion also in the inserting direction.

[0035] According to a preferred embodiment, the connecting device further comprises a notch which is aligned with a seat for a pin when the automatic fastening locking element locks the engagement portion with respect to the guide member. This feature allows improving the stability of the connection between the filter body and the connection interface.

[0036] According to a further aspect of the invention, the connecting device comprises at least two guide members and at least two respective engagement portions, the guide members and the engagement portions being disposed spaced apart along the periphery of the opening and of the filter body. Also this allows improving the stability of the connection between the filter body and the connection interface.

Brief description of the drawings

[0037] These and other features and advantages of the invention will be better apparent from the following description of some exemplary and non-limitative embodiments, to be read with reference to the attached drawings, wherein:

- Fig. 1 is a perspective view of a laundry washing machine according to the present invention;
- Fig. 2 is a perspective view of the laundry machine of Fig. 1 in which a front panel of an outer casing is removed in order to show internal components of the laundry washing machine;
- Figs. 3 and 3A are a front view of the laundry washing machine of Fig. 1 and a side section taken along line III-III in an enlarged view, respectively;
- Figs. 4A and 4B are a perspective view of a filter assembly and of a respective connection interface of the washing machine of the present invention and an exploded perspective view thereof;
- Figs. 5A, 5B and 5C are two different top perspective views and a rear view of the filter assembly and the respective connection interface in a partially engaged configuration;
- Figs. 6A, 6B and 6C are a top perspective view, a bottom perspective view and a rear view of the filter assembly and the respective connection interface in a fully engaged configuration;
- Figs. 7A and 7B are a perspective view of a filter assembly and of a respective connection interface according to an alternative embodiment and an exploded perspective view thereof; and
- Fig. 8 is a perspective view of the filter assembly and the connection interface of Fig. 6A-6C fixed on a supporting structure of the washing machine and shown with a respective pump unit connected to the filter assembly.

Detailed description of the invention

[0038] With reference to Fig. 1, a laundry washing machine (called also simply "washing machine") realized according to the present invention is globally indicated with the reference number 100.

[0039] It should be noted that in the context of the present invention with the expression "washing machine" is referred both to a "standard" washing machine, adapted only for washing and rinsing the laundry, and to a washer-drier, which is adapted for washing, rinsing, and also for drying the laundry.

[0040] The laundry washing machine 100 comprises an outer casing, globally indicated with the reference number 101, preferably but not necessarily parallelepiped-shaped, and a treatment chamber 1, preferably comprising a washing tub, housing a drum, not shown in the Figures, for receiving the laundry and in general the clothes and garments to be washed and/or dried. Preferably, the drum has the shape of a hollow cylinder and it is rotatably fixed to the casing, so that it can rotate around an axis thereof. According to the present embodiment, the rotation axis of the drum is substantially horizontal but it should be appreciated that, as an alternative, the drum can be positioned in the casing 101 in such a position that its rotation axis is vertical or tilted.

[0041] According to a preferred embodiment, the outer casing 101 comprises at least a front panel 101a, a top panel 101c and side panels 101c. An aperture is advantageously defined in the front panel 101a of the casing 101, facing the treatment chamber and thus granting access to the drum for loading and unloading the laundry in the machine. The washing laundry machine 100 further comprises a door assembly 102, preferably pivotally supported on the casing 101 and displaceable between a closed position, shown in Fig. 1 and in which the aperture is closed or preferably sealed and an open position in which access to the drum is granted.

[0042] According to the present embodiment, in the front panel 101a of the casing 101 are also located a control panel 103 of the machine 100 and a drawer 104 suitable for containing washing/rinsing products, e.g. detergents, bleach, softeners, etc.,.

[0043] In other words, the machine 100 of the present embodiment is a front-load device. Nevertheless it will be appreciated that the present invention could also apply to different type of laundry washing machines, such as top-loading ones.

[0044] With reference now to Fig. 2, the washing machine 100 according to the present invention further comprises a supporting structure 5 of the treatment chamber 1, to which the panels 101a,b,c of the outer casing 101 are preferably connected.

[0045] The washing machine 100 also advantageously comprises a pump unit 4 for discharging washing/rinsing liquid from the washing tub or, more in general, from the treatment chamber 1, e.g. during or at the end of washing cycles.

[0046] A filter assembly 2 is interposed between the treatment chamber 1 and the pump unit 4, such that water discharged from the treatment chamber 1 passes through a filter element 21 in order to block foreign material (e.g. coins, buttons, toothpicks, etc.) that may clog the pump. To this end, the filter element 21, shown in greater detail in Fig. 4B, can be advantageously formed by a plurality of chambers 210 through which water passes when flowing from an inlet 241 of the filter assembly 2 to an outlet 242 thereof.

[0047] Preferably, the inlet 241 is connected via a discharge conduit 41, shown in Fig. 2, to the treating chamber 1, and the outlet 242 is connected via a drainage conduit 42 to an external drainage, not shown in the Figures, in order to discharge water e.g. to a domestic drainage system to which the washing machine 100 is connected.

[0048] According to an alternative embodiment, not shown in the Figures, the washing machine can be also provided with recirculation circuit for reintroducing into the treatment chamber washing/rinsing liquid discharged from the latter; in this case a further pump, called recirculation pump, may be preferably provided, connected downstream the filter assembly (or, in a further advantageous embodiment, to a further filter assembly) so as to be protected by the latter form foreign bodies exiting the chamber, and which outlet is connected to a duct arranged to re-admit into the chamber washing/rinsing liquid removed from the recirculation pump.

[0049] In another advantageous embodiment, also not illustrated, a same pump, connected downstream the filter assembly, is used both for draining and for recirculating washing/rinsing liquid; in this case a valve, not illustrated, is provided downstream the pump for connecting it selectively to the draining circuit or to the recirculation circuit.

[0050] With reference now to Figs. 4A and 4B, according to a preferred embodiment, the filter assembly 2 comprises a filter body 20 defining a seat 200 for removably housing the filter element 21. Preferably, the filter body 20 is tubular shaped and a first open end 201 thereof is connected to the pump unit 4, while its second end, defined by a collar 23, is advantageously connected to the outer casing 101 via a connection interface 30 and through which the filter element 21 can be inserted in/removed from the filter body 20. To this end, the connection interface 30 comprises an opening 103 through which the filter element 21 can pass in order to be inserted into/removed from the filter body 20. According to a preferred embodiment, and as will be described in greater detail in the following, the collar 23 is shaped such that it can pass through the opening 103 and, preferably, it has a complementary shape to the opening 103.

[0051] In the present embodiment, the filter body is preferably directly connected to the pump unit 4 at the first end 201, but it will be appreciated that the connection between the pump unit and the filter body, or more in general the filter assembly, in a further advantageous embodiment, can be formed by means of an intermediate conduit connecting them.

[0052] Preferably, inlet 241 and outlet 242 are both formed on the filter body, advantageously radially extending therefrom, with the outlet 242 located downstream the inlet 241 with respect to the pump unit 4. Accordingly, water from the treating chamber 1 is sucked in through the inlet 241 by means of the suction of the pump unit 4, passes through chambers 210 of filter element and is discharged through outlet 242 to the drainage conduit 42.

[0053] It will be appreciated that, as will be clearer in the following, the present invention can also apply to

washing machines in which water from the treating chamber can be both discharged to the drainage and recirculated to the treating chamber.

[0054] With reference now to Figs. 2 and 3A, according to a preferred embodiment, the filter assembly 2 is located such that the filter element 21 is positioned at a lower corner of the front panel 101a, preferably with a handle 211 thereof directed towards the external side of the connection interface 30 and, consequently, of the outer casing 101. In this manner, the handle 211 can be advantageously pulled by a user in order to remove the filter element 21 for cleaning or other maintenance purposes. Furthermore, the handle 211 permits to hold the filter unit 21 when it is inserted back into the seat 200 of the filter body 20, and pushed until it abuts against an annular projection 202 delimiting the stroke of the filter element 21 within the filter body 20, which shown in Fig. 6B.

[0055] According to a preferred embodiment, the connection interface 30 is formed as a distinct body from the front panel 101a forming of the external casing 101 to which the connection interface 30 is associated or connected, preferably by means of the supporting structure 5. In other words, the connection interface 30 and the external casing 101 are connected therebetween (optionally, but not necessarily, slightly spaced apart one another) since they are both fixed to the supporting structure 5. To this end, the connection interface 30 comprises at least one fixing element 305, preferably two, formed e.g. by a seat for receiving a respective pin 53, partially shown in Figure 8, to be connected to a hole in the supporting structure. Using a front panel 101a and a connection interface 30 formed as distinct bodies advantageously allows manufacturing these components separately. In particular, this allows using the same filter body 20 also with connection interface 30 having different shapes, such as the one shown in Figs. 7A and 7B. With reference again to Fig. 3A and 3B, always according to a preferred embodiment, the connection interface 30 is box-shaped and recessed. According to this shape, the connection interface comprises a base surface 131 into which the opening 103 is defined, which is recessed with respect to the front panel 101 when connected thereto.

[0056] In order to connect the filter body 20 to the connection interface 30, the washing machine 100 comprises a connecting device, globally indicated with the reference number 3. More precisely, the connecting device 3 allows connecting the filter body 20 to the connection interface 30 such that the seat 200 of the filter body 20 is aligned with the opening 103 and, accordingly, the filter element 21 can be inserted in the seat 200 passing through the opening 103. In other words, the connection interface 30 defines the opening in the external casing 101 through with the filter element 21 can be inserted and removed.

[0057] Preferably, the collar 23 projects from the opening 103 when the filter body 20 is connected to the connection interface 30. Nevertheless, the collar 23 remains preferably within a volume defined by the box-shaped form of the connection interface 30 and it does not project from an ideal surface defined by the front panel 101a. In this manner, it is possible to cover the connection interface and the filter element 21 by means of a removable cover 106, which remains flush with the front panel, as shown in Figs. 1 and 3.

[0058] With reference now to Figs. 5A-C and 6A-C the connecting device 3 comprises guide members 31, preferably formed on the base surface 131 of the connection interface 30 and projecting towards an internal portion of the washing machine 100.

[0059] According to a preferred embodiment, each guide member 31 comprises a slot 312, adapted to match with (in this advantageous example to receive) a respective engagement portion 32 formed on the filter body 20. Preferably, the engagement portions 32 are formed by a projection radially extending from the filter body 20. The shape of the engagement portions 32 is advantageously complementary to the one of the slots 312, such that the engagement portion 32 can be at least partially housed in the slot 312 and consequently coupled to guide member 31. Preferably, the engagement portions 32 are tapered, i.e. they gradually become thicker from an insertion end thereof towards their opposite end. In this manner, they can enter the slot 312 smoothly, and an increasing interference between the engagement portion 32 and the slot 312 is obtained as the former enters the latter. It will be also appreciated that, according to an alternative embodiment, not illustrated, the guide members can be formed on the filter body and the engagement portions on the connection interface.

[0060] Preferably, the slots 312 also comprise a closed end 311, defining a stopping end of the guide members 31, delimiting the stroke of the engagement portions 32 into the guide members 31.

[0061] Always according to a preferred embodiment, the slots 312 develop parallel to a plane defined by a mouth of said opening 103, i.e. parallel to the base surface 131. It will be therefore appreciated that the insertion of the engagement portions 32 in the guide members 31 allows connecting the filter body 20 and the connection interface 30, coupling them together at least along an axis X corresponding to the removal and insertion direction of the filter element 21 in the seat 200.

[0062] It should be also understood that the connection between the guide members 31 and the engagement portions 32 can be obtained by sliding the latter inside the slots 312 and this can be achieved by moving accordingly the filter body 20 relative to the connection interface 30 along a direction defined by the slots 312 of the guide members.

[0063] According to a preferred embodiment, the filter body 20 is cylindrical and the guide members 31 and their slots 312 develop as an arc of circumference concentric to the filter body 20. Accordingly, the connection between the guide members 31 and the engagement portions 32 is achieved by rotating the filter body 20 relative to the connection interface 30 about axis X. Preferably,

the collar 23 extends axially from the engagement portions 32, such that when they are aligned with the slots 312 or inserted therein, the collar is at least partially inserted in the opening 103, projecting therefrom as previously explained. In this manner, the collar 23 can help positioning the filter body 20 when connecting it to the connection interface 30.

[0064] Always preferably, the guide members 31 and the engagement portions 32 are disposed spaced apart along a periphery of the opening 103 and of the filter body 20, respectively. The distance between consecutive guide members 31 is preferably wide enough to house an engagement portion 32 when it is not inserted in the slot 312.

[0065] It should be anyhow observed that the connecting device 3 can also comprise a single guide member 31 and a respective engagement portion 32, provided that their development allows a coupling between the filter body 20 and the connection interface 30 capable of bearing the stresses generated during the operation of the washing machine 100 or due to the withdrawal and insertion of the filter element 21, or provided that they are associated to other fixing elements. The connecting device 3 further comprises an automatic fastening locking element 33 preventing movement of the engagement portions 32 with respect to the guide members 31 at least along a withdrawal direction of the engagements portion 32 from the slots 312 when the engagement portion 32 is in the guide member 31.

[0066] According to a preferred embodiment, automatic fastening locking element 33 is a snap-fit locking element. Preferably, as the engagement portions 32 are inserted into the slots 312 for a certain extent, the locking element 33 urges away a resilient stopping element 34, until the former passes the latter and the resilient stopping element 34 returns in a non-deformed condition. In the following, the position in which the locking element 33 passes the resilient stopping element 34 during insertion of the engagement portions 32 will be indicated as fastening position. It will be therefore appreciated that when the resilient stopping element 34 is in the non-deformed condition and after the locking element 33 reaches the fastening position, if the filter body 20 is moved back in the withdrawal direction of the engagement portions 32 from the slots 312, an abutment surface 334 of the locking element 33 abuts against the stopping element 34. In this manner, movements of the engagement portions 32 with respect to the guide member 31 are prevented and the connection between the filter body 20 and the connection interface 30 is locked.

[0067] According to a preferred embodiment, the resilient stopping element 34 is formed on a resilient flap 340, shown in Fig. 5B, 6B and 6C, against which the automatic fastening locking element 33 urges before reaching the predetermined fastening position. The flap 340 develops along a surface which is tilted with respect to a path followed by an outermost portion of the automatic fastening locking element 33 as said engagement portions 32 travel into the guide members 31. It should be observed that in the present embodiment, the outermost portion of the automatic fastening locking element 33 basically corresponds to the abutment surface 334. Preferably, since the flap 340 is also resilient, it also deforms gradually as the automatic fastening locking element 33 urges it upon rotation of the filter body 20.

[0068] According to alternative advantageous embodiments, not illustrated in the Figures, the automatic fastening locking element can be a bayonet device or any other system allowing to fasten the filter body 20 to the connection interface 30 automatically when the engagement portions 32 are inserted into the guide members 31, i.e. the fastening occurs as the result of the relative movement between the filter body 20 and the connection interface 30, without requiring additional operations.

[0069] According to a preferred embodiment, the filter body 20 comprises a fixing element 245 for connecting it to the supporting structure 5. Preferably, the fixing element 245 of the filter body 20 is a snap-fix element, snapping into a respective seat 52, formed in the supporting structure 5 and shown in Fig. 3A, when the engagement portions 32 are inserted into the guide members 31. Always preferably, the fix element 245 of the filter body is positioned at an end of an arm 245' extending radially from said filter body 20.

[0070] In order to improve the steadiness of the connection between the filter body 20 and the connection element, the connecting device 3 can also comprise a notch 35, preferably formed on the filter body 20, and a seat 36, preferably formed on the connection interface 30, for housing a pin, not shown in the Figures. When the automatic fastening locking element 33 locks the engagement portion 32 with respect to the guide member 31 the notch 35 is aligned to the seat 36 and their position can be also lock by inserting the pin.

[0071] According to a preferred embodiment, the filter body 20 further comprises a lateral extension 24, covering a recess 304 formed on the connection interface 30 for housing a strip of a door lock emergency device, not shown in the Figures, which is pulled in order to unlock the door in emergency conditions, e.g. in case of an electrical failure. It will be therefore appreciated that according to this aspect, the recess 304 for the strip is easily reachable during the assembling of the washing machine and then covered by the lateral extension 24, thus protecting the strip from the dust, when the filter body is connected to the connection interface 30.

[0072] It has thus been shown that the present invention allows all the set objects to be achieved. In particular, the filter body can be connected to the connection interface and to the supporting structure of the washing machine in a particularly simple manner, as it is only required to rotate the filter body until it reaches the snapping position. Furthermore, both filter body and connection interface can be moulded independently, allowing to the produce filter body and the connection interface with integrated features, such as fixing elements to the support-

ing structure or the recess for the door lock emergency device.

[0073] In addition, the external aspect of the washing machine, defined by the outer casing, can be modified without requiring a new design for the filter body, that would otherwise require a new reliability and leakage test.

Claims

1. A washing machine (100) comprising:

• an outer casing (101);
• a treatment chamber (1) for receiving a load to be washed;
• a pump unit (4) for discharging water from said treatment chamber (1);
• a filter assembly (2) interposed between said treatment chamber (1) and said pump unit (4) for filtering washing/rinsing liquid discharged from said treatment chamber (1), said filter assembly (2) comprising a filter element (21) and a filter body (20) defining a seat (200) for removably housing said filter element (21);
wherein washing machine (100) comprises a connection interface (30) into which an opening (103) is defined and through which said filter element (21) can be inserted into/removed from said filter body (20);
said filter assembly (2) further comprising:
• a connecting device (3) for connecting said filter body (20) to said connection interface (30) such that said seat (200) of said filter body (20) is aligned with said opening (103);
characterized in that
said connecting device (3) comprises:

- a guide member (31) and a respective engagement portion (32) that is shaped for matching with said guide member (31) such that said filter body (20) and said connection interface (30) are coupled together at least along an axis (X) corresponding to the removal and insertion direction of said filter element (21) in said seat (200),
- an automatic fastening locking element (33), automatically fastening said engagement portion (32) to said guide member (31) when said engagement portion (32) reaches a predetermined fastening position into said guide member (31), so as to prevent movements of said engagement portion (32) with respect to said guide member (31) at least along a withdrawal direction of said engagement portion (32) from said guide member (31).

2. The washing machine (100) according to claim 1, wherein said connection interface (30) is formed as a distinct body from a panel (101a, 101b, 101c) of said external casing (101), said connection interface (30) being associated or associable to said external casing (101).

3. The washing machine (100) according to claim 1 or 2, wherein said filter body (20) is cylindrical and said guide member (31) develops as an arc of circumference concentric to said filter body (20).

4. The washing machine (100) according to claim 3, wherein said guide member (31) is formed on said connection interface (30) and comprises a slot (312) into which said engagement portion (32) slides, said slot (312) developing parallel to a plane defined by a mouth of said opening (103), said engagement portion (32) being formed on said filter body (20) by a projection radially extending from said filter body (20).

5. The washing machine (100) according to claim 4, wherein said filter body (20) comprises a collar (23) in which a mouth of said seat (200) for said filter element (21) is defined and axially extending from said engagement portion (32), said collar being complementary shaped to said opening (103) and being inserted therein when said engagement portion (32) is aligned with said slot (312).

6. The washing machine (100) according to any of the preceding claims, wherein said connection interface (30) defines a recessed part of said external casing (101), said guide member (31) projecting from a base surface (131) of said connection interface (30) towards an internal portion of said washing machine (100).

7. The washing machine (100) according to any of the preceding claims, wherein said automatic fastening locking element is a snap-fit locking element, said connecting device (3) further comprising a resilient stopping element (34) which is urged away by said snap-fit locking element (33) until said engagement portion (32) matches with said guide member (31) at least up to said predetermined fastening position, said resilient stopping element (34) abutting against an abutment surface (334) of said snap-fit locking element (33), preventing the movement of said engagement portion (32) with respect to said guide member (31), when said engagement portion (32) is moved back from said predetermined fastening position.

8. The washing machine (100) according to claim 7, wherein said resilient stopping element (34) comprises a flap (340) against which the snap-fit locking

element (33) urges before reaching said predetermined fastening position, said flap (340) developing along a surface which is tilted with respect to a path followed by an outermost portion of said snap-fit locking element (33) as said engagement portion (32) travels into said guide member (31), such that said flap (340) is gradually deformed by the urging of said snap-fit locking element (33).

9. The washing machine (100) according to any of the preceding claims, further comprising a supporting structure (5) to which outer casing (101) and said treatment chamber (1) are connected, said connection interface (30) and said filter body (20) comprising a respective fixing element (305, 245) to said supporting structure (5).

10. The washing machine (100) according to claim 9, wherein said fixing element (245) of said filter body (20) is a snap-fix element, snapping into a respective seat (52) formed in said supporting structure (5) when said engagement portion (32) matches with said guide member (31).

11. The washing machine (100) according to claim 10, wherein said snap-fix element (245) is positioned at an end of an arm (245') extending radially from said filter body (20).

12. The washing machine (100) according to any of the preceding claims, wherein said guide member (31) comprises a stopping end (311) delimiting the stroke of said engagement portion (32) into said guide member (31).

13. The washing machine (100) according to any of the preceding claims, wherein said connecting device (3) further comprises a notch (35) which is aligned with a seat (36) for a pin when said automatic fastening locking element (33) locks said engagement portion (32) with respect to said guide member (31).

14. The washing machine (100) according to any of the preceding claims, wherein said connecting device (3) comprises at least two guide members (31) and at least two respective engagement portions (32), the guide members (31) and the engagement portions (32) being disposed spaced apart along a periphery of said opening (103) and of said filter body (20).

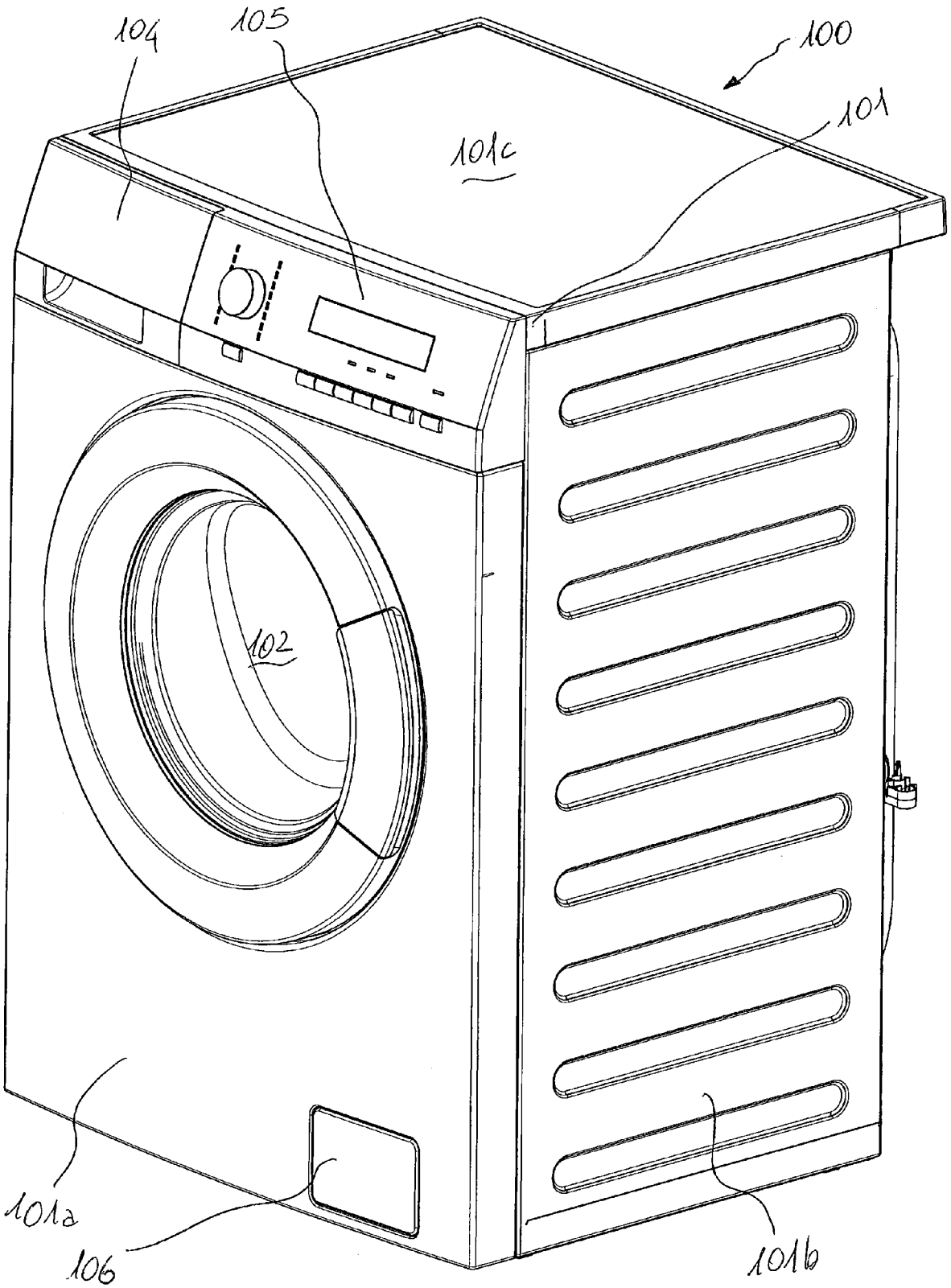

FIG. 1

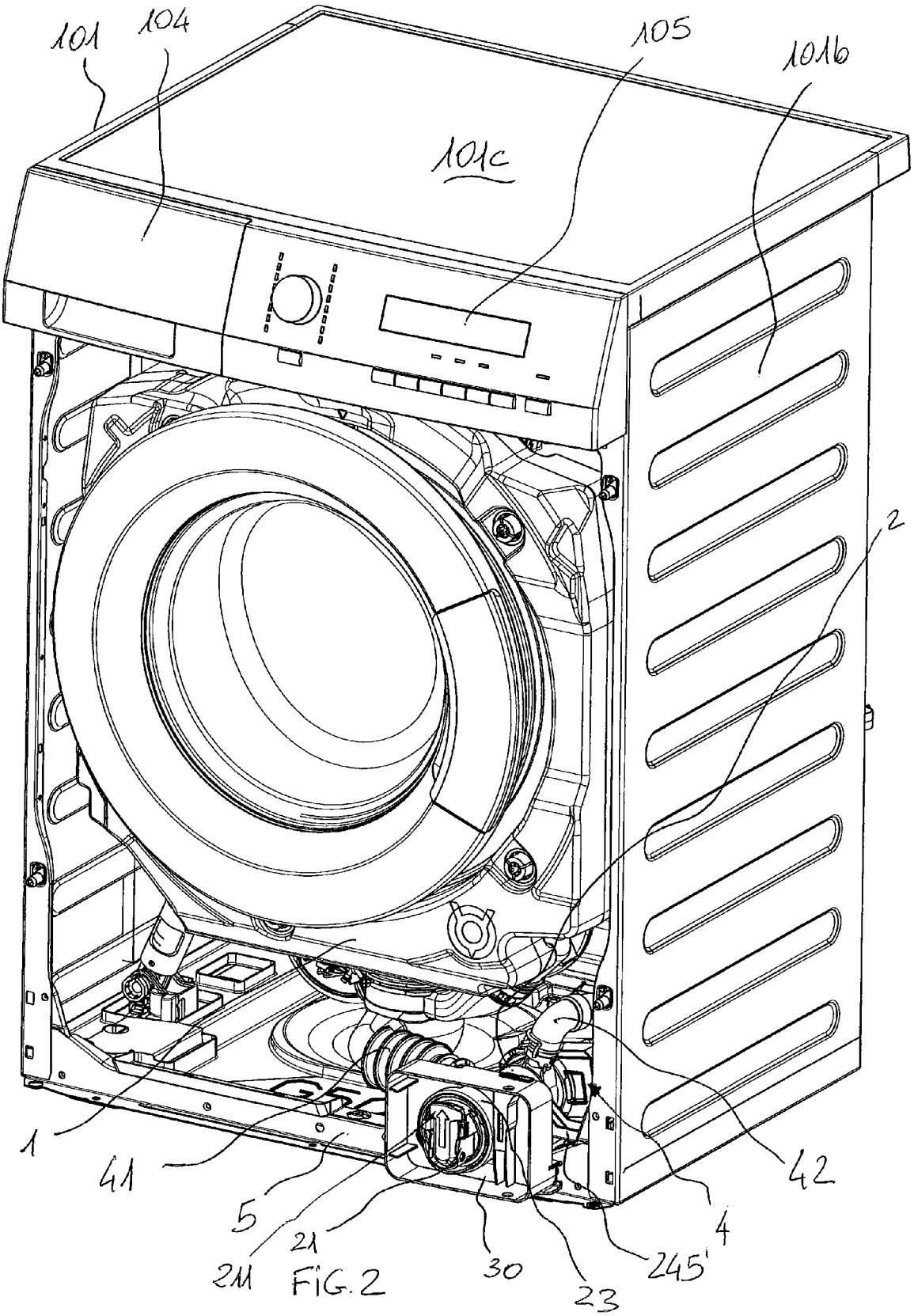

FIG. 2

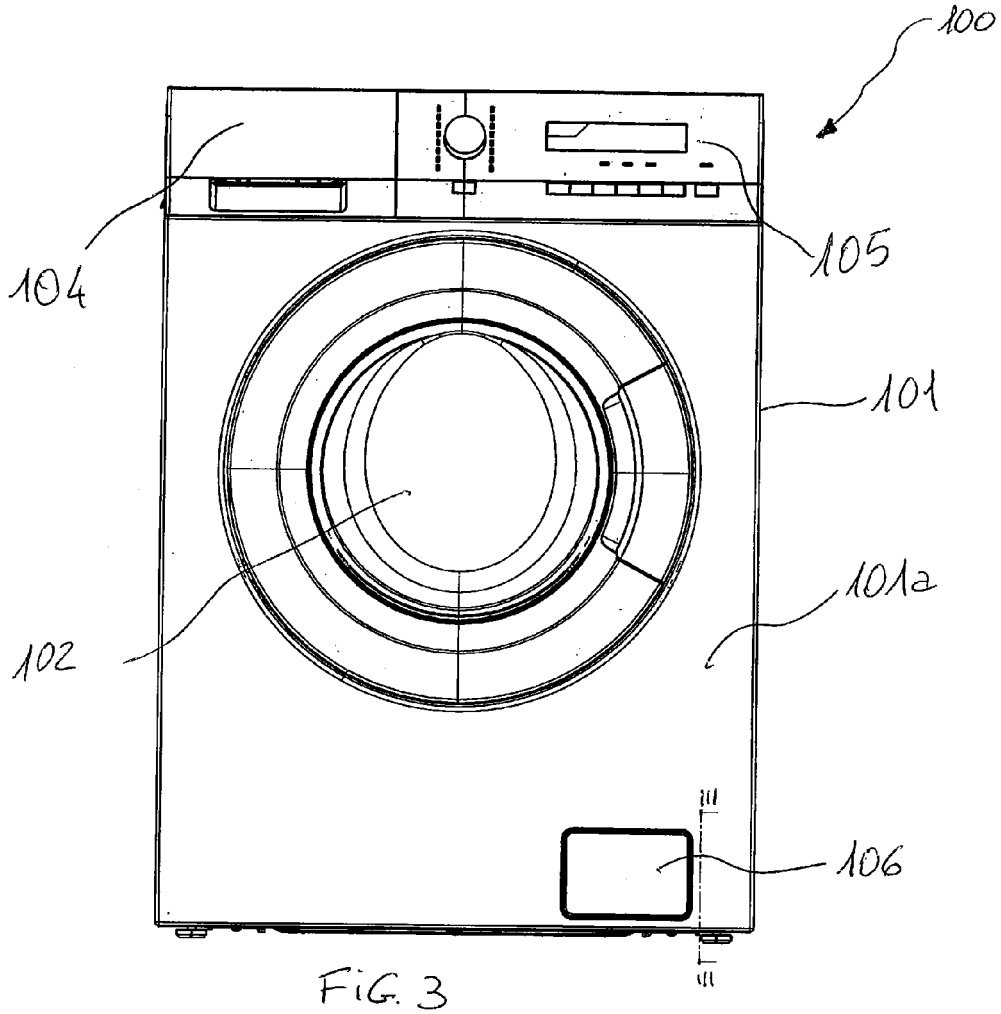
100
104
105
101
102
101a
106
III
III

FiG. 3

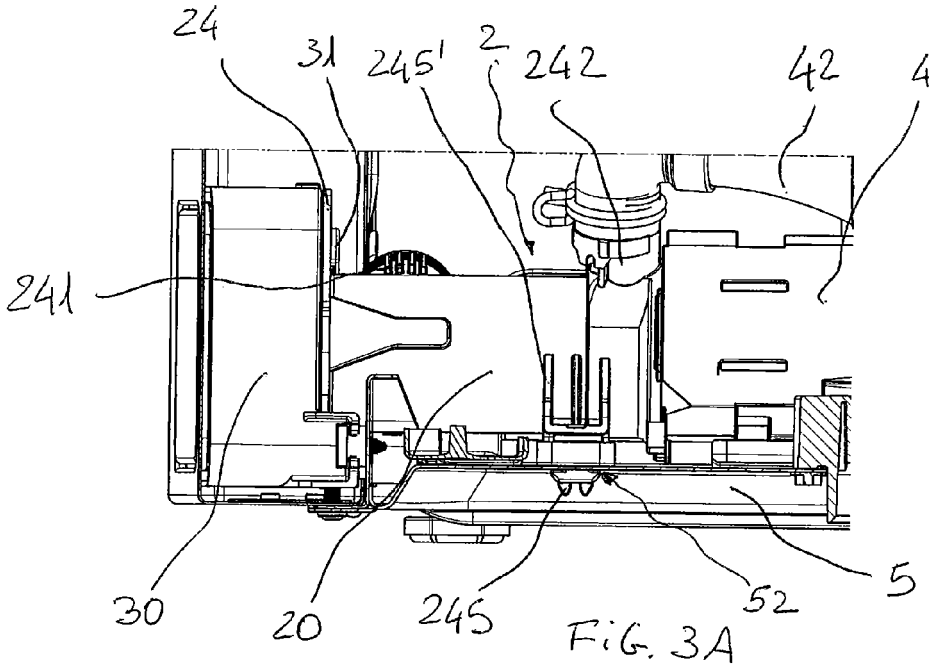
24
31
245'
2
242
42
4
241
30
20
245
52
5

FiG. 3A

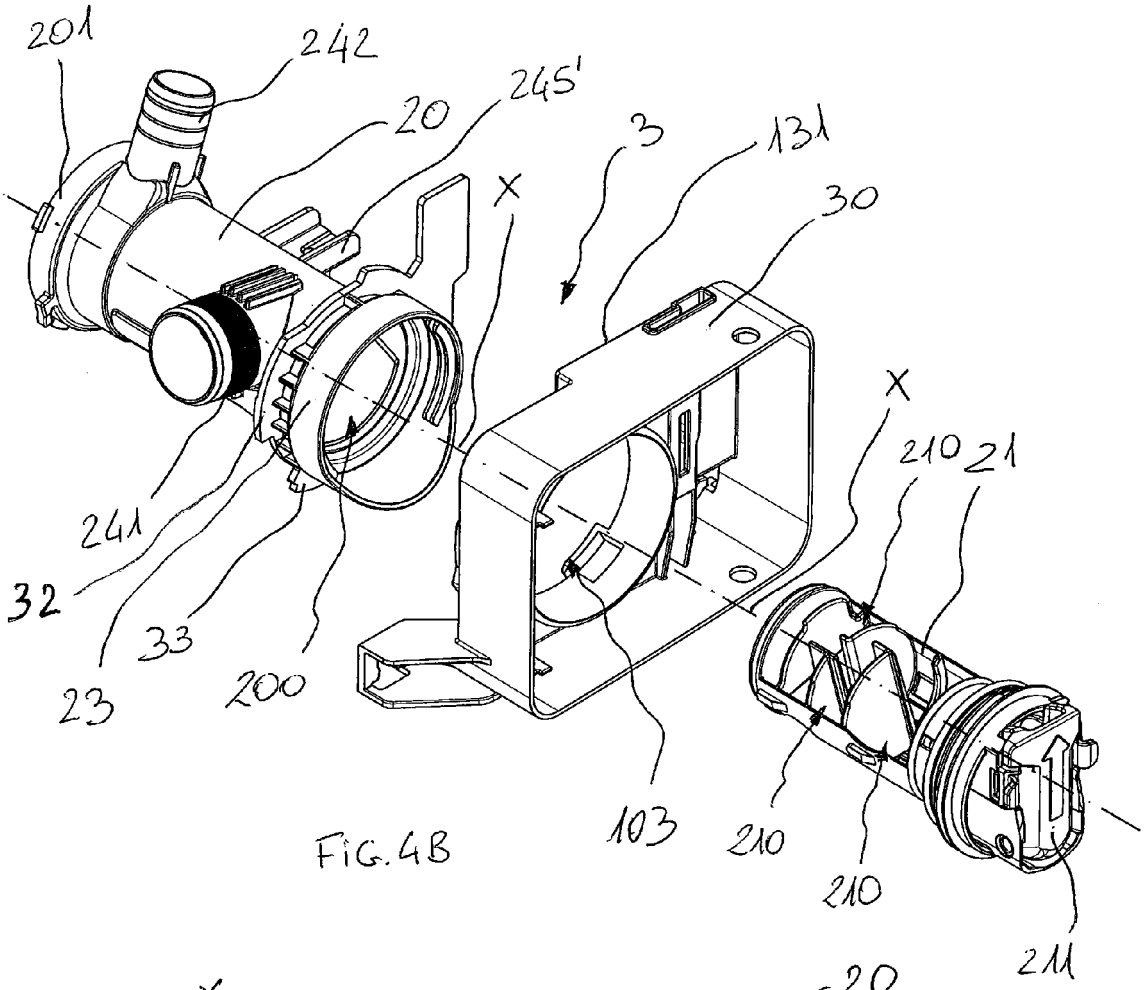
201
242
245'
20
3
131
30
X
X
210
21
241
32
33
23
200
103
210
210
211

FIG. 4B

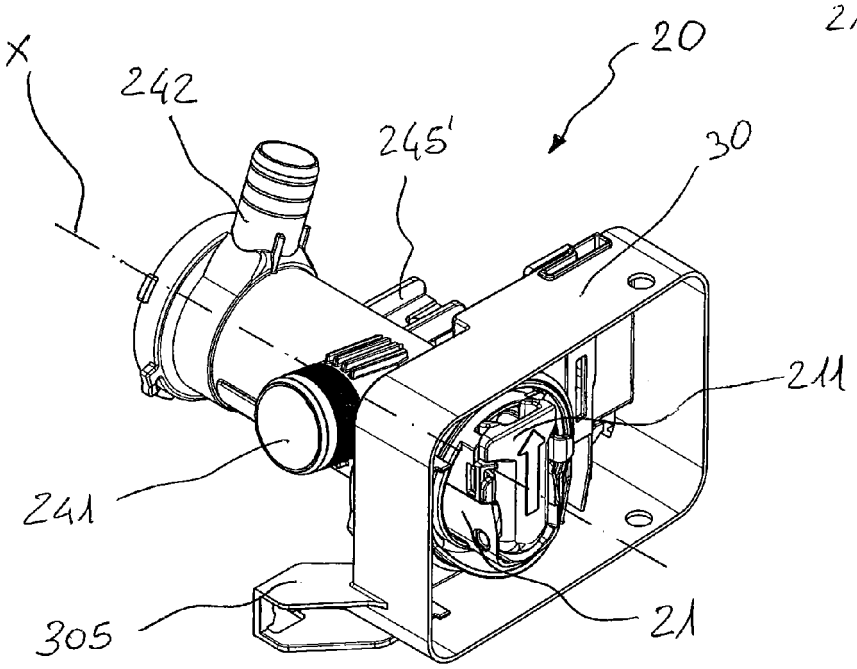
X
242
20
245'
30
211
241
305
21

FIG. 4A

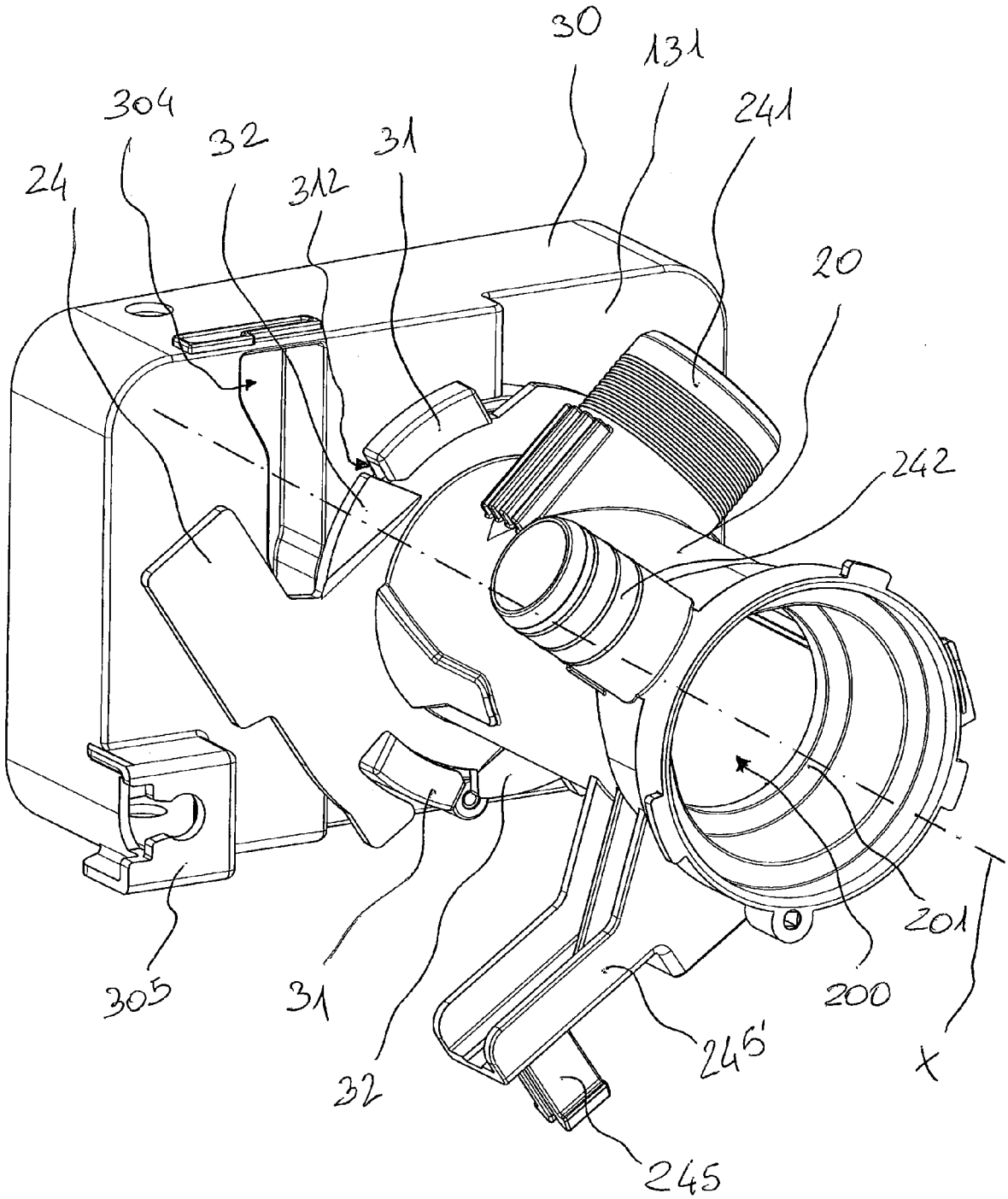

FIG. 5A

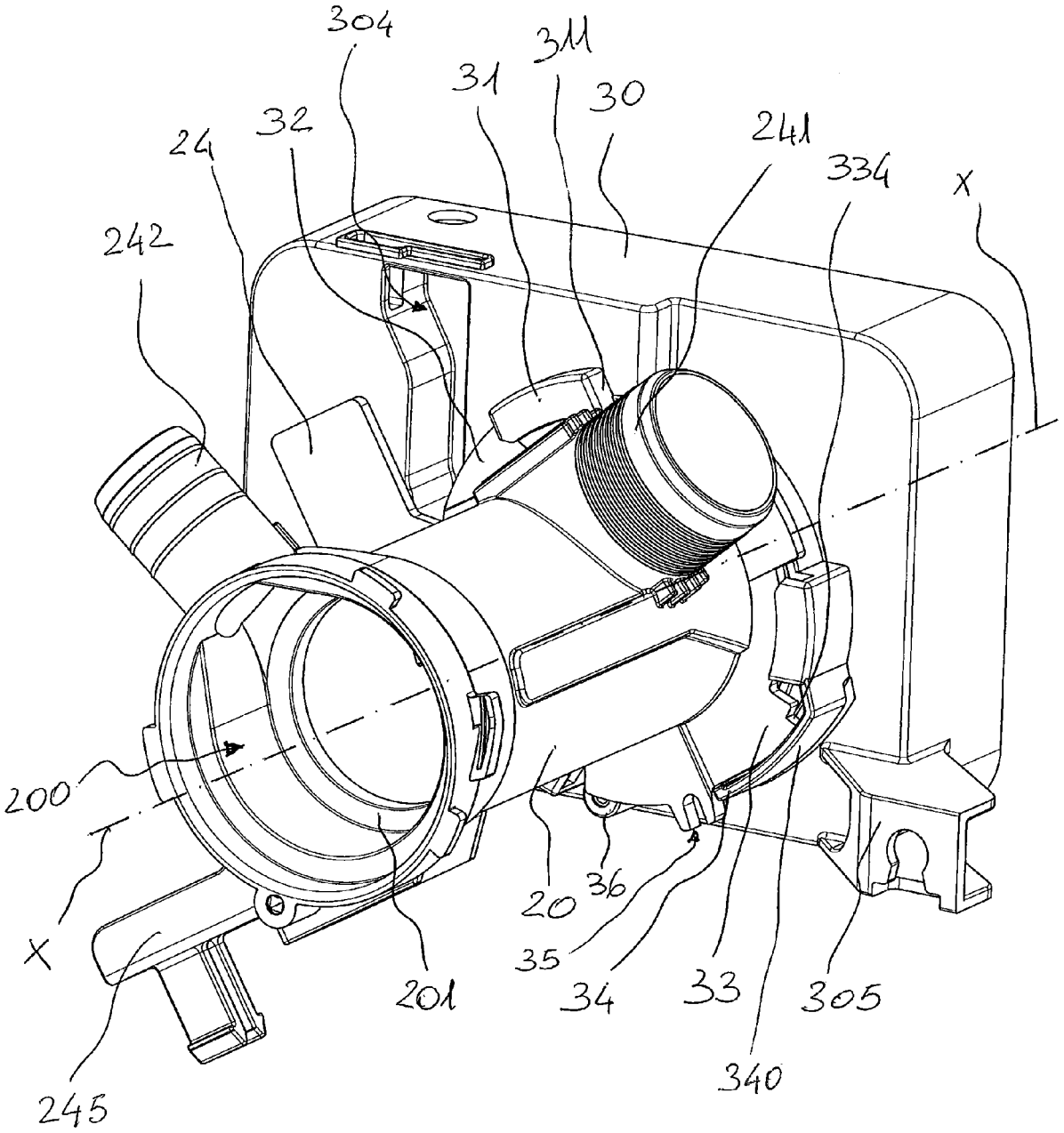
304
311
31
30
32
24
241
334
X
242
200
X
20
36
35
34
33
305
201
340
245

FIG. 5B

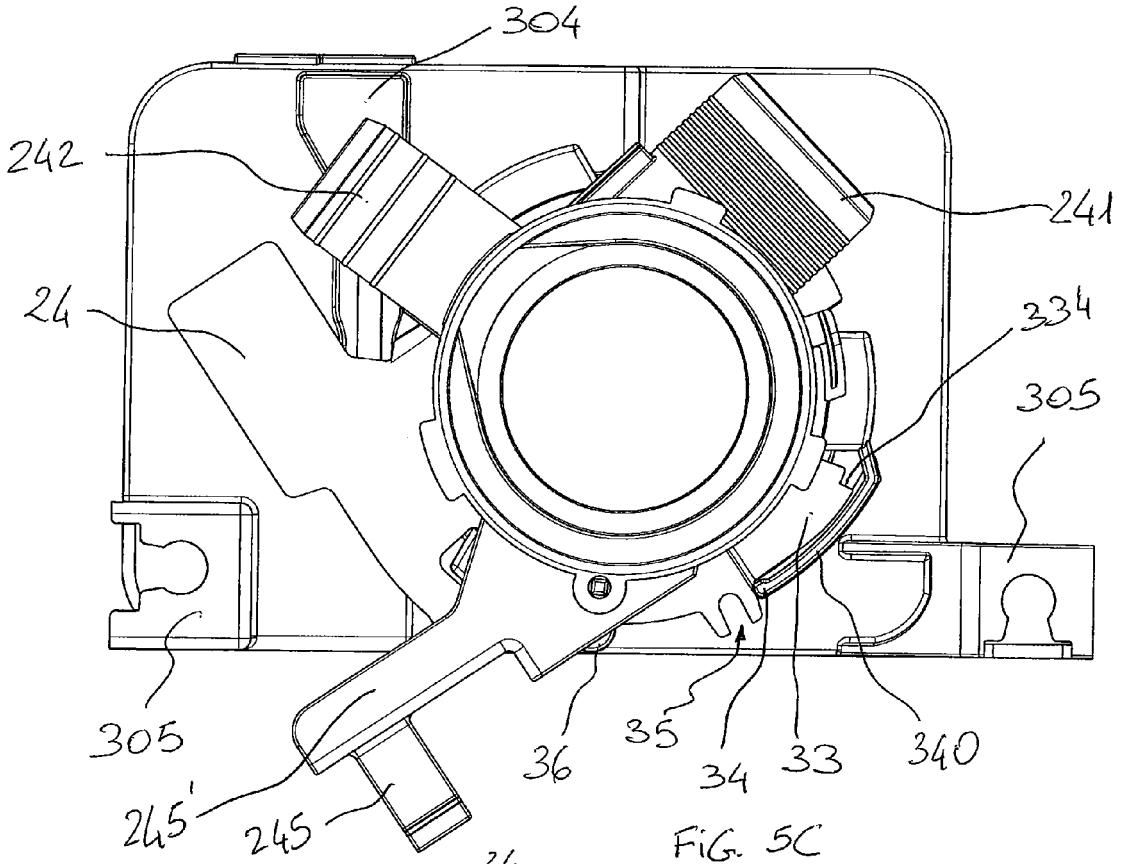
304
242
241
24
334
305
305
245'
245
36
35
34
33
340

FIG. 5C

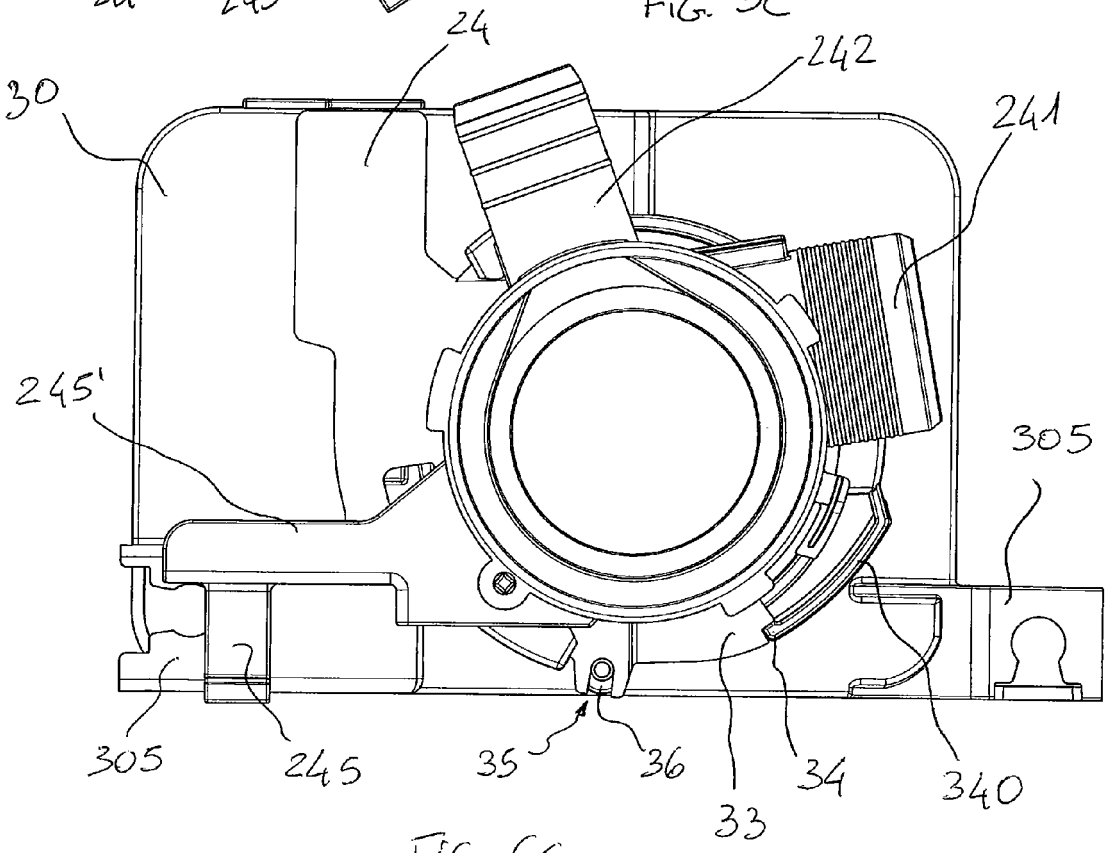
24
242
30
241
245'
305
305
245
35
36
34
340
33

FIG. 6C

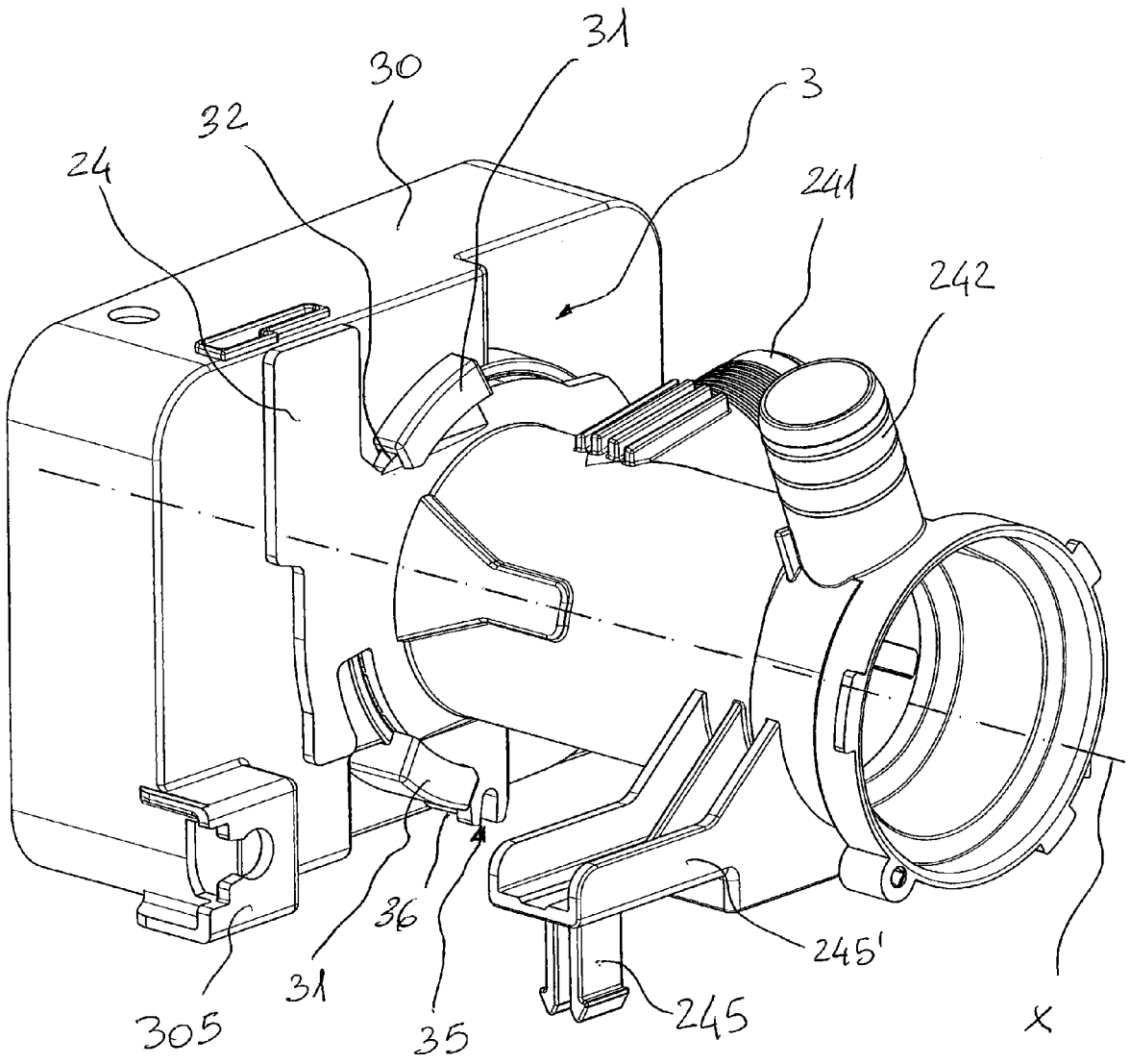

FIG. 6A

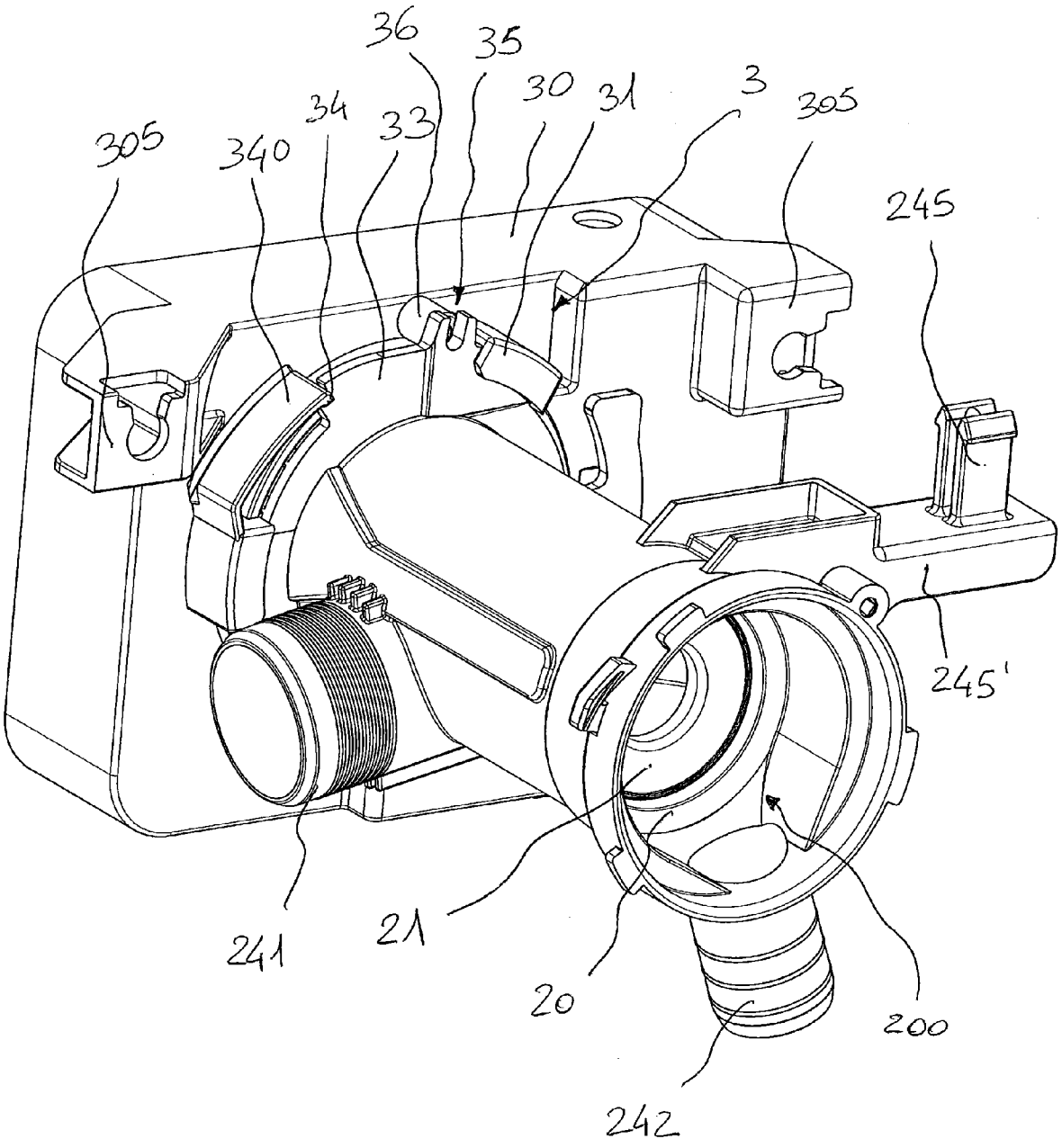

FIG. 6B

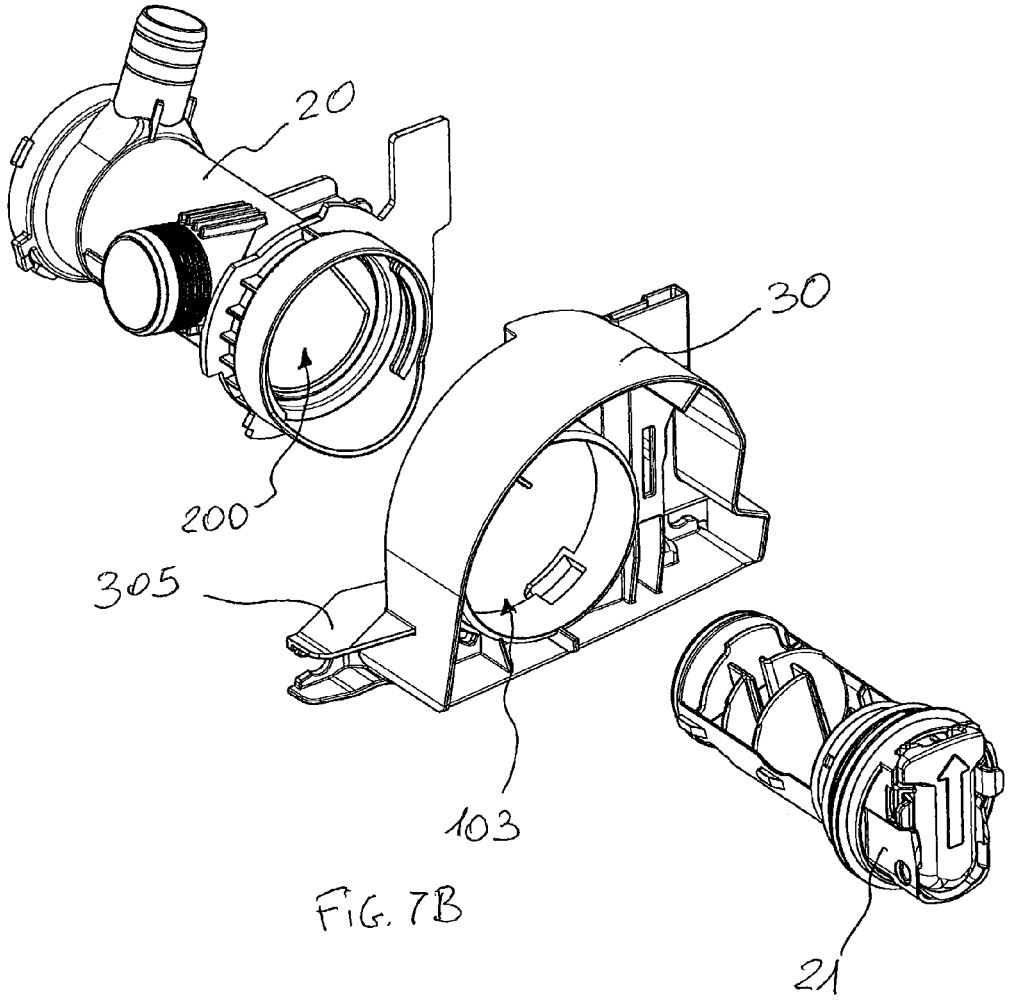

FIG. 7B

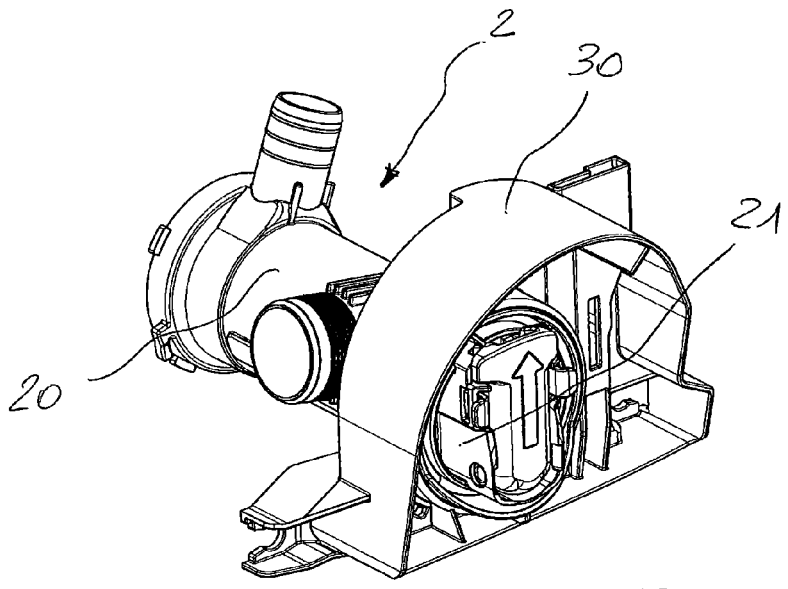

FIG. 7A

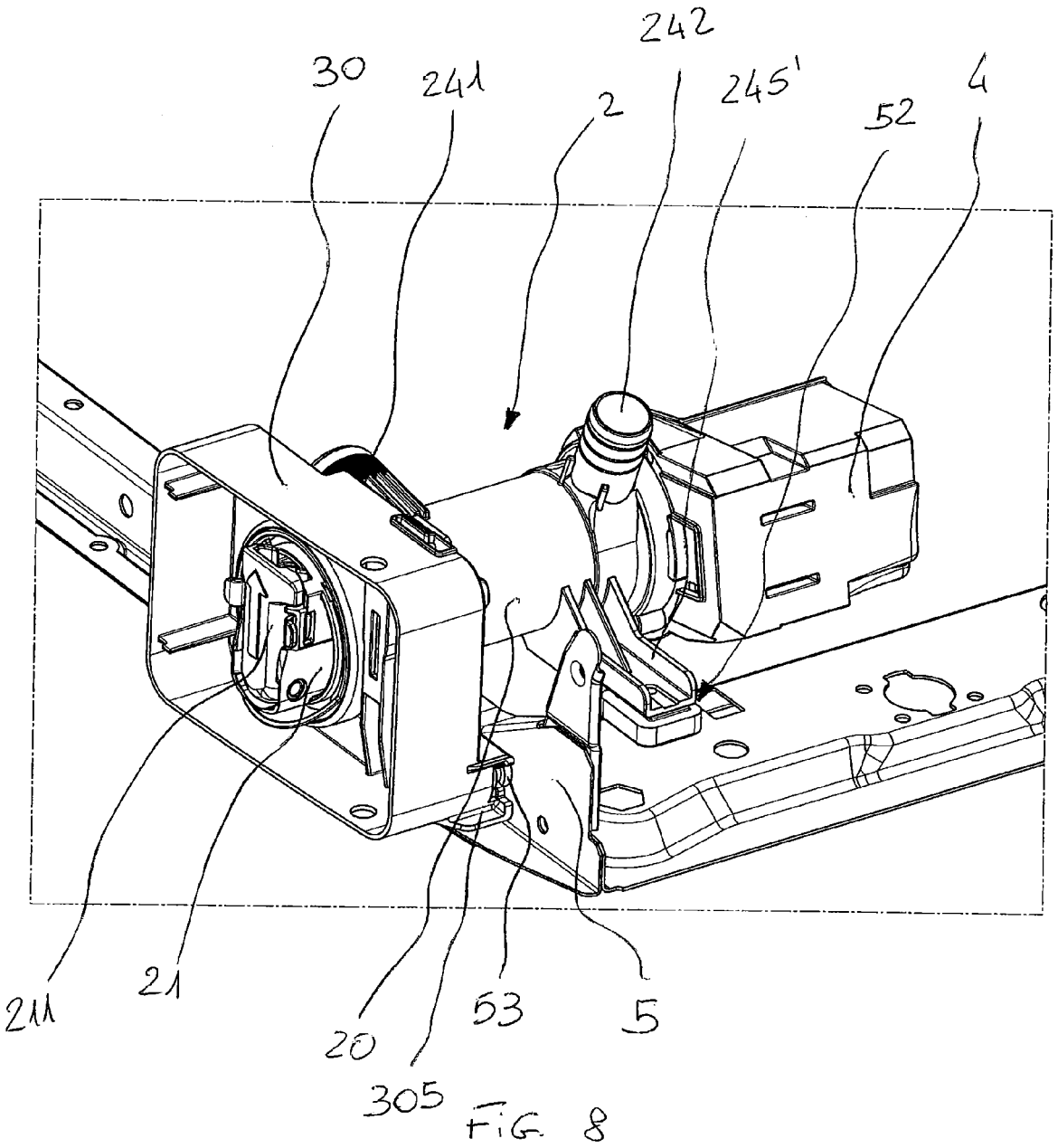

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
Munich	28 March 2014	Prosig, Christina

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