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(54) **Improvements to draining circuit filter arrangement for washing appliances**

(57) A washing machine **(100)** comprising: a washing tub **(125);** a drum **(130)** rotatably accommodated within the washing tub; a draining sump **(160)** fluidly communicating with the internal of the washing tub **(125)** and fluidly connected to a draining circuit **(170)** operable for draining liquid from the washing tub; a filter **(185)** provided between the washing tub **(125)** and the draining sump **(160)** and accessible from the inside of the drum through a drum aperture **(205).** The washing machine **(100)** comprises a lighting device **(305)** arranged for generating a light which is emitted inside the drum **(130)** for helping a user to find the location of the filter **(185).**

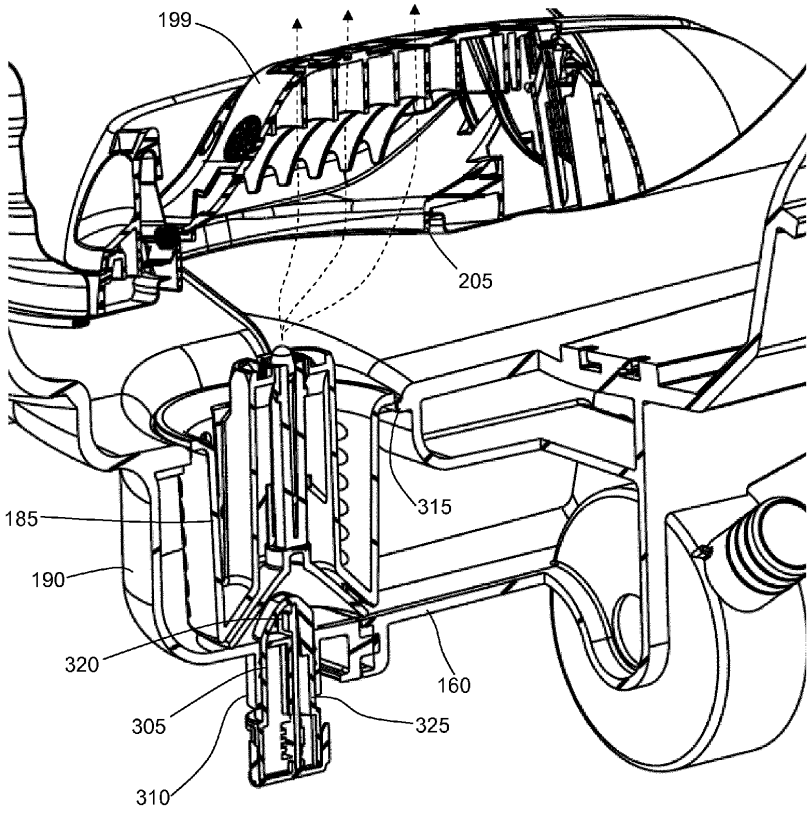

Fig. 3C

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Description

Field of the invention

[0001] The present invention generally relates to washing appliances such as laundry washing machines and laundry washing/drying machines. Within this field, the present invention relates to improvements to the arrangement of the draining circuit filter for those washing machines.

Overview of the related art

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

[0003] Known washing machines comprise a water inlet circuit adapted to feed water and washing/rinsing products (i.e. detergent, softener, etc.) into the tub.

[0004] Known washing machines also comprise a water outlet circuit, typically comprising a drain pump and draining pipes, adapted to drain the washing/rinsing liquid (i.e. water and water mixed with washing and/or rinsing products) from the tub after the washing and rinsing phases.

[0005] The water outlet circuit usually comprises a filtering device, placed in the water outlet circuit upstream of the drain pump, adapted to retain the fluff and any undesirable body (for example buttons came off from the laundry, coins erroneously introduced into the washing machine, etc.) that may happen to pass 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 clog, obstruct or even damage the drain pump.

[0006] The most common of these filtering devices consists of a cylindrical box attached to the base of the washing machine and containing a removable filter fluidly connected upstream of the drain pump. This box containing the filter is accessible through a quick-removable plug that allows the filter to be removed and cleaned, the plug being hidden by a door located, depending on the case, on the front or back wall of the external casing of the washing machine.

[0007] There are also known washing machines comprising a draining sump, obtained on the lower region of the lateral surface of the tub (i.e. in the bottom of the tub), fluidly communicating with the internal of the latter and fluidly connected upstream of the drain pump.

[0008] The filter is placed in the draining sump and is typically a cup-shaped body provided with a filtering surface, i.e. a surface provided with a plurality of apertures which are dimensioned in order to allow the passage of the washing/rinsing liquid, but to prevent the passage of fluff and foreign bodies of prefixed dimensions. In this case the rotatable drum of the washing machine is provided with at least one opening, closable by a removable or openable lid, adapted to allow a user to reach the filter from the internal of the washing machine, for example for inspection or cleaning; typically the filter may be removed from and repositioned into the draining sump, so as to facilitate its inspection, cleaning or replacement.

[0009] A prior art washing machine containing a filter used to prevent residual particles of dirt from reaching and obstructing the drain pump and its drainage duct, and which can be removed from the internal of the tub, for inspection, cleaning and replacement, is shown, for example, in GB 1197919, which discloses a washing machine comprising a tank (i.e. a tub) for liquid with an opening in its base, a draining pump connected by a pipe to the opening of the tank, and a basket (i.e. a rotary drum) arranged within the tank; a cup-like filter element having filter openings in its side wall is removably seated in the tank opening, and an opening is provided in the basket, provided with a removable closure, to provide access to the filter element.

[0010] Another example of known washing machine provided with a filter which can be removed from the internal of the tub is illustrated in FR 2190966, which discloses a top-loading washing machine comprising a tub containing a rotary drum provided, on its lateral surface, with a first door, adapted for loading/unloading the laundry, and with a second door, arranged opposite to the first door and adapted to allow the recovering of linen which would have slipped between the tank and the drum. A connector is fixed to the bottom of the tub, such connector being provided, at his inferior region, with a duct adapted to receive one of the extremities of a discharging pipe. A housing is provided in the connector, adapted to receive a filter accessible by simultaneously opening the two doors of the drum.

[0011] A further known washing machine comprising a filter accessible from the internal of the tub is illustrated in the European patent n. EP 1849904, which discloses a top-loading washing machine comprising a draining filter access apparatus integrated in a lifter diametrically opposite to the drum access door (i.e. to the internal lid allowing the access to the drum). The draining filter access apparatus comprises a body, including an opening aligned with an opening of the same shape and dimensions made in the body of the drum, and a lid, hinged to the body and locking on the body by a simple ratchet mechanism.

[0012] EP 2325377, in the name of the present Applicant, discloses a washing machine comprising a washing tub, a draining sump fluidly communicating with the internal of the washing tub and fluidly connected to a draining circuit, a filter, removably associable to a seat provided between the washing tub and the draining sump, adapted to allow the passage of a liquid and to impede the passage of bodies of fixed dimensions. The filter comprises an indicator adapted to be displaced in a first position if the filter is correctly inserted into the seat, and in a second position if the filter is incorrectly inserted into

seat.

Summary of the invention

[0013] Applicant has observed that the known solutions of washing machines with filter accommodated in a seat provided between the washing tub and the draining sump, and accessible from inside the drum, are not fully satisfactory, because the location of the filter is not straightly visible from outside the machine (also due to scarce illumination of the drum internal space), and unless the user carefully reads the machine instruction manual (a burden that often the users are not willing to sustain), the user might be induced to look for the more usual filter compartment door on the machine cabinet, and not finding it, the user may at the end forget to periodically clean the filter.

[0014] The Applicant has thus faced the problem of overcoming this drawback.

[0015] Applicant has found that by providing a lighting device arranged for generating a light which is emitted inside the drum for helping a user to find the location of the filter, the user can easily spot the location of the filter inside the drum, and therefore the risk of forgetting the maintenance of the filter is reduced and also the maintenance of the filter is simplified.

[0016] According to an aspect of the present invention, there is provided a washing machine comprising:

- a washing tub;
- a drum rotatably accommodated within the washing tub;
- a draining sump fluidly communicating with the internal of said washing tub and fluidly connected to a draining circuit operable for draining liquid from the washing tub;
- a filter provided between said washing tub and said draining sump and accessible from the inside of the drum through a drum aperture.

[0017] The washing machine comprises a lighting device arranged for generating a light which is emitted inside said drum for helping a user to find the location of said filter.

[0018] Advantageously, said filter is housed in a filter seat provided between said washing tub and said draining sump, said filter seat being accessible from the inside of the drum through a drum aperture. Said lighting device is advantageously associated with said filter seat.

[0019] A closing device is advantageously provided, coupled or couplable to the drum for selectively closing/opening the drum aperture for accessing said filter. Advantageously, the closing device is at least partly in a material transparent to the light for the transmission of the light generated by the lighting device.

[0020] Said closing device may comprise an upper region having formed therein a self-explanatory word or symbol in transparent material.

[0021] Expediently, the closing device comprises a drum lifter provided along the drum lateral surface for improving the stirring of the laundry during the drum rotation.

[0022] Said drum lifter may be pivotable with respect to the lateral surface of the drum or removably coupled to the lateral surface of the drum.

[0023] Advantageously, said filter is at least partly in a material transparent to the light for the transmission through it of the light generated by said lighting device.

[0024] The lighting device may be arranged to emit light along a direction parallel to an axis of the filter seat, or along a direction transversal to an axis of the filter seat.

[0025] Preferably, the lighting device is water-resistant, and comprises a light source advantageously housed inside a water-tight case.

Brief description of the drawings

[0026] These and other features and advantages of the present invention will clearly result by the following detailed description of exemplary and non-limitative embodiments of the present invention, which, for its better intelligibility, should be read in conjunction with the attached drawings, wherein:

Fig. 1 is a schematic, lateral and partially sectioned view, of a washing machine according to the present invention;

Fig. 2A to **Fig. 2C** show, in isometric views from the outside of a washing machine according to the present invention, some steps of the extraction procedure of the filter for foreign bodies;

Fig. 3A and **Fig. 3B** are isometric view partially in cross section of a washing tub and drum assembly of the washing machine of **Figs. 2A - 2C,** in an embodiment of the present invention;

Fig. 3C shows an enlarged a detail of **Fig. 3A;**

Fig. 4A and **Fig. 4B** are isometric view partially in cross section of a washing tub and drum assembly of the washing machine of **Figs. 2A - 2C,** in another embodiment of the present invention;

Fig. 4C shows an enlarged a detail of **Fig. 4A;**

Fig. 5 to **Fig. 7** show, in cross-section and in exploded isometric view, a filter according to an embodiment of the present invention.

Detailed description of exemplary embodiments of the invention

[0027] The washing machine according to the exemplary invention embodiment which will be here considered and is illustrated in the drawings is of the front-loading type; it is however clear that the invention is applicable, substantially without any crucial modification, to a top-loading washing machine.

[0028] It is also clear that the invention can be applied, substantially without any modification, both to a "simple"

washing machine (i.e. a washing machine which can only wash and rinse the laundry) and to a washing-drying machine (i.e. a washing machine which can also dry the laundry).

[0029] With reference to the schematic representation of **Fig. 1,** the washing machine **100** according to the exemplary invention embodiment here considered comprises an external casing or cabinet **105** having a frontal wall **110** in which an access opening **115** is provided, with an associated laundry loading/unloading door **120,** which allows the access to a washing tub **125** contained in the external casing 105; the washing tub **125** contains a rotatable perforated drum **130** in which the laundry to be washed, not illustrated, can be loaded (in the drawings, the holes in the lateral surface of the rotatable perforated drum **130** have not been depicted).

[0030] The washing tub **125** is connected to the external casing 105 preferably via a flexible bellows **135,** connected between the frontal, opened, surface of the washing tub **125** facing the access opening **115,** and the border of the latter.

[0031] The washing machine **100** comprises a water inlet circuit **140** adapted to feed water and washing/rinsing products (i.e. detergents, softeners, etc.) into the washing tub **125;** the water inlet circuit **140** advantageously comprises a removable drawer **145,** adapted to be filled with washing and/or rinsing products, for example detergents, softener, bleaching substances, etc.

[0032] The water inlet circuit **140** comprises also an inlet duct **150,** connectable to water delivery mains present outside the washing machine **100,** and adapted to deliver fresh water to the drawer **145;** the water inlet circuit **140** comprises also an outlet duct **155,** fluidly connecting the drawer **145** and the tub **125** and adapted to deliver water and washing/rinsing products into the washing tub **125.** Advantageously the water inlet circuit **140** also comprises one or more valves, not shown, adapted to regulate the flow of water.

[0033] When fresh water is admitted into the drawer **145** via the inlet duct **150,** such fresh water washes away the washing/rinsing products contained in the drawer **145,** and delivers these products into the washing tub **125** via the outlet duct **155.**

[0034] In other embodiments, not shown, the water inlet circuit **140** comprises one or more reservoirs for one or more washing/rinsing products from which a certain amount of these washing/rinsing products, depending on the washing program, is automatically delivered to the washing tub **125.**

[0035] The washing machine **100** comprises a draining sump **160,** obtained preferably on a lateral surface **165** of the tub **125,** fluidly communicating with the internal of the tub **125,** and fluidly connected to a draining circuit **170** adapted to drain the washing/rinsing liquid (i.e. water and water mixed with washing and/or rinsing products) from the washing tub **125.**

[0036] Advantageously, as better explained in the following, in the exemplary invention embodiment here considered the draining sump **160** is accessible from inside the drum **130.**

[0037] Advantageously, the draining sump **160** is placed in the lower region of the washing tub **125,** so that the liquid contained in the latter can be conveyed by gravity towards the draining sump **160,** and therefore to the draining circuit **170.**

[0038] In other words, the draining sump **160** is a sort of container associated downstream to the washing tub **125** and adapted to collect the washing/rinsing liquid exiting the latter.

[0039] Preferably, the draining sump **160** is obtained in a single-piece construction with the lower region of the tub **125,** advantageously by moulding of a plastic material.

[0040] The draining circuit **170** comprises a draining pump **175** provided with an impeller, not illustrated, housed in an impeller chamber **180** which is preferably, but not necessarily, obtained in a single-piece construction with the draining sump **160** and with the washing tub **125,** preferably in correspondence to an extension of the draining sump **160.**

[0041] In other advantageous embodiments of the invention, not shown, the draining circuit **170** can be also provided with a recirculation circuit, adapted to drain the washing/rinsing liquid from the bottom of the tub **125,** and to re-admit such liquid into an upper region of the tub, for improving the wetting of the laundry. The recirculation circuit of a washing machine is well known in the art, and therefore will not be described in detail.

[0042] The washing machine **100** comprises a filter **185,** provided between the washing tub **125** and the draining sump **160,** advantageously accommodated, preferably removably, in a suitable seat **190** provided between the washing tub **125** and the draining sump **160,** and adapted to allow the passage of washing liquid and to prevent the passage of foreign bodies of fixed dimensions from the washing tub **125** to the draining circuit **170** (and therefore to the draining pump **175).** These foreign bodies can be, for example, buttons came off from the laundry, coins or other little objects contained in the pockets of trousers or other clothes and erroneously introduced into the washing machine **100,** lint, fluff, etc.

[0043] In the exemplary embodiments here considered, the seat **190** for the filter **185** is advantageously obtained inside the draining sump **160,** and partially coincides with the latter; in other advantageous embodiments, not shown, the seat **190** may be provided partially internally and partially externally to the draining sump **160,** or totally externally to the draining sump **160,** provided that it is arranged in such a way that when the filter **185** is correctly inserted in the seat **190,** all the washing/rinsing liquid has to pass through the filter **185** in order to flow into the draining sump **160.**

[0044] Advantageously, the seat **190** is accessible from inside the drum **130.**

[0045] The access to the filter **185,** for example for its inspection, cleaning and/or replacement (provided that

filter **185** is removable), is performed from the internal of the drum **130** via a suitable aperture (visible for example in **Figs. 2A - 2C,** wherein it is indicated as **205)** provided on the lateral surface **197** of the drum **130** so that, in a particular angular position of the latter, such aperture **205** faces the seat **190;** during the washing machine operation, this aperture **205** is closed by a closing device **199,** for example a lid or a porthole, adapted for selectively closing the aperture **205.** In an exemplary embodiment of the invention, the closing device **199** advantageously comprises a drum lifter (i.e. one of the laundry lifters that are often provided along the drum lateral surface **197** for improving the stirring of the laundry during the drum rotation) which is pivotable with respect to the lateral surface **197** of the drum **130,** so that it can be swiveled open for allowing the access to the underlying aperture; when not swiveled open, this lifter operates as a traditional laundry lifter, and is therefore useful for improving the stirring of the laundry during the rotation of the drum **130.** In other embodiments of the invention, the closing device (e.g. a lifter) may be removably coupled to the drum lateral surface **197,** instead of being hinged thereto.

[0046] The filter **185** may be for example box-shaped (or cup-shaped) and it may be preferably substantially cylindrical (but it may be also prismatic, or cubic, or parallelepiped, or may have any other box-shaped conformation). Later on, an exemplary filter structure will be described.

[0047] The filter **185** advantageously comprises a filtering surface **195,** advantageously perforated, adapted to allow the passage of a liquid and for retaining fluff, lint and foreign bodies of fixed dimensions; the filtering surface **195** allows the passage of the washing liquid from the washing tub **125** to the draining circuit **170,** but prevents the passage of foreign bodies of prefixed dimensions, for example buttons, coins, etc.

[0048] **Fig. 2A** to **Fig. 2C** show some steps of a procedure of extraction of the filter **185** from its seat **190.** After opening the loading/unloading door **120,** the user rotates the drum **130** to reach the proper angular position in which the aperture **205** faces the seat **190,** for example bringing the closing device (e.g. lifter) **199** at the bottom; then the user swivels the lifter **199** open to free the access to the aperture **205** in the lateral surface **197** of the drum **130,** and thus to the filter seat **190** (in **Fig. 2A,** the filter **185** - still within its seat **190 -** is not visible being hidden by the cabinet). The user then grasps the filter (later on, an exemplary embodiment of filter **185** will be described, and the means for facilitating the grasping by the user will be shown) and pulls it out of the seat **190,** as shown in **Fig. 2B.** The user can then extract the filter from the machine.

[0049] It is underlined that the present description of an advantageous embodiment refers to a removable filter **185,** but it is clear that the present invention can be applied as well to a non-removable filter (i.e. a filter fixed in a non-removable way to the seat **190),** which may be cleaned by a user via the aperture **205,** but not removed.

[0050] According to the present invention, in order to facilitate the user in spotting the location where the filter **185** is (as already explained in the foregoing, the accessibility of the filter **185** from inside the drum **130,** even if it is a solution already known in the art, is something still uncommon for most of the users, who are accustomed to having the filter accessible by opening a small door at the bottom of the front panel of the machine cabinet, and moreover, the drum internal space is scarcely illuminated), a lighting device is provided, arranged for generating a light which is emitted inside the drum **130** for helping a user to find the location of the filter **185.** It is underlined that, if the filter is removable, *"location of the filter"* means, when the filter is associated to its seat in the washing machine, the position in which the filter is placed, while, when the filter has been removed from the machine (for example for its cleaning), the position in which the removed filter have to be repositioned.

[0051] Preferably, the lighting device is associated with the draining sump **160;** more preferably, the lighting device is associated with the filter seat **190.** Advantageously the closing device provided for closing the aperture **205** in the lateral surface **197** of the drum **130,** i.e. the lifter **199** in the current advantageous embodiment, is formed at least partly transparent to light; for example, an upper region of the closing device **199** may have formed therein a self-explanatory word, like the word "FILTER" (possibly in the language of the country where the appliance is sold), or a self-explanatory symbol, e.g. "F", in transparent material. The lighting device advantageously comprises a light source **320** operable to generate light, which for example may comprise a lamp or a LED; the light generated by the lighting device is transmitted through the closing device **199,** and is easily visible by the user when looking into the drum **130,** who can thus spot the location of the filter **185.**

[0052] Hereinafter, two exemplary and non-limitative embodiments of the present invention are presented.

[0053] In the embodiment depicted in **Fig. 3A** to **Fig. 3C,** the lighting device **305** is located below the filter **185** (when the latter is housed in its seat **190),** preferably at the bottom of the filter seat **190,** preferably in such a way that the light generated by the light source **320** of the lighting device **305** propagates along the direction of the axis of the filter seat **190** (upwards in the current embodiment). For example, the lighting device **305** may be accommodated inside a receptacle **310** provided in proximity of the bottom of the filter seat **190,** preferably projecting down from the bottom of the filter seat **190;** the receptacle **310** is preferably in one piece construction with the draining sump **160.** The receptacle **310** may for example take the form of a sleeve open at the bottom end for the insertion of the lighting device **305,** and opening into the filter seat **190,** at the bottom of the latter. The lighting device **305** is connected, preferably by wires (not shown), or wireless, to a control electronics of the machine (also not shown), which controls inter alia the activation of the lighting device **305.** The lighting device **305**

is advantageously water-resistant, with the light source **320** advantageously housed inside a water-tight case **325.**

[0054] When the filter **185** is inside the filter seat **190** and the lighting device **305** is activated to emit light, the emitted light (schematized in **Fig. 3C** by the arrows in broken line) passes through the filter **185** and through the closing device **199** (which, as mentioned, is at least partly transparent to light) and goes into the drum **130,** where the user can see it, thereby easily spotting the location where the filter **185** is. Preferably, in order to enhance the transmission of light, the filter **185** structure is at least partly made of transparent material (later in the present description, a filter structure according to an exemplary embodiment of the present invention will be presented).

[0055] In the embodiment depicted in **Fig. 4A** to **Fig. 4C,** the lighting device **305** is located laterally to the filter **185** (when the latter is housed in its seat **190),** preferably on one side wall of the filter seat **190,** in such a way that the light is emitted by the light source **320**of the lighting device approximately orthogonally (or, more generally, not parallel) to the direction of the axis of the filter seat **190.** For example, the lighting device **305** may be accommodated inside a receptacle **410** placed in proximity of the side wall of the filter seat **190,** preferably projecting from the side wall of the filter seat **190** transversally (more preferably orthogonally)to the axis of the filter seat **190.**

[0056] The receptacle **410** is preferably in one piece construction with the draining sump **160.** The receptacle **410** may for example take the form of a sleeve with open end for the insertion of the lighting device **305,** and opening into the filter seat **190.** Preferably, the receptacle **410** opens into the filter seat **190** in a region proximate to the bottom wall thereof. The lighting device **305** is connected preferably by wires (not shown), or wireless, to a control electronics of the machine (also not shown), which controls inter alia the activation of the lighting device **305.** The lighting device **305** is advantageously water-resistant, with the light source **320** preferably housed inside a water-tight case **325.**

[0057] When the filter **185** is inside the filter seat **190** and the lighting device **305** is activated to emit light, the emitted light (schematized in **Fig. 4C** by the arrows in broken line) passes through the perforated filtering surface **195** of the filter **185** and propagates up to the closing device **199,** which, being as mentioned is at least partly transparent to light, allows the light to pass through and to go into the drum **130,** where the user can see it, thereby easily spotting the location where the filter **185** is. Preferably, in order to enhance the transmission of light, the filter **185** structure may be at least partly in transparent material.

[0058] In this embodiment of the invention, the provision of the lighting device **305** has, in addition to the function of easing the spotting of the filter location by the user, the further function of warning the user when the filter **185** is clogged: when this happens, the light emitted by the lighting device **305** can not pass through the perforated filtering surface **195** of the filter **185,** due to the presence of fluff or other bodies inside the filter. As a consequence, the light generated by the light source **320** cannot reach the closing device (e.g. lifter) **199** and pass therethrough to reach the inside of the drum **130.** The user can in this way be warned of the necessity of cleaning the filter **185.**

[0059] In **Fig. 5** to **Fig. 7,** the structure of the filter **185** according to an exemplary embodiment of the present invention is shown. The exemplary filter structure corresponds to that described in the EP 2325377.

[0060] In this exemplary embodiment the filter **185** is substantially cylindrical, and the filtering surface **195** is comprised in the lateral cylindrical surface of the filter **185.**

[0061] Advantageously, the filtering surface **195** is provided with a plurality of openings **510** adapted to allow the passage of liquids, but preventing the passage of fluff, lint and foreign objects (e.g. coins, buttons, etc.) whose dimensions are higher than a prefixed value depending on the dimensions of the openings **510.**

[0062] The filter **185** is advantageously adapted to be removably inserted into the seat **190,** and advantageously comprises a coupling device adapted to releaseably fix it to the seat **190.** For example, the coupling device comprises an outwards-projecting peripheral flange **515,** projecting from an upper border **520** of the filter **185** and adapted (as visible for example in **Fig. 3C** and **Fig. 4C)** to abut against a border of washing tub **125** surrounding the filter seat **190,** while the remaining of the filter **185** is received inside the seat **190,** for avoiding that the filter **185** fall into the draining sump **160.**

[0063] In the shown exemplary embodiment, the coupling device advantageously also comprises snap-fitting means adapted to allow a snap-fit connection of the filter **185** to the seat **190.** For example, the snap-fitting means comprise two or more arms **705a, 705b,** associated with the filter **185,** and elastically deformable so that they may be elastically pressed in a radial direction with respect to the lateral cylindrical surface of the filter **185.** In the shown embodiment, the arms **705a, 705b** are connected to the lateral cylindrical surface of the filter **185** in proximity of the bottom surface **505** thereof.

[0064] The arms **705a, 705b** comprise a first region **710,** connected to the lateral cylindrical surface of the filter **185** in proximity of the bottom surface **505** thereof, and sloped in such a way that its distance from the lateral cylindrical surface of the filter **185** increases while approaching the upper border **520** of the filter **185.** The arms **705a, 705b** comprise a second region **715,** contiguous to the first region **710** and sloped in an opposite direction with respect to the first region **710** of the same arm, comprising the free end **720** of each arm; the arms **705a, 705b,** in proximity of their free ends **720,** are therefore sloped in such a way that their distance from the lateral cylindrical surface of the filter **185** decreases while approaching the upper border **520** of the filter **185.**

[0065] As visible in **Fig. 3C** and **Fig. 4C,** an annular riddle **315** advantageously protrudes from the border of the washing tub **125** surrounding the seat **190,** towards the internal thereof. During the insertion of the filter **185** into the seat **190,** the first region **710** of the arms **705a, 705b** slides against the annular riddle **315,** and, due to the slope of such first region **710,** the arms **705a, 705b** are elastically pushed towards the lateral cylindrical surface of the filter **185.** After the free end **720** of the arms **705a, 705b** trespasses the annular riddle **315,** the arms **705a, 705b** elastically move towards the external of the filter **185,** positioning with their free ends **720** below the annular riddle **315;** the filter **185** is therefore locked to the seat **190.** For removing the filter **185** from the seat **190,** the user has to pull the filter **185** in the opposite direction with respect to the draining sump **160;** the free ends **720** of the arms **705a, 705b** slide against the annular riddle **315** and, due to their particular slope, they cause the arms **705a, 705b** to elastically flex towards the lateral cylindrical surface of the filter **185,** releasing the arms **705a, 705b** from the annular riddle **315,** and allowing the free removal of the filter **185.**

[0066] Advantageously, the filter **185** comprises a grasping element, which will be better described in the following, adapted for allowing a user to easily remove the filter **185** form the seat **190.**

[0067] As will be better explained in the following, the filter **185** advantageously comprises an indicator adapted to be displaced in a first position if the filter **185** is correctly inserted into the seat **190,** and in a second position if the filter **185** is incorrectly inserted into the seat **190.** This allows the user to check whether or not the filter **185** has been correctly inserted into the seat **190,** simply by looking at the position of the indicator: if the indicator is in the first position, the user is aware that the filter **185** has been correctly inserted into the seat **190,** whereas if the indicator is in the second position, the user is aware that the filter **185** has been incorrectly inserted into the seat **190.**

[0068] Preferably, but not necessarily, when the indicator is in the above mentioned first position, the indicator is visible from the external of the filter **185,** while when in the second position the indicator is not visible from the external of the filter **185.** In other embodiments, the indicator may be visible from the external of the filter **185** in both the first and second positions.

[0069] Advantageously, as will be better explained in the following, the indicator is arranged in such a way that if the filter **185** is correctly inserted into the draining sump **160,** the indicator engages the internal surface of the draining sump **160** and is moved into the first position.

[0070] In the shown exemplary embodiment, the indicator comprises a movable element, like a pin **525,** associated with the filter **185,** in such a way that, if the filter **185** is correctly inserted into the seat **190,** the pin **525** is displaced into a first position, while if the filter **185** is incorrectly inserted into the draining seat **190,** the pin **525** is displaced into a second position.

[0071] The filter **185** comprises a guide **530** adapted to allow the sliding of the pin **525** therein. The bottom surface **505** of the filter **185** is opportunely substantially frusto-conical, with an aperture **535** preferably provided in correspondence of the minor base of the frustum of cone.

[0072] The filter **185** advantageously comprises a hollow body **540,** preferably tubular, projecting from the border of the aperture **535** provided at the bottom surface **505** of the filter **185,** partially positioned internally to the lateral cylindrical surface of the filter **185** and extending with its upper end **545** above the upper border **520** of the filter **185,** so that when the filter is positioned into the seat **190** the upper end **545** of the hollow body **540** protrudes above the bottom of the washing tub **125,** so as to be stricken by the flux of water moved by the rotatable drum **130** during its rotation.

[0073] Moreover, the upper end **545,** extending above the upper border **520** of the filter **185,** may be grasped by a user in order to remove the filter **185** from the seat **190;** in this case, therefore, the grasping element comprises the upper end **545** of the hollow body **540.**

[0074] The washing liquid enters the filter **185** from the upper border **520** thereof, and goes to the draining sump **160** passing through the filtering surface **195** (i.e. the holes **510);** fluff, lint and foreign bodies contained in the washing liquid and whose dimensions are bigger than the holes **510** remains trapped between the filtering surface **195,** the bottom surface **505** of the filter **185** and the external surface of the hollow body **540.**

[0075] The guide **530,** preferably substantially cylindrical, for the movable element, is advantageously provided inside the hollow body **540,** preferably, but not necessarily, concentrically thereto, in such a way that there is a first gap **550** between the internal surface of the hollow body **540** and the external surface of the guide **530.**

[0076] Preferably, but not necessarily, the upper end **555** of the guide **530** is opened, and it is placed in correspondence of the free end **545** of the hollow body **540.**

[0077] Advantageously, the hollow body **540** comprises one or more apertures **560,** provided on its upper end **545,** fludily communicating with the first gap **550** and adapted for allowing the entrance of washing liquid from the washing tub **125** into the above mentioned first gap **550.** Advantageously, the apertures **560** are adapted to allow the passage of liquids, but for preventing the passage of objects (e.g. coins, buttons, etc.) whose dimensions are higher than a prefixed value depending on the dimensions of the apertures **560;** in particular the dimensions of the apertures **560** are such that if a body can not pass through the filtering surface **195,** it can neither pass through the apertures **560** (in the embodiments illustrated in the enclosed figures, therefore, the dimensions of the apertures **560** are equal or smaller than the dimensions of the holes **510).**

[0078] Advantageously, the apertures **560** are positioned in such a way that when the filter **185** is in the seat **190,** they are stricken by the flux of water moved by the

rotatable drum **130** during its rotation.

[0079] A foot **565** protrudes from the second end **570** of the pin **525,** preferably at least partially countershaped to the external surface of the bottom surface **505** of the filter **185,** and therefore, in this embodiment, substantially frusto-conical.

[0080] The pin **525** may therefore slide from the first position, in which a stopping element **575** (for example an annular riddle) provided on the lateral surface of the pin **525,** contacts a second flange **577** protruding from a lower end **579** of the guide **530,** towards the internal of the latter, and the second position, in which the foot **565** contacts a plurality of spacing elements **580** protruding from the external surface of the bottom surface **505** of the filter **185.**

[0081] When the pin **525** is in the second position, a second gap **583** is obtained between the external surface of the bottom surface **505** of the filter 185 and the foot **565;** this second gap **583** fluidly communicates with the first gap **550.**

[0082] Advantageously, the length of the pin **525** is such that when it is in the first position, the first end **585** of the pin **525** protrudes from the upper end **555** of the guide **530,** so as to be visible and/or touchable from outside the filter **185;** on the contrary, when the pin **525** is in the second position, the first end 585 of the pin **525** is totally contained in the guide **530,** and therefore can not be seen nor touched by a user. This feature allows a user to easily check if the filter **185** has been correctly inserted into the seat **190** or not.

[0083] The pin **525** may be arranged in such a way that it is visible both in the first position and in the second position, but in such a way that in these two positions it protrudes from the guide **530** in two different ways.

[0084] When the filter **185** is correctly inserted into the seat **190,** the foot **565** contacts (i.e. engages) the internal surface of the seat **190** (in this case the bottom of the draining sump **160),** and the pin **525** is positioned in the first position; in this position a by-pass conduit, comprising the apertures **560,** the first gap **550** and the second gap, fluidly connects the washing tub **125** and the internal of the draining sump **160,** by-passing the filtering surface **195** of the filter **185.**

[0085] As mentioned in the foregoing, in order to improve the transmission of the light generated by the lighting means **305,** the filter **185** is advantageously made at least partly in transparent material. For example, the pin **525** may be made in a material transparent to light, so as to behave as a light guide.

[0086] Some embodiments of the present invention have been here described; it should be clear to those skilled in the art that several changes to the described embodiments, as well as alternative ways of practicing the invention are possible.

Claims

1. Washing machine **(100)** comprising:

- a washing tub **(125);**
- a drum **(130)** rotatably accommodated within the washing tub;
- a draining sump **(160)** fluidly communicating with the internal of said washing tub **(125)** and fluidly connected to a draining circuit **(170)** operable for draining liquid from the washing tub;
- a filter **(185)** provided between said washing tub **(125)** and said draining sump **(160)** and accessible from the inside of the drum through a drum aperture **(205),**

characterized in that

said washing machine **(100)** comprises a lighting device **(305)** arranged for generating a light which is emitted inside said drum **(130)** for helping a user to find the location of said filter **(185).**

2. The washing machine of claim 1, wherein said filter **(185)** is housed in a filter seat **(190)** provided between said washing tub **(125)** and said draining sump **(160),** said filter seat **(190)** being accessible from the inside of the drum through a drum aperture **(205),** and wherein said lighting device **(305)** is associated **(310)** with said filter seat **(190).**

3. The washing machine of claim 1 or 2, comprising a closing device **(199)** coupled or couplable to the drum **(130)** for selectively closing/opening the drum aperture **(205)** for accessing said filter **(185),** wherein the closing device **(199)** is at least partly in a material transparent to the light for the transmission of the light generated by the lighting device **(305) .**

4. The washing machine of claim 3, wherein said closing device **(199)** comprises an upper region having formed therein a self-explanatory word or symbol in transparent material.

5. The washing machine of claim 3 or 4, wherein the closing device **(199)** comprises a drum lifter **(199)** provided along the drum lateral surface for improving the stirring of the laundry during the drum rotation.

6. The washing machine of claim 5, wherein said drum lifter **(199)** is pivotable with respect to the lateral surface of the drum or removably coupled to the lateral surface of the drum **(130).**

7. The washing machine of any one of previous claims, wherein said filter **(185)** is at least partly in a material transparent to the light for the transmission through it of the light generated by said lighting device **(305) .**

8. The washing machine of any one of claims 2 to 7,

wherein the lighting device **(305)** is arranged to emit light along a direction parallel to an axis of the filter seat **(190).**

9. The washing machine of any one of claims 2 to 7, wherein said lighting device **(305)** is arranged to emit light along a direction transversal to an axis of the filter seat **(190).**

10. The washing machine of any one of the preceding claims, wherein the lighting device **(305)** is water-resistant, and comprises a light source **(320)** advantageously housed inside a water-tight case **(325).**

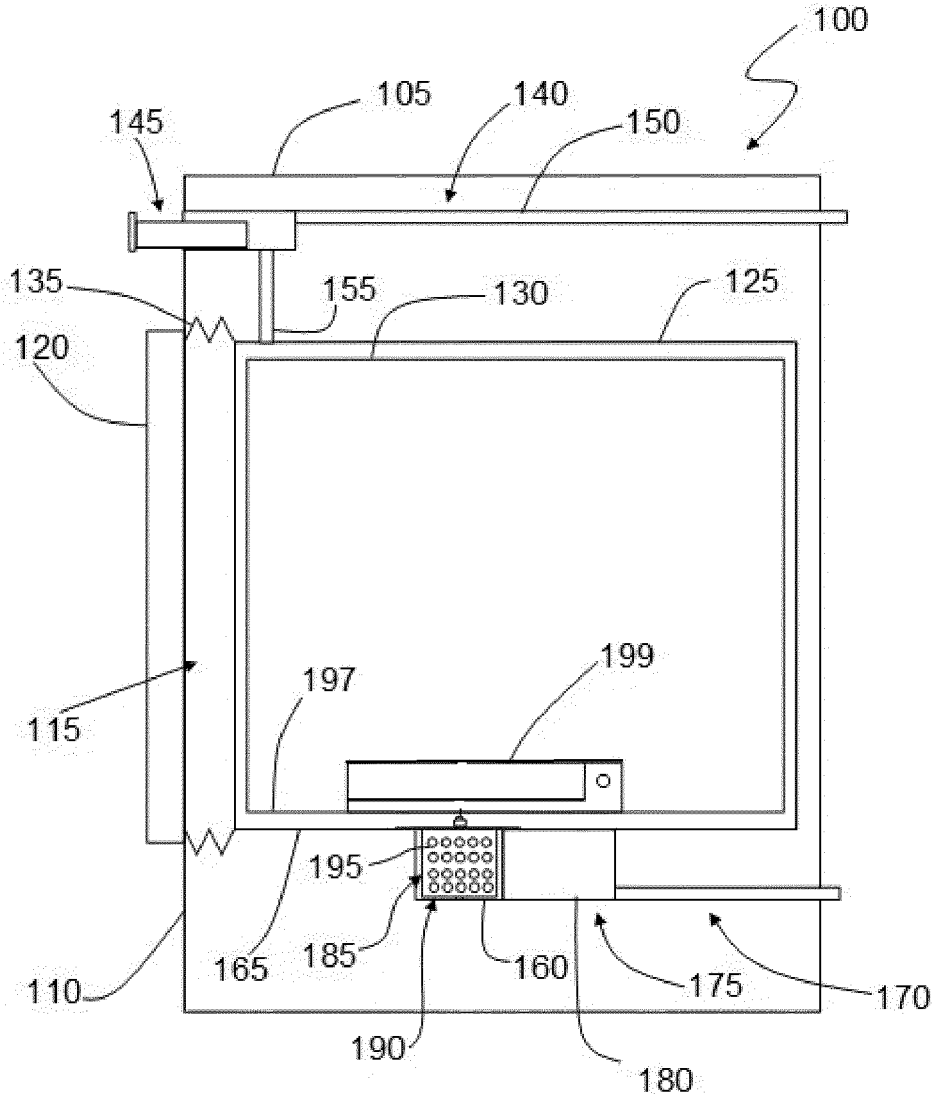
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Fig. 1

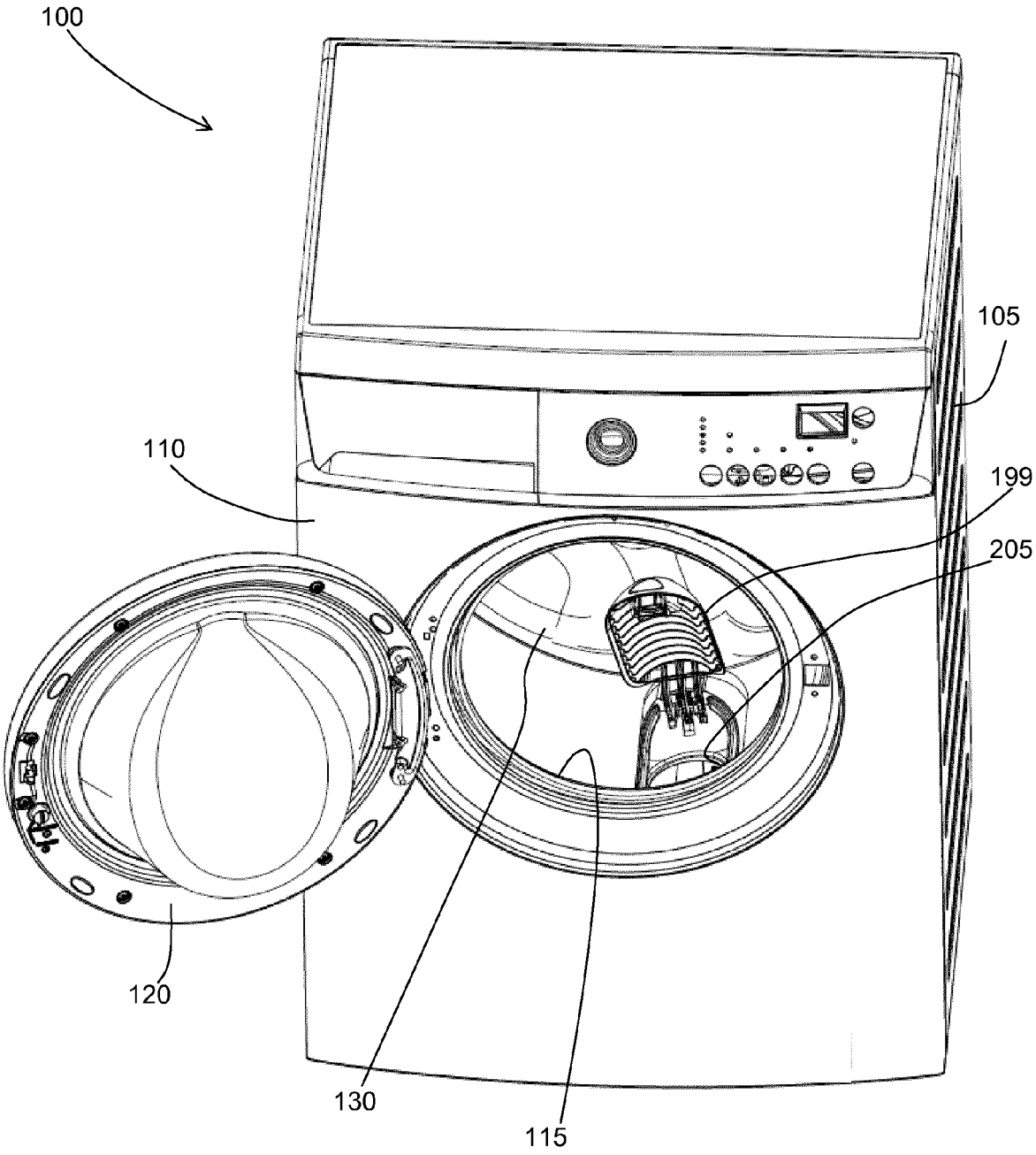

Fig. 2A

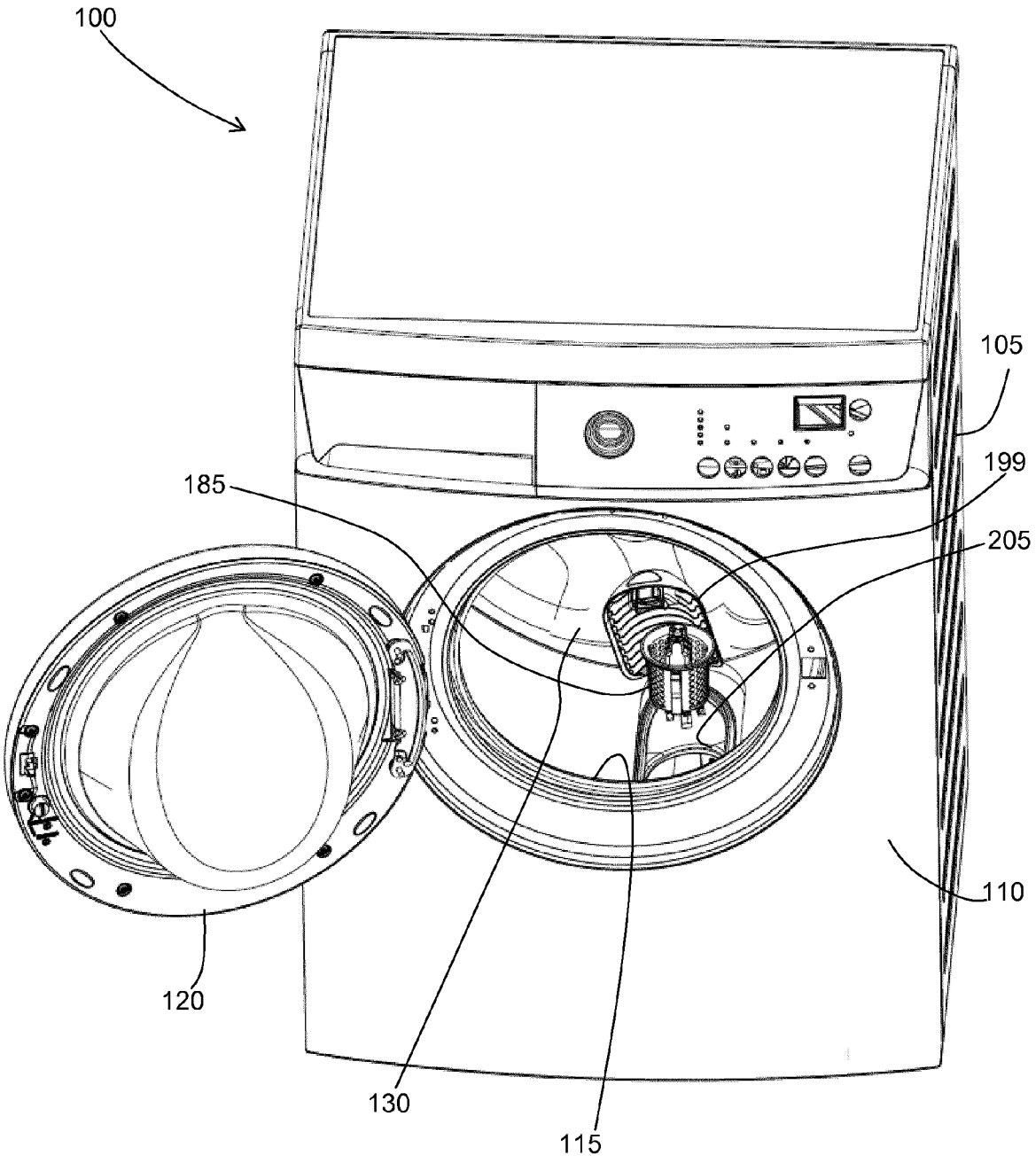

Fig. 2B

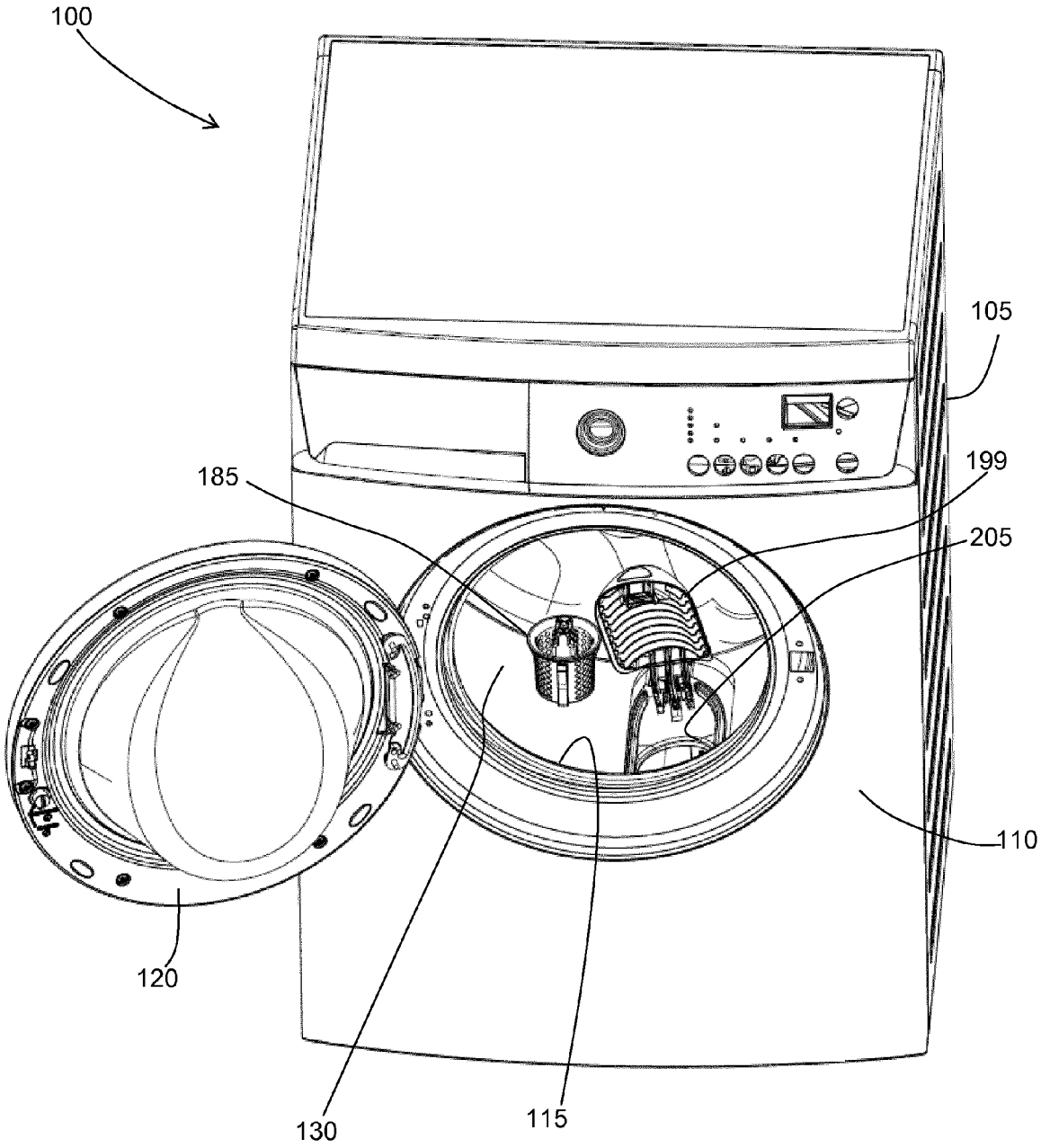

Fig. 2C

Fig. 3A

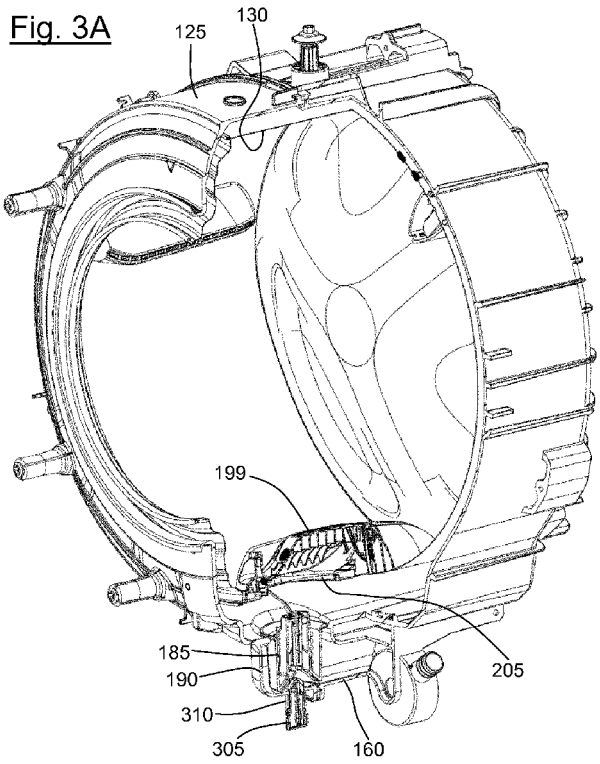
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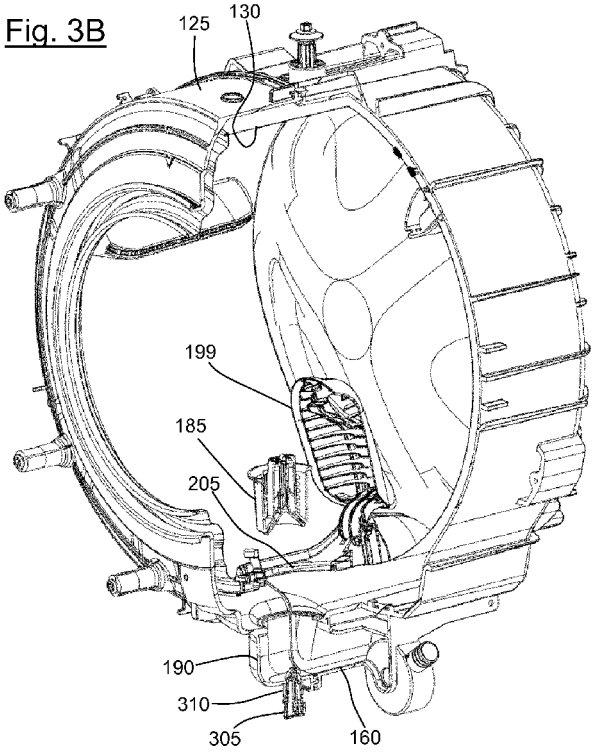
Fig. 3B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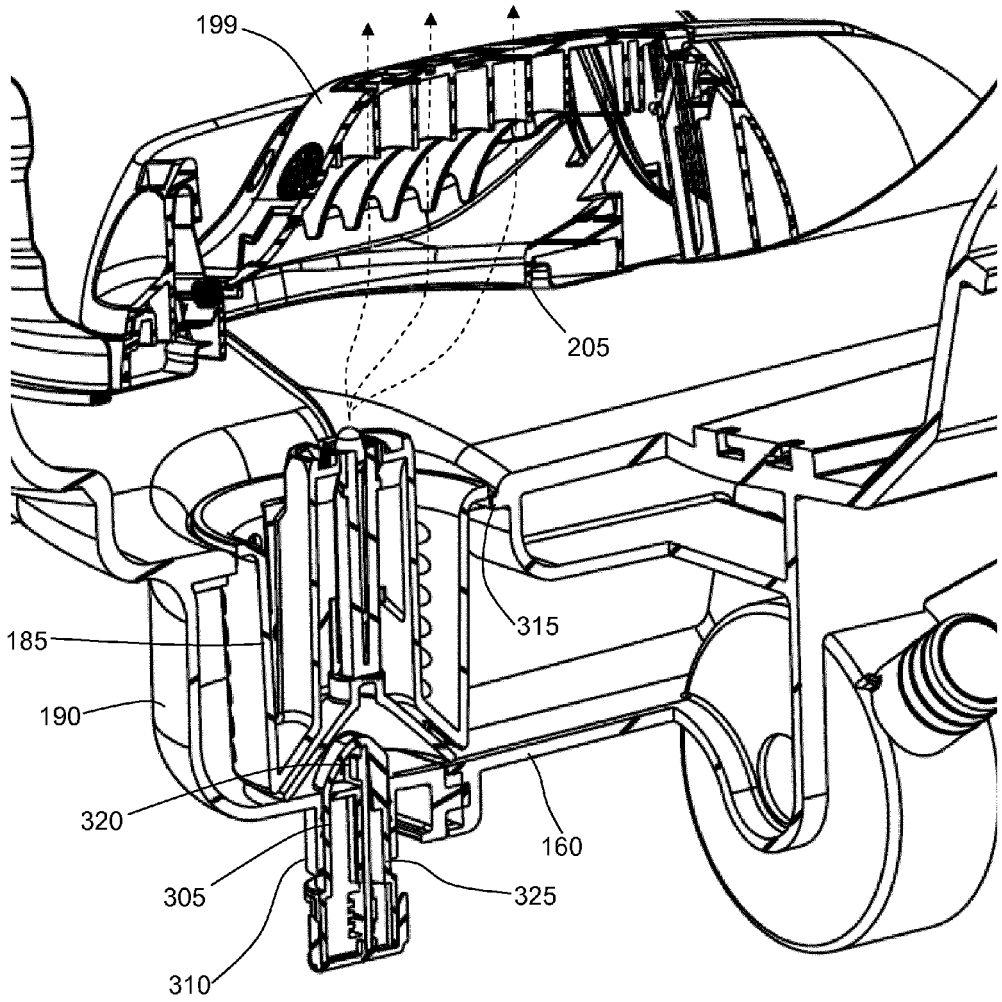


Fig. 3C

Fig. 4A

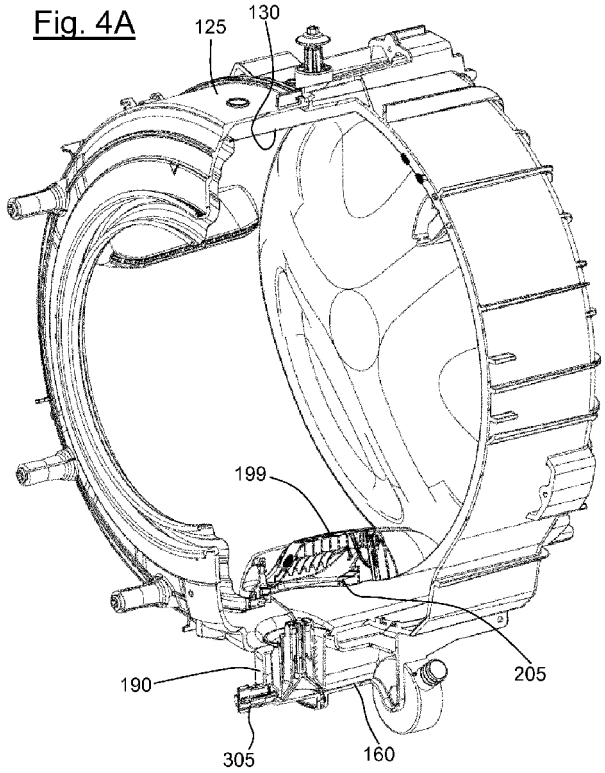
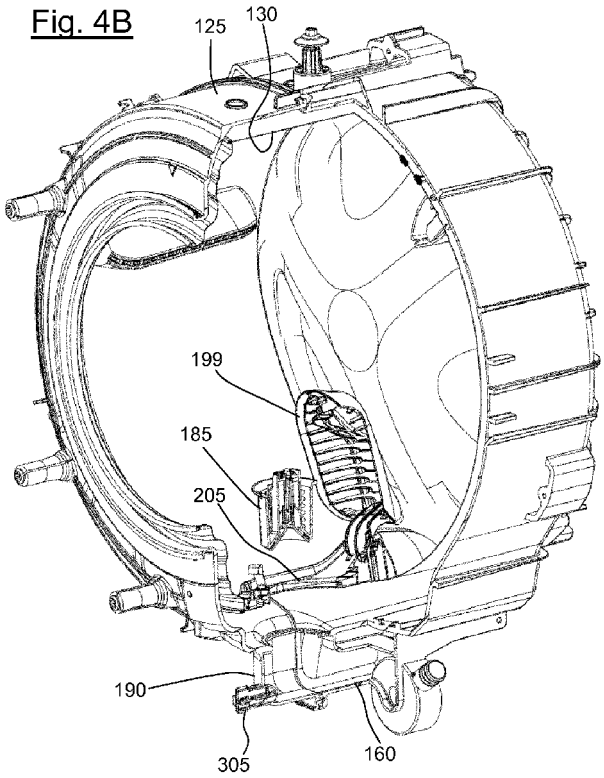


Fig. 4B



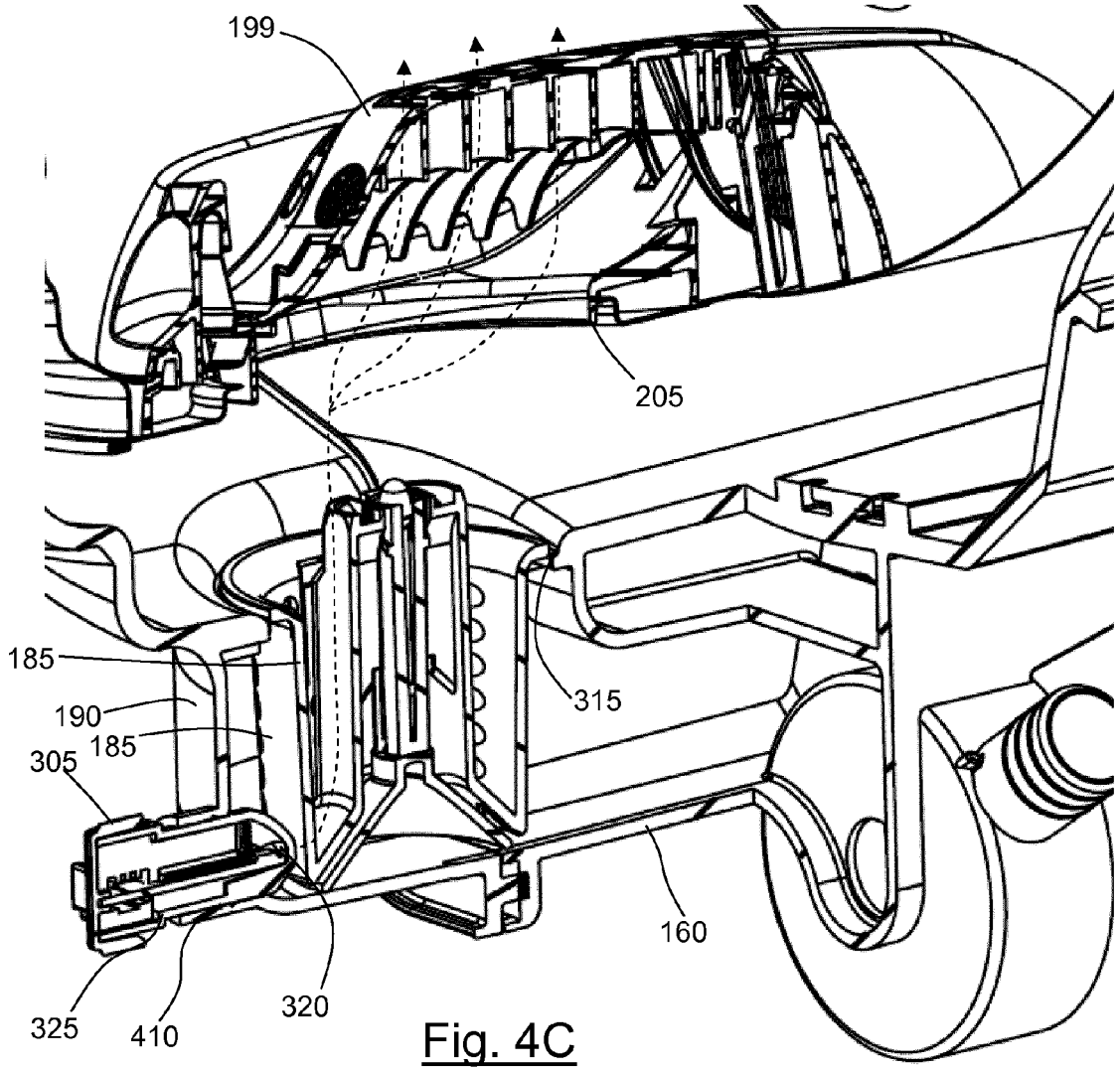


Fig. 4C

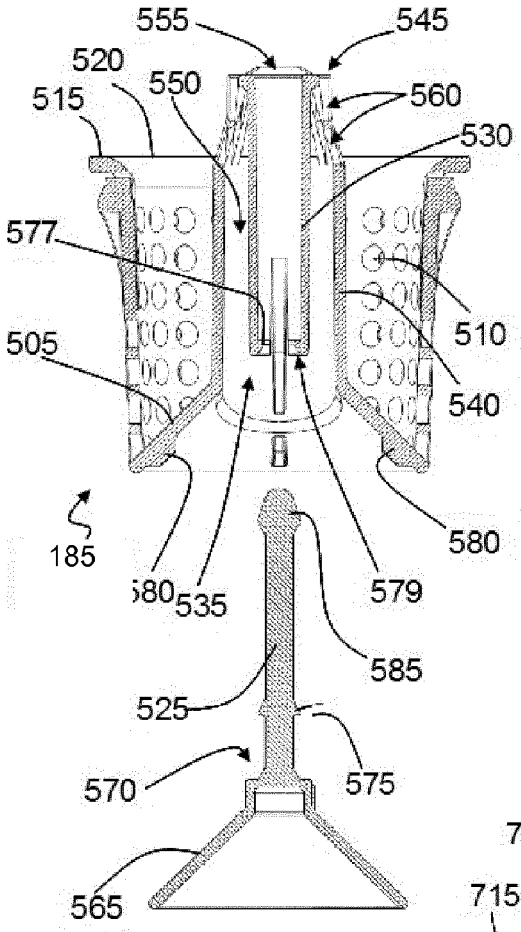


Fig. 5

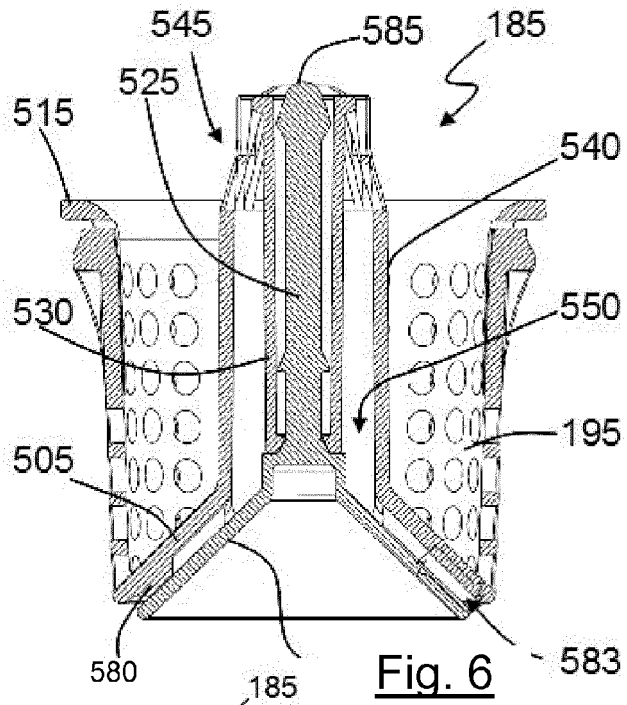


Fig. 6

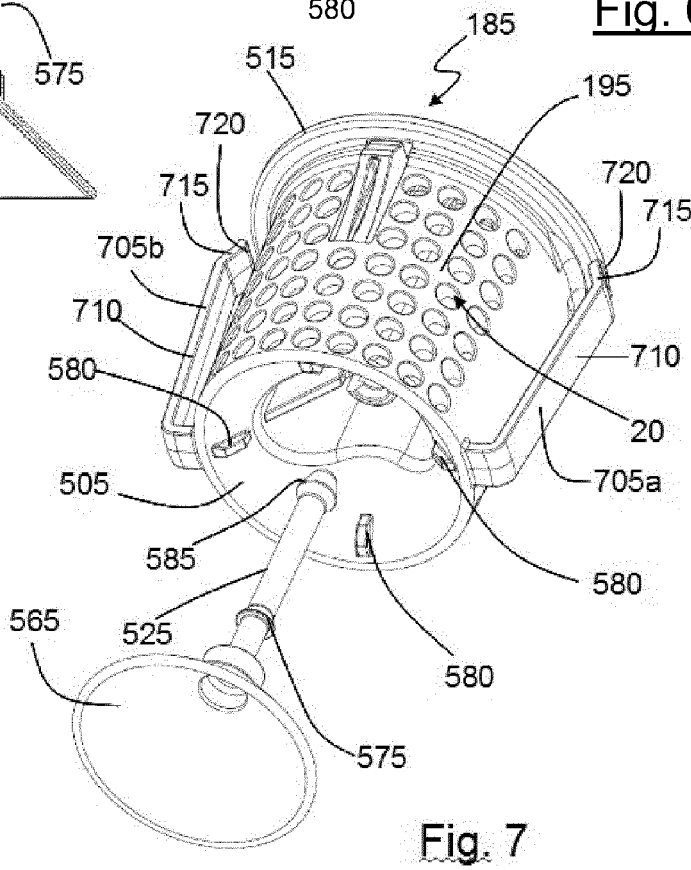


Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 3490

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 January 2013	Weinberg, Ekkehard

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