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(54) PUMP ASSEMBLY WITH MOVABLE FILTER FOR WASHING MACHINES

(57) The present invention relates to a pump assembly (1,1') for household appliances such as washing machines, dishwashers and the like, comprising a body (2, 2') fitted with fluid passage means (23, 24, 27) for letting a wash fluid flow therethrough, at least one pump (3,4,3',4') associated with the body for pumping the fluid, a filter (9, 9') for filtering the fluid flowing through the body (2, 2'),wherein the filter (9,9') is movable between a first position, in which a fluid flow runs through it towards a first side of the filter, and a second position, in which a fluid flow runs through it towards the opposite side of the filter, wherein the pump assembly (1,1') comprises two pumps (3, 4; 3', 4') associated with respective outlet ducts (24, 25; 24', 25') arranged in the body (2, 2') of the assembly. According to the invention, the cross-section of the second outlet duct (25, 25') is greater than the cross-section of the first outlet duct (24, 24'), so that, in particular, said filter (9,9') covers the cross-section of the second outlet duct (25, 25') only partially.

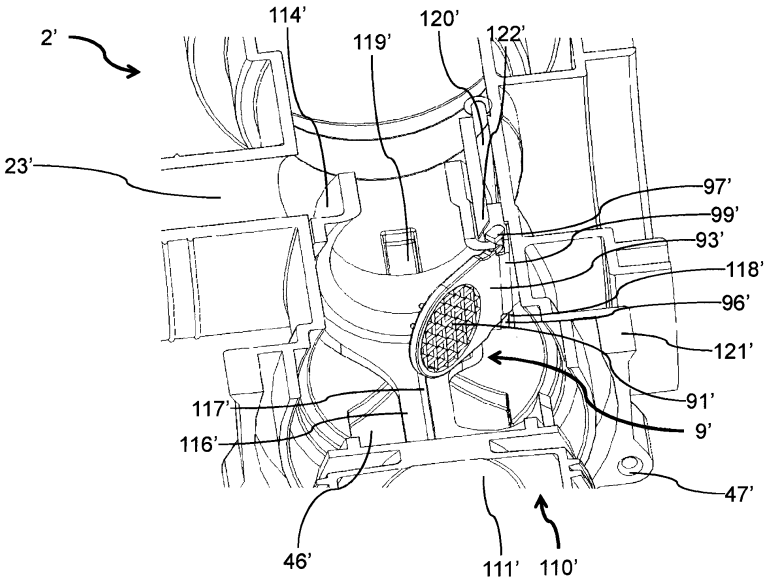

Fig. 9

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Description

[0001] The present invention relates to a pump assembly for household appliances such as washing machines, dishwashers and the like.

[0002] As known, modern washing machines and dishwashers very often include "low-consumption" wash cycles; such cycles allow the appliance to reduce the consumption of both water and electric energy. Lower consumptions can be obtained by reducing the quantity of wash liquid remaining between the tub bottom and the drum through a better imbibition of the textile items; to this end, it is possible to use a recirculation circuit including a pump, which has a filter capable of capturing the dirt suspended in the wash liquid flow, thus allowing for an efficient utilization of said pump.

[0003] During a "low consumption" wash program, the wash liquid may be recirculated multiple times, and therefore the filter must filter the wash liquid multiple times as well in order to protect the recirculation pump against the risk of clogging. By way of example, some washing machines manufactured by company V-Zug are equipped with a recirculation circuit whose filter consists of a fixed bulkhead arranged on the intake side of the recirculation pump. The filter needs frequent maintenance to remove the accumulated impurities.

[0004] This is a difficult task because the filter cannot be reached from the outside.

[0005] It becomes therefore necessary to counter the phenomenon of the accumulation of impurities that tend to clog the filter, so as to lengthen the service life of the latter, by facilitating the cleaning and maintenance thereof, resulting in a greater effectiveness of the recirculation process over time.

[0006] The present invention aims at solving these and other problems by providing a pump assembly having such structural and functional features that the water can be filtered and the filter can be cleaned without incurring in the above-mentioned drawbacks.

The idea that allows to overcome said problem is to provide a pump assembly for household appliances, such as washing machines, dishwashers and the like, which is fitted with a filter capable of moving between at least two stable positions:

- in the first position, the filter is run through by a fluid flow directed towards a first side of the filter, thereby allowing said flow to be filtered;
- in the second position, the filter is run through by a fluid flow directed towards the opposite side of the filter, thereby allowing the filter to be cleaned.

[0007] This advantageously allows to increase the service life of the filter, which thus becomes similar to the service life of the household appliance employing it.

[0008] Further advantageous features of the present invention will be set out in the appended claims.

[0009] These features, as well as the results and advantages of the present invention, will become more apparent from the following description of an embodiment thereof as shown in the annexed drawings, which are supplied by way of non-limiting example, wherein:

Fig. 1 is a perspective view of a pump assembly according to the present invention, in the assembled condition;

Fig. 2 is an exploded view of the pump assembly of Fig. 1;

Fig. 3 is a sectional view of the pump assembly of Fig. 1, wherein the filter is in the wash liquid recirculation and filtering position;

Fig. 4 is a sectional view of the pump assembly of Fig. 1, wherein the filter is in the wash liquid drain and filter cleaning position;

Fig. 5 is an exploded view of a second embodiment of the pump assembly;

Fig. 6 is a perspective view of a filter cartridge of the second embodiment of the pump assembly;

Fig. 7 is a top view of the second embodiment of the pump assembly of Fig. 5, with the filter cartridge in the installed condition;

Fig. 8 is a sectional view along the plane D-D shown in Fig. 7 of the second embodiment of the pump assembly;

Fig. 9 is a sectional perspective view along the plane E-E shown in Fig. 8 of the second embodiment of the pump assembly.

[0010] Referring now to Figs. 1 and 2, there is shown a pump assembly 1 comprising a body 2 in fluidic communication with a recirculation pump 3 and a drain pump 4, a support bracket 5 positioned under the recirculation pump 3, an actuator 6 positioned on a cover 7 placed on top of the body 2, a crank 8, and a filter 9.

[0011] The recirculation pump 3 comprises an intake duct 31 and a delivery duct 32, preferably having both a circular cross-section, and a container 33 for the motor assembly.

[0012] The drain pump 4 comprises an intake duct 41, a delivery duct 42, preferably having both a circular cross-section, a container 43 for the motor assembly, a maintenance cover 44, and an inspection duct 46 comprising a mounting flange 121, which in turn comprises fastening seats 47 on its frame to allow it to be coupled to a wall of a case (not shown in the drawings), such as a cabinet of a washing machine.

[0013] The delivery duct 32 of the recirculation pump 3 comprises circular gaskets 35 capable of ensuring a sealed coupling with a hose (not shown in the drawings) communicating with a wash tub (not shown in the drawings); likewise, the delivery duct 42 comprises circular gaskets 45 capable of ensuring a sealed interference coupling with a drain hose (not shown in the drawings).

[0014] The body 2 comprises a central portion 21 substantially shaped like a parallelepipedon with a top aperture 22, an intake duct 23 having a circular cross-section

in fluidic communication with the wash tub (not shown in the drawings), a first outlet duct 24, also having a circular cross-section, coupled to the intake duct 31 of the recirculation pump 3; the body 2 also includes a second outlet duct 25 sealingly coupled to the intake duct 41 of the drain pump 4.

[0015] The sealing between the first outlet duct 24 and the intake duct 31 is ensured by a sealing element 102, preferably an O-ring, as is the sealing between the second outlet duct 25 and the intake duct 41, which is also provided by a sealing element 103, preferably an O-ring.

[0016] The top aperture 22 of the body 2 is coupled to the cover 7 by means of a sealing interface; for this purpose, the top aperture 22 has a shape conjugated to that of the cover 7 facing the inside of the body 2. In order to ensure a sealed interface between the two components, the top aperture 22 comprises a housing seat 26 in which a rectangular sealing gasket 101 is placed, whose shape follows the edge of the housing seat 26.

[0017] The cover 7 is secured to the top aperture 22 by means of fastening tabs 71 compatible with fastening seats 27 obtained on the frame of the aperture 22; the positioning of said fastening seats 27 is such that they do not interfere with the housing seat 26.

[0018] Both the fastening tabs 71 and the fastening seats 27 have holes, preferably four pairs thereof, the axes of which are aligned with one another when the cover 7 is coupled to the top aperture 22, so as to allow the use of screw-type fastening means (not shown in the drawings).

[0019] The cover 7 further comprises a fitting system for the actuator 6 positioned on the outer surface of the cover, and a hole 74 for positioning a profiled head 94 included in the filter 9; said fitting system comprises a pair of centering guides 72 and a pair of snap-on coupling tangs 73.

[0020] The actuator 6 is preferably a linear thermoactuator which comprises a stator body 61 shaped substantially like a parallelepipedon, from which a piston 62 protrudes, a pair of electric contacts 63, and a pair of centering tabs 64 which, together with the centering guides 72, allow the actuator 6 to be properly positioned on the cover 7.

[0021] When the electric contacts 63 are subjected to an adequate potential difference for a certain period of time (typically 2 or 3 minutes), the piston 62 comes out of the stator body 61 by developing a force in a direction parallel to the longitudinal axis of symmetry of the stator body 61 towards the outside of said body 61; on the contrary, when the potential difference is null, the piston 62 retracts inside the stator body 61 by applying a force in the direction opposite to the force previously exerted.

[0022] At the end opposite to the stator body 61, the piston 62 comprises an elongated hole 65 that allows coupling to the crank 8, whose crankpin 81 can move along the elongated hole 65 in a direction orthogonal to the direction of motion of the piston 62.

[0023] In addition to the crankpin 81, the crank also comprises a perforated journal 82 featuring an axial hole (not shown in the drawings) having a cross-like or polygonal cross-section.

[0024] The journal 82 of the crank 8 is inserted in the pivoting hole 74 positioned at one corner of the cover 7: in this manner, the linear motion of the piston 62 is converted into a rotary motion of the crank 8 relative to its journal 82.

[0025] Referring now to the filter 9, it comprises a filtering mesh 91 and a transmission shaft 92 connected to the filtering mesh 91 by means of a flat support 93; the shaft 92 in turn comprises a profiled head 94, the end of which, in the assembled condition, is inserted in the matching hole obtained in the journal 82 of the crank 8, with which it is coupled. At the base of the profiled head there is a stop ring 95, whereas at the opposite end of the shaft 92 with respect to the profiled head there is a pivoting tip 96 that enters into a housing seat (not shown in the drawings) obtained inside the pump body.

[0026] The sealing between the pivoting hole 74 and the stop ring 95 is ensured by a gasket co-moulded on the ring 95, or alternatively by an O-ring arranged between the ring 95 and the hole 74 (not shown in the drawings).

[0027] For the purpose of fulfilling the design requirements, the man skilled in the art will choose the appropriate mesh size of the filtering mesh 91 in accordance with the dimensions of the dirt particles to be removed from the wash liquid flow: for example, in order to make the filtering mesh 91 suitable for this purpose, he will adopt a mesh size of 2 millimetres by 2 millimetres.

[0028] In the assembled condition, the shaft 92, and therefore the filter 9 integral therewith, can rotate about its own axis because of the drive torque applied by the crank 8, with which it is coupled through the profiled head 94.

[0029] Fig. 3 shows the pump assembly 1 with the filter 9 in the position for recirculating the wash tub water; in such a condition, the filtering mesh 91 is in front of the intake duct 31 of the recirculation pump 3, and therefore the recirculated wash liquid flows through the filtering mesh 91. In this manner, the filtering mesh 91 will remove from said liquid any impurities bigger than the mesh size of the filtering mesh 91.

[0030] Fig. 4 shows the pump assembly 1 with the filter 9 in the position for draining the wash liquid and cleaning the filter, wherein the filtering mesh 91 is in front of the intake duct 41 of the recirculation pump 4, so that all the wash liquid being drained will flow through the filtering mesh 91.

[0031] It must be pointed out that the cross-section of the second outlet duct 25 is bigger than the cross-section of the first outlet duct 24, so that in the drain position the filtering mesh 91 will not cover the whole flow passage section; it follows that, even if the filter 9 were irreversibly clogged, the household appliance according to the present invention will still be able to carry out the water drain step successfully.

[0032] In this condition, it should be noted that the direction of the wash liquid flow is opposite to that of the flow through the filter when the latter is in the recirculation position, so that the impurities can be removed and the filtering mesh 91 can be washed.

[0033] In other words, it can be stated that, assuming a first imaginary surface and a second imaginary surface, both of which are integral with the filter, transversal (in particular, orthogonal) to the flow direction, and arranged at a non-null distance between each other, it follows that in the first position the flow will first run through the first imaginary surface and then through the second imaginary surface, whereas in the second position the flow will first run through the second imaginary surface and then through the first imaginary surface.

[0034] During a wash cycle, the filter 9 normally remains in the recirculation position; during the drain step the actuator 6 is then activated.

[0035] The piston of the latter advances and, as previously explained, its linear motion rotates the crank 8, which in turn controls the rotation of the shaft 92 and hence of the filtering mesh 91.

[0036] It is apparent that the man skilled in the art may decide when and how many times the actuator 6 must be activated in order to fulfill the design requirements at best.

[0037] Of course, the example described so far may be subject to many variations.

[0038] With reference to Figs. 5, 6, 7, 8 and 9, there is shown a first variant comprising a pump assembly 1' operating in the same manner as that of the main embodiment 1, but physically implemented in such a way as to advantageously reduce the number of parts required, and also allowing maintaining a filter 9' without requiring the use of any tools and without disassembling the entire pump assembly 1'.

[0039] It is apparent that a smaller number of parts, in this case making up the pump assembly 1', implies lower production costs as well as an advantageous increase in the strength and reliability of the part.

[0040] The description of this second embodiment will mainly take into account the new or modified components, while similar parts will be designated in the drawings by the same reference numerals with the addition of an apostrophe.

[0041] The pump assembly 1' comprises a body 2', a recirculation pump 3', a drain pump 4', a crank 8', the filter 9' and a filter cartridge 110.

[0042] In this variant, the body 2' incorporates a greater number of parts necessary for the operation of the pump assembly 1', i.e. it includes the following components: the recirculation flow delivery duct 32', a fastening flange 28' for coupling to the recirculation pump 3', the drain flow delivery duct 42', a fastening flange 29' for coupling to the drain pump 4', the snap-on tangs 73' for securing the actuator 6' onto the top of the body 2' and in the pivoting hole 74'.

[0043] It should be noted that the minimal angle formed by the main directions of the drain and recirculation flows is similar to that of the main embodiment, thus allowing the actuator 6' and the filter 9' to operate in a manner wholly similar to the above.

[0044] In this embodiment as well, the cross-section of the second outlet duct 25' is greater than the cross-section of the first outlet duct 24', for the same purpose of allowing the filter 9' to intercept the entire flow during the recirculation steps and to leave a free port for the flow during the drain steps.

[0045] The recirculation pump 3' comprises the container 33' with the motor assembly, which is coupled to an impeller 38' through a direct coupling or a suitable reduction gear (not shown in the drawings).

[0046] Likewise, the drain pump 4' comprises the motor 43', which is coupled to an impeller 48 through a direct coupling or a suitable reduction gear (not shown in the drawings).

[0047] The coupling between the pumps 3' and 4' and the respective fastening flanges 28' and 29' is done by using fastening means, preferably screws, which are inserted through holes 39' and 49' obtained in the frames of the supports of the respective impellers 38' and 48'.

[0048] The distinctive element of this variant is a filter cartridge 110' that can be inserted into and removed from the pump body 2'.

[0049] In particular, the cartridge 110' comprises a circular cover 111', which in turn is fitted with an unscrewing tab 112' which, in the assembled condition, is mounted outside the inspection duct 46', and a thread 113' running along the edge which is compatible with a thread (not shown in the drawings) which is present inside the inspection duct 46'.

[0050] The cartridge 110' also includes a filter support structure 114' having a substantially cylindrical geometry, which is open to allow free access to the inside, and whose ends are joined together; in particular, the structure's proximal end includes a circular seat (coaxial to the cover 111') with an undercut joint that couples to teeth projecting from the surface of the cover 111' opposite to that from which the tab 112' protrudes, and which is connected to the distal end by means of strips 115', 116' extending along generatrices of the cylindrical structure, located on diametrically opposed sides.

[0051] The coupling between the cover 111' and the structure 114' (even when implemented in a way other than that described above) is such that it only allows the cover 111' one degree of freedom relative to the structure 114', consisting of the ability to rotate about an axis A (shown in Fig. 6).

[0052] Along one of these strips there is a centering rib 117' that allows the cartridge to be correctly inserted into the corresponding seat in the body 2'.

[0053] For supporting the filter 9', the structure 114' includes a housing seat 118' that allows the filter 9' to pivot by approximately 90° about the axis BB towards the inside of the volume occupied by the filter cartridge 110' (as shown in Fig. 6).

[0054] The shape of the filter cartridge 110' has been studied to minimize the load losses of the wash liquid flows running therethrough during both the recirculation and drain steps.

[0055] The material of the filter cartridge 110' is preferably plastic, so that it is advantageously not subject to any type of corrosion.

[0056] As to the sealing between the cover 111' and the inspection duct 46', at least one circular sealing element 104'(such as an O-ring) is preferably employed in the area of the thread 113'.

[0057] In order to allow installing the filter cartridge 110' into the inspection duct 46', the cover 111' is free to rotate about an axis AA (shown in Fig. 6) relative to the parts 114', 115' and 116', which during installation keep the same orientation with respect to the inspection duct 46'.

[0058] The filter 9' operates in a manner similar to the above-described filter 9, but includes a number of devices that allow it to be uninstalled and removed from the pump assembly 1'.

[0059] In fact, the filter 9' is joined, through a parallelepiped head 97', to a hollow base 98' of a control pin 92'.

[0060] The head 97' is located at one end of the pin 99' , in a position opposite to the pivoting head 96'; the base 98' is located at one end of the pin 92', in a position opposite to the cross-like head 94', which in turn fits, through the interposition of a sealing element 105', into a blind hole (non shown in the drawings) obtained on the crank 8'.

[0061] The pin 92' crosses the entire thickness of the body 2', going through the pivoting hole 74' and fitting into the hole in the crank 8'.

[0062] In order to make it easier to properly place the filter 9' into the recirculation position during installation, the body 2' also includes a positioning guide 120' having the same width as one dimension (in particular the minor dimension) of the parallelepiped head 97', so as to allow engaging the latter in the guide 120' and consequently placing the entire filter 9' integral therewith in the appropriate position for mounting the cartridge.

[0063] In fact, in order to avoid that the filter cartridge 110' might suffer undesired blockage and/or stopping when inserted into the inspection duct 46, the positioning guide 120' has a draft 122' at its inlet which, as shown in Fig. 9, helps progressively aligning the filter 9' in the recirculation position starting from any other position.

[0064] In practice, the parallelepiped head 97' has bevelled corners that come in contact with the draft 122', thus aligning with the positioning guide 120'; the head 97' then rotates the pin 99' of the filter 9'.

[0065] Finally, it must be pointed out that in this variant of the invention the body 2' further comprises a centering guide 119' in which the matching rib 117' provided on the cartridge 112' slides in order to ensure the correct alignment during installation.

[0066] As far as the other parts of the filter 9' are concerned, the base 98 of the pin 92' performs the same function as the stop ring 95' of the preceding embodiment of the invention, and is coupled to the crank 8' through the pivoting hole 74' in a way similar to the main embodiment, while the sealing between the pin 92' and the pivoting hole 74' is ensured by a sealing element 105'.

[0067] The crank 8' carries out the same functions already described, the only difference being that the crankpin 81' is directly positioned on the crank journal 82' in an eccentric manner.

[0068] Further variants of the pump assembly 1 and 1' may however also be conceived, wherein the filter may be positioned, through the same or different actuation means, in two or more positions for the purpose of filtering different flows, without however departing from the teachings of this patent.

Claims

1. A pump assembly (1,1') for household appliances such as washing machines, dishwashers and the like, comprising a body (2, 2') fitted with fluid passage means (23, 24, 27) for letting a wash fluid flow therethrough, at least one pump (3,4,3',4') associated with the body for pumping the fluid, a filter (9, 9') for filtering the fluid flowing through the body (2, 2'),
   wherein the filter (9,9') is movable between a first position, in which a fluid flow runs through it towards a first side of the filter, and a second position, in which a fluid flow runs through it towards the opposite side of the filter,
   wherein the pump assembly (1,1') comprises two pumps (3, 4; 3', 4') associated with respective outlet ducts (24, 25; 24', 25') arranged in the body (2, 2') of the assembly,
   characterized in that the cross-section of the second outlet duct (25, 25') is greater than the cross-section of the first outlet duct (24, 24'), so that, in particular, said filter (9,9') covers the cross-section of the second outlet duct (25, 25') only partially.

2. A pump assembly (1, 1') according to claim 1, wherein the filter (9, 9') in said first and second positions cooperates with the fluid passage means (23, 24, 27) in a manner such that the fluid flow is directed towards either side of the filter.

3. A pump assembly (1, 1') according to any one of the preceding claims, wherein the filter (9, 9') is housed in the body (2, 2') when it is in the filtering operating condition.

4. A pump assembly according to any one of the preceding claims, wherein the filter (9, 9') comprises a filtering mesh (91).

5. A pump assembly (1,1') according to claim 4, wherein the filter (9,9') comprises a filtering mesh (91) which can rotate about an axis (B) to move between

said first and second positions.

6. A pump assembly (1, 1') according to any one of the preceding claims, wherein the filter (9') can be extracted from the body (2, 2') without requiring the removal of at least one pump (3, 4; 3', 4') associated therewith.

7. A pump assembly (1, 1') according to claim 6, wherein the filter (9, 9') is arranged in a cartridge (110) which can be extracted from the body (2, 2').

8. A pump assembly (1, 1') according to claim 7, comprising guiding means (120') with which the filter (9') engages when the cartridge is inserted into the body (2'), so that the filter is oriented in a predetermined condition.

9. A pump assembly (1, 1') according to any one of the preceding claims, comprising a linear actuator (6) which actuates the filter (9, 9') in order to move it between said first and second positions, said body (2, 2') including in particular a cavity open at the top and closed by a removable cover (7, 7'), on which the linear actuator (6, 6') is mounted.

10. A household appliance such as a washing machine, a dishwasher or the like, comprising a pump assembly according to any one of the preceding claims.

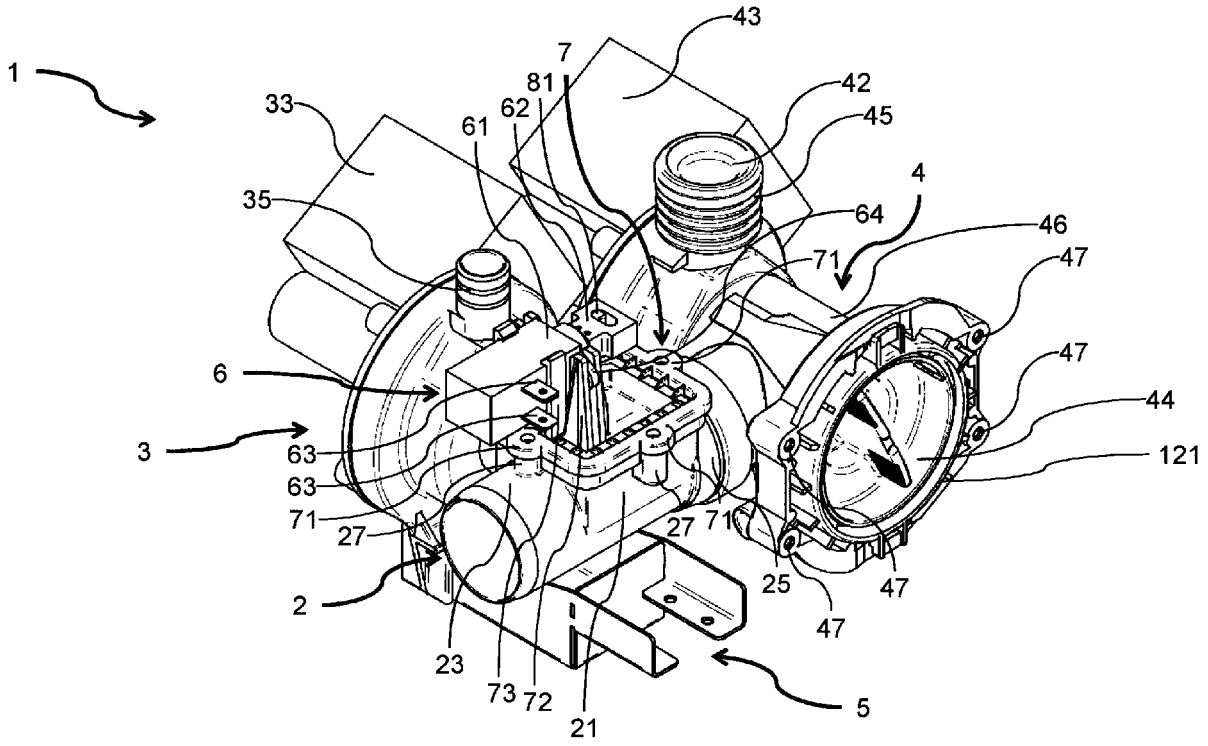
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Fig. 1

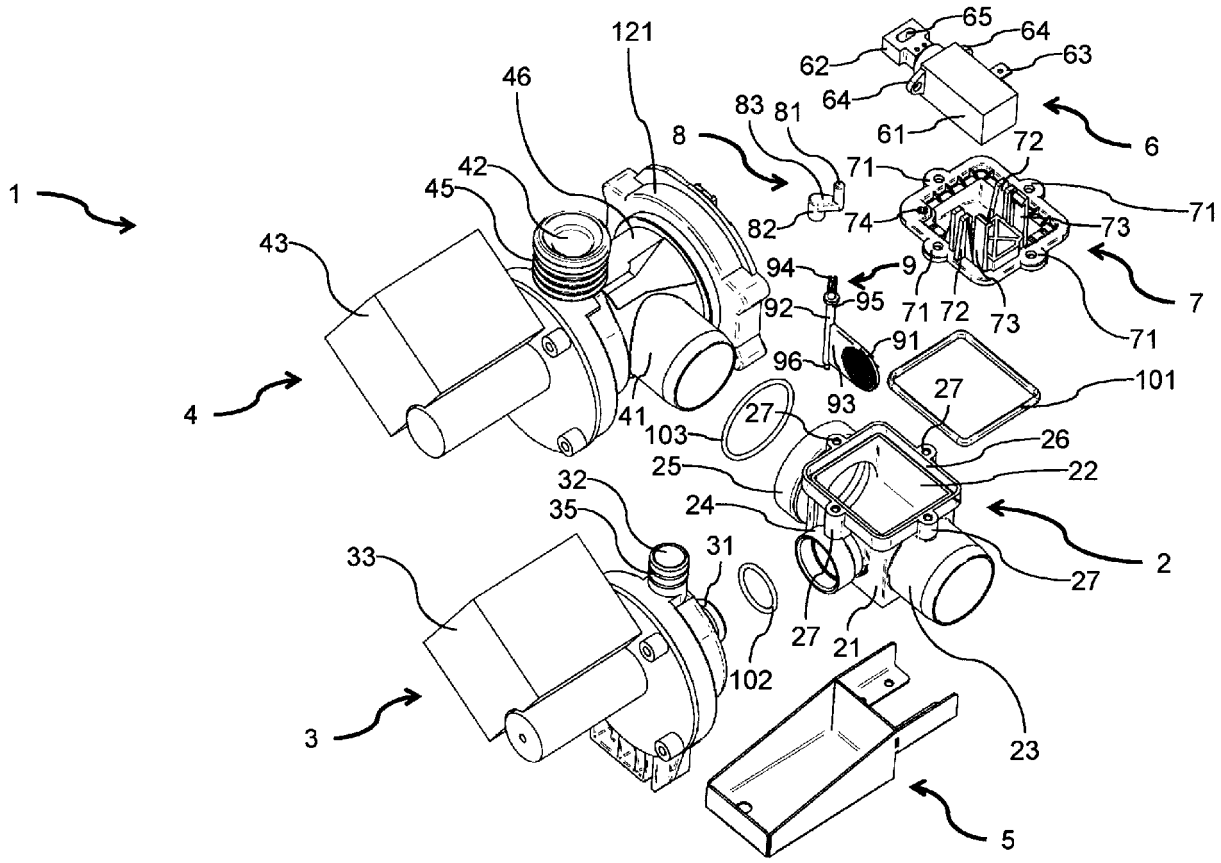
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Fig. 2

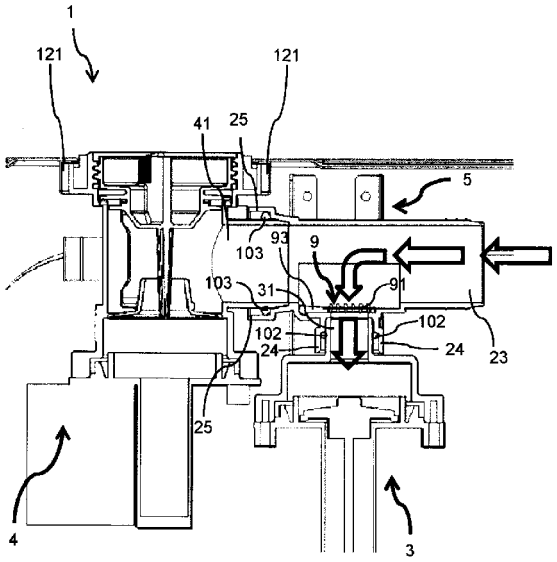
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Fig. 3

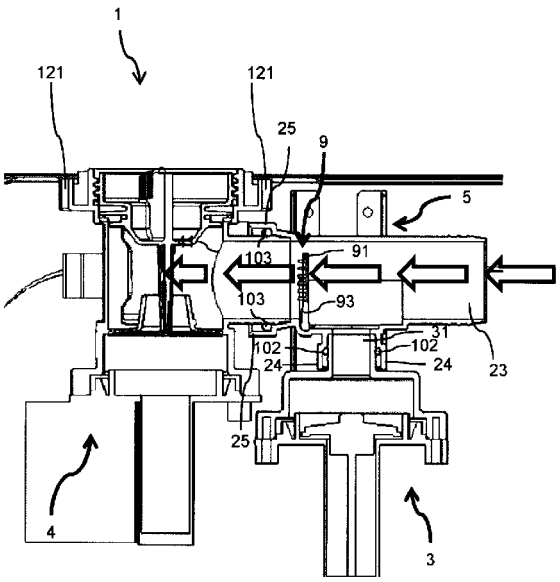
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Fig. 4

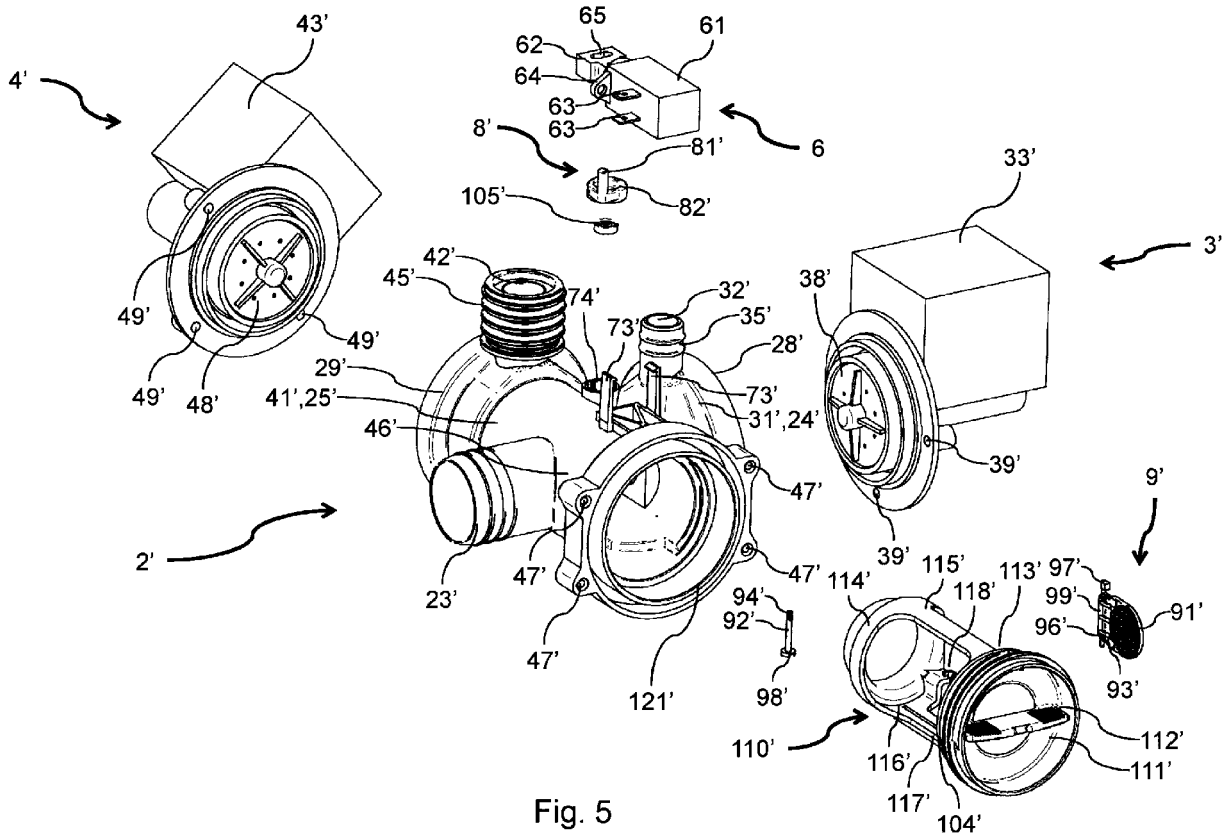
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Fig. 5

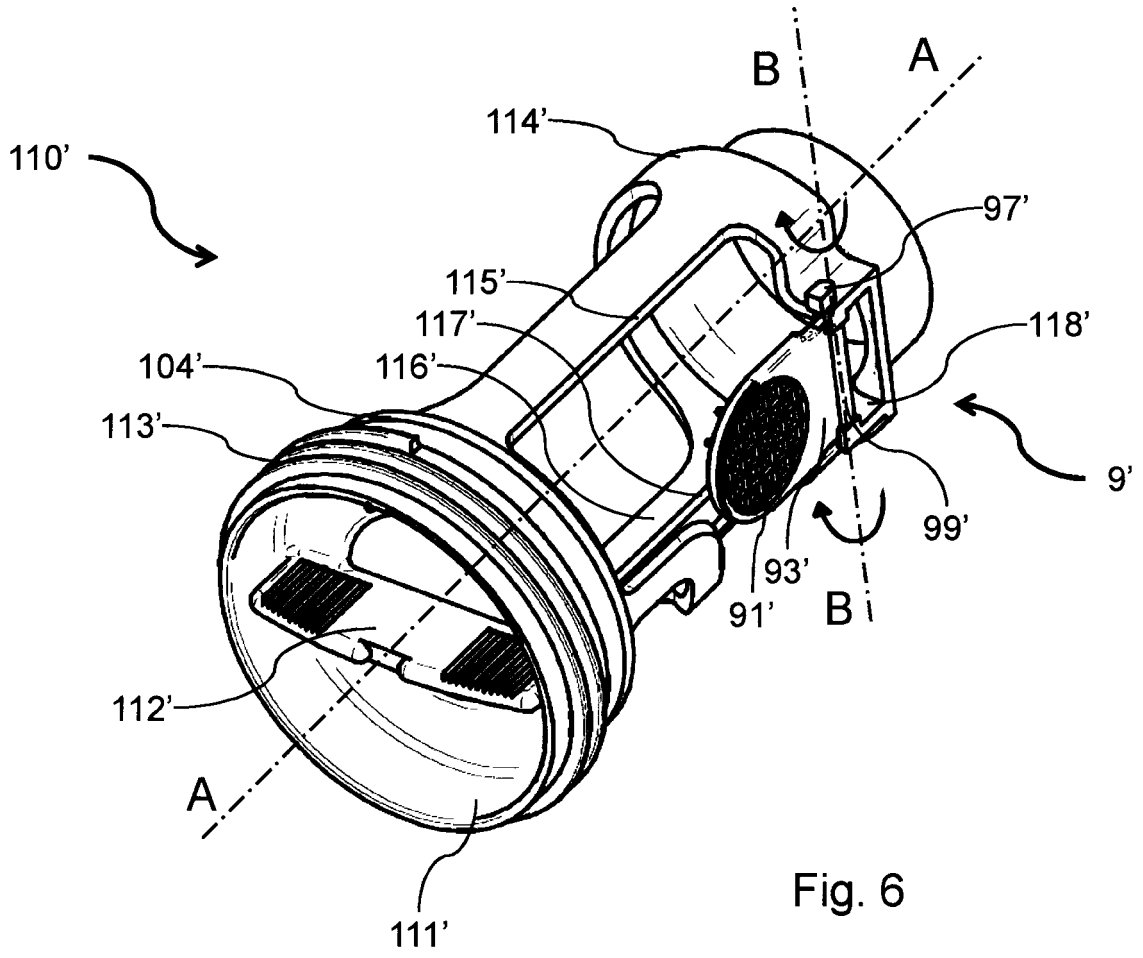

Fig. 6

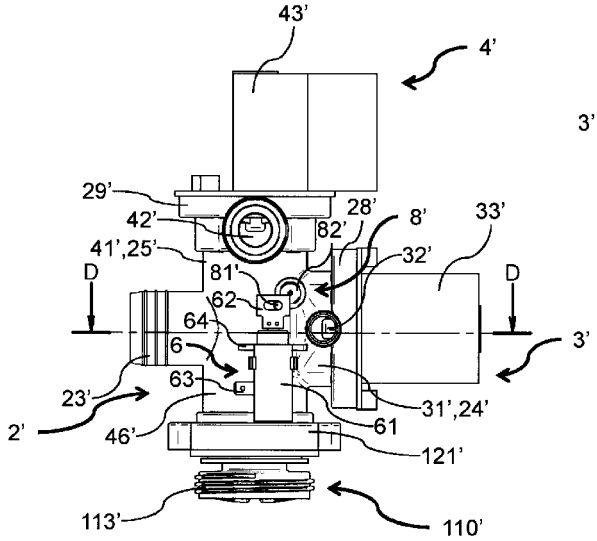
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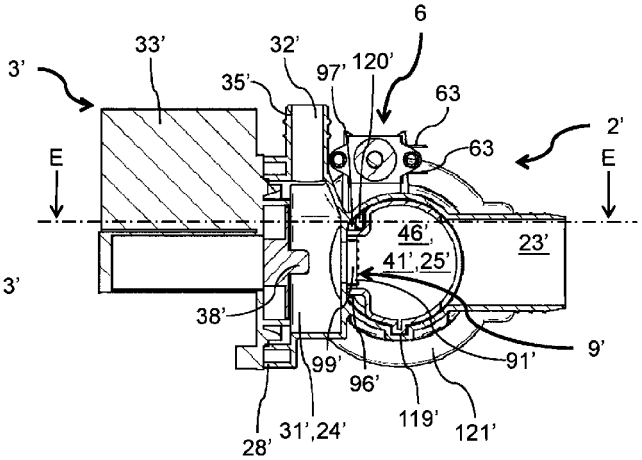
Fig. 7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119'
121'

Fig. 8

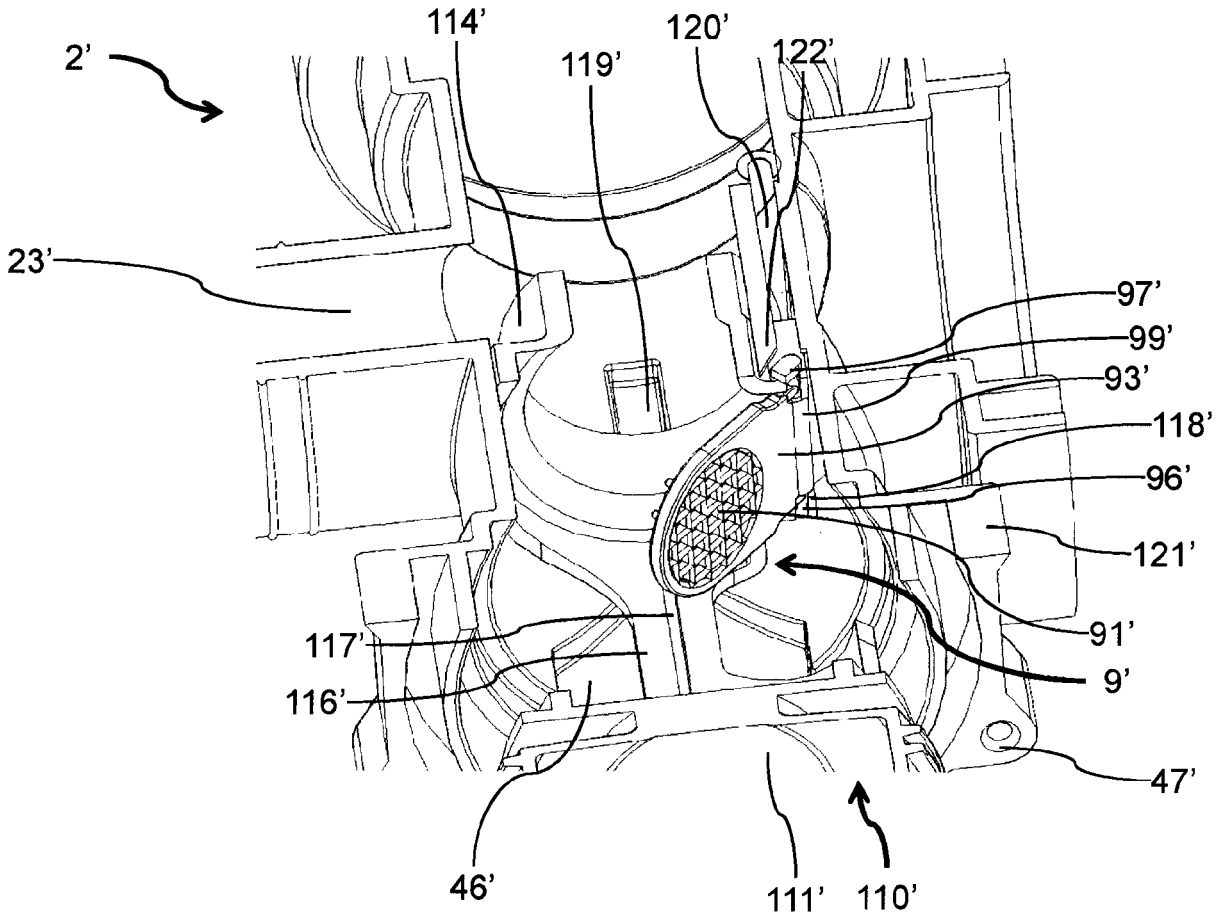

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 2949

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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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A	US 2 512 394 A (SULLIVAN WILLIAM G) 20 June 1950 (1950-06-20) * column 3, line 24 - column 5, line 36; figures 1-3 * -----	1	
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TECHNICAL FIELDS SEARCHED (IPC)

A47L
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 June 2016	Lopez Vega, Javier

CATEGORY OF CITED DOCUMENTS

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14-06-2016

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82