(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 374 764 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.05.2024 Bulletin 2024/22

(21) Application number: **22209147.2**

(22) Date of filing: **23.11.2022**

(51) International Patent Classification (IPC):
A47L 15/00 *(2006.01)* ***A47L 15/42*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A47L 15/0026; A47L 15/0057; A47L 15/4225;
A47L 15/4221; A47L 2401/34; A47L 2501/03

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

(71) Applicant: **Bonferraro S.p.A.**
37060 Bonferraro (VR) (IT)

(72) Inventors:
- **AMBROSI, Andrea**
  37052 Casaleone VR (IT)
- **PINAROLI, Eros**
  37060 Castel d'Azzano VR (IT)
- **REBECCHI, Fulvio**
  46100 Mantova MN (IT)
- **TOSI, Mauro**
  37051 Bovolone VR (IT)

(74) Representative: **Concone, Emanuele et al**
Società Italiana Brevetti S.p.A.
Via Carducci 8
20123 Milano (IT)

(54) DISHWASHER AND RELEVANT OPERATING CYCLE

(57) A dishwasher includes a load valve (1) that controls the inflow of water from the mains through a load duct to load water into a bottom sump (4) through an inlet (5), a wash pump (7) that draws water from the bottom sump (4) through a suction duct (9) and sends it to a plurality of sprayers (10, 11) through a delivery duct (12) and a diverter valve (18), a drain pump (13) connected to a drain duct (14) so as to discharge water from the bottom sump (4), and a recirculation duct (15), provided with a shut-off valve (16), extending between the delivery duct (12) and an additional inlet (17) of the bottom sump (4).

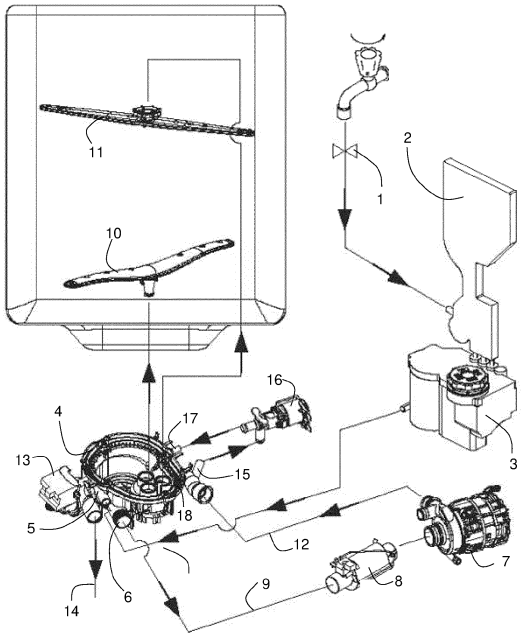

FIG.1

EP 4 374 764 A1

Description

[0001] The present invention relates to dishwashers, both for domestic and professional use, and in particular to a dishwasher with an improved hydraulic circuit and a relevant operating cycle.

[0002] It is well known that the increasingly stringent regulations concerning the energy classes of household appliances, and in particular of dishwashers, push manufacturers to reduce the operating temperatures and the volumes of water used, so that the same quantity of dishes to be treated with less wash water leads the latter to a higher concentration of dirt and detergent. As the hydraulic circuit inevitably has areas where stagnation occurs at the end of the wash water drainage phase, these stagnation areas become more polluted and it is therefore even more important to eliminate them in order to have water that is as clean as possible in the subsequent rinse phases.

[0003] To this purpose, after the wash phase and before the final rinse with hot water, an intermediate rinse is traditionally carried out with cold water, to reduce energy consumption, in order to remove the residues of polluted water that remain after the drainage of the wash water. In this way, the hydraulic circuit is cleaned in preparation for the final rinse, which must be carried out with water that is as clean as possible, but at the same time there is the disadvantage that the hydraulic circuit, the wash tank and the dishes are also cooled.

[0004] As a result, compared to a cycle without an intermediate rinse, the dishwasher is forced to heat the final rinse water more, resulting in higher energy consumption. Obviously, it would be possible to avoid this by also using hot water for the intermediate rinse, but the overall energy consumption would not change because the heating for the intermediate rinse would compensate for the reduction in heating for the final rinse. Similarly, it would be possible to dispense with the intermediate rinse, but in that case the water for the final rinse would be polluted with not fully satisfactory washing results.

[0005] To overcome these drawbacks, it is known from EP 2759244B1 to introduce mains water into the dishwasher through the wash pump while it is turned off, so that the water fed into the wash pump flows through it and from there goes directly to the bottom sump of the wash tank through the relevant connecting pipes, from where it is discharged by activating the drain pump. In this way, an almost complete disposal of the residual wash liquid can be achieved without affecting the wash tank and dishes by moving the water inlet from the sump to the wash pump.

[0006] However, it has been found that due to the pressure of the wash pump during normal operation, the wash liquid can flow back into the mains water line with the risk of undesirable contamination.

[0007] To solve this problem, DE 102017129052A1 describes a dishwasher equipped with a mains water supply line controlled by a two-way valve with a first outlet leading to the bottom sump of the wash tank, as in conventional dishwashers, and a second outlet leading to the delivery duct of the wash pump. In the intermediate rinse phase, water can be loaded by switching the valve to the second outlet while the wash pump is off and the drain pump is running. In this way, the advantage of EP 2759244B1 of washing only the most critical areas of the hydraulic circuit, without affecting the wash tank and dishes, is maintained, but during normal operation of the wash pump there is no risk of contamination in the mains water line. In fact, in that phase the two-way valve is switched to the first outlet and thus prevents the backflow of washing liquid from the delivery duct of the wash pump.

[0008] This second solution is also not without drawbacks, as it requires an expensive and bulky two-way valve and a more complex hydraulic circuit. In addition, both of the above-mentioned prior art solutions involve a non-negligible consumption of water, since the water is immediately discharged by the drain pump as soon as it enters the sump after flowing back through the delivery duct and the wash pump.

[0009] The object of the present invention is therefore to provide a dishwasher which overcomes said drawbacks. This object is achieved by means of a dishwasher provided with a recirculation duct extending between the delivery duct of the wash pump and the sump, said recirculation duct being provided with a shut-off valve. Other advantageous features of the present dishwasher are specified in the dependent claims.

[0010] The main advantage of the dishwasher according to the present invention is that it is possible to carry out the intermediate rinse by limiting it to the most critical areas of the hydraulic circuit, without affecting the wash tank and the dishes, with a simpler and less bulky hydraulic circuit. This result in a reduction of the dishwasher cost both in terms of components and labor for its assembly, as well as greater designing freedom in choosing the arrangement of the components.

[0011] A further advantage of this dishwasher and its operating cycle derives from the fact that the intermediate rinse phase requires less water consumption because the drain pump is activated only at the end of this phase, so that the water loaded for this phase can be circulated several times for better cleaning of the affected portion of the hydraulic circuit.

[0012] These and other advantages and features of the dishwasher according to the present invention will be apparent to those skilled in the art from the following detailed description of an embodiment thereof with reference to the accompanying drawings in which:

Fig.1 is a schematic view illustrating the connections between the main elements of the dishwasher;
Fig.2 is a bottom view of the main elements of the hydraulic circuit of the dishwasher; and
Fig.3 is top perspective view similar to Fig.2.

[0013] Referring to Fig.1, it can be seen that a dish-

washer according to the present invention traditionally comprises a load duct, controlled by a shut-off solenoid valve 1, for loading mains water from a tap to an air break 2, then passing through a softener 3 containing descaling resins, to be finally loaded into a sump 4 at the bottom of the wash tank through an inlet 5. The water is then withdrawn for the wash/rinse phases, through an outlet 6, by a wash pump 7, preceded by a resistor 8 arranged on the suction duct 9. The wash pump 7 sends the water to the sprayers 10, 11 through a delivery duct 12 and a diverter valve 18, which controls the inflow to the various sprayers via its three outlets (there is also a third sprayer, not shown, on the ceiling of the wash tank). The machine further comprises a drain pump 13, for sending water from sump 4 to a drain duct 14.

[0014] The innovative aspect of this dishwasher consists in the possibility of choosing an alternative water delivery path thanks to a recirculation duct 15, provided with a shut-off valve 16, extending between the delivery duct 12 and an additional inlet 17 of sump 4. In fact, by closing all outlets of the diverter valve 18 and opening the shut-off valve 16, it is possible to send the water from the delivery duct 12 directly into sump 4 through the additional inlet 17, without having it reach the sprayers.

[0015] In the light of the above description, the simple and effective operation of the dishwasher according to the present invention is readily understood.

[0016] In the phase of water loading into sump 4 through inlet 5 at the beginning of the operating cycle, followed by the wash phase, valve 16 is closed. After the wash phase, in the water loading phase for the intermediate rinse, valve 16 is opened and the three outlets of valve 18 are closed, so that the water goes from the delivery duct 12 to the recirculation duct 15.

[0017] The wash pump 7 thus circulates the water only in the bottom part of the hydraulic circuit of the dishwasher, along the delivery duct 12 and the recirculation duct 15 until it enters sump 4 through inlet 17, and then flows back towards the wash pump 7 through the suction duct 9 and resistor 8. Upon completion of the circuit cleaning, the water is discharged by the drain pump 13 through the drain duct 14, leaving the wash/rinse circuit clean and ready for the final rinse.

[0018] Note that the duration of the intermediate rinse phase and the amount of water loaded for this phase (indicatively 200-300 ml) can be freely chosen depending on the specific circuit cleaning requirements. In addition, this phase could be divided into multiple sub-phases, that is, it could include multiple sequences of water loading, circuit cleaning, and water draining.

[0019] Thus, the relevant operating cycle of a dishwasher according to the present invention can be summarized in the following steps:

(a) initial loading of water into sump 4;
(b) performing of the washing phase;
(c) discharge of the washing water;
(d) opening of the shut-off valve 16;
(e) closing of all outlets of the diverter valve 18;
(f) loading water for the intermediate rinse into sump 4;
(g) activation of the wash pump 7;
(h) deactivation of the wash pump 7;
(i) discharge of the intermediate rinse water;
(j) closing of the shut-off valve 16;
(k) opening of all outlets of the diverter valve 18;
(l) loading the final rinse water into sump 4;
(m) performing of the final rinse phase;
(n) discharge of the final rinse water.

[0020] Note that, as mentioned earlier, the sequence of steps f)-i) could also be performed several times, and the order of steps d)-f) could be varied freely, as could the order of steps j)-1).

[0021] From the above, it is easy to understand how the dishwasher according to the present invention can perform the final rinse with less energy consumption, since the wash tank and the dishes have not been cooled by the cold water loaded in the previous phase. Moreover, the quantity of water required for washing the wash/rinse circuit, which is in any case the part of the hydraulic circuit with the greatest stagnation of polluted water, is significantly less than that required for a traditional intermediate rinse.

[0022] Note that softener 3 and/or air break 2 could be absent, and that in the case of an industrial dishwasher, pump 7 and sprayers 10, 11 would only be intended for washing and there would be a further pump and two further sprayers specifically intended for rinsing, but the part of the circuit illustrated in the figures would not change.

[0023] It is clear that the embodiment of the dishwasher according to the above-described and illustrated invention is only an example susceptible to numerous variations. In particular, the exact shape and arrangement of valves 16 and 18, of ducts 9, 12, 14, 15 and of inlets 5 and 17, as well as of the possible softener 3 and/or air break 2, may be freely varied according to specific constructional requirements, as long as their relative arrangement within the hydraulic circuit illustrated above is maintained.

Claims

1. A dishwasher comprising a load valve (1) controlling the inflow of water from the mains through a load duct to load water into a bottom sump (4) through an inlet (5), a wash pump (7) that draws water from said bottom sump (4) through a suction duct (9) and sends it to a plurality of sprayers (10, 11) through a delivery duct (12) and a diverter valve (18) that controls the flow of water to said sprayers (10, 11), and a drain pump (13) connected to a drain duct (14) so as to discharge water from the bottom sump (4), **characterized by** comprising a recirculation duct (15), provided with a shut-off valve (16), extending between

said delivery duct (12) and an additional inlet (17) of the bottom sump (4).

2. Operating cycle of a dishwasher according to claim 1, comprising the following steps:

(a) initial loading of water into the bottom sump (4);
(b) performing of the washing phase;
(c) discharge of the washing water;
(d) loading of water for the intermediate rinse into the bottom sump (4);
(e) activation of the wash pump (7);
(f) deactivation of the wash pump (7);
(g) discharge of the intermediate rinse water;
(h) loading of water for the final rinse into the bottom sump (4);
(i) performing of the final rinse;
(j) discharge of the final rinse water;
characterized by comprising between steps (c) and (d) the additional steps of:
(c') opening of the shut-off valve (16);
(c") closing of all outlets of the diverter valve (18);
and between steps (g) and (h) the additional steps of:
(g') closing of the shut-off valve (16);
(g") opening of all outlets of the diverter valve (18);
where the order of steps c')-c")-d) can be varied freely, and the order of phases g')-g")-h) can be varied freely.

3. Operating cycle according to claim 2, **characterized in that** the sequence of steps d)-g) is performed several times.

4. Operating cycle according to claim 2 or 3, **characterized in that** in step d) an amount of water of 200-300 ml is loaded.

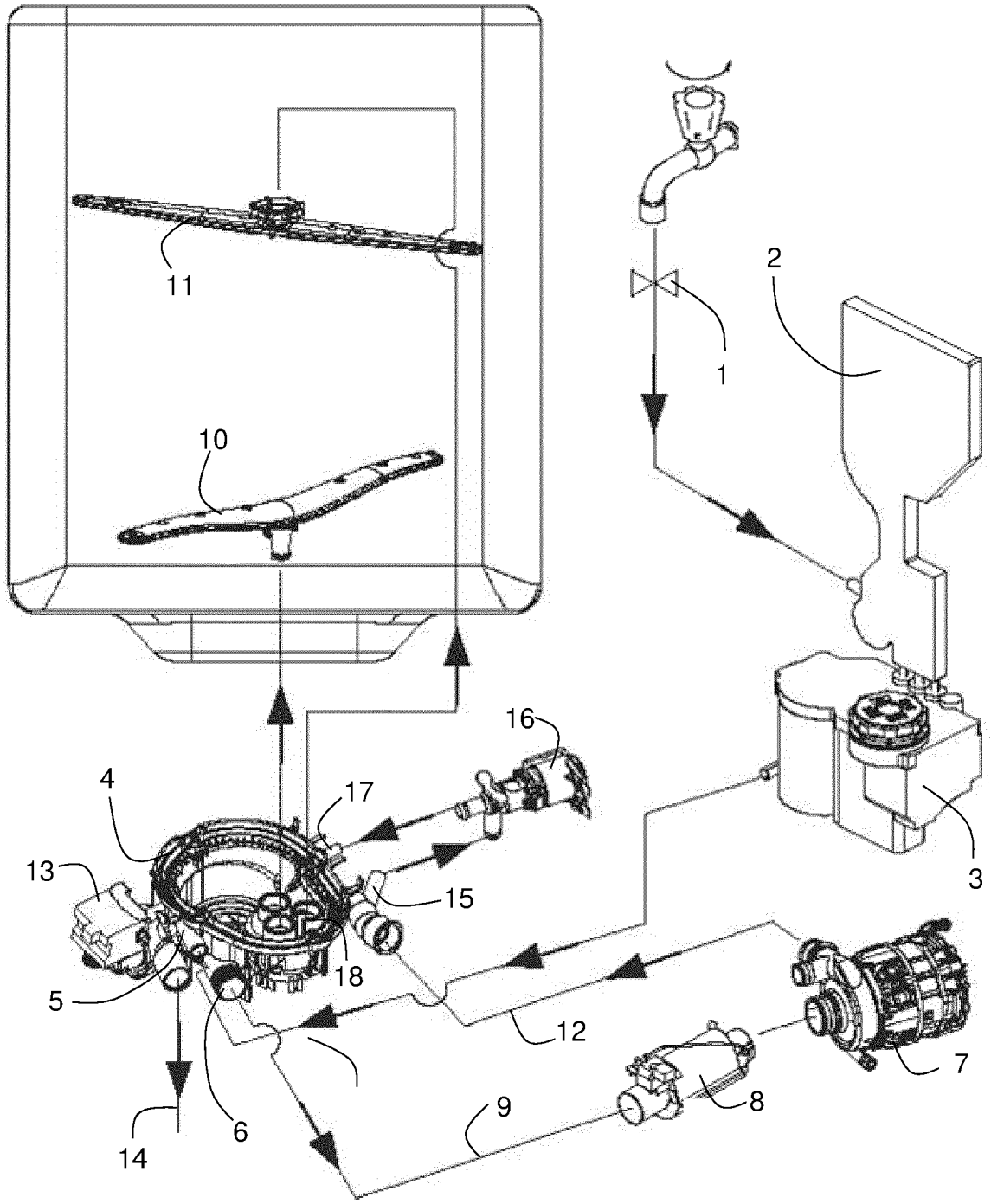

FIG.1

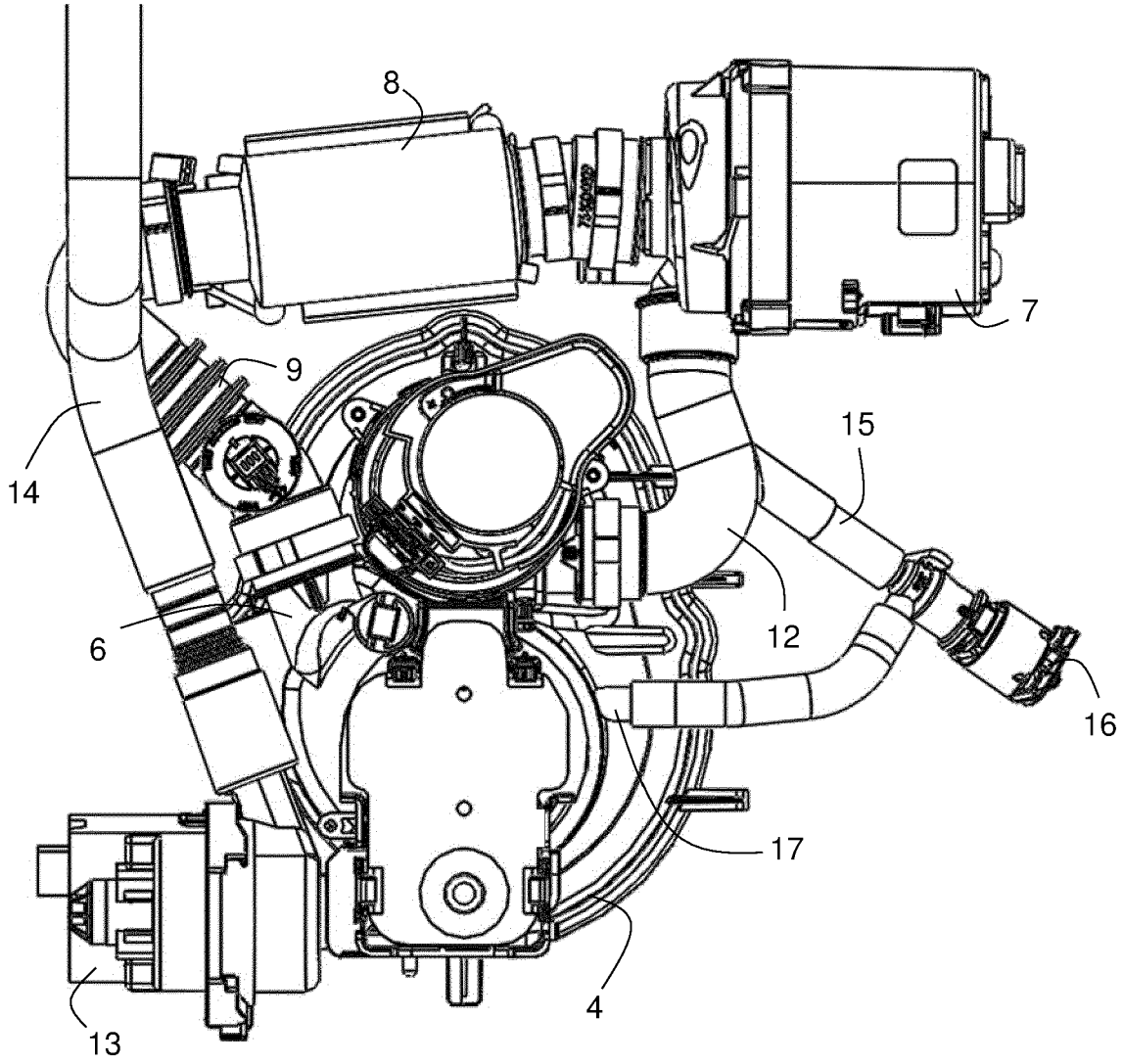

FIG.2

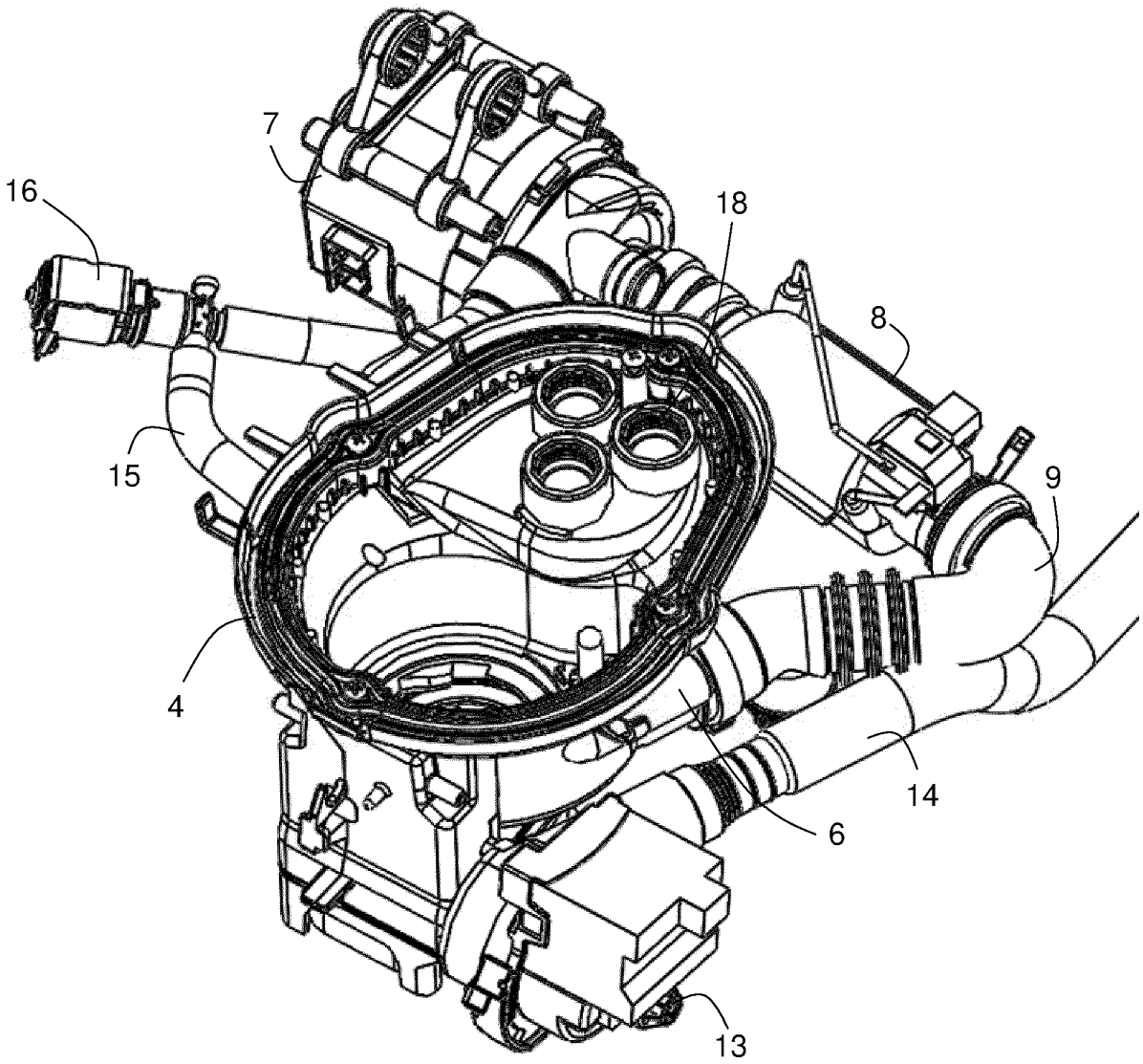

FIG.3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 20 9147

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2011/132407 A1 (FAUTH MICHAEL [DE] ET AL) 9 June 2011 (2011-06-09) * figure 1 * * paragraph [0043] * * paragraph [0047] *	1	INV. A47L15/00 A47L15/42
A	US 2014/060579 A1 (SLABBEKOORN SCOTT D [US] ET AL) 6 March 2014 (2014-03-06) * figures 6-7 *	1-4	
A	US 2011/056527 A1 (CLASSEN EGBERT [DE] ET AL) 10 March 2011 (2011-03-10) * figures 1-2 *	1-4	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 May 2023	Werner, Christopher

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 20 9147

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-05-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011132407 A1	09-06-2011	AU 2009273322 A1	28-01-2010
		CN 102098953 A	15-06-2011
		CN 102131437 A	20-07-2011
		DE 102008040653 A1	28-01-2010
		EP 2312987 A1	27-04-2011
		JP 2011528594 A	24-11-2011
		NZ 589937 A	21-12-2012
		PL 2312987 T3	29-11-2019
		RU 2011103118 A	27-08-2012
		RU 2011103711 A	27-08-2012
		TR 201910098 T4	22-07-2019
		US 2011114140 A1	19-05-2011
		US 2011132407 A1	09-06-2011
		WO 2010009890 A1	28-01-2010
		WO 2010010012 A1	28-01-2010
US 2014060579 A1	06-03-2014	NONE	
US 2011056527 A1	10-03-2011	AT 511381 T	15-06-2011
		CN 101902948 A	01-12-2010
		DE 102007060196 A1	18-06-2009
		EP 2222218 A1	01-09-2010
		ES 2365036 T3	20-09-2011
		PL 2222218 T3	31-10-2011
		US 2011056527 A1	10-03-2011
		WO 2009077286 A1	25-06-2009

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2759244 B1 **[0005] [0007]**
- DE 102017129052 A1 **[0007]**