(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 July 2017 (06.07.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/114559 A1

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

(21) International Application Number:
PCT/EP2015/081336

(22) International Filing Date:
29 December 2015 (29.12.2015)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

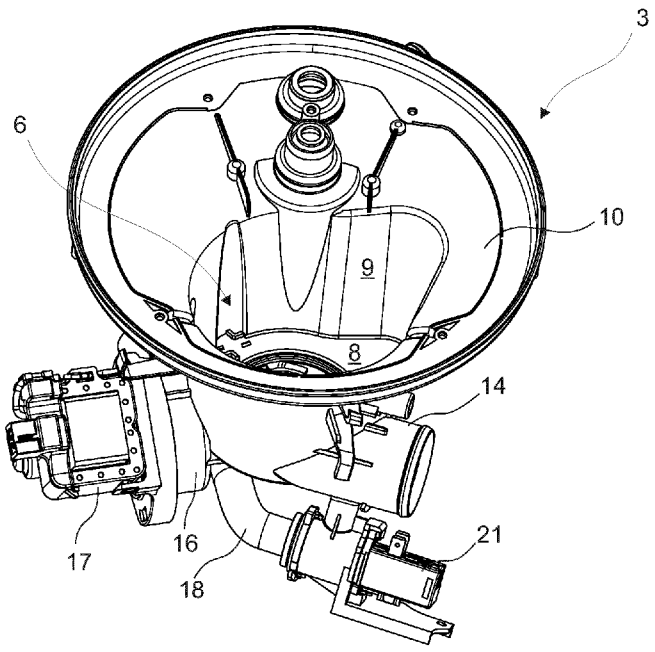
Published:

— *with international search report (Art. 21(3))*

WO 2017/114559 A1

(54) Title: A DISHWASHER

Figure 3



(57) Abstract: The present invention relates to a dishwasher (1) comprising: a tub (2) in which the dishes to be washed are placed; a sump (3) which is arranged in the lower section of the tub (2) to collect the washing liquid that has been distributed on the dishes during washing operation and which comprises a housing (6) having an opening (7) on the top for receiving the washing liquid; a tubular hollow filter (12) having a through hole (13) and mounted in the housing (6) of the sump (3) with its through hole (13) aligned with the opening (7) of the housing (6), the tubular filter (12) separating in the housing (6) a drainage channel within its through hole (13) and a recirculation volume; a recirculation duct (14), connected to the recirculation volume of the housing (6) of the sump (3) for conveying the filtered washing liquid from the sump (3) back to the tub (2); and a main drain duct (16), connected to the drainage channel of the housing (6) of the sump (3) for draining the washing liquid collected in the sump (3) at the end of the cleaning operation out of the dishwasher (1(.

Description

A DISHWASHER

[0001] The present invention relates to a dishwasher having improved washing performances and, more in detail, having an enhanced draining capability.

[0002] As it is known, dishwashers generally comprise a sump 3' arranged in the lower section of the tub in which the dishes to be washed are placed, to collect the washing liquid that has been sprayed on the dishes during washing operations, and at least a filter arranged in the sump for preventing the dirt from getting into the circulation during washing, which dirt would decrease the effectiveness of washing.

[0003] More in detail, the sump 3' comprises a tubular housing 6', wherein a hollow cylindrical microfilter is inserted, and a peripheral portion 10', sloping toward the tubular housing 6' and covered with a filter screen having a funnel shape that aids conveying the washing liquid across the filter screen to the hole of the cylindrical microfilter.

[0004] A recirculation duct 14', for conveying the filtered washing liquid from the sump 3' to the spray arms that distribute the washing liquid on the dishes to be washed, and a drain duct 16', for draining the washing liquid collected in the sump 3' at the end of the cleaning operation out of the dishwasher, are connected to the sump, at the bottom of it.

[0005] More in detail the recirculation duct 14' is connected to the sump 3' through a first outlet provided on the lateral wall of the tubular housing 6' in order to mainly collect the washing liquid previously passed through the microfilter. The drain duct 16' is connected to the sump 3' through a second outlet provided on the bottom wall of the tubular housing 6', in correspondence of the hole of the cylindrical microfilter, in order to mainly collect the washing liquid.

[0006] It often happens, however, that possible clogging of the microfilter or the presence of large sized particles, such as for instance olive seeds, corn grains, toothpicks, beans, screws, paper napkins or porcelain, glass or plastic fragments, trapped on the bottom of the tubular housing, in correspondence of the hole of the cylindrical microfilter, do not allow the complete draining of the washing liquid.

[0007] This adversely affects the cleaning performances of the dishwasher, since the undischarged washing liquid that remains in the sump, containing residual soil and detergent, mixes with the clean washing liquid newly introduced in the tub for the subsequent cleaning operations of the same cleaning program or for the subsequent cleaning programs during the recirculation of the latter.

[0008] At the moment no solution has been provided for overcoming such technical problem.

[0009] The aim of the present invention is the realization of a dishwasher having improved washing performances and, more in detail, having an enhanced draining capability, ensuring the complete drainage of the washing liquid out of the dishwasher at the end of the cleaning operation.

[0010] The dishwasher realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises, besides the main drain duct, an additional drain duct connecting the portion of the sump receiving the washing liquid to be recirculated with the main drain duct for conveying, through an alternative or additional path, the washing liquid from the sump toward the main drain duct. This allows to by-pass possible clogging in the sump preventing the washing liquid to enter in the main drain duct.

[0011] In an embodiment the dishwasher comprises a valve arranged on the additional drain duct to allow or to stop the flow of washing liquid in the additional drain duct and, in a further embodiment, it comprises a control unit programmed to command the opening and closing of the valve, depending on the operational step performed by the dishwasher.

[0012] In a version of this embodiment, the control unit is programmed to command the opening of the valve during each drainage operation, while in an alternative version of this embodiment, the control unit is programmed to command the opening of the valve during a drainage operation when the presence of residual washing liquid in the housing is detected.

[0013] According to an embodiment, the additional drain duct is connected to the bottom of the sump to ensure the drainage of all the washing liquid

contained therein.

[0014] In a further embodiment, the additional drain duct is connected to the recirculation duct to drain washing liquid from the sump through the latter.

[0015] In an embodiment, the additional drain duct is connected to the main drain duct at the connection of the latter with the sump.

[0016] According to a further embodiment, the main drain duct is connected to the bottom wall of the sump.

[0017] In the dishwasher of the present invention, the complete drainage of the washing liquid at the end of the cleaning operation is ensured even in the presence of clogging or obstructions that prevent all the washing liquid from reaching the main drain duct through the conventional path providing an extra path for the liquid to reach the main duct and hence to be expelled from the dishwasher.

[0018] A dishwasher realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0019] Figure 1 – is a perspective view of a sump of a dishwasher according to the prior art.

[0020] Figure 2 – is the schematic view of a dishwasher according to the invention.

[0021] Figure 3 – is a first perspective view of a sump of a dishwasher according to the present invention.

[0022] Figures 4 and 5 – are respectively a second perspective view of a sump of a dishwasher according to the present invention and an enlarged detail of the sump of Figure 4.

[0023] Figure 6 – is a third perspective view of a sump of a dishwasher according to the present invention.

[0024] Figure 7 – is an enlarged perspective view of a particular of a sump of a dishwasher according to the present invention, relative to an additional drain duct and to a valve placed on it.

[0025] The elements illustrated in the figures are numbered as follows:

1. Dishwasher
2. Tub
3. Sump

4. Rack
5. Spray arm
6. Housing
7. Opening
8. Bottom wall
9. Lateral wall
10. Peripheral portion
11. Filter screen
12. Tubular filter
13. Through hole
14. Recirculation duct
15. Circulation pump
16. Main drain duct
17. Drain pump
18. Additional drain duct
19. First end
20. Second end
21. Valve
22. Control unit
23. Main inlet
24. Additional inlet
25. Recirculation inlet
26. Outlet

[0026] The dishwasher 1 comprises a tub 2, in which the dishes to be washed, i.e. dishes, kitchenware, tableware, crockery etc. to be washed, are placed, and a sump 3 which is arranged in the lower section of the tub 2 to collect the washing liquid that has been distributed on the dishes during washing operation.

[0027] More in detail, the dishwasher 1 comprises one or more racks 4 which are extendably disposed into the tub 2 one above the other to be loaded with the dishes to be washed and one or more rotatable spray arms 5 which are arranged in the tub 2 and associated to respective racks 4 to spray the dishes with the washing liquid.

[0028] The sump 3 comprises a housing 6 having an opening 7 on the top for receiving the washing liquid.

[0029] In particular the housing 6 has substantially a tubular shape and it is delimited by a bottom wall 8 and by one or more lateral walls 9 extending from the bottom wall 8, substantially perpendicular to it, till the opening 7. According to the embodiment illustrated in the attached Figures 3-6 the sump 3 further comprises a peripheral portion 10 connected to lateral wall or walls 9 of the housing 6 at the opening 7, sloping toward the housing 6 and covered with a filter screen 11 having a funnel shape that aids conveying the washing liquid across the filter screen 11 to the housing 6.

[0030] The dishwasher 1 further comprises a tubular hollow filter 12 having a through hole 13 and mounted in the housing 6 of the sump 3 with its through hole 13 aligned with the opening 7 of the housing 6. In an embodiment, the tubular filter 12 is mounted on the bottom wall 8 delimiting the housing 6, spaced apart from the lateral wall or walls 9. The sump 3 and the filter screen 11 are in particular designed so that the washing liquid dropping to the bottom of the tub 2 is guided toward the opening 7 of the housing 6 and toward the through hole 13 of the tubular filter 12. The latter comprises advantageously a first tubular coarse filter, aimed to entrap large sized particles, and a second tubular microfilter, coaxially disposed around the first tubular coarse filter.

[0031] The tubular filter 12 separates the housing 6 in a drainage channel within its through hole 13, where mainly the unfiltered washing liquid flows, and in a recirculation volume, where mainly filtered washing liquid is collected. More in detail, the recirculation volume is comprised between the tubular filter 12 and the lateral wall or walls 9 delimiting the housing 6.

[0032] The dishwasher 1 further comprises a recirculation duct 14, connected to the recirculation volume of the housing 6 of the sump 3 for conveying the filtered washing liquid from the sump 3 back to the tub 2.

[0033] In particular, as illustrated in the attached Figure 2, the dishwasher 1 comprises a circulation pump 15 arranged on the recirculation duct 14 to draw the washing liquid from the sump 3 toward the spray arms 5 through the duct 10.

[0034] The dishwasher 1 comprises also a main drain duct 16, connected to the drainage channel of the housing 6 of the sump 3 for draining the washing liquid collected in the sump 3 at the end of the cleaning operation out of the dishwasher 1. To this aim the dishwasher 1 comprises a drain pump 17, associated to the drain duct 16. In particular the main drain duct 16 is connected to the drainage channel through a main inlet 23 which, according to a preferred embodiment illustrated in the attached figures, is provided on the bottom wall 8 of the sump 3, in correspondence of the drainage channel of the housing 6.

[0035] Operationally, the washing liquid sprayed on the dishes by the spray arms 5 drops on the bottom of the tub 2 and on the filter screen 11 and it is conveyed by the latter and by the peripheral portion 10 of the sump 3 toward the through hole 13 of the tubular filter 12 placed on the housing 6 of the sump 3, i.e. toward the drainage channel. A minimum part of the washing liquid enters directly in the recirculation volume through the filter screen 11.

[0036] Due to the functioning of the circulation pump 15, the washing liquid is dragged from the drainage channel toward the recirculation volume, by passing through the tubular filter 12, so that it is finely filtered before reaching the recirculation duct 14 to be conveyed toward the tub 2 again.

[0037] When, at the end of the cleaning operation, the washing liquid has to be drained from the sump 3, the drain pump 17 is activated and the washing liquid is attracted into the main drain duct 16 through the drainage channel. Therefore the washing liquid in the recirculation volume is attracted toward the drainage channel through the tubular filter 12.

[0038] According to the present invention, the dishwasher 1 further comprises an additional drain duct 18 having a first end 19 connected to the recirculation volume of the housing 6 of the sump 3 and a second end 20 connected to the main drain duct 16 for conveying washing liquid from the recirculation volume toward the main drain duct 16.

[0039] This ensures the complete drainage of the washing liquid from the sump 3, even in case the tubular filter 12 is clogged or in case any obstruction in the drainage channel at the main inlet 23 of the main drain duct 16 is

present.

[0040] As previously specified, in fact, in case the tubular filter 12 is clogged or in case large sized particles, such as for instance olive seeds, corn grains, toothpicks, beans, screws, paper napkins or porcelain, glass or plastic fragments, are trapped on the drainage channel obstructing the main inlet 23 to the main drain duct 16, the complete draining of the washing liquid would be hindered. Therefore, the presence of an additional drain duct 16 which drains the washing liquid from the recirculation volume, without requiring such liquid to pass through the tubular filter 12 or to enter through the main inlet 23 into the main drain duct 16, provides a further, alternative or additional, path for the washing liquid to be drained, thus ensuring the complete emptying of the sump 3 and avoiding that possible residual liquid and soil could mix with washing liquid newly introduced in the tub 2 during subsequent cleaning operations.

[0041] In an embodiment illustrated in the attached Figures the dishwasher 1 further comprises a valve 22 arranged on the additional drain duct 18 to allow or to stop the flow of washing liquid in the additional drain duct 18. In particular the valve 22 is intended to be closed during the recirculation of the washing liquid through the recirculation duct 14 and it is intended to be optionally opened during the drainage of the washing liquid.

[0042] In particular, according to an embodiment, the dishwasher 1 further comprises a control unit 22 programmed to command the opening and closing of the valve 2.

[0043] In an embodiment, the control unit 22 is programmed to command the opening of the valve 21 during each drainage operation. This allows the draining operation to be faster, since the washing liquid is expelled from the sump 3 both through the main drain duct 16 and through the additional drain duct 18.

[0044] In an alternative embodiment, the control unit 22 is programmed to command the opening of the valve 21 during a drainage operation only when the presence of residual washing liquid in the housing 6 is detected. To this aim the dishwasher 1 advantageously comprises a sensor (not illustrated), such as for instance a pressure sensor, placed in the housing

6 of the sump 3 and preferably mounted on the bottom wall 8 of it, to detect the presence of residual washing liquid. In this embodiment the additional drain duct 18 functions as a safety additional duct, to avoid malfunctioning of the dishwasher due to incomplete drainage of the washing liquid.

[0045] According to a further embodiment, the control unit 22 is programmed to emit a warning signal when, by draining the washing liquid only through the main drain duct 16, difficulty in the draining operation is encountered and the presence of residual washing liquid is detected, in order to inform the user about possible clogging of the tubular filter 12 or about possible large sized particles obstructing the main inlet 23 to the main drain duct 16, so that the user can proceed with the cleaning of the tubular filter 12 and of the sump 3 to restore the optimal functioning conditions of the dishwasher 1.

[0046] According to an embodiment, the first end 19 of the additional drain duct 18 is connected to the sump 3 at the bottom of the housing 6. In particular the first end 19 of the additional drain duct 18 is connected to the recirculation volume of the housing 6 through an additional inlet 24 which, according to this last embodiment, is provided on the bottom wall 8 of the sump 3 in correspondence of the recirculation volume of the housing 6, on the lateral wall 9 close to the bottom wall 8, or on the interception of the bottom wall 8 with the lateral wall 9. This ensures that all the washing liquid in the recirculation volume can be drained.

[0047] According to an alternative embodiment, the first end 19 of the additional drain duct 18 is connected to the recirculation duct 14, in order as well to ensure the complete drainage of the washing liquid in the recirculation volume.

[0048] Preferably the recirculation duct 14 is connected to the recirculation volume of the housing 6 through a recirculation inlet 25 which is advantageously provided on the bottom wall 8 of the sump 3, on the lateral wall 9 of it close to the bottom wall 8, or on the interception of the bottom wall 8 with the lateral wall 9.

[0049] In a version of this embodiment, the additional inlet 24 to the additional

drain duct 18 is provided in correspondence of the recirculation inlet 25 to the recirculation duct 14, as illustrated in Figure 6. This solution is constructionally simpler to be realized.

[0050] According to a further embodiment, the second end 20 of the additional drain duct 18 is connected to the main drain duct 16 at the connection of the latter with the drainage channel of the housing 6. More in detail, the outlet 26 of the additional drain duct 18 is preferably arranged in correspondence of the main inlet 23 to the main drain duct 16, as illustrated in Figures 4 and 5. This solution is constructionally simple to be realized and it allows to reduce the amount of space occupied by the additional drain duct 18.

[0051] By means of the present invention, a dishwasher is realized that has enhanced draining capability and that therefore ensures optimal cleaning performances.

Claims

1. A dishwasher (1) comprising:
   - a tub (2) in which the dishes to be washed are placed;
   - a sump (3) which is arranged in the lower section of the tub (2) to collect the washing liquid that has been distributed on the dishes during washing operation and which comprises a housing (6) having an opening (7) on the top for receiving the washing liquid;
   - a tubular hollow filter (12) having a through hole (13) and mounted in the housing (6) of the sump (3) with its through hole (13) aligned with the opening (7) of the housing (6), the tubular filter (12) separating in the housing (6) a drainage channel within its through hole (13) and a recirculation volume;
   - a recirculation duct (14), connected to the recirculation volume of the housing (6) of the sump (3) for conveying the filtered washing liquid from the sump (3) back to the tub (2);
   - a main drain duct (16), connected to the drainage channel of the housing (6) of the sump (3) for draining the washing liquid collected in the sump (3) at the end of the cleaning operation out of the dishwasher (1);
   characterized in that the dishwasher (1) further comprises:
   - an additional drain duct (18) having a first end (19) connected to the recirculation volume of the housing (6) of the sump (3) and a second end (20) connected to the main drain duct (16) for conveying washing liquid from the recirculation volume toward the main drain duct (16).
2. A dishwasher (1) as in Claim 1, **characterized in that** it further comprises a valve (21) arranged on the additional drain duct (18) to allow or to stop the flow of washing liquid in the additional drain duct (18).
3. A dishwasher (1) as in Claim 2, **characterized in that** it further comprises a control unit (22) programmed to command the opening and closing of the valve (21).
4. A dishwasher (1) as in Claim 3, **characterized in that** the control unit (22) is programmed to command the opening of the valve (21) during each drainage operation.
5. A dishwasher (1) as in Claim 3, **characterized in that** the control unit (22) is programmed to command the opening of the valve (21) during a drainage

operation when the presence of residual washing liquid in the housing is detected.

6. A dishwasher (1) as in any of the preceding claims, **characterized in that** the first end (19) of the additional drain duct (18) is connected to the sump (3) at the bottom of the housing (6).
7. A dishwasher (1) as in any of the claims 1-5, **characterized in that** the first end (19) of the additional drain duct (18) is connected to the recirculation duct (14).
8. A dishwasher (1) as in any of the preceding claims, **characterized in that** the second end (20) of the additional drain duct (18) is connected to the main drain duct (16) at the connection of the latter with the drainage channel of the housing (6).
9. A dishwasher (1) as in any of the preceding claims, **characterized in that** the housing (6) of the sump (3) is delimited by a bottom wall (8) and by at least one lateral wall (9).
10. A dishwasher (1) as in Claim 9, **characterized in that** the main drain duct (16) is connected to the bottom wall (8) of the sump (3) in correspondence of the drainage channel of the housing (6).

Figure 1

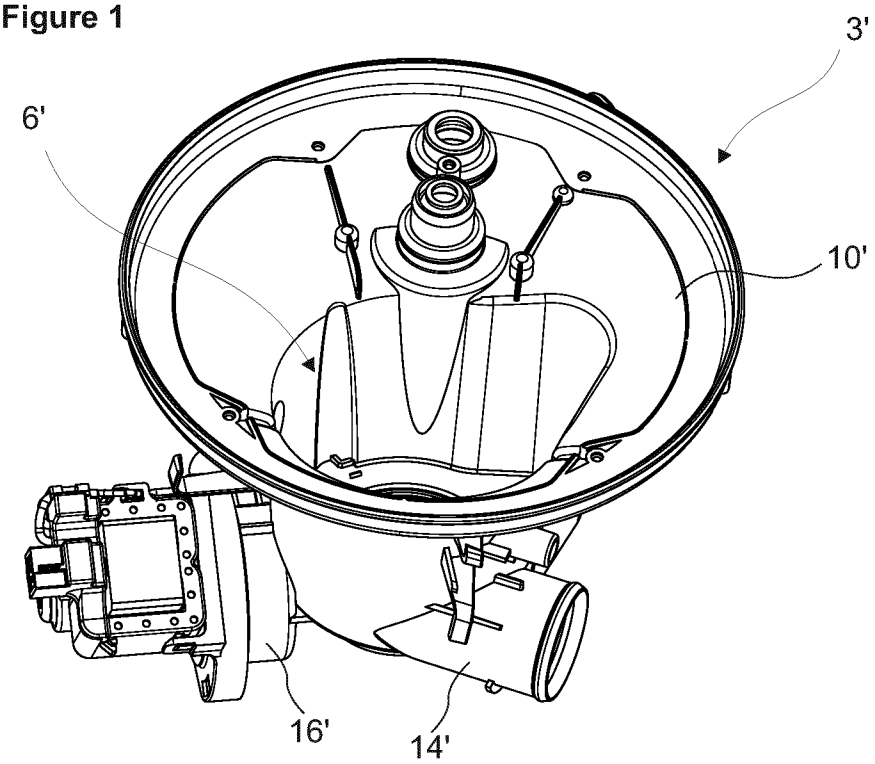


Figure 2

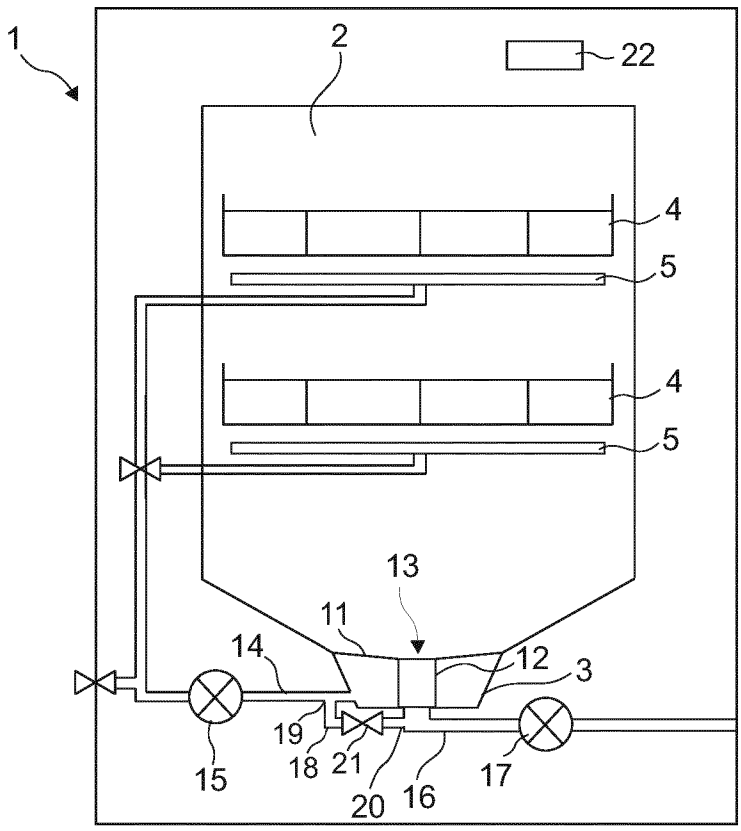


Figure 3

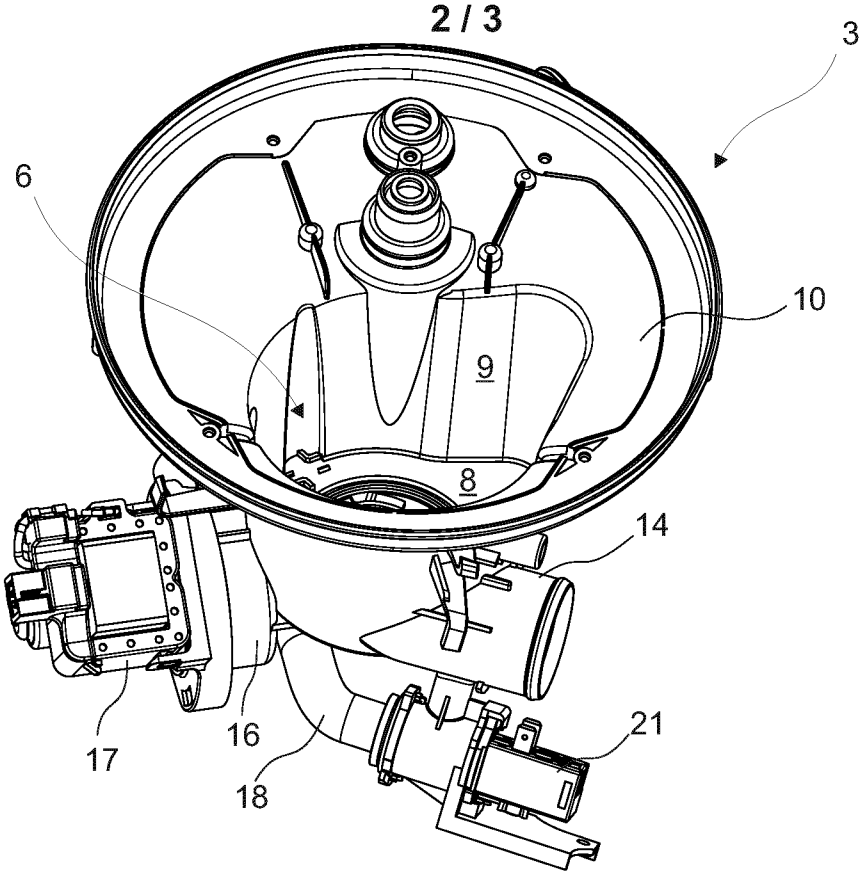


Figure 4

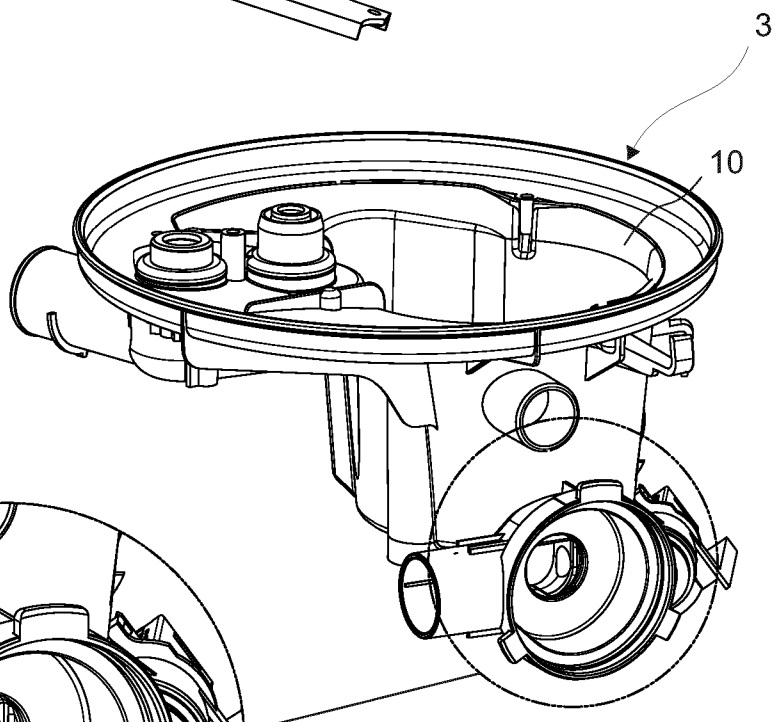


Figure 5

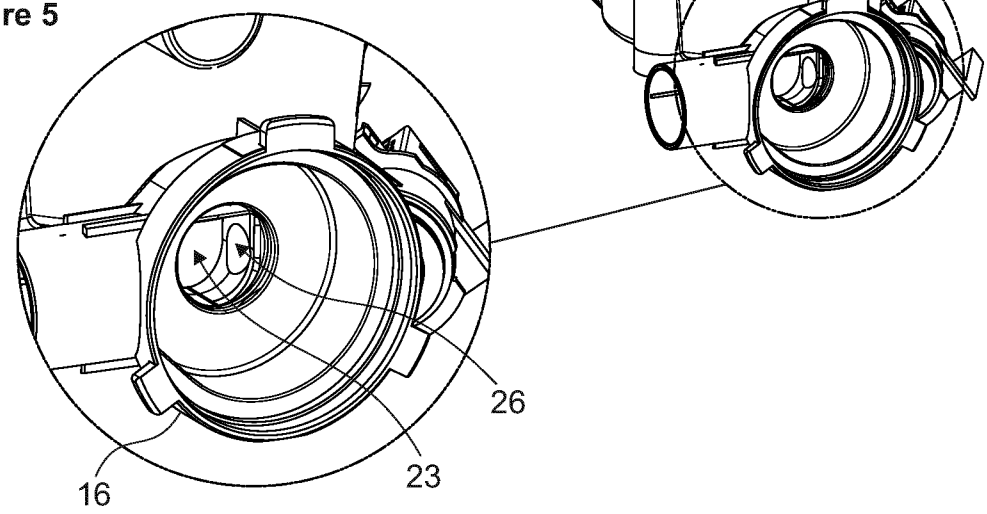


Figure 6

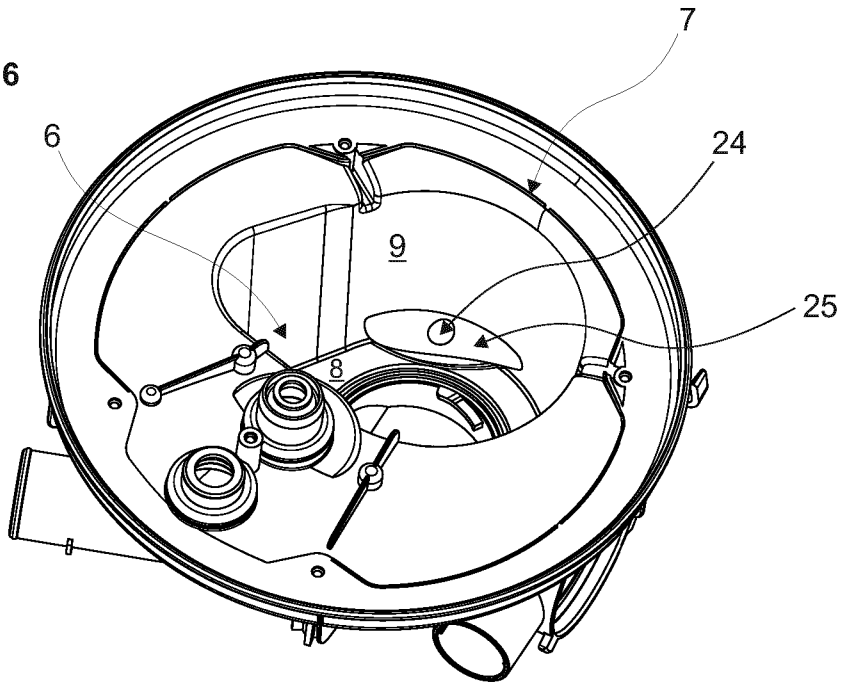
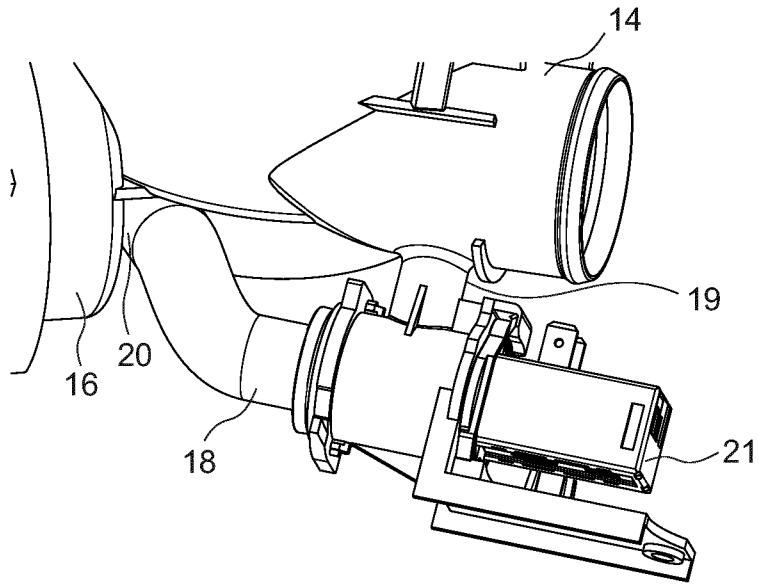


Figure 7



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/081336

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L15/00 A47L15/42
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 156 779 A2 (LG ELECTRONICS INC [KR]) 24 February 2010 (2010-02-24) paragraph [0021] - paragraph [0039]; claim 11; figures 1-5	1-4,6-10
X	EP 2 022 385 A1 (ELECTROLUX HOME PROD CORP [BE]) 11 February 2009 (2009-02-11) paragraph [0060] - paragraph [0061]; figure 6	1,6,8-10
X	US 5 762 080 A (EDWARDS JAMES M [US] ET AL) 9 June 1998 (1998-06-09) column 3, line 16 - column 7, line 59; figures	1,6,8-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
9 May 2016	18/05/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Beckman, Anja

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/081336

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