



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.04.2015 Bulletin 2015/16

(51) Int Cl.:
D06F 39/08 (2006.01) **A47L 15/42 (2006.01)**
E03C 1/10 (2006.01)

(21) Application number: **14188513.7**

(22) Date of filing: **10.10.2014**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Candy S.p.A.**
20900 Monza (MB) (IT)

(72) Inventor: **Fumagalli, Aldo**
I-20900 MONZA, MONZA BRIANZA (IT)

(74) Representative: **Leihkauf, Steffen Falk et al**
Jacobacci & Partners S.p.A.
Via Senato, 8
20121 Milano (IT)

(30) Priority: **11.10.2013 IT MI20131678**
13.05.2014 IT MI20140868

(54) **Laundry treatment machine**

(57) A laundry treatment machine (1,2) comprises a laundry container (3) suitable to contain the laundry to be treated, a treatment device (4;32) that uses water and that cooperates with the laundry container (3), a first supply duct (6) connectable to the water grid and in communication with the treatment device (4;32), wherein the first

supply duct (6) comprises an upright length with an air gap (10) formed between an upper tube end (11) and a lower tube end (12) aligned and facing the upper tube end (11), so as to prevent a water flow back into the water grid.

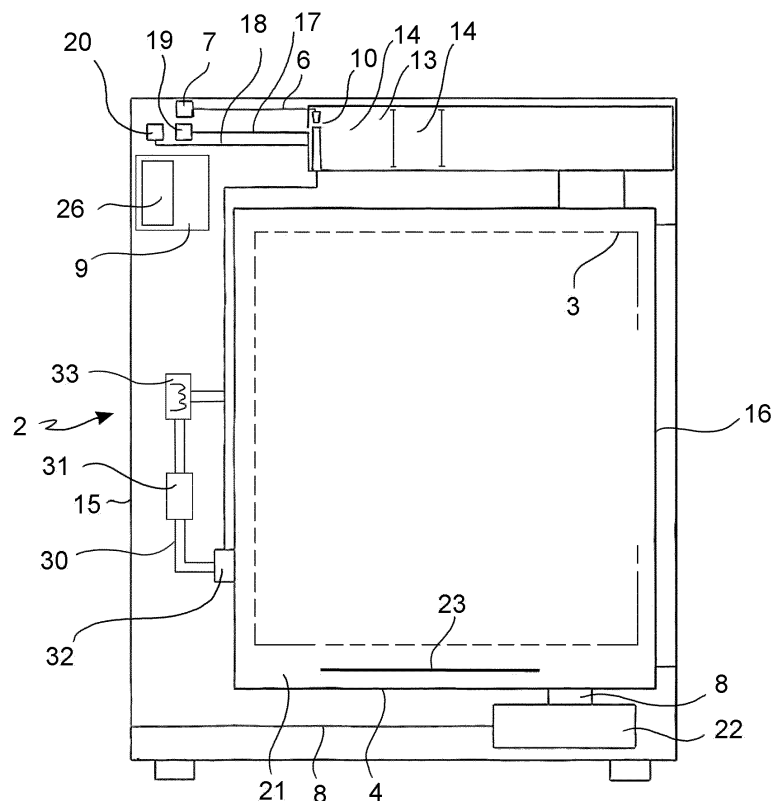


FIG. 1

Description

[0001] The present invention relates to a device for treating laundry by means of water, particularly, a household washing machine, washer dryer machine, or dryer machine.

[0002] The washing and washer dryer machines have to meet stringent regulations with reference to the prevention of the flowback of a liquid (which could be polluted) from the household appliance into the water grid. To this aim, there are tests and regulation constraints, the meeting of which poses expensive and sometimes technically complex design choices.

[0003] This is particularly felt in the case of washer dryer machines ("washer dryers") of the prior art, in which a double-membrane non-return valve is used to prevent water from being able to flow back to the water grid in the case that a vacuum is applied thereto.

[0004] The object of the present invention is to provide a laundry treatment machine using water, having such characteristics as to obviate the drawbacks of the prior art.

[0005] A particular object of the invention is to provide a washing and/or washer dryer machine having such characteristics as to prevent water from flowing back to the water grid in the case of a vacuum applied to the duct in communication with the household appliance, and which is less expensive and/or structurally less complex than the washing and/or washer dryer machines of the prior art.

[0006] A further object of the invention is to propose an alternative solution to the known use of double-membrane non-return valves.

[0007] A further object of the invention is to provide a washing and/or washer dryer machine with an improved water supply system.

[0008] These and other objects are achieved by a laundry treatment machine, comprising:

- a laundry container suitable to contain the laundry to be treated,
- a treatment device that uses water and that cooperates with the laundry container,
- a water loading system having a first supply duct connectable to the water grid and in communication with the treatment device,
- a first supply electrovalve arranged in the first supply duct,
- a drain duct to drain the washing liquid from the treatment device,
- an electronic control unit that controls the first supply electrovalve to supply grid water to the treatment device depending on a predetermined and/or user-selectable treatment program,

characterized in that the first supply duct comprises, downstream of the first supply valve and upstream of the treatment device, an approximately vertical upright

length, with an air gap or interspace formed between an upper tube end and a lower tube end (concentrically) aligned and facing the upper tube end, so as to prevent a water flow back into the water grid.

[0009] This allows obviating complex and expensive double-membrane non-return valves, while ensuring meeting the stringent regulations described in the introduction.

[0010] Further advantageous aspects of the invention will be apparent from the following description of some embodiments thereof by way of non-limiting example, with reference to the appended Figures, in which:

[0011] - Fig. 1 is a schematic view of a laundry treatment machine, particularly a washer dryer machine, according to an embodiment of the invention;

[0012] - Fig. 2 shows an enlarged detail of a water supply system of the treatment machine in Fig. 1;

[0013] - Fig. 3 is an enlarged schematic view of a detail of the water supply system of the treatment machine according to an embodiment;

[0014] - Fig. 4 is a schematic view of a laundry treatment machine, particularly a top-loading washing machine, according to an embodiment;

[0015] - Fig. 5 is a sectional view of an upright length with air gap of a water supply duct of the treatment machine according to an embodiment;

[0016] - Fig. 6 is a schematic view of a laundry treatment machine, particularly a front-loading washing machine, according to an embodiment of the invention;

[0017] - Fig. 7 shows an enlarged detail of a water supply system of the treatment machine in Fig. 6;

[0018] With reference to the figures, and in accordance with a general principle of the invention, a laundry treatment machine, for example a washing machine 1, a washer dryer machine 2, or a dryer machine, comprises a laundry container 3 suitable to contain the laundry to be treated, a treatment device, for example a washing tub 4 or a condensation unit 32, that uses water and that cooperates with the laundry container 3 for the purpose of the treatment (e.g., washing, drying, moisture condensation, etc.) of the laundry, a water loading system having a first supply duct 6 connectable to the water grid and in communication with the treatment device 4, 32, a drain duct 8 for draining the washing liquid from the treatment device 4, 32, a first supply electrovalve 7 arranged in the first supply duct 6, as well as an electronic control unit 9 that drives the first supply electrovalve 7 to supply grid water to the treatment device 4, 32 depending on a predetermined and/or user-selectable treatment program.

[0019] According to an aspect of the invention, the first supply duct 6 comprises, downstream of the first supply valve 7 and upstream of the treatment device 4, 32, an approximately vertical upright length, with an air gap or interspace 10 formed between an upper tube end 11 and a lower tube end 12 (concentrically) aligned with and facing the upper tube end 11, so as to prevent a water flow back into the water grid.

[0020] This allows obviating complex and expensive

double-membrane non-return valves, while ensuring meeting the stringent regulations described in the introduction.

[0021] The laundry treatment machine can be a washing machine 1 (Figs. 4, 6) with a support and housing structure 15, inside which a washing tub 4 is housed (which forms part of the above-mentioned treatment device) provided with a front opening closable by a porthole door 16 frontally hinged to the housing 15. The laundry container 3 is housed inside the washing tub 4 in a rotatable manner about a horizontal or inclined axis, embodied as a perforated drum or bucket to receive the laundry to be subjected to a washing operation. The bucket 3 also defines a front opening arranged at the washing tub 4 opening, in order to be able to carry out the laundry loading and unloading.

[0022] The washing tub 4 is suitable to contain the washing liquid during the laundry washing steps.

[0023] In order to allow the loading of the washing tub 4 with grid water and cleaning substances and additives, the water loading system comprises, beside the first supply duct 6, one or more further supply ducts 17, 18 extending from one or more further supply electrovalves 19, 20 through corresponding detergent compartments 14 of a detergent drawer 13, up to the washing tub 4.

[0024] A drain duct 8 connects to the bottom 21 of the washing tub 4, with associated drain pump 22 which provides for the removal of the washing liquid from the tub 4 and which controls, together with the supply electrovalves 7, 19, 20, the liquid level within the tub 4.

[0025] In order to heat of the washing liquid contained in the tub 4, an electric coil resistor 23 may be provided for, which is arranged inside the tub 4, particularly on the tub bottom 21, in the interspace between the wall of the tub 4 and the laundry basket 3.

[0026] For stirring and mixing the laundry with the washing liquid, the laundry basket 3 may be actuated in rotation by an electric motor 24 and a transmission 25.

[0027] The operation of the washing machine 1 is controlled by an electronic, electric, or electro-mechanical control unit 9, operatively connected to a user control interface 26 which is located at an outer wall of the housing 15 and which allows selecting the washing programs and the characteristics thereof. In response to the selections carried out by the user by the user interface 26, the control unit 9 drives the various components of the washing machine 1.

[0028] The washing machine 1 may further comprise a recirculation system of the washing liquid with a traditional recirculation pump or by an ejector (jet pump) 27 in flow communication with the bottom 21 of the washing tub 4 and the bucket laundry 3.

[0029] In accordance with an aspect of the invention, the first supply duct 6 is so located as to convey the grid water from the first supply electrovalve 7 (preferably directly) into the washing tub 4 and the upright length with the air gap 10 of the first supply duct 6 is advantageously arranged inside the detergent drawer 13.

[0030] This obviates the need to arrange, in the washing machine, an additional space for the air gap 10 and an additional system for the collection and drain of water that is not led away (for example, in the case of an obstruction) by the lower tube 12 of the air gap 10. In fact, the detergent drawer 13 collects and discharges all the liquids directly in the washing tub 4, ensuring that the zone of the air gap 10 always remains clear.

[0031] The characteristics of the treatment machine hereto described with reference to a front-loading washing machine similarly refers to top-loading washing machines (Fig. 4). In such machines, the laundry basket 3 has a loading opening 27, for example, of the shutter type, formed in a side wall of the basket 3 and which can be overlapped by an upper opening 28 of the washing tub 4 and of the support structure 15, which can be closed and opened by a hinged upper lid 29. In the top-loading washing machines, the detergent drawer 13 can be preferably formed or connected directly to the upper lid 29 and is arranged in flow connection with the various ducts at least when the upper lid 29 is closed (operative state of the machine).

[0032] In accordance with a further aspect of the invention, the laundry treatment machine is a dryer machine (not illustrated separately, since Fig. 1 shows a washer dryer machine incorporating, besides to the drying functions, also the washing functions). Besides the general characteristics and functions of the laundry treatment machine according to the invention, the dryer machine comprises a drying circuit with a suctioning group 31, a condensation unit 32, and a heating unit 33 mutually communicating by a drying duct 30 and configured to convey a drying air flow through the laundry container 3, in which the first supply duct 6 is located to convey the grid water from the first supply electrovalve 7 into the condensation unit 32 to cool and condense the moisture extracted from the laundry. In this case, the upright length with the air gap 10 of the first supply duct 6 is arranged upstream of the condensation unit 32.

[0033] In this manner the grid water can sprinkle the condensation unit 32 to extract the moisture from the drying air flow and, in the case that a vacuum was applied upstream of the first supply electrovalve, this would draw only air suctioned through the air gap 10.

[0034] In accordance with a further aspect of the invention, the laundry treatment machine is a washer dryer machine 2 (Fig.1) having the structural and functional characteristics of the washing machine for washing and those of the dryer machine for drying the laundry.

[0035] In this case, the first supply duct 6 can be located to convey the grid water from the first supply electrovalve 7 into the washing tub and/or in the condensation unit 32.

[0036] With further advantage, in the washer dryer machine 2 also, the upright length with the air gap 10 of the first supply duct 6 is arranged inside the detergent drawer 13.

[0037] In this manner, the grid water can sprinkle the

condensation unit 32 to extract the moisture from the drying air flow and/or enter the tub 4 to the purposes of the washing operation, and, in the case that a vacuum was applied upstream of the first supply electrovalve 7, this would draw only air suctioned through the air gap 10.

[0038] Generally, besides the first supply duct 6, the water loading system could comprise:

- a second supply duct 34 connectable to the water grid and in communication with a second treatment device, for example the condensing unit 32, in the case that the washing tub 4 was the first treatment device,
- a second supply electrovalve 35 arranged in the second supply duct 34,

in which the second supply duct 34 also forms, downstream of the second supply valve 35 and upstream of the second treatment device, an approximately vertical upright length, with an air gap or interspace 10 formed between an upper tube end 11 and a lower tube end 12 aligned and facing the upper tube end 11, so as to prevent a water flow back into the water grid,

in which the electronic control unit 9 also drives the second supply electrovalve 35 to supply grid water to the second treatment device depending on the predetermined and/or user-selectable treatment program.

[0039] In the case of the washer dryer machine 2, the first supply duct 6 could be located to supply grid water from the first electrovalve 7 in the washing tub 4, and the second supply duct 34 could be located to supply grid water from the second supply electrovalve 35 to the condensation unit 32. Both the first 6 and second 34 ducts could form the corresponding air gaps 10 in the detergent drawer 13.

[0040] Figs. 3 and 5 illustrate exemplary embodiments of the air gap 10. Advantageously, the upper tube end 11 tapers in a convergent manner downwardly and forms a convergent nozzle that accelerates the water flow so as to create a liquid sheet having a spray with a reduced output width. The liquid exiting the convergent nozzle, passing through the air gap 10, reaches the lower tube end 12 (which may form a funnel-shaped edge 36 to collect the entire flow) located under the convergent nozzle of the upper tube end 11. The height 37 of the air gap, i.e., the vertical distance between the upper 11 and lower 12 tube ends can range from 2mm to 5mm, preferably about 3 mm.

[0041] Although the presence, which is possible, but not indispensable, of the funnel-shaped edge 36, the inner diameter of the lower tube 12 gradually tapers in a convergent manner upwardly moving near to the upper tube 11 end.

[0042] The convergence angle 38 of the upper tube 11 (i.e., the angle between two inner surface portions of the tube in a sectional plane comprising the central axis of the tube) can be advantageously in the range of 12° ... 17.1° ... 22°, while the convergence angle 39 of the lower

tube 12 can be advantageously in the range of 4° ... 5.9° ... 8°.

[0043] The end portions of the upper 11 and lower 12 tubes can be tapered from a maximum diameter 40 of 6mm ... 7.5mm ... 9 to a minimum diameter 41 of 2mm ... 3mm ... 4mm at the free ends facing the air gap 10, see Fig. 5).

[0044] It shall be apparent that, to the laundry treatment machine according to the present invention, those skilled in the art, in order to meet contingent, specific needs, will be able to make further modifications and variations, all of which anyhow fall within the protection scope of the invention, as defined by the following claims.

Claims

1. A laundry treatment machine (1,2), comprising:

- a laundry container (3) suitable to contain the laundry to be treated,
- a treatment device (4;32) that uses water and that cooperates with the laundry container (3),
- a water loading system having a first supply duct (6) connectable to the water grid and in communication with the treatment device (4;32),
- a first supply electrovalve (7) arranged in the first supply duct (6),
- a drain duct (8) to drain the washing liquid from the treatment device (4;32),
- a control unit (9) that controls the first supply electrovalve (7) to supply grid water to the treatment device (4;32) depending on a predetermined and/or user-selectable treatment program,

characterized in that the first supply duct (6) comprises, downstream of the first supply valve (7) and upstream of the treatment device (4;32), an upright length with an air gap (10) formed between an upper tube end (11) and a lower tube end (12) aligned and facing the upper tube end (11), so as to prevent a water flow back into the water grid.

2. The machine (1,2) according to claim 1, which is a washing machine (1), wherein:

- the treatment device comprises a washing tub (4) suitable to contain a washing liquid,
- the laundry container (3) is a perforated laundry basket rotatably arranged inside the washing tub (4), and the first supply duct (6) is located to convey the grid water from the first supply electrovalve (7) into the washing tub (4),
- the water loading system comprises one or more further supply ducts (17,18) extending from one or more further supply electrovalves (19,20), through corresponding detergent com-

partments (14) of a detergent drawer (13), up to the washing tub (4).

3. The machine (1,2) according to claim 1, which is a dryer machine, in which the treatment device comprises a drying circuit with a suctioning group (31), a condensation unit (32), and a heating unit (33) mutually communicating by a drying duct (30) and configured to convey a drying air flow through the laundry container (3) and to extract moisture from the laundry, wherein the first supply duct (6) is located to convey the grid water from the first supply electrovalve (7) into the condensation unit (32) to cool and condense the extracted moisture, wherein the upright length with the air gap (10) of the first supply duct (6) is arranged upstream of the condensation unit (32).

4. The machine (1,2) according to claim 1, which is a washer dryer machine, wherein:

- the treatment device (4;32) comprises a washing tub (4) suitable to contain a washing liquid, and the laundry container (3) is a perforated laundry basket that is rotatably arranged inside the washing tub (4),
- the treatment device further comprises a drying circuit with a suctioning group (31), a condensation unit (32), and a heating unit (33) mutually communicating by a drying duct (30) and configured to convey a drying air flow through the laundry container (3) and to extract moisture from the laundry,
- the water loading system comprises one or more further supply ducts (17,18) extending from one or more further supply electrovalves (19,20), through corresponding detergent compartments (14) of a detergent drawer (13), up to the washing tub (4),

wherein the first supply duct (6) is located to lead the grid water from the first supply electrovalve (7) into the washing tub (4) and/or into the condensation unit (32) to cool and condense the extracted moisture.

5. The machine (1,2) according to claim 2 or 4, wherein the upright length with the air gap (10) of the first supply duct (6) is arranged inside the detergent drawer (13).

6. The machine (1,2) according to one of the preceding claims, wherein the water loading system comprises:

- a second supply duct (34) connectable to the water grid and in communication with a second treatment device (32;4),
- a second supply electrovalve (35) arranged in the second supply duct (34),

wherein the second supply duct (34) forms, downstream of the second supply valve (35) and upstream of the second treatment device (32;4), an upright length with an air gap (10) formed between an upper tube end (11) and a lower tube end (12) aligned and facing the upper tube end (11), so as to prevent a water flow back into the water grid, wherein the control unit (9) also controls the second supply electrovalve (35) to supply grid water to the second treatment device (32,4) depending on the predetermined and/or user-selectable treatment program.

7. The machine (1,2) according to the claims 4 and 6, wherein the first supply duct (6) is located to supply grid water from the first electrovalve (7) in the washing tub (4), and the second supply duct (34) is located to supply grid water from the second supply electrovalve (35) to the condensation unit (32).

8. The machine (1,2) according to claim 7, wherein both the first (6) and second (34) supply ducts form the corresponding air gaps (10) in the detergent drawer (13).

9. The machine (1,2) according to one of the preceding claims, wherein the upper tube end (11) tapers in a convergent manner downwardly and forms a convergent nozzle.

10. The machine (1,2) according to claim 9, wherein an inner diameter of the lower tube (12) gradually tapers in a convergent manner upwardly moving near to the air gap (10).

11. The machine (1,2) according to claim 10, wherein:

- a vertical distance (37) between the upper (11) and lower (12) tube ends is in the range from 2mm to 5mm, preferably about 3 mm,
- a convergence angle (38) of the upper tube (11) is in the range of $12^\circ \dots 17.1^\circ \dots 22^\circ$,
- a convergence angle (39) of the lower tube (12) is in the range of $4^\circ \dots 5.9^\circ \dots 8^\circ$,
- the end portions of the upper (11) and lower (12) tubes are tapered from a maximum diameter (40) of 6mm ... 7.5mm ... 9mm to a minimum diameter (41) of 2mm ... 3mm ... 4mm at the free ends facing the air gap (10).

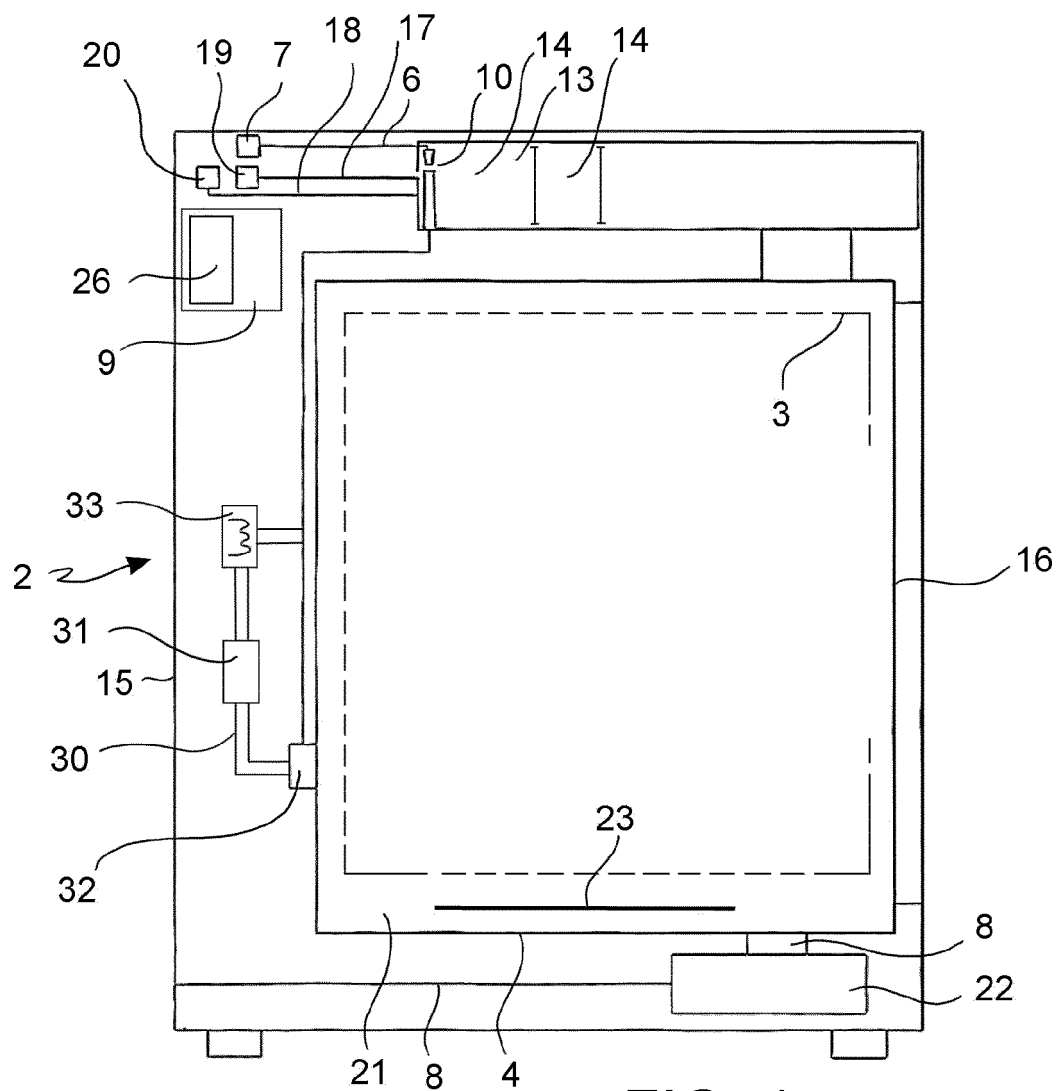


FIG. 1

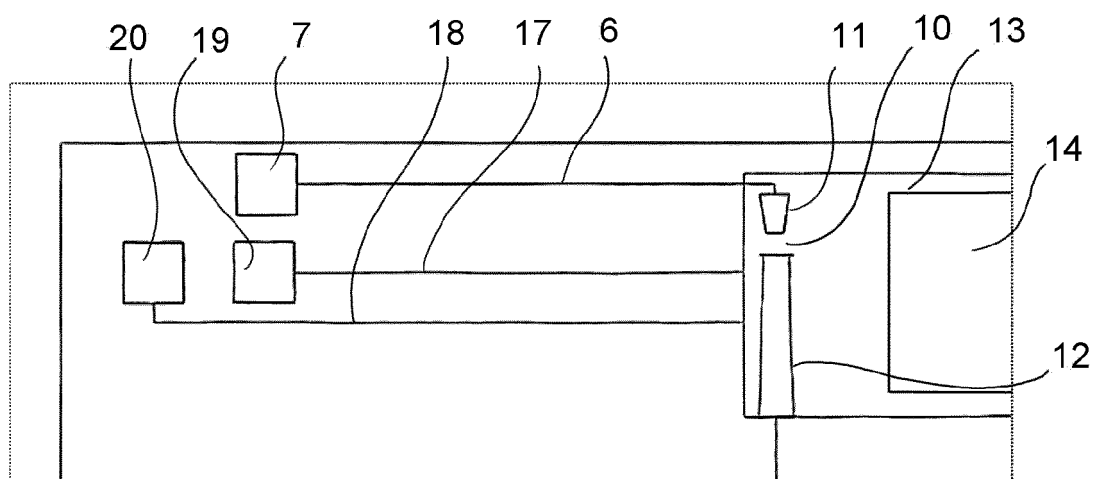


FIG. 2

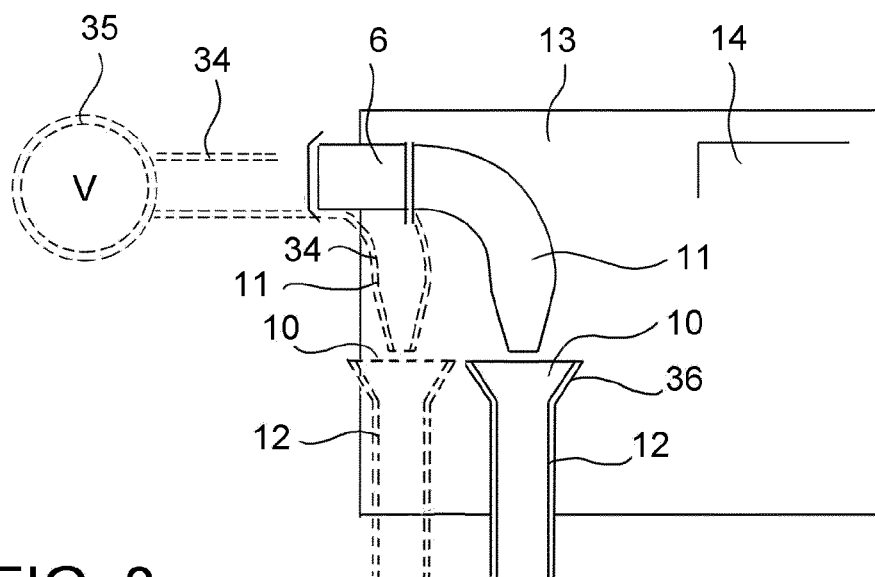


FIG. 3

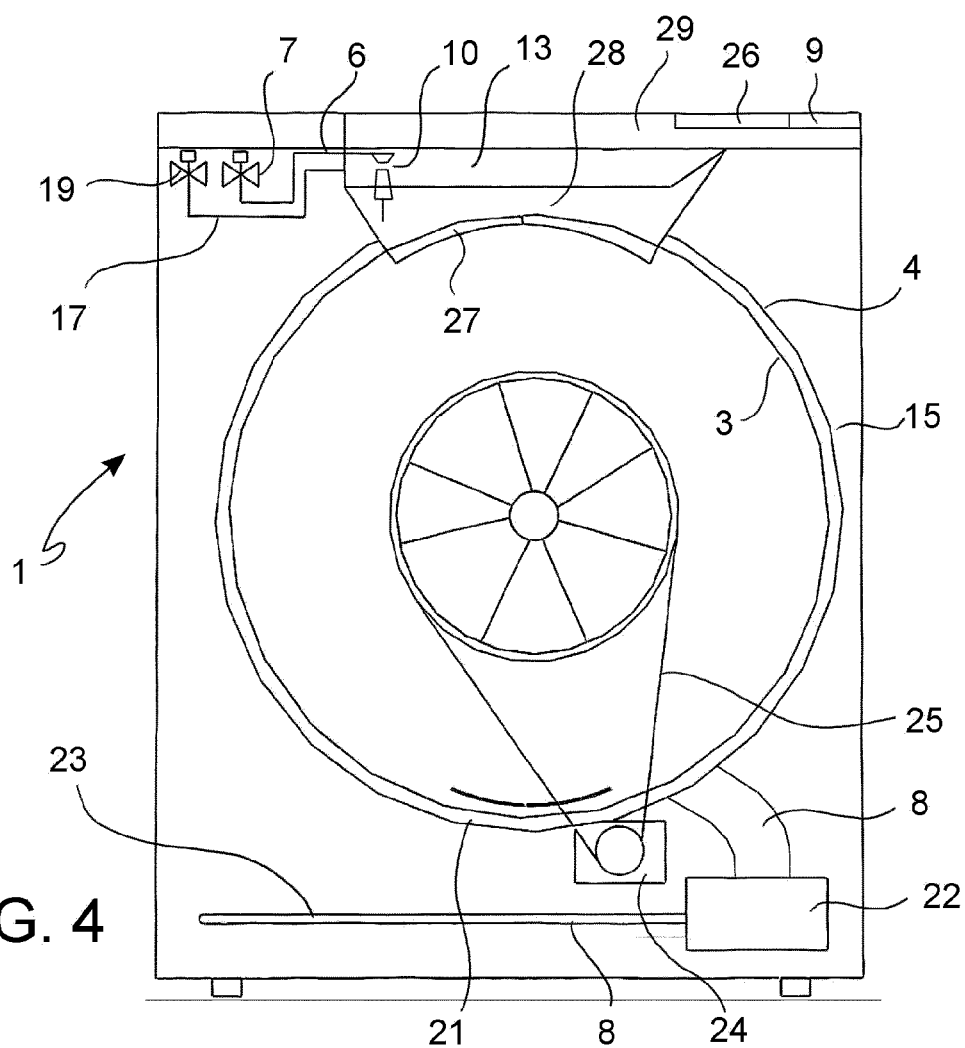


FIG. 4

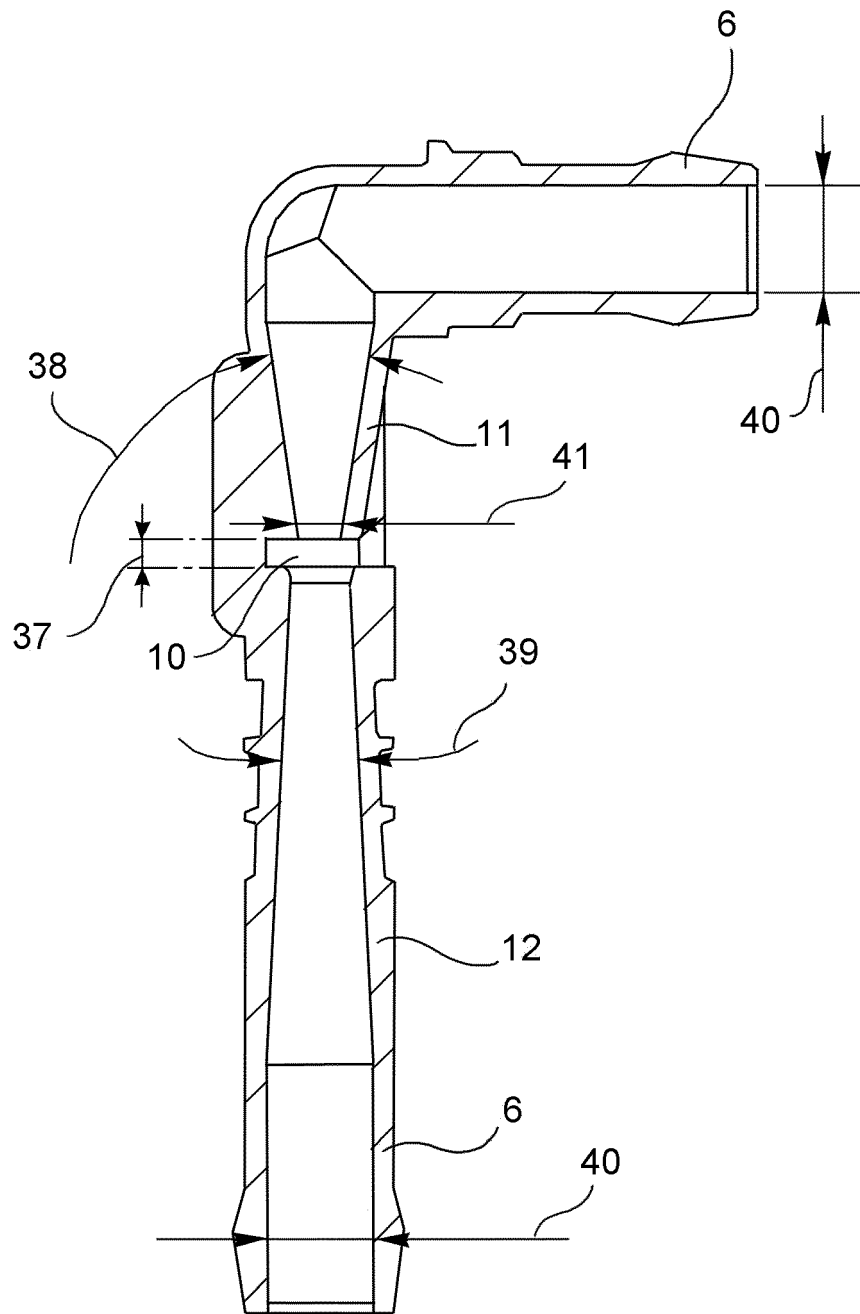
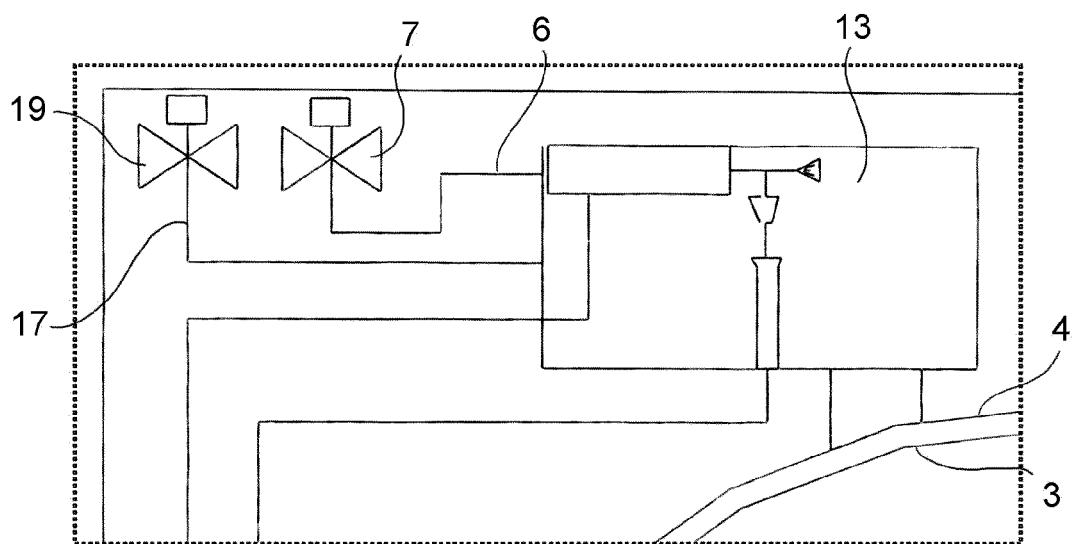
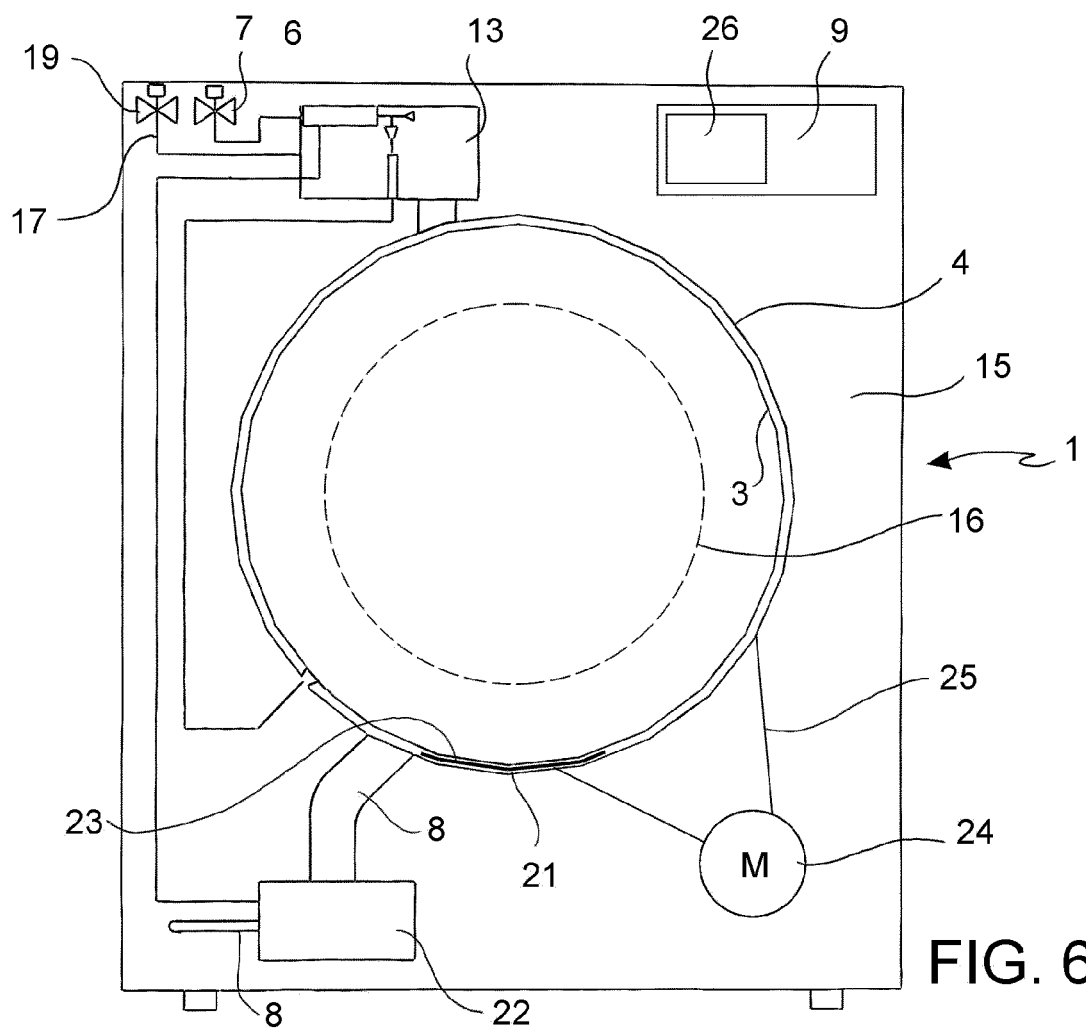


FIG. 5





EUROPEAN SEARCH REPORT

Application Number
EP 14 18 8513

5

10

15

20

25

30

35

40

45

50

55

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	GB 725 031 A (GEN ELECTRIC) 2 March 1955 (1955-03-02) * page 2, line 95 - page 3, line 7; figures 1, 4-5 *	1	INV. D06F39/08 A47L15/42 E03C1/10
A	US 2 619 977 A (HAGEN ROBERT C) 2 December 1952 (1952-12-02) * the whole document *	1-11	
X	US 3 176 484 A (SHELTON WINSTON L) 6 April 1965 (1965-04-06) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F A47L E03C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 February 2015	Examiner Diaz y Diaz-Caneja
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 14 18 8513

5

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.

19-02-2015

10

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 725031	A	02-03-1955	NONE	
US 2619977	A	02-12-1952	NONE	
US 3176484	A	06-04-1965	NONE	

15

20

25

30

35

40

45

50

55

EPO FORM P0459

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