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Remarks:

Amended claims in accordance with Rule 137(2) EPC.

(54) **Apparatus for circulating flows of washing and rinsing liquids in a laundry washing machine**

(57) Apparatus for circulating flows of washing and rinsing liquids in a laundry washing machine of the type comprising a tank (2), a drum (3) for the laundry to be washed arranged so as to be able to rotate inside the tank, a plurality of nozzles (4a) for releasing the liquids into the tank (2) and an opening (6) in the base of the tank (2) for the discharge of said liquids, said apparatus comprising a reservoir (1) arranged below the base of the tank (2) and able to hold a predetermined amount of washing or rinsing liquid, said reservoir being hydraulically connected to said nozzles (4a), to said opening (6) in the base of the tank (2) and to an outlet (15) outside the machine and being provided with a longitudinal axis (X-X) which extends between two opposing end walls (7,8), a base wall (9), a top wall (10) and side walls (11,12) extending parallel to said longitudinal axis (X-X), first pumping elements (13) for circulating liquids from the reservoir (1) to the tank (2) and vice-versa, second pumping elements (14) for discharging liquids from the reservoir (1) and from the machine, heating means (20) arranged inside the reservoir (1) and elements (23,24) for filtering liquids circulating in the reservoir (1).

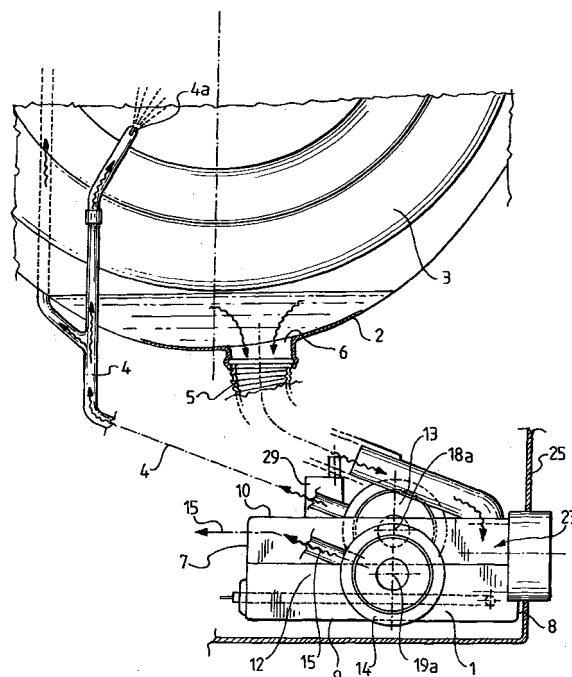


Fig.2

Description

[0001] The present invention relates to an apparatus for circulating flows of washing and rinsing liquids in a laundry washing machine of the type comprising a tank, a drum for the laundry to be washed arranged rotatably inside the tank, a plurality of nozzles for releasing the liquids into the tank and an opening in the base of the tank for the discharge of said liquids, said apparatus comprising a reservoir arranged below the base of the tank and able to hold a predetermined amount of washing or rinsing liquid, said reservoir being hydraulically connected to said nozzles, to said opening in the base of the tank and to an outlet outside the machine and being provided with a longitudinal axis which extends between two opposing end walls, a base wall, a top wall and side walls extending parallel to said longitudinal axis, first pumping elements for circulating liquids from the reservoir to the tank and vice-versa, second pumping elements for discharging liquids from the reservoir and from the machine,

heating means arranged inside the reservoir and elements for filtering the liquids circulating in the reservoir. **[0002]** Apparatuses of the type mentioned above are known in the art and the various component parts, in particular the recirculation and discharge pumps and the filtering elements, are usually arranged in the lower portion of the laundry washing machine, below the tank and fixed to the frame thereof set apart from one another depending on the available space. It is thus necessary for such components parts to be connected to one another and to the tank via flexible or rigid tubes, which leads to the formation of substantially extended hydraulic circuits.

[0003] Therefore, according to the known art, when the machine is in operation not only the amount of laundry to be washed and the machine volumes which are strictly operational during washing and rinsing, but also the volume of the tubes which form the hydraulic circuit connecting the various components must be taken into consideration when determining the amount of liquid necessary for correct functioning of the machine, this liquid normally being water with detergent during the washing stages and only water during the rinsing stages.

[0004] It follows that the amount of liquid is greater than that strictly necessary for washing a specific amount of laundry, having an adverse effect on the energy consumption for heating and circulation and thus lower overall energy efficiency of the machine in general.

[0005] The object of the present invention is to try to reduce the energy consumption of a laundry washing machine functioning with a reduced amount of liquids circulating therein during both the washing and rinsing stages.

[0006] The object is achieved with the apparatus according to claim 1 below.

[0007] The invention will now be described in greater detail with reference to various exemplary and non-limiting embodiments illustrated in the accompanying drawings, in which:

- Fig. 1 is an overall perspective schematic view of a laundry washing machine incorporating the apparatus according to the invention;
- Fig. 2 schematically shows the apparatus according to the invention arranged below the tank of a laundry washing machine;
- Fig. 3 is a plan view, partly in section, of a first embodiment of the apparatus according to the invention;
- Fig. 4 is a partial sectional view of the apparatus taken along axis X-X of the reservoir;
- Fig. 5 is a partial sectional view of the apparatus taken along line V-V of Fig. 2;
- Fig. 6 is a plan view, partly in section, of a second embodiment of the apparatus;
- Fig. 7 is a plan view, partly in section, of a third embodiment of the apparatus.

[0008] With particular reference to Figs. 1 to 5, the apparatus, in accordance with the invention, comprises a reservoir 1 for installation in the laundry washing machine below the tank 2, in which a drum 3 is conventionally arranged so as to be able to rotate and into which the laundry to be washed is placed.

[0009] The reservoir 1, designed to contain at least a substantial portion of the amount of liquid used during washing and/or rinsing operations, depending on the operative phase of the machine, is connected in a conventional manner to the tank 2 via a hydraulic feed connection illustrated by the line 4 shown in Figs. 1 and 2 and via a return connection illustrated by the conduit 5.

[0010] The feed connection 4 is directed to the nozzles 4a for feeding liquid into the tank whilst the return connection 5 comes from the discharge opening 6 in the base of the tank 2.

[0011] The reservoir 1 has a longitudinal axis X-X which extends between the opposing end walls 7 and 8 and comprises a base wall 9, a top wall 10 and side walls 11 and 12 which extend parallel to the axis X-X.

[0012] In accordance with the invention, the apparatus comprises first pumping elements 13 for circulating liquid from the reservoir 1 to the tank 2 and vice-versa, and second pumping elements 14 for discharging liquid from the reservoir 1 and from the machine via an evacuation conduit indicated by the reference numeral 15 in Figs. 2 and 3.

[0013] The pumping elements 13 and 14, preferably formed by conventional centrifugal pumps, are controlled by respective electric motors indicated by reference numerals 16 and 17 in the drawings.

[0014] In accordance with the invention, in the embodiment shown in Figs. 2, 3, 4 and 5, the pumps 13 and 14 are directly arranged on the walls 11 and 12 of the reservoir 1 respectively and communicate with the interior thereof via respective openings 18 and 19 formed in the walls 11 and 12 of the reservoir 1.

[0015] The central axis of symmetry 18a of the opening 18 associated with the pump 13 for recirculating liquid

inside the tank 2 is perpendicular to the axis X-X of the reservoir 1 and is arranged in the region of the reservoir between said longitudinal axis X-X and the top wall 10 of the reservoir 1.

[0016] The central axis of symmetry 19a of the opening 19, associated with the pump 14 for discharging and evacuating liquid from the reservoir 1, for example at the end of washing cycles, is also perpendicular to the longitudinal axis X-X of the reservoir 1 and is arranged in a region of the reservoir in such a way that the lower edge 19b of the opening 19 is positioned between the longitudinal axis X-X of the reservoir and the base wall 9 thereof, remaining, however, higher than the heating means 20 arranged inside the reservoir 1 so as to avoid exposing said heating means at the end of a liquid discharge phase.

[0017] In particular, the distance between the axis 18a of the opening connected to the recirculation pump 13 and the axis 19a of the opening connected to the discharge pump 14 is advantageously maintained at approximately 35 mm taking into account that the overall volume of the reservoir 1 must not exceed 600 ml.

[0018] Such heating means are conventionally formed by an electrical resistance fed via the terminals 21 and 22.

[0019] In accordance with the embodiment of Figs. 2, 3, 4 and 5, the apparatus also comprises filtering elements, indicated as a whole with reference numeral 23, arranged in a socket 24 formed in the reservoir 1 through the wall 8 thereof and accessible from outside the profile 25 of the laundry washing machine in a conventional manner via a cover 26.

[0020] The socket 24 communicates with the interior of the reservoir 1 via the opening 27 and with the conduit 5, coming from the tank 2, via the opening 28.

[0021] The filtering elements 23, however, remain positioned in the hydraulic path coming from the tank 2 before both the recirculation pump 13 and the discharge pump 14 and mounted on the reservoir 1 with the substantial elimination of external connecting tubes.

[0022] The apparatus is completed with a pressure regulator 29 which is also mounted on the reservoir 1.

[0023] With reference to the embodiment shown in Fig. 6, in which parts similar or equivalent to those in the embodiment of Figs. 2, 3, 4 and 5 have like reference numerals, it can be seen that the recirculation pump 13 and the discharge pump 14 are mounted on the reservoir 1 on the same wall, in this case on the wall 11.

[0024] The filtering elements 23 are positioned before the discharge pump 14 and therefore are active only when liquid is discharged from the reservoir 1 and not during recirculation, as is the case in the embodiment of Figs. 2, 3, 4 and 5.

[0025] With reference to Fig. 7 a different positioning of the recirculation 13 and discharge 14 pumps can be seen, in accordance with which the central axis of the openings in the reservoir connected to the pumps is arranged parallel to the longitudinal axis X-X of the reservoir 1.

[0026] As a result of the description above, the apparatus according to the invention is presented as a compact module of interconnected elements with no hydraulic conduits and therefore with a substantial reduction in the volumes which are to be filled with washing and recirculation liquids, with the advantage of savings in the amount of energy consumed by the machine when it is in operation.

Claims

1. Apparatus for circulating flows of washing and rinsing liquids in a laundry washing machine of the type comprising a tank (2), a drum (3) for the laundry to be washed arranged so as to be able to rotate inside the tank, a plurality of nozzles (4a) for releasing the liquids into the tank (2) and an opening (6) in the base of the tank (2) for the discharge of said liquids, said apparatus comprising a reservoir (1) arranged beneath the base of the tank (2) and able to hold a predetermined amount of washing or rinsing liquid, said reservoir being hydraulically connected to said nozzles (4a), to said opening (6) in the base of the tank (2) and to an outlet (15) outside the machine and being provided with a longitudinal axis (X-X) which extends between two opposing end walls (7, 8), a base wall (9), a top wall (10) and side walls (11, 12) extending parallel to said longitudinal axis (X-X), first pumping elements (13) for circulating liquids from the reservoir (1) to the tank (2) and vice-versa, second pumping elements (14) for discharging liquids from the reservoir (1) and from the machine, heating means (20) arranged inside the reservoir (1) and elements (23, 24) for filtering liquids circulating in the reservoir (1), **characterised in that** at least said first (13) and said second (14) pumping elements are fixed directly onto one of the walls of said reservoir (1).
2. Apparatus according to claim 1, **characterised in that** said first (13) and said second (14) pumping elements are both mounted on the same side wall (11) of the reservoir (1).
3. Apparatus according to claim 1, **characterised in that** said first (13) pumping elements are mounted on one (11) of the walls of the reservoir (1) whilst said second pumping elements (14) are mounted on the opposing wall (12) of the reservoir (1).
4. Apparatus according to claims 1 to 3, **characterised in that** said first (13) and said second (14) pumping elements are connected to the interior of said reservoir (1) via openings (18, 19) formed in the respective walls of the reservoir (1), said openings each being provided with a central axis (18a, 19a) arranged perpendicular to said longitudinal axis (X-X) of the res-

ervoir (1).

5. Apparatus according to claims 1 to 3, **characterised in that** said first (13) and said second (14) pumping elements are connected to the interior of said reservoir (1) via openings (18, 19) formed in the respective walls of the reservoir, said openings (18, 19) each being provided with a central axis (18a, 19a) arranged parallel to said longitudinal axis (X-X) of the reservoir (1). 5
6. Apparatus according to either claim 4 or claim 5, **characterised in that** the central axis (18a) of the opening (18) connected to the first said pumping elements (13) for circulating liquids into and from the tank (2) of the laundry washing machine, is arranged in the region of the reservoir (1) between the longitudinal axis (X-X) of the reservoir and the top wall (10) thereof. 10
7. Apparatus according to either claim 4 or claim 5, **characterised in that** the central axis (19a) of the opening (19) connected to said second pumping elements (14) for discharging liquids from the reservoir (1) and from the machine is arranged in a region of the reservoir (1) in such a way that the lower edge (19b) of the opening is positioned between the longitudinal axis (X-X) of the reservoir (1) and the base wall (9) thereof, remaining at a level higher than that where said heating means (20) are positioned. 15
8. Apparatus according to claim 1, **characterised in that** said elements (23, 24) for filtering liquid are positioned on said reservoir (1) and are arranged in the path of fluid issuing from the tank (2) of the machine to the reservoir (1) before said first pumping elements (13). 20
9. Apparatus according to claim 8, **characterised in that** said elements (23, 24) for filtering liquid are fixed to one (11) of said walls of the reservoir (1) which extend parallel to the longitudinal axis (X-X) thereof. 25
10. Apparatus according to claim 1, **characterised in that** said elements (23, 24) for filtering liquid are positioned on said reservoir (1) and are fixed on one (8) of said end walls of the reservoir and are arranged in the path of fluid between said reservoir (1) and said second pumping elements (14) for discharging liquids from the reservoir and from the machine. 30

Amended claims in accordance with Rule 137(2) EPC. 35

1. Apparatus for circulating flows of washing and rinsing liquids in a laundry washing machine of the type comprising a tank (2), a drum (3) for the laundry 40

to be washed arranged so as to be able to rotate inside the tank, a plurality of nozzles (4a) for releasing the liquids into the tank (2) and an opening (6) in the base of the tank (2) for the discharge of said liquids, said apparatus comprising a reservoir (1) arranged beneath the base of the tank (2) and designed to contain a substantial portion of the amount liquid used during washing or rinsing operation, said reservoir being hydraulically connected to said nozzles (4a), to said opening (6) in the base of the tank (2) and to an outlet (15) outside the machine and being provided with a longitudinal axis (X-X) which extends between two opposing end walls (7, 8), a base wall (9), a top wall (10) and side walls (11, 12) extending parallel to said longitudinal axis (X-X), first pumping elements (13) for circulating liquids from the reservoir (1) to the tank (2) and vice-versa, second pumping elements (14) for discharging liquids from the reservoir (1) and from the machine, heating means (20) arranged inside the reservoir (1) and elements (23, 24) for filtering liquids circulating in the reservoir (1), **characterised in that** at least said first (13) and said second (14) pumping elements are fixed directly onto one of the walls of said reservoir (1) and are connected to the interior of said reservoir (1) via respective openings (18,19 forming in the walls of the reservoir. 45

2. Apparatus according to claim 1, **characterised in that** said first (13) and said second (14) pumping elements are both mounted on the same side wall (11) of the reservoir (1). 50

3. Apparatus according to claim 1, **characterised in that** said first (13) pumping elements are mounted on one (11) of the walls of the reservoir (1) whilst said second pumping elements (14) are mounted on the opposing wall (12) of the reservoir (1). 55

4. Apparatus according to claims 1 to 3, **characterised in that** said openings (18,19) each are provided with a central axis (18a, 19a) arranged perpendicular to said longitudinal axis (X-X) of the reservoir (1).

5. Apparatus according to claims 1 to 3, **characterised in that** said openings (18, 19) each are provided with a central axis (18a, 19a) arranged parallel to said longitudinal axis (X-X) of the reservoir (1).

6. Apparatus according to either claim 4 or claim 5, **characterised in that** the central axis (18a) of the opening (18) connected to the first said pumping elements (13) for circulating liquids into and from the tank (2) of the laundry washing machine, is arranged in the region of the reservoir (1) between the longitudinal axis (X-X) of the reservoir and the top wall (10) thereof.

7. Apparatus according to either claim 4 or claim 5,
characterised in that the central axis (19a) of the

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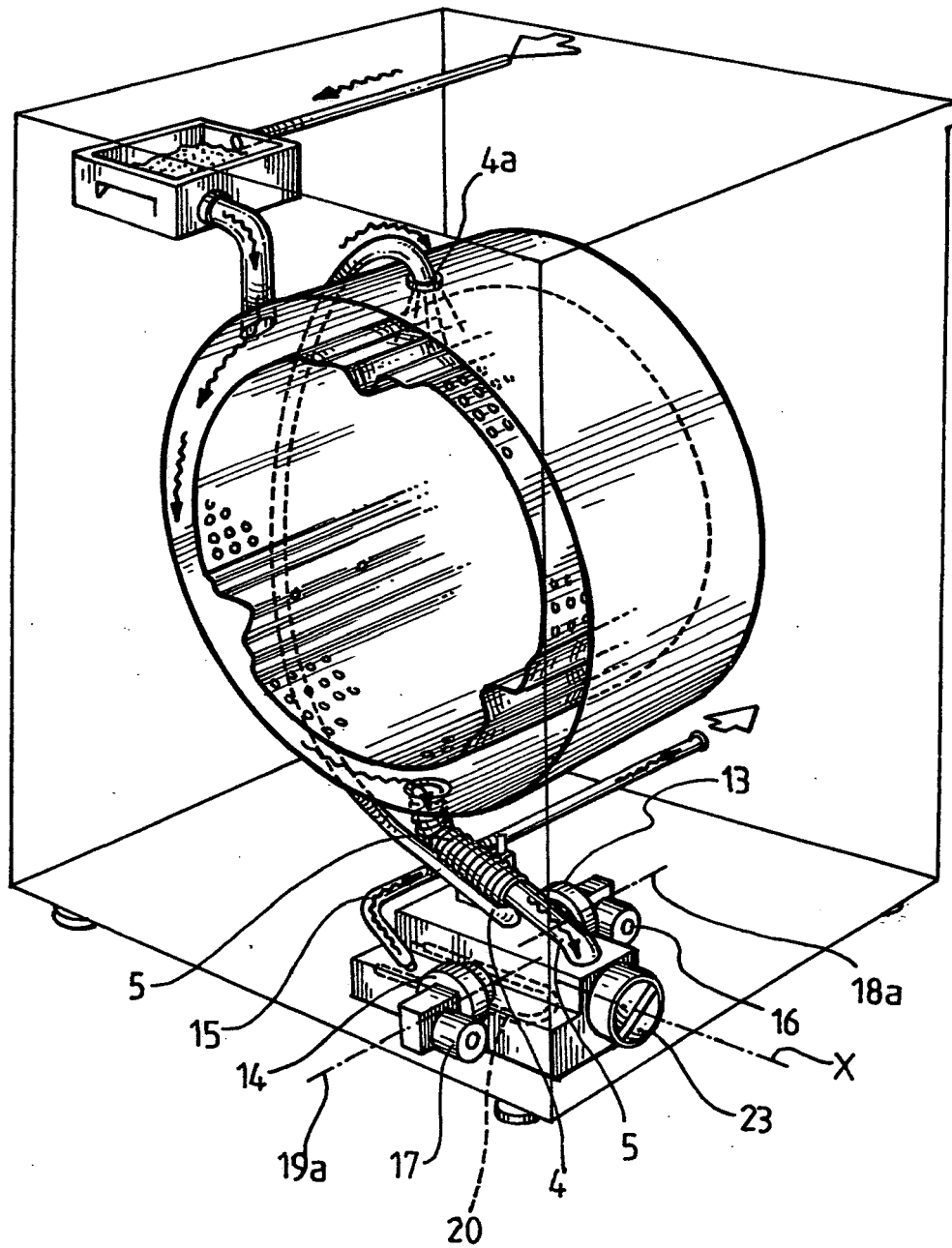


Fig. 1

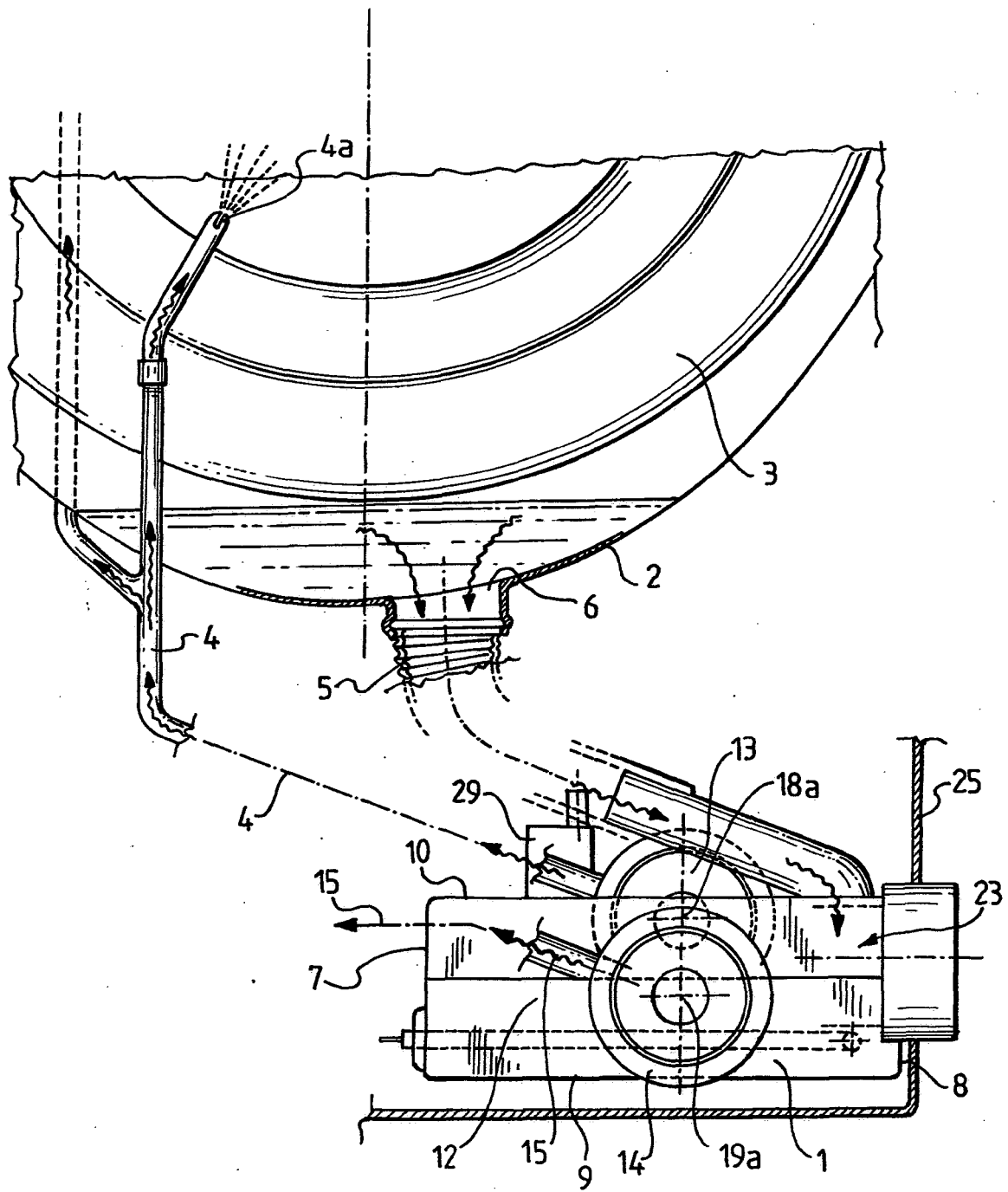


Fig. 2

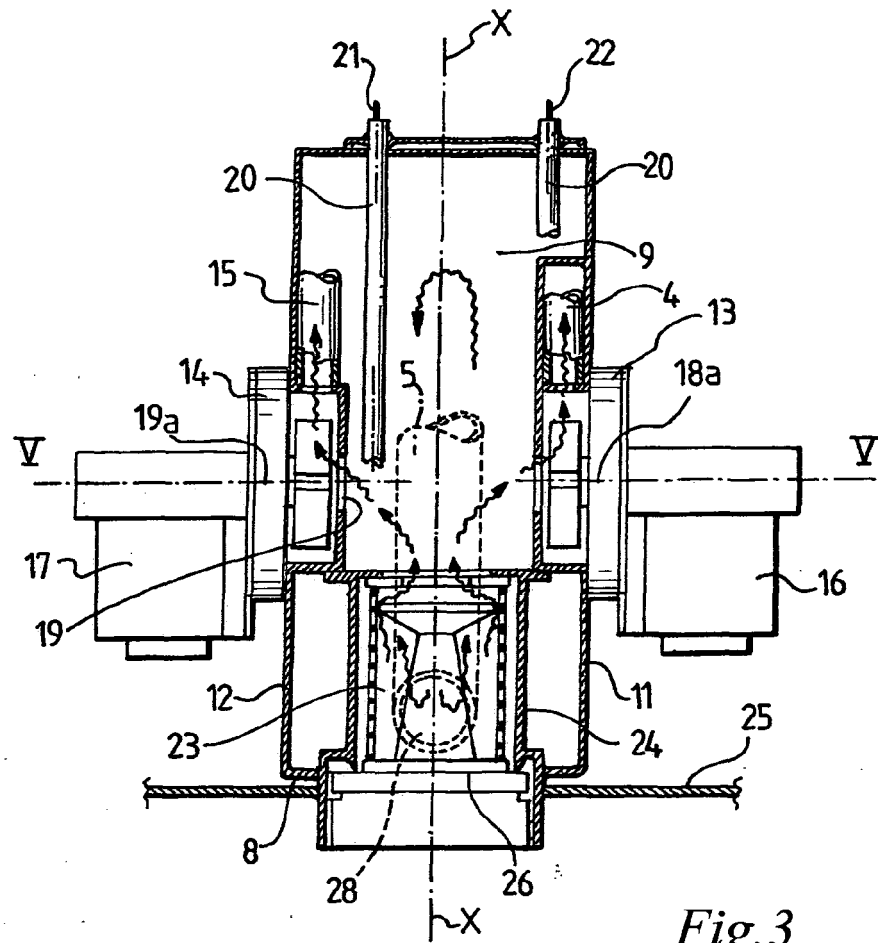


Fig. 3

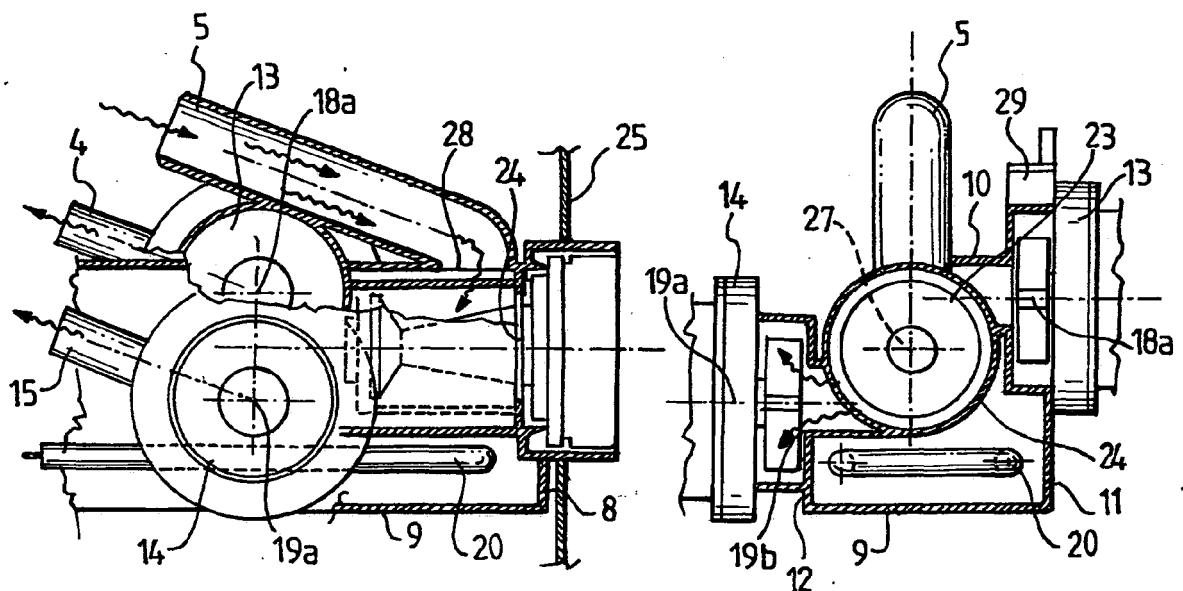


Fig. 4

Fig. 5

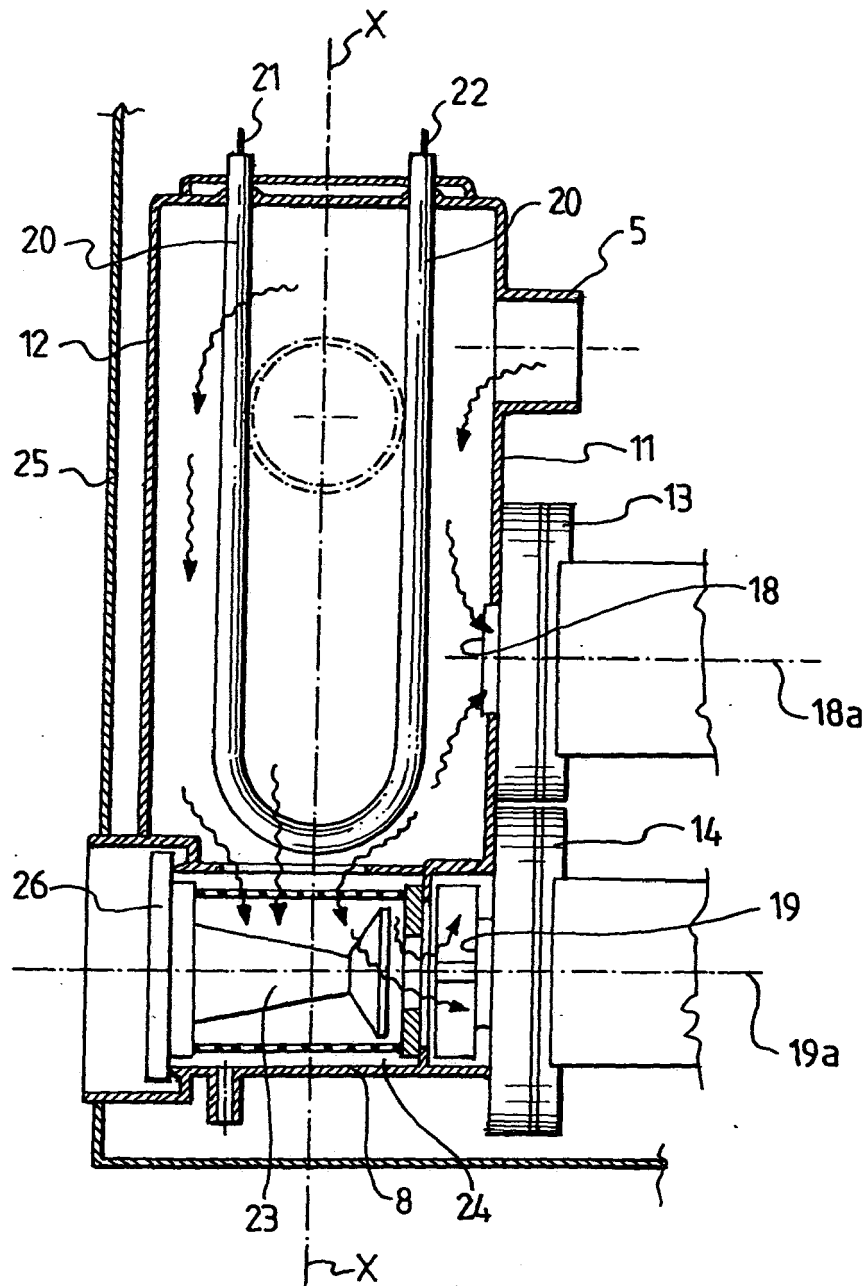


Fig. 6

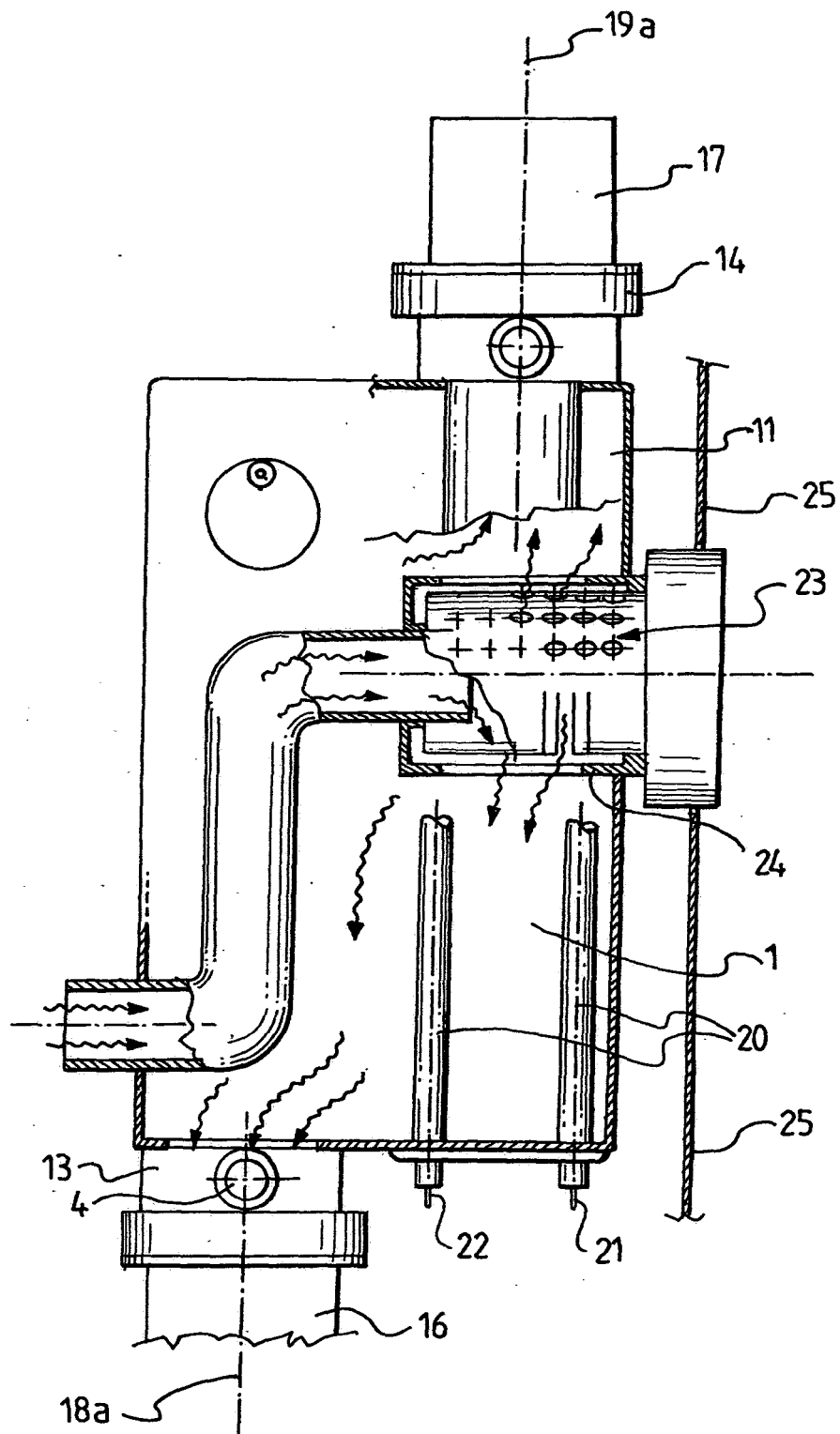


Fig. 7



EUROPEAN SEARCH REPORT

Application Number
EP 08 42 5443

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 6 167 733 B1 (LEE SANG DAE [KR]) 2 January 2001 (2001-01-02) * column 4, lines 28-39; figures 3,4 *	1-10	INV. D06F39/08 A47L15/42
A	US 2006/000240 A1 (SONG CHANG M [KR]) 5 January 2006 (2006-01-05) * paragraph [0037]; figures 2,3 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F A47L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 November 2008	Examiner Dupuis, Jean-Luc
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 42 5443

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
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19-11-2008

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