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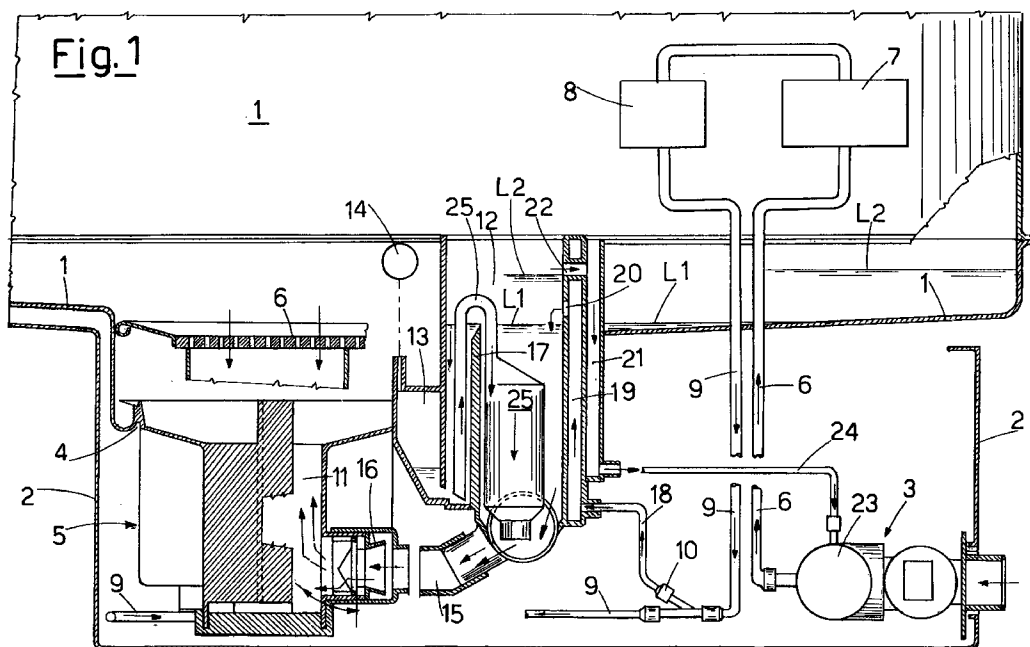
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(54) Device for controlling the feed of washing liquid in a dishwasher machine

(57) A device for controlling the feed of washing liquid in a dishwasher machine comprises a first tank (12) branching off at the supply of liquid from a feed solenoid valve (3) to a washing tub (1) of the dishwasher in order to receive a first smaller fraction of the liquid, and level detector means (13,14,17), related to the first tank, for commanding the closure of the feed solenoid valve (3) when the level of the liquid in the first tank (12) exceeds a first preset level (L1); the first tank (12) is connected to

the washing tub (1) by valve means (16) suitable for allowing the passage of a flow of liquid from the first tank (12) to the tub (1) but not vice versa, and which, during feeding of the liquid, are maintained open by the flow of liquid which flows from the first tank (12) to the tub (1), so that the level of liquid in the latter coincides with the level of the liquid in the first tank (12); the first preset level (L1) is the level of liquid which is required in the washing tub (1) at the end of the feed.

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Description

The present invention relates to a device for controlling the feed of washing liquid in a dishwasher machine.

The importance of fitting dishwashers with devices for controlling the volume of liquid fed into the washing tub is known.

Known control devices are substantially of three types: those for direct control in the tub, partialising ones and volumetric ones.

In the so-called type for "direct control in the tub", a pressure chamber is located at the top of a liquid column leading into the washing tub, so that the pressure in the pressure chamber is proportional to the level of liquid in the tub. The pressure chamber is connected to a pressure switch which, when the pressure exceeds a given value, interrupts the flow of liquid in the tub.

A problem affecting the systems of direct control in the tub lies in the possibility of the dirt and greasy deposits incorporated in the washing liquid causing clogging of the column whereto the pressure chamber is connected and the loss of efficacy of the control device.

A "partialising" control device is for example described in the Italian patent application no. MI92A000957; the device comprises a measuring tank branching off at the water feed pipe from a feed solenoid valve to the washing tub. The flow of water entering the dishwasher is divided between the washing tub and the measuring tank (thus the term "partialiser"); a pressure switch detects the level of the water in the measuring tank (a level which is proportional to the level in the tub and which is translated into the pressure of the air inside the tank) and interrupts the inflow of water, closing the solenoid valve, when this level reaches the required value.

In order to prevent, after closure of the feed solenoid valve, the measuring tank from emptying into the tub and disabling the pressure switch (which would delete the memory of the device and allow a new feed of water by manual operation), a solenoid valve must be provided between the measuring tank and the tub, which solenoid valve is only opened when water is discharged from the tub.

A "volumetric" control device is for example described in the Italian patent application no. MI94A000353. In this device the liquid is fed by the decanting principle, feeding specific volumes of liquid into a measuring tank and decanting the liquid into the washing tub. Therefore a control is not kept of the effective level of liquid in the tub, but instead of the volume of liquid which is fed.

In view of the state of the art described, the object of the present invention is that of providing a new type of device for controlling the feed of washing liquid in a dishwasher.

In accordance with the present invention, this object is achieved thanks to a device for controlling the feed of washing liquid in a dishwasher, comprising a first tank branching off at the supply of liquid from a feed solenoid

valve to a washing tub of the dishwasher so as to receive a first smaller fraction of said liquid, and level detector means connected to said first tank for commanding closure of the feed solenoid valve when the level of liquid in said first tank exceeds a first preset level, characterised in that said first tank is connected to the washing tub by valve means suitable for allowing the passage of a flow of liquid from the first tank to the tub but not vice versa and which, during the feed of liquid, are maintained open by the flow of liquid which flows from the first tank to the tub, so that the level of liquid in the latter coincides with the level of liquid in the first tank, said first preset level being the level of liquid which is required in the washing tub at the end of the feed.

Thanks to the present invention, it is possible to provide a control device substantially of the partialising type, wherein however the closure of the feed solenoid valve is linked to the preset level of liquid being reached in the tub, similarly to the process in devices for direct control in the tub. The presence of the valve means which allow the liquid to pass only from the tank to the tub prevents the dirt and greasy residues in the washing liquid from clogging the control device.

These and other features of the present invention will be made clearer from the following detailed description of some of its embodiments, illustrated by way of non-limiting examples in the accompanying drawings, in which:

Figure 1 is a schematic view sectioned along a vertical plane of a dishwasher fitted with a control device according to a first embodiment of the present invention;

Figure 2 is a plan view of the tub;

Figure 3 is a view similar to that of Figure 1, showing a second embodiment of the present invention;

Figure 4 is a view on an enlarged scale of a detail of the device of Figure 3;

Figure 5 is a plan view similar to that of Figure 2;

Figure 6 is a view similar to that of Figure 3, showing a third embodiment of the invention;

Figure 7 shows a variant of the embodiment of Figure 6.

With reference to Figure 1, a washing tub 1 of a dishwasher is shown, partially sectioned along a vertical plane. The tub 1 is enclosed in a framework 2 forming the external casing of the dishwasher. Mounted on said framework 2 is a feed solenoid valve 3, connected externally to a pipe for feeding clean water (not shown in that known).

At the bottom of the tub 1, below an opening 4, a sump 5 is mounted in a known manner and has a sub-

stantially elliptic shape (Figure 2). This leads into the washing tub 1 via a filtering plate 6. The sump 5 is connected to a washing pump and a drain pump (not shown in that known); the washing pump feeds spraying rotors positioned inside the washing tub 1.

Flowing out from the feed solenoid valve 3 the clean water is sent, via a conduit 6, to a mandatory air break device 7, and from the latter to a decalcifier (neither shown in that known and for example described in detail in the patent application no. MI94A000353).

The decalcified water flows out from the decalcifier 8 and is sent, via a conduit 9, to the bottom of the sump 5. A partialising nozzle also branches off at the conduit 9, via which nozzle the decalcified water is fed to a device for controlling the feed of water in the tub 1.

The control device substantially comprises a tank 12 with an associated pressure chamber 13 which is connected to a pressure switch 14. A conduit 18 connects the partialising nozzle 10 to the base of a feed column 19 formed in the tank 12 and having the function of preventing, during feeding of the tank 12, the water from creating foam. The feed column 19 leads at its top into the tank 12 via an opening 20. Inside the tank 12 there is also a baffle 17 which extends from the bottom of the tank 12 to a predefined height, which height, when the tank is installed on the dishwasher, coincides with the level of water L1 ("static" level) which is required in the washing tub 1.

The bottom of the tank 12 is connected to the sump 5 by means of a conduit 15 and a check valve 16 which engages horizontally in a vertical wall of the sump 5. The check valve 16 is such as to allow water to flow only in the direction which goes from the conduit 15 to the sump 5, and not in the opposite direction. The check valve 16 leads into a chamber 11 of the sump 5 having a calibrated surface for the passage of water (Fig. 2) for reasons which are to be explained hereinafter. Figure 2 also shows how the tank 12 and the associated pressure chamber 13 are usefully housed in a cavity 50 between a vertical wall of the washing tub 1 and a vertical wall of the framework 2, in order not to cause increases in the overall dimensions of the dishwasher.

When, during a washing cycle, one of the water feed phases is reached, a programming device or timer (not shown) causes in a manner in itself known opening of the feed solenoid valve 3. The water enters the dishwasher, flows into the air break device 7, decalcifies in the decalcifier 8 and, once decalcified, is fed via the conduit 9 directly to the sump 5 and, in the proportion established by the partialising nozzle 10, to the tank 12 via the conduit 18.

The flow of water which arrives directly in the sump 5 initially fills the latter, and then rises through the opening 4 into the tub 1. The level of water in the tub 1 then rises gradually. The partial flow of water which feeds the tank 12 also flows, via the conduit 15 and the check valve 16, into the sump 5, in that said flow maintains the check valve 16 open. Given that during the phase of water feed the check valve 16 is kept open, the tank 12 and the

washing tub 1 form two basins connected at the bottom: the level of water in the washing tub 1 thus rises simultaneously to the level of water in the tank 12. When the water in the tub 1 reaches the required level L1 (known as "static level", since it is the level of water in the tub when the pump feeding the spraying rotors is switched off), which, as mentioned previously, coincides with the top of the baffle 17 in the tank 12, inside the tank 12 the water overflows into the pressure chamber 13, causing therein an increase in the pressure of the air until the pressure switch 14 trips and signals to the programming device that the required level has been reached in the tub. The programming device will command closure of the solenoid valve 3.

It should be underlined that, although during feeding of water the check valve 16 is kept open by the flow of water from the tank 12, any washing residues in the sump 5 cannot return up the conduit 15, since the same flow of water which maintains the check valve 16 open prevents the return of dirty water. Once the water feed has ended, after the feed solenoid valve 3 has been closed, without the thrust of the flow of water from the nozzle 10, the check valve 16 is kept closed by the pressure of the water column in the washing tub 1. There is therefore no risk that the residues of washing in the sump 5 can clog the conduits of the control device, jeopardising efficacy thereof.

A safety column 21 is also provided in the tank 12 and leads into the tank 12 via an opening 22 at a height corresponding to the reaching in the tub 1 of a warning level L2. The safety column 21 is connected via a conduit 24 to a safety lock pressure switch device 23 on the solenoid valve 3. Thus it is guaranteed that any malfunctions of the solenoid valve 3, or manual regulations by an operator which alter the sequence of operations of the programming device (for example, double setting of a water feed) cannot lead to overflows from the washing tub and to floods.

During the discharge phase, the vacuum created in the sump 5 by the drain pump causes opening of the check valve 16, and triggering of a siphon pipe 25 which empties the pressure chamber 13, in order to restore the original conditions for a subsequent feed phase.

In this first embodiment, operation of the control device is affected by the imperfect horizontal arrangement of the dishwasher: in fact, since triggering of the pressure switch 14 is linked to the water in the tank 12 reaching the top of the baffle 17, it is clear how, if the dishwasher is tilted to the right in Figure 1, water will overflow from the tank 12 to the pressure chamber 13 when a larger quantity of water than the predefined quantity has been fed, whereas if the dishwasher is tilted to the left in Figure 1, water will overflow from the tank 12 to the pressure chamber 13 when a smaller quantity of water than the predefined quantity has been fed.

Due to the considerable surface area of the washing tub 1, tilting of the dishwasher by only 3 mm to the right or to the left in Figure 1 may vary the quantity of water in the tub by 0.5 l. In the case wherein this variation is in

excess, the problems are limited to a greater consumption of electrical energy for heating. In the case however of this variation being downward, problems of cavitation of the washing pump may be caused, and hence washing may be insufficient. Experimental tests have shown that, also in this latter case, by appropriately calibrating the surface of passage of the chamber 11 of the sump 5 wherein the check valve 16 leads, it is possible to exploit the vacuum which is created when the washing pump is switched on in order to draw further water from the pressure chamber 13 (through the siphon pipe 25, the conduit 15 and the check valve 16). This makes the pressure in the pressure chamber 13 fall below the trigger pressure of the pressure switch 14, and the feed solenoid valve is reopened to allow inflow of an additional quantity of water for restoring the quantity of water required.

Figure 3 shows a control device according to a second embodiment of the present invention, whose operation is not affected by the imperfect horizontal arrangement of the dishwasher.

In this embodiment, the control device again comprises the tank 12, fed via the conduit 18 branching off at the conduit 9, and the check valve 16, which is however inserted vertically in the base of the sump 5. A tank 30 is also provided and fed via a conduit 32 and a second partialising nozzle 31, also branching off at the conduit 9. The tank 30 is provided with two siphon pipes 33 and 34, having mouths at the base of the tank 30, and different trigger levels L1 and L1', which both flow into the tank 12. Opening of the mouth of the siphon pipe 34 is controlled by a solenoid valve 35 (Fig. 4).

When the feed solenoid valve 3 is open, the clean and decalcified water is fed to the tub 1 and, via the partialising nozzles 10 and 31 and the conduits 18 and 32, to the tank 12 and to the tank 30. As in the case of the previous embodiment, the water entering the tank 12 flows, via the conduit 15 and the check valve 16, into the sump 5, and the level of water in the tank 12 rises together with that in the tub 1. Simultaneously, the level of water in the tank 30 also rises. Assuming that the solenoid valve 22 is closed, when the water in the tank 18 has reached the trigger level L1 of the siphon pipe 33, the latter starts to discharge water rapidly in the tank 12. The volume of the tank 30 and the diameter of the partialising nozzle 31 are chosen so that the siphon pipe 33 triggers when a level slightly lower than the required static level L1 has been reached in the tub 1. The water transferred by the siphon pipe 33 into the tank 12 makes the latter overflow into the pressure chamber 13 and trips the pressure switch 14, which causes closure of the feed solenoid valve 3.

The intervention of the pressure switch 14 is no longer linked, as in the previous case, to reaching in the tub 1 of the level L1 which causes water to overflow from the tank 12 to the pressure chamber 13, but instead when the trigger level L1 of the siphon pipe 33 is reached in the tank 30, which occurs when a fully defined volume of water has been fed into the tank 30. The quantity of water fed into the tub 1 will therefore be independent of

the conditions of horizontal arrangement of the dishwasher. It is no longer necessary to provide in the sump 5 a chamber 11 having a calibrated passage surface (Fig. 5).

In this second embodiment, the device therefore allows a double control of the volume of water fed into the tub: a volumetric control of a partialised flow, by means of the tank 30 and the siphon pipe 33, and a level control by means of the tank 12 which operates, as in the previous case, by triggering the pressure switch 14 when the level in the tub exceeds the required level L1.

The device according to this second embodiment also allows differentiated volumes of water to be fed. More specifically, when a reduced feed of water has to be performed, because for example the load of dishes to be washed is also reduced, the solenoid valve 35 opens the mouth of the siphon pipe 34, which has a lower trigger level L1' than the siphon pipe 33. Therefore the siphon pipe 34 will trigger before the siphon pipe 33, when a reduced volume of water has been fed into the tub 1.

Figure 6 shows a third embodiment of the present invention, functionally identical to that of Figure 3, but made as a single block 100 incorporating the tank 12, the pressure chamber 13, the tank 30 and the siphon pipes 33 and 34. This single block 100 can be made in a plastic material by moulding, and is also housed in the cavity 50 of Figure 2.

A possible disadvantage which may lead to non-functioning of the control devices illustrated hitherto consists of the clogging of the partialising nozzle or nozzles 10 and 31. In this case, without the flow of water which keeps the check valve 16 open, the connection between the tank 12 and the washing tub also fails; the level in the tank 12 is therefore no longer related to the level of liquid in the tub 1. In order to avoid this disadvantage, it is possible for example to modify the device in Figure 6 in the manner shown in Figure 7: a conduit 90 connects the sump 5 to a column 91 formed inside the tank 12. This column is equal in height to the safety level L2, and it leads at its upper end into the safety column 21.

When the dishwasher is first switched on, a certain quantity of washing liquid flows from the sump 5 to the column 91 through the conduit 90. The level which the liquid reaches in the column 91 is lower than the level L1 in the washing tub. This quantity of liquid remains in the column 91.

If faults do not occur (i.e. blockages in the nozzles 10, 31), the operation of the device is wholly similar to what has already been described, and the presence of liquid in the column 91 has no effect.

Should however the nozzles 10, 31 be clogged, the control device does not trigger and the level of liquid in the tub 1 rises beyond the safety level L2. Simultaneously the level of liquid in the column 91 also rises. Before the liquid overflows from the tub 1, the column 91 is completely filled and the liquid flows over from it into the safety column 21, thus actuating the block of the feed solenoid valve 3.

Claims

1. Device for controlling the feed of washing liquid in a dishwasher, comprising a first tank (12) branching off at the supply of liquid from a feed solenoid valve (3) to a washing tub (1) of the dishwasher so as to receive a first smaller fraction of said liquid, and level detector means (13,14,17) connected to said first tank for commanding the closure of the feed solenoid valve (3) when the level of the liquid in said first tank (12) exceeds a first preset level (L1), characterised in that said first tank (12) is connected to the washing tub (1) by valve means (16) suitable for allowing the passage of a flow of liquid from the first tank (12) to the tub (1) but not vice versa and which, during the feed of liquid, are kept open by the flow of liquid which flows from the first tank (12) to the tub (1), so that the level of the liquid in the latter coincides with the level of liquid in the first tank (12), said first preset level (L1) being the level of liquid required in the washing tub (1) at the end of the feed.
2. Device according to claim 1, said washing tub comprising a sump (5) positioned below and connected to the latter, characterised in that said valve means (16) comprise a check valve (16) which flows into said sump (5), and which during the feed of liquid is kept open by the pressure of the flow of liquid itself which flows from the first tank (12) to the sump (5) but which, when the feed of liquid has ended, is maintained closed by the pressure of the liquid in the washing tub (1).
3. Device according to claim 1 or 2, characterised in that said level detector means (13,14,17) comprise a pressure chamber (13) related to said first tank (12) and separated therefrom by a baffle (17) equal in height to said first preset level (L1), and a pressure switch (14) for detecting the pressure inside said pressure chamber (13) and commanding closure of the feed solenoid valve (3) when said pressure exceeds a preset value.
4. Device according to claim 3, characterised in that it comprises a first siphon pipe (25) which connects the bottom of the pressure chamber (13) to the bottom of said first tank (12), and which allows emptying of the pressure chamber (13) during an operation of discharge of the liquid from the washing tub (1).
5. Device according to claim 4, characterised in that said check valve (16) leads into a chamber (11) of the sump (5), said chamber (11) having a surface for passage of the liquid towards the tub (1) with a calibrated area so that, should the quantity of liquid fed into the tub (1) be lower than that required, the actuation of a washing pump generates in said chamber (11) a vacuum which causes opening of said check valve (16) and the drawing, through said first siphon pipe (25), of the liquid contained in the pressure chamber (13), so that the pressure switch (14) causes further opening of the feed solenoid valve (3) to feed further liquid.
6. Device according to any one of claims 1 to 4, characterised in that it comprises a second tank (30) also branching off at the supply of liquid from the feed solenoid valve (3) to the washing tub (1) so as to receive a second smaller fraction of said liquid, and a second siphon pipe (33) which triggers when the second tank (30) contains a first volume of liquid required for transferring completely said first volume of liquid to the first tank (12), and causing triggering of said level detector means (13,14,17).
7. Device according to claim 6, characterised in that said first tank (12), second tank (30), pressure chamber (13), first siphon pipe (25) and second siphon pipe (33) form a single block (100) housed in a cavity (50) between a vertical wall of the washing tub and a vertical wall of a framework (2) of the dishwasher.
8. Device according to claim 6 or 7, characterised in that it comprises a third siphon pipe (34) which can be triggered when the second tank (30) contains a second required volume of liquid, smaller than said first volume, for completely transferring said second volume of liquid to the first tank (12) and causing triggering of said level detector means (13,14,17), valve means (35) also being provided and which can be actuated to enable triggering of said third siphon pipe (34).
9. Device according to any one of the previous claims, characterised in that it comprises safety lock means (21-24) of the feed solenoid valve (3) which trigger when, during the feed of liquid, the liquid reaches a second preset level (L2) in the washing tub (1).
10. Device according to claim 9, characterised in that said means comprise a safety column (21) formed in said first tank (12) and which leads into the latter through an opening (22) placed at a height equal to said second preset level (L2), said safety column (21) being connected to a pressure switch device (23) for blocking the feed solenoid valve (3).
11. Device according to claim 10, characterised in that it also comprises a further column (91) formed in said first tank (12) and connected via a conduit (90) to the top of a sump (5) positioned below the washing tub (1), having a height equal to said second preset level (L2) and connected at its top to said safety column (21), said further column (91) causing triggering of said pressure switch lock device when, following blocking of the means (10) for partialising the flow of washing liquid which feed said first tank (12),

the level of liquid in the washing tub (1) rises beyond said second preset level (L2).

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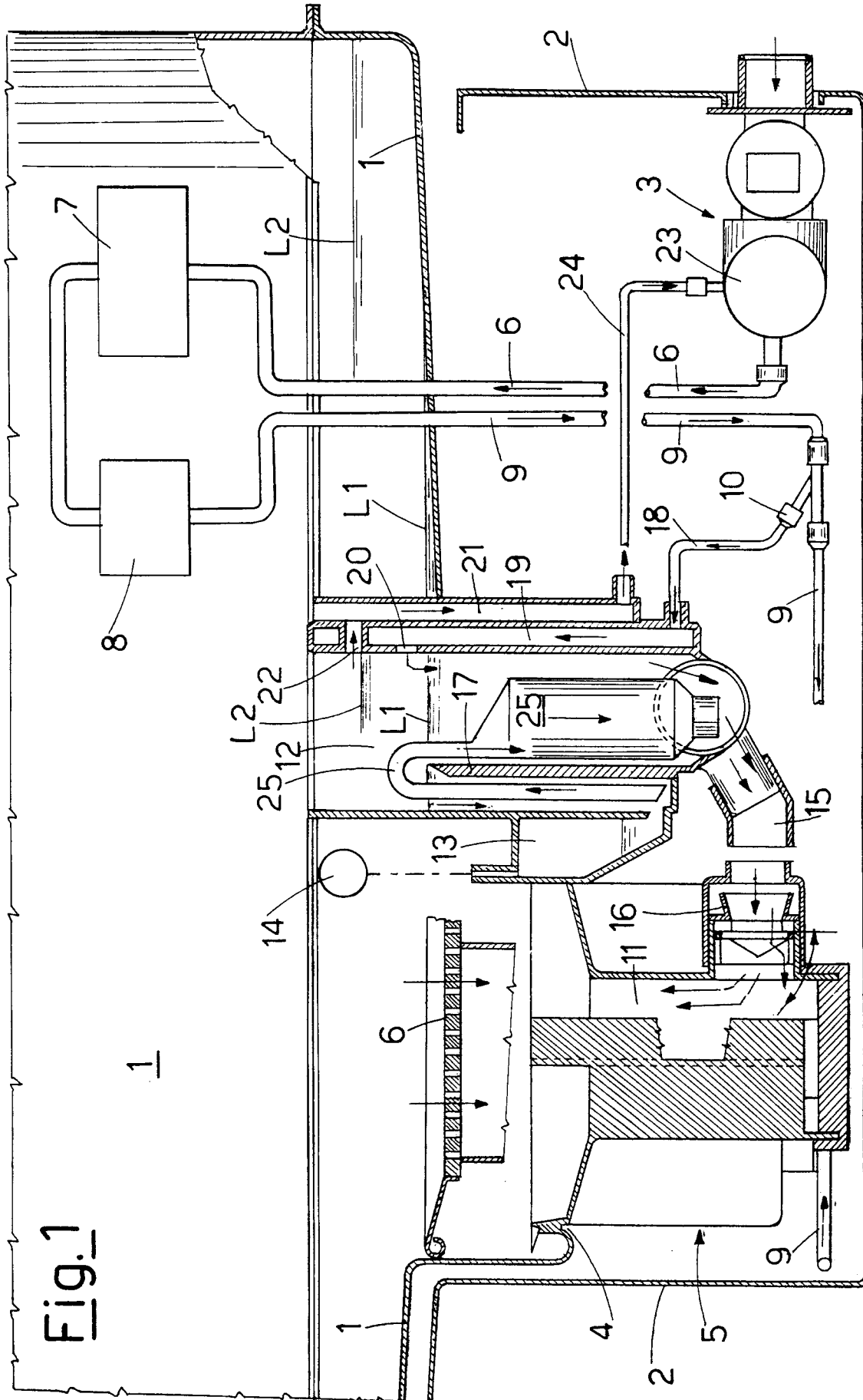
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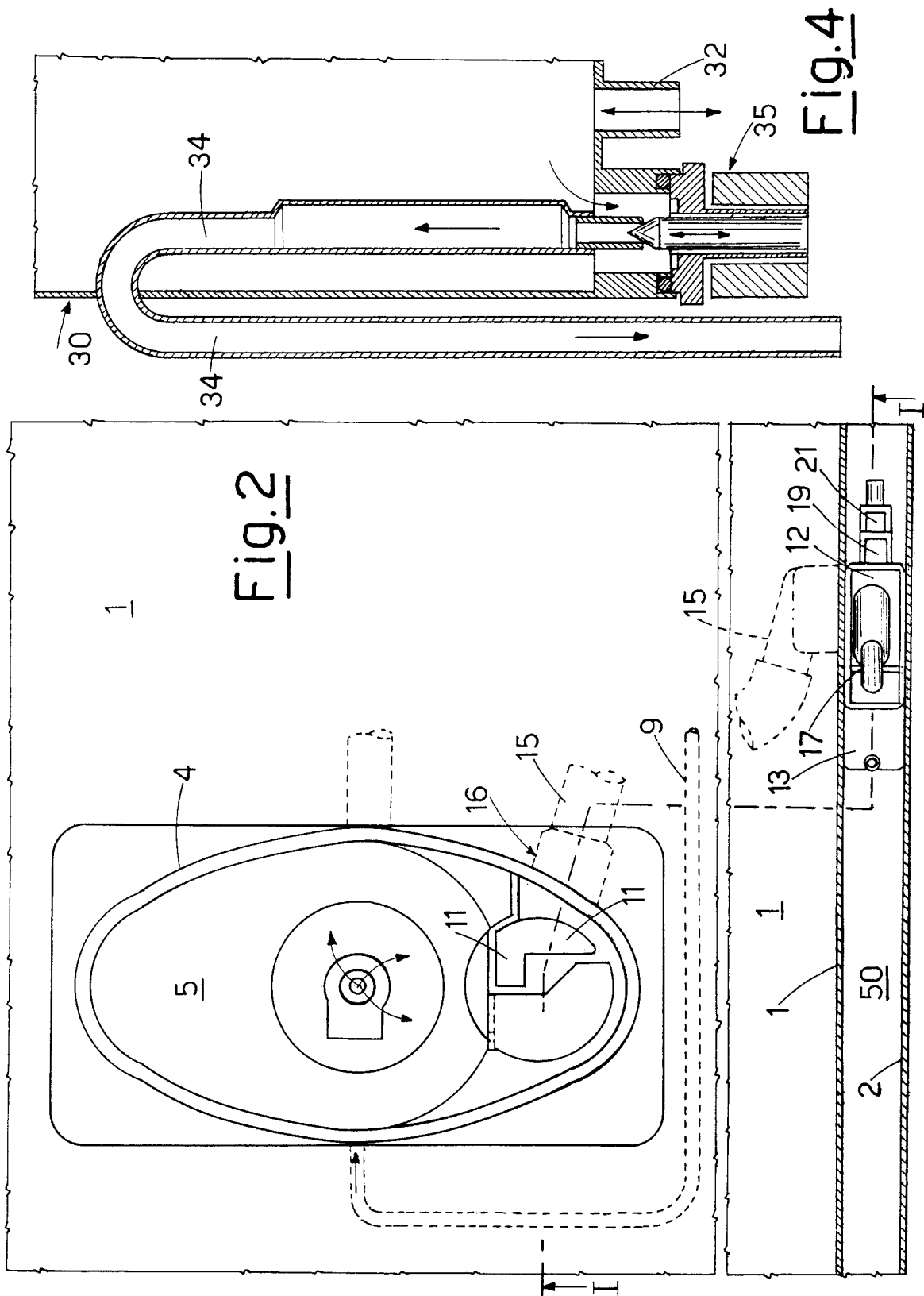
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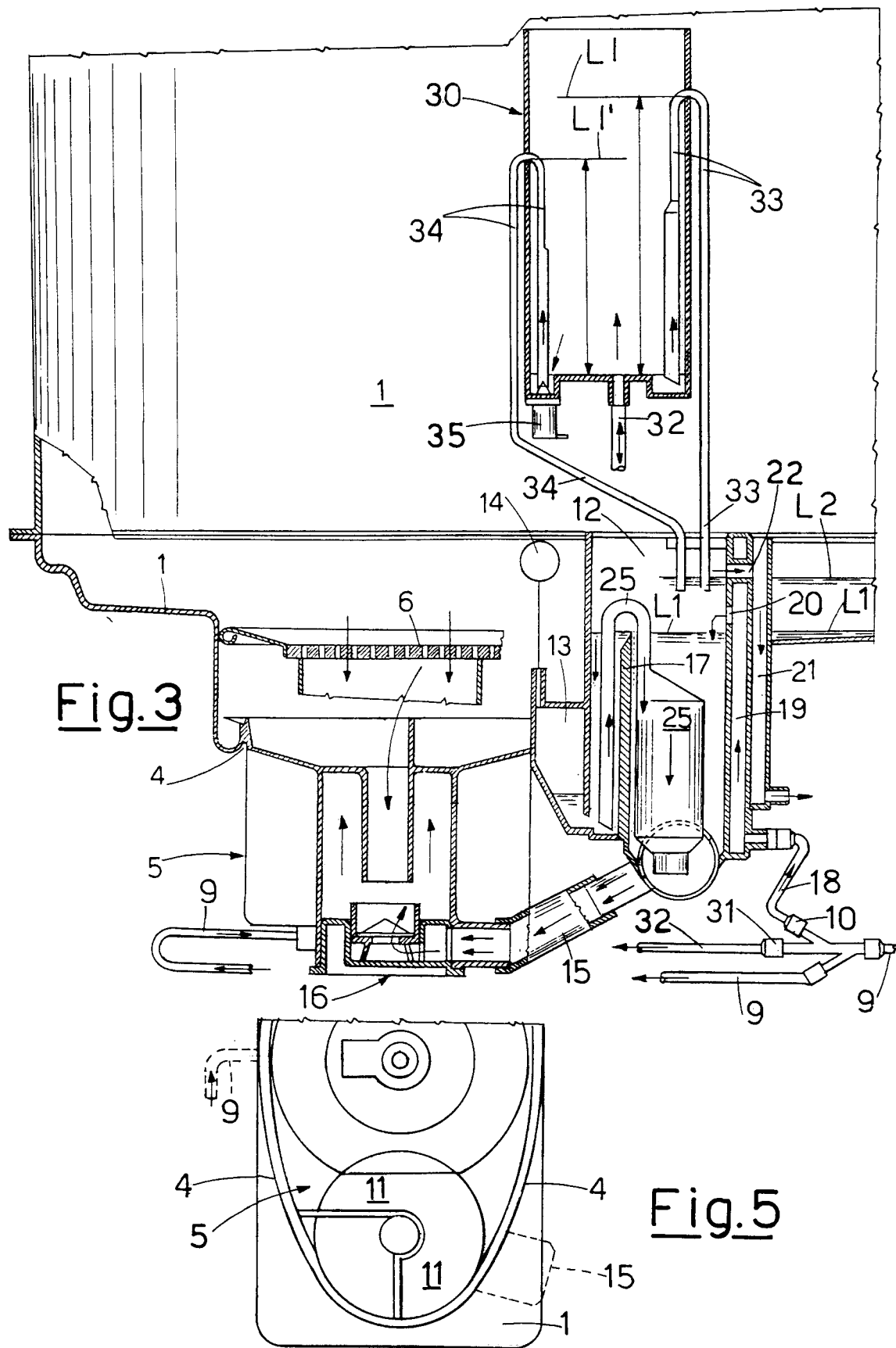


Fig. 6

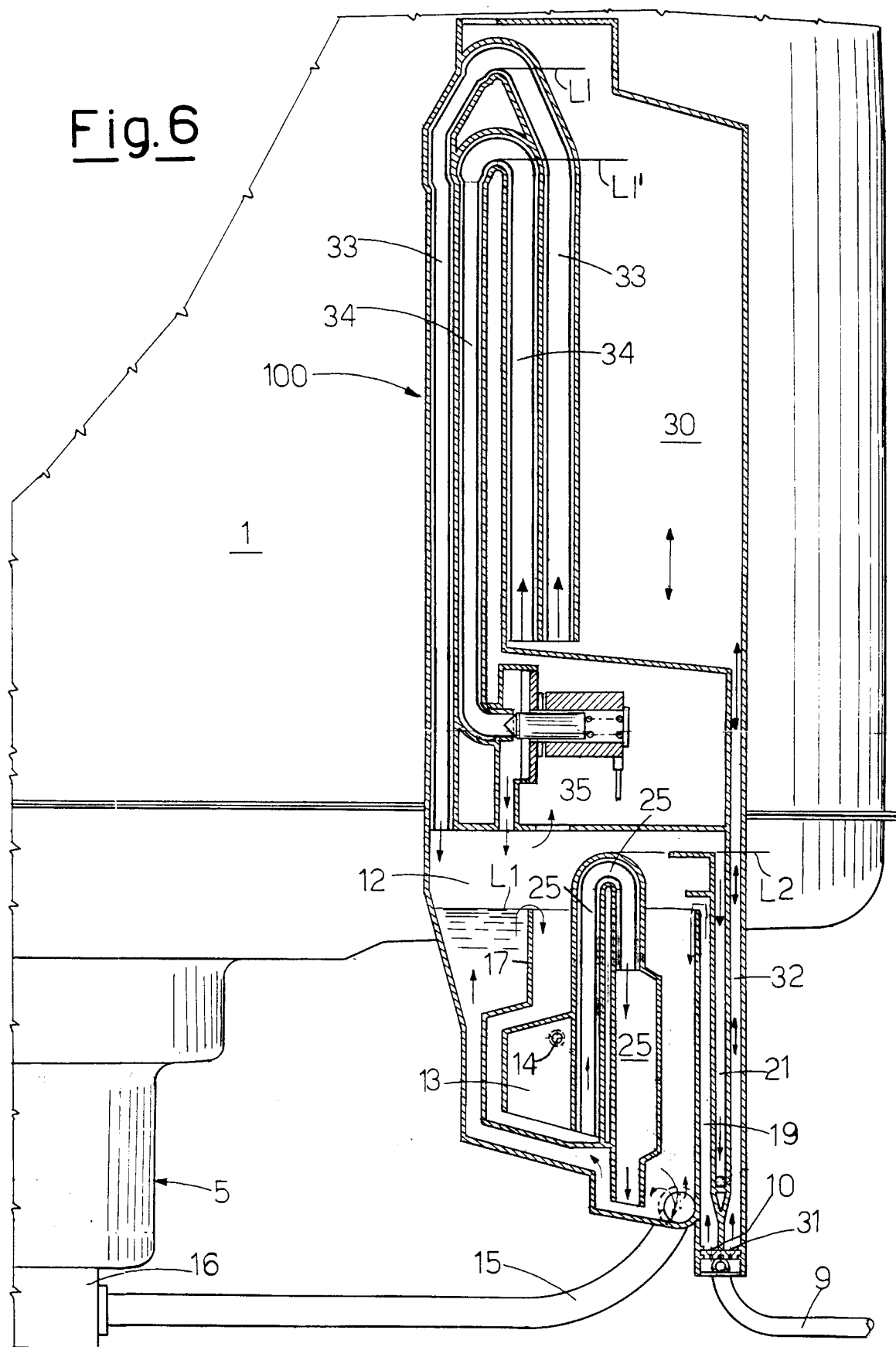
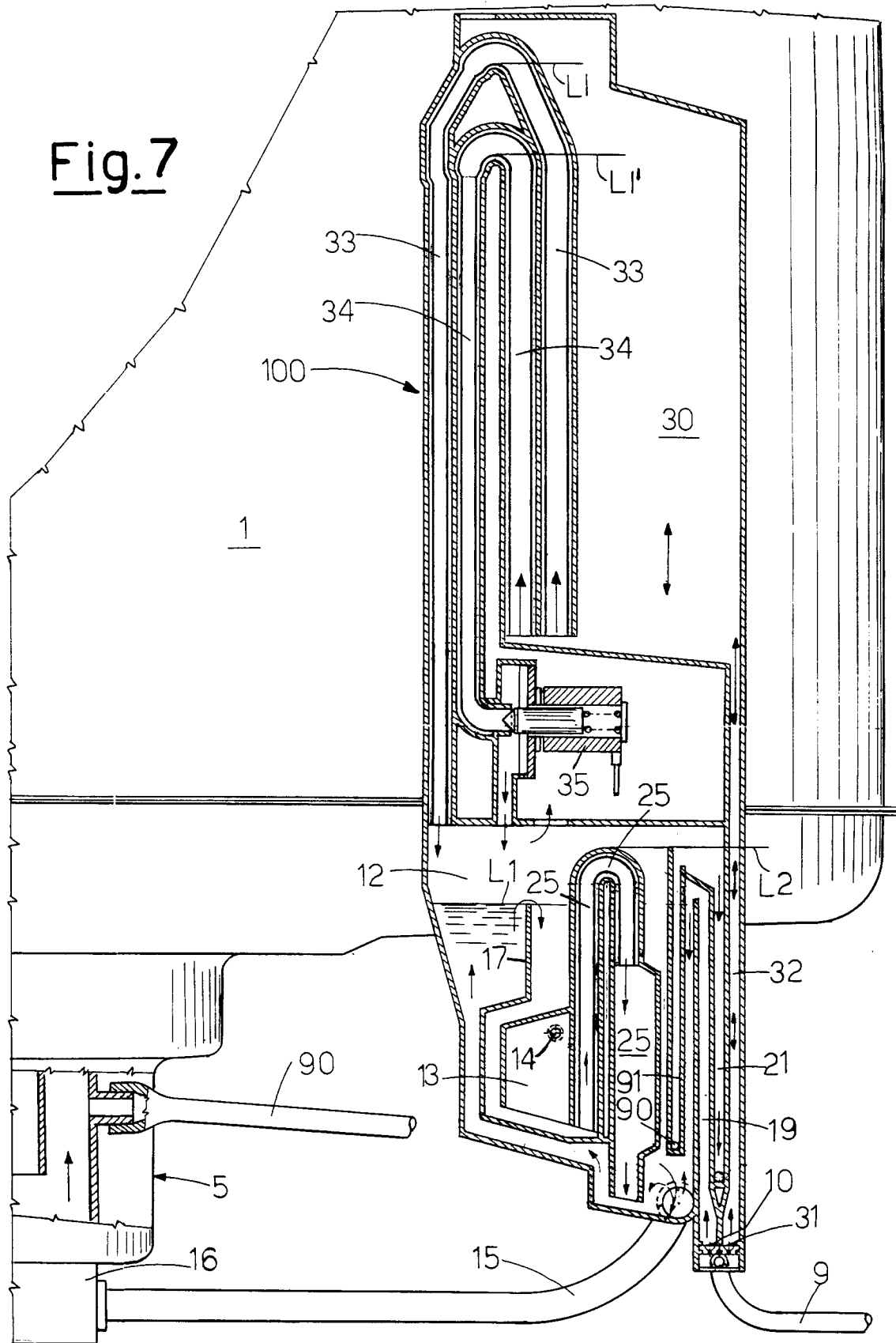


Fig. 7





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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2782

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR-A-2 589 262 (LICENTIA GMBH) 30 April 1987	1-3	A47L15/42
A	* page 2, line 2-15 * * page 3, line 31 - page 4, line 9 * * page 4, line 21 - page 5, line 20 * * page 6, line 9-17 * * page 6, line 29-35; figure 1 *	6,7	
Y	FR-A-2 630 321 (ESSWEIN SA) 27 October 1989 * page 8, line 17 - page 9, line 26; figure 3 *	1-3	
A	GB-A-2 123 148 (BOSCH SIEMENS HAUSGERAETE) 25 January 1984 * page 1, line 116 - page 2, line 11; figures 1-4 *	1	
A	DE-A-27 16 252 (BOSCH SIEMENS HAUSGERAETE) 19 October 1978 * page 5, line 21 - page 7, line 11; figure 1 *	1,4,6	
A	GB-A-2 250 911 (ZANUSSI ELETTRODOMESTICI) 24 June 1992 * the whole document *	5	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A47L
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 13 February 1996	Examiner Laue, F
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