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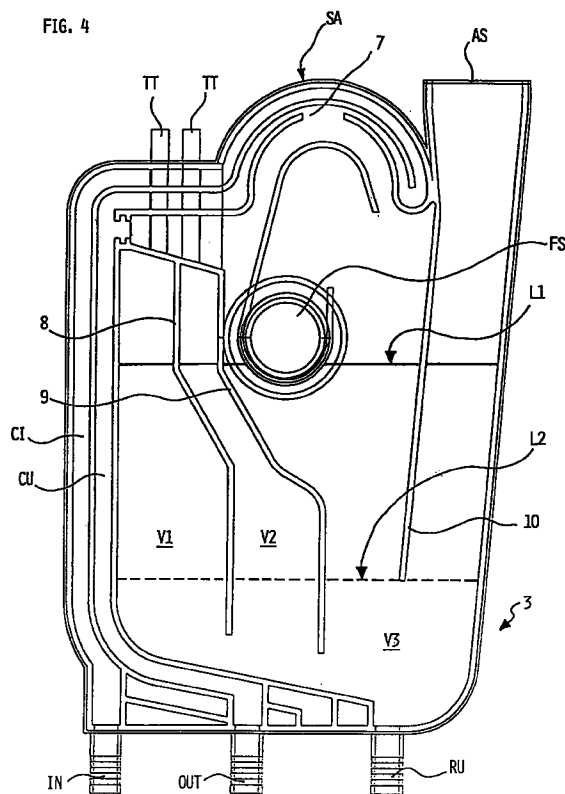
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(54) **Dishwashing machine with improved liquid dosage device**

(57) A washing machine is described, comprising a liquid metering device (3), having a first opening (FS) communicating with the inside of the washing tub (1) of the machine and a second opening (AS) in communication with the environment outside of said tub (1).

According to the invention, during a substantial part of a washing, a fluid level (L1) is maintained in said device (3), which is apt to interrupt the communication between said first opening (FS) and said second opening (AS), in order to reduce noise, heat and vapor transmission from inside said tub (1) to the external environment.



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Description

The present invention refers to a dishwashing machine of the type indicated in the preamble of Claim 1, and a liquid metering method of the type indicated in the preamble of Claim 11.

As known, dishwashing machines are commonly equipped with a metering device for the water required to regenerate softening resins. Said device also fulfills other functions, such as hindering the backflow of dirty water to the water mains, and the condensation of a portion of vapor forming in the dishwasher washing tub during the operation of the machine.

Moreover, some known solutions also use said device to meter the water being required for the washing of crockery.

Such a multifunction device is usually fixed to a side wall of the washing tub, so that in operation it is housed in a gap being defined between said tub wall and a wall of the dishwasher cabinet, or of the built-in cabinet within which the dishwasher is housed.

Said devices are generally known as such and do not require here a detailed description (see for instance IT-B-1.238.419).

However, in view of the present invention it should be underlined that such devices usually have a first opening, which communicates with the inside of the wash tub and a second opening communicating with the external environment, i.e. with the gap defined between the tub and the machine cabinet.

The first opening allows to discharge into the washing tub any excess water eventually supplied inside the device. Moreover, through said two openings, the device is apt to allow the communication from inside the washing tub to the external environment. Thus, a certain amount of the vapor forming inside the tub is led to flow through the device, where a partial condensation occurs.

However, as it can be appreciated, this does not hinder a certain amount of vapor or anyway damp air to flow out and to collect within the cited gap. This dampness may cause with time damages to the built-in cabinet, usually a wooden cabinet housing the dishwasher, as well as to the surrounding pieces of furniture being part of a built-in kitchen.

It is also known that washing machines produce a certain noisiness during their operation.

In the case of a dishwasher, this noisiness is due to certain devices which are operated several times during a washing cycle, such as for instance a discharge pump or a recycling pump for the washing liquid.

Dishwasher noisiness is also due to the fluid jets being splashed by the rotary collectors for the washing of the crockery; in the practice, in fact, both the water jets reaching the crockery and part of the jets hurting the machine washing tub walls generate noisiness.

In this connection, it should be noted that a dishwasher washing tub practically operates as a resonance

box for said noisiness.

Also in this connection, since the cited multifunction device puts the inside of the washing tub in communication with the external environment through its openings, it will cause some disadvantages; it is obvious, in fact, that noise like vapor can pass from the washing tub to the outside.

The aim of the present invention is that of solving the above problems, indicating a dishwashing machine wherein noise and vapor or dampness passage from said multifunction device to the external environment may be reduced through the use of simple and cost-effective means.

Said purposes are reached according to the present invention by a dishwashing machine and a liquid metering method having the features of the annexed claims, which form an integral part of the present description.

Further purposes, features and advantages of the present invention will become apparent from the following detailed description and the annexed drawings, supplied by way of a non limiting example, where:

- Fig. 1 shows schematically a detail of a dishwashing machine according to a possible embodiment of the present invention;
- Fig. 2 shows schematically a vertical section of a device being part of a dishwashing machine according to the invention, in a first operating condition;
- Fig. 3 shows schematically a perspective view of the device represented in Fig. 1;
- Fig. 4 shows schematically a vertical section of the device represented in Fig. 1 in a second operating condition.

Figure 1 represents schematically a part of a dishwashing machine according to the present invention.

In this figure, number 1 indicates as a whole the washing tub of the machine, which is realized with generally known procedures, and has a front loading door 2.

Number 3 indicates schematically a multifunction device, i.e. as mentioned at the beginning of the present description, which is apt to meter the water required for the regeneration of softening resins, hindering the backflow of water to the water mains and condensing at least a portion of the vapor forming within the tub 1 during the washing.

Said device 3 has a body of reduced dimensions, whose structure is conveniently made of plastic material, for example through the molding of two pieces, which are subsequently welded to each other in a known manner (for instance by a hot blade procedure).

As it can be seen, the device 3 is fixed to the external surface of a side wall of the tub 1, so that for operation purposes it is located in the gap between said tub wall and a wall of the dishwasher cabinet, or of the built-

in cabinet wherein the machine is housed (these elements are not represented in Fig. 1).

The device 3 has a hole FS facing the inside of the tub 2; to this purpose, the wall of the tub 1 on which the device 3 is fixed has a proper opening. The hole FS can be equipped with suitable screening means (not represented), such as a small plastic grid to hinder that dirt residues removed from the crockery can enter the hole itself during the washing.

Moreover, the device 3 has an opening AS in its upper part, which faces towards the external environment, i.e. in the gap mentioned above, between the tub and the machine cabinet.

A possible embodiment of the device 3 according to the invention is represented in Figures 2 and 3 through a schematic upright section and a perspective view, respectively, where a device wall has been removed for better representation.

The device 3 has a hollow body having a set of inlet and outlet connectors for the water supplied by the mains to the devices provided within the machine, as well as the cited openings FS and AS which put the device itself in communication with the washing tub and the environment outside the tub itself. Within the device 3, ducts and chambers for water flow and metering are also defined by a plurality of walls or bulkheads.

Specifically, IN represents a water inlet connector for the water fed from the water mains and OUT an outlet connector for the same water to a dishwasher decalcifying device, not shown in the figures.

Water inlet and outlet from the IN inlet and the OUT outlet, respectively, are controlled by electric valves, which are actuated in a generally known manner, in the proper time by the control system of the machine.

Said decalcifying device is generally known as such and for its operation, and therefore it will not be described in detail herein.

It is enough to point out that once water has been softened through said decalcifying device, it reaches the tub 1 and is used for the washing of the crockery.

In a possible embodiment of a dishwasher according to the invention, the metering of the water required for the washing can take place through a common electromechanical pressure-switch located in the lower section of the washing tub; however, since the metering system for the washing water leave out of consideration from the purposes of the present invention, it will not be described in detail.

Inside the device 3A a duct CI and a duct CU are present between the connectors IN and OUT. The so-called air-break device, indicated with SA as a whole, is present in the upper section of the device 3, between the two ducts CI and CU.

Also the air-break device SA is known as such and for its operation, and consequently it is here enough to point out that its function is that of preventing water supplied to the dishwasher hydraulic circuit to be sucked into the water mains, should any vacuum occur in the

latter.

To this purpose, the air-break device has an interruption 7, which can be overcome by the water from the duct CI before entering the duct CU, due to the kinetic energy acquired.

The remaining internal part of the device 3 is practically forming a container for metering and collecting the water required for the regeneration of the decalcifying resins.

Said container has two walls, indicated with 8 and 9, which are configured and arranged to divide the container in three separate chambers of different capacity, indicated with V1, V2, V3. Chambers V1 and V2 are closed on their top and may eventually communicate through their top with the outside the device 3 by means of small pipes TT only, whose function will be explained in the following. The chamber V3, on the contrary, is not closed on its top.

On the bottom of the container consisting of the above three chambers V1, V2, V3 a second outlet connector RU is present. Also in this case, the exit of water from the connector RU is controlled by a solenoid valve, not shown, which is actuated in a generally known manner at the right time by the machine control system.

In fact, the water collected in the chambers V1, V2, V3 is discharged at regular intervals through the connector RU in a salt container, which is a part of the decalcifying device, to produce a brine for the regeneration of the water decalcifying resins. As said above, water decalcification and resin regeneration procedures are generally known as such, so they will not be further described in detail herein.

A hole similar to the one already shown in Fig. 1 is indicated with FS; it should be noticed that, according to the present invention, said hole FS is substantially located in the upper half of the device 3, whereas according to the known state of the art, a hole having similar functions is usually located in the lower half of the device.

The device 3 also has an opening AS in its upper section, similar to the one shown in Fig. 1; as it can be seen in the representation of Fig. 1, i.e. when no water is present inside the device 3, both the hole FS and opening AS put the inside of the washing tub in communication with the external environment.

According to the present invention, the device 3 has a wall or bulkhead 10 arranged in the chamber V3, between the hole FS and the opening AS; as it can be seen, said wall 10 starts from the upper section of the device 3 directed downwards, but it does not reach the bottom of the chamber V3.

As represented by the arrow F, the wall 10 is meant to extend the throughpath between the hole FS and the opening AS, or better to define a forced passage between the two openings, located in the lower section of the device 3.

The operation of the dishwasher is now described, with reference to the part of interest for the purposes of

the present invention.

To this purpose, it should be remembered that the operating condition shown in Fig. 2 is typically the one occurring at the beginning of a washing cycle, when the machine washing tub is not yet loaded with water.

Upon starting the washing cycle, water from the mains enters the device 1 through the connector IN, according to generally known procedures; then water rises towards the upper section of the device 1 along the duct CI; once it has overcome the air-break SA, it enters the duct CU; however, a certain volume of water is unable to overcome the air-break SA and falls into the container consisting of the three chambers V1, V2, V3, which gradually fills up.

The water flowing through the duct CU can flow out of the device 3 through the connector OUT and reach the decalcifying device mentioned above; after having been softened, the water can then reach the washing tub.

As said, chambers V1 and V2 have each one a small pipe TT in their upper section, to let the air available in them to flow out under the thrust of the water column rising in the same chambers V1 and V2, following the dripping from the air-break SA.

According to known procedures, during the machine installation, the pipes TT may be either open or closed, to allow changing the volume of water available for the resin regeneration as a function of the hardness of the mains water. It is clear, in fact, that if both pipes TT are closed, then water can practically fill up only the chamber V3, if only the pipe TT of the chamber V1 is closed, then water can fill chambers V2 and V3, whereas if pipe TT of the chamber V2 is closed, water can fill chambers V1 and V3. Finally, if both pipes TT are open, then water can fill all the three chambers V1, V2 and V3.

The capacity of the three chambers mentioned above is obviously determined at the design stage and their filling procedures depend essentially on the air-break size, on the water flowrate permitted by the ducts CI and CU, and by the time required for the water to be supplied in the tub.

It should also be appreciated that the filling condition of the three chambers is not necessarily reached during the first water inlet step of the dishwasher, but it can be reached following several subsequent liquid supplies.

Let it be assumed, for instance, that a washing cycle foreseen by the machine according to the invention comprises a prewash, a wash phase and two rinses. Now, based on the choices made at the design stage, the filling of the three chambers may be reached during the first water supply (i.e. during the water supply required for the prewash), or during the first four fluid supplies (i.e. during the relevant water supplies required for the prewash, the wash and the two rinses).

When one or more chambers V1, V2, V3, according to the cases described above, are filled with liquid,

water in excess coming from the air-break SA can overflow directly into the tub, through the hole FS (obviously, such excess water cannot be softened; anyway, it should be remembered that this is always a rather small volume of water, which is mixed with the softened water already contained in the tub, i.e. not significantly affecting the washing quality).

Figure 4 actually represents a situation where chambers V1, V2 and V3 are filled with the water required for the regeneration; in this figure, the maximum filling level of said chambers is indicated with L1.

Viceversa, L2 indicates the minimum water level apt to warrant the correct operation of the dishwasher according to the teachings of the present invention; this situation can already be reached, for example, at the end of the first water supply inside the dishwashing machine, i.e., with reference to the example previously mentioned, during the water supply required for the prewash.

As said above, the wall 10 is meant to define a forced passage between the hole FS and the opening AS, located in the lower section of the device.

Therefore, already upon reaching the level L2, the water forms a real true barrier interrupting the communication between the hole FS and the opening AS. According to the present invention, such a water barrier fulfills multiple functions.

First of all, the water barrier has an important function in order to prevent the passage of noise through the device 3 from the inside of the washing tub to the external environment.

Similarly, said water barrier prevents vapor and hot air from flowing out of the tub; in this way, loss of heat and consequently energy consumption are reduced, since the heat generated for the washing of crockery is maintained by the tub inside.

As a result, in the dishwashing machine according to the invention, most of vapor forming during a washing cycle is condensed within the tub, at least till the water in the device 3 does not go under the level L2.

Such a condition occurs only after the water discharge from the chambers V1, V2 and V3, which operation is required to carry out the regeneration of the water decalcifying resins.

According to the invention, the regeneration of resins and consequently the water discharge from the device 3 occurs only during the final part of the washing cycle.

Specifically, in a preferred embodiment of the invention, resin regeneration is obtained during the final part of the last rinse foreseen by the cycle, i.e. nearly at the end of the last step during which "noisy" components of the dishwasher are activated.

Following the water discharge from the device 3, the communication between the hole FS and the opening AS, i.e. between the tub inside and the external environment is restored; however, this occurs practically only at the end of a washing cycle, so that both the

noise emission and the loss of heat are very low.

It will be appreciated that in a dishwashing machine the last rinse is usually followed by a drying phase of the crockery.

Such a drying phase is usually obtained by leaving the crockery within the washing tub for a certain time interval, during which vapor is partially eliminated through a condensation effect realized by the tub walls, and leaving a part of vapor to penetrate the multifunction device. In other solutions, the drying can be expedited by favoring the air circulation inside the washing tub, using to this purpose a proper fan or a natural ventilation system.

In any case, it will be appreciated that, according to the invention, the air being present in the gap between the tub and the dishwasher cabinet is heated during most of time of a wash cycle, by the dissipation of heat from the walls of the tub itself.

As a result, when approaching the end of a washing cycle, i.e. when the resin regeneration is started, the air available in such a gap will not be damp, as it occurs on the contrary according to the known state of art, but is hot and dry since up to that time there has been no communication path between the tub and outside.

Thus, the reduced quantity of vapor flowing out of the device 3 during said drying phase of the crockery will mix with such hot and dry air, and dilute fast. It is quite clear that the damp air stagnation in the gap between the dishwasher cabinet and the tub is drastically reduced, thus reducing any risks of damages for the surrounding furniture, as previously mentioned.

The features of the present invention have been made apparent from the above description.

Specifically, a dishwashing machine has been described, comprising a fluid metering device with a hollow body having a first opening communicating with the inside of the machine washing tub, and a second opening in communication with the environment outside of said tub, both the first and second openings being located in particular at a higher level than the level usually reachable by the fluid within the body of the device.

According to the invention, means are provided apt to interrupt the communication between the first and the second opening, with the purpose of reducing noise, heat and vapor emission from inside the tub to the external environment.

Said means comprise specifically a wall to define a forced passage between the first and second opening, located in the lower section of the device body; the machine control system will then properly actuate a solenoid valve associated with the connector RU, so that during a substantial part of a washing cycle foreseen by the machine a water level is maintained within the device, apt to plug said forced passage.

Thus, also the advantages of the present invention are apparent.

Specifically, both the simplicity and cost-effectiveness of the suggested solution have to be underlined,

which allow for a substantial reduction of noise and vapor/dampness transmission, from the machine tub to the external environment, and energy savings due to a reduced heat emission from the washing tub.

It is obvious that many changes are possible for the man skilled in the art to the dishwashing machine described by way of example, without departing from the novelty spirit of the innovating idea, as it is also clear that in the practical actuation of the invention the components described above can be replaced by technically equivalent elements.

It is obvious, for instance, that both the configuration, the arrangement and sizes of the wall 10 may be different from the ones represented in Figs. 2 and 3, and it is also clear that the forced passage between the hole FS and the output AS may be provided by means of procedures differing from the ones previously represented and described, without any prejudice to the basic concept of the present invention. For the man skilled in the art it is also obvious that, in order to restore the communication between the hole FS and the opening AS, it is not absolutely necessary to discharge the whole water contents of the device 3, but it will be enough to discharge such a volume of water to bring the level L2 to a height being lower than the one represented in Fig. 2.

Finally, the basic concept of the invention may also be applied for those cases where the multifunction device is also provided for the metering of water being required for the washing; in this instance, said water barrier may be obtained through the water to be used for the washing of crockery, instead of that destined to be used for the regeneration of decalcifying resins.

Claims

1. Dishwashing machine of the type comprising a fluid metering device, said device having a hollow body (3) having a first opening (FS) communicating with the inside of the washing tub (1) of the machine, and a second opening (AS) in communication with the environment outside of said tub (1), said first opening (FS) and said second opening (AS) being located in particular at a higher level with respect to the level usually reachable by the liquid within said body (3), characterized in that means (10) are provided apt to interrupt the communication between said first opening (FS) and said second opening (AS), in order to reduce noise, heat and vapor transmission from inside said tub (1) to the external environment.
2. Dishwashing machine according to claim 1, characterized in that said means comprise:
 - first means (10) for defining a passage within said body (3) between said first opening (FS) and said second opening (AS);
 - second means to plug said passage during a

part of a washing cycle which can be executed by the machine, so as to interrupt the communication between said first opening (FS) and said second opening (AS).

3. Dishwashing machine according to claim 2, characterized in that said first means comprise a wall (10) arranged in said body (3) between said first opening (FS) and said second opening (AS).

4. Dishwashing machine according to claim 3, characterized in that said wall (10) extends from the upper zone of said body (3) directed to the bottom of the latter, so that said passage is located in the lower zone of said body (3).

5. Dishwashing machine according to claim 2, characterized in that said second means comprise a control system, apt to control the discharge of the liquid contained in said body (3).

6. Dishwashing machine according to claim 5, characterized in that said control system is apt to inhibit the discharge of the liquid contained in said body (3) during said part of the washing cycle, so as to maintain in said body (3) a level of liquid (L1) apt to plug said passage.

7. Dishwashing machine according to claim 1, characterized in that said first opening (FS) and said second opening (AS) are substantially located in the upper half of the body of said device (3).

8. Dishwashing machine according to claim 1, characterized in that said device is fixed to a side wall of said tub (1) and for operation purposes it is housed in the gap existing between said tub wall and a wall of a dishwasher cabinet.

9. Dishwashing machine according to at least one of the previous claims, characterized in that said device is provided for the metering of water required for the operation of a water decalcifying device.

10. Dishwashing machine according to at least one of the previous claims characterized in that said device is provided for the metering of water required for the washing of crockery.

11. Method for the liquid metering in a dishwashing machine, where said metering is carried out by means of a proper device, said device having a hollow body (3) with a first opening (FS) communicating with the inside of the washing tub (1) of the machine, and a second opening (AS) in communication with the environment outside of said tub (1), said first opening (FS) and said second opening

(AS) being located in particular at a higher level with respect to the level usually reachable by the fluid within said body (3), characterized in that a forced passage between said first opening (FS) and said second opening (AS) is defined within said body (3), and that during a part of a washing cycle which can be executed by the machine, in said container (3) a liquid level (L1) is maintained, apt to plug said forced passage, so as to interrupt the communication between said first opening (FS) and said second opening (AS), in order to reducing noise, heat and vapor transmission from the inside of said tub (1) to the external environment.

12. Method according to claim 11, characterized in that said forced passage is released by the discharge of the liquid contained in said body (3).

13. Method according to the previous claim, characterized in that the fluid discharged from said body (3) is used to carry out the regeneration of decalcifying resins of a water softener device.

14. Method according to claim 12 or 13, characterized in that said discharge occurs during a final phase of the washing cycle.

15. Method according to the previous claim, characterized in that the step of the washing cycle during which said discharge occurs is followed by a drying phase of the crockery inside said tub (1).

16. Method according to the previous claim, characterized in that the liquid discharged from said body (3) is used for the washing of the crockery contained in said tub (1).

17. Method according to at least one of the previous claims, characterized in that the liquid contained in said body (3) comes from an air-break device, which is part of said liquid metering device.

18. Method according to at least one of the previous claims, characterized in that the liquid eventually supplied in excess to said body (3) can overflow directly into said tub (1), through said first opening (FS).

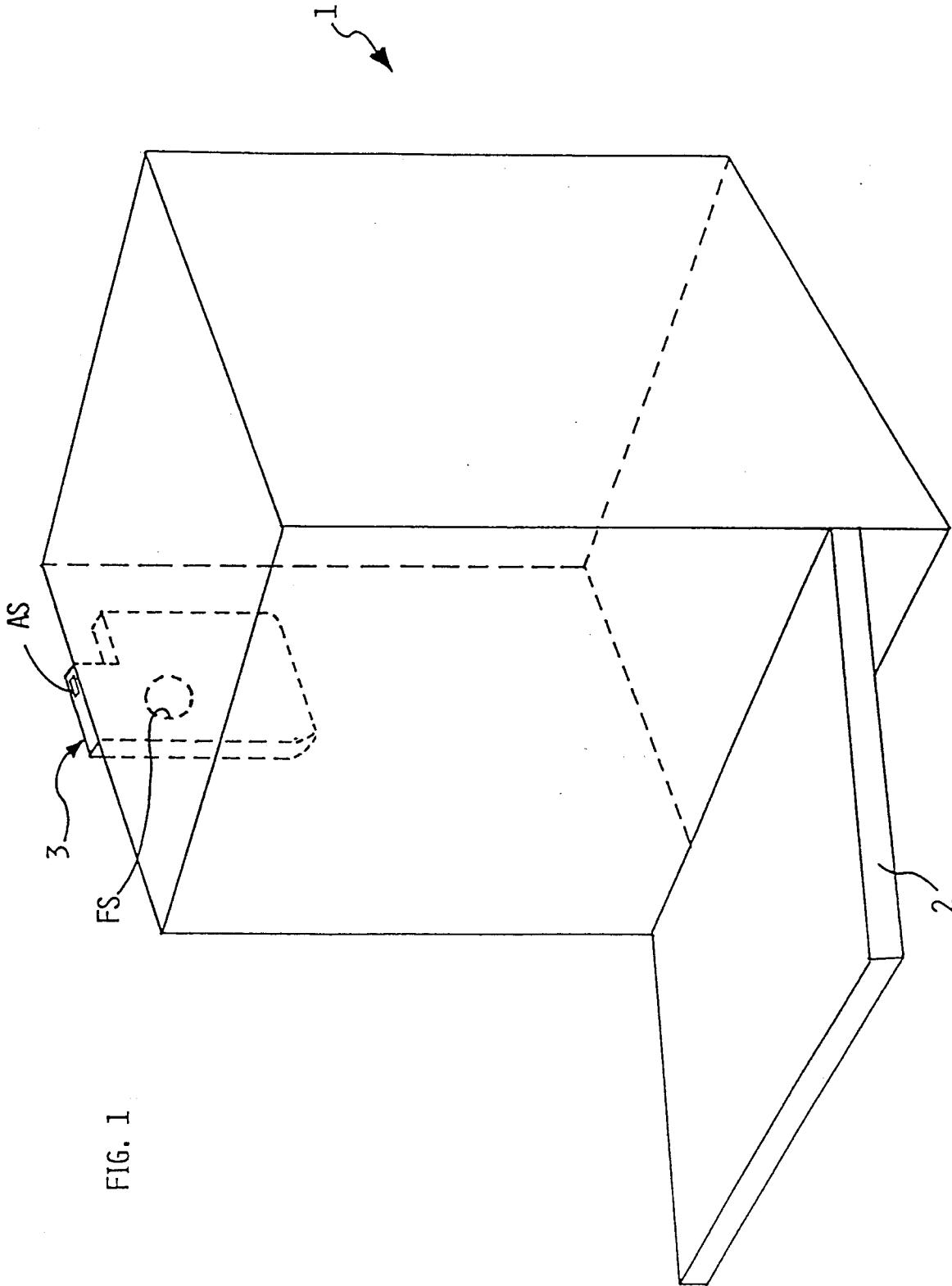
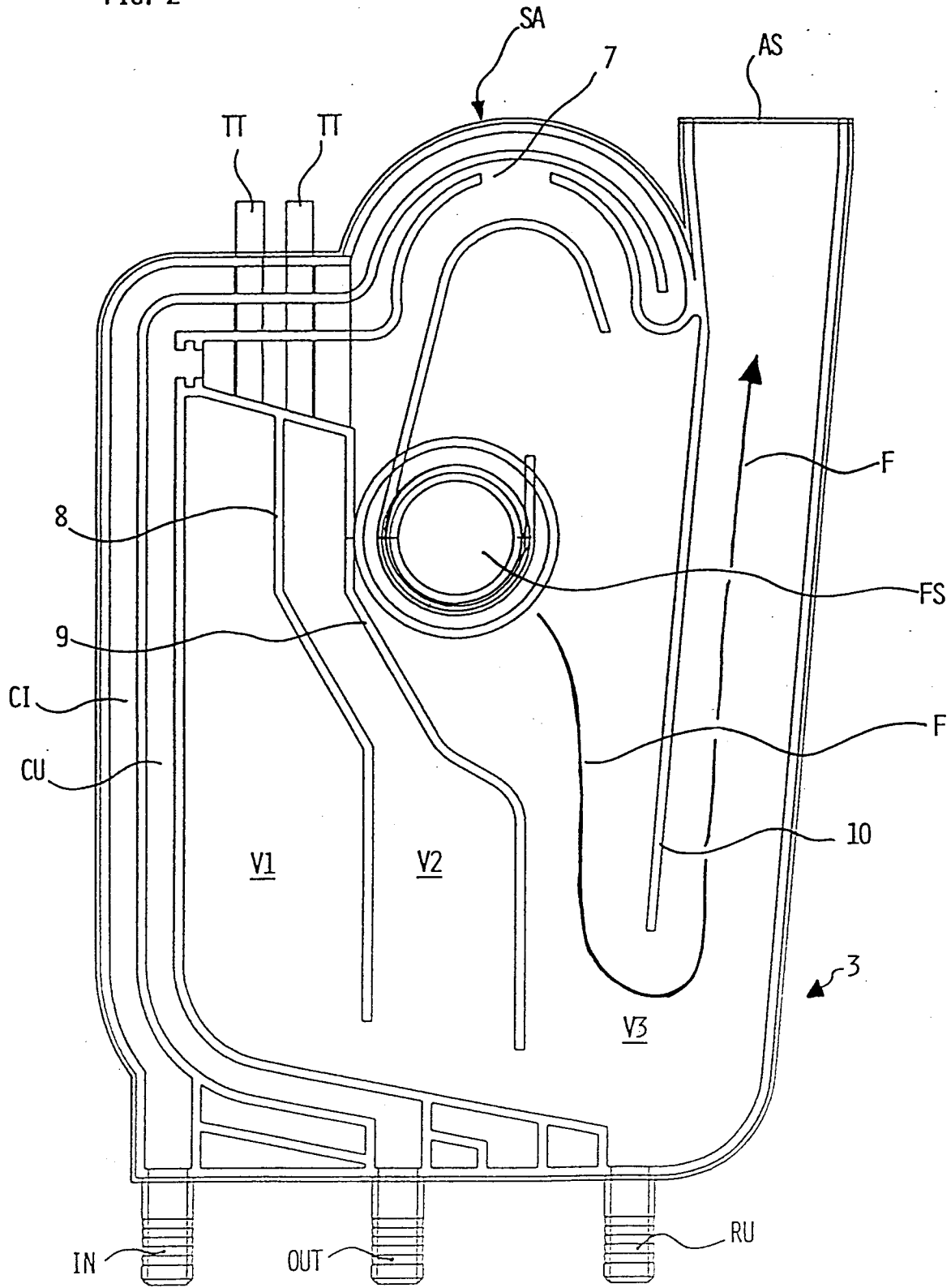


FIG. 2



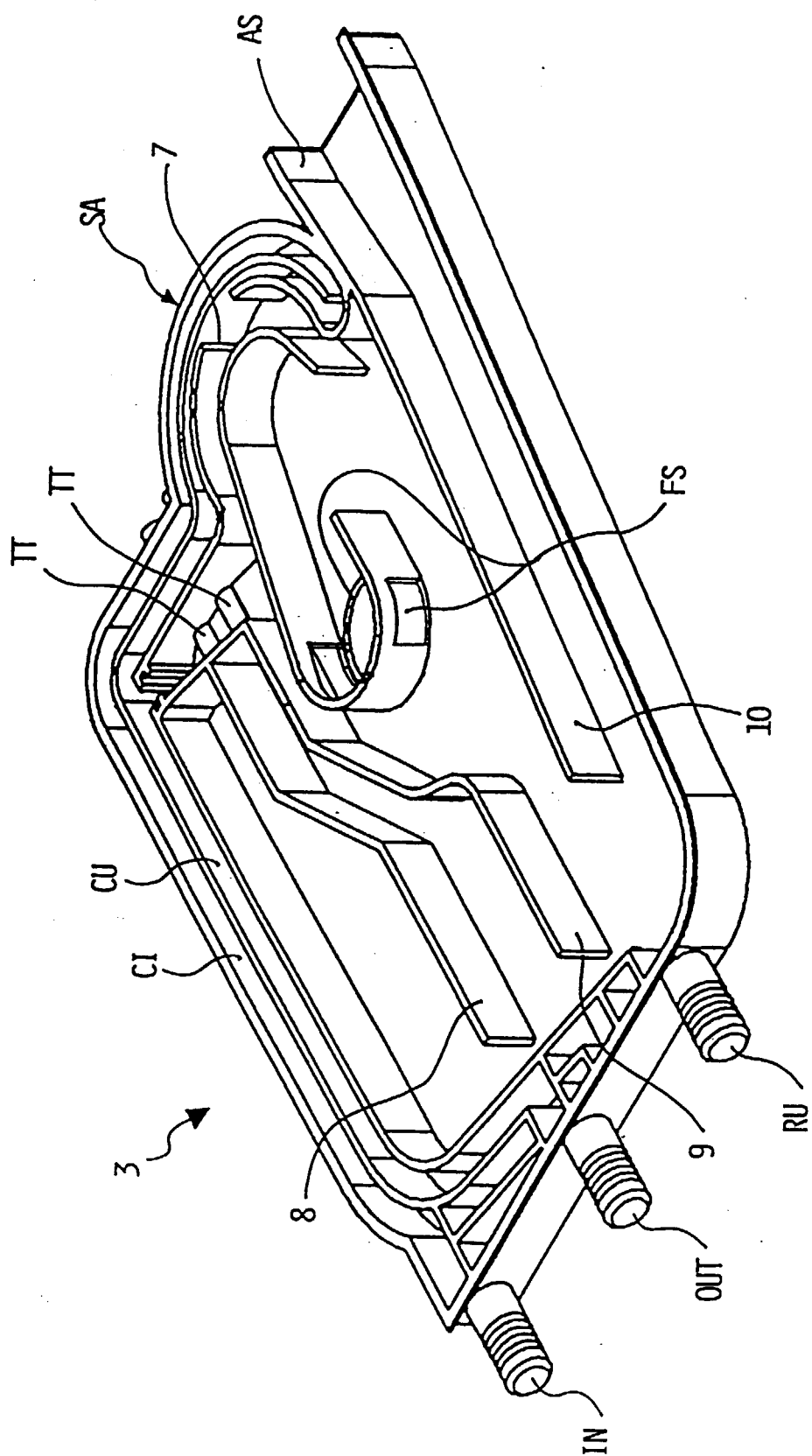
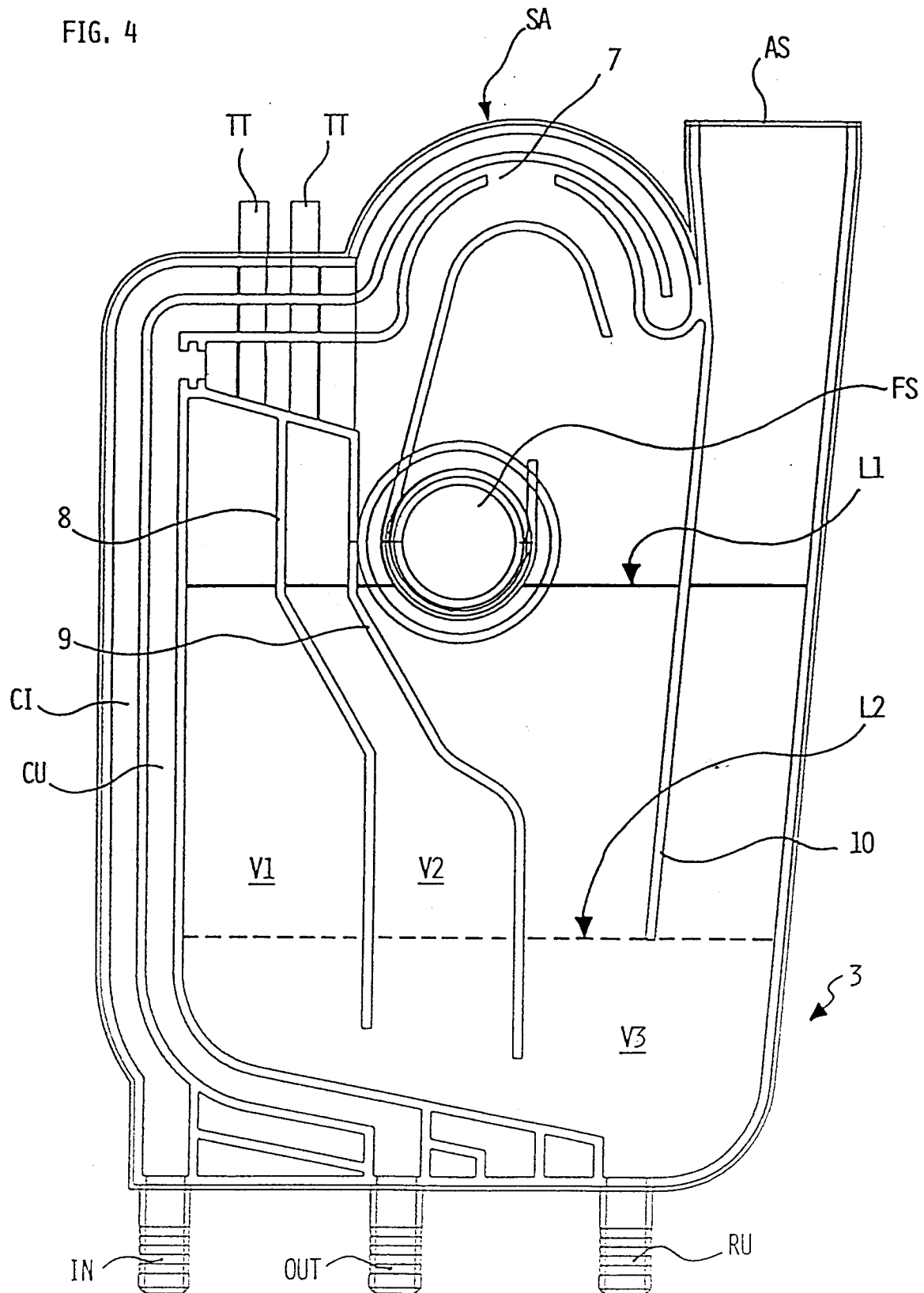


FIG. 3

FIG. 4





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 7374

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)
D, A	IT 1 238 419 B (MERLONI ELETTRODOMESTICI SPA) 26 July 1993 * the whole document * -& EP 0 435 119 A ---	1, 11	A47L15/00 A47L15/48 A47L15/42
A	EP 0 752 232 A (MERLONI ELETTRODOMESTICI SPA) 8 January 1997 * the whole document * ---	1, 11	
A	EP 0 520 898 A (ESSWEIN SA) 30 December 1992 * the whole document * -----	1, 11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A47L
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		17 August 1998	Madsen, P
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