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(54) Improved dishwashing machine

(57) A dishwashing machine (1) comprises a washing chamber (3) formed in a machine body (2), a pump (12) for the washing water, spraying means (8) for spraying washing water onto the dishes, a delivery duct (13) for establishing fluid communication between the pump (12) and the spraying means (8), and an electrical re-

sistance (15) associated with a section (14) of the delivery duct (13), for heating the washing water. The dishwashing machine (1) also comprises thermal regulation means (16, 17) for regulating the current supply of the electrical resistance (15) depending on the water level in the section (14) containing the resistance (15).

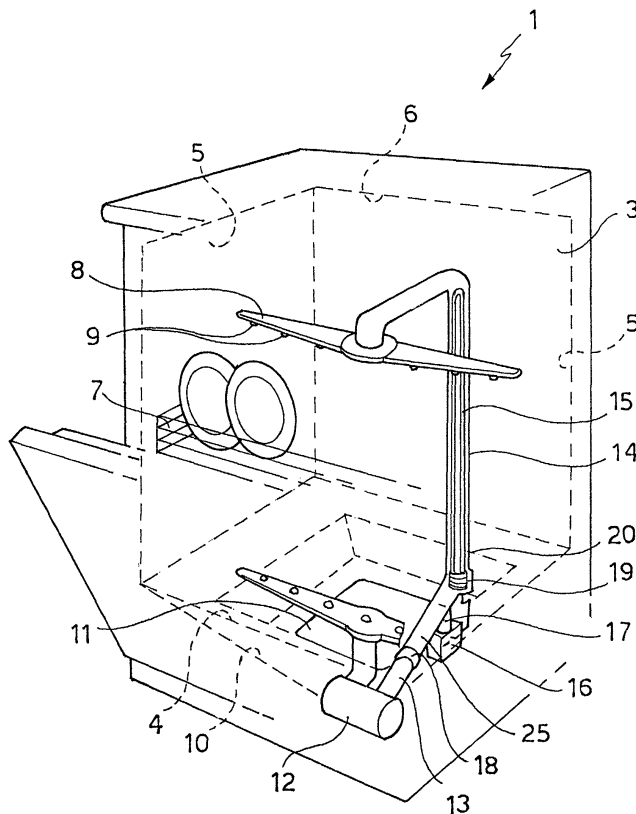


FIG. 1

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Description

[0001] The present invention relates to a dishwashing machine of the type comprising a washing chamber formed in a machine body, a pump for the washing water, means for spraying the washing water, a delivery duct for establishing fluid communication between the pump and the spraying means, and heating means for heating the water which is sprayed onto the dishes to be washed.

[0002] These heating means are usually provided in the form of electrical resistances, for example of the type comprising a plated tube, which are mounted by the water supply system, in heat exchange relation with the washing water.

[0003] Systems are known where an electrical resistance, shaped in the form of a coil, is housed inside a heating tank formed directly in the bottom part of the washing chamber or consisting of a separate container arranged inside or outside the washing chamber and in fluid communication with the pump and with the spraying means.

[0004] This solution is constructionally complex, bulky and difficult to assemble, in addition to increasing the quantity of water drawn from the water mains and conveyed by the pump.

[0005] Moreover, the heat exchange between the electrical resistance and the washing water varies depending on the volume of water present in the heating tank as well as on the quantity, speed and pressure with which the water is drawn from and supplied into the tank.

[0006] This makes controlled heating of the washing water very difficult, if not impossible, with the additional risk of overheating both of the electrical resistance and of the walls of the heating tank.

[0007] In order to eliminate the bulkiness of the heating tank it was proposed to insert the heating resistance directly inside the supply duct for the sprayers, realising instantaneous heating of the water passing through this duct.

[0008] In these systems, the heat exchange between the electrical resistance and washing water is very sensitive to variations in the filling level of the duct as well as the speed and pressure of the water, jeopardising reliable control over the temperature of the water sprayed onto the dishes.

[0009] There exists moreover a considerable risk of overheating of the walls of the supply duct, due to the small distance between the electrical resistance and these walls. This jeopardises, for example, the use of pipes made of synthetic material.

[0010] In other systems of the prior art, the electrical resistance is mounted on the outside of the supply duct, forming for example a heating helix around said duct, which must be formed by metal pipes.

[0011] In this case, the electrical resistance, in addition to heating the metal duct, also heats the environment outside the duct. Consequently, in order to avoid

damage to the dishwashing machine, it is necessary to protect its sensitive parts or make it using a material which is heat-resistant.

[0012] Since the heat exchange between the supply duct and the washing water is very irregular and sensitive to the variation in the level of filling of the duct and the flow speed inside it, regulation of the temperature of the washing water and the overall efficiency of the heating system are unsatisfactory.

[0013] The object proposed by the present invention is therefore that of solving the problems mentioned above, by providing a dishwashing machine with characteristics such as to ensure controlled and efficient heating of the washing water, without any risk of overheating.

[0014] The abovementioned object is achieved by means of a dishwashing machine according to Claim 1.

[0015] In order to understand the invention better, the description of a non-limiting example of embodiment thereof is provided below, as illustrated in the accompanying drawings in which:

[0016] Figure 1 is a sectioned prospective view of a dishwashing machine according to the invention;

[0017] Figure 2 is a sectioned view of the heating system of a dishwashing machine according to the invention;

[0018] Figure 3 is an enlarged view of the detail III in Figure 2.

[0019] With reference to Figure 1, a dishwashing machine according to the invention is indicated in its entirety by the reference number 1.

[0020] The dishwashing machine 1 comprises a machine body 2, inside which a washing chamber 3 is formed. The washing chamber 3 is delimited by a bottom 4, by a top wall 6 and by side walls 5. In a manner which is entirely conventional (and therefore not shown in the figures), the washing chamber 3 and the machine body 2 have a front opening provided with a door, opening of which allows access inside the washing chamber 3 in order to introduce or remove the dishes.

[0021] The washing chamber 3 houses extractable baskets 7 inside which the dishes are positioned.

[0022] The washing chamber 3 has, arranged inside it, spraying means, preferably rotating arms 8 provided with a plurality of nozzles 9, through which the washing and rinsing water is delivered.

[0023] The water delivered by the spraying means is collected by means of gravity inside a storage basin 10 positioned underneath the bottom 4 of the washing chamber 3. For this purpose, the bottom is formed so as to convey the water towards the abovementioned storage basin 10 and is provided with special openings 11 for allowing through-flow of the water.

[0024] The dishwashing machine 1 comprises a pump 12 which, by means of delivery ducts 13, conveys the pressurised washing or rinsing water to the spraying means 8. Depending on the operating cycle envisaged, the pump 12 may be supplied with water from the water

mains or, alternatively, may draw the water from the storage basin 10.

[0025] In the example, the dishwashing machine 1 comprises a delivery duct 13 which establishes fluid communication between the pump 12 and the spraying means, for example the upper rotating arms 8.

[0026] The delivery duct comprises a section 14 which extends substantially vertically, preferably but not necessarily inside the washing chamber 3 from the bottom 4. Advantageously, said section 14 extends adjacent to one of the side walls 5, preferably the wall opposite the front opening of the washing chamber 3.

[0027] The dishwashing machine 1 is equipped with at least one electrical heating resistance 15 associated with said section 14 of the delivery duct 13 so as to heat the washing water inside it and comprises thermal regulation means able to regulate the current supply of said electrical resistance 15 depending on the level of filling of the section 14 with washing water. Preferably said thermal regulation means comprise a microswitch 16 which can be actuated by means of a sensor detecting the pressure of the washing water, for example a pressure membrane 17 arranged in the wall of the delivery duct 13.

[0028] Advantageously, the dishwashing machine 1 comprises flow regulating means for regulating the water filling level of said section 14. Preferably, said flow regulating means comprise a slow-return valve 18 able to limit and prevent rapid emptying of the section 14 of the delivery duct 13.

[0029] Preferably, the slow-return valve 18 has a resistance such as to delay emptying of the section 14 containing the resistance 15 for the time necessary for cooling of the resistance 15.

[0030] In accordance with the preferred embodiment, the heating resistance 15 is housed inside said section 14 of the delivery duct 13, extending substantially along the whole of its length. The section 14 itself is advantageously straight and extends vertically inside the washing chamber 3, occupying preferably the whole height thereof.

[0031] The electrical resistance 15, which is preferably U-shaped and has a sealing base-piece 19, is inserted inside said section 14 of the delivery duct 13 through a special opening provided along an elbow portion 20 thereof and equipped with suitable seals 21 so that the sealing base-piece 19 seals said opening hermetically, and the ends 22 of the resistance 15 for electrical connection, passing through said sealing base-piece 19, emerge from the delivery duct 13 so as to be connected to the electrical circuit of the dishwashing machine 1.

[0032] Advantageously, the part of the sealing base-piece 19 which is directed towards the inside of the delivery pipe is shaped so as to form a flow guide for the washing water.

[0033] In the region of the elbow portion 20 there is provided a safety conveyor 23 able to collect the lost water due to any permeability between the sealing base-

piece 19 and the opening and convey it into a safety basin.

[0034] The electrical resistance 15 extends substantially centrally inside the straight section 14 which may have a cross section suitably widened to house more easily the resistance 15 itself. In any case the resistance 15 inserted inside the delivery duct 13 preferably does not have any points of direct contact with the walls of the duct 13 and is therefore equipped with at least one spacer 24 made of material having a low coefficient of thermal conductivity, preferably ceramic material, for ensuring positioning thereof inside the delivery duct 13.

[0035] The pressure membrane 17, which is advantageously arranged in a lower portion 25 of the delivery duct 13, via which the pump 12 conveys the washing water into the section 14 containing the resistance 15, is deformable depending on the water pressure inside said lower portion 25 of the duct 13 and consequently depending also on the hydrostatic pressure due to the filling level of the section 14 containing the heating resistance 15.

[0036] The pressure membrane 17, being deformed as a result of the water pressure, is intended to actuate the microswitch 16, which in turn regulates the current supply of the heating resistance 15 depending on the filling level of the section 14 containing the resistance 15 and more precisely depending on the degree of immersion of the resistance 15 in the washing water, interrupting for example automatically the supply of current to the resistance 15 when it is not immersed in the washing water.

[0037] The slow-return or non-return valve 18, which is arranged advantageously in said lower portion 25 of the delivery duct 13 between the pump 12 and the pressure sensor 17, allows the passage of the washing water from the pump 12, but delays and/or prevents the back-flow of the water from the section 14 containing the resistance 15 towards the pump, ensuring a filling level of the section 14 such that the resistance 15 is always immersed in the water during the heating phases and during the delayed cooling phases owing to the thermal inertia of the resistance 15.

[0038] Operation of the dishwashing machine according to the invention will be described below.

[0039] During a washing cycle, the pump 12 draws the washing water from the water mains or from the storage basin 10 and conveys it, via the delivery duct 13, to the spraying means 8. If the step in the washing or rinsing programme requires heating of the washing water, the resistance 15 inside the section 14 of the delivery duct 13 is supplied with electric current and, heating up, heats the washing water passing through said section 14.

[0040] In the event of emptying of the section 14, and more precisely in the event of incomplete immersion of the electrical resistance 15, the pressure sensor 17 actuates the microswitch 16, which reduces or interrupts the current supply of the resistance 15, thus preventing

overheating of said resistance 15 and the walls of the delivery duct 13.

[0041] At the end of pumping and heating of the washing water, the slow-return or non-return valve 18 delays or prevents backflow of the water from the section 14 containing the resistance 15 towards the pump 12, so as to ensure that the electrical resistance 15, which is now deactivated, but still hot owing to its thermal inertia, is immersed in the water for the period during which it cools.

[0042] In accordance with an embodiment of the invention, door-locking means are provided, said means being able to prevent undesirable opening of the dishwashing machine, for example during the heating phases, in order to avoid any deficiency of water around the resistance. Advantageously, supplying of power to the heating resistance 15 and the pump 12 is controlled by means of a control unit, preferably on the basis of signals supplied by the pressure sensor 17 and any additional thermal sensors, the door-locking means and the washing programme selected.

[0043] The dimensions of the section 14 as well as those of the resistance 15 can obviously be adapted to the spatial constraints inside the dishwashing machine. The resistance could for example be envisaged also inside a section of a delivery pipe for supplying the bottom spraying means so as to allow varied washing of the load inside the washing chamber 3.

[0044] The dishwashing machine 1 according to the invention has numerous advantages.

[0045] Automatic regulation of the current supply of the heating resistance 15 depending on the pressure conditions of the washing water inside the delivery duct 13 allows controlled and efficient heating of the washing water, without any risk of overheating.

[0046] Regulation of the current supply of the resistance 15 may be performed both depending on the filling level of the section 14 containing the resistance 15 and depending on the pressure condition of the entire water, and more precisely depending on the filling level (hydrostatic pressure) and the flow speed (hydrodynamic pressure).

[0047] The flow regulating means, and more precisely the valve means 18 located inside the delivery duct 13, allow adjustment of the degree of immersion of the resistance 15 in the water, as well as the flow of the washing water, in particular during the transition phases of the washing cycle.

[0048] Therefore, the dishwashing machine 1 according to the invention ensures an optimum washing performance and reliable and safe operation, in particular in transition or emergency situations, such as sudden changes in the washing programme, unprogrammed switching off of the dishwashing machine, opening of the door and deliberate interruption of the washing programme during the recycle phase.

[0049] The dishwashing machine according to the invention does not increase the quantity of water in use

and leaves the flow circuit unchanged, avoiding moreover an excessive dispersion of heat.

[0050] Obviously, a person skilled in the art, in order to satisfy contingent and specific requirements, may make further modifications and variations to the dishwashing machine according to the present invention, all of which moreover are contained within the scope of protection of the invention, as defined by the following claims.

Claims

1. Dishwashing machine (1) comprising a washing chamber (3) formed in a machine body (2), a pump (12) for the washing water, spraying means (8) for the washing water, a delivery duct (13) for establishing fluid communication between the pump (12) and said spraying means (8), and heating means, preferably an electrical resistance (15), associated with a section (14) of the delivery duct (13), **characterized in that** it comprises thermal regulation means (16, 17) able to regulate the current supply of the electrical resistance (15) depending on the level of filling of said section (14) with washing water.
2. Dishwashing machine (1) according to Claim 1, in which said thermal regulation means (16, 17) comprise a microswitch (16) which can be actuated by means of a pressure sensor (17) for the washing water.
3. Dishwashing machine (1) according to Claim 2, in which said pressure sensor is a pressure membrane (17) arranged in the wall of the delivery duct (13).
4. Dishwashing machine (1) according to one of the preceding claims, comprising flow regulating means (18) able to regulate the filling level of said section (14) with washing water.
5. Dishwashing machine (1) according to Claim 4, in which said flow regulating means (18) comprise a slow-return valve (18) able to delay and prevent emptying of the section (14) of the delivery duct (13).
6. Dishwashing machine (1) according to any one of the preceding claims, in which said electrical resistance (15) is housed inside the section (14) of the delivery duct (13).
7. Dishwashing machine (1) according to Claim 6, in which said section (14) of the delivery duct (13) is substantially straight.

8. Dishwashing machine (1) according to Claim 6 or 7, in which said section (14) of the delivery duct (13) extends substantially vertically inside the washing chamber (3).
5
9. Dishwashing machine (1) according to any one of Claims 6 to 8, in which the electrical resistance (15) extends centrally inside the section (14), at a distance from the wall of the delivery duct (13).
10
10. Dishwashing machine (1) according to any one of Claims 6 to 9, in which said electrical resistance (15) is provided with at least one spacer (24) made of material having a low coefficient of thermal conductivity, preferably ceramic material, in order to ensure positioning thereof inside the section (14).
15
11. Dishwashing machine (1) according to any one of Claims 6 to 10, in which said electrical resistance (15) is substantially U-shaped with its ends (22) for electrical connection emerging in a sealed manner from said delivery duct (13).
20
12. Dishwashing machine (1) according to any one of Claims 6 to 11, in which said section (14) of the delivery duct (13) extends substantially over the entire height of the washing chamber (3) and the electrical resistance (15) extends substantially over the entire height of the section (14).
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13. Dishwashing machine (1) according to any one of Claims 6 to 12, in which said section (14) of the delivery duct (13) has a widened form in cross section.
14. Dishwashing machine (1) according to any one of Claims 6 to 13 insofar as dependent on Claim 5, in which said slow-return valve (18) is arranged in the delivery duct between the pump (12) and the section (14) containing the electrical resistance (15).
35
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15. Dishwashing machine (1) according to Claim 13, in which the pressure membrane (17) is arranged in the delivery duct between the slow-return valve (18) and the section (14) containing the electrical resistance (15).
45
16. Dishwashing machine (1) according to any one of the preceding claims, comprising moreover door-locking means able to prevent opening of the dishwashing machine door during the washing programme.
50
17. Dishwashing machine (1) according to any one of the preceding claims, in which the heating resistance (15) is arranged inside a section (14) of the hydraulic system of the dishwashing machine (1) which allows varied supplying of top and bottom spraying means inside the washing chamber (3).
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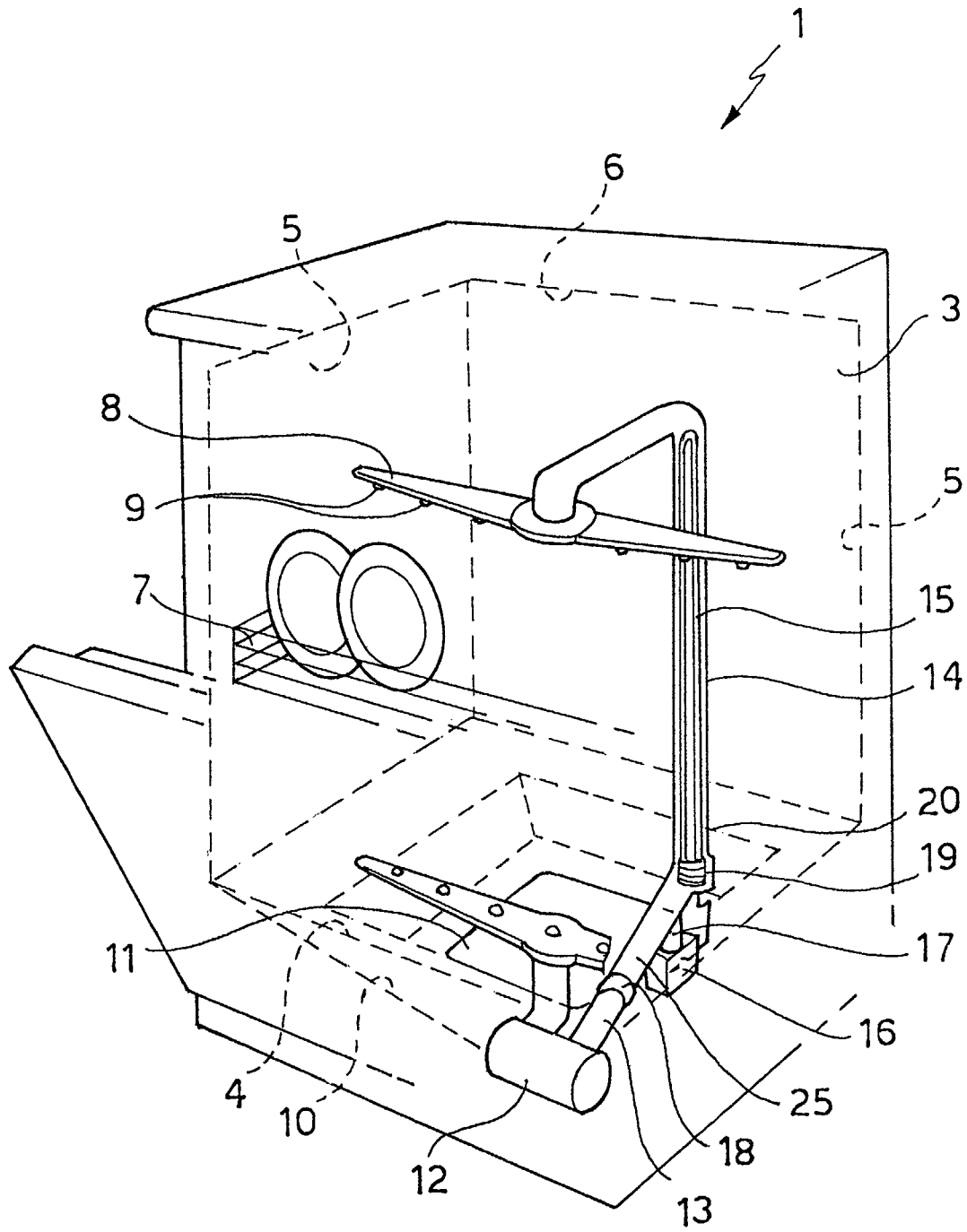


FIG. 1

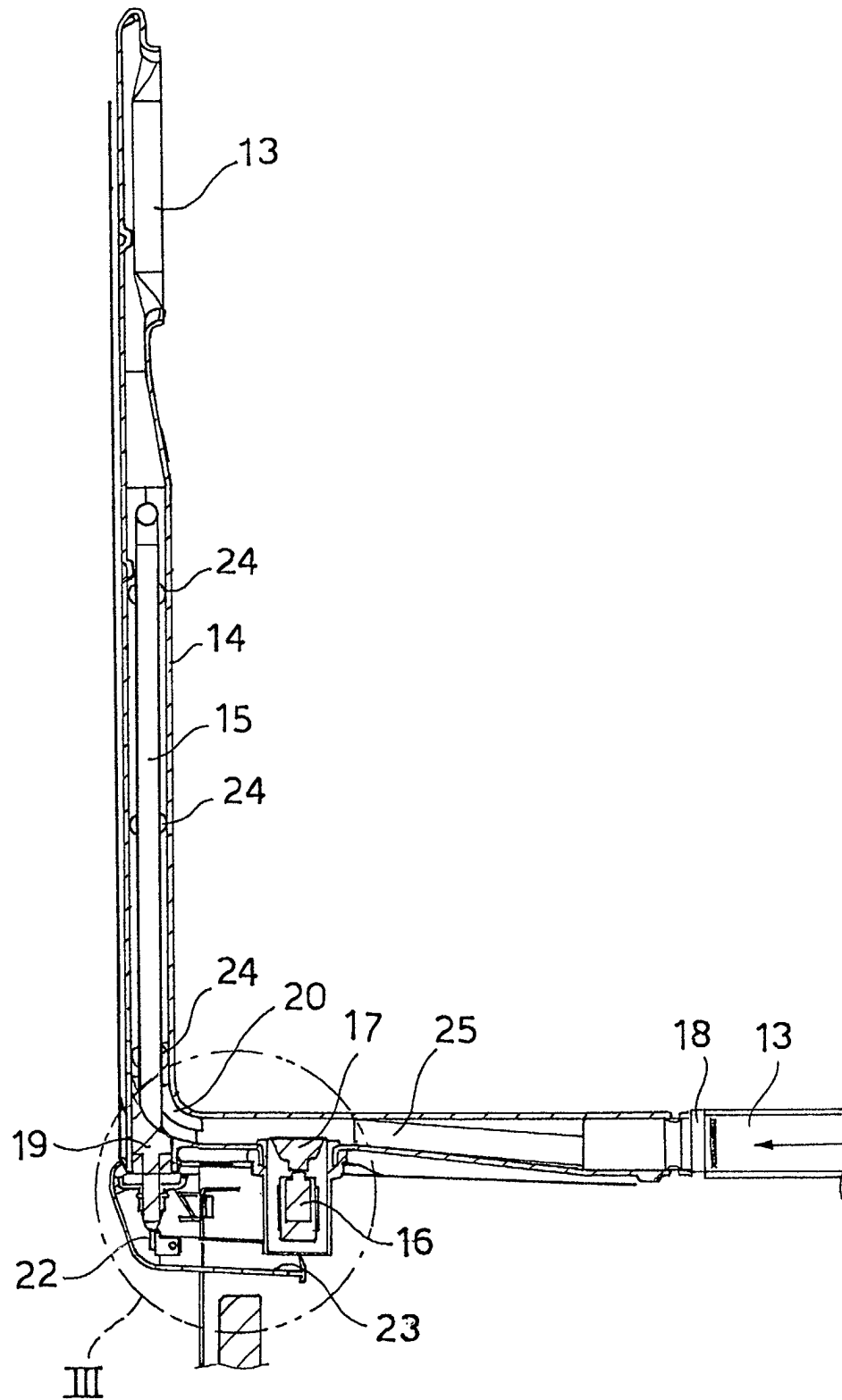


FIG. 2

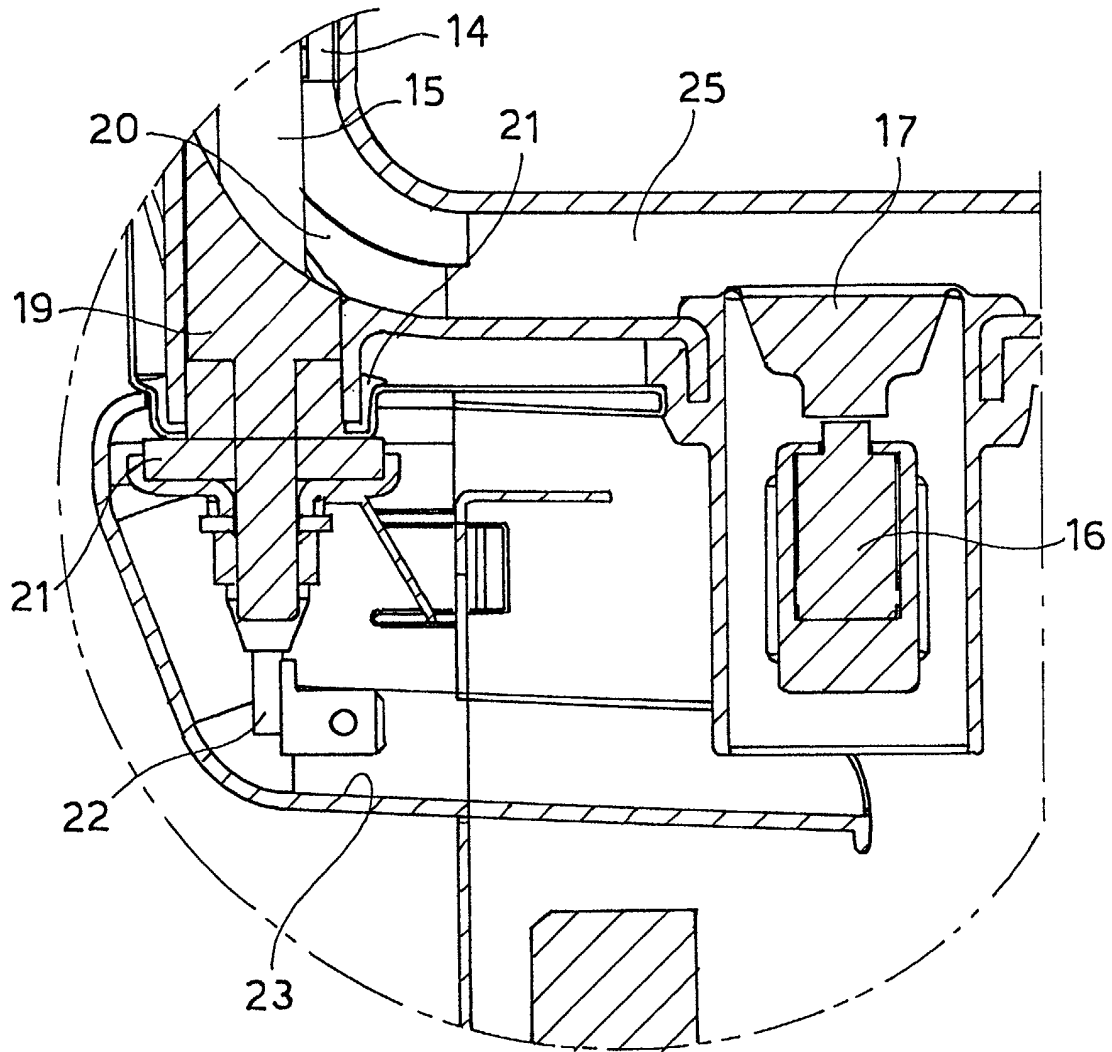


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5368

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 October 2002	Examiner Courrier, G
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