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(54) **Double-tank dishwasher with hydraulic interconnection circuit**

(57) A dishwasher includes a washing tank with a dividing baffle (10) that performs the division of the tank into two independent sectors each of which is provided with a collecting sump (3; 13), with a relevant pressure switch (4; 14) to control the water level, from which the water reaches a wash pump (1; 11) through a heating resistor (2; 12), as well as a pair of sprinklers (5; 15) that receive the water from the wash pump (1; 11) through a supply duct (8; 18), the two sectors being connected by a hydraulic circuit that includes two three-way deviating valves (6; 16) each of which is arranged on the supply

outlet of a wash pump (1; 11) and has two outlets respectively toward the supply duct (8; 18) and toward a transfer duct (9; 19) connected to the sump (3; 13) of the other sector. In this way each of the two sectors can operate independently, yet in the case of simultaneous washing with the same cycle in the two sectors it is possible to use the same water for the alternate washing in the two sectors, therefore with a water amount almost reduced by half as well as a lower consumption of energy and detergent since the water transferred from a first sector to the other has already been heated and added with detergent in the first sector.

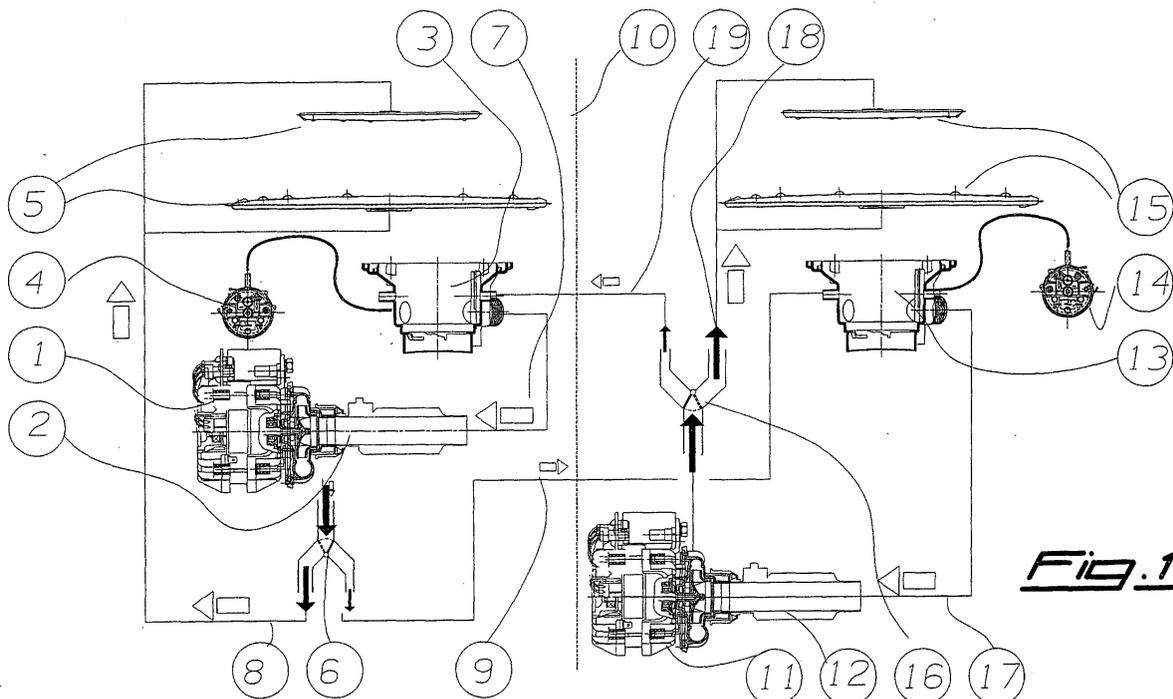


Fig. 1

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Description

[0001] The present invention relates to dishwashing machines, and in particular to a dishwasher for domestic use with the washing tank divided into two sectors that can be used separately yet are connected through a hydraulic interconnection circuit.

[0002] It is known that dishwashers for domestic use are provided with various arrangements for adapting them to the number and type of dishes to be washed, such as the setting of low-temperature, or energy-recovery, cycles or the feeding of one sprinkler only and so on. Regardless of the adopted solution, in known dishwashers the washing affects the whole tank and therefore the whole structure of the machine is heated through the contact with hot water.

[0003] As a consequence, the actual energy saving with respect to the conventional full load operation does not exceed 20%. Moreover, it is not possible to differentiate the type of washing between the two racks as to temperature, jet pressure and detergent since there is a single washing circuit fed by a single wash pump. Theoretically, a certain degree of differentiation could be achieved by changing the temperature and washing time together with the alternate feeding of the sprinklers, but this implies a more complicated circuit and a significant extension of the cycle length.

[0004] A first example of a dishwasher with the washing tank divided into two independent sectors is disclosed in DE 7105474U. A second more sophisticated example of this type of dishwasher is disclosed in the previous patent by the applicant EP 1371319, that also provides a hydraulic interconnection system between the two sectors to automatically adjust the water level between the two sumps in the case of simultaneous operation. The element that performs the connection is a four-way valved manifold that receives water from the washing pumps and mutually connects the two sumps for the equalization of the water through the communicating vessels principle.

[0005] However even these dishwashers do not allow to maximize the water and energy saving since they do not provide means to combine two simultaneous washing cycles with the greatest efficiency.

[0006] Therefore the object of the present invention is to provide a dishwasher that overcomes the above-mentioned limits.

[0007] This object is achieved by means of a dishwasher provided with a hydraulic interconnection circuit between the two sectors that includes two three-way deviating valves and the relevant ducts for the interchange of water between the two sectors.

[0008] The main advantage of the dishwasher according to the present invention is exactly that of being able to use, in case the same cycle is carried out simultaneously in the two sectors, the same water for the alternate washing in the two sectors therefore with a water amount reduced almost by half with respect to the

amount required by the presence of two non-interconnected washing pumps. This obviously implies also a reduction in the consumption of energy and detergent since the water passing from one sector to the other has already been heated and added with detergent in the first sector.

[0009] It should be noted that in any case there is still the possibility to achieve a total operating differentiation between the two sectors, each of which can operate according to its own cycle with specific parameters of temperature, duration and type of detergent even in different moments with respect to the other sector.

[0010] A second significant advantage of this dishwasher is that it can also use the different times of the wash phases to "combine" the cycles in the two sectors. For example, while a first sector carries out the wash phase, the second sector loads the water for rinsing and starts the rinse phase; or it is possible to carry out the prewash phase in the two sectors simultaneously since the water loaded in this phase although being in a greater amount is not heated.

[0011] A further advantage of this type of machine is its low cost and simplicity that stem from the fact that not only the elements in the two sectors are identical but even the two valves of the interconnection circuit are identical, whereby the molds required to manufacture them and the working out required are cut by half.

[0012] These and other advantages and characteristics of the dishwasher according to the present invention will be clear to those skilled in the art from the following detailed description of an embodiment thereof, with reference to the only drawing, annexed as fig.1, wherein a diagrammatic front view shows some essential elements of the present dishwasher and the interconnection system between the two sectors.

[0013] Referring to said figure, there is seen that a dishwasher according to the invention conventionally includes a horizontally extending washing tank with a central dividing baffle 10 which performs the division of the tank into two independent sectors, a left sector and a right sector.

[0014] In each of the two sectors there are provided all the elements required for the individual operation: in the left/right sector, respectively, a collecting sump 3/13, with a relevant pressure switch 4/14 to control the water level, from which the water goes through a suction duct 7/17 to a wash pump 1/11 passing through a heating resistor 2/12; as well as a pair of sprinklers 5/15 that receive the water from the above-mentioned pump 1/11 through a supply duct 8/18.

[0015] It is obvious that also other elements not illustrated in the figure are provided, such as temperature sensors, a microprocessor to control the operation of the machine, drain pumps, and various other members common to the two sectors for the supply and drain of water (an electrovalve controlling the entrance of water from the network, a flow meter, a softening unit with a deviating valve, a drain connector, etc.) that correspond

to those described in the above-mentioned patent EP 1371319.

[0016] The novel aspect of the present dishwasher consists of the interconnection circuit between the two sectors that allows to transfer the water between the two sumps in the case of simultaneous operation with the same cycle. In this way it is possible to use the smallest amount of water while achieving the best consumption/performance ratio.

[0017] The elements that perform the interconnection are two deviating valves 6/16, substantially Y-shaped and arranged on the supply outlets of the wash pumps 1/11, which through respective transfer ducts 9/19 are connected to the sump of the other sector. In other words, valve 6 of the left sector can deviate the water to sump 13 of the right sector, and similarly valve 16 of the right sector can deviate the water to sump 3 of the left sector.

[0018] In the light of the description above, first of all it is clear that the dishwasher can operate in standard mode simply by keeping the deviating valves 6/16 open toward the respective supply ducts 8/18, so that the two sectors are independent of each other.

[0019] On the contrary, if the user sets the same cycle simultaneously in the two sectors, then it is possible to perform the above-mentioned transfer of water from one sector to the other in order to minimize the consumption as illustrated hereunder.

[0020] Let us assume that the water is loaded in the left sector, where the wash phase is started by activating pump 1 that sucks water from sump 3 through duct 7 and sends it to valve 6 that directs the flow to duct 8, so that it reaches sprinklers 5.

[0021] After a set time, with pump 1 still working, valve 6 is switched by closing the outlet toward duct 8 while opening the outlet toward duct 9 that leads the water to sump 13 in the right sector. It should be noted that the outlet of the deviating valve 6 toward duct 9 has a smaller cross-section and/or constrictions (as shown by the smaller arrow) to achieve a gradual transfer, over 12-15 seconds' time, i.e. with a flow rate approximately reduced by 60-80% with respect to the normal flow rate to sprinklers 15.

[0022] When the control unit of the machine detects, by means of pressure switch 14, the presence of a certain amount of water in sump 13, it activates the washing pump 11 with valve 16 open toward the transfer duct 19, valve 16 being then switched within seconds to the supply duct 18 (this is necessary to reduce the noise that would be caused by pump 11 if it should start at full flow rate). Once a minimum water level is detected in sump 3, by means of pressure switch 4, the washing pump 1 is stopped.

[0023] All this water transfer phase is quite complex and delicate to manage if only fixed speed pumps are considered, but if variable speed pumps are used it becomes much easier. In fact in such case it is possible to manage the flow of pump 11 at start by using a low

speed of rotation, whereby valve 16 can be immediately opened toward duct 18 while pump 11 is taken to the nominal speed simultaneously with the stopping of pump 1.

[0024] After the set time, valve 16 that takes back the water in the same way to the left sector is switched, with the relevant switching of valve 6 always according to the type of pump 1 in use (fixed or variable speed).

[0025] The water heating phases obviously take place by activating the heater in the sector where the water is present at the moment, which is checked by pressure switches 4, 14. At the end of the single phases of the cycle (wash, rinse, etc.) there is the simultaneous or independent activation of the drain pumps (not shown) connected to each sump. The detergent and the brightener are loaded in one of the two sectors, and then used in both by mixing them in the water.

[0026] It is clear that the above-described and illustrated embodiment of the dishwasher according to the invention is just an example susceptible of various modifications. In particular, the number, shape and arrangement of the elements of each sector may be somewhat changed for example by providing additional heating resistors, one or more sprinklers, a crockery tray above the rack and so on. Moreover, the deviating valves 6/16 could be made in another way, e.g. with two separate shutters for the two outlets rather than with a single shutter that alternately closes them as illustrated above.

Claims

1. Dishwasher including a washing tank with a dividing baffle (10) that performs the division of the tank into two independent sectors each of which is provided with a collecting sump (3; 13), with a relevant pressure switch (4; 14) to control the water level, from which the water reaches a wash pump (1; 11), as well as at least a heating resistor (2; 12), a detergent distributor and at least a sprinkler (5; 15) that receives the water from said wash pump (1; 11) through a supply duct (8; 18), **characterized in that** it further includes two three-way deviating valves (6; 16) each of which is arranged on the supply outlet of a wash pump (1; 11) and has two outlets respectively toward said supply duct (8; 18) and toward a transfer duct (9; 19) connected to the sump (3; 13) of the other sector.
2. Dishwasher according to claim 1, **characterized in that** in the deviating valves (6; 16) the outlet toward the transfer duct (9; 19) has a smaller cross-section and/or constrictions to obtain a reduced flow rate with respect to the outlet toward the supply duct (8; 18).
3. Dishwasher according to claim 1 or 2, **characterized in that** the deviating valves (6; 16) are sub-

stantially Y-shaped.

4. Dishwasher according to one of the preceding claims, **characterized in that** the deviating valves (6; 16) are provided with a single shutter that alternately closes the two outlets. 5
5. Dishwasher according to one of the preceding claims, **characterized in that** the wash pumps (1; 11) are variable speed pumps. 10
6. Dishwasher according to one of the preceding claims, **characterized in that** each sector includes an upper sprinkler and a lower sprinkler. 15

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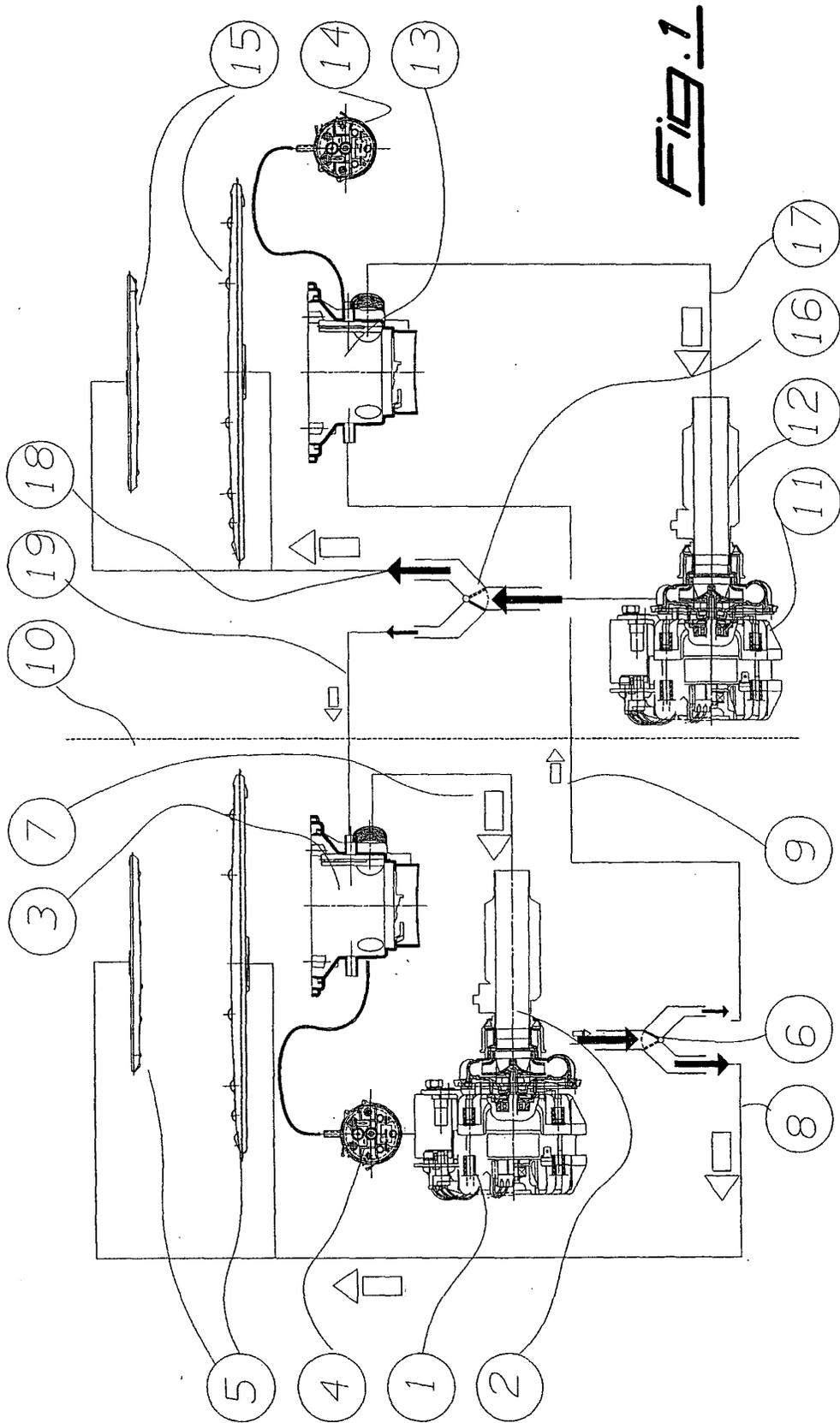
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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 October 2004	Examiner Martin Gonzalez, G
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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