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(54) **Water temperature sensing device for a washing machine, in particular a dishwasher, and washing machine employing such device**

(57) A device (9) for detecting the water temperature in a washing machine, in particular a dishwasher, is described, which comprises at least a temperature sensor (13), a support (12) for carrying said temperature sensor (13), electric connecting means (10) for connecting said temperature sensor (13) to an electronic card (8). The

invention is featured in that the support (12), carrying the temperature sensor (13), is obtained on a portion (12) of the electronic card (8), said portion being capable of separation from the remaining portion of the electronic card (8) in order to locate the support (12) carrying the sensor (13) at a remote position with respect to the electronic card (8).

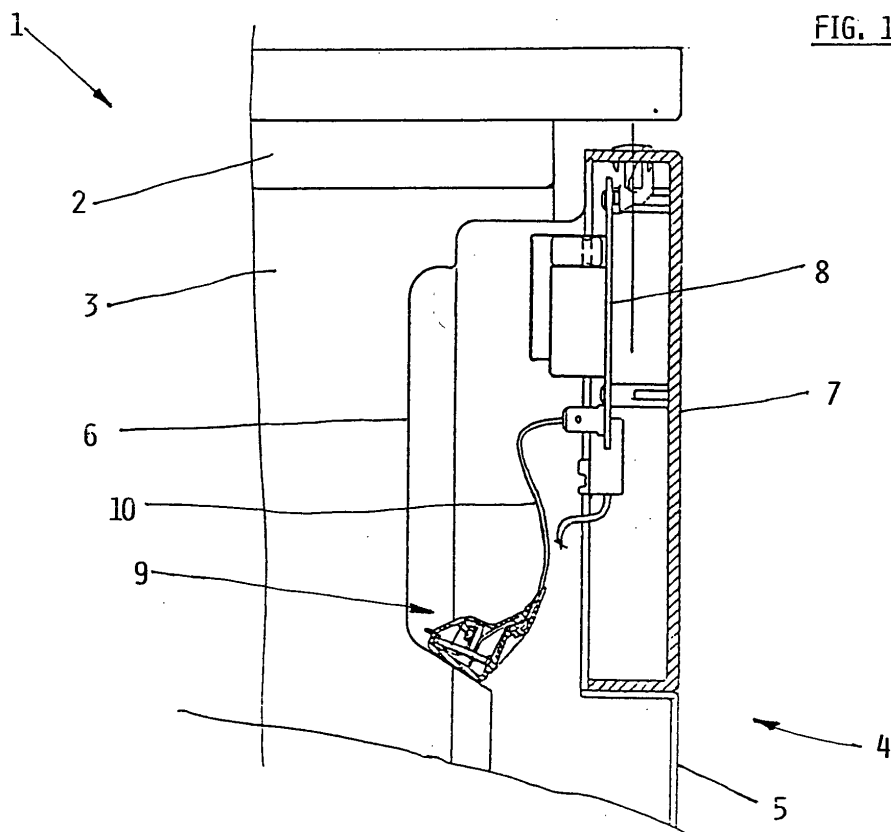


FIG. 1

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Description

[0001] The present invention relates to a temperature detection device for a washing machine, in particular a dishwasher.

[0002] As known, washing machines are equipped with devices for detecting the wash water temperature through temperature detection of the washing tub.

[0003] These devices normally consist of temperature sensors located outside under the bottom of the washing tub, which are used for indirect temperature detection of the water inside the washing tub.

[0004] In washing machines fitted with electromechanical control of machine operation, these sensors are metal thermostats located against the outer surface of the washing tub, which are generally kept in position with the use of elastic means; they are electrically connected to the heater for heating the wash water, with switching functions of the power supply to the heater when water has reached a preset temperature.

[0005] Washing machines with electronic control have NTC temperature sensors, i.e. a thermistor featured by its resistance decrease with increasing temperature.

[0006] NTC sensors, due to their small size, are inserted in a cylindrical container closed on one end, whereas the other end is closed by a metal cover.

[0007] NTC sensors are in thermal contact with the metal cover by means of a thermal grease interlaying between the sensor and the cover.

[0008] The cylindrical container with the NTC sensor inserted inside it, is housed in a suitable seat of a support made from plastic material; this support is appropriately fastened outside the washing tub in such a way to have the metal cover of the container with the NTC sensor resting against the outer wall of the washing tub.

[0009] In order to maintain a good contact between the tub wall and the metal cover of the container with the NTC sensor, elastic means are provided, such as springs, which are inserted between the support and the bottom of the container with the NTC sensor, in such a way that its metal cover is pushed against the wall of the washing tub for detecting its temperature.

[0010] Both the container with the NTC sensor and the support are made from a heat resistant plastic material with suitable electric features for electric components, which are therefore expensive parts.

[0011] The NTC sensor is connected to an electronic control card for washing machine operation.

[0012] In general, the electronic control card for washing machine operation is located inside the controls panel on the upper section outside the closing door of the washing machine.

[0013] This location requires the use of connection cables from the electronic card to the NTC sensor; the cables have to go under the tub bottom and then through to the inner door for connection to the electronic card.

[0014] In order to obtain this connection, the cables

should have a certain length; moreover, the cables should also have suitable terminals for connection to the electronic card, with relevant costs for materials and components.

[0015] The cables of the electric components housed inside the cabinet, which should be connected to the electronic card and go through from the cabinet to the door, including those of the NTC sensor, are subject to a kinking movement due to the door being opened and/or closed for loading and/or unloading the crockery. In the long run this movement may damage one or more cables subject to this stress.

[0016] Other washing machines are also known, which have a temperature sensor in contact with the inner wall surface of the machine door.

[0017] However, if on one hand this position of the temperature sensor can solve the kinking problem of the sensor cables for connection to the control device of the washing machine, as being no longer required since the sensor is located near the control devices, on the other hand it does not solve the problems related to manufacturing costs nor the problems related to the connection.

[0018] It is the object of the present invention to solve the above drawbacks and provide a device for detecting water temperature in a washing machine, in particular a dishwasher, which is simple to manufacture at low cost, is highly reliable and is capable of versatile use.

[0019] In this frame, a first aim of the present invention is to provide a washing machine, wherein the device for detecting the temperature of the wash water is located near an electronic control card.

[0020] A second aim of the present invention is to provide a washing machine having an improved support for the temperature sensor.

[0021] A further aim of the present invention is to provide a washing machine, wherein the temperature sensor can be separated from the electronic card and located accordingly for temperature detection of the wash water.

[0022] These and other aims further cleared hereafter are reached according to the present invention by a washing machine, in particular a dishwasher, incorporating the features of the annexed claims, which form an integral part of the present description.

[0023] Further objects, features and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are provided by way of non limiting example, wherein:

- Fig. 1 shows schematically a partial vertical section of a washing machine, in particular a dishwasher, according to the present invention;
- Fig. 2 shows schematically a section of a device for detecting water temperature of a washing machine, according to the present invention;
- Fig. 3 shows schematically a lengthwise section of a component of the temperature detection device

according to an embodiment of the present invention;

- Fig. 4 shows schematically a front view of an electronic control card of a washing machine, according to the present invention.

[0024] Fig. 1 is representing schematically a partial vertical section of a washing machine according to the present invention, where reference 1 indicates the washing machine in main line. Reference 2 indicates the cabinet of the washing machine, reference 3 indicates a washing tub; the washing tub 3 has inner means for the washing machine operation, such as baskets being apt to contain the crockery to be washed, water sprayers and heating means for the wash water, not illustrated in the figure as being commonly known.

[0025] Reference 4 indicates a closure door of the front part of the washing machine; the door 4 providing an outer side indicated with 5 and an inner side 6 fastened to the outer side 5.

[0026] Reference 7 indicates a control panel commonly fastened to the outer side 5 of the door 4. Reference 8 indicates an electronic card with its relevant components for controlling and operating the washing machine in a usual way; the electronic card 8 is located between the outer side 5 and inner side 6 of the door 4, fastened to the inner side of the controls panel 7. In this position the electronic card 8 is protected against the wash water by the inner door 6 of the door 4.

[0027] Reference 9 indicates a device for detecting water temperature; the device 9 is fastened by means of an adhesive to the inner door 6. This adhesive will be a common good heat conductor, suitable to withstand temperature changes of the inner door 6 without losing its adhering properties.

[0028] Reference 10 indicates the cables connecting the device 9 for temperature detection to the electronic card 8.

[0029] In Figures 2 and 3 representing schematically a section of a device for water temperature detection of a washing machine and the lengthwise section of a component of the detection device, respectively, according to an embodiment of the present invention, reference 9 indicates the device for water temperature detection in its whole.

[0030] The device 9 for detecting water temperature comprises an envelope 11 housing a support 12, with a temperature sensor 13 fastened on it. The temperature sensor 13 is an NTC sensor type.

[0031] The envelope 11 consists of two half shells indicated with 11A and 11B, respectively, which are joined together by a flexible element 14 operating as a hinge to ensure their folding up for obtaining the envelope.

[0032] The half shell 11A has an outer side 11C, whose form is apt to be coupled to the inner door 6 of the door 4; reference 15 indicates some flat laying sections for positioning the support 12 on which the temperature sensor 13 is resting. On one end of the half

shell 11A a hooking tooth 16 is apt to engage the end of the half shell 11B to keep both half shells joined together when they are folded to obtain the envelope 11.

[0033] Moreover, the half shell 11A has on each side wall 11D a small wing 17, perpendicular to the resting plane of the support 12; Fig. 3 shows only one of the side walls and one of the two wings, since the others are symmetric to the first ones; the wings 17 have a central slit 18 being apt to be coupled with a small tooth 19 located outside each side wall 11E of the half shell 11B for the closure of the envelope 11 and avoid a possible opening of both half shells.

[0034] The half shell 11B also has a central rib 20 being apt to maintain the support 12 in position with the temperature sensor 13.

[0035] In order to obtain a good thermal contact between the sensor 13 and the outer part 11C in contact with the inner door 6 of the door 4 for its temperature detection, the compartment between the support 12 and the inner surface of the part 11C is filled with thermal grease 21.

[0036] Before insertion of the temperature sensor 13 inside the envelope 11, the former is positioned on a corner of the electronic card 8 (see Fig. 4) during its preparation stage and electrically connected to the components on the card by means of the small cables 10.

[0037] Therefore, the small cables 10 are welded on one end to the support 12 and electrically connected to the temperature sensor 13, whereas on the other end they are welded to the printed circuit of the electronic card 8 and are electrically connected to the other electronic components arranged on the card.

[0038] The corner of the electronic card 8, whereon the temperature sensor 13 is arranged, can be separated from the card by means of notches 22, which ensure its detachment through a breaking of the base, obtaining the support 12 carrying the temperature sensor 13, to be inserted in the envelope 11.

[0039] Thus, the temperature sensor 13 will be separated from the electronic card 8 but directly in electric connection to the electronic card without the need of any further intermediate connections, i.e. saving time and connections. The small cables 10 are long enough for locating the temperature detection device 11 on the inner door 6 of the door 4.

[0040] The device 9 for water temperature detection will be able to detect directly the temperature of the inner side 6 of the door 4 reached by the wash water of the sprayers during the wash cycle of the crockery, and indirectly the temperature of the wash water.

[0041] The ratio from the temperature detected on the inner door of the machine door to the actual water temperature is established by the electronic card according to preset parameters.

[0042] As it can be guessed from the above description, the device for water temperature detection in a washing machine, in particular a dishwasher, is obtained by means of a temperature sensor inserted since

assembly stage in an electronic card used in the washing machine, whose electric connections were made during card manufacture, i.e. without any additional components for locating the sensor in the washing machine.

[0043] The features of the device for water temperature detection of the washing machine, in particular a dishwasher, according to the present invention, are clear from the above description and annexed drawings.

[0044] From the above description also the advantages of the device for water temperature detection described above are clear. In particular, these advantages are:

- the device for detecting the wash water temperature is located near the electronic control card;
- the device for detecting the wash water temperature uses a portion of the electronic control card as a support of the temperature sensor;
- electric connection from the device for detecting the water temperature to the electronic card is obtained by means of components prearranged on the electronic card since the assembly stage of the electronic card, i.e. requiring no additional means during assembly of the washing machine.

[0045] It is obvious that many changes and applications are easily possible and usable for the man skilled in the art to a device for detecting the water temperature of a washing machine, in particular a dishwasher, described above by way of example, without departing from the novelty principles of the inventive idea, and it is also clear that in practical actuation of the invention the various components described may be different in form and size and be replaced with technical equivalent elements.

Claims

1. A device (9) for detecting the temperature of a washing machine, in particular a dishwasher, comprising:

- at least a temperature sensor (13),
- a support (12) for said temperature sensor (13),
- electric means (10) for connecting said temperature sensor (13) to an electronic card (8),

characterized in that,

said support (12), associated to said temperature sensor (13), is located on a portion (12) of said electronic card (8), said portion being capable of separation from the remaining portion of said electronic card (8) for locating said support (12) carrying said sensor (13) in a remote location with respect to said electronic card (8).

2. A device according to claim 1, **characterized in that** said temperature detection device (9) is located in a remote position from said electronic card (8) during the assembly stage of the washing machine.

3. A device according to claim 1, **characterized in that** said electric connecting means (10) of said sensor (13) are obtained during manufacture of said electronic card (8).

4. A device according to claim 3, **characterized in that** said electric connecting means (10) comprise small cables (10).

5. A device according to the previous claim, **characterized in that** a first end of said small cables (10) is connected to said support (12), in particular it is electrically connected to said sensor (13).

6. A device according to claim 4, **characterized in that** a second end of said small cables (10) is connected to the remaining portion of said electronic card (8), in particular it is electrically connected to the electronic components located on said electronic card (8).

7. A device according to claim 1, **characterized in that** said support (12) carrying said sensor (13) is apt to be housed in an envelope (11) following its separation from said electronic card (8).

8. A device according to claim 7, **characterized in that** said envelope (11) is obtained by means of two half shells (11A, 11B) hinged to each other by a flexible element (14).

9. A device according to claim 8, **characterized in that** said half shells (11A, 11B) have means (15, 20) being apt to position said support (12) of said temperature sensor (13) in said half shells (11A, 11B).

10. A device according to claim 6, **characterized in that** said half shells (11A, 11B) have hooking means (16, 17, 18) for closing said envelope (11).

11. A device according to claim 7, **characterized in that** said envelope (11) contains a thermal conductive material (21).

12. A device according to the previous claim, **characterized in that** said thermal conductive material is a thermal grease (21).

13. A device according to claim 1, **characterized in that** said electronic card (8) has means (22) being apt to separate said support (12) from said electronic card (8).

14. A device according to the previous claim, **characterized in that** said separating means (22) have notches (22).

15. A washing machine comprising at least a temperature detection device (9) according to one or more of the previous claims.

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