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A thermostat safety device.

A safety device for a thermostat to be used in washing machines, dish washers or similar electric household appliances and adapted to regulate the heating temperature of the water. The device comprises an elastically deformable bellows (24) to be moved by the expansion of the liquid contained in the capillary tube (11) and in the temperature sensor (12) of the thermostat, in accordance with the variations of the heating temperature of the water.

Said bellows (24) acts, through a rigid arm (19) and an antagonistic spring (20), against an electric switch (16) connected to the heating element (9) of the machine, in series with the thermostatic switch (8) to be actuated by a corresponding bellows (4) of the thermostat.

In this way, if the thermostat ceases functioning the bellows (24) causes the switch (16) to open, thereby switching off the heating element (9) and avoiding dangerous overheating of the machine.

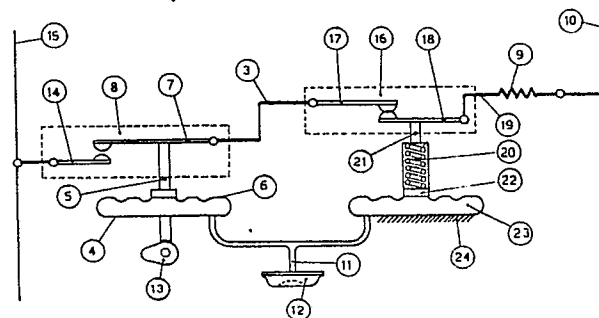


FIG. 1

EP 0 342 356 A1

A thermostat safety device

The present invention relates to a safety device for a thermostat to be used in particular for regulating the heating temperature of the water contained in the washing tank of a washing machine or dish washer.

At present, one regulates the heating temperature of the water contained in the washing tank of a washing machine or dish washer, or else in the reservoir of a water heater or similar electric household appliance, using a thermostat substantially comprising an elastically deformable metal bellows connected to an elongate capillary tube introduced into said tank or reservoir and provided at its end with a temperature sensor preferably formed as a circular capsule.

Every thermostat of this type is furthermore provided with at least one electric switch to be connected to one or more electric heating elements of the washing machine, dish washer, water heater or similar electric household appliance, and moved into the open or closed position by the bellows as a result of the expansion of a liquid contained within the capillary tube and the sensor of the thermostat, the extent of expansion being dependent on the heating temperature of the water of said tank or reservoir.

Such thermostats permit effective regulation of the heating temperature of the water but show the disadvantage of not ensuring such regulation if the thermostat ceases to function due, for example, to rupture or deformation of the capillary tube of the thermostat, in which case the liquid contained within said capillary tube and said sensor is prevented from expanding, thereby maintaining the bellows in its position of rest in which it keeps the electric switch closed and thus the heating element of the washing machine or household appliance constantly switched on.

In this state, the water is thus heated to the boiling point during the washing cycles of the washing machine, thereby possibly damaging and singeing the laundry as well as the structural parts of the machine.

The present invention is based on the object of overcoming the cited disadvantages by means of a thermostat for washing machines, dish washers or similar electric household appliances, realized in such a way as to prevent the water from overheating and thus damaging the laundry and the structural parts of the machine in the case of any functional failure of the thermostat.

This and other goals are obtained according to the invention using a safety device for a thermostat for regulating the heating temperature, to be used in particular in washing machines, dish washers or

similar electric household appliances and substantially comprising an elastically deformable, hollow metal bellows that acts against a corresponding electric switch means to be connected to at least one electric heating element of the machine in question, said bellows being connected to an elongate capillary tube provided at its end with at least one temperature sensor whose inside cavity contains a liquid capable of expanding in accordance with the temperature detected by said sensor, said bellows being movable by the expansion of said liquid from a first to a second operative position, in which said electric switch means is moved into the closed and open position, respectively.

Such a safety device is characterized by at least one further electric switch means connected to said switch means and said heating element and capable of being moved by the expansion of said liquid through elastically deformable means, against the action of elastic means, from a first to a second operative position, in which said further switch means is moved into the open and closed position, respectively.

The features of the invention will be better understood from the following description, which is intended solely as a nonlimitative example, with reference to the adjoined drawings in which

Fig. 1 shows schematically a thermostat safety device according to the invention, in a first embodiment;

Fig. 2 shows schematically the inventive safety device in a second embodiment.

Fig. 1 shows a conventional type thermostat 3 to be used in particular within the washing tank (not shown) of a washing machine or dish washer or else in the reservoir (not shown) of a water heater or similar electric household appliance, in order to permit regulation of the heating temperature of the water contained within said tank or reservoir.

This thermostat substantially comprises a metal bellows 4 of the elastically deformable and hollow type, preferably realized in a flat circular shape and provided with a central pin 5 protruding from deformable surface 6 of the bellows and acting against moving contact 7 of a conventional type elastic switch 8 to be connected to at least one electric heating element 9 of the electric circuit of the machine, that is provided for heating the water and connected to an electric supply line 10.

In particular, such a bellows is connected to an elongate capillary tube 11 to be introduced and fixed in position within the tank of the washing machine or dish washer (or within the reservoir of the water heater), said capillary tube being pro-

vided at its end with a temperature sensor 12 formed preferably as a circular capsule and adapted to detect the temperature of the water on the basis of the expansion of a liquid contained within said sensor and said capillary tube and acting in such a way as to cause a progressive deformation of bellows 4 upon increases in the heating temperature of the water.

The bellows in question is furthermore equipped with a conventional type regulating mechanism 13 adapted to vary the position of the bellows with respect to the switch, thereby varying the range of the thermostat regulating temperature.

Moving contact 7 of switch 8 can in turn be closed on a fixed contact 14 of the switch, the latter contact being connected to the other electric supply line 15 of the machine, and the moving contact being movable by bellows 4 into the closed or open position with respect to fixed contact 14, depending on whether or not the predetermined heating temperature of the water has been reached during the heating phase.

To guarantee safety even if the thermostat ceases to function due, for example, to rupture or deformation of capillary tube 11, in which case the liquid should be prevented from expanding within said capillary tube and said sensor, thereby maintaining bellows 4 in its position of rest and contacts 7 and 14 in the closed position and therefore keeping heating element 9 in the switched on state, the invention provides for the use of a safety device comprising at least one further electric switch 16 provided with a fixed contact 17 and a moving contact 18 which cooperate mutually and are connected in series to moving contact 7 of switch 8 and to heating element 9, respectively.

More specifically, moving contact 18 is connected mechanically to a rigid arm 19 disposed preferably perpendicular to the contact and loaded by a tension spring 20 to be displaced into a position in which contacts 17 and 18 are open, said spring being in turn interposed between a stop zone 21 connected to arm 19 and pin 22 protruding centrally from deformable surface 23 of a further metal bellows 24 of the elastically deformable type, which is also connected to capillary tube 11.

It is thus evident how the inventive safety device functions.

In the normal operative states of the thermostat, in which the variations in the heating temperature of the water in the tank (or reservoir) are detected by sensor 12 due to the expansion of the liquid contained in capillary tube 11 and in the sensor, both bellows 4 and 24 are loaded by the liquid, thereby permitting heating element 9 to be switched on and off via the closing and opening of contacts 7 and 14 of switch 8 by bellows 4, while contacts 17 and 18 of switch 16 are in turn main-

tained in the closed position by bellows 24, whose expansive action in such as to exceed the resistive action exerted by spring 20.

Conversely, in the case of any rupture or deformation of capillary tube 11, when the liquid contained in the tube and in sensor 12 can no longer expand, thereby maintaining both bellows 4 and 24 in the position of rest in which they are not expanded, contacts 7 and 14 of switch 8 are kept in the closed position, while contacts 17 and 18 of switch 16 are displaced into the open position, due to the displacement of arm 19 caused by the elastic action of spring 20.

By consequence, heating element 9 is in this case switched off, thus preventing the water from overheating and any damage being caused to the laundry and the structural parts of the washing machine or dish washer (or the water heater or similar electric household appliance).

Looking now at Fig. 2, in which the same components of Fig. 1 are marked by the same reference numbers, one sees that this version of the safety device uses only one bellows 4 instead of two as above. Central pin 5 of the bellows acts against elongate arm 25 connected to moving contact 18 of switch 16 and provided with stop zone 21 and with tension spring 20 which is interposed between said stop zone and said pin.

This safety device furthermore comprises fixed and moving contacts 14 and 7 of switch 8 connected to electric line 15 and in series to moving contact 18 of switch 16, respectively, whose fixed contact 17 is in turn connected to the other main line 10, in series with heating element 9.

More specifically, moving contact 7 of switch 8 can be moved by stop zone 21, simultaneously with moving contact 18 of switch 16, during the expansion or the contraction of bellows 4 produced by the expansion of the liquid in capillary tube 11 and in sensor 12.

In this case, the thermostatic regulation of the heating temperature is therefore obtained, as above, by the expansion of bellows 4 which effects the opening or closing of contacts 14 and 7 of switch 8, while simultaneously keeping contacts 18 and 17 of switch 16 in the closed position.

Conversely, in the case of rupture or deformation of capillary tube 11 of this thermostat the liquid contained in the tube and in the sensor can no longer expand and one therefore causes bellows 4 to be displaced into its contracted position of rest under the action of tension spring 20, in which case contacts 14 and 7 of switch 8 are kept closed while contacts 17 and 18 of switch 16 are moved into the open position, thereby switching off heating element 9 and obtaining the same goals and advantages as cited above.

Claims

1. A safety device for a thermostat for regulating the heating temperature, to be used in particular in washing machines, dish washers or similar electric household appliances and substantially comprising an elastically deformable, hollow metal bellows that acts against a corresponding electric switch means to be connected to at least one electric heating element of the machine, said bellows being connected to an elongate capillary tube provided at its end with at least one temperature sensor whose inside cavity contains a liquid capable of expanding in accordance with the temperature detected by said sensor, said bellows being movable by the expansion of said liquid from a first to a second operative position, in which said electric switch means is moved into the closed and open position, respectively, characterized by at least one further electric switch means (16) connected to said switch means (8) and said heating element (9) and movable by the expansion of said liquid through elastically deformable means (24, 4), against the action of elastic means (20), from a first to a second operative position, in which said further switch means (16) is moved into the open and closed position, respectively.

2. The safety device of claim 1, characterized in that said elastically deformable means comprise a further bellows (24) connected to said capillary tube (11) and said sensor (12) and acting against said further switch means (16) through a rigid arm (19) and through the intermediary of said electric means preferably embodied by a tension spring (20).

3. The safety device of claim 2, characterized in that said elastically deformable means comprise said bellows (4) acting simultaneously, through a rigid arm (25) and through the intermediary of said tension spring (20), against said switch means (8) and said further switch means (16).

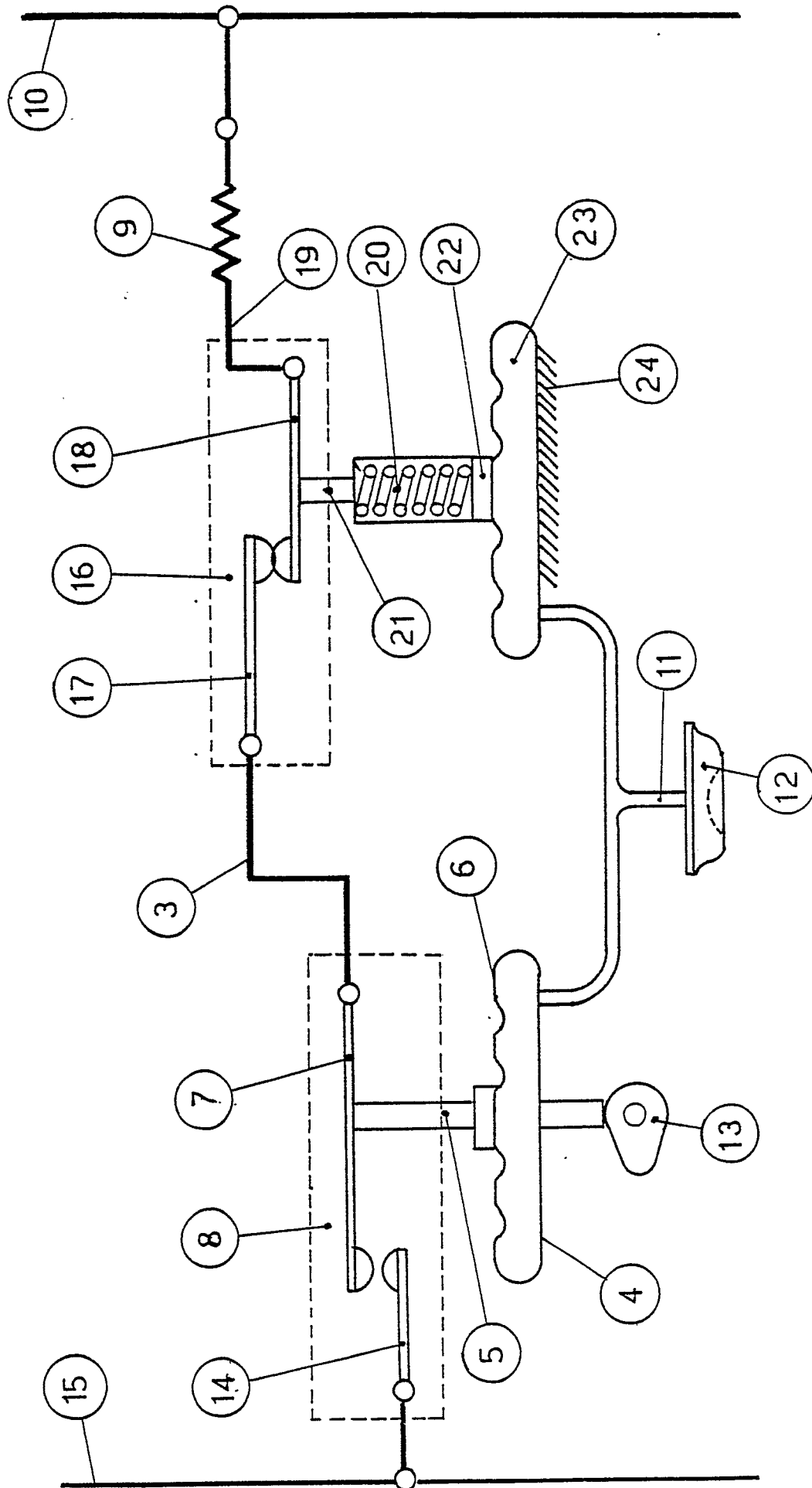


FIG. 1

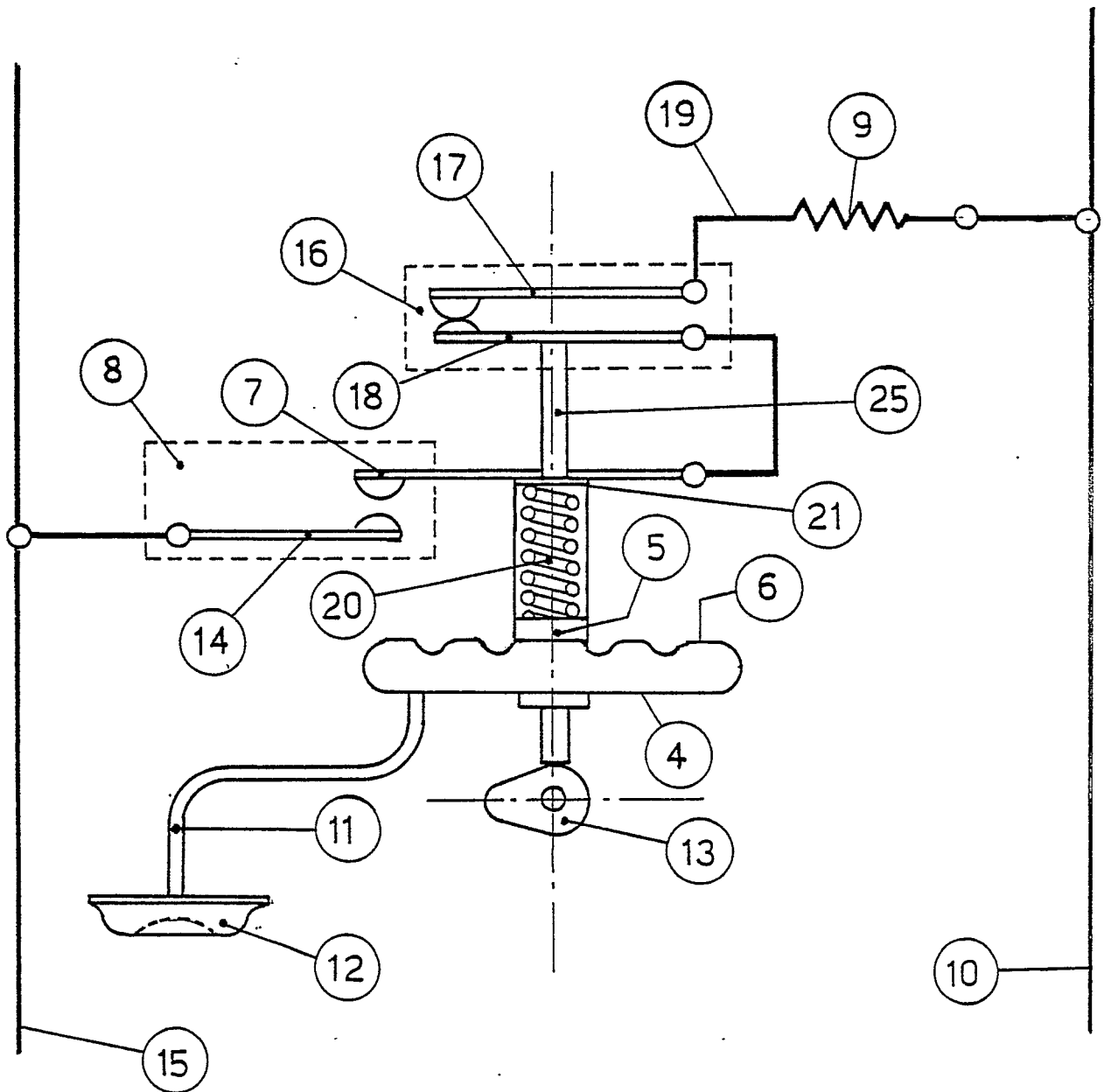


FIG. 2



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. 4)
X	DE-A-2 111 066 (R. BOSCH HAUSGERAETE GMBH) * whole document *	1	H 01 H 35/26
A	----	3	
X	DE-A-1 673 472 (EBERLE WERKE KG) * page 2, line 18 - page 4, line 18; figures 1,2 *	1	
X	DE-A-2 005 763 (P. HARDER) * page 2, line 15 - page 3, line 13; claims 1; figures 1-3 *	1	
A	US-A-4 596 361 (J.J. THEISS et al.) * column 1, lines 13-43; column 2, lines 21-55; figure 2 *	1,2	
A	FR-A-2 290 592 (DANFOSS A/S) * page 2, line 22 - page 3, line 8; page 5, line 31 - page 6, line 6; figure 1 *	1,2	
A	FR-A-2 304 954 (S.A.R.L. PRODUITS ET APPLICATIONS GAZ ET ELECTRICITE) * whole document *	1,3	
A	DE-U-8 204 097 (STIEBEL ELTRON GMBH & CO KG) * page 3, line 6 - page 4, line 20; figure 1 *	1	
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 21-08-1989	Examiner BEITNER M.J.J.B.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			