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54 **Heating element for household electrical appliances.**

57 A heating element for connecting into the wash circuit of a household electrical appliance, characterised by consisting substantially of a die-cast aluminium alloy tubular-shaped body (1), inside which the water to be heated passes, said body being coupled to an armoured resistance element (2) and being internally treated with a protective material layer (1').

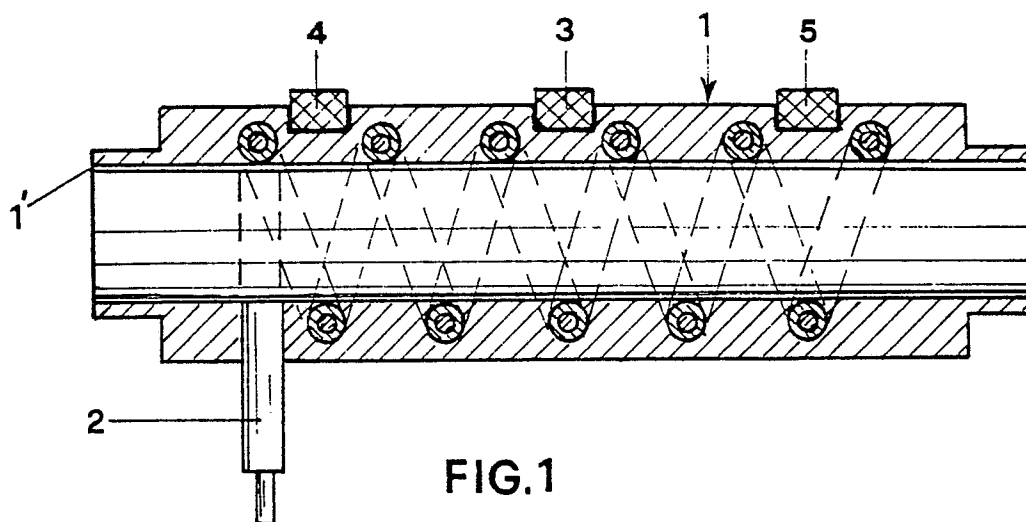


FIG.1

This invention relates to a heating element for household electrical appliances.

In known household electrical appliances which during their operating cycle comprise a wash stage with previously heated water, this heating is done by a resistance element immersed in the water contained in the bottom of the appliance. During operation the water is circulated through an appropriate utilisation circuit and is heated to the correct temperature while lying in the bottom of the appliance.

The methods used up to the present time for carrying out this wash stage have brought to light two types of drawback, of an aesthetic nature and technical nature respectively.

From an aesthetic viewpoint the method (employed in dishwashers) involving the use of a conventional armoured resistance element visible on the bottom of the appliance has often been considered unacceptable.

From the functional viewpoint the need for the resistance element to be always immersed in water means that a water quantity has to be used which is certainly greater than that strictly necessary for correctly performing the wash cycle, leading to energy wastage.

The obviate this latter drawback, ie to reduce the water quantity always present in the bottom of the appliance, it has been proposed to construct increasingly flat resistance elements and install them in a position increasingly closer to said bottom.

However, for constructional reasons it is not possible to flatten the resistance element beyond a certain limit, and its installation closer than a certain limit to the bottom of the appliance can result in technical problem, particularly if this is of plastics construction.

A further drawback of known methods is the need in such household electrical appliances to use safety and operational thermostats which have necessarily to be installed in the bottom of the appliance and inevitably require this to be drilled.

Another drawback is that if the minimum water quantity to be heated, and already representing energy wastage, corresponds to that required for operating the household electrical appliance at full load, it is certainly excessive for reduced loads, at which it also represents excessive detergent and electricity consumption.

It has also been proposed to heat the water by passing it through a steel tube externally surrounded by a resistance element brazed to it. This method allows reduction of the water quantity to be heated but results in further drawbacks, namely:

- a quick forming of calcareous incrustations which quickly compromise the correct operating of the resistance,

- the need for strict and continuous checking of the resistance element, which is highly loaded and which, if it accidentally separates from the tube even over a short length, can undergo very rapid temperature increase to unacceptable levels, possibly resulting in destruction of the element

- in order to avoid this latter drawback, the need to monitor the resistance element by means of a capillary tube wound together with it and connected to a thermostat, which interrupts power supply to the element as soon as the temperature exceeds the set value.

It has also been proposed to heat the water by passing it through a plastics container housing a resistance heating element. However the dirt and loose material from the fabric, which inevitably become contained in the wash water, adhere to the resistance element with the passage of time, to create build-ups which gradually form incrustations and constitute an insulating lay about the resistance element. Because of this formation the element disperses its heat to a lesser degree, overheats and rapidly become damaged beyond repair.

Aim of the invention is to carry out the heating of the water in household electrical appliances eliminating all the above mentioned drawbacks and particularly reducing at the least the quantity of water to be heated, thus considerably reducing the forming of calcareous incrustations on the surface of the resistance and however making easier their removal.

A further aim of the invention is to realize a heating element for water which can be used also for generating steam in the household appliances which require it.

All these aims are achieved according to the invention by a heating element for connecting into the wash circuit of a household electrical appliance, characterised by consisting substantially of a die-cast aluminium alloy tubular-shaped body, inside which the water to be heated passes, said body being coupled to an armoured resistance element and being internally treated with a protective material layer.

A preferred embodiment of the present invention is described in detail hereinafter with reference to the accompanying drawings in which:

Figure 1 is a longitudinal section of a heating element according to the invention

Figure 2 is a diagrammatic representation showing it connected into the spray circuit of a dishwasher,

Figure 3 shows it located in the steam feeding circuit in a steam oven, and

Figure 4 shows it in the same view as figure 1 in a different embodiment.

As can be seen from the figures, the element according to the invention consists essentially of

die-cast aluminium alloy tube 1 in which an armoured resistance element 2 disposed in a coil arrangement is embedded. In order to prevent the direct contact of the metallic material with the detergent liquid, the inner surface of the tube 1 is covered with a protective material layer 1'.

This layer can consist of nickel or chromium, applied with an electrochemical process, or of silicon varnish or teflon. In this case the material has also the function of reducing the lime deposit on the inner surface.

Also embedded in said die-cast aluminium alloy body is a safety thermostat 3 which is electrically connected into the power supply circuit of the resistance element 2.

Further operational thermostats 4 and 5 can also be embedded in the die-cast body 2, as clarified hereinafter.

In the embodiment shown in figure 3, the described heating element, indicated overall by 6, is connected into the spray circuit of a household electrical appliance such as a dishwasher. In particular it is connected, in series with a pump 7, to the feeding duct of the upper rotary sprinkler 8 provided in the dishwasher wash compartment.

The insertion of the element 6 only in the feeding duct of the upper rotary sprinkler 8 and not in the common feeding duct 10 of the two rotary sprinklers 8 and 8' enables to reduce the sizes of the heating element due to the smaller quantity of water to be heated.

The operation of the element according to the invention as used is as follows:

during filling, a valve 9 is opened to allow water feed from the outside. After filling, the valve 9 is closed and the pump 7 and resistance element 2 of the device 6 are powered. As the water circulated by the pump 7 passes through the tube 1, it is gradually heated and emerges from the upper rotary sprinkler 8 at a temperature which increases until the predetermined temperature for the particular chosen wash cycle is reached.

Depending on the particular stage in the wash cycle, the water can be circulated either alone or together with detergent fed simultaneously with it or separately.

When the water has reached the predetermined temperature, the operational thermostat 4 or 5, depending on the chosen wash cycle, interrupts power supply to the resistance element 2 until heating is again required. If water should lack for any reason, the rapid temperature increase of the body 1 triggers the safety thermostat, which interrupts the operation of the household appliance itself.

From the aforesaid it is apparent that the heating element according to the invention has numerous advantages over conventional heating ele-

ments, and in particular, compared with a resistance element immersed in the water lying in the bottom of the appliance:

- it reduces the quantity of water to be heated, the quantity of electrical energy required for its heating, and the quantity of detergent.

- it enables the thermostat or thermostats to be mounted directly in the heating element, so substantially simplifying the assembly of the household electrical appliance and avoiding the need to make holes in the base of the appliance, which besides creating installation problems often produce sealing problems;

compared with a heating element in the form of a tube with a brazed resistance element and wound capillary:

- it reduces the deposit of calcareous incrustations and easily allows their removal,

- it does not require the use of capillary thermostats, which are costly to assemble and delicate to use; compared with a heating element in the form of a container housing a resistance element and traversed by the water to be heated:

- it is of much simpler and cheaper construction, and

- it does not result in the formation of any incrustation around the resistance element, consequently ensuring long life.

In figure 3, the heating element, always indicated overall by 6, is connected to the feeding steam circuit of a steam oven.

In this case, inside the frame 11 of the oven but in a compartment distinct from the muffle 12 thereof, a vessel 13 for water is provided which feeds at constant level a basin 14 communicating with one end of the element 6 horizontally placed. The other end of the element 6 communicates through a duct 15 with the inside of the muffle 12. The level of the water, equal in the basin 14 and in the element 6, is lower than the highest level which can be reached inside the same element 6.

During the operation the electrical resistance 2 embedded in the aluminium alloy tube 1 heats the water contained inside the same tube 1, partly changing it into steam, which passes through the duct 15 and enters the muffle 12 to carry out the steam cooking.

Also in this case the protective inner layer 1' of the tube 1 reduces the lime deposit on the inner surface of the same tube and in any case makes easier its removal.

In another different embodiment, not shown in the drawings, the heating element is connected to the steam generating circuit of a coffee-machine. Also in this case, as in the previous one, the main advantages of this embodiment, with respect to the traditional ones, essentially consist in the lower consumption of energy, due to the generation of

steam in a quantity corresponding to the required one, as well as in the greater cleaning, due to the smaller lime deposits and to the greater easy of removing them.

In figure 4 the armoured resistance 2 is externally surrounding and brazed to the tubular-shaped body 1.

This embodiment present, apart from the above described advantages, the further ones and in particular:

- a simple construction since the aluminium alloy tubular-shaped body can be obtained through an extrusion process and of the desired length according to the user's requirements,
- the possibility to use armoured resistance covered with aluminium sheath, which has a better thermal conductivity with respect to the steel sheath, even allowing to carry out a good brazing.

Claims

1. A heating element for connecting into the wash circuit of a household electrical appliance, characterised by consisting substantially of a die-cast aluminium alloy tubular-shaped body (1), inside which the water to be heated passes, said body being coupled to an armoured resistance element (2) and being internally treated with a protective material layer (1')

2. An element as claimed in claim 1 characterised in that the armoured resistance (2) is externally surrounded and brazed to the tubular-shaped body (1).

3. An element as claimed in claim characterised in that the armoured resistance (2) is embedded in the tubular-shaped body (1).

4. An element as claimed in claim 1, characterised in that the armoured resistance element (2) is coupled to the body (1) in a coil arrangement.

5. An element as claimed in claim 1, characterised by comprising at least one thermostat (3,4,5) embedded in the die-cast aluminium alloy body (1) and acting on the power supply circuit of the armoured resistance element (2).

6. An element as claimed in claim 4, characterised by comprising a safety thermostat (3) and at least one operational thermostat (4,5) embedded in the die-cast aluminium body (1).

7. An element as claimed in claim 1 characterised in that the protective material consists of a silicon varnish.

8. An element as claimed in claim 1 characterised in that the protective material consists of teflon.

9. An element as claimed in claim 1 characterised in that the protective material consists of an electrodeposition of nickel.

10. An element as claimed in claim 1 characterised in that the protective material consists of an electrodeposition of chromium.

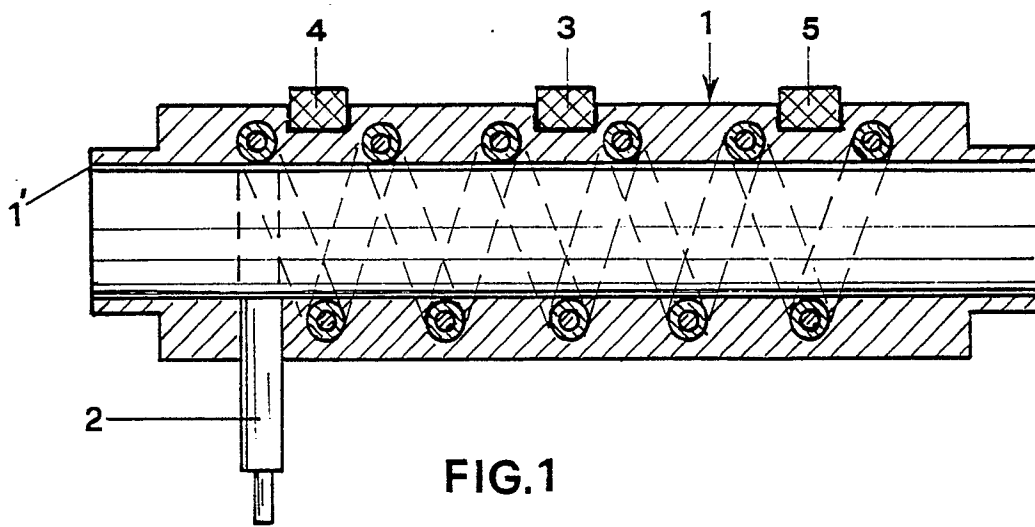


FIG. 1

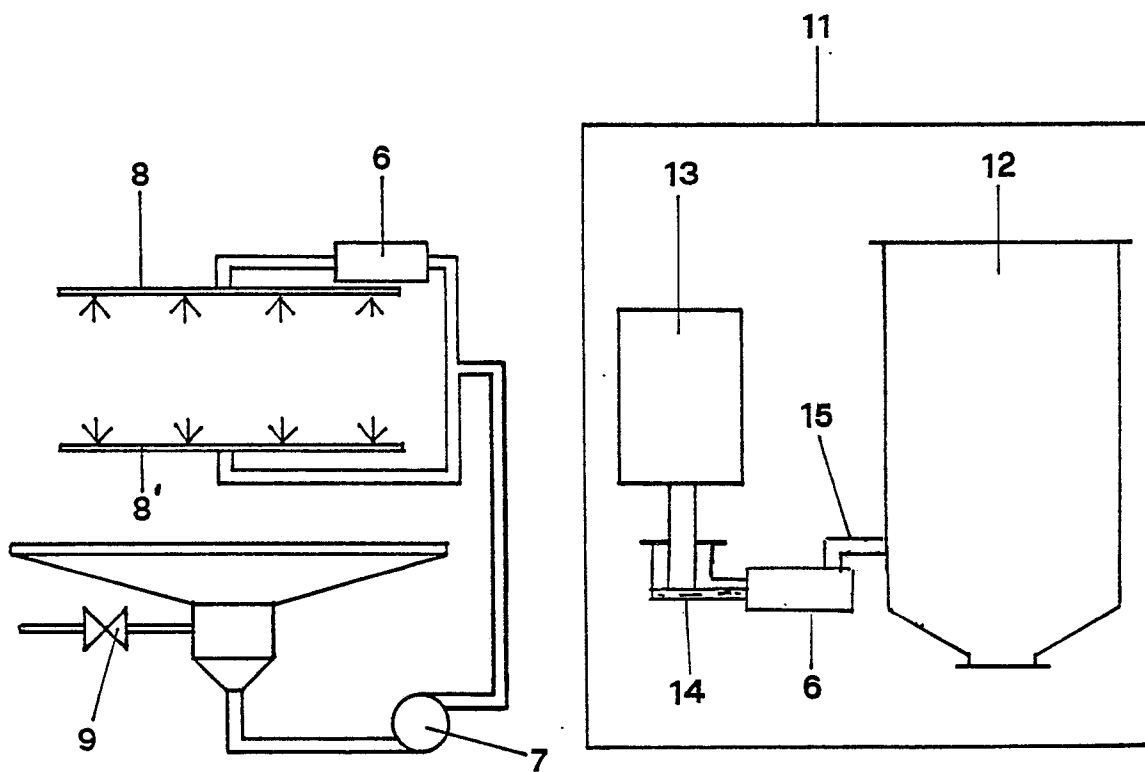


FIG. 2

FIG. 3

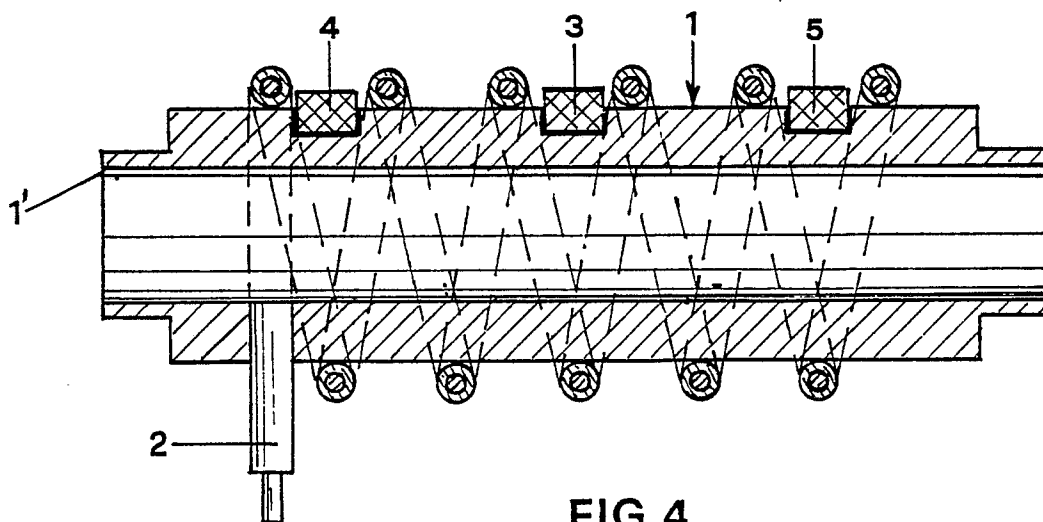


FIG. 4



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-U-8 529 085 (TUERK & HILLINGER) * Whole document * ---	1,3,8	A 47 L 15/42 F 24 H 1/14
X	GB-A- 285 034 (THOMSON-HOUSTON) * Whole document * ---	1,3,4	
X	DE-U-7 132 664 (ELPAG AG) * Whole document * ---	1,3,4	
X	DE-U-7 041 876 (CERU) * Whole document * ---	1,2,4	
X	EP-A-0 185 874 (ELPAG AG) * Page 4, lines 14-17; figure 2 * ---	1,2,4	
A	DE-U-8 601 293 (SIEMENS AG) * Claim 1; figure 1 * ---	1,2,4,9	
A	EP-A-0 202 586 (E.G.O.) * Claims 7,8; figure 3 * ---	1,2,4,5	
A	DE-U-7 124 870 (KRUPS) * Claim 1 * ---	7,8	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	FR-A-1 491 609 (OMRE) * Page 2, left-hand column * -----	5,6	A 47 L D 06 F F 24 H A 47 J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11-10-1988	Examiner SCHARTZ J.
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			