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(54) **RESISTANCE FOR WASHING MACHINE**

(57) It is provided a resistance (1) for washing machine comprising a resistive element (2) made of a metallic material configured to emit heat, connection means (3) suitable for operatively connecting the resistive ele-

ment (2) to an external electrical network and a cover layer (4) surrounding the resistive element (2) and comprising a refractory material.

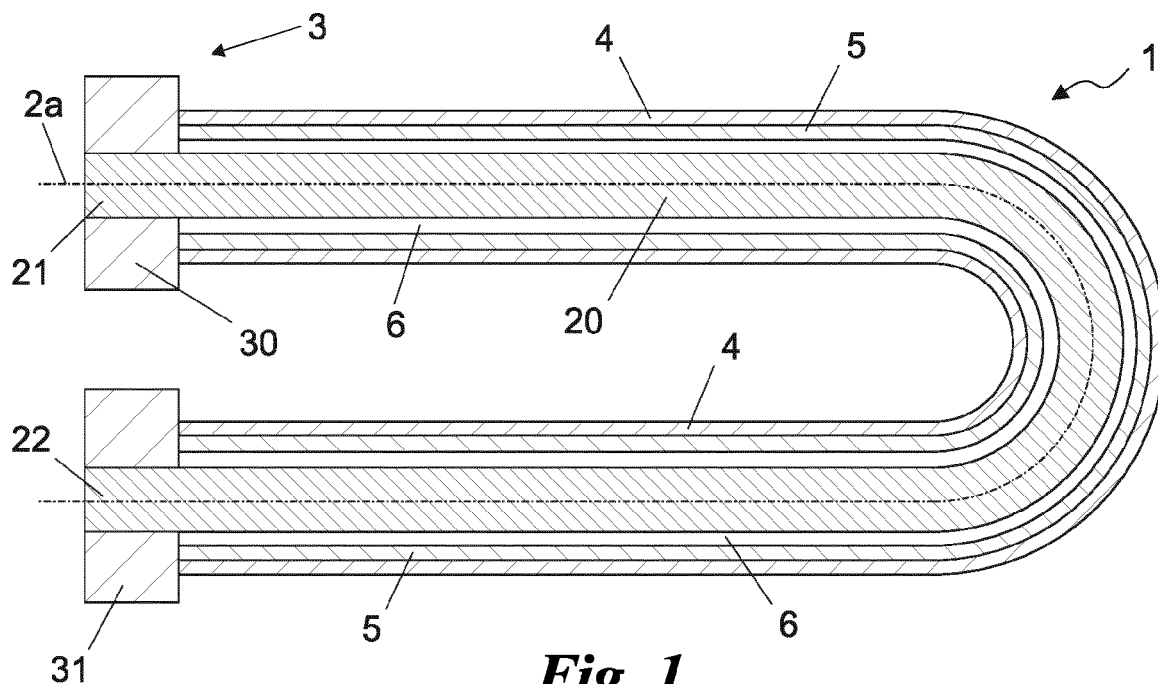


Fig. 1

Description

[0001] The present invention relates to a resistance for washing machine of the type specified in the preamble to the first claim.

[0002] The object of the present invention is a resistance, which is mainly, but not exclusively, used inside a household appliance such as a washing machine or a tumble dryer in which a liquid or a gas needs to be brought to a desired temperature.

[0003] As is well known, the resistance is an electronic component that enables an electrical resistance to be introduced into a branch of an electrical network. One consequence of the action of this component is the Joule effect which, by causing the component's temperature to rise, makes it usable as a heating element. Indeed, resistances are components that are also widely used in thermal applications. These resistances consist of the actual resistive element, which is typically made of metal material, and the connection means to the electrical network, which must necessarily be made of a material with high electrical conductivity.

[0004] These components allow fluid media, such as air or water, to be heated when in contact with them. Thus, they can easily be used in various types of household appliances. The known technique described includes some major drawbacks. The main drawback is the high energy expenditure that characterises the operation of this type of component.

[0005] In particular, the heat is exchanged between the resistance and the fluid in a short time, leading to rapid cooling of the resistance once it is no longer in use. This phenomenon does not allow optimal use of the energy expended to operate the device.

[0006] In this situation, the technical task at the basis of the present invention is to devise a resistance which substantially obviates at least part of the aforementioned drawbacks.

[0007] In this situation, the technical task underlying this invention is to devise a resistance that allows you to substantially remedy at least part of the cited inconveniences.

[0008] In the context of this technical task, it is an important purpose of the invention to obtain a resistance that allows at least one partial recovery of the residual thermal energy of the resistance to use ceased for any reuse of the appliance in which it finds application. Furthermore, a further purpose of the invention is to achieve resistance which, in the face of high efficiency, allows to reduce the energy expenditure of the appliance on which it is used.

[0009] The specified technical task and purposes are achieved by a resistance as claimed in the appended claim 1.

[0010] Preferred technical solutions are highlighted in the dependent claims.

[0011] The features and advantages of the invention are hereinafter clarified by the detailed description of pre-

ferred embodiments of the invention, with reference to the accompanying drawings, in which:

the **Fig. 1** illustrates a longitudinal sectional view of a resistance according to the invention; and the **Fig. 2** illustrates an example of a washing machine comprising a resistance according to the invention.

[0012] In the present document, the measurements, values, shapes and geometric references (such as perpendicularity and parallelism), when associated with words like "about" or other similar terms such as "approximately" or "substantially", are to be considered as except for measurement errors or inaccuracies due to production and/or manufacturing errors, and, above all, except for a slight divergence from the value, measurements, shape, or geometric reference with which it is associated. For instance, these terms, if associated with a value, preferably indicate a divergence of not more than 10% of the value.

[0013] Moreover, when used, terms such as "first", "second", "higher", "lower", "main" and "secondary" do not necessarily identify an order, a priority of relationship or a relative position, but can simply be used to clearly distinguish between their different components.

[0014] Unless otherwise specified, as results in the following discussions, terms such as "treatment", "computing", "determination", "calculation", or similar, refer to the action and/or processes of a computer or similar electronic calculation device that manipulates and/or transforms data represented as physical, such as electronic quantities of registers of a computer system and/or memories in, other data similarly represented as physical quantities within computer systems, registers or other storage, transmission or information displaying devices.

[0015] The measurements and data reported in this text are to be considered, unless otherwise indicated, as performed in the International Standard Atmosphere ICAO (ISO 2533:1975).

[0016] With reference to the Figures cited, the resistance per washing machine according to the invention is globally indicated by the number 1.

[0017] The resistance 1 is preferably used inside a washing machine. However, this does not preclude the use of the heating element 1 also in other household appliances possibly also for purposes other than those subsequently better described.

[0018] The resistance 1 comprises, for the most part, at least one resistive element 2.

[0019] The resistive element 2 is preferably the element of the resistance 1 that emits heat during operation in the established configuration. Therefore, the resistive element 2 is preferably made of a metal material.

[0020] Furthermore, the resistive element 2 may include further features.

[0021] In detail, the resistive element 2 may comprise a body 20. The body 20 may be a long or stubby element,

possibly also hollow and/or tubular. Preferably, the body 20 develops along a predetermined trajectory 2a.

[0022] The predetermined trajectory 2a may be a straight trajectory. Or it may be curved, or even only partially curved, and may have several curvature zones.

[0023] In particular, the predetermined trajectory 2a may be U-shaped, as for example shown in Fig.1 or, the body 20 may develop as a serpentine, between parallel portions and connecting curves.

[0024] In any case, preferably, the body 20 develops along the predetermined direction 2a between a first end 21 and a second end 22.

[0025] The first end 21 and the second end 22 are essentially free ends, or boundaries, of the body 20. Thus, in other words. The body may be an elongated element starting at the first end 21 and ending at the second end 22.

[0026] The strength 1 further comprises connection means 3.

[0027] The connection means 3 are preferably connected to the resistive element 2. The connection means 3, in particular, are configured to allow the resistive element 2 to connect to an external electrical network. Suitably, the connection means 3 are capable of operatively connecting the resistive element 2 with the external electrical network. The connection means 3 preferably comprise materials with high electrical conductivity. Furthermore, in more detail, the connection means 3 may comprise a first connector 30 and a second connector 31.

[0028] The first connector 30 and the second connector 31 are substantially electrical connectors, i.e., capable of flowing an electrical current from an external electrical circuit to a device connected to the connectors 30, 31.

[0029] Thus, for example, the first connector 30 may be an input connector, while the second connector 31 may be an output connector, or vice versa.

[0030] Preferably, the first connector 30 is arranged at the first end 21 of the body 20. The second connector 31 is, on the other hand, arranged at the second end 22 of the body 20.

[0031] Thus, the connectors 30, 31 electrically connect a respective end 20, 21 to the external electrical network. Thus, the body 2 essentially becomes an arm of the electrical circuit defined by the external electrical network.

[0032] The resistance 1 advantageously comprises a cover layer 4.

[0033] The cover layer 4 is preferably surrounding the resistive element 2. In addition, the cover layer 4 performs the function of attenuating the dispersion of the thermal energy stored by the resistive element 2, for example at the end of use of the latter. The advantage of this solution is that the thermal energy not dissipated by resistance 1 can later be reused.

[0034] Therefore, the cover layer 4 is preferably made of refractory material.

[0035] In particular, the cover layer 4 may be in a refractory material of choice between zirconia or steatite.

[0036] The cover layer 4 can be, in a preferred config-

uration, a coating arranged around the resistive element 2 and in contact with it. This configuration optimises the performance of the function of attenuating the heat loss of the resistive element 2 by the cover layer 4. Alternatively, and as further specified below, the cover layer may be arranged around the resistive element without being in contact with it. This alternative configuration may be useful, for example, in the case where, during operation, the resistive element 1 is subjected to such temperature excursions that the expansion of the materials is not negligible.

[0037] In addition, the cover layer 4 may entirely surround the resistive element 2, i.e. over the entire extent of its surface. This configuration allows for the most effective action of the cover layer 4. However, in an alternative configuration, the cover layer 4 may also only partially surround the resistive element 2.

[0038] The resistive element 1 may comprise an intermediate layer 5.

[0039] If present, the intermediate layer is placed between the resistive element 2 and the cover layer 4. This intermediate layer 5 has the function of reducing the difference in thermal expansion coefficient between the cover layer 4 and the resistive element 2. The intermediate layer 5 may be exactly interposed between the cover layer 4 and the resistive element 2, thus being in contact with both the cover layer 4 and the resistive element 2 and, in fact, separating them.

[0040] Alternatively, the intermediate layer 5 may be positioned between the cover layer 4 and the resistive element 2, but spaced apart from one or more of them.

[0041] Preferably, in the configuration in which the intermediate layer 5 is in contact with the cover layer 4 and the resistive element 2, the intermediate layer 5 comprises a material that performs the function of an adhesive. In detail, it may be formulated to work at temperatures between room temperature and a maximum temperature of 750°C.

[0042] In the configuration in which the intermediate layer 5 is not in contact with the cover layer 4 and/or the resistive element 5, the heating element 1 preferably comprises a separation layer 6.

[0043] In general, the separation layer 6 may be present in the resistance 1 even in the absence of an intermediate layer 5.

[0044] Therefore, if present, the separation layer 6 is, in general, arranged between the resistive element 2 and the cover layer 4 and realises a separation space at least between them.

[0045] If, however, the intermediate layer 5 is also present, in particular, the separation layer 6 may be arranged between the resistive element 2 and the intermediate layer 5 and/or between the intermediate layer 5 and the cover layer 4.

[0046] Preferably, in any case, the separation layer 6 is a space occupied by an inert gas at a pressure preferably below 1 Atm.

[0047] The inert gas occupying the separation layer 6

may preferably be one of a choice of argon or nitrogen.

[0048] As mentioned above, the separation layer 6 may be an alternative or an addition to the intermediate layer 5.

[0049] The processes by which the cover layer 4 can be arranged on the resistive element 2 or the intermediate layer 5 respectively are preferably a deposition or a sintering process. These techniques result in a continuous coating, which optimises the thermal barrier properties of the cover layer 4.

[0050] One application for resistance 1 is as a water heating element in the basket of a washing machine. Therefore, the heating element 1 according to the invention enables a new washing machine 10 to be realised.

[0051] The washing machine 10 essentially comprises the heating element 1.

[0052] More in detail, as already mentioned, the washing machine 10 comprises a containment chamber of a spin-drying basket including the heating element 1.

[0053] The heating element 1 according to the invention enables important advantages to be obtained.

[0054] The heating element 1 makes it possible to achieve at least partial recovery of residual heat energy.

[0055] In particular, when the heating element 1 is used in a household appliance, it is able to retain thermal energy even when the household appliance is no longer active.

[0056] More specifically, the washing machine 10, which includes the heating element 1, has reduced energy consumption compared to existing washing machines, being able to reuse the thermal energy stored by the heating element 1.

[0057] The invention is susceptible to variations within the scope of the inventive concept as defined by the claims.

[0058] As partly explained above, the variants in which the intermediate layer 5 and the separation layer 6 are present can be combined to give rise to further configurations. A first further variant is configured in such a way that the cover layer 4 is separated from the intermediate layer 5 by the separation layer 6. Thus, the intermediate layer 5 covers the resistive element 2.

[0059] A second further variant is configured so that the cover layer 4 is in direct contact with the intermediate layer 5, and between the intermediate layer 5 and the resistive element 2 is the separation layer 6.

[0060] Within this scope all details are replaceable by equivalent elements, the shapes and dimensions can be any.

Claims

1. Resistance (1) for washing machines comprising:

- a resistive element (2) of metallic material configured to emit heat,
- connection means (3) capable of operatively

connecting said resistive element (2) to an external electrical network,

and **characterised by** comprising:

- a cover layer (4) surrounding said resistive element (2) and comprising a refractory material.

2. Resistance (1) according to claim 1, wherein said refractory material is one at choice between zirconia or steatite.

3. Resistance (1) according to any one of the preceding claims, comprising an intermediate layer (5) disposed between said resistive element (2) and said cover layer (4) and comprising material performing the function of an adhesive.

4. Resistance (1) according to any preceding claim, comprising a separation layer (6) between said resistive element (2) and said cover layer (4) and occupied by a gas at a pressure of less than 1 Atm.

5. Resistance (1) according to claim 4, wherein said gas is either argon or nitrogen.

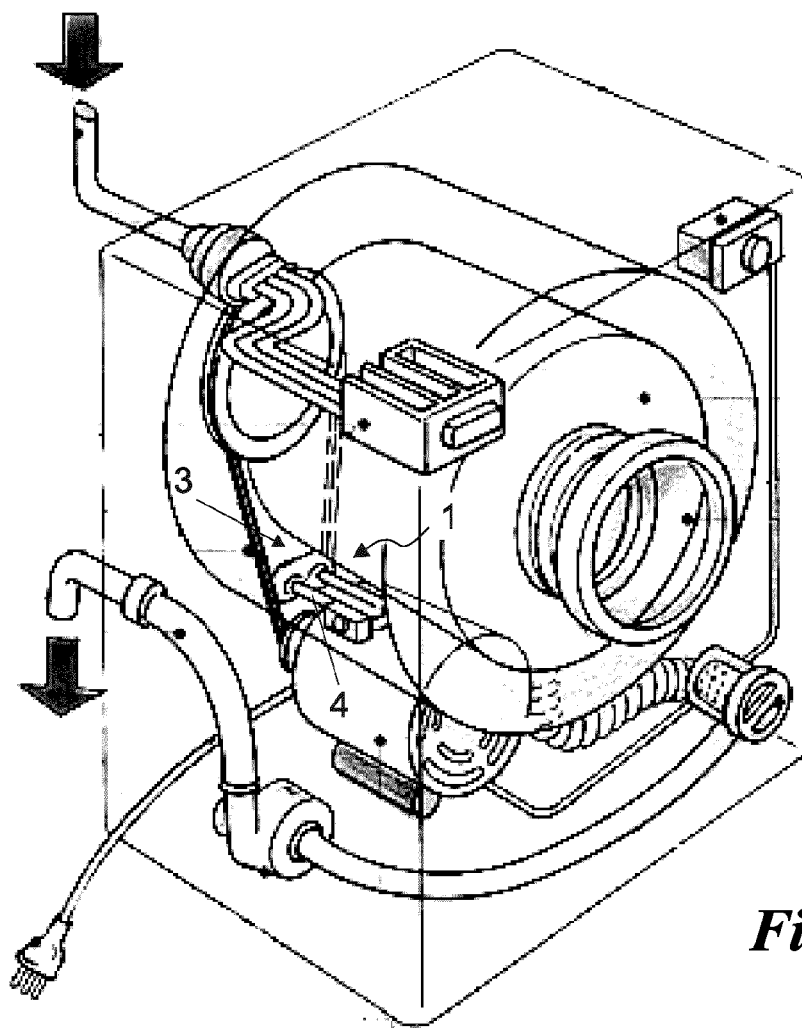
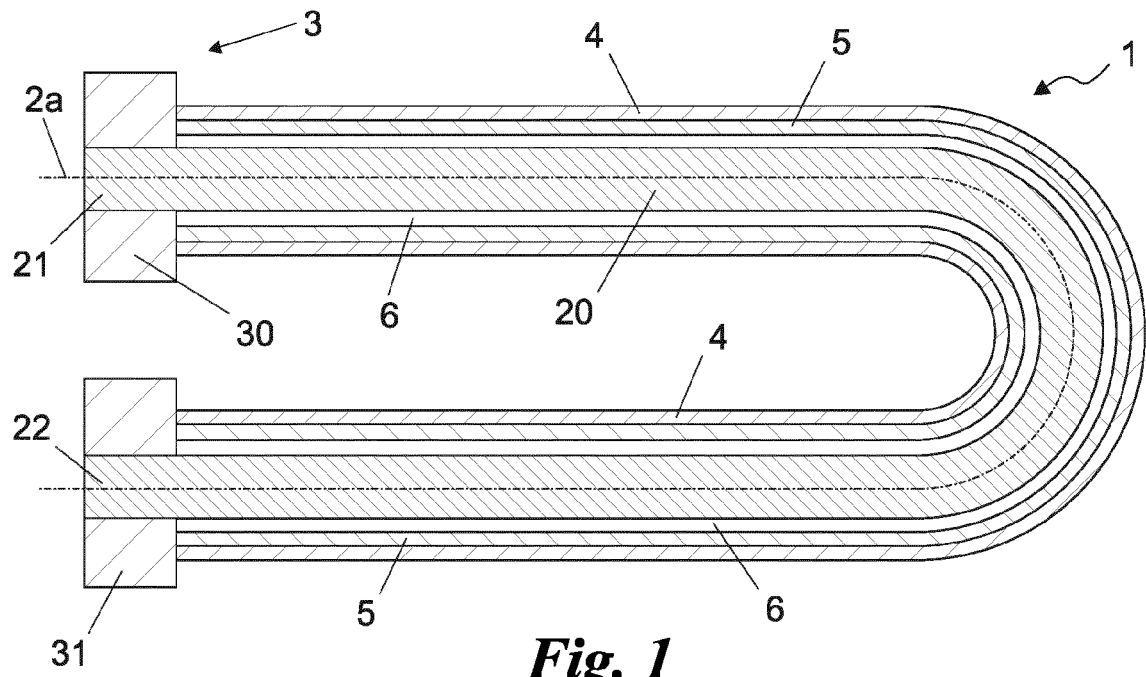
6. Resistance (1) according to any of the claims 1-2, in which said cover layer (4) is a coating arranged around said resistive element (2) and in contact with this resistive element (2).

7. Resistance (1) according to claim 6 or claim 3, wherein said cover layer (4) is disposed respectively on said resistive element (2) or on said intermediate layer (5) respectively by a deposition or sintering process.

8. Resistance (1) according to any preceding claim, wherein said cover layer (4) entirely surrounds said resistive element (2).

9. Resistance (1) according to any one of the preceding claims, wherein said resistive element (2) comprises a body (20) developing along a predetermined trajectory (2a) between a first end (21) and a second end (22), said connection means (3) comprising a first electrical connector (30) disposed at said first end (21) and a second electrical connector (31) disposed at said second end (22), and said cover layer (4) continuously extending from said first connector (30) to said second connector (31).

10. Washing machine (10) comprising said resistance (1) according to any one of the preceding claims.





EUROPEAN SEARCH REPORT

Application Number

EP 23 15 5067

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 293 597 A2 (BLECKMANN GMBH [AT]) 19 March 2003 (2003-03-19) * paragraphs [0002], [0027]; claims 1,2,8; figures 3A-3C *	1-5, 7-10	INV. H05B3/82 D06F39/04
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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EPO FORM 1503 03.82 (P04C01)

Place of search	Date of completion of the search	Examiner
Munich	14 June 2023	Pierron, Christophe
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 15 5067

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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