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(54) **Method for making heating elements using electrical resistors and heating element made according to said method**

(57) A method for making heating elements using electrical resistors, comprising the following steps:
- arranging a metal casing (12), inside which at least one electric resistor (10) is placed, said resistor (10) being inserted inside a tube (11) made of conductive material;
- arranging at least one coil (14) containing a fluid, such as water, outside said tube (11) and within said metal casing (12);

- inserting in said metal casing (12) a conductive powder and/or conductive fragments;
- compressing the metal casing (12) from the outside, so as to model said casing (12) according to a desired shape, thus obtaining an effective heat exchange and a rapid and uniform heating of the fluid contained inside the coil (14).

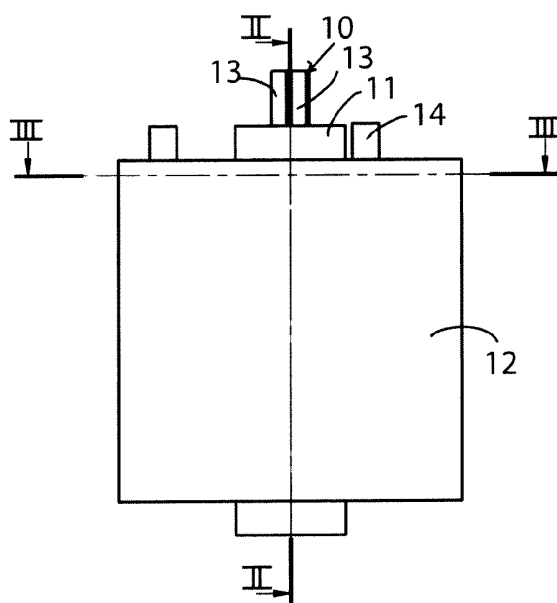


Fig. 1

Description

[0001] The present invention generally relates to a process for making heating elements with electric resistors. More particularly, the invention relates to a method for making heating elements having a substantially tubular and/or cylindrical structure, which are able to provide thermal power and which can be used within any thermal exchanging device and/or other devices able to dissipate heat, such as electric radiators, heated towel rail, heat exchangers, steam generators, hot water generators, etc.

[0002] The known sink devices and/or heat exchangers usually include an immersion electrical resistor, which is employed as a heating element able to deliver heat, which is normally positioned within the device and immersed in a fluid (water and/or oil), that constitutes the propagating and spreading element for providing the available thermal power (heat).

[0003] The electric resistor is generally controlled by a thermostat, which is activated when the fluid temperature exceeds a predetermined threshold value, interrupting the supply of electrical energy until the temperature of the fluid decreases to values below said threshold value.

[0004] The thermostat is generally mounted inside the exchanging device or the steam or hot water generator and is placed at a certain distance from the resistor so that the fluid operating temperature can be measured without any alterations that can be caused by the action of the heating resistor.

[0005] In practice, the device works properly and the activations of said device, resulting in a dissipation of heat to the outside, do not normally need any special remarks, either by the user or by qualified personnel.

[0006] However, it is increasingly felt the need to have electrical resistors which can be used in heating elements and/or apparatus, such as heat exchangers and/or steam and hot water generators, which can be made in a simple way and quickly, with respect to the prior art, and, above all, at low costs, with respect to the prior art, in order to make quickly and at low costs, with respect to the prior art, also the heating elements.

[0007] An object of the present invention is therefore to overcome the above mentioned drawbacks and, in particular, is to provide a process for making heating elements with electric resistors, which is particularly effective and reliable and which allows to greatly reduce both the time processing and the overall costs, with respect to the prior art.

[0008] Another object of the present invention is to provide a heating element, such as a heat exchanger and/or a steam or hot water generator, by means of the above process.

[0009] Said objects are achieved by a process for making heating elements with electric resistors, according to the appended claim 1, and by a heating element, which is made according to the above process, according to the appended claim 2.

[0010] Other technical features are disclosed in the dependent claims.

[0011] Advantageously, the heating element according to the present invention is constituted by a shaped metal container or casing, comprising a resistor which is centrally placed and an outer coil, within which the fluid (such as water) to be heated flows.

[0012] A conductive element, such as metal powder, is dispersed in the container and is able to cause an efficient heat exchange, thus ensuring a quick and homogeneous heating of the fluid and a total uniformity of the fluid temperature, also thanks to the fact that a cold compression of the container is performed. Further objects, features and advantages of the present invention will become clear from the following description, which refers to a preferred, but not limiting, embodiment of a heating element with electrical resistors, which is made by means of the process according to the invention, and from the enclosed drawings, in which:

- figure 1 is a partial side view of the heating element, which is made through the method according to the present invention;
- figure 2 is a section view along the line II-II of figure 1, according to the invention;
- figure 3 is a section view along the line III-III of figure 1, according to the invention;
- figure 4 is a bottom view of the heating element of figure 1;
- figure 5 is a top view of the heating element of figure 1, according to the present invention, in which the internal components of the heating element are also shown;
- figures 6 and 7 show two side views of the heating element of figure 1, according to the invention, in which the internal components of the heating element are also shown;
- figures 8 and 9 show two perspective views of the heating element of figure 1, according to the invention, in which the internal components of the heating element are also shown.

[0013] With reference to the above mentioned figures, the heating element of the present invention comprises an electrical resistor 10 having a tubular structure, which is inserted inside a metal tube 11 (preferably made of steel) and able to provide thermal energy.

[0014] The electrical resistor 10 and the tube 11 are inserted within a shaped metal container or casing 12 (which is preferably cylindrical) and in a central position of said casing 12; said casing 12 may also include one or more thermostats (not shown in the enclosed figures), which are series connected with the resistor 10 and which are normally positioned in correspondence of one and/or both the ends of the metal casing 12.

[0015] The resistor 10 which is housed in the metal tube 11 has one or more external connectors 13, which are connected, possibly through said thermostats, to the

internal connectors of the resistor 10, so as to provide the electrical power (heat) which is requested. When the heating element is used as a heat exchanger or steam and/or hot water generator, a coil 14 is provided around the metal tube 11 and inside the metal casing 12; the coil 14 is also wrapped around the tube 11 and externally to said tube 11 and is provided with an inlet and an outlet and contains the fluid (which can be simply constituted by water) to be heated. According to the present invention, a conductive element is placed inside the container 12 (said conductive element being constituted, according to a preferred embodiment of the invention, by scrap powder and/or copper shavings), so that the suitable heat exchange takes place and the heat generated by the resistor 10 is quickly and almost homogeneously sent to the fluid contained within the coil 14.

[0016] The heat exchange takes place in an appropriate manner since, according to the present invention, the heating element thus formed is compressed from the outside, so as to achieve one or more desired shaping.

[0017] In practice, therefore, a cold compression of the heating element is performed, in order to obtain a suitable shape of said heating element, without using molds and/or hot casting steps (according to which the molten metal is injected at high pressure into a mold), which have overall high costs.

[0018] Therefore, according to the invention, the resistor 10 which is enclosed within the metal tube 11 is immersed in a conductive metal powder and the whole structure is subjected to a phase of cold compression, in order to achieve the desired heat exchange, thanks to the close contact between the tube 11 and the coil 14 within the fluid to be heated flows.

[0019] This gives an efficient and rapid heat exchange, as well as a remarkable uniformity of the fluid temperature within the coil 14.

[0020] From the above description, the characteristics of the method for making heating elements with electric resistors, which is the object of the present invention, are clear as well as the advantages are also clear.

[0021] Finally, it is also clear that other variations may be made to the method and to the heating element of the invention, without departing from the principles of novelty expressed in the appended claims, as it is clear that in the practical implementation of the invention, materials, shapes and dimensions of the technical elements may be any according to the requirements and they can be replaced with other technically equivalent.

Claims

1. Method for making heating elements using electrical resistors **characterized in that** it comprises the following steps:

- arranging a container or metal casing (12), inside which at least one electric resistor (10) is

placed, said resistor (10) being inserted inside a tube (11) made of conductive material;

- arranging at least one coil (14) outside said tube (11) and within said container or metal casing (12), said coil (14) being provided with an inlet opening and an outlet opening and containing a fluid, such as water;

- inserting in said container or metal casing (12) a conductive element or medium that is reduced in powder or fragments;

- compressing said container or metal casing (12) from the outside, so as to model said container (12) according to a desired shape, by contacting said tube (11) with said coil (14) within which the fluid to be heated is flowing, thus obtaining an effective heat exchange with said fluid flowing in the coil (14) and a rapid and uniform heating of said fluid which has a total uniform temperature.

2. Method as claimed in claim 1, **characterized in that** said compression step of said container (12) is performed by means of a cold diecast.

3. Heating element made according to a method as claimed in at least one of the preceding claims, **characterized in that** said electric resistor (10) is placed centrally in said container or metal casing (10) and said coil (14) is positioned externally to said electrical resistor (10) and to said tube (11).

4. Heating element according to claim 3, **characterized in that** said conductive medium includes metal powder and/or dust or shavings of scrap copper.

5. Heating element according to at least one of the preceding claims, **characterized in that** said heating element is used as a heat exchanger or steam and/or hot water generator.

6. Heating element according to at least one of the preceding claims, **characterized in that** said electric resistor (10) is enclosed within said tube (11) and is encased by a conductive metal powder.

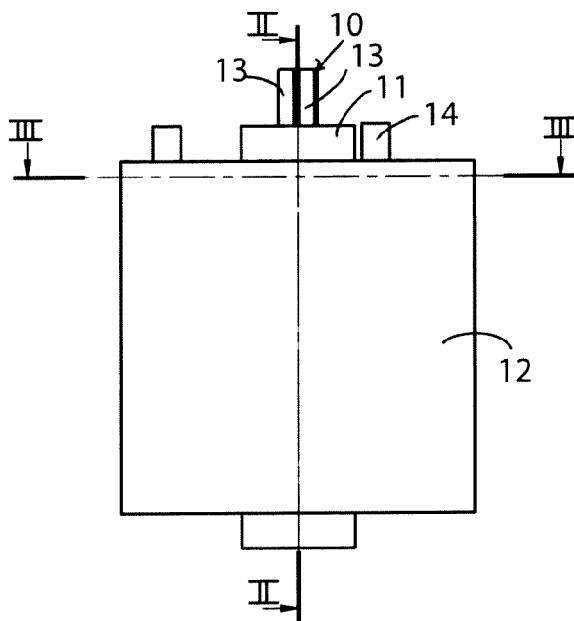


Fig. 1

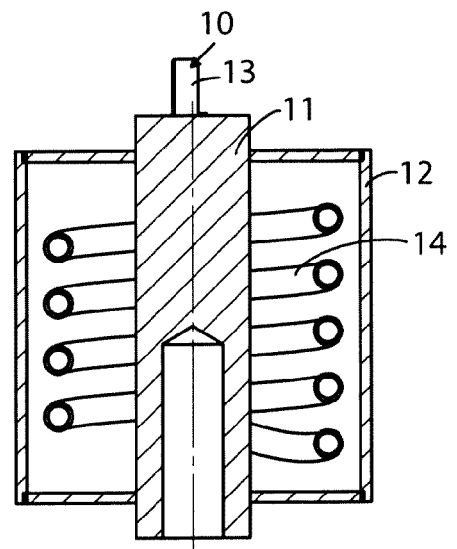


Fig. 2

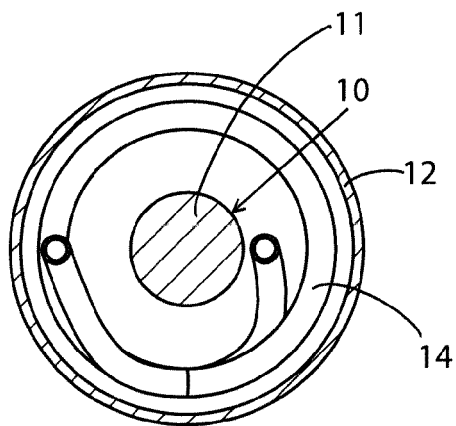


Fig. 3

Fig. 4

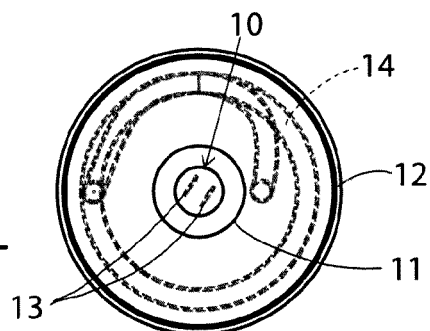


Fig. 6

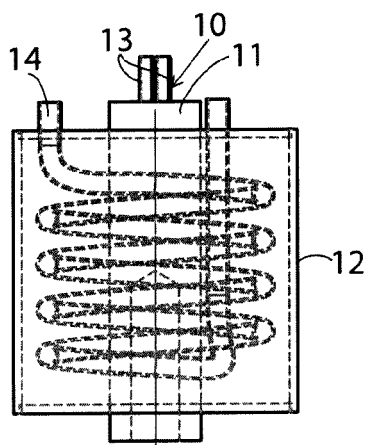


Fig. 7

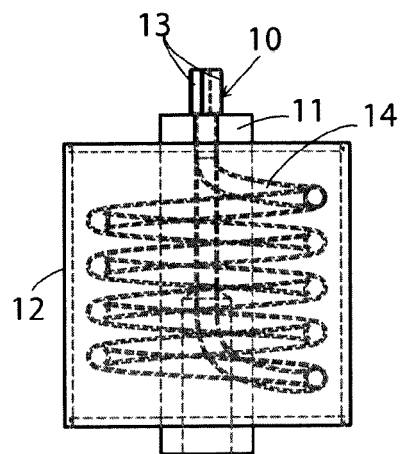


Fig. 5

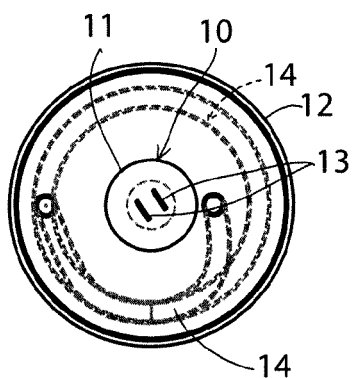


Fig. 8

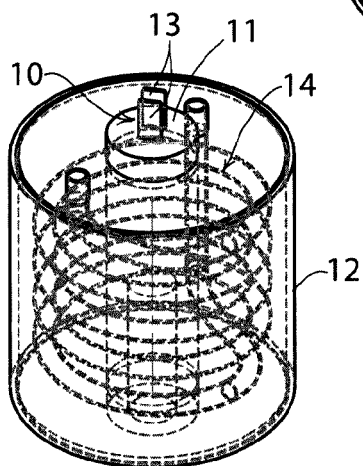
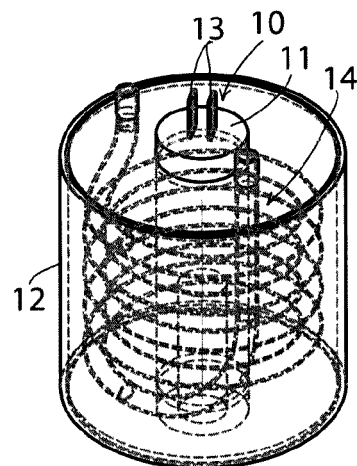


Fig. 9





EUROPEAN SEARCH REPORT

Application Number
EP 13 42 5127

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	JP 2003 190846 A (MORIYA FIELD KK) 8 July 2003 (2003-07-08) * paragraphs [0006], [0011]; figure 1 *	3-6	INV. F24H1/16 F24H7/04 H05B3/42
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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 23 January 2014	Examiner García Moncayo, O
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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