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54 **Heating device.**

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Description

This invention relates to a heating device for according to the precharacterizing for example the sole of an electric iron, part of claim 1.

Such a device is known from DE-1 299 089, wherein the heating means are received between the sole and a cover and either the thermosensor is a bimetallic strip or the thermosensor is received therein as well.

The drawback of this known heating device is that the heating means and the thermosensor are spaced from the sole and that therefor the regulating of the heat supply to the sole is relatively slow.

The invention has for its purpose to provide a heating device which includes a temperature sensor displaying a highly reduced delay and which enables a continuous regulation of the heat supply without causing delay therein, which makes it possible to operate the electrical heating means with a greater power, for example 3,000 instead of 1,000 watts, without overheating being able to occur as a result of too slow a regulation. With the heating device according to the invention it is in addition possible when the metal plate cools to immediately regulate the supply of heat to it.

To this end the heating device according to the invention is characterized according to claim 1.

The thermistor can only be applied on a non-conductive surface and this is achieved by the sole partly being of ceramic material.

Further characteristics and details of the heating device according to the invention will become apparent with reference to a drawing, in which :

figure 1 shows a perspective, partly broken away top view of a heating device according to the invention arranged on a ceramic part of a body, figure 2 shows a diagram of the heating device in figure 1,

figure 3 shows a perspective, partly broken away top view of another embodiment of a heating device according to the invention, in which the body is a sole of an iron,

figure 4 is a diagram of the heating device as according to figure 3,

figure 5 shows an exploded, perspective top view of another embodiment of a heating device according to the invention, and

figure 6 shows an exploded, perspective top view of yet another embodiment of the heating device according to the invention, in which a plurality of independently controllable heating means is embedded in a body.

In a ceramic layer 15 of a plate 2 provided with a temperature sensor 4, which layer 15 is formed for example by an enamelled metal plate 16, there is embedded a heating device 1 according to the invention, using thick film technique, this heating device 1

comprising electrical heating means 3 in the form of resistance paths 7 connected between two conducting strips 17 and a thermistor 6 in the form of a thermo path 32 (figure 1). Both the resistance paths 7 and one or more thermo paths 32 are preferably crenellated or meander shaped to increase their length. A resistance path can however also take a rectangular form in order to obtain the greatest possible power transfer to the plate 2 ; the power transfer per surface is in any case bound to a maximum because of the properties of the enamel layer.

In figure 2 can be seen schematically a regulating circuit 5 in which a resistance path 7, using a power supply source connected between terminals 18 and 19, is provided with an electrical current generating heat by means of a regulating member 20. The resistance path 7 consists for example of screen-printed resistance paste having a low coefficient of resistance ; the thermo path 32 consists for example of NTC or PTC paste having a high temperature coefficient. The pastes from the 7600/7700 Du Pont range are suitable for this purpose. The regulating member 20 is activated by an electrical signal originating from an operational amplifier 10, this electrical signal being a measure for the value of the temperature dependent resistance of thermo path 32 relative to the adjustable resistor 21 which is coupled to a thermostat knob (not shown). The operational amplifier 10 is biased by the bias resistors 22 and 23. Schematically is indicated that thermo path 32 as well as resistance path 7 are crenellated in form, and in a way such that thermo path 32 is located in the vicinity of resistance path 7 so that regulation of the temperature takes place quickly.

In another embodiment of the heating device according to the invention (figure 3) plate 2 is formed by a metal sole 12 of an unshown iron provided with an enamel layer 15. For a still quicker reaction to temperature changes of the underside of the sole 12, which can cool off rapidly during the ironing of for example a wet sheet, sole 12 is provided on both sides with NTC or PTC thermo paths, whereby the non-visible lower thermo paths 6' can be connected via holes filled with conducting paste 8 and provided with an enamel layer 24 onto regulating circuit 5.

The advantage of these lower thermo paths 6' is that they are located on the ironing surface of the metal plate 25 having a large heat capacity, so that the supply of heat to metal plate 25 has already got under way before a considerable discharge of heat through the insulating enamel layer to the object to be ironed from the metal plate takes place.

The supply of current to electrical heating means 3 is regulated by a regulating member 11 which is controlled by electrical signals originating from two operational amplifiers 26, 27 (figure 4). Amplifiers 26, 27 are biased using resistors 28, 29 and 30 and using an adjustable resistor 31 connected onto an unshown

thermostat knob, and amplify the temperature dependent resistance changes of respectively the lower thermo paths 6' and the resistors 6.

The regulating members 10 and 11 can for example be standard PID regulators suitable for one or two inputs.

In another embodiment of the heating device according to the invention (figure 5), using the same screen-print pattern, electrical heating means 3 in the form of resistance paths 7 arranged between conducting strips 17 as well as a thermistor 6 in the form of thermo paths 32 arranged between conducting strips 33 can be applied onto a metal plate 16 provided with an enamel layer 15, with an intermediate insulating layer 13. Either the heating means 3 or thermistor 6 can hereby be embedded in the enamel layer, on the upper as well as on the lower part of for example a sole of an iron.

Another embodiment of heating device 1 according to the invention (figure 6) is applied in so-called spot heating for manufacturing semi-conductor elements, whereby, by regulating the temperature of a plate 34 accurately from point to point, the viscosity and thereby the thickness of semi-conductor material (not shown) to be applied to plate 34 can be regulated. At each surface 35 are arranged an embedded resistance path 7 and a thermo path 32 using which the temperature of such a small surface can be accurately controlled with the aid of a control member 14 arranged at each surface. By means of a central key board, connected with control members 14 and secured on a frame 37, and associated electronics (not shown), the temperature of the surfaces 35 can be adjusted and measured, and these temperature values can be read on a display panel 38.

Claims

1. Heating device, comprising :

- a metal plate (16, 12) ;
- at least one resistance path (7) for electrically heating said plate ;
- a thermistor (6') for sensing the temperature of said plate ; and
- a regulating circuit (5) for keeping said body at the requested bias temperature, characterized by
 - a ceramic layer (15) arranged between said plate and said resistance path, wherein said resistance path and said thermistor are embedded in said ceramic layer by means of thick film technique.

2. Heating device according to claim 1, wherein said plate is an enamelled plate having on both sides printed thermistors onto said enamelled layer and wherein said plate is provided with enamelled holes (9).

3. Heating device according to claim 1 or 2, whe-

rein the regulating circuit (5) is comprised of an amplifier (10) and a regulating member (11) in integrated form.

4. Heating device according to claim 1, 2 or 3, wherein one or more thermo paths (32) as thermistors are embedded in said plate in the vicinity of said resistance path.

Ansprüche

1. Heizvorrichtung mit :

- einer Metallplatte (16, 12) ;
- wenigstens einer Widerstandsbahn (7) zum elektrischen Heizen der Platte ;
- einem Heißelement (6') zum Fühlen der Temperatur der Platte ; und
- einer Regelschaltung (5), um den Körper auf der gewünschten, vorgespannten Temperatur zu halten ; **gekennzeichnet durch** eine zwischen der Platte und der Widerstandsbahn angeordnete keramische Schicht (15), wobei die Widerstandsbahn und das Heißelement in die keramische Schicht mittels Dickschichttechnik eingebettet sind.

2. Heizvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Platte eine emaillierte Platte ist, die auf beiden Seiten gedruckte Heißelemente auf der emaillierten Schicht hat, und bei der die Platte mit emaillierten Löchern (9) versehen ist.

3. Heizvorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Regelschaltung (5) einen Verstärker (10) und ein Reguliertteil (11) in integrierter Form aufweist.

4. Heizvorrichtung nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß eine oder mehrere Thermobahnen (32) als Heißelemente in der Platte in der Umgebung der Widerstandsbahn eingebettet sind.

Revendications

1. Dispositif de chauffage comprenant :

- une plaque de métal (16, 12) ;
- au moins un élément de circuit formant résistance (7) pour chauffer de manière électrique ladite plaque ; et
- une thermistance (6') pour détecter la température de ladite plaque ; et
- un circuit régulateur (5) pour maintenir ledit corps à la température de polarisation requise, caractérisé par
 - une couche de céramique (15) placée entre ladite plaque et ledit élément formant résistance, ledit élément formant résistance et ladite thermistance étant encastrés dans ladite couche de céramique au moyen d'une technique de film

épais.

2. Dispositif de chauffage selon la revendication 1, caractérisé en ce que ladite plaque est une plaque émaillée présentant sur les deux côtés des thermistances imprimées sur ladite couche émaillée et en ce que ladite plaque est pourvue d'orifices émaillés (9).

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3. Dispositif de chauffage selon la revendication 1 ou 2, caractérisé en ce que le circuit régulateur (5) se compose d'un amplificateur (10) et d'un organe de régulation (11) de forme intégrée.

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4. Dispositif de chauffage selon la revendication 1, 2 ou 3, caractérisé en ce qu'un ou plusieurs éléments de circuit thermiques (32) tels que des thermistances sont encastrés dans ladite plaque à proximité dudit élément de circuit formant résistance.

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