



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
11.01.2017 Bulletin 2017/02

(51) Int Cl.:
H05B 3/20 (2006.01) H01H 37/00 (2006.01)
H05B 1/02 (2006.01)

(21) Application number: **15879268.9**

(86) International application number:
PCT/CN2015/081334

(22) Date of filing: **12.06.2015**

(87) International publication number:
WO 2016/183889 (24.11.2016 Gazette 2016/47)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

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(30) Priority: **15.05.2015 CN 201510247130**

(54) **THERMALLY-INSULATED TEMPERATURE-CONTROLLED HEATING PLATE**

(57) The present invention discloses a new temperature-controlled heat-insulated heating plate, including a heating plate and a double-contact temperature control-

ler. The present invention has beneficial effects of: a compact structure, convenient mounting, quick heating, being safe and reliable, and a long service life.

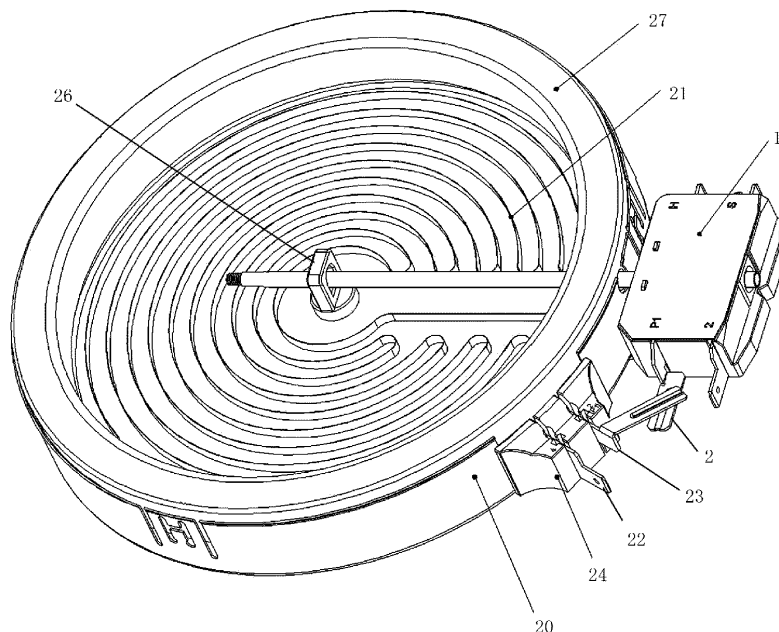


FIG. 1

Description**BACKGROUND****Technical Field**

[0001] The present invention relates to a new temperature-controlled heat-insulated heating plate.

Related Art

[0002] Currently, an existing high-temperature heating plate technology is generally winding an annular heating wire in a ceramic plate as a heating body, and is characterized in that temperature can rise quickly after power-on. Existing high-temperature heating plates all use a heating wire with a circular section. As the sectional area is small, the service life is short, and the principle of economy is not met. The product does not have a temperature control device. As a result, the temperature is not controlled, leading to a safety hazard. Without a temperature control device, the product keeps running with highest power, consuming much electricity. In addition, because a ceramic is used as an insulating casing, the temperature insulation capability is very poor, much heat is wasted, and the principle of economy is not met, either.

SUMMARY

[0003] The objective of the present invention is to provide a new temperature-controlled heat-insulated heating plate that is reliable in performance, is stable and safe in temperature control, has a better heat insulation effect, has a better thermal effect, has a longer service life, and is energy saving and environmentally friendly.

[0004] In order to resolve the foregoing technical problem, the present invention provides the following technical solution:

A new temperature-controlled heat-insulated heating plate includes a heating plate and a double-contact temperature controller, where

the double-contact temperature controller includes a base, the base has a side provided with a first terminal and a second terminal, and the other side provided with a third terminal and a fourth terminal, the first terminal and the third terminal are respectively provided with a first elastic piece and a third elastic piece, the first elastic piece and the third elastic piece are respectively provided with a first contact and a third contact, the second terminal and the fourth terminal are respectively provided with a second contact and a fourth contact, the first contact is opposite the second contact, and the third contact is opposite the fourth contact; a ceramic thimble runs through the first elastic piece and the third elastic piece, and the ceramic thimble has an end abutting a metal tube,

and the other end abutting a movable piece; the movable piece is sleeved with a spring, and a blocking piece is disposed at the bottom; and the metal tube extends out of the base, and has a tail end provided with a plug, a ceramic bar and a metal bar that abut in sequence are disposed in the tube, and a bottom end of the metal bar abuts the ceramic thimble;

the heating plate includes a bottom plate and a heating belt, the heating belt is curled on the bottom plate, two ends of the heating belt are located on an edge of the bottom plate, and are respectively welded to external terminals, the external terminals are disposed on a ceramic base, and the ceramic base is fastened to the edge of the bottom plate; and

the base of the double-contact temperature controller is fastened to the edge of the bottom plate of the heating plate, the first terminal is welded to an external terminal on the heating plate, and the tail end of the metal tube extends above the center of the heating plate.

[0005] Preferably, the heating belt is corrugate, and has a flat-shaped section.

[0006] Preferably, a heat insulation pad is disposed between the heating belt and the bottom plate.

[0007] Preferably, a ceramic holder is disposed on the center of the heating plate, and the tail end of the metal tube is fastened in the ceramic holder.

[0008] Preferably, an edge on an inner side of the bottom plate of the heating plate is provided with a retaining ring.

[0009] Preferably, weight percents of components of the heat insulation pad are collocated as follows:

(1). an aggregate component is 5% to 70% vermiculite;

(2). a filling component is 1% to 20% white carbon black, 1% to 20% silica powder or expanded perlite, 1% to 20% mullite powder, 1% to 20% silica fume, and 1% to 20% diatomaceous earth;

(3). an opacifier component is 2% to 25% titanium dioxide and 2% to 25% silicon carbide;

(4). a binder component is 5% to 30% cement, windshield washer fluid, or aluminium dihydrogen phosphate solution;

(5). a refractory fiber component is 1% to 30% ceramic fiber, aluminium oxide fiber, or mullite fiber; and

(6). a water component percent is 10% to 40%.

[0010] By means of the foregoing technical solution,

the present invention has beneficial effects of:

1. A metal casing has an appropriate structure, where strut member mounting legs are disposed at the bottom, burrs are peripherally disposed to fasten a heat carrier, and a ceramic member and a temperature controller are fastened to an edge. A heat insulation pad at the bottom and a heat insulation ring at the peripheral are fastened in the metal casing. Mounting is simple and convenient.

2. For a material formula of a heat insulation layer, properties of raw materials such as expansion coefficients, contraction coefficients, heat conductivity, and moisture absorption rates are fully considered and used, and the raw materials are divided into five components: aggregate, filling, opacifier, binder, and water, thereby making an optimal proportional collocation, and achieving objectives of improving the product performance, lengthening the product service life, and the like. The product does not craze and deform after use for a long time.

3. A temperature control device is fastened on a heating plate, and a metal tube on a front end of the temperature control device extends into the heating plate, thereby implementing more appropriate and accurate temperature control.

[0011] In conclusion, the heating plate has a compact structure, is convenient in mounting, is quick in heating, is safe and reliable, and has a long service life.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a schematic diagram of an overall structure of the present invention;

FIG. 2 is a schematic structural diagram of a temperature controller;

FIG. 3 is a diagram of states of contacts of the temperature controller at a low temperature;

FIG. 4 is a section view of a structure of the temperature controller;

FIG. 5 is a schematic structural diagram of a heating belt; and

FIG. 6 is a section view of a structure of a heating plate.

DETAILED DESCRIPTION

[0013] The following further describes the present in-

vention with reference to the accompanying drawings and embodiments.

[0014] A new temperature-controlled heat-insulated heating plate includes a heating plate and a double-contact temperature controller.

[0015] The double-contact temperature controller includes a base 1, the base has a side provided with a first terminal 2 and a second terminal 3, and the other side provided with a third terminal 4 and a fourth terminal 5, the first terminal and the third terminal are respectively provided with a first elastic piece 6 and a third elastic piece 7, the first elastic piece and the third elastic piece are respectively provided with a first contact 8 and a third contact 9, the second terminal and the fourth terminal are respectively provided with a second contact 10 and a fourth contact 11, the first contact is opposite the second contact, and the third contact is opposite the fourth contact; a ceramic thimble 12 runs through the first elastic piece and the third elastic piece, and the ceramic thimble has an end abutting a metal tube 13, and the other end abutting a movable piece 14; the movable piece is sleeved with a spring 15, and a blocking piece 16 is disposed at the bottom; and the metal tube extends out of the base, and has a tail end provided with a plug 17, a ceramic bar 18 and a metal bar 19 that abut in sequence are disposed in the tube, and a bottom end of the metal bar abuts the ceramic thimble. There are two ceramic bars in total, the ceramic bars and the metal bar in the metal tube function as transmission parts, the metal tube expands when heated and contracts when cooled, so that the ceramic bars and the metal bar pushes the elastic piece, to disconnect or connect the contacts. With the two ceramic bars, it can be ensured that each ceramic bar is straight during manufacture so that the ceramic bars move smoothly in the metal tube, as an excessive length leads to a curve problem.

[0016] According to this device, changes that the metal tube expands when heated and contracts when cooled are transformed into kinetic energy to control the spring to stretch or contract, and the movable piece pushes the elastic piece to disconnect or connect the contacts, thereby controlling power-on or off of a heating object and achieving an objective of temperature control.

[0017] This device is mounted on the heating plate during work. The first terminal and the second terminal are connected to a main loop of the heating plate, the third terminal and the fourth terminal are connected to an indication loop of the heating plate, and the metal tube is placed above the center of the heating plate to directly sense a temperature. When the metal tube senses a high temperature, the metal tube expands and becomes longer, so that the spring on the movable piece stretches, and drives the ceramic thimble to move upwards. In this case, the ceramic thimble drives the first elastic piece far away from the second elastic piece at the bottom, the first contact is separated from the second contact, and the main loop is cut. In addition, the third elastic piece moves upwards, and drives the third contact to keep in

contact with the fourth contact, to turn on the work indication loop. When the temperature decreases, the metal tube is cooled and contracts, so that the terminals are reversely disconnected or connected. Actions are repeated like that, thereby achieving the objective of temperature control. A temperature controlled according to the present utility model can reach 800 degrees Celsius.

[0018] The heating plate includes a bottom plate 20 and a heating belt 21, the heating belt is curled on the bottom plate, two ends of the heating belt are located on an edge of the bottom plate, and are respectively welded to external terminals 22 and 23, the external terminals are disposed on a ceramic base 24, and the ceramic base is fastened to the edge of the bottom plate.

[0019] The base of the double-contact temperature controller is fastened to the edge of the bottom plate of the heating plate, the first terminal is welded to the external terminal 23 on the heating plate, and the tail end of the metal tube extends above the center of the heating plate.

[0020] The heating belt is corrugate, and has a flat-shaped section. Because a heating belt with a flat-shaped section is used, a sectional area is increased, which greatly lengthens the life.

[0021] A heat insulation pad 25 is disposed between the heating belt and the bottom plate.

[0022] Weight percents of components of the heat insulation pad are collocated as follows:

- (1). an aggregate component is 5% to 70% vermiculite;
- (2). a filling component is 1% to 20% white carbon black, 1% to 20% silica powder or expanded perlite, 1% to 20% mullite powder, 1% to 20% silica fume, and 1% to 20% diatomaceous earth;
- (3). an opacifier component is 2% to 25% titanium dioxide and 2% to 25% silicon carbide;
- (4). a binder component is 5% to 30% cement, windshield washer fluid, or aluminium dihydrogen phosphate solution;
- (5). a refractory fiber component is 1% to 30% ceramic fiber, aluminium oxide fiber, or mullite fiber; and
- (6). a water component percent is 10% to 40%.

[0023] The raw materials above are mixed by stirring, die-cast and molded, and shaped after baked and sintered. For a material formula, properties of raw materials such as expansion coefficients, contraction coefficients, heat conductivity, and moisture absorption rates are fully considered and used, and the raw materials are divided into five components: aggregate, filling, opacifier, binder, and water, thereby making an optimal proportional col-

location, and achieving objectives of improving the product performance, lengthening the product service life, and the like.

[0024] A ceramic holder 26 is disposed on the center of the heating plate, and the tail end of the metal tube is fastened in the ceramic holder.

[0025] An edge on an inner side of the bottom plate of the heating plate is provided with a retaining ring 27. The retaining ring has a high temperature resistant and insulation structure, and an underside of the retaining ring has a groove.

[0026] In addition, the base of the heating plate has burrs on the peripheral, and fastening and mounting can be directly performed by using the burrs. The base of the heating plate has three mounting legs at the bottom, which directly fasten a mounting strut member at the bottom. For the heating belt, a 0.05 to 0.1 cm thick iron chromium alloy sheet is used as an alloy material, and a rare earth element is added. The heating belt has strong oxidation resistance and belongs to a thin iron chromium alloy sheet. Compared with a conventional heating wire, the heating belt has a larger surface area. A larger surface area indicates quicker heat transfer. The iron chromium alloy sheet has a low temperature, and the temperature is close to an environment temperature in a cavity of the heat insulation pad, so that the iron chromium alloy sheet has a long life and a high thermal benefit.

[0027] The foregoing embodiments are merely intended to describe the present invention, but not intended to limit the present invention. A person skilled in the art may make modifications and variations without departing from the scope of the present invention. Therefore, all equivalent technical solutions also fall within the scope of the present invention, which should be defined by the claims.

Claims

1. A new temperature-controlled heat-insulated heating plate, comprising a heating plate and a double-contact temperature controller, wherein the double-contact temperature controller comprises a base, the base has a side provided with a first terminal and a second terminal, and the other side provided with a third terminal and a fourth terminal, the first terminal and the third terminal are respectively provided with a first elastic piece and a third elastic piece, the first elastic piece and the third elastic piece are respectively provided with a first contact and a third contact, the second terminal and the fourth terminal are respectively provided with a second contact and a fourth contact, the first contact is opposite the second contact, and the third contact is opposite the fourth contact; a ceramic thimble runs through the first elastic piece and the third elastic piece, and the ceramic thimble has an end abutting a metal tube, and the other end abutting a movable piece; the movable piece is sleeved with a spring,

and a blocking piece is disposed at the bottom; and the metal tube extends out of the base, and has a tail end provided with a plug, a ceramic bar and a metal bar that abut in sequence are disposed in the tube, and a bottom end of the metal bar abuts the ceramic thimble;

the heating plate comprises a bottom plate and a heating belt, the heating belt is curled on the bottom plate, two ends of the heating belt are located on an edge of the bottom plate, and are respectively welded to external terminals, the external terminals are disposed on a ceramic base, and the ceramic base is fastened to the edge of the bottom plate; and the base of the double-contact temperature controller is fastened to the edge of the bottom plate of the heating plate, the first terminal is welded to an external terminal on the heating plate, and the tail end of the metal tube extends above the center of the heating plate.

2. The temperature-controlled heat-insulated heating plate according to claim 1, wherein the heating belt is corrugate, and has a flat-shaped section.

3. The temperature-controlled heat-insulated heating plate according to claim 1, wherein a heat insulation pad is disposed between the heating belt and the bottom plate.

4. The temperature-controlled heat-insulated heating plate according to claim 1, wherein a ceramic holder is disposed on the center of the heating plate, and the tail end of the metal tube is fastened in the ceramic holder.

5. The temperature-controlled heat-insulated heating plate according to claim 1, wherein an edge on an inner side of the bottom plate of the heating plate is provided with a retaining ring.

6. The temperature-controlled heat-insulated heating plate according to claim 3, wherein weight percents of components of the heat insulation pad are collocated as follows:

(1). an aggregate component is 5% to 70% vermiculite;

(2). a filling component is 1% to 20% white carbon black, 1% to 20% silica powder or expanded perlite, 1% to 20% mullite powder, 1% to 20% silica fume, and 1% to 20% diatomaceous earth;

(3). an opacifier component is 2% to 25% titanium dioxide and 2% to 25% silicon carbide;

(4). a binder component is 5% to 30% cement, windshield washer fluid, or aluminium dihydrogen phosphate solution;

(5). a refractory fiber component is 1% to 30% ceramic fiber, aluminium oxide fiber, or mullite

fiber; and

(6). a water component percent is 10% to 40%.

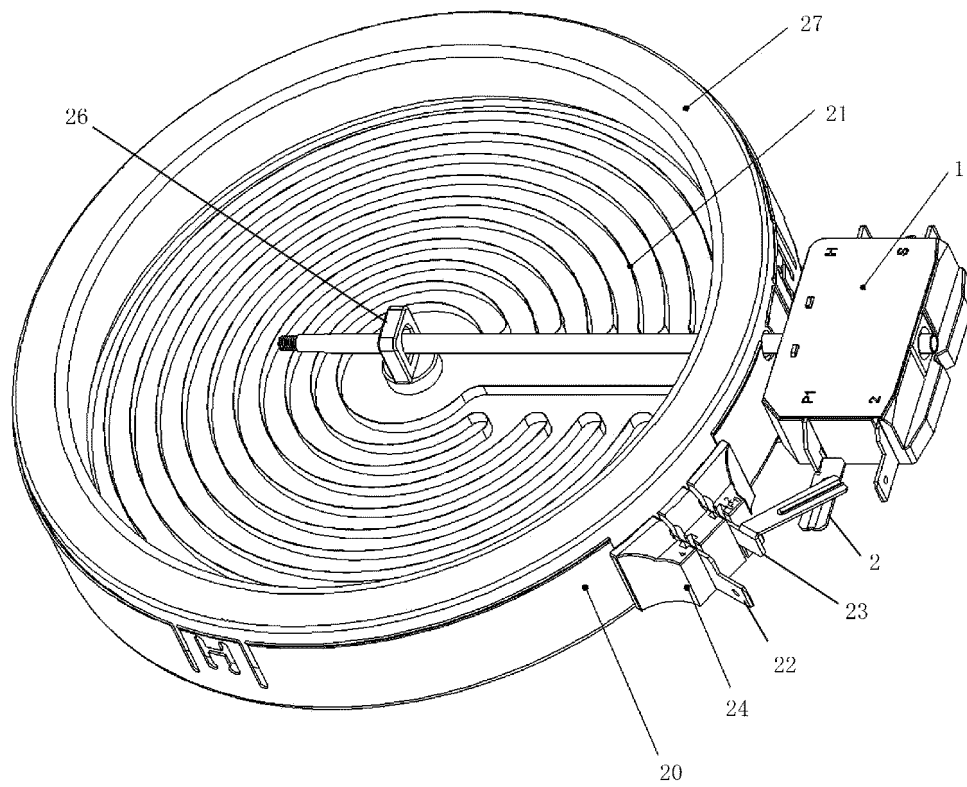


FIG. 1

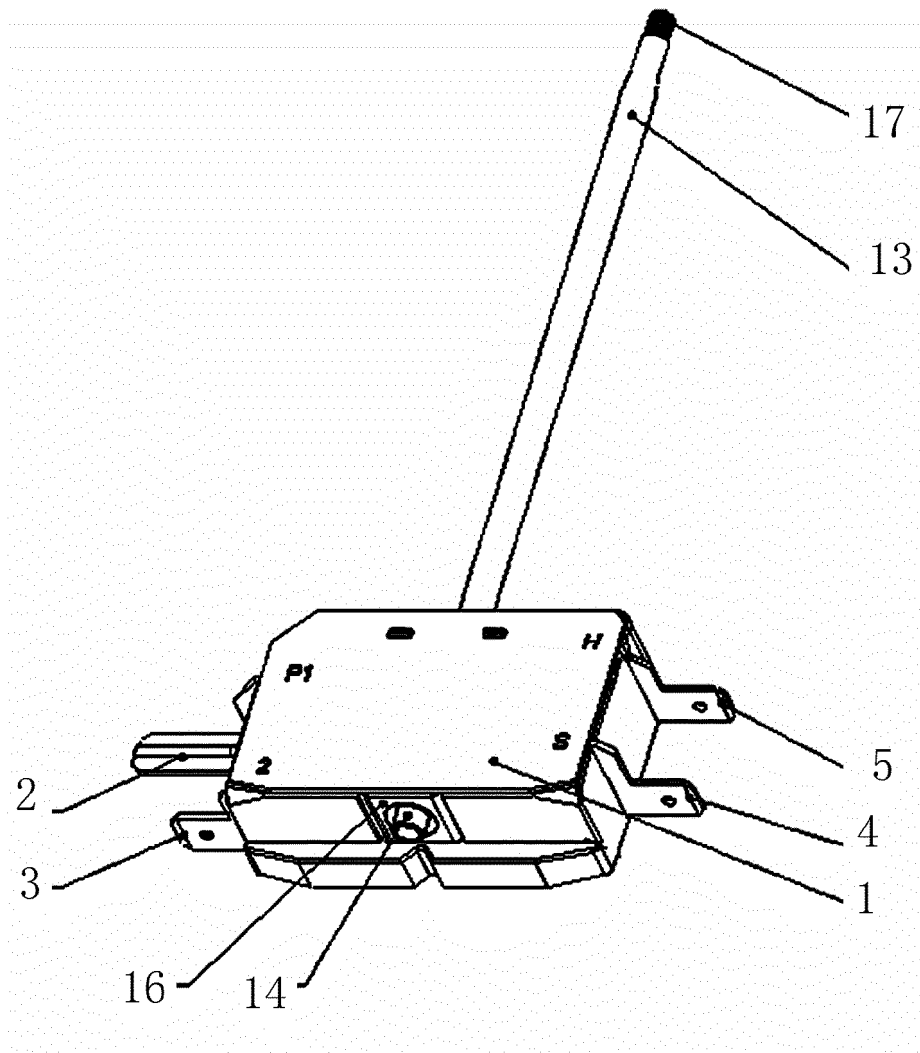


FIG. 2

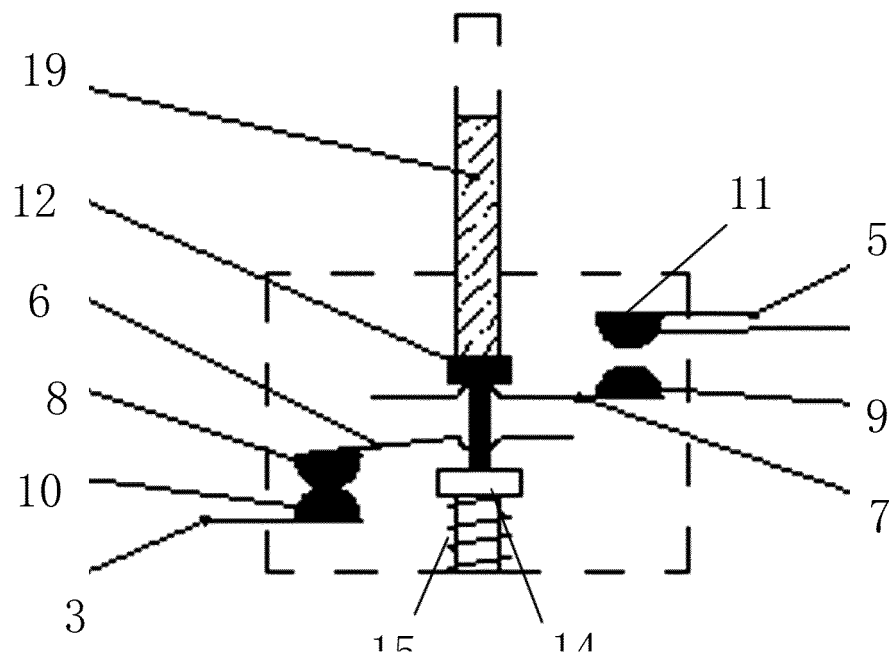


FIG. 3

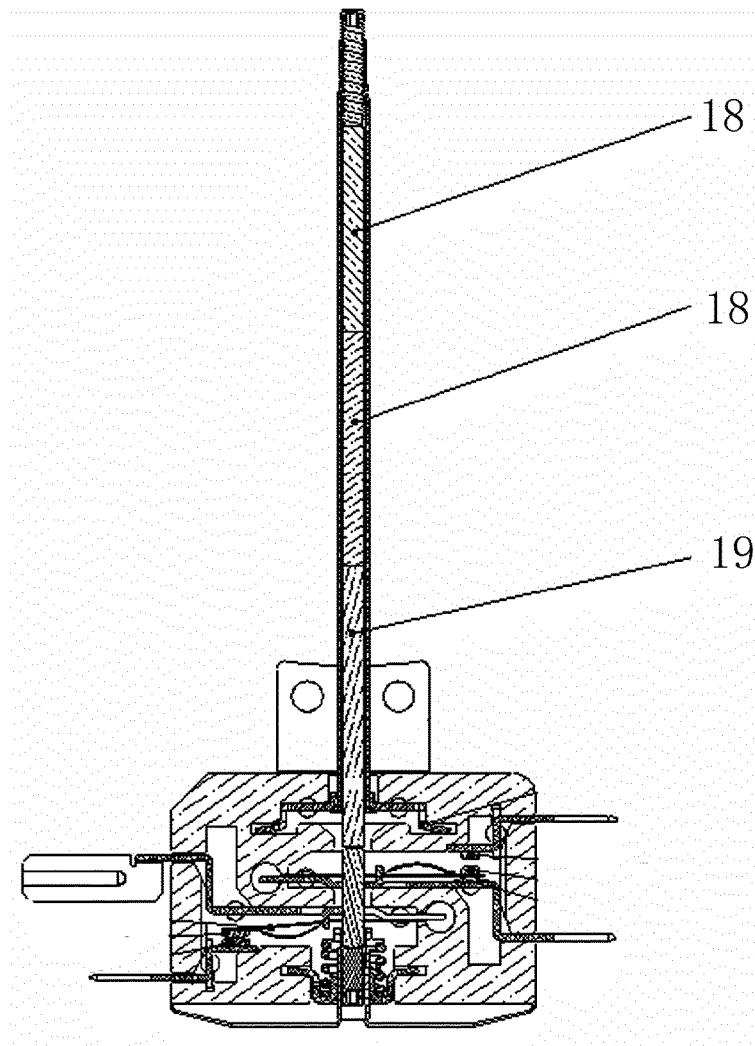


FIG. 4

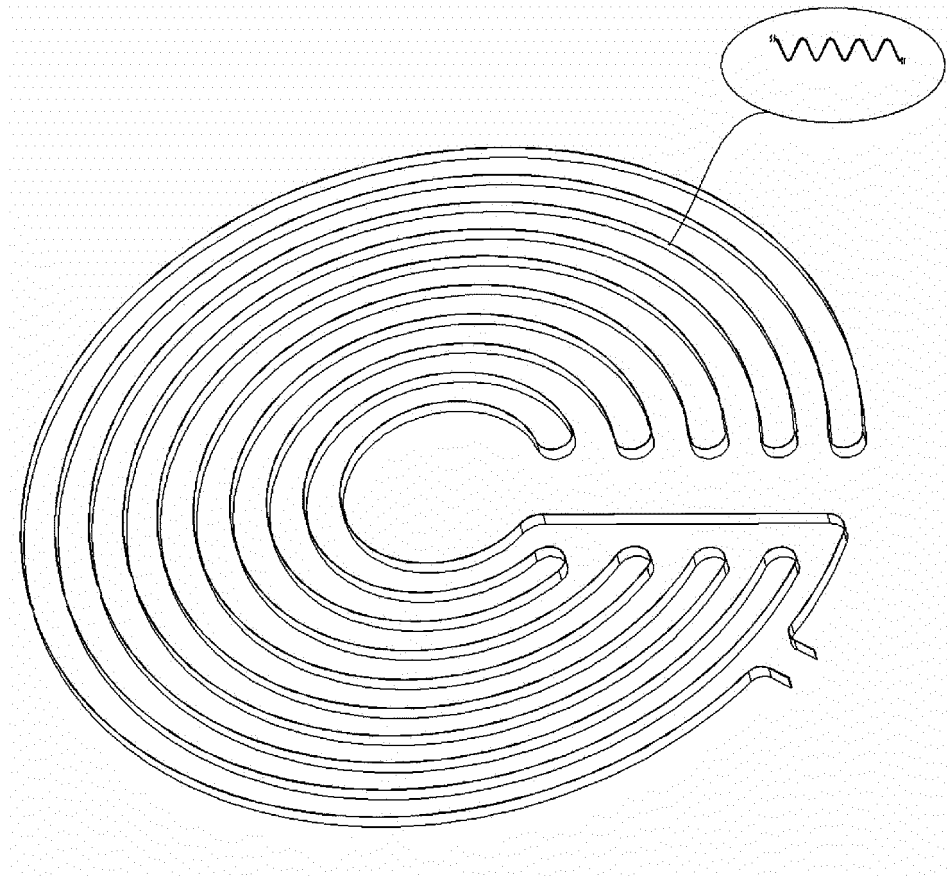


FIG. 5

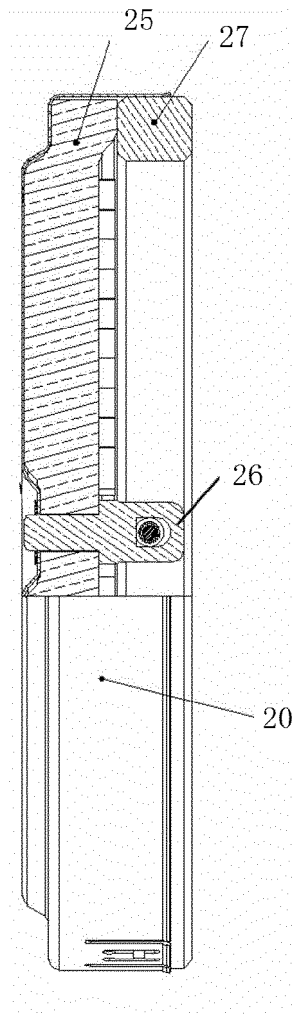


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/081334

A. CLASSIFICATION OF SUBJECT MATTER

H05B 3/20 (2006.01) i; H01H 37/00 (2006.01) i; H05B 1/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H05B, H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, CNPAT, CNKI: electric heating, resistance, temperature control, protect, shrapnel, elasticity; heat+, sensor, temperature, switch+, limiter, contact+, break+, spring+, expansion

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 28 December 2015 (28.12.2015)	Date of mailing of the international search report 06 February 2016 (06.02.2016)
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer PEI, Jingli Telephone No.: (86-10) 62413296

INTERNATIONAL SEARCH REPORT
 Information on patent family members

International application No.

PCT/CN2015/081334

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