July 11, 1950

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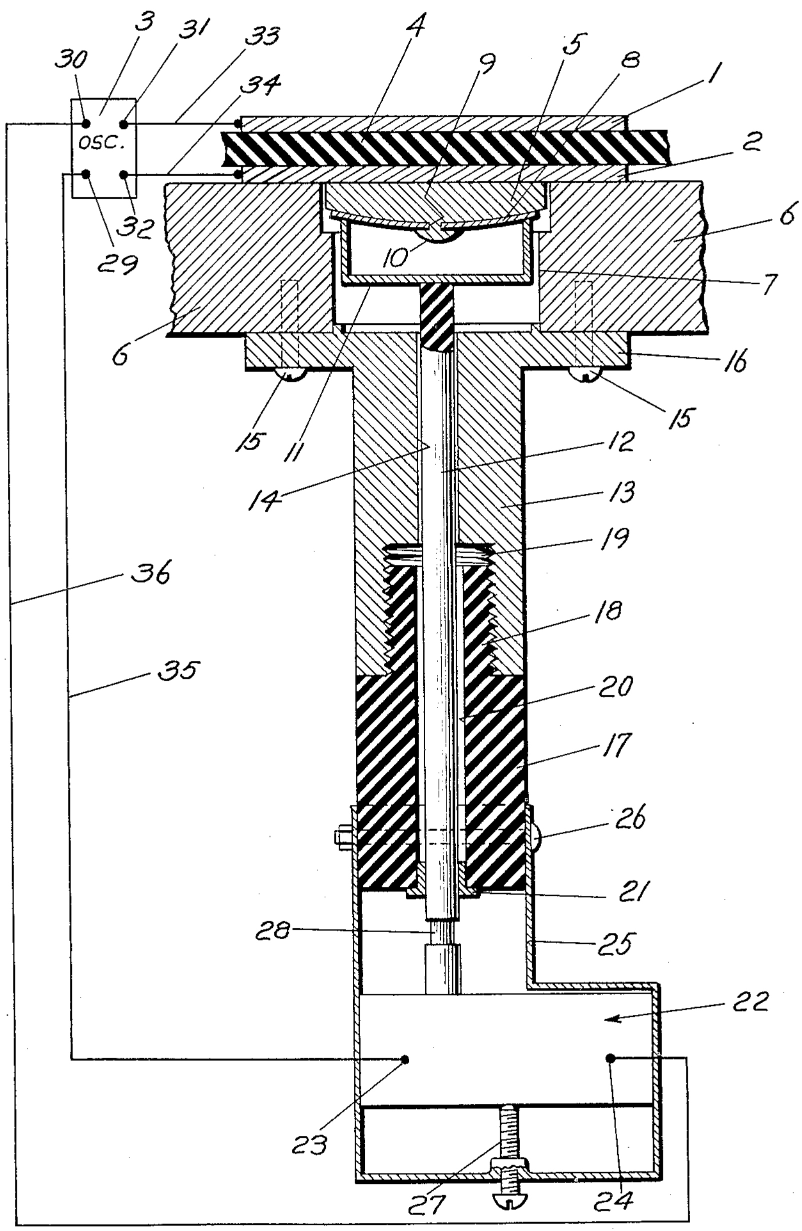
SWITCH MECHANISM ADAPTED FOR USE IN A HIGH-FREQUENCY HEATING SYSTEM

Filed July 16, 1946

2,515,152



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Patented July 11, 1950 2,515,152

UNITED STATES PATENT OFFICE

2,515,152

SWITCH MECHANISM ADAPTED FOR USE IN A HIGH-FREQUENCY HEATING SYSTEM

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Application July 16, 1946, Serial No. 684,036

2 Claims. (Cl. 219—47)

1

This invention relates to a switch mechanism, and more particularly to a switch which is adapted for use in a high-frequency, high-voltage system.

An object of this invention is to devise a temperature-responsive switch adapted for use in a high-frequency heating system.

Another object is to devise a thermal switch in which the temperature-responsive element of said switch is adapted to be placed in a radio-frequency field, without any of the difficulties ordinarily existing when the temperatures of radio-frequency fields are measured with conventional devices.

A further object is to devise a means for measuring temperatures under adverse conditions of high voltage and high frequency.

A still further object is to devise a temperature shut-off device responsive to radio-frequency conditions, which device is efficient yet relatively simple and therefore inexpensive.

The foregoing and other objects of the invention will be best understood from the following description of an exemplification thereof, reference being had to the accompanying drawing, wherein the single figure is a vertical section through a device embodying the present invention.

Referring, now, to the drawing, two electrodes 1 and 2 are connected, by means of conductors 33 and 34, to the output terminals 31 and 32 of a high-frequency oscillator 3, for example, one whose output is in the radio-frequency range, the dielectric material 4 to be heated being placed between the two electrodes. Electrode 2 is supported by a suitable supporting block 6, for example, of metal, which has an aperture 7 therein. Adjacent the lower face of electrode 2, firmly attached thereto, and positioned in aperture 7, there is an intermediate piece or disc 5 of heat-transmitting material, for example, of copper. A bimetallic thermal-responsive disc 8 has a central aperature 9, through which a rivet 10 extends in order to firmly fasten the center of said disc to the central portion of the bottom surface of piece 5. A cup-shaped member 11 is positioned centrally of disc 8 and piece 5, said member being of such diameter that its upstanding end engages the lower surface of disc 8 near its periphery. Aperture 7 is of sufficient diameter to freely accommodate disc 8, cup 11, and piece 5.

Firmly attached to the bottom of cup 11, and supporting the same in position, is a cylindrical elongated rod 12 of a suitable dielectric or insulating material. An elongated metallic member 13, having a longitudinal central bore 14 therein of sufficient diameter to allow free movement of rod 12 with respect to member 13 and through which bore rod 12 extends, is firmly attached, as by means of bolts 15 which pass through an outwardly-extending flange 16, to the lower surface of supporting block 6. An elongated member 17 made of a suitable insulating material is fastened to member 13 by means of a threaded shank portion 18 at its upper end which threadedly engages with a centrally-located threaded recess 19 provided in the lower end of member 13. Member 17 is provided with a centrally-located longitudinally-extending bore 20, which is aligned with bore 14 when members 13 and 17 are assembled and which is of sufficient diameter to allow free movement of rod 12 with respect to member 17, rod 12 extending through bore 20 when members 13 and 17 are assembled. Member 17 has a grommet 21 mounted therein at its lower end for the purpose of guiding rod 12 in its vertical or longitudinal movement.

2

A microswitch 22, having two electrical terminals 23 and 24, between which a circuit is made or broken by the operation of said microswitch, is mounted adjacent the lower end of member 17 by means of a supporting framework 25, for example of metal, which is in firm engagement with the outer surface of the microswitch body or container and which is secured to member 17 by means of a bolt 26 which passes through a transverse aperture in member 17 near the lower end thereof. Microswitch 22 is held in position in framework 25 by means of a bolt 27 which threadedly engages said framework and contacts the body or container of said microswitch. The microswitch is mounted in such position that the lower end of rod 12 engages, and is supported by, the actuating button 28 of said microswitch, so that vertical movement of the rod will actuate the microswitch and, at the same time, the microswitch will support rod 12 and cup 11 in position.

Oscillator 3 is provided with two control terminals 29 and 30 and these terminals are so connected into the circuit of said oscillator that, when an external circuit between said terminals is interrupted, said oscillator will be turned off. Terminals 29 and 30 are connected, by means of conductors 35 and 36 respectively, to terminals 23 and 24, respectively, of the microswitch, so that, in response to operation of the microswitch, oscillator 3 may be turned on or off.

The thermal-responsive disc 8, at temperatures below the control temperature for which it is designed, has a curvature in the direction shown in the drawing, but it is adapted, when said control temperature is reached, to suddenly reverse its curvature. The temperature of the electrode 2 is transmitted through piece 5 of heat-conducting material to disc 8. At temperatures below the shutoff or control temperature for which disc 8 is designed, the elements have the position shown in the drawing, with microswitch 22 closed and oscillator 3 turned on. When the control temperature is reached by the dielectric material 4 which is being heated by radio-frequency energy supplied from oscillator 3, this temperature is also reached by disc 8, causing said disc to suddenly reverse its direction of curvature, moving cup 11 and rod 12 downwardly to actuate microswitch 22 to its open position, thereby turning off oscillator 3 and stopping the supply of radio-frequency energy to material 4. This switch mechanism therefore acts as a temperature shutoff device or a temperature-limiting switch to control the heat in a radio-frequency dielectric heating system.

Since disc 8 operates at a fixed temperature, the device may be considered to be a temperature measuring device, because the temperature of the material 4 is transmitted to the disc 8, where it is measured as being above or below the control temperature. It will be noted that no electrical contact between the radio-frequency electrode and the temperature-responsive element is required, so that there is no possibility of arcing to the temperature-responsive element. Since the high-voltage portions of the system are electrically insulated, by means of rod 12 and member 17 of dielectric material, from the microswitch itself, there is no possibility of the high voltage radio-frequency energy interfering with the operation of the switch mechanism. It will therefore be seen that I have provided a temperature-responsive switch mechanism which is useful under adverse conditions of high voltage and high frequency, and which at the same time is relatively inexpensive.

Of course, it is to be understood that this invention is not limited to the particular details as described above, as many equivalents will suggest themselves to those skilled in the art. It is accordingly desired that the appended claims be given a broad interpretation commensurate with the scope of this invention within the art.

What is claimed is:

1. A temperature-responsive switch mechanism for use in a high-frequency electrical system, comprising a thermal-responsive disc in heat-conducting relation with a source of high-frequency electrical energy the temperature of which is to be measured, a cup-shaped member in engagement with said disc, an elongated insulating member attached to said member, a guiding member of insulating material surrounding said last-named member, and a remotely-located microswitch having an actuating element, said microswitch being supported directly from said guiding member and being so located that said actuating element is mechanically connected to said elongated member.

2. A high frequency electrical system, comprising a pair of electrodes connected to be supplied with energy from an oscillator, means for supporting one of said electrodes, said means covering the exterior surface of said one electrode but being provided with an aperture which exposes a portion of the exterior surface of said one electrode, a thermal-responsive disc connected at its center to a metallic block positioned in said aperture and in heat-conducting relation with said one electrode, said disc moving in response to heating thereof, a remotely-located switch having an actuating element and a pair of terminals, insulating means mechanically coupling said disc to said element to transmit movements of said disc to said element, and means electrically connecting said terminals to said oscillator.

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