June 13, 1961 D. F. HOUSER 2,988,618

THERMOSTAT

Filed Sept. 22, 1958

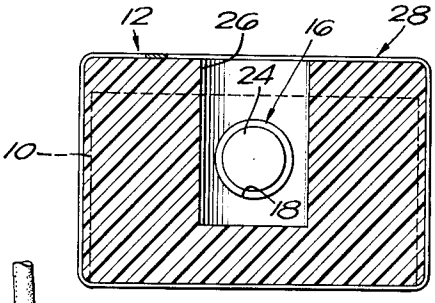


FIG. 3.

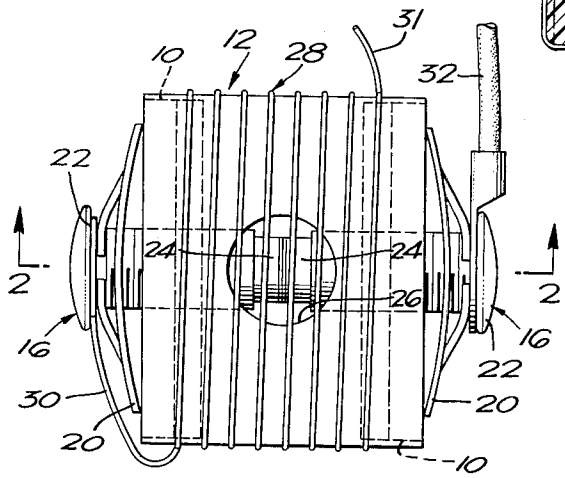


FIG. 1.

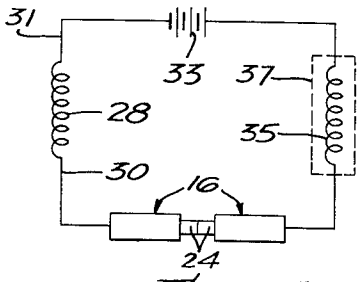


FIG. 5.

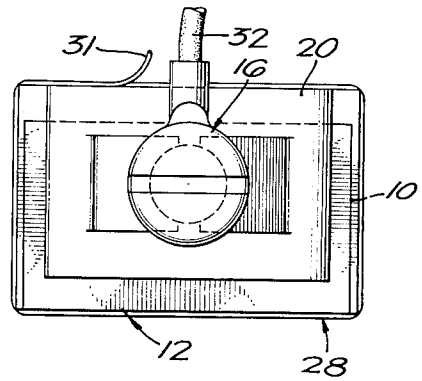


FIG. 4.

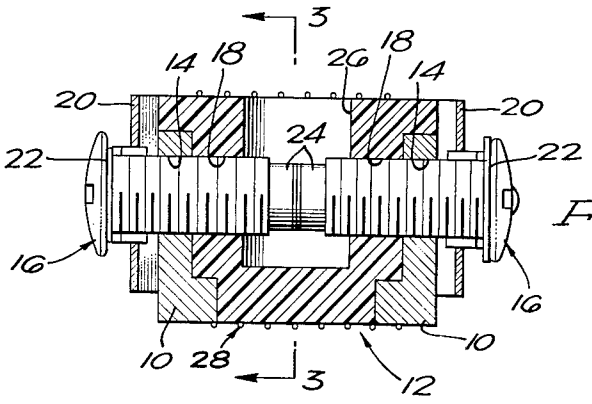


FIG. 2.

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THERMOSTAT

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This invention is concerned with a thermostat which is adapted to open and close an electrical circuit used for heating purposes, within predetermined temperature limits.

In the operation of many instruments such as electrical strain wire transducers, in order to obtain the best accuracy of the instrument, it is often necessary to place the instrument in an insulating case and maintain the temperature therein within certain limits during operation of the transducer. One such type of heat regulator or insulator case employed has an electrical coil mounted in the wall or heating jacket of the case to heat the interior of the case to a desired temperature.

To control the heating current so as to maintain the temperature of the interior of the case within certain limits, a thermostat or like device is required. It is the chief object of the invention to design a simple, yet reliable thermostat particularly suited for the aforementioned purpose.

According to the invention, I have provided a thermostat composed of an insulating resin body member, preferably formed of a plastic or resin having a high coefficient of expansion, a pair of conducting members adjustably mounted in said body member, said conducting members being in axial alignment, the outer ends of said conducting members forming electrical contacts, the inner adjacent ends of said conducting members being in removable contact with each other. The contacts at the outer ends of the conducting members are connected in the circuit being controlled, e.g., a circuit including a heater winding positioned in the heater jacket about an insulating case whose temperature is to be controlled.

In preferred practice, a pair of supports, preferably formed of metal, are bonded to the body member at opposite ends thereof, said conducting members passing through said supports. The function of said supports will be discussed more fully below. As an additional feature of the invention, an electrical coil is positioned about said resin body member. As described more fully below, according to one embodiment, said coil is disposed in a circuit for the heater winding of a heating jacket which is being controlled, to narrow the temperature range within which the heater jacket is controlled by the thermostat of the invention. The coil is termed herein an anticipator coil. Where an anticipator coil is employed according to preferred practice, both the coil and the conductive members of such thermostat are connected in series circuit with the circuit being controlled, e.g. the heater winding of the above mentioned insulating case.

When, for example, the walls or heating jacket of the insulator case whose temperature is being controlled reaches a predetermined temperature, the thermostat of the invention is calibrated so that the magnitude of the current in the circuit is such that the resin body member of the thermostat is heated to a temperature at which the resin body member expands sufficiently to cause displacement of the conductive members mounted in said body member away from each other, to produce a separation of the inner adjacent ends of such members. This separation opens the circuit being controlled, and prevents further heating of the walls of the insulating case. The winding about the resin body of the thermostat compensates for the lag in warm-up of the resin body of the thermostat compared to the rate of warm-up of the insulating case whose temperature is being controlled. In other words, the coil about the resin body member of the

thermostat causes the resin body to heat up and cool down faster than the walls of the insulating case undergoing temperature control, to thus narrow the temperature range within which the circuit to the heater jacket opens and closes as regulated by my thermostat. Thus, for example, without an anticipator coil such temperature range may be say 130 to 160° F. while when employing the anticipator coil the temperature range can be narrowed to say about 130 to 135° F.

The controlling temperature at which the thermostat is set to operate can be regulated by adjusting the degree of contact between the adjacent ends of the conductive members. The inner portion of the resin body member preferably has an aperture formed therein so that the inner ends or contacting tips of the conductive members are not in direct engagement with the resin body member. This aids in preventing corrosion of said contacting tips due to "gassing" of the resin body member when it is heated up.

The invention will be more clearly understood by reference to the description below of a preferred embodiment taken in connection with the accompanying drawing wherein:

FIG. 1 is a plan view of the invention thermostat;
FIG. 2 is a section taken on line 2—2 of FIG. 1;
FIG. 3 is a section taken on line 3—3 of FIG. 2;
FIG. 4 is an end view of the device of FIG. 1; and
FIG. 5 is a schematic illustration of a circuit controlled by my thermostat.

Referring to the drawing, the thermostat is formed of a body member **12** with two L-shaped, preferably aluminum, support or end members **10** mounted in spaced relation on body member **12**. The body member **12** is preferably composed of a resin which expands on heating and contracts on cooling without cracking. Suitable resins for this purpose are the epoxy resins, such as the resin marketed as Epicast 17 by Furane Plastics, Inc., of Los Angeles, California. However, other thermoplastic or thermosetting resins can be employed, and preferably those which can be cast from a liquid form. The resins or plastics used should be such as do not decompose or soften substantially at the temperatures of operation of the thermostat, and they should have a high coefficient of expansion.

Threadably received in an aperture **14** in one of the support members **10** is a first screw **16**, which is also threaded into aperture **18** of the resin body member **12**. A second like screw **16** is similarly mounted in the opposite end member **10** and received within body member **12**. The two screws **16** are in axial alignment with each other, and are formed of a conductive material. It is preferred to employ for this purpose a metal having as low a coefficient of expansion as possible, so that the extent of relative movement between the conductive members **16** on expansion of the plastic body member **12** will be as great as possible. I preferably make the screws **16** of Invar, although other metals having the aforementioned properties can be employed.

The screws **16** are maintained in a fixed preselected position by means of spring pressed speed nuts **20** abutting the outer surface of the support members **10**. While the support members **10** may be omitted, they are preferably employed in conjunction with the speed nuts **20** since the latter exert considerable pressure against metal members **10**, and would tend to injure the plastic if metal end members **10** are not employed. The outer ends of screws **16** form electrical contacts **22**, and at the inner adjacent ends of the screws are preferably mounted tips **24**, e.g. by welding them to the ends of screws **16**, to produce good electrical contact with minimum corrosion and sparking tendencies. Such tips are preferably formed of platinum, although other suitable materials can also be

used. It will be noted that an aperture 26 is provided in the central portion of body member 12 adjacent the inner ends of the screws and the tips 24 thereon, and communicating with the atmosphere. This aids to prevent corrosion of the platinum tips 24 by any gassing of the resin which may take place when it is heated by the electrical current.

A coil 28 is wound about the wall of the body member 12 between the end members 10. If desired, such coil can be embedded in the plastic member 12. The coil is preferably made of copper although other materials can be employed. Referring to FIGS. 1 and 5, one end 30 of such coil is connected to one of the contacts 22 at the outer end of one of the screws 16, the other end 31 of coil 28 is connected to a source of potential indicated at 33. The screws 16 and the coil 28 are connected in series with the winding 35 of heater jacket indicated schematically at 37, of an insulating case (not shown) whose temperature is being controlled. A device of this type is described, for example, in the application of Earl W. Grant, Serial No. 457,191, filed September 20, 1954, now Patent No. 2,855,495, assigned to Statham Instruments, Inc.

When the adjacent inner tips 24 of screws 16 are in physical contact, current passing through the winding 35 of the heater jacket being controlled, also passes through the screws 16 and the anticipator coil 28, heating the resin body 12 in which the screws are positioned. This causes expansion of the resin body member 12 and displacement of the screws outwardly away from each other. A separation of the platinum tips 24 thus takes place, opening the circuit in which the screws 16, coil 28, and the heater winding 35 of the heater jacket 37 are contained, and preventing further heating of the wall and interior of the heater jacket.

When the body member 12 cools sufficiently, it will contract, drawing screws 16 toward each other until the inner tips 24 again make contact. This closes the circuit to the heater jacket 37 to again permit the current to raise the temperature of the heater jacket to a predetermined maximum value by passage through winding 35, at which time the invention thermostat again opens the circuit in the manner described above. Thus, the heater jacket is maintained within certain preselected temperature limits controlled by the thermostat of the invention.

The screws 16 can be adjusted to vary the amount of physical contact between the tips 24 to change the temperature range of operation of the thermostat.

While I have described my thermostat particularly for use in controlling the temperature of an insulating case of a type such as that described in the above-mentioned copending Grant application, utilizing an electrical heating circuit, it will be understood that my thermostat can be employed to control any electrical circuit.

While I have described a particular embodiment of my invention for purposes of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. A thermostat which comprises an insulating resin body member, a pair of conducting members adjustably mounted in and engaging said body member, said conducting members being in axial alignment, the outer ends of said conducting members forming electrical contacts, the inner adjacent ends of said conducting members being in removable contact with each other, said resin body member being apertured in the space around said inner ends of said conducting members, and electrical connections connected to said contacts, said resin body member having a higher coefficient of expansion than said conducting members.

2. A thermostat which comprises an insulating resin body member, a pair of conducting members adjustably mounted in said body member, said conducting members being in axial alignment, the outer ends of said conducting members forming electrical contacts, the inner adjacent ends of said conducting members being in removable contact with each other, said resin body member being apertured in the space around said inner ends of said conducting members, an electrical coil positioned about said resin body member, one end of said coil being electrically connected to one of said contacts, and an electrical connection connected to said other contact, said coil and conducting members being connected in series circuit, said resin body member having a higher coefficient of expansion than said conducting members.

3. A thermostat which comprises an insulating resin body member, a pair of supports bonded to said body member at opposite ends thereof, a pair of conducting adjustable screws mounted on said supports and engaged in said body member, means cooperating with said supports and said screws and frictionally engaging said screws to prevent inadvertent rotation thereof, said screws being in axial alignment, the outer ends of said screws forming electrical contacts, the inner adjacent ends of said conducting members being in removable contact with each other, and electrical connections connected to said contacts, said resin body member having a higher coefficient of expansion than said screws.

4. A thermostat which comprises an insulating resin body member, a pair of supports bonded to said body member at opposite ends thereof, a pair of conducting adjustable screws, mounted on said supports and engaged in said body member, said screws being in axial alignment, the outer ends of said screws forming electrical contacts, a highly conductive tip mounted on the inner end of each of said screws, said tips being in removable contact with each other, said resin body being apertured in the space around said tips, whereby said tips are free from engagement with said resin body member, and electrical connections connected to said contacts, said resin body member having a substantially higher coefficient of expansion than said screws.

5. A thermostat which comprises an insulating resin body member having a high coefficient of expansion, a pair of supports bonded to said body member at opposite ends thereof, a pair of conducting adjustable screws mounted on said supports and received in said body member, said screws formed of metal having a low coefficient of expansion and being in axial alignment, the outer ends of said screws forming electrical contacts, a highly conductive tip mounted on the inner end of each of said screws, said tips being in removable contact with each other, said resin body being apertured in the space around said tips, whereby said tips are free from engagement with said resin body member, an electrical coil positioned about said resin body member, one end of said coil being electrically connected to one of said contacts, and an electrical connection connected to said other contact, said coil and said screws being connected in series circuit.

6. A thermostat which comprises an insulating resin body member having a high coefficient of expansion, a pair of L-shaped metal supports bonded to said body member at opposite ends thereof, a pair of conducting adjustable screws mounted on said supports, means abutting said supports and locking said screws in position, said screws formed of a metal having a low coefficient of expansion and passing into said body member in axial alignment, the outer ends of said screws forming electrical contacts, a highly conductive tip mounted on the inner end of each of said screws, said tips being in removable contact with each other, the inner central portion of said body member being apertured about the adjacent inner ends of said screws and said tips, an anticipator winding positioned around the outer wall of said body member between said supports, one end of said winding being connected to one of said contacts, and an electrical connection connected to the other end of

said winding, said winding and said screws being connected in series circuit, whereby heating of said resin body member by an electric current passing through said screws and through said winding expands said resin body and causes separation of said tips and opening of said electrical circuit.

7. A thermostat which comprises an insulating epoxy resin body member, a pair of L-shaped metal supports bonded to said body member at opposite ends thereof, a pair of adjustable Invar screws mounted on said supports, means on said supports and locking said screws in position, said screws passing into said body member in axial alignment, the outer ends of said screws forming electrical contacts, a platinum tip mounted on the inner end of each of said screws, said tips being in removable contact with each other, the inner central portion of said body member being apertured about the adjacent inner ends of said screws and said tips, an anticipator winding positioned around the outer wall of said body member between said supports, one end of said winding being connected to one of said contacts, and an electrical connection connected to the other end of said winding, said winding and said screws being connected in series circuit, whereby heating of said resin body member by an electric current passing through said Invar screws and through said winding expands said resin body and causes separation of said tips and opening of said electrical circuit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,217,982	Neahr	Mar. 6, 1917
1,330,753	Webb	Feb. 10, 1920
1,822,191	Appelberg	Sept. 8, 1931
1,851,657	Appelberg	Mar. 29, 1932
1,935,762	Appelberg	Nov. 21, 1933
2,356,039	Ellis et al.	Aug. 15, 1944
2,664,481	Pearl et al.	Dec. 29, 1953
2,744,981	Spears	May 8, 1956