June 20, 1933. L. SATCHWELL 1,914,675

THERMOSTAT

Filed March 4, 1931

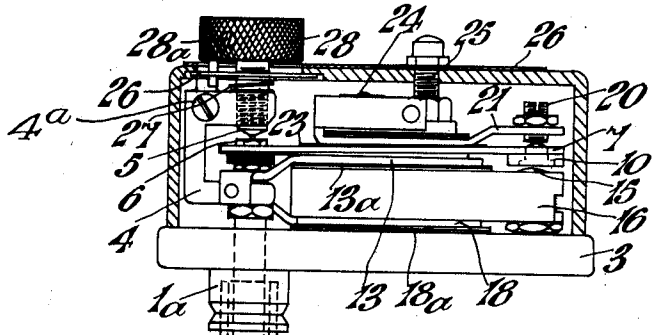


Fig. 1.

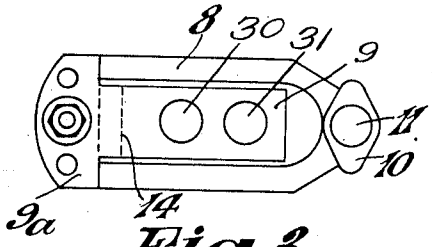


Fig. 3.

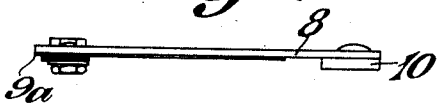


Fig. 4.

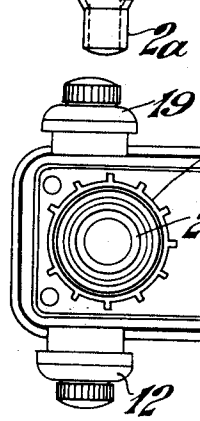


Fig. 2.

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UNITED STATES PATENT OFFICE

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THERMOSTAT

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This invention relates to thermostats and more particularly to thermostats of the type in which an electric switch is adapted to be controlled by a heat sensitive element extending into the medium to be controlled such as a liquid and comprises an expanding member in the form of a tube or rod associated with a non-expansible member in the form of a rod or tube.

The invention has for its object to provide an improved construction of such thermostat.

In thermostats of the kind referred to it is usual to make the switch lever turn about a pivot. Such an arrangement is quite unsatisfactory in thermostatic switches where great sensitivity and consistency of operation are required. For instance due to the play usually provided or produced by wear in pivots the switch lever will not respond always exactly to movements of the heat sensitive element.

A feature of the present invention resides in an improved mounting of the switch lever. Other features will hereinafter be described in conjunction with the accompanying drawing illustrating one embodiment of the invention.

In the drawing Fig. 1 is a side elevation of a thermostat in accordance with the invention, the cover of the switch mechanism being shown in section in order to illustrate the mechanism. Fig. 2 is an end elevation of Fig. 1. Figs. 3 and 4 are detail views, Fig. 3 showing the switch lever detached in front elevation and Fig. 4 showing it in side elevation.

Referring to the drawing, 1 indicates a tube of metal which expands and contracts under the action of heat or cold and 2 is a non-expansible rod such as a rod of invar fixed to the tube at one end 2*a*. At the opposite end the tube 1 is screwed into the base 3 of the switch head, the rod 2 extending through the base 3 and being secured at its end to a U-shaped member 4 in which is fitted a screw 5 which is capable of adjustment therein. The member 4 is split to allow the screw thread in the member 4 engaged by the adjusting screw 5 to be tightened around the adjusting screw by screwing up a screw 4*a* engaging the split halves of the member 4. On the switch base 3 is supported a magnet 16 and between the magnet and the base is a contact plate 18 connected with a terminal 19, the contact plate 18 making electrical contact with the magnet, but being insulated from the base by mica insulation 18*a*. On the other side of the magnet and insulated therefrom by mica insulation 13*a* is a contact plate 13 connected with the terminal 12. Between the poles of the magnet 16 is mounted a fixed contact 15 adapted to co-operate with a contact 11 on an iron armature 10 carried by one end of a compound switch lever 7 and at its other end the lever is provided with a steel pad 6 adapted to be operated by the point of the screw 5 carried by the U-shaped member 4. This switch lever 7 which is shown separately in Figs. 3 and 4, comprises a flexible strip 9 which is secured by the clamping screws 24 and 25 to the base, these screws passing through holes 30 and 31 therein. Attached at one end 9*a* is a comparatively rigid member 8 which surrounds the strip and carries the iron armature 10 and the switch contact 11. The edge of the contact plate 13 which lies underneath the strip 9 near the end 9*a*, forms a pivot about which the switch lever 7 bends at the point 14 upon movement of the screw 5 against the pad 6 by the U-shaped lever 4.

In the embodiment shown an abutment 20 for limiting the movement of the switch lever 7 is provided. This abutment is mounted on top of strip 9 and held in place by the screws 24 and 25 which hold the strip in place. The abutment extends out over the contact bearing end of the lever 7 and limits its upward movement. It may be insulated from the lever by insulation 23 between the abutment and the strip 9 and may carry contact 11 forming an electrical connection to the lever 7 when the lever moves against it. In order to use this contact, a terminal 22 is connected to the abutment. The whole switch is insulated from its base plate 3 by mica plates between the terminal plate 18 and the base and also mica bushes on the clamping screws

24 and 25 which serve also to hold the magnet to the base. The whole switch mechanism is protected by a dust tight cover 26 held in position by a nut on clamping screw 25. A washer 26 held in position by a spiral spring 27 serves to make a dust tight joint round the adjusting knob 28. To facilitate calibrating the instrument the knob 28 is in the form of a loose collar on the adjusting screw 5. The instrument can then be brought to a predetermined temperature and the knob 28 turned to set it to record the actual temperature on a scale 29 on the cover 26, the loose collar being then made fast to the adjusting screw 5 by a set screw 28*a*.

The instrument operates as follows: Assuming it is controlling the temperature of a liquid in which the non-expansible rod and tube 2 is immersed, and the electrical heating means is connected to the supply through the terminals 12 and 19 and contacts 11 and 15, then as the temperature of the liquid rises, the tube and rod 1 and 2 will take up the increasing temperature causing the tube 1 to increase its length slightly, carrying with it rod 2. This action draws the member 4 towards the base 3 causing the adjusting screw 5 to press upon the hard steel pad 6 fixed in the lever 7. The pressure of the screw 5 on the pad 6 produces flexure of the strip 9 of lever 7 about the point 14 and as the portion 8 of the lever on which the pad is fixed is much more rigid than the spring portion 7 a force is exerted upon armature 10 to pull it away from the magnet 16. When the temperature reaches the figure corresponding to the setting of the instrument this flexing force causes the separation of contacts 11 and 15 interrupting the supply of energy say to the heater for the liquid. On the liquid temperature falling the tube 1 contracts allowing member 4 and adjusting screw 5 to move away from the base 3 reducing the force deflecting the spring 9. The armature 10 is thereby attracted to the magnet 16 bringing together contacts 11 and 15 and re-establishing the circuit to the heater.

It should be noted that a true lever action is obtained by the relative proportioning of the parts of lever 7 without the use of any form of pivot such as commonly employed thus allowing great consistency of operation to be obtained.

I claim:—

1. A thermostat for use in controlling the temperature of liquids including a heat sensitive element comprising an expansible tube and a non-extensible rod immersed in the liquid, a switch base anchored to the tube and traversed by the rod, a switch operating member carried by the rod, a magnet secured to the switch base, a contact embraced by the poles of the magnet, a switch lever comprising a flexible part and a rigid part connected together, the flexible part being secured to the base and the rigid part carrying at one end a contact co-operating with the contact embraced by the poles of the magnet, and adapted to be engaged by the switch operating member adjacent its other end, a stop limiting the movement of the contact bearing end of the switch element away from the magnet and contact plates connected with terminals, one of said contact plates forming a fulcrum about which the flexible part of the switch lever may bend on movement of the switch operating member.

2. A thermostat for use in controlling the temperature of liquids including a heat sensitive element comprising an expansible tube and a non-extensible rod immersed in the liquid, a switch base anchored to the tube and traversed by the rod, a switch operating member carried by the rod, an electric switch element operated by said switch operating member and connected with a circuit, a magnet secured to the switch base and controlling the operation of the switch element, a contact embraced by the poles of the magnet, said contact connected with said circuit, said switch element comprising a flexible part and a rigid part connected together, the flexible part being secured to the base and the rigid part carrying at one end a contact co-operating with the contact embraced by the poles of the magnet, and adapted to be engaged by the switch operating member adjacent its other end, a stop limiting the movement of the contact bearing end of the switch element away from the magnet and contact plates connected with terminals, one of said contact plates forming a fulcrum about which the flexible part of the switch lever may bend on movement of the switch operating member.

In testimony whereof I have signed my name to this specification.

LEONARD SATCHWELL.