March 29, 1932. A. O. APPELBERG 1,851,657

THERMOSTATIC SWITCH

Filed March 15, 1928

Fig. 1.

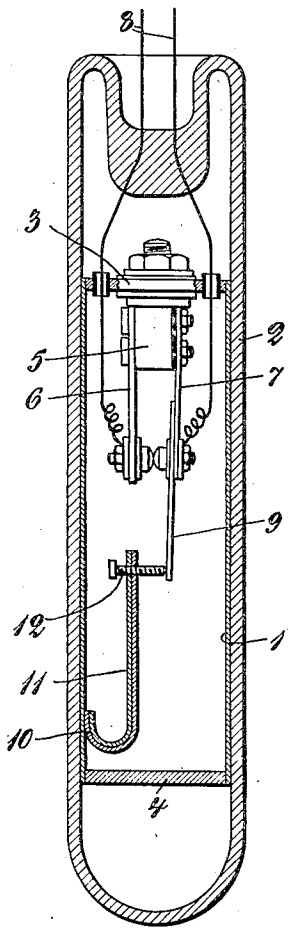


Fig. 2.

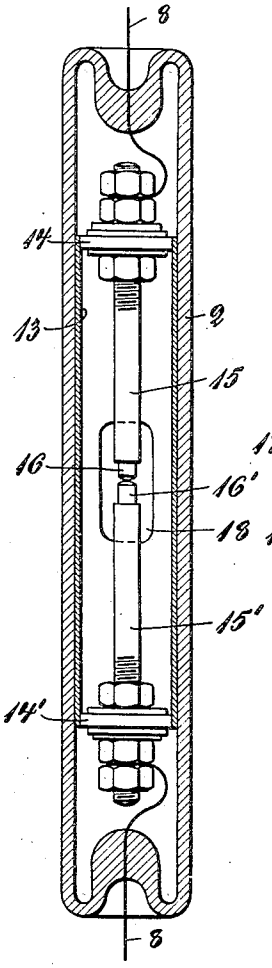
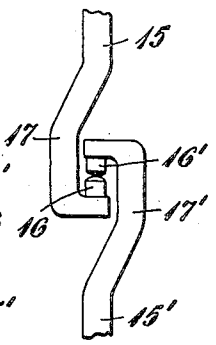


Fig. 3.



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UNITED STATES PATENT OFFICE

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THERMOSTATIC SWITCH

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The invention relates to thermostatic switches in which the thermostat and its contact device are disposed in an evacuated or gas-filled receptacle made of electrically insulating material. It is a known fact that by enclosing the contact device in an evacuated receptacle a considerable reduction of the arcing or sparking occurring upon the breaking of the contact is attained. An effective interruption of the current can then be produced by quite small mechanical displacements of the contact members in relation to each other.

In previously known thermostatic switches of this kind, the enclosing of the thermostat and its contact device will, however, impair the thermal connection between said elements and the outer surrounding medium, which entails a practical inconvenience, especially if the thermostat is arranged to be actuated by an external source of heat or by variations in the temperature of an external medium. The invention has for its main purpose to eliminate this inconvenience by arranging that part of the thermostat which is most sensitive to heat in an effective thermal connection with the walls of the enclosing receptacle. Such a heat conducting connection can be established by disposing the said operative part in metallic connection with metallic surfaces arranged to close by the walls inside the receptacle or by forming the operative part itself as a similar heat conducting surface. It may be of advantage to arrange also the contact device in metallic connection with the heat conducting surface or surfaces in order to produce an effective conduction of heat from the contact surfaces. This has the further advantage that the discharge gap is deionized quicker upon interruption the sparking being thus still further reduced.

The invention will be further described with reference to the accompanying drawings, which show a few different embodiments. Figure 1 is a longitudinal section of an embodiment and Figure 2 is a corresponding section of another embodiment. Figure 3 shows a modification of the contact device according to Figure 2.

In the embodiment according to Figure 1 the switch as a whole and the appertaining thermostat are supported by a metallic tube or cylinder 1 which by way of example may consist of copper and which is inserted in a protecting receptacle 2 which is evacuated or provided with a suitable gas-filling and made of an electrically insulating material, for instance glass. The tube 1 should be arranged in an effective thermal connection with the wall of the receptacle and should therefore be made to fit closely to the interior surface of the receptacle, for instance by cutting up the tube longitudinally and by making it slightly elastic.

The tube 1 is provided with end pieces 3, 4 the first of which is provided with a support 5 for mounting the contact device which latter consists of a rigid metallic bar 6 provided with a suitable contact surface, and an opposing contact spring 7, provided with a corresponding contact surface. The bar and the spring are secured to the support 5 by leading-through bolts and appertaining nuts. The leads 8 connected to the contacts extend through insulating bushings in the end piece 3 and are fused into one end of the glass receptacle. They are insulated from the bar 6 and the spring 7 respectively and directly connected to the contacts provided thereon.

The spring 7 carries an arm 9 for actuating the contact device by the thermostat. The latter consists of a bent bimetallic stem 11 soldered at 10 to the inside of the tube 1 close to the end piece 4. The free end of the stem is provided with a screw 12, which is arranged to actuate the arm 9.

The contact 6, 7 is normally closed. If the temperature of the surrounding medium is increased, heat will be conducted through the wall of the receptacle 2 to the tube 1 which is in thermal contact with the wall. It is then rapidly conducted through the soldered contact at 10 to the bimetallic stem 11 which is then bent to the right in Figure 1. If the rise of temperature exceeds a certain predetermined limit the screw 12 comes into contact with the arm 9 of the contact spring 7 and breaks the main contact.

In the embodiment according to Figure 2 that part of the thermostat which is most sensitive to heat is formed with heat conduct-

ing surface in thermal connection with the wall of the receptacle. The above mentioned operative part is here designed as a tube or a cylinder 13 which is in close contact with the inside of the receptacle and also serves as a support for the contact device similarly as the heat conducting cylinder 1 in the above described embodiment. The tube 13 is provided with end pieces 14, 14', each supporting one contact member. The contact members consist of two rods 15, 15' extending in the axial direction of the tube and provided with suitable contact surfaces 16, 16' at the opposing ends. The rods are made of a material with a smaller coefficient of expansion than that of the enclosing metallic tube 13. The rods 15, 15' can for instance be made of invar or any other practically non-expansible alloy. The current supply leads 8 to the rods are fused each into one end of the receptacle 2. At least one of the rods must, of course, be electrically insulated from the supporting tube 13. The metallic tube 13 is provided with an aperture 18 opposite the point of contact, through which the contact and its operation can be observed.

Upon an increase of the surrounding temperature the tube 13 expands more than the rods 15, 15' whereby the contact opens. The heat caused by the sparking can, if necessary, be neutralized by disposing heat accumulating copper tubes or the like in heat conducting connection with the contacts 16, 16', said tubes surrounding the rods 15, 15'. One of the rods may be arranged in direct metallic connection with the tube 13.

Figure 3 shows a modification of the break contacts according to Figure 2, whereby the thermostat can be changed to close its contact upon an increase of temperature. For this purpose the ends of the rods 15, 15' are formed into hooks 17, 17' which catch in each other, the contacts 16, 16' being disposed on opposite sides of the hooks in such a manner as to be brought into contact when the tube 13 expands.

The thermostatic switch according to the invention can also be adapted to be actuated by the heat produced in a special heating coil by an electric current. The coil may, in such a case, be placed with advantage on the outside of the receptacle. The arranging of an efficient heating winding for the thermostat inside the receptacle presents difficulties from a practical point of view on account of the very limited space. It further results in the disadvantage that the vacuum or gas-filling of the receptacle is deteriorated by the development of gaseous substances which are produced when heating the insulation of the coil. An interior heating coil must further be adjusted once and for all to a certain voltage or amperage. According to the present invention these difficulties can be entirely eliminated by placing the heating coil directly outside the wall of the receptacle, this wall being utilized as an electrical insulation between the winding and the thermostat which for instance can be arranged according to Figure 2. The heating coil will then be in a good thermal connection with the thermostat on account of the effective heat conducting connection between the wall of the receptacle and the thermostat. An exterior winding can easily be adapted to different voltages or amperages and may easily be exchanged whenever required. The exterior heating coil can be protected by an insulating cylinder enclosing the coil which cylinder at the same time will prevent the loss of heat. The protecting cylinder can be fixed to the winding for instance by cementing.

The transmission of heat from outside to the thermostat can be further improved by designing the receptacle in such a manner that it is composed by the metal tube 1 or 13 respectively and end pieces of glass or other similar material gas-tightly fused to the ends of the tube. The exterior coil may in such a case be placed around the metal tube with only a thin intermediate lining of an electrically insulating material as mica or the like.

I claim:

1. A thermostatic switch, comprising in combination, a thermostat, a hermetically sealed tubular receptacle of insulating material enclosing said thermostat, a tubular metal lining arranged inside said receptacle and conforming with the wall thereof, and means for causing operation of the thermostatic switch by heat transferred to said lining through the walls of the receptacle.

2. A thermostatic switch comprising in combination a tubular metallic member, two stiff contact rods arranged coaxially with said tubular member and connected with the ends thereof, said rods being normally in contact with one another, and a hermetically sealed tubular receptacle enclosing said tubular member and substantially conforming therewith.

3. A thermostatic switch comprising in combination a thermostat composed of parts of different heat sensitivity, a hermetically sealed receptacle of insulating material enclosing said thermostat, a metal lining inside said receptacle conforming with the wall thereof and covering a substantial part of the wall, and means establishing an effective heat conducting connection between the most heat sensitive part of the thermostat and said lining.

4. A thermostatic switch comprising in combination a thermostat, a hermetically sealed receptacle of insulating material enclosing said thermostat, a metal lining inside said receptacle conforming with the wall thereof and covering a substantial part of the

wall, and means causing operation of the thermostatic switch by heat transferred from the surroundings to said metal lining through the wall of the receptacle.

5. A thermostatic switch comprising in combination a thermostat, a hermetically sealed receptacle of insulating material enclosing said thermostat, a metal support for the thermostat forming a lining inside the receptacle and covering a substantial part of the wall thereof, and means causing operation of the thermostatic switch by heat transferred from the outer surroundings to said support through the wall of the receptacle.

6. A thermostatic switch as claimed in claim 3, characterized in that the tubular member forms the most heat sensitive part of the thermostat.

In testimony whereof I affix my signature.

AXEL OSVALD APPELBERG.