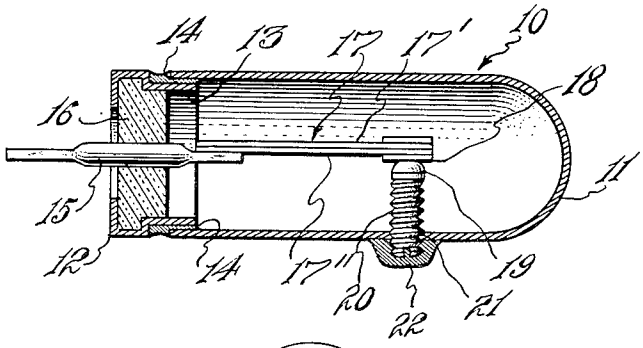
Dec. 11, 1956 D. C. PERST 2,773,962

THERMOSTATIC SWITCH

Filed Oct. 10, 1955

Fig. 1



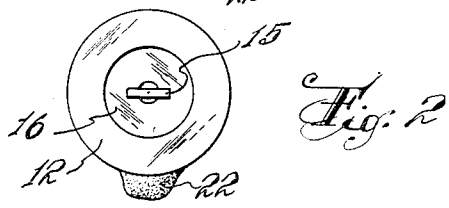


Fig. 2

Fig. 3

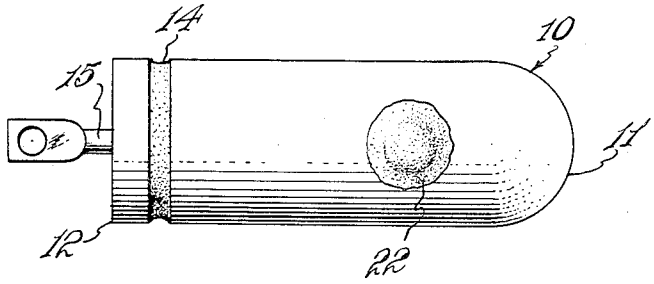
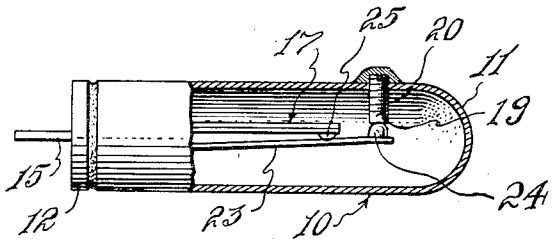


Fig. 4



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United States Patent Office 2,773,962 Patented Dec. 11, 1956

2,773,962

THERMOSTATIC SWITCH

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Application October 10, 1955, Serial No. 539,535

4 Claims. (Cl. 200—138)

The invention relates to thermostatic switches such as are employed to control the operation of various types of apparatus by opening and closing an electric circuit in response to changes in ambient temperature.

Because of the small space generally available for the accommodation of a thermostatic switch within the confines of the apparatus it serves, the trend is toward extreme miniaturization in switch structure. In addition to miniaturization, it is desirable to hermetically seal the operating parts of the switch in a protective casing. However, when this is done, the electrical contacts of the switch, whose meeting faces become pitted and otherwise impaired in electrical effieciency due to the creation of arcs when the circuit is made and broken, are inaccessible for wiping, scraping or other restorative action. Consequently, prior inventors in this art have incorporated in the switch structure means to produce automatic wiping action between the contacts at the time of closing and separation.

The comparable prior art thermostatic switch structures, however, depend entirely upon thermal expansion and contraction of the sealing casing to effect both the making and breaking of electrical contact and the simultaneous wiping action between contact faces. This is undesirable because the wiping action is too short in linear extent and is peformed under varying contact pressure as the electrical contacts approach and recede in the alternate closing and opening of the switch. As a result, uneven wear on the meeting faces of the contacts occurs.

With the above-enumerated disadvantages of the prior art contact-wiping means in mind, it is the primary object of the present invention to provide an improved switch structure in which contact-wiping action occurs while the contacts are in close and even bearing contact.

To be more explicit, one electrical contact is supported by the tubular switch casing and the other contact is supported by an element of the structure having a coefficient of expansion much lower than that of the casing. Both contacts are mounted to open and close in a direction radial to the casing axis and these movements are actuated by a typical bimetallic element that cannot commence to function as quickly as the expansible and contractible casing in which the said element is confined, because outside heat must be conducted through the casing thereto and that takes an appreciable length of time. Consequently, in a direct acting thermostatic switch, for instance, wherein the contacts are normally closed, wiping action between the meeting faces of the contacts in the axial direction of expansion of the casing will occur before the heat has penetrated to the depth of the bimetallic element and the contacts have had time to separate. Instead, the contacts will still be held in tight, even surface contact by resilient means provided for that purpose. Similarly, in an inverse acting switch, wherein the contacts are normally open and are closed by an increase in ambient temperature, subsequent contraction of the casing will cause contact-wiping action before the reduction in ambient temperature has caused the bimetallic element to open the contacts again.

Another object of the invention is to provide novel spring means to press the electrical contacts tightly together in closed-contact condition and thereby maintain desirable pressure during wiping action.

Further objects, features and advantages of the invention will become apparent as the following specific description is read in connection with the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view of the simplified direct acting embodiment of the invention, on a greatly enlarged scale, showing the electrical contacts in normal closed condition; Fig. 2 is an end elevation; and Fig. 3 is a top plan view.

Fig. 4 is a side elevation of a modified form of the device, showing the same on a somewhat less enlarged scale and partially broken away.

Referring now in detail to the drawing, wherein like reference characters designate corresponding parts in the several views, Figs. 1 to 3, inclusive, represent a simplified embodiment of the invention that is direct acting in principle of operation, i. e. the electrical contacts are normally in closed condition and will be caused to open a control circuit only upon the occurrence of a rise in ambient temperature.

The device includes a frame **10** that preferably is in the form of a thimble-shaped tubular casing having one end closed by an end wall **11**. In the interest of miniaturization, it is desirable to utilize frame, or casing, **10** as one side of the electrical control circuit. Therefore, casing **10** should be made of a metal possessing suitable high electrical conductivity, such as brass, which also happens to possess a high coefficient of expansion and thus is well adapted to serve its other useful purpose in connection with the contact-wiping action to be described in greater detail later herein.

The open end of casing **10** is adapted to receive perforated cap **12**, whose reduced portion **13** is of such outside diameter that it will fit with a pressed-joint degree of tightness in said end of the casing after the meeting surfaces have been wiped with a coating **14** of soft solder in a molten condition. As a result, when the solder coating **14** has become solidified there will be a perfect hermetic seal at this area of juncture between casing **10** and cap **12**. A stem-like electrical terminal member **15** to complement casing **10** at the opposite side of the control circuit is mounted in centered penetrating relation to cap **12** of the casing in a molded block **16** of electrical insulation. By using glass as the insulating material, a glass-to-metal base is formed for casing **10** to provide a hermetic seal as well as insulation.

A bimetallic element **17**, which is preferably in the conventional strip form and in substantially straight condition at room temperatures, has its base end affixed to the inner end of terminal member **15** by suitable electrically conductive means, such as soldering, brazing or welding. Bimetallic element **17** extends axially in casing **10** and is composed of two integrally united components **17'** and **17''** possessing widely separated coefficients of expansion in accordance with conventional practice, so that the said element will bend laterally when subjected to a change in ambient temperature. Therefore, by making component **17'** of Invar and component **17''** of iron, element **17** will bend upward in Fig. 1 when heated.

There are two coacting electrical contacts **18** and **19** for the switch. These contacts are both preferably made of silver or platinum due to the well known high con-

ductivity and other superior electrical characteristics of these particular metals. Contact **18** may be termed the "movable contact" because it is supported by the free end, or tip, of bimetalic element **17** and therefore is movable under the influence of changes in ambient temperature. On the other hand, contact **19** may be called the "stationary contact" because it is supported by an adjusting screw **20** that has screwthreaded engagement with a radial hole **21** in casing **10** and will be stationary with respect to the casing except during momentary radial adjustment by manipulation of said screw. Contacts **18** and **19** are in radial registration within casing **10** and, as shown in Fig. 1, are in closed-circuit contact under ambient temperature conditions below that at which it is desired that the control circuit shall open.

Obviously, when the thermostatic switch is to be direct acting, as shown, the component **17''** of bimetallic element **17**, which has a high coefficient of expansion, will be arranged on the side near to stationary contact **19** and the other component **17'** will be on the opposite or far side. However, it is very easy to convert the thermostatic switch into an inverse acting switch by simply reversing the components **17'** and **17''** 180 degrees about the axis of bimetallic element **17** and then bending said element laterally until the contacts **18** and **19** are normally separated into open-circuit condition.

After proper adjustment of stationary contact **19** has been effected, the juncture of screw **20** with casing hole **21** may be sealed hermetically by applying a drop of molten soft solder **22** over the outer end of the screw. However, even if this seal be omitted, casing **10** will still be impervious to dust and explosion-proof.

As has already been pointed out, it is not necessary to open casing **10** during the normal life of the switch in order to wipe, scrape or otherwise clean the meeting faces of contacts **18** and **19**, due to the automatic wiping action which occurs due to the wide difference in coefficients of expansion of casing **10** (brass) and another part of the structure, which happens to be bimetallic element **17** whose expansion and contraction lengthwise of casing **10** is determined by its component of lower expansion coefficient **17'** (Invar). The manner in which contact-wiping occurs will now be described.

Before bimetallic element **17** has become subjected to an increase in ambient temperature by conduction through the metallic mass of casing **10** so as to break the contact between contacts **18** and **19**, the said casing will have expanded lengthwise sufficiently to cause adequate wiping action between the meeting faces of the contacts in a direction lying in the momentary common plane of said faces. Consequently, this wiping action will occur while the contact faces are in even bearing contact and while being pressed tightly together by the inherent resiliency of bimetallic element **17**. Such periodic wiping of the contact faces will preserve them in perfect electrically efficient condition during the life of the switch.

Fig. 4 discloses a modified form of direct acting thermostatic switch which differs from the preceding embodiment in the provision of a separate linear spring **23** to support the movable contact, which in this instance is designated by the numeral **24**. Spring **23** tends at all times to press movable contact **24** into close bearing contact with stationary contact **19** and is made of a metal, such as stainless steel, having a coefficient of expansion lower than that of casing **10**. Therefore, it is necessary to reverse the positions of the respective components of bimetallic element **17**. In this instance, the component **17'** having the lower coefficient of expansion (Invar) will be on the bottom and the more expansible component **17''** (iron) will be on top, so that downward

curling of said element due to an increase in ambient temperature will cause its free end to bear down on spring **23** and thereby move contact **24** away from stationary contact **19**. For more efficient bearing contact between bimetallic element **17** and spring **23**, the free end portion of said element is downwardly indented to provide a smoothly rounded tit **25** to bearing against the upper face of the spring.

Due to the interacting relation of expansible casing **10** and bimetallic element **17** to perform two distinct useful functions in consecutive order, the over-all diameter of the switch as a whole has been extremely reduced in the interest of miniaturization. The actual diameter of the smaller switches is seven thirty-seconds of an inch. Because of the even contact-wiping action under proper pressure throughout each such action, the life of the switch while permanently sealed has been greatly increased beyond that of any of the prior art devices of which I am aware.

It will be understood that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of illustration which do not constitute departures from the spirit of the invention and scope of the appended claims.

I claim:

1. A thermostatic switch comprising: an elongated, substantially straight terminally closed tubular, metallic frame; a substantially straight bimetallic element in strip form arranged substantially parallel to the axis of said frame inside the same with its base end rigidly supported at one end of the frame and its opposite end free; and a coacting pair of electrical contacts of which one is stationarily supported by said frame in radially direct electrical connection therewith adjacent to the free end of the bimetallic element and the other is movable laterally with respect to said frame by temperature-responsive movement of the bimetallic element and is maintained in lateral registration with the first-mentioned stationary contact, said frame and at least one metallic component of the bimetallic element being possessed of different coefficients of expansion whereby heat penetration from the frame to the bimetallic element is retarded so that axial wiping will occur between the meeting faces of both contacts due to initial linear expansion of said frame under the influence of changes in ambient temperature while said contacts are in closed condition.

2. A thermostatic switch as defined in claim 1, wherein the movable contact is directly supported by the free end of the bimetallic element.

3. A thermostatic switch as defined in claim 1, to which is added a substantially straight linear spring having a coefficient of expansion differing from that of the frame and arranged substantially adjacently parallel to the bimetallic element with one end rigid with the rigidly supported end of the latter and with the opposite end free and projecting beyond the free end of said element and being in electrical bearing contact therewith, the movable electrical contact being supported by the free end of said spring and in contact-closed condition being pressed against the stationary contact.

4. A thermostatic switch as defined in claim 1, to which is added a radially extending screw radially adjustable in the tubular frame and supports the stationary contact at its inner end to permit adjustment of the latter toward and away from the coacting movable contact.

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