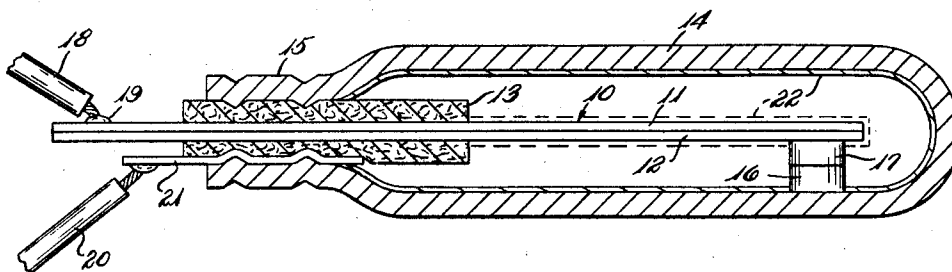


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METHOD OF REDUCING ARCING IN SEALED ELECTRICAL
CONTROLS AND ARTICLES PRODUCED THEREBY
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METHOD OF REDUCING ARCING IN SEALED ELECTRICAL CONTROLS AND ARTICLES PRODUCED THEREBY

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6 Claims. (Cl. 200-138)

The present invention relates to methods and means for the reduction of arcing in thermostats, motor protector, or other sealed electrical controls.

In the control of temperatures of electrical heating apparatus, and electrical appliances in general, it is customary to employ temperature controlling devices in which a bimetal strip changes its shape when heated and cooled and such bimetal strip is used to open the electrical circuit of the apparatus when the temperature reaches a desired limit. In most apparatus, such temperature controls are hermetically sealed and include a conductive capsule, or case, usually of copper. A bimetal strip, insulated from the capsule, is mounted therein, and the capsule and the free end of the bimetal strip are each provided with a contact button, usually of silver, which engage each other when the control is cold and complete a circuit, or which separate at a critical temperature to break the circuit, or vice versa.

It has been found that temperature controls or thermostats of the sealed type sometimes break down under high voltage conditions and examination indicates that the breakdown may have been due to arcing within the case or capsule, which actions would increase conductivity of the contained gases, and permit further arcing. Such arcing appears to have occurred as burned or charred portions of the bimetal strip and blackened areas of the interior of the capsule have been found in many thermostats after they have been tested, or used until failure occurs. These burned or charred portions of the bimetal strip may occur at positions remote from the free end of the bimetal strip where electrical currents normally would never flow.

It is an object of the present invention to reduce arcing in sealed thermostats and other temperature, or electrical controls.

It is a further object of the invention to provide a novel method of treating thermostats, and similar articles, to improve the service life thereof.

The foregoing and other objects will appear from the following description, reference being had to the accompanying drawing forming a part hereof.

Referring to the drawing, which shows a longitudinal cross-sectional view of a temperature control or thermostat constructed in accordance with and embodying the invention, the numeral 10 designates a bimetal strip comprising a layer 11 of a metal having one coefficient of expansion and a layer 12 having a higher coefficient of expansion. The strip extends through a tubular body 13 of insulating materials such as a plastic impregnated fiberglass material. A seamless capsule, or case 14, usually made of copper, surrounds the free end of the bimetal strip and is contracted about the bimetal strip and the insulation body 13 as at 15 to provide an air-tight seal.

Within the capsule 14, a non-corroding contact button 16 of metal, such as silver, is welded to the metal capsule, and a similar contact button 17 is welded to the bimetal strip at its free end to normally contact the button 16 under slight pressure. A wire lead 18 is soldered, brazed or otherwise secured to the exposed end of the bimetal strip as at 19 and a wire lead 20 is suitably secured to a terminal strip 21 lying against or secured to the capsule 14.

2

To provide for reducing ionization and consequent continued arcing within the capsule, a very thin continuous coating 22 is provided on the entire interior surface of the capsule. The coating may be provided by bringing the inner surface of the capsule before its assembly with the other elements into contact with a halogen element, such as iodine, to an extent to form a thin film of infinitesimal thickness over the inner surface. The deposit may be formed by wetting the interior of the capsule with either an aqueous or alcohol solution of iodine. Thus filling the inside of the case or capsule 14 with about a one to four percent water or alcohol solution of iodine for about between three to five minutes, preferably with some agitation of the solution, and then removing the solution and drying gives a desirable, very thin film on the inner surface of the case or capsule. The action provides a noticeable discoloration of the case surface, which discoloration is a darkening of the normal shiny surface of the copper capsule. The contact, or contact button 16 normally is secured to the capsule 14 after it has been treated with the iodine solution. I am of the opinion that the iodine combines with the copper of the capsule to form a deposit of copper iodide. The bimetal strip also may be treated with the iodine solution before the contact button 17 is secured thereto. Tests of thermostats of similar construction in which a number of thermostats having the coating and an equal number of similar thermostats not having the coating were compared showed that less breakdown occurred in the thermostats having the coating, and that improved contact life was obtained. If desired, the thermostat capsule would be filled with the iodine solution and the bimetal strip 19 and contacts 16 and 17 may be covered with iodine, or compounds thereof. Any such iodine on the contacts is removed by the initial current arc therebetween. In some instances, the bimetal strip 10 or the capsule 14 only may be coated, as the iodine seems to distribute itself over all exposed surfaces in the closed article with use thereof. I have observed that the destructive arcing previously mentioned only occurs when the sealing of the thermostat capsule approaches the hermetic, e.g. open ended or partially sealed units do not exhibit the condition. Analysis of black deposits around this silver contact yields copper and some iron but no silver. I am of the opinion, therefore, that atmospheric ionization takes place when the high temperature electric arc breaks down the existing carbon dioxide to form carbon monoxide. Carbon monoxide then reacts with copper of this case and iron of the bimetal in the presence of the silver contacts as a catalyst to form very complex compounds of chain construction, most probably carbonyls. The resulting vapors being highly conductive permit arcing from the bimetal to the case. While I am unable to identify the reaction, or lack of reaction, which takes place when the iodide coating is present, I am certain that there is some "poisoning" process of opposite complex nature to the formation of conductive carbonyls, resulting in the elimination of internal arcing and greatly improved contact life in tightly sealed thermostat capsules.

Although I prefer to apply the coating by wetting the surface of the copper with an aqueous or alcoholic solution of elemental iodine, it is apparent that iodine might be applied by sublimation or other method as the high temperatures of the thermostat arcs at make and break contact thereof, it is thought, would distribute iodine particles over the exposed walls of the control article. While I have disclosed one method of applying the coating it will be apparent to those skilled in the art that other embodiments of the invention may be made without departing from the invention as it is defined by the following claims.

What is claimed is:

1. A closed thermostat comprising a copper capsule, a bimetal strip extending into the capsule, insulating means between a fixed end of the strip and the wall of said capsule and sealed thereto, said bimetal strip and said capsule having contacts normally engaging to close a circuit and adapted to open the circuit upon rise in temperature, and a material within said capsule adapted to reduce ionization due to arcing, said material comprising a continuous thin iodine-containing coating covering the entire inner surface of the copper capsule.

2. A closed thermostat comprising a copper capsule, a bimetal strip extending into the capsule, insulating means between a fixed end of the strip and the wall of said capsule and sealed thereto, said bimetal strip and said capsule having contacts normally engaging to close a circuit and adapted to open the circuit upon rise in temperature, and a material within said capsule adapted to reduce ionization due to arcing, said material comprising a continuous thin coating of iodine-containing material integrally bonded to the inner surface of the copper capsule.

3. A closed thermostat comprising a copper capsule, a bimetal strip extending into the capsule, insulating means between a fixed end of the strip and the wall of said capsule and sealed thereto, said bimetal strip and said capsule having contacts normally engaging to close a circuit and adapted to open the circuit upon rise in temperature, and a material within said capsule adapted to reduce ionization due to arcing, said material comprising copper iodide.

4. The method of reducing arcing in a closed case electrical control article which comprises providing a coating over the interior of a copper case of the article by contact of said case for about 3 to 5 minutes to a 1 to 4 percent solution of iodine, drying the solution to deposit a coating of iodine onto the entire interior surface of said case, and completing the article including sealing the case.

5. A method as in claim 4 where any components to be assembled in said case are provided with a coating of a solution of iodine and dried before assembly within said case.

6. The method of reducing arcing in a closed case electrical control article which comprises providing a coating over the interior of a copper case of the article by contact of said case with elemental iodine in the form of a solution thereof, drying the case and the coating material on the interior thereof, and completing the article including sealing the case.

References Cited in the file of this patent

UNITED STATES PATENTS

1,819,198	Reichmann et al. -----	Aug. 18, 1931
1,862,317	Ringwald -----	Dec. 23, 1927
2,497,397	Dales -----	Jan. 19, 1946
2,757,262	Yeamans -----	May 23, 1955
2,773,962	Perst -----	Oct. 10, 1955
2,925,599	Wells -----	July 29, 1958