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2,745,924

BI-METAL STRIP MOUNTING

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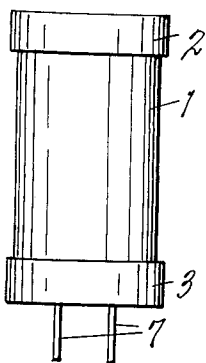


Fig. 1.

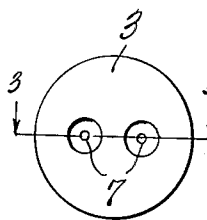


Fig. 2.

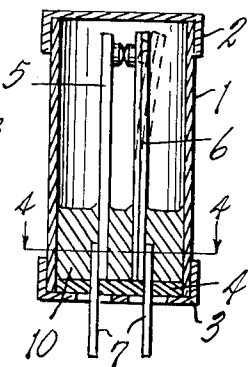


Fig. 3.

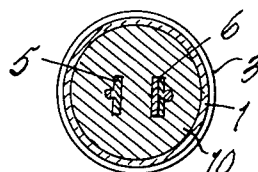


Fig. 4.

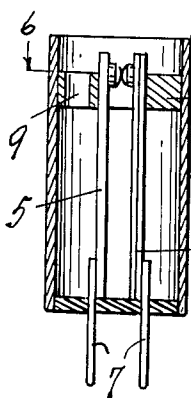


Fig. 5.

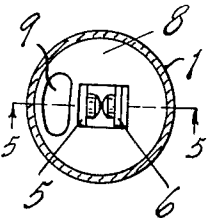


Fig. 6.

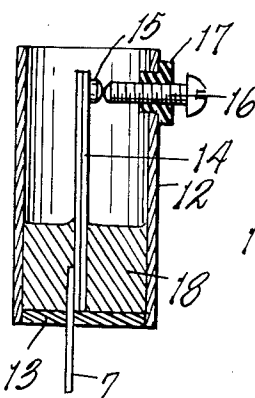


Fig. 7.

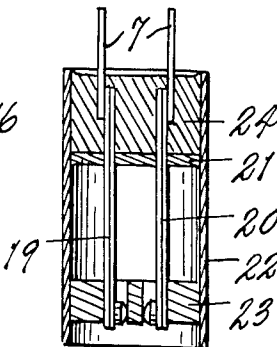


Fig. 8.

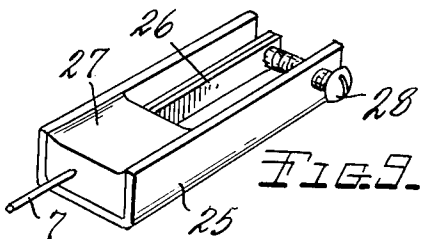


Fig. 9.

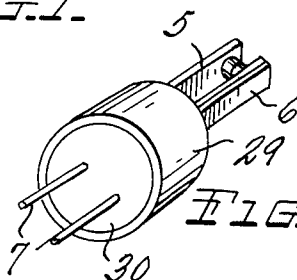


Fig. 10.

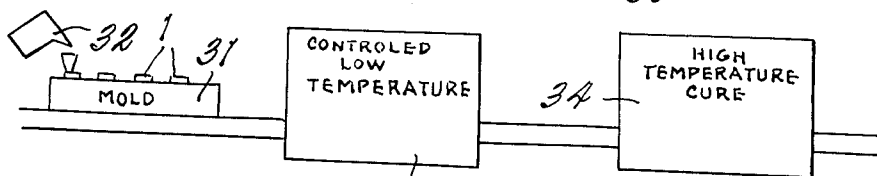


Fig. 11.

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BI-METAL STRIP MOUNTING

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This invention relates to improvements in thermostatic switch and method of producing the same. The principal objects of the invention are:

First, to provide a novel thermostatic switch of the bi-metal actuated type in which the bi-metal element is securely and permanently mounted in a support by having its end embedded in a supporting mass of material that is cast or molded in plastic condition around the element and hardened or set in place to secure the element.

Second, to provide a novel thermostatic switch having a fixed contact support and a movable bi-metal contact support fixedly secured in a cast or molded mass that is hardened to hold the contact supports in predetermined relative positions to open and close the contacts at predetermined temperatures.

Third, to provide a thermostatic switch which can be economically produced in quantity to operate at any predetermined temperature.

Fourth, to provide a method of producing thermostatic switches which permits the thermal characteristics of the switches to be predicted and accurately controlled.

Fifth, to provide a method of producing thermally actuated switches which permits switches to be made to open or close at predetermined temperatures.

Sixth, to provide a novel method of producing thermally actuated switches which produces a permanently stable switch at minimum cost.

Other objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings, of which there is one sheet, illustrate several forms of the switch and the steps in the method of producing it. No particular one of the forms illustrated is preferred as each form has advantages in different situations and uses.

Fig. 1 is an elevational view of a first form of the switch.

Fig. 2 is a bottom plan view of the switch in Fig. 1.

Fig. 3 is a cross sectional view along the line 3—3 in Fig. 2.

Fig. 4 is a cross sectional view along the line 4—4 in Fig. 3.

Fig. 5 is a longitudinal cross sectional view through the switch shown in Figs. 1 to 4 at an intermediate point in the process of its manufacture.

Fig. 6 is a cross sectional view taken along the plane of line 6—6 in Fig. 5.

Fig. 7 is a longitudinal cross sectional view through a second form of the switch.

Fig. 8 is a longitudinal cross sectional view through a third form of the switch in an intermediate point in a slightly modified method of its assembly.

Fig. 9 is a perspective view of a fourth form of the switch.

Fig. 10 is a perspective view of a fifth form of the switch.

Fig. 11 is a schematic view illustrating several steps in the method of producing the switch.

Heretofore thermal switches of the bi-metal type have resorted to screws, rivets or mechanical clamps of some

sort to hold the fixed end of the bi-metal element in place. This is objectionable particularly in switches that require an insulated mount for the bi-metal as the clamping means is liable to fracture the insulation or the insulation will deteriorate in time and permit the clamp to loosen and the temperature setting of the switch to drift. The present invention overcomes these difficulties and permits more accurate predetermination of the operating temperature of the switch.

It is first pointed out that any given bi-metal element has definite predictable deflection characteristics. That is, if one end is clamped or fixed, the free end will deflect a certain distance per unit length per degree of temperature change. The direction of deflection is also of course known.

Starting from this point, the invention contemplates taking a bi-metal element and an ordinary contact element or two bi-metal elements and temporarily holding them in a predetermined relative position, either in contact closed or contact open position. Then pour or cast a fluid or plastic material in a mass around the fixed ends of the elements. The elements and mass are then held at a fixed temperature until the mass solidifies and grips the elements in a permanent base. The base may be an integral or separable part of a more extensive mounting for the switch.

If the temperature at which the mass of the base is solidified is the same as the temperature corresponding to the operating position at which the terminal elements are held temporarily, the elements will assume an unstressed position in the solidifying mass and the finished switch will be automatically calibrated. That is, elements positioned in a predetermined position, either open or closed, at a predetermined operating temperature will remain in that position if the mass of the base hardens at the same predetermined temperature. Once the base has set or hardened it may be further cured at higher temperatures without displacing the contact elements from their calibrated positions.

For switches designed to operate at normal or atmospheric temperatures or somewhat higher, the mass of base material consists of a synthetic resin or plastic material that has the property of setting or hardening at the desired temperature. Such materials are known as cold setting casting resins as distinguished from high temperature or pressure setting plastics. When a high temperature switch is to be manufactured a high temperature setting plastic having a setting temperature corresponding to the switch temperature may be used.

A wide variety of cold setting resins or plastics are available. They usually include the resin proper and a catalyst that is mixed with the resin to start the hardening process. Usually, a filler such as silica flour, is mixed with the resin to reduce shrinkage and produce a harder base. The filler also reduces the amount and cost of the resin in each switch. The proportions and specific ingredients of the base can be varied considerably but the following are examples of satisfactory ingredients.

A. Electrical embodiment resin #2 and hardener (catalyst) B or C available from the Minnesota Mining and Manufacturing Company, inert filler, 50% by weight of base.

B. Araldite resin D and associated catalyst available from Ciba Company, Incorporated, New York City, inert filler.

C. Polyform G and associated catalyst available from B. G. Forman Company, New York City, inert filler.

These resins are in the epoxy group and sometimes referred to as ethoxylines but it is pointed out that other resins or plastics having the desired property can be used. In fact where a single bi-metal element is to co-act with an adjustable contact that can be insulated from

the bi-metal mount, a low melting point metal may be used as the mass of the base.

The examples of the switch illustrated include in Figs. 1 to 6 an outer tubular body 1 having upper and lower end caps 2 and 3. A gasket 4 in the bottom of the body supports a fixed cantilever element 5 and a bi-metal element 6. Terminal wires 7 attached to the contact elements extend through holes in the gasket and lower cap and temporarily locate the lower ends of the elements 5 and 6.

In assembly of the switch a temporary spacer disc 8 is inserted in the body 1. The disc has a hole 9 that receives the upper ends of the contact elements and holds them in contact. The mass of resin that forms the base 10 is introduced in fluid or plastic form either before or after the disc as by pouring the resin through the hole 9. The switch is then held at a temperature corresponding to the desired switch closing temperature until the base material sets after which the disc 8 is removed. The switch or its base material can then be further cured at higher temperature and the end caps installed.

The switch shown in Fig. 7 includes a tubular body 12 that may be of either metallic or electrically insulating material. A gasket 13 in the bottom of the body initially supports a single bi-metal element 14 having a contact point 15. The contact point 15 coacts with an adjustably fixed contact point or screw 16. If the body 12 is metal and must be insulated from the bi-metal, a grommet 17 is provided in the wall of the body. The base 18 is molded in the body and around the element 14.

Since the contact 16 is adjustable, less care is required in positioning the element 14. The material of the base 18 may be hardened at any temperature and may even consist of a low melting point metal.

The switch shown in Fig. 8 includes two bi-metal elements 19 and 20. The lower ends of the elements 19 and 20 are located by a gasket 21 in the body 22 and a spacer 23 locates the points of the contact elements in spaced relationship. The base 24 is molded around the ends of elements 19 and 20 by inverting the body and pouring the base forming material therein. The base material is hardened as in the case of the switch in Figs. 1 to 6 at a predetermined temperature so that when the spacer 23 is removed the bi-metal elements will assume the position illustrated whenever the temperature of the switch approximates the temperature at which the base material was cured or set.

The switch in Fig. 9 substitutes a channel shaped body 25 for the previously described tubular bodies. The bi-metal element 26 is secured in a molded base 27 that may be either cold setting resin or a chemically setting material such as Portland cement or plaster of Paris or the base may be of molded or cast metal. The contact point 28 is adjustable.

The switch shown in Fig. 10 is similar to that shown in Figs. 1 to 6 except that a separate reusable mold is used to receive the sleeve 29 and base 30. This switch in Fig. 10 is adapted to be mounted in any suitable mounting or holder.

Fig. 11 shows conventionally the method of producing the switches. The switches are mounted in a suitable mold or holder 31 and the base material poured as at 32. The switches are then hardened at predetermined controlled temperature at 33 and may be further cured at higher temperature at 34.

It should be pointed out that most cold setting resins and chemically setting materials harden in an exotherm process that develops some heat in the bi-metal elements embedded therein. This exothermic heat must be taken into account in determining the initial setting temperature maintained at 33. Depending on the quantity of the mass in each base and the heat developed thereby, the setting temperature maintained at 33 may be

several degrees lower than the temperature at which the switch is designed to operate.

For the purpose of this disclosure and appended claims, the term chemically setting plastic material is defined as any material or combination of materials that will change from a liquid or semi-liquid state at various temperatures to a solid state as a result of chemical reaction and without recourse to heating or cooling the material to any particular temperature.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A thermostatic switch comprising, an elongated tubular body, a gasket of insulating material in one end of said body, a pair of elongated contact elements positioned in said body and seated against said gasket, lead wires secured to said elements and projecting through said gasket and located thereby, and a base comprising a mass of chemically setting resin molded and solidified in place within said body and against said gasket and around the ends of said elements, one of said elements being a bi-metal element, said resin having the property of solidifying at the temperature at which the switch operates.

2. A thermostatic switch comprising, an elongated body, a gasket of insulating material in one end of said body, a pair of elongated contact elements positioned in said body, lead wires secured to said elements and projecting through said gasket and located thereby, and a base comprising a mass of chemically setting resin molded and solidified in place within said body and against said gasket and around the ends of said elements, one of said elements being a bi-metal element, said resin having the property of solidifying at the temperature at which the switch operates.

3. A thermostatic switch comprising, an elongated tubular body, a pair of elongated contact elements positioned in said body, lead wires secured to said elements and projecting from the end of said body, and a base comprising a mass of chemically setting electrically insulating material and an inert filler molded and solidified in place within said body and around the ends of said elements, one of said elements being a bi-metal element, said insulating material having the property of solidifying at the temperature at which said switch operates.

4. A thermostatic switch comprising, an elongated body, a pair of elongated contact elements positioned in said body, and a base comprising a mass of chemically setting electrically insulating material and an inert filler molded and solidified in place within said body and around the ends of said elements, one of said elements being a bi-metal element, said insulating material having the property of solidifying at the temperature at which said switch operates.

5. A thermostatic switch comprising a pair of elongated coating contact elements, lead wires secured to said elements and projecting therefrom, and a base comprising a mass of chemically setting electrically insulating material and an inert filler molded and solidified in place around the ends of said elements, one of said elements being a bi-metal element, said insulating material having the property of solidifying at the temperature at which said switch operates.

6. A thermostatic switch comprising a pair of elongated coating contact elements, and a base comprising a mass of chemically setting electrically and insulating material molded and solidified in place around the ends of said elements, one of said elements being a bi-metal element, said insulating material having the property of solidifying at the temperature at which said switch operates.

7. A thermostatic switch comprising a bi-metal contact elements having one end molded and secured in a mass of chemically setting material, said material having the property and ability to solidify at the operating temperature of the switch.

8. A thermostatic switch comprising, an elongated

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body, an elongated contact element positioned in said body, a lead wire secured to said element and projecting from said body, a second contact element adjustably mounted on said body to coact with one end of said first element, and a base comprising a mass of chemically setting material molded and solidified in place within said body and around the other end of said first element, said first element being a bi-metal element and being insulated from said second element, said material having the property of solidifying at the temperature at which the switch operates.

9. A thermostatic switch comprising, an elongated body, an elongated contact element positioned in said body, a second contact element adjustably mounted on said body to coact with one end of said first element, and a base comprising a mass of material molded and solidified in place within said body and around the other end of said first element, said first element being a bi-metal element and being insulated from said second element, said material having the property of solidifying at the temperature at which the switch operates.

10. The method of producing a thermostatic switch which comprises the steps of, placing a pair of contact elements including a bi-metal element in predetermined coacting relationship in a body with their contact points in contact, molding a base of chemically setting material around the opposite ends of said elements from their points while the material is plastic in character, subjecting elements and base to a predetermined temperature corresponding to the designed operating temperature of the switch until the material hardens and while the elements are held in said predetermined position, and thereafter releasing the free ends of said elements and curing said base at a higher temperature.

11. The method of producing a thermostatic switch which comprises the steps of, placing a pair of contact elements including a bi-metal element in predetermined coacting relationship in a body, molding a base of chemically setting material around the opposite ends of said elements from their points while the material is plastic in character, subjecting elements and base to a predetermined temperature corresponding to the designed operating temperature of the switch until the material hardens and while the elements are held in said predetermined position, and thereafter releasing the free ends of said elements.

12. The method of producing a thermostatic switch which comprises the steps of, placing a pair of contact elements including a bi-metal element in predetermined coacting relationship in a body with their contact points out of contact, molding a base of chemically setting material and an inert filler around the opposite ends of said elements from their points while the material is plastic in character, subjecting elements and base to a predetermined temperature corresponding to the designed operating temperature of the switch until the material hardens and while the elements are held in said predetermined position, and thereafter releasing the free ends of said elements and curing said base at a higher temperature.

13. The method of producing a thermostatic switch which comprises the steps of, placing a pair of contact elements including a bi-metal element in predetermined coacting relationship in a body, molding a base of chemi-

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cally setting material and an inert filler around the opposite ends of said elements from their points while the material is plastic in character, subjecting elements and base to a predetermined temperature corresponding to the designed operating temperature of the switch until the material hardens and while the elements are held in said predetermined position, and thereafter releasing the free ends of said elements.

14. The method of producing a thermostatic switch which comprises the steps of, placing a bimetal contact element with its contact point in predetermined coacting relationship with a fixed contact point and its support, molding a base of chemically setting material around the opposite end of said bimetal element from its point and between said bimetal element and the support for said fixed contact point, and holding the structure thus assembled at a predetermined temperature corresponding to the operating temperature of the switch while the material of said base hardens and while holding said points in said predetermined position whereby said bimetal element assumes a shape corresponding to said temperature and is held by the hardened base in said predetermined position.

15. The method of producing a thermostatic switch which comprises the steps of, placing a bimetal contact element with its contact point in predetermined coacting relationship with a fixed contact point and its support, molding a base of chemically setting material around the opposite end of said bimetal element from its point and between said bimetal element and the support for said fixed contact point, holding the structure thus assembled at a predetermined temperature corresponding to the predetermined position of said points, and causing the material of said base to harden while holding said points and said temperature whereby the embedded end of said bimetal element assumes a position corresponding to said temperature and is held by the hardened base in said predetermined position.

16. The method of producing a thermostatic switch which comprises the steps of, placing a bi-metal contact element with its contact point in predetermined coacting relationship with a support for a fixed contact point, molding a base of chemically setting material around the opposite end of said bi-metal element from its point and between said bi-metal element and said support for the fixed contact point, holding the structure thus assembled at a predetermined temperature corresponding to the predetermined position of said point, and causing the material of said base to harden while holding said point and said temperature whereby the embedded end of said bi-metal element assumes a position corresponding to said temperature and is held by the hardened base in said predetermined position.

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