

May 6, 1969

G. E. WEHL ET AL

3,443,259

CREEPLESS SNAP-ACTING THERMOSTATIC SWITCH

Filed May 16, 1967

FIG. 1.

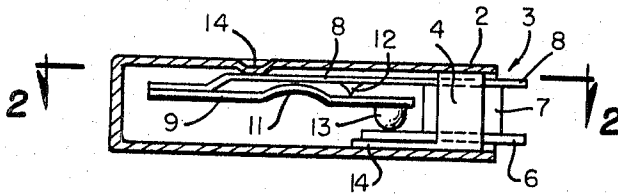


FIG. 3.

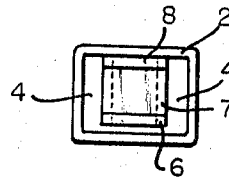


FIG. 2.

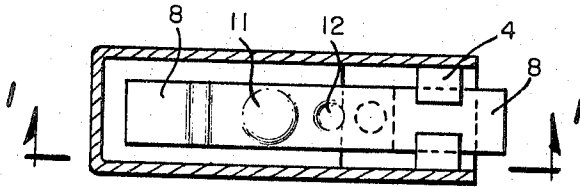


FIG. 4.

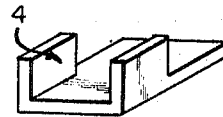


FIG. 7.

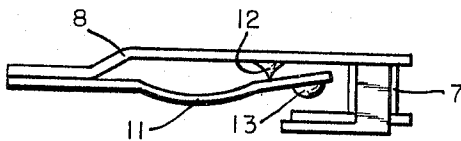


FIG. 5.

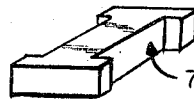


FIG. 8.

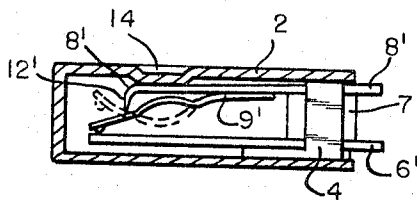
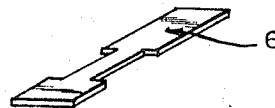


FIG. 6.



INVENTORS

Glenn E. Wehl
Thomas E. Welker

BY

Max L. Libman

ATTORNEY

1

2

3,443,259 CREEPLESS SNAP-ACTING THERMOSTATIC SWITCH

Glenn E. Wehl and Thomas E. Welker, North Canton,
Ohio, assignors to Portage Electric Products, Inc., North
Canton, Ohio, a corporation of Ohio
Filed May 16, 1967, Ser. No. 638,818
Int. Cl. H01h 61/01, 37/54, 37/12
U.S. Cl. 337—89

7 Claims

ABSTRACT OF THE DISCLOSURE

A small, inexpensive, mass-produced thermostatic switch having a bimetallic electric-contact-carrying blade with a dish-shaped snap portion, in which "creep" opening of the contacts prior to snap-open action is substantially eliminated by provision of a rigidly mounted fulcrum, at all times in contact with the bimetallic blade beyond the dish-shaped portion thereof, the blade flexing about the fulcrum contact as a pivot point.

BACKGROUND

This invention relates to small, inexpensive mass-produced thermostatic switches such as are used for overload protective purposes with small electric motors, home appliances, etc. U.S. Patent No. 2,820,870 to Moku shows a thermostat of this general type, in which an effort is made to secure positive quick-opening (and closing) action by providing a dish-shaped portion in a bimetallic temperature-sensitive arm. In the fabrication and mass assembly of small snap blades it is extremely difficult to prevent such an assembly from being subject to "creep," i.e., a tendency for the electric contacts to separate slightly before the snap action occurs. Such creep action is destructive to the contacts and destroys the intended beneficial effect of the snap action, which is to rapidly separate the electric contacts when a predetermined temperature has been reached, so as to minimize arcing and extend contact life, as well as to provide accurate, consistently repeatable operation. The present invention overcomes or greatly reduces the creep tendency as well as providing a very simple and reliable thermostatic switch which lends itself to rapid and inexpensive assembly and production.

SUMMARY

In accordance with the present invention, a bimetallic contact-carrying switch arm is provided with a dish-shaped portion for snap action. This arm is supported at one end by a first terminal strip, of heavier and more rigid construction than the bimetallic arm, and carries an electric contact at the other end, which contact, in the closed position of the switch, engages and makes electrical contact with a rigid terminal strip. At some predetermined temperature, the snap dish flexes into its snap position (in which its concave side becomes convex), causing the free end of the bimetallic strip to flex away from said rigid terminal with which its contact had been engaged. A rigid fulcrum, preferably formed as a part of the first terminal strip and extending from it toward and in engagement with the bimetallic strip at a point toward the free end of the bimetallic strip and beyond at least the major portion of the dish-shaped snap portion, is at all times in physical contact with the bimetallic strip so that the bimetallic strip flexes about its point of engagement with said fulcrum. By virtue of this construction the electrical contacts remain fully and positively engaged as the temperature increases until the dish snaps, at which time the electrical contacts are very rapidly

separated. The reverse action also occurs, i.e., on cooling, the contacts close suddenly, although this is normally less of a problem in such switches.

The specific nature of the invention, as well as other objects and advantages thereof, will clearly appear from a description of a preferred embodiment as shown in the accompanying drawing, in which:

FIG. 1 is a sectional view of a switch according to the invention, taken on line 1—1 of FIG. 2;

FIG. 2 is a similar sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is an end view of the device shown in FIG. 1; FIGS. 4, 5 and 6 are perspective views showing individual components of part of the switch assembly;

FIG. 7 shows the components of FIGS. 4, 5 and 6 assembled together with the bimetallic unit; and

FIG. 8 is a view similar to FIG. 1, but showing an alternative form of construction.

As shown in FIGS. 1 and 2, the thermostatic switch is housed in and supported by a casing 2, preferably in the form of drawn metal tube of generally rectangular shape, although in some instances the tube may be omitted and the thermostat suitably located for the type of protection desired. The entire thermostat assembly 3 comprises, in addition to the housing 2, an insulating retaining subassembly of rigid elements 4 and 7, which interlock to retain between them a rigid terminal arm 6, as best shown in FIGS. 1 and 3. On top of this subassembly, and between the upstanding arms of insulating member 4, is placed terminal arm 8, which at its exposed end is shaped similarly to terminal arm 6, so that when this entire switch assembly is slid into the tubular casing 2, it is rigidly held against displacement or relative movement of the parts, due to the interlocking construction. However, as the purpose is merely to retain elements 6 and 8 in the relative position shown in the figures, it will be apparent that other suitable insulating supporting means could be employed. After the assembly has been completed as shown in FIG. 1, the elements may be firmly locked into place by distorting the casing so as to exert pressure between the top and bottom sides, this being a well-known technique as shown, for example, in U.S. Patent No. 3,223,808 to Wehl, for retaining a switch assembly in a metal casing.

As previously stated, lower terminal arm 6 is made rigid and immovable in the assembly. The upper terminal arm 8 may also be similarly rigid, although in some instances it may be permitted a small amount of flexibility if desired. Arm 8 carries at its end within the casing, the bimetallic strip 9, to the end of which it is secured in any suitable fashion so that arm 8 and strip 9 form a unitary subassembly. Bimetallic strip 9 has a dish-shaped portion 11 preferably located fairly close to the center thereof intermediate its ends, and carries at its free end a suitable electrical contact 13 which is normally in electrical engagement with terminal arm 6. If desired, a suitable electrical contact may also be provided on arm 6 for engagement with contact 13. A fulcrum 12 extends out from arm 8 into contact with bimetallic strip 9 at a point close to the dish-shaped portion 11, and between this dish-shaped portion and contact 13. It is possible for the fulcrum point to engage strip 9 somewhat within the confines of the dish-shaped portion, but if so this should be quite close to the edge of the dish-shaped portion, so that when, as the bimetallic strip 9 heats up, the dish-shaped portion 11 assumes the shape shown in FIG. 7, in which its previously concave side becomes convex, the fulcrum point will at all times remain in contact with the bimetallic member; obviously, this is not possible if the fulcrum point 12 extends too far into the dish-shaped portion, since in that case the sudden flexure of this por-

tion would cause contact with the fulcrum point to be lost. To avoid this, the fulcrum should be in contact with the bimetallic element well beyond the center point of the dish-shaped portion and toward the contact end.

FIG. 7 shows the thermostatic subassembly in the switch-open position, after the dish-shaped portion 11 has flexed. In this position, an electrical circuit controlled by the thermostatic switch will obviously be opened, and since the switch flex is due to a condition of overheating, the electrical equipment will be given a chance to cool down, which is the manner in which such thermostatic switches are usually employed.

Due to the position of the fulcrum point 12, it will be apparent that flexure of the dish-shaped portion 11 causes a very large and rapid movement of the contacts, and therefore they can be initially so firmly biased into engagement that there is very little possibility of any creep occurring right up to the moment when the dish snaps.

In order to set the initial calibration of the switch so that it will open at a desired point, the case may be distorted by external pressure as shown at 14, as is also well-known in the art, and shown, for example, in the above-mentioned patent to Wehl, No. 3,223,808.

FIG. 8 shows an alternative form of construction, in which parts which are the same as those shown in the previous modification bear the same reference numerals as in FIG. 1, while corresponding parts which are altered on construction bear the same reference numeral with a prime (') added. It will be seen that the only difference between the two embodiments is that the bimetallic strip 9' is supported on terminal arm 8' in a reverse position relative to FIG. 1, and the fulcrum point 12' is provided at the end of arm 8', instead of being intermediate its ends. The lower rigid terminal arm 6' is necessarily made longer than in FIG. 1, in order to engage the contact at the end of the bimetallic strip, but otherwise the operation is the same. The flex position of the bimetallic arm 9' is indicated by dotted lines. It will be apparent that the operation of the modification shown in FIG. 8 is essentially the same as that shown in FIG. 1.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of our invention as defined in the appended claims.

We claim:

1. Thermostatic snap switch construction comprising:
 - (a) an insulated mounting member,
 - (b) first and second terminal arms supported by said mounting member and extending out therefrom in spaced, substantially parallel relation, the second of said arms being a rigid member,
 - (c) a bimetallic arm parallel to and spaced from said first terminal arm, the other end being a free end,

(d) a dish-shaped thermal snap portion intermediate the ends of said bimetallic arm, said snap portion having two positions at different temperatures,

(e) a fulcrum point element extending toward and in contact with said bimetallic arm at a point toward the other end of said bimetallic arm from the fixed end thereof and beyond the center point of said dish-shaped portion,

(f) said bimetallic arm extending still further beyond said fulcrum point and bearing an electrical contact near its first end, said electrical contact being electrically engaged with said rigid second arm in one thermal position of said thermal snap portion and being disengaged from contact with said rigid arm in the other thermal position of said snap portion as the bimetallic arm flexes about said fulcrum point,

(g) said fulcrum point remaining in contact with the bimetallic arm in both thermal positions.

2. The invention according to claim 1, said fulcrum point extending from and being supported by said first arm.

3. The invention according to claim 2, at least a portion of said first arm having some flexibility toward and away from the second arm, but being less flexible than said bimetallic arm.

4. The invention according to claim 2, and a closed metallic casing supporting and enclosing said thermostatic snap switch.

5. The invention according to claim 1, said bimetallic arm being fixed at said one end to the end of said first arm remote from said mounting member.

6. The invention according to claim 1, said bimetallic arm being fixed to said first arm at a point intermediate its ends.

7. The invention according to claim 4, said mounting member comprising an assembly of two interlocking members of rigid insulating material, said terminal arms having cut-out portions near the mounted ends thereof, so arranged that the entire assembly is interlocked immovably when assembled in said casing.

References Cited

UNITED STATES PATENTS

2,820,870	1/1958	Moksu	337-368
3,104,296	9/1963	Moksu et al.	337-89
3,194,924	7/1965	Moksu et al.	337-89

BERNARD A. GILHEANY, *Primary Examiner*.

R. L. COHRS, *Assistant Examiner*.

U.S. Cl. X.R.

337-368