

HEAT OPERATED SWITCH

This invention relates to a heat operated switch, having a housing, a bimetallic snap disc, a contact adapted to be operated by the bimetallic snap disc, and an associated contact, contact and associated contact being in electrically
5 conductive connection with one another via contact surfaces in a first position whereas when a predetermined temperature is traversed the bimetallic snap disc snaps over into a second position and lifts the contact away from the associated contact.

10 Such heat operated switches are incorporated in electrical circuits in many different kinds of electrical appliances, more especially in electrical heating apparatus. In the first portion of the switch, e.g. the low temperature position, the switch is closed so that the current being monitored flows,
15 whereas if the temperature rises above a predetermined value, the bimetallic snap disc snaps over so that the flow of current through the switch and thus the supply of energy to the monitored apparatus is interrupted. In a very simple constructional form of heat operated switches of the category
20 described a special current transmitting element is not provided, so that in the low temperature position the current to be monitored flows via the bimetallic snap disc, which is disadvantageous since the current loading of the bimetallic

snap disc influences the switching behaviour thereof. In known heat operated switches (cf. British Patent Specification 1394612), with the further development of which the invention is particularly concerned, 5 this is countered by providing a spring snap disc as a current transmitting element additionally to the bimetallic snap disc. The current to be controlled flows through an associated contact, a contact and a spring snap disc, the bimetallic 10 snap disc itself carrying no current. The spring snap disc has less spring force (generally only slightly less) than the bimetallic snap disc, and therefore is pressed into its opposite situation on change-over to the high temperature position. 15 When the temperature drops again, the internal spring forces in the bimetallic snap disc are reduced to such an extent that they are overcome by the spring snap disc, and the switch returns to the low temperature position. In these known 20 heat operated switches of the category described, current is usually supplied to the actual switching mechanism by way of the housing which comprises a housing base and a housing cover which are connected together in electrically 25 insulated fashion and respectively form the associated contact (integral with the housing) and connect conductively to the contact (through spring or bimetallic snap disc), or vice versa.

In specified heat operated switches described 30 hereinbefore, the contact actuated by the bimetallic snap disc consists of a more or less considerably arched dome

which in the low temperature position usually abuts on the plane housing base or cover respectively. This constructional form, which seems an obviously attractive arrangement for reasons of manufacturing technique, has proved to be quite successful in the switching of small currents; difficulties arise when relatively large currents have to be controlled, or such switches are overloaded. As the contact lifts away from the associated contact, a switching spark forms, and because of the geometric facts of life in the known heat operated switches this switching spark creeps over the contact dome to the bimetallic snap disc. The high electrical field intensities involved result, particularly at the edges of the bimetallic snap disc, in changes in the elastic properties, perhaps by annealing. These changes, at any rate, have the disadvantageous effect that the bimetallic snap disc no longer snaps over within a narrowly defined temperature position but changes from the low to high temperature position with a "creeping" action within a wide temperature range, so that a precise switch-over temperature is no longer observed.

The invention has as its object to develop further a heat operated switch of the type initially described in such a manner as to obviate operationally caused impairment of the switch-over behaviour of the bimetallic snap disc, more particularly impairment caused by switching sparking

The present invention provides a heat operated protective switch, comprising: a housing comprising an electrically conductive body, an electrically conductive cover mounted on the body, which cover
5 forms an associated contact having a first contact surface, a spring snap disc arranged in the housing and facing the cover, and a bimetallic snap disc between the spring snap disc and the cover, the spring snap disc and the bimetallic
10 snap disc being mounted on a contact having at one end thereof a flange overlapping said bimetallic snap disc and a second contact surface facing the first contact surface, wherein the first contact surface is convex towards the second contact
15 surface, the curvature of said first contact surface is greater than the curvature of said second contact surface and the second contact surface is bound by a circumferential edge which is spaced from said bimetallic snap disc to prevent the
20 transfer of a switching spark from the second contact surface to the bimetallic snap disc, the arrangement being such that in a first snap action position of said bimetallic snap disc said body is electrically connected to said
25 cover via said spring snap disc, said contact and said first and second contact surfaces, and when a predetermined temperature is traversed the bimetallic snap disc snaps over into a second snap action position whereby said second contact
30 surface is lifted away from said first contact surface to break said electrical connection.

The edge can be formed by a line of contact between the second contact surface and a wall extending from the second contact surface to the bi-
35 metallic snap disc or, preferably, a bevelled edge is provided between the second contact surface and a wall extending to the bimetallic snap disc.

The contact may be in the form of a stud

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extending through apertures in the bimetallic snap disc and the spring snap disc, the flange being formed by flanging over an end of the stud or by a cap fixed to the stud by a pin extending from the cap
5 and located in an axial aperture in the stud.

There are assembly technique advantages where the bimetallic snap disc is held on the contact by the flange and can be assembled together with the stud as a sub-assembly. This is further
5 improved if the bimetallic snap disc is fixed between the flange and stud in the axial sense also - of course with an amount of play appropriate to manufacturing conditions and function - and the cap and the stud are connected by means
10 of a pin formed on the cap and extending through an axial aperture of the stud. There are various possibilities open for securing the pin in the stud, for example pressing-in, upsetting, grooved rivet construction, etc. The
15 pin formed on the cap can also be rivetted through the stud, which is particularly advantageous if the stud has a specially narrowed neck extending through the central aperture of the bimetallic snap disc, so that
20 a certain amount of play is ensured.

As explained initially, the invention proceeds more particularly from a constructional form wherein additionally to the bimetallic snap disc a special current transmitting element in the
25 form of a spring snap disc is provided. The contact is preferably formed by a stud which extends through central apertures of bimetallic snap disc and spring snap disc with a narrowed neck in each case. Proceeding from there,
30 at least the neck extending through the spring snap disc may be connected therewith by flanging-over. The flange already discussed, engaging over and holding the bimetallic

snap disc, can likewise be formed by flanging-over the corresponding neck, in so far as this can be combined with the construction of the contact surface of the movable contact.

- 5 In the present specification "amount of curvature" means the amount of (convex or concave) curvature of the contact surfaces as mathematically defined in the usual way. By the convexly arched construction of the first
- 10 contact surface in conjunction with the, in contrast, relatively smaller curvature of the second contact surface, the invention achieves the result that the bimetallic snap disc is not impaired by the switching sparking.
- 15 As regards details, various possibilities exist for the construction of the contact surfaces. Preferably the contact surface of the contact connected with the bimetallic snap disc is of flat construction. In some cases it may
- 20 also be advantageous to provide the contact with a concavely arched contact surface, achieving a better fit between contact and associated contact with correspondingly reduced current densities, and at the same time transfer
- 25 of the switching spark is obviated. In some circumstances it is also sufficient even if the second contact surface is likewise convex but with a smaller curvature than the first contact surface.

It is also advantageous to situate the first contact surface in the region of a recess forming an outwardly directed projection relatively to the housing interior, so as further reduce the overall height of the heat operated protective switch according to the invention in this way. With this arrangement, the inwardly directed first contact surface is surrounded at the outside of the housing by a projecting annular surface formed by the recessing, at which the necessary electrical connection can be made in a simple way when fitting the switch in an apparatus. The first contact and recess can readily be formed in a single operation by pressing, stamping or the like on the housing cover.

The invention will be further described by way of example with reference to the accompanying drawings, in which:

Fig. 1 shows an embodiment of a heat operated protective switch according to the present invention in longitudinal section in the low temperature position, and

Fig. 2 shows the embodiment of Fig. 1 in the high temperature position.

The heat operated switch shown in the drawings has in the first instance a housing comprising a housing base 1 with side wall 2 connected thereto, and a housing cover 3, these consisting of electrically satisfactorily conductive material. The housing cover 3 is inserted in the opening of the side wall 2 with interposition of an electrical insulation 4, and

secured by flanging-over, so that the housing interior is closed in sealing-tight manner. The switching mechanism arranged in the interior of the housing comprises substantially a bimetallic 5 snap disc 5, a spring snap disc 6 and a stud 7 which with one narrowed neck in each case extends through central apertures in the bimetallic disc 5 and spring snap disc 6. The lower neck 8, projecting through the spring snap disc 6, 10 is flanged-over so that the spring snap disc 6 and the stud 7 are connected together in shape-locking manner. On the upper neck 9 extending through the bimetallic snap disc 5, there is provided a cap 10 which engages over the 15 bimetallic snap disc 5, so that the latter also is connected positively to the stud 7. Thus the switching mechanism forms a coherent unit which can be pre-assembled in a simple manner and inserted in the housing. The cap 10 20 comprises at its underside a pin 11 which extends through an aperture of the stud 7 and is rivetted thereto (see Fig. 2).

The stud 7 with cap 10 forms a movable contact which is adapted to be operated by 25 bimetallic and spring snap discs 5, 6 and whose contact surface 12 in the illustrated constructional example is plane in configuration, i.e. has zero curvature.

The contact surface 12 is set off sharply from the bimetallic snap disc 5 by angular circumferential edge 18, which, as can be seen from the drawing, is formed by surfaces mating at an angle.

Allocated to the movable contact formed by the collar 10 is an associated contact which is integral with the housing and comprises a cup-shaped recess 13 in the housing cover 3. The contact surface 14 of the associated contact is arched convexly with respect to the interior of the housing and therefore relatively to the movable contact. The recess 13 forming the associated contact and projecting towards the housing interior is situated in the region of a frustoconical recess 15 projecting outwardly from the housing interior, and is thus surrounded by an outwardly projecting annular contact surface 16.

Electrical connection for the heat operated switch in the fitted state is provided directly by way of the housing base 1 on the one hand and the housing cover 3 on the other, these consisting of electrically conductive material, (for example a suitable metal plated with silver) and being insulated electrically from one another. In the low temperature position shown in Fig. 1 the spring snap disc 6 abuts peripherally in electrically conductive manner on an abutment 17 provided at the housing base 1, and by virtue of its spring force presses the movable contact surface 12 of the collar 10 against the fixed contact 14 of the cup-shaped recess 14 provided at the housing cover 3, so that the switch is closed. In this position the bimetallic snap disc 5 held on the stud 7 is free of forces. If a predetermined

temperature is exceeded, the bimetallic snap disc 5 snaps over into the high temperature position shown in Fig. 2. The bimetallic snap disc in this position bears peripherally on the insulation 4 and presses the stud 7 downwardly, 5 overcoming the spring force of the spring snap disc 6, so that the movable contact surface 12 is lifted from the fixed contact surface 14, and the flow of current through the heat operated switch is interrupted. As soon as the temperature returns below the predetermined temperature, the internal 10 forces of the bimetallic snap disc 5 decline, until finally they are overcome by the spring snap disc 6, and the switching mechanism returns to the low temperature position shown in Fig. 1.

Conversely, it can be seen that the bimetallic snap disc 15 may be mounted so as to interrupt the flow of current at the lower temperature.



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CLAIMS:

1. A heated operated protective switch, comprising:
a housing comprising an electrically conductive body,
an electrically conductive cover mounted on the body,
which cover forms an associated contact having a
5 first contact surface, a spring snap disc arranged
in the housing and facing the cover, and a bimetallic
snap disc between the spring snap disc and the cover,
the spring snap disc and the bimetallic snap disc
being mounted on a contact having at one end thereof
10 a flange overlapping said bimetallic snap disc and
a second contact surface facing the first contact
surface, wherein the first contact surface is convex
towards the second contact surface, the curvature
of said first contact surface is greater than the
15 curvature of said second contact surface and the
second contact surface is bound by a circumferential
edge which is spaced from said bimetallic snap disc
to prevent the transfer of a switching spark from the
second contact surface to the bimetallic snap disc,
20 the arrangement being such that in a first snap
action position of said bimetallic snap disc said
body is electrically connected to said cover via
said spring snap disc, said contact and said first
and second contact surfaces, and when a predetermined
25 temperature is traversed the bimetallic snap disc
snaps over into a second snap action position whereby
said second contact surface is lifted away from said
first contact surface to break said electrical
connection.
- 30 2. A switch as claimed in claim 1, wherein the
contact comprises a stud extending through apertures
in the bimetallic snap disc and the spring snap
disc, the said one end of the contact being flanged



over to form said flange.

3. A switch as claimed in claim 1, wherein the contact comprises a stud having a cap connected at said end by a pin extending axially from the cap and located in an axial aperture of the stud, the cap extending radially to form said flange.

4. A heat operated switch according to claim 1, 2 or 3, wherein the stud has narrowed necks which extend through a central aperture of the bimetallic snap disc and a central aperture of the spring snap disc, one neck for each aperture, characterised in that the neck which extends through the spring snap disc is connected therewith by flanging-over.

5. A heated operated switch according to any one of claims 1 to 4, wherein the contact surface of the contact is flat.

6. A heat operated switch according to any one of claims 1 to 4, wherein the contact surface of the contact is concave.

7. A heat operated switch according to any one of claims 1 to 6, characterised in that the first contact surface is situated in the region of a recess which projects outwardly relative to the housing interior.

8. A switch as claimed in any one of claims 1 to 7, wherein said edge is a bevelled edge.

9. A heat operated switch substantially as hereinbefore described with reference to the accompanying drawings.

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