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71 Applicant: Hargreaves, Karl Michael
 60 Braemor Road
 Calne Wiltshire, SN11 9DU(GB)

71 Applicant: Stening, Michael Alan
 74 Oldfield Park
 Westbury Wiltshire(GB)

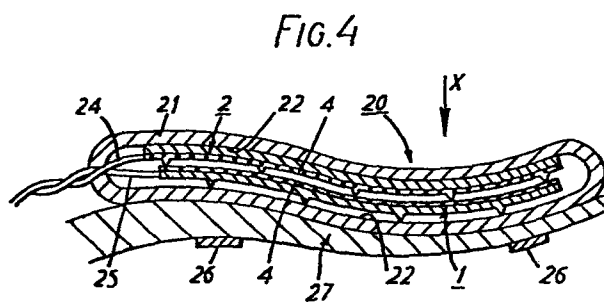
72 Inventor: Hargreaves, Karl Michael
 60 Braemor Road
 Calne Wiltshire, SN11 9DU(GB)

72 Inventor: Stening, Michael Alan
 74 Oldfield Park
 Westbury Wiltshire(GB)

74 Representative: Page, Edmund John et al,
 PAGE & CO Temple Gate House Temple Gate
 Bristol BS1 6PL(GB)

54 Flexible electric switches.

57 A flexible electric switch comprising two sheets of resiliently-flexible electrically-insulating material moulded onto one face of each of which is a woven or expanded electrically-conductive material wherein one of the sheets is moulded with spacing elements which project through the electrically-conductive material on its face, the arrangement being such that when the two sheets are assembled with said one face of each of which opposed one to the other these faces are held apart by the spacing elements until pressure is applied across the sheets causing said one faces to be brought into contact one with the other between the spacing elements and thereby intercontacting the electrically-conductive material on said one faces.



Flexible Electric Switches

This invention relates to flexible electric switches.

5 Such switches are, of themselves, well known and are used, for example, in burglar-detection systems as floor switches and on garage forecourts to detect the arrival of a potential customer as he drives his car over the switch. Problems exist with such switches,
10 particularly those which are frequently operated, as the metal contacts are subject to work-hardening with consequent malfunction of the switch. Attempts have been made to overcome these problems by using metal gauze as the contacts or, at least, one of them, but
15 the problem remains of such switches malfunctioning by shorting should a "whisker" of the gauge become displaced and bridge the gap between the contacts. To obviate this problem, it has been proposed to insert collapsible insulating spacers between the two contacts
20 but such an arrangement provides an expensive assembly.

The present invention seeks to overcome many of the problems inherent in previously-proposed switches and to offer a cheap but reliable construction.

25 Accordingly, the present invention provides a flexible electric switch comprising a sheet of resiliently-flexible electrically-insulating material moulded onto one face of which is woven or expanded
30 electrically-conductive material wherein the sheet is moulded with spacing elements which project through the electrically-conductive material on its face, the arrangement being such that when the sheet is assembled with said one face opposed to one face of another sheet
35 of electrically-conductive material, these faces are

held apart by the spacing elements until pressure is applied across the sheets causing said one faces to be brought into contact one with the other between the spacing elements and thereby intercontacting the electrically-conductive material of said one faces.

The spacing elements may be spaced bars extending across one dimension of said one of the sheets, the bars being spaced apart one from the another along the other dimension of the sheet.

The other of the sheets may also be a sheet of resiliently-flexible electrically-insulating material into one face of which is moulded a woven or expanded electrically-conductive material which constitutes said another sheet, said other of the sheets being moulded with upstanding projections on its face opposite to said one face of that sheet and the two sheets are assembled such that the projections are interspersed between the spacing elements. In this case, the upstanding projections may also be spaced bars extending across one dimension of one of the sheets being spaced one from another along the other of the dimensions of that sheet.

Such switches may be incorporated into the switch claimed in any one of the Claims of earlier Application No. 8230912, the two sheets of this Application being mounted each on one of opposed inner surfaces of the pressure sensitive member of the earlier Application and thereby providing the contacts of that earlier Application.

Embodiments of the present invention will now be described in greater detail, by way of example only,

with reference to the accompanying drawings of which:-

Fig. 1 is an exploded view of the switch, the sheets being shown thicker in their cross-sectional direction for the sake of clarity,

Fig. 2 shows a partial cross-sectional view of the switch under pressure,

Fig. 3 shows a view similar to Fig. 2 of a modification of the switch of Fig. 1, and

Fig. 4 shows a cross-sectional view of the modified switch of Fig. 3 utilised as the switch in the bicycle stop light system described in earlier Patent Application No. 8230912.

Referring to Fig. 1, the switch comprises two sheets 1 and 2 formed of resiliently-flexible electrically-insulating material such as synthetic plastic material. The sheets 1 and 2 are formed by moulding and each have, moulded into one face 3 woven or expanded electrically-conductive material 4. This material may be brass or copper gauge. The material 4 is moulded onto the face 3 such that the material is exposed on the face 3.

The sheet 2 is moulded to provide a series of spacing elements 5 spaced along the length of the sheet 2. These elements 5 are bar-shaped and each extends across the face 3 of the sheet 2. The elements 5 are formed by the electrically-insulating material being allowed, in the course of the moulding of the sheet 2, to project through the woven or expanded material 4.

The sheets 1 and 2 are shown separated one from the other in Fig. 1. In use, the sheets 1 and 2 would be arranged with the elements 5 of the sheet 2 abutting the face 3 of the sheet 1. With the sheets 1 and 2 so arranged, as shown in Fig. 2 the application of pressure across the sheets 1 and 2 in the direction of the arrows A would cause the faces 3 of the sheets 1 and 2 to be brought into contact in the areas 6 thereof between the elements 5. Such contact will electrically intercontact the woven or expanded material 4 of the two sheets and thus provide an electrical switch which, upon release of the pressure will recover to restore electrical separation of the faces 3 by the elements 5 by virtue of the inherent resilient flexibility of the material of which the sheets 1 and 2 are formed.

Whilst the construction of Fig. 1 will be satisfactory for many applications, if the pressure to be applied across the sheets 1 and 2 were to be applied via some rigid planar actuator, electrical intercontact of the faces 3 may not be satisfactorily effected. To enhance the certainty of such intercontacting, the construction of Fig. 3 may be used.

In this construction, the sheet 1 is also formed with elements 7 which are similar to the elements 5 of sheet 2; that is to say, they are formed during the moulding of sheet 1 and are bar-shaped being spaced one from another along the length of the sheet 1 and each extending thereacross. However, the elements 7 are formed on the back face 8 of sheet 1 and not on the face 3 as are the elements 5. The elements 7 are arranged along the length of the sheet 1 so that when the sheet 1 is arranged with the sheet 2 so as to be abutted by the elements 5 of sheet 2, the elements 7

lie between the elements 5 in the direction of the length of the sheets.

5 If, now, pressure is applied across the sheets 1 and 2 in the direction of the arrows A through rigid planar actuators 9 and 10, the planar actuator 9 will be engaged by the elements 7. Thus, the woven material 4 on each of the faces 3 will positively be urged to intercontact in the areas 6.

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In earlier Patent Application No. 8230912 there is described and claimed cycle stop-light equipment which requires, inter alia, an electrical switch mountable on the cycle hand-brake lever. The switch of this present
15 Application is particularly suitable for use in the switch of the earlier Application.

Referring now to Fig. 4, there is here shown a switch
20 identical in function to the switch 1 of the earlier Application. The switch 20 comprises a closed generally tubular-shaped moulded member 21 which can be seen in longitudinal cross-section in Fig. 4. The member 21 has opposed internal faces 22 onto which are mounted the sheets 1 and 2. Connected to the woven
25 material 4 one to each of the sheets 1 and 2 are wires 24 and 25 which permit external electrical connection to the material 4. The member 21 has integrally moulded with it a pair of loops 26 through which can be threaded a hand-brake lever 27.

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The member 21 and the loops 26 are a one-piece moulding made from any suitable synthetic or natural plastic resilient material of sufficient rigidity as, together with the resilience of the sheets 1 and 2 as normally
35 to hold the faces 3 of the sheets out of contact one

with the other in the undeformed condition of the member 21 whilst being readily manually resiliently deformable when the lever 27 is pulled in the direction of arrow "X" to apply the brake associated therewith, to bring the faces 3 into contact one with the other upon the member 21 being squashed between the cyclist's hand and the hand-brake lever 27.

The above described switch 20 will be connected in an electrical circuit as described in the earlier Application.

It will be seen that the electrical switch provided by the sheets 1 and 2 is particularly easy of manufacture whilst providing a highly-effective switch of wide application. The sheets 1 and 2 can be manufactured in large areas and subsequently cut to the required dimensions. In larger areas, the switch can be used, for example, for burglar-detection when positioned under, say, a carpet. In longer lengths it could also, for example, be used on garage forecourts to detect the entrance of a customer or could be used in roadways to monitor passing traffic.

Whilst in the above described embodiments the sheet 1 is of similar construction to that of sheet 2, this need not necessarily be so and sheet 1 could equally well be merely a plain sheet of electrically-constructive material such as copper or phosphor bronze.

Claims:

1. A flexible electric switch comprising a sheet of
resiliently-flexible electrically-insulating
5 material moulded onto one face of which is a woven
or expanded electrically-conductive material
wherein the sheet is moulded with spacing elements
which project through the electrically-conductive
material on its face, the arrangement being such
10 that when the sheet is assembled with said one face
opposed to one face of another sheet of
electrically-conductive material, these faces are
held apart by the spacing elements until pressure
is applied across the sheets causing said one faces
15 to be brought into contact one with the other
between the spacing elements and thereby
intercontacting the electrically-conductive
material of said one faces.
- 20 2. A switch as claimed in Claim 1, wherein the spacing
elements are spaced bars extending across one
dimension of said one sheet and being spaced apart
one from the another along the other dimension of
the sheet.
- 25 3. A switch as claimed in Claim 1 or Claim 2 wherein
the other of the sheets is also a sheet of
resiliently-flexible electrically-insulating
material into one face of which is moulded a woven
30 or expanded electrically-conductive material which
constitutes said another sheet, said other of the
sheets being moulded with upstanding projections on
its face opposite to said one face of that sheet
and the two sheets are assembled such that the
35 projections are interspersed between the spacing

elements.

4. A switch as claimed in Claim 3, wherein the
upstanding projections are spaced bars extending
5 across one dimension of said another of the sheets
being spaced one from another along the other of
the dimensions of that sheet.
- 10 5. A switch as claimed in any one of the preceding
Claims wherein the switch is incorporated into the
switch claimed in any one of the Claims of earlier
Application No. 8230912, the the first mentioned of
the sheets of this Application and said another
15 sheet of this Application being mounted each on one
of opposed inner surfaces of the pressure sensitive
member of the earlier Application and thereby
providing the contacts of that earlier Application.
- 20 6. A switch substantially as herein described with
reference to and as illustrated in either Fig. 1 and
Fig. 2 of Fig. 3 or Fig. 4 of the accompanying
drawings.

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