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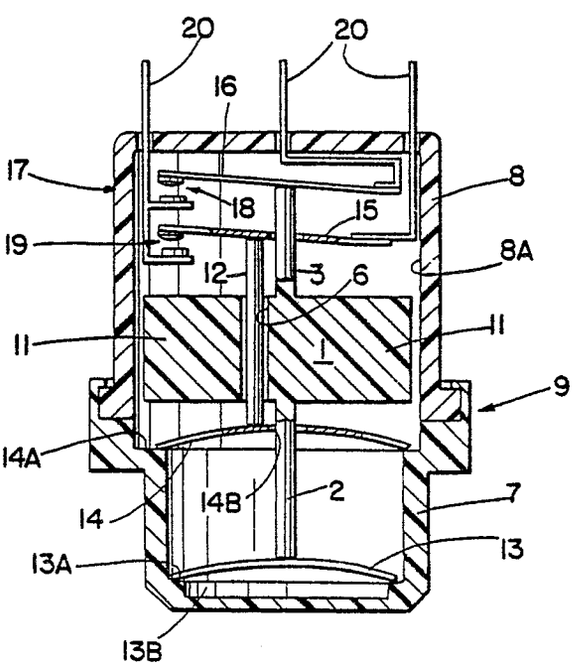
(54) Two-temperature thermoswitch.

(57) A two-part housing (7, 8) supports bimetallic wafers (13, 14) near one end and switches (18, 19) near the other end with respective shafts (1, 12) contacting the wafers and the switches for separate actuation of the switches. In order to guide the shafts (1, 12) in operable contact with the switches (18, 19), the housing (8) has a wall (8A) and one of the shafts has at least one extension (11) to contact the wall in guiding relationship with the wall and that shaft having an opening (6) which receives and guides the second shaft (12).



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Two-temperature Thermoswitch

The present invention relates to a device in which a switching condition will change at each of first and second temperatures. There may be reasons for desiring two or more different temperatures to be sensed at electrical discontinuties in a system. The present invention uses a respective bimetallic disc to sense each temperature. Such a disc may be convex in one direction when below a certain temperature, and inverts its shape to present a concave surface in said one direction, when above the certain temperature. The other disc will invert at a different temperature. The inversion of shape occurs suddenly, i.e., for a very small temperature change at the certain temperature.

The invention concerns such devices in which the sudden change in shape of a disc causes a respective shaft to move axially and thereby to open to close a contact. Such a device is seen in prior German Application DT-OS 1916646 in which two such discs inverting at different temperatures, and having their centres non-aligned, move separate shafts through respective guide holes in a central mass within a housing.

The structure of this prior thermoswitch thus comprises three main parts, first a main housing body in which the two discs are housed at different levels, secondly a top part and cover, generally containing the contacts and terminals, and thirdly the central mass or insert in the housing, above the

discs, which has parallel bores guiding the axially moving contact drive rods. One rod passes through a hole in the top bimetallic disc in order to communicate movements of the lower disc to a respective moving contact of a pair.

The presence of the central mass or insert causes the housing to need three parts to be joined e.g., welded together. It would be desirable to need only two housing parts in order to save e.g., weight, trouble in welding or otherwise joining the parts, and thermal inertia.

According to the present invention, one of the two drive shafts comprises wing-shaped projections which enable the shaft movements to be guided by the housing wall itself. The central origin of the wings will have an approximately cylindrical piece with a longitudinal bore or groove in which the second shaft can reciprocate.

There may be more than two temperatures, ie., three or more discs and respective shafts. The central origin piece of the first shaft may then have two or more bores for the remaining shafts. Conceivably these shafts could instead pass along or through guide grooves or bores in the wings, but the central origin piece from which the wings radiate is the presently preferred site for the one of more shaft guides. There may be several longitudinal bores merely to provide alternatives for the one or more second shafts, to simplify the assembling.

The housing needs then only to comprise two parts. The first houses the discs and guides the wing-shaped extensions of the first shaft. This in turn guides the one or more further shafts. The second part of the housing comprises a cover or top for the contacts and terminals. These two parts are then joined after assembly of the electrical parts, the shaft and the guides, and much simplicity is achieved with concomitant engineering and economical advantages.

An embodiment of the invention is now described with reference to the drawings, in which:

Figure 1 shows in perspective part of a contact drive shaft, such part having wing-shaped extensions and a guide aperture for a second shaft; and Figure 2 shows a diametrical sectional elevation on an assembled thermoswitch showing all essential components.

Referring to Figure 1 a first shaft 1 has a lower rod-shaped part 2, an upper rod-shaped part 3 and an intermediate enlarged part 4. Part 4 has a central origin piece 5 from which three or more wings 11 radiate (to points of abutment with the housing as will become apparent below). The central origin piece has a bore 6 which is parallel to the rod-shaped parts 2 and 3. There may be several longitudinal bores 6, either in the central origin piece or in one or more of the wings.

A second shaft 12, only a small part of which is shown, is arranged to slide in bore 6 for its guidance. If there are several bores 6, the second

shaft will slide in that one which was most conveniently placed to receive the second shaft during construction or assembly. All these parts can be seen again in the sectioned assembly of Figure 2. The assembly comprises a housing 17 consisting only of a bottom part 7 and a cover part 8 welded or otherwise held together along a circular line of contact 9.

The bottom housing part 7 contains a first bimetallic disc 13 resting on an annular platform 13A. This has a shape as shown being convex upwards so that it pushes shaft 1 upwards by abutting lower shaft rod-shaped portion 2, so that the upper portion 3 of the shaft 1 holds a contact arm 16 upwards and hence contacts 18 are kept open.

The housing cover part 8 contains the contacts 18, contact arm 16 and the upper shaft portion 3. When the temperature rises, disc 13 inverts at its critical temperature to become convex downwards and project into a recess 13B in the housing. Shaft 1 then drops, as does contact arm 16 and contacts 18 touch, so that an electrical circuit is completed as a manifestation of a sensing of this first critical temperature.

The movement of shaft 1 is guided by the tips of the three wings 11 bearing on the inner cylindrical wall 8A of e.g., upper portion 8 of the housing 17. This is an important asset of the present two-temperature thermoswitch device.

The housing 17 contains a second bimetallic disc 14 resting on a second annular platform 14A. The second disc has an aperture 14B threaded by lower shaft 2 and, like the first disc, drives the shaft 12 which as aforesaid passes through aperture 6 in the first shaft 1. Shaft 12 bears on a contact blade or arm 15, which like blade or arm 16 may be biased downwards to close the contacts of a second pair 19 whenever the contact arm is released by the second disc 14 "tripping" i.e., becoming concave upwards at its critical temperature.

The contact pairs 18, 19 are terminated at two, three or more terminals 20 passing through the lid part of the upper housing portion 8. The mode of contact termination is immaterial to the invention. In fact there may be two independent terminals per pair, or two terminals altogether may terminate pairs in series or pairs in parallel, as required.

Thus the housing body 17 guides one drive shaft 1; and at least one aperture or bore 6, or a groove as an alternative, guides one or more further shafts such as 12 from one or more further discs such as 14.

Preferably the shaft portions 2 and 3 and the bore 6 are oppositely displaced from the central axis of the housing, which may correspond with the axes of the disc and their annular platforms. Thus the central axis may pass midway between the shafts 2 and 12.

The rods 12, 2 and 3 are of insulating material, or are otherwise insulated from the discs and each other. Most conveniently rods 2 and 3 and extensions 11 are injection moulded or compression moulded to integrally form drive shaft 1; alternatively one or more separate pieces may be made and bonded to form drive shaft 1.

One of the key advantges of the invention is that no central portion of the housing, or static insert therein need be provided to guide the drive shafts, because the invention provides that the one shaft guides one or more further drive shafts. Effectively, therefore, one set of wings 11 guides all the shaft movements

Claims:

1. A two-temperature thermoswitch, comprising a housing (7,8) having spaced ends,
a first bimetallic wafer (13) supported within the housing,
a second bimetallic wafer (14) supported within the housing, the second wafer having an aperture (14B),
first and second switches (18,19) supported within the housing,
a first shaft (1) having a portion (2) contacting the first wafer and extending through the aperture of the second wafer and contacting one of the switches, and
a second shaft (12) contacting the second wafer and the second switch,
characterized in that
the housing (8) between the ends has a wall (8A),
the first shaft has an extension (11) to contact the wall (8A) in guiding relationship with the wall, the first shaft having a bore (6) extending axially thereof, and
the second shaft extends through said bore.

2. The switch as claimed in claim 1, wherein
the housing is elongated and has an axis,
the first wafer (13) is supported in axial alignment with the housing adjacent to one end of the housing,
the switches (18,19) are axially spaced from the wafers adjacent to the other end of the housing,
the second wafer (14) is positioned between the first wafer and the switches in axial alignment, with the first wafer and the first shaft (1) extends in axial alignment with the housing.

3. The switch as claimed in claim 1, wherein the wall (8A) of the housing (8) is continuous, the first shaft (1) has a first rod-shaped part (2), a second rod-shaped part (3) and an intermediate enlarged part (4), the first rod-shaped part contacts the first bimetallic wafer (13) and the second rod-shaped part (3) contacts one of the switches (18,19), and
the enlarged part (4) includes at least one radially extending wing (11) to contact the wall (8A) in guiding relation.

4. The switch as claimed in claim 3, wherein the wall (8A) of the housing (8) is cylindrical in configuration, and
the enlarged part (4), of shaft 1 includes at least three wings (11) to contact the wall (8A) in guiding relationship.

5. The switch as claimed in claim 4, wherein the rod-shaped parts (2,3) and the bore (6) are oppositely displaced radially from the axis of the intermediate enlarged part (4).

6. The switch as claimed in claim 5, wherein the housing includes first and second cylindrical sections (7,8),
the first section (7) having a closed end and an open end, the second section (8) having a closed end and an open end, the open ends having a line of contact (9) holding the sections in sealed interfitting relationship with one another.

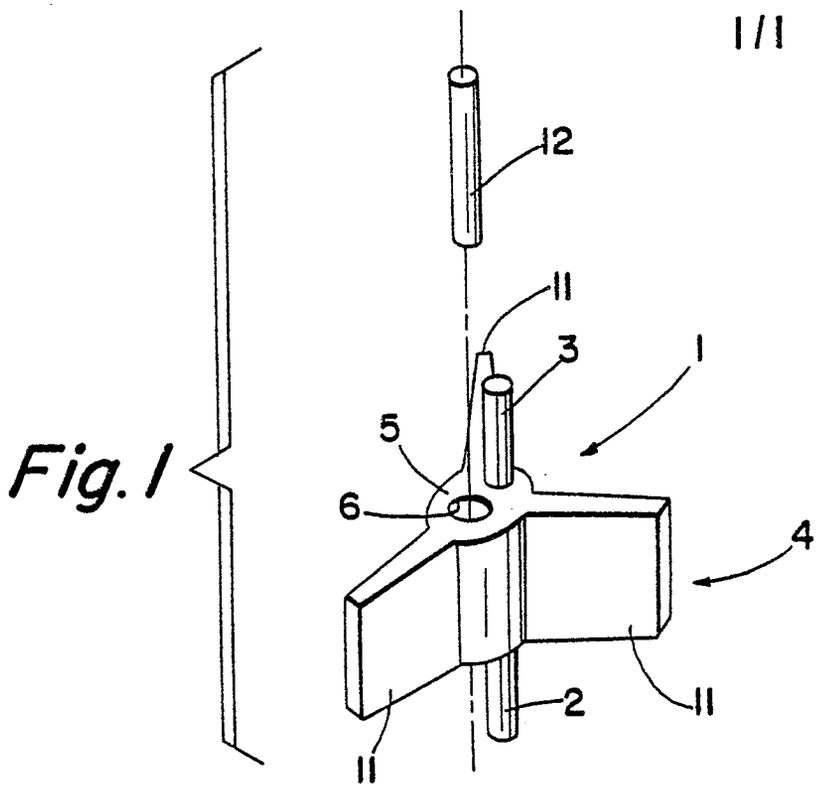
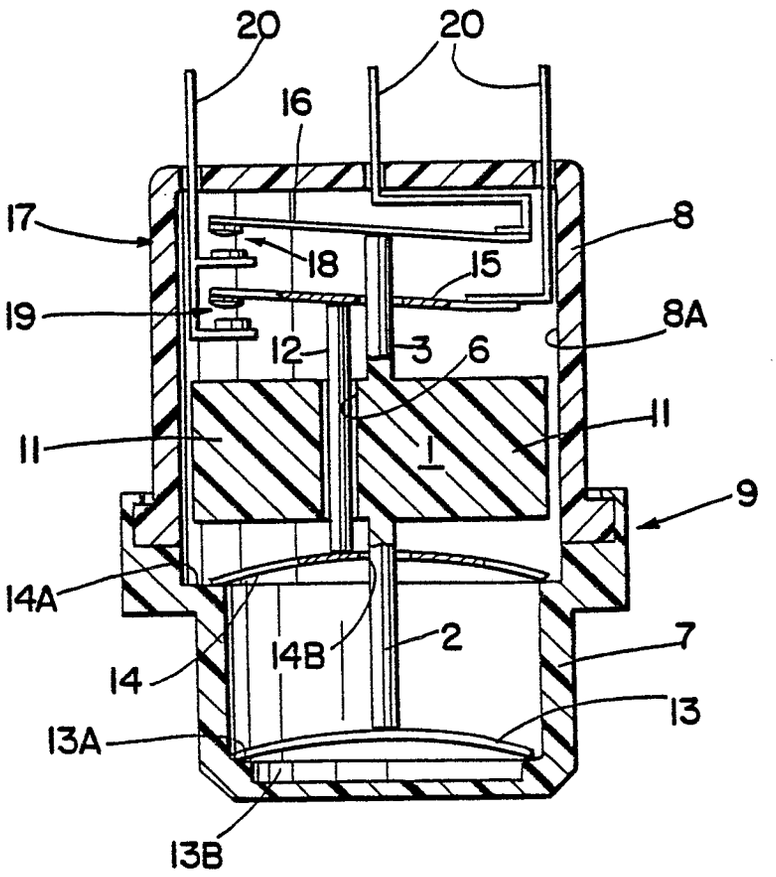

12
11
3
1
5
6
4
2
11
11

Fig. 1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14A
14B
2
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14
13
13A
13B

Fig. 2