

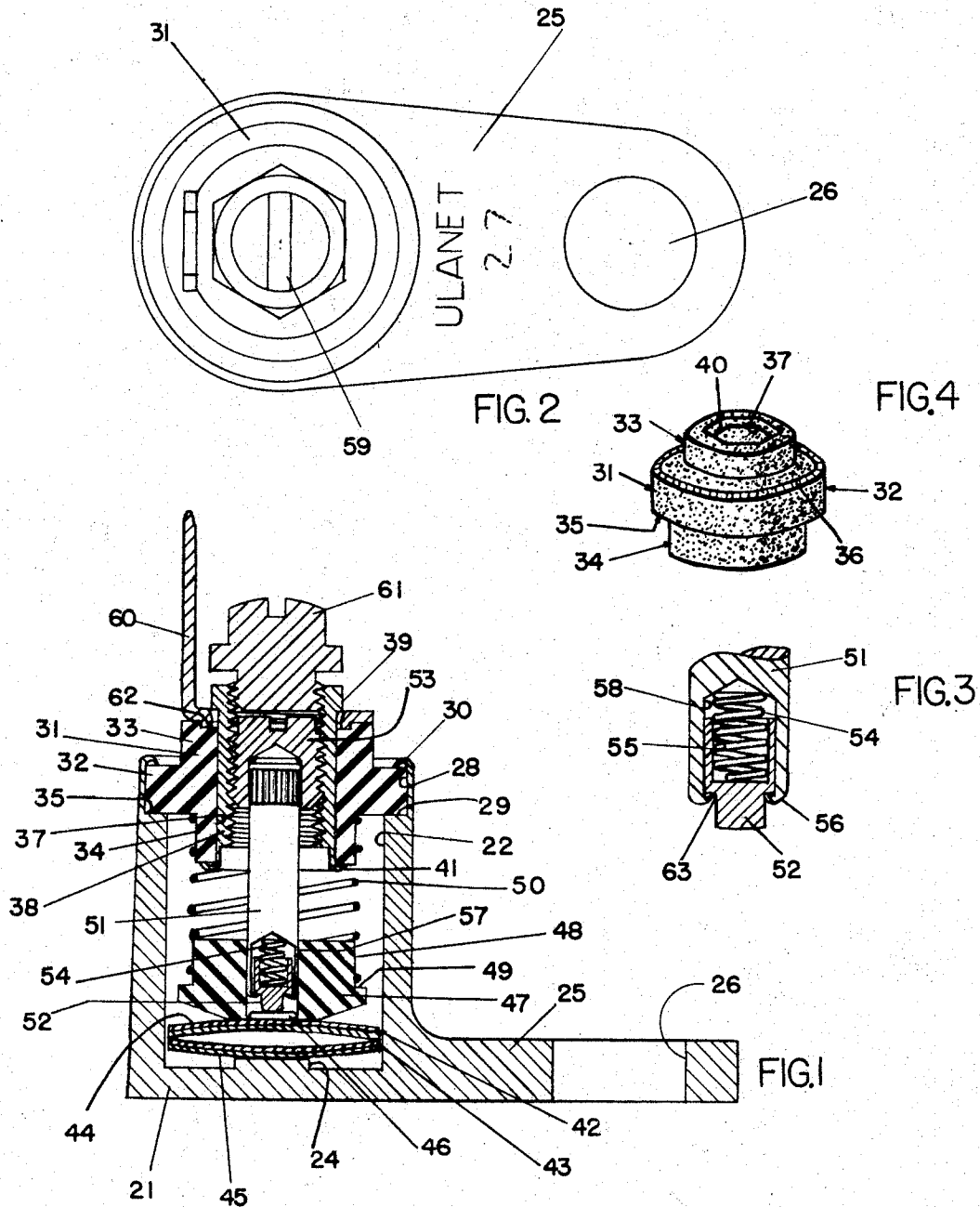
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SURFACE SENSING BIMETAL THERMOSTATIC SWITCH

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SURFACE SENSING BIMETAL THERMOSTATIC SWITCH

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The instant application is a continuation-in-part application of the parent application Ser. No. 40,851, now Patent No. 3,255,331.

One object of this application is to provide a shock and vibration resistant surface sensing thermostat to detect dangerous temperature on heavy machinery bearings, railroad car journals, air cooled engines and even liquid cooled engines in which no provision is made to insert an immersion type over-temperature sensor. My invention would be useful also for sensing surface temperature on tanks, gear boxes and the like, requiring a minimum of installation cost.

Another object of this invention is to prevent calibration drift from its original temperature setting after the thermostat is subjected to temperature substantially higher than that at which thermostat was originally calibrated.

A further object of my invention is to assure consistent and maximum linear expansion of opposing convex-concave thermostatic bimetal elements.

An additional object of my invention is to provide a thermosensitive switch in which the thermosensitive elements and electrical contact members are sealed securely against dirt, dust, grease and corrosive substances.

Still another object of my invention is to provide a thermostatic switch that may be assembled so that its contacts open with temperature rise or close with temperature rise, without requiring tooling changes.

Another object of my invention is to provide a thermostatic switch which may be easily calibrated at any desired temperature.

FIGURE 1 is a side elevation and cross-sectional view of my thermostatic switch.

FIGURE 2 is a plan view of subject thermostatic switch.

FIGURE 3 is a partial and sectional view showing construction of adjustable stationary contact member with built-in mechanical strain relief feature.

Referring to FIGURE 1, my invention comprises a body 21 made of material of high thermal and electrical conductivity, having a bore 22 at the bottom of which is a protrusion 24 integral with body 21. Also integral with body 21 is a mounting flange 25 with a through hole 26 to accommodate a mounting bolt, which is merely one possible means of fastening my thermostatic device to an object the temperature of which is to be sensed or controlled.

To assure efficient heat transfer from the object to the thermostatic switch the coplanar bottom 27 of the switch body 21 and flange 25 is smooth. The upper end of bore 22 communicates with recess 28. The intersection of bore 22 and recess 28 defines an annular shoulder 29. The top of the hollow body 21 terminates in a relatively thin walled annular lip 30.

An insulator 31 (see FIGURES 1 and 4) is seated within recess 28. The insulator 31 has a body portion 32 having a diameter slightly less than that of recess 28 and an outer neck 33 of reduced diameter. The intersection between body 31 and the inner neck 34 defines an annular shoulder 35.

The annular shoulder 35 of insulator 31 abuts on annular shoulder 29 of body 21 and the lower neck 34 projects into bore 22. The lip 30 at the upper end of bore 22 is rolled over against the top shoulder of insulator 31,

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thereby securing it within recess 28. The insulator 31 may be secured against rotation within recess 28 by providing a plurality of wedges 36 cut in the outer periphery of insulator 31 shown in FIGURE 4. In addition, an application of suitable sealing cement to the contiguous surfaces of insulator 31 and recess 28 before rolling over lip 30 would not only add to the prevention of rotation of insulator 31 within recess 28 but also serve as a seal against foreign matter entering into the working parts of thermostatic switch.

FIGURE 1 shows two alternate means of connecting a lead wire to the thermostat, namely the commonly known terminal screw 61 and quick connect tab terminal 60. The latter is considered more convenient by some users.

The bottom portion of terminal 60 has a hexagon extrusion that telescopes into hexagon recess 40 on top of insulator 31 (see FIG. 4). Then hexagon shoulder 39 of electrically conductive internally threaded bushing 38 seats into hexagon recess on top surface of the bottom portion of terminal 60. Bushing 38 and terminal 60 are assembled into bore 37 of insulator 31 and the thin wall 41 at lower end of bushing 38 is rolled over against the bottom of inner neck 34. Thus a subassembly is effected so that rotation of bushing 38 within bore 37 is prevented.

In cases where a terminal screw for fastening a lead wire to the thermostat is preferred tab terminal 60 is eliminated from the assembly. The annular hexagon shoulder 39 fits directly in hexagon recess 40 of insulator 31 and is fastened to said insulator in similar manner described. As an added precaution against foreign matter and corrosive substances entering the working parts of the thermostat, a suitable cement is applied to the contiguous surfaces between bushing 38 and insulator 31. Shoulder 39 of bushing 38 and recess 40 could be square or any other geometric shape to prevent rotation of bushing within insulator bore.

A pair of thermosensitive bimetallic elements 42 and 43 are seated at the bottom of bore 22 and rest on protrusion 24. If it is desirable to increase the total linear expansion and the expansive force, it can be effected by adding multiple pairs of bimetal elements, such as 42 and 43. The bimetallic elements are convex discs or can be of any other convenient geometric shape, positioned in opposition to one another touching at the periphery and separated at their centers. If the bimetal elements are in the shape of discs, their diameter is slightly less than the diameter of bore 22 at its lower end. The high expansion sides of the elements 42 and 43 are located on the convex outer surfaces 44 and 45 respectively. Bimetal 43 is in thermal contact with protrusion 34 whereas bimetal 42 is provided with an electrically conductive contact 46, which may be fine silver, for example, and located at its convex side.

An insulator 47 is slidably seated in the lower part of bore 22. The insulator 47 has an upper integral neck 48 of reduced diameter which defines the annular shoulder 49. The diameter of integral neck 48 of insulator 47 is equal to the diameter of lower neck 34 of insulator 31. The insulator 47 is also provided with an axial bore 57. A coil spring 50 is positioned between insulators 31 and 47 abutting against the annular shoulders 49 and 35. The spring 50 is normally under compression urging insulators 31 and 47 apart. Insulator 47 is then pressed firmly into engagement with bimetal 42 with contact 46 projecting into bore 57 of insulator 47.

An electrically conductive rod 51 is slidably positioned within bore 57 with its contact end 52 spaced a short distance away from contact 46 on bimetal 42. The opposite end of rod 51 is secured to an electrically conductive calibration screw 53 threadably engaged within bushing 38. The screw is provided with an adjustment slot 59.

A threaded terminal screw 61 engages in the top of internally threaded bushing 38 for attaching a lead wire.

FIGURE 3 shows contact 52 resiliently assembled in the lower part of rod 51. Silver contact 52 slidably fits into bore 58 at lower end of rod 51. Compression spring 54 slidably fits into bore 55 of contact 52. End of rod 51 is rolled over against shoulder 63 of contact 52 to such an extent that contact 52 has space to travel upward against opposing resistance of compression spring 54.

My thermostatic switch assembled with the bimetal flexural orientation as shown in FIGURE 1 will function in a manner whereby contacts 52 and 46 will close a circuit on temperature rise.

Functioning of said thermostat is described as follows: Suppose thermostat is tightly fastened to the surface of an outboard engine by a suitable bolt passing through mounting hole 26. Should the passage for water cooling the engine be clogged up with sand or seaweeds the engine would soon heat up to abnormal temperature. The heat path through the thermostat would be as follows: Heat would be readily picked up from the engine surface to the bottom surface 27 of body 21 made of brass or of other material of good thermal conductivity. Because protrusion 24 is integral with the base of body 21 there would be a rapid heat transfer to opposed bimetal elements 42 and 43. These would consequently flex more convexly in opposite directions and impart a force and linear motion against the bottom of insulator 47 causing the latter to move upward until contacts 52 and 46 engage with each other at preset temperature, and thus close the circuit for operation of a warning signal such as a buzzer or an incandescent bulb. The switch might also be connected across the magneto contacts so that when contacts 52 and 46 close it will short out the magneto and thus stop the engine.

When contacts 46 and 52 close the electrical circuit extends from housing 21 which may be considered "ground" through bimetals 42 and 43, contacts 46 and 52, rod 51, adjustable screw 53, bushing 38 and tab terminal 60 and through the alarm device to the live side of the line of a low voltage power source.

The thermostatic switch is calibrated to function at a given temperature by manipulating adjustment screw 53 so that it varies the gap between contacts 52 and 46. The greater the gap the higher is the temperature setting on the normally open thermostat as it is illustrated in FIGURE 1. Normally open contacts close on temperature rise.

However, it should be noted that said thermostatic switch may be made normally closed by merely reversing the flexural orientation of bimetals 42 and 43 so that they touch at their centers and are apart at their peripheries. The contact 46 is then positioned on the concave inner face of bimetal 42. The high expansion side of the bimetal is on the concave side and contacts 52 and 46 normally are engaged. As the temperature rises the bimetals assume a less convex configuration causing contacts to separate and break the circuit at a preset temperature.

Without protrusion 24 the bimetals might shift in such position at the bottom of bore 22 so that there would be a loss of expansive force and movement against the bottom of surface of insulator 47. Besides, the shift may be in a different position in bore 22 from time to time, causing inconsistent operation.

By providing protrusion 24 the positioning of bimetals 42 and 43 is defined and maximum expansive movement and force of bimetals 42 and 43 against insulator 47 is realized. This results also in consistent operation of the thermostatic switch.

Referring to FIGURE 1, suppose a silver contact was fastened directly to the bottom of a solid rod similar to 51 and should the thermostat be subjected to substantial temperature over-ride above its precalibrated temperature, bimetals 42 and 43 would tend to expand still further but would be prevented from doing so because of the mechan-

ical resistance of the solid rod. Therefore, bimetals 42 and 43 would be mechanically strained and would take on a permanent set and cause a calibration drift. When the thermostatic switch would be called upon to function again it would not close its contacts at the original calibrated temperature.

To prevent such damage to my thermostatic switch, I added a mechanical strain relief feature illustrated in FIGURE 3. Silver contact 52 fits into bore 58 at bottom of rod 51. Upper part of contact 52 is provided with bore 55 in which is seated compression spring 54 which exerts a force between bottom of bore 55 and top of bore 58 in rod 51. End of rod 51 is turned over at 56 against annular shoulder 63 of contact 52 to such extent that contact 52 is resiliently suspended in bore 58 of rod 51.

With resiliently suspended contact feature it can readily be understood that when bimetals 42 and 43 tend to expand further due to temperature over-ride mechanical strain on the bimetals will be eliminated because small compression spring 54 would offer resiliency to contact 52.

It is apparent that the electric arc formed when contacts 52 and 46 (FIGURE 1) engage and disengage is always confined within bore 57 of movable insulator 47. Because the arc is thus confined its duration is greatly shortened and the life of the electrical contacts is prolonged.

The foregoing description is merely intended to illustrate an embodiment of my invention. The component parts have been shown and described. They each may have substitutes which may perform a substantially similar function. Such substitutes may be known as proper substitutes for the said components and may have actually been known or invented before the present invention. These substitutes are contemplated as being within the scope of the appended claims, although they are not specifically catalogued herein.

I claim:

1. A thermostatic switch comprising an electrically and thermally conductive hollow body closed at one end, and said body having an integral flat extension of substantial area for mounting to an object, the temperature of which is to be sensed or controlled, one or more pairs of opposed concave-convex bimetals, the center of one of said bimetals seated at the closed end of the body and resiliently engaged with the other of said bimetals, a movable insulator seated within the hollow body resiliently engaged with one of the bimetals, the movable insulator having a bore, means within the hollow body for maintaining the movable insulator in resilient engagement with the bimetal, a stationary insulator seated within the opposite end of the body, the stationary insulator having a bore, an electrically conductive, internally threaded annular collar seated within the bore in the stationary insulator, a threaded calibration screw positioned within the collar, an electrically conductive rod mounted within the hollow body having one end secured to the calibration screw and the opposite end slidably positioned within the bore in the movable insulator, and provided with a resilient contact to prevent permanent set of bimetals and consequent calibration drift, for electrical engagement with opposed contact on adjacent bimetal in response to thermally induced changes in the curvature of the bimetals, and an external electrical contact member electrically connected to the collar but electrically insulated from the body.

2. A thermostatic switch comprising an electrically and thermally conductive hollow body closed at one end and said body having an integral flat extension of substantial area for mounting to an object, the temperature of which is to be sensed or controlled, one or more pairs of opposed concave-convex bimetals, the center of one of said bimetals seated on a central protrusion integral with the closed end of the body assuring consistent expansive force and movement of bimetals induced by heat and resiliently engaged with the other of said bimetals, a movable insu-

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lator seated within the hollow body resiliently engaged with one of the bimetals, the movable insulator having a bore, means within the hollow body for maintaining the movable insulator in resilient engagement with the bi-metal, a stationary insulator seated within the opposite 5 end of the body, the stationary insulator having a bore, an electrically conductive, internally threaded annular collar seated within the bore in the stationary insulator, a threaded calibration screw positioned within the collar, an electrically conductive rod mounted within the hollow 10 body having one end secured to the calibration screw and the opposite end slidably positioned within the bore in the movable insulator, for electrical engagement with opposed contact on adjacent bimetal in response to thermally induced changes in the curvature of the bimetals, 15 and an external electrical contact member electrically connected to the collar but electrically insulated from the body.

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3. A thermostatic switch comprising the structure in accordance with claim 1, whereby opposing electrical contacts engage and disengage within the confines of the bore of the movable insulator thus quenching the electric arc caused by opening and closing of the circuit into which said thermostatic switch is connected.

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