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I. F. MATTHYSSE ET AL

2,705,745

THERMAL SWITCH

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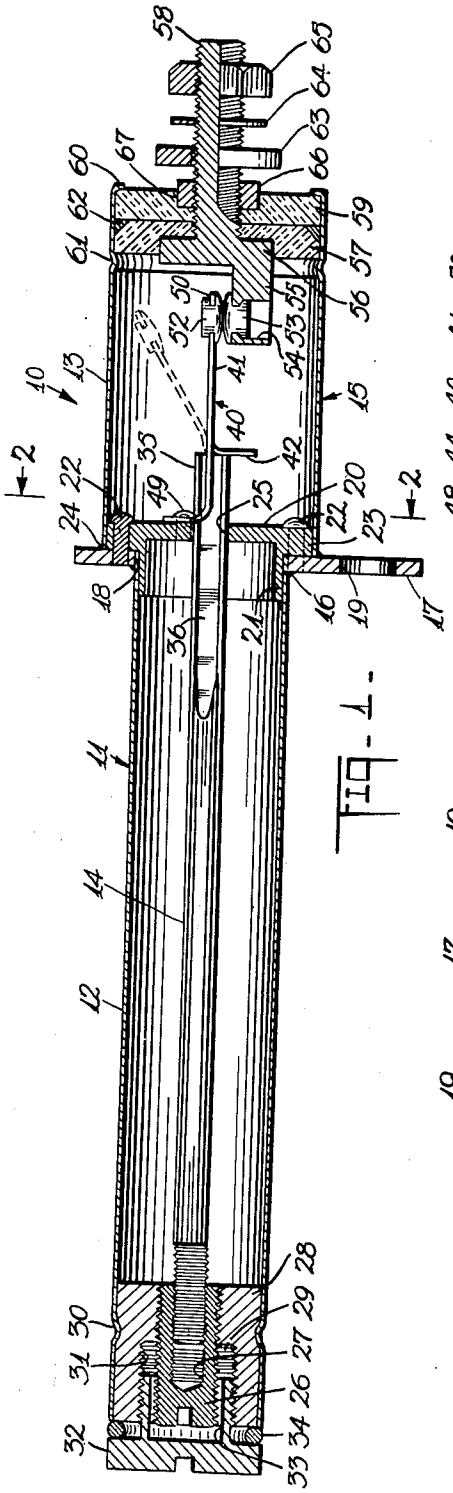


FIG. 1.

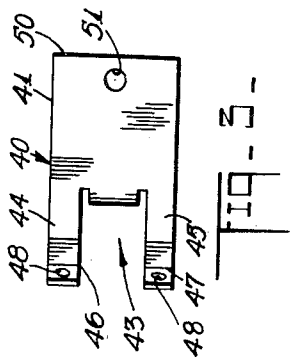


FIG. 3.

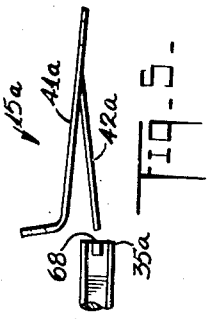


FIG. 5.

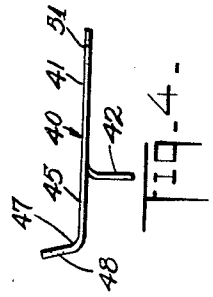


FIG. 4.

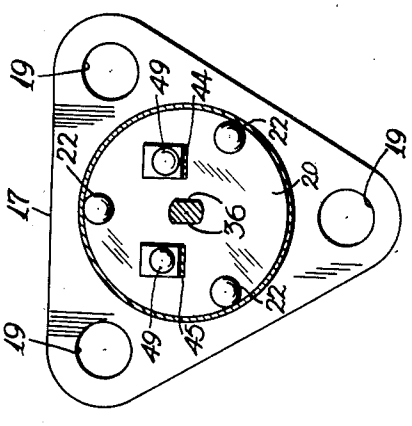


FIG. 2.

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THERMAL SWITCH

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3 Claims. (Cl. 200—137)

Our invention relates to an electrical switch and more particularly to a thermal switch whereby a differential rate of expansion of the metallic parts of the switch will make or break an electrical circuit such as an alarm circuit.

The use of thermal switches for controlling an electrical circuit has for the most part in the past been limited to the use of bimetallic elements in contiguous relation, whereby a given temperature differential will cause the elements to flex and make or break an electrical circuit. This type of switch has a limited application, for it is sensitive to vibration and is mechanically weak.

We have devised a thermal switch that has a cartridge-like metallic shell member and a longitudinally displaced metallic rod member, each member having a different rate of expansion, whereby for a given temperature change, one of the members will actuate a spring contact member to make or break the electrical circuit.

Accordingly it is a primary object of our invention to provide in a thermal switch a sturdy and light weight resilient contact member to obtain a positive response to temperature changes and which is relatively unaffected by external vibration and shock.

Further objects of our invention are to provide in a thermal switch, a sheet metal contact member, which can be inexpensively manufactured by stamping; to provide a sheet metal contact member that has a wide angle of movement between the open and closed position for a small movement of its actuating member by constructing the axis of pivot in the contact member slightly offset from the line of force exerted by the actuating member; to provide a resilient contact member that is spring biased to make an electrical circuit; to provide a differential means for setting the device to the proper operating temperature thus obtaining a small change in the setting through a relatively large adjustment of the setting device; to provide a thermal switch that is hermetically sealed and completely protected from the entrance of gases or liquids; to provide a thermal switch having a wide degree of adjustment in the temperature range that can be set at the factory or in the field; and to provide a thermal switch which is simple in construction that can be readily assembled, and that can withstand flash temperatures of 2000° F.

We accomplish these and other objects and obtain our new results as will be apparent from the device described in the following specification, particularly pointed out in the claims, and illustrated in the accompanying drawing, in which—

Fig. 1 is a longitudinal cross sectional view of our thermal switch.

Fig. 2 is a cross sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a plan view of the contact member.

Fig. 4 is a side elevation view of the same.

Fig. 5 is a side elevation of a modified form of our contact member.

In the drawing, reference numeral **10** designates generally our thermal switch comprising a housing **11** constructed of two hollow sleeves **12** and **13** positioned end-to-end, which house respectively a low expansion metal actuating member **14** and a contact unit **15**. We prefer to construct the sleeves of stainless steel because of its relative light weight and excellent non-corrosive properties, but it is understood that there are other metals having a high coefficient of expansion which may be used to practice this invention.

The inner end of sleeve **12** is brazed or welded at **16** to a triangularly shaped stainless steel mounting flange **17** containing a central aperture **18**. Apertures **19** are provided at each corner of the mounting flange **17** for attachment by bolts, to a supporting structure, not shown, which forms the ground connection for one side of the electrical circuit. A supporting plate **20** having a longitudinally extending aligning shoulder **21** supported within the bore of sleeve **12**, is secured to the mounting flange **17** by rivets **22** passing through the portion **23** of the plate **20** extending transversely beyond the end of sleeve **12**.

The sleeve **13** is mounted over the periphery of the supporting plate **20** and is brazed or welded at **24** to the mounting flange **17**. The supporting plate **20** is provided with a central aperture **25** to slidably receive and guide the actuating member as will be described later.

The actuating member **14**, may be in the form of a rod and constructed of a low expansion metal, such as "Kovar" manufactured by Stupakoff Ceramic & Mfg. Co., and is threaded on its outer end to a stainless steel calibrating adjusting screw **26**, containing the tapped recess **27**. The adjusting screw is threadedly mounted to stainless steel nut **28** having a recessed portion **29**. The nut is grooved to permit crimping at **30** within the bore of sleeve **12** and brazed or welded thereto. The recess **29** of the nut is internally threaded at **31** to receive the threaded stainless steel sealing nut **32** having a central recess **33** to accommodate the head of adjusting screw **26**, and hermetically seals this end of the thermal switch through a copper sealing gasket **34**.

The inner end **35** of the actuating member **14** slidably extends through aperture **25** in the supporting plate **20** being guided therein to engage the contact unit **15**. Opposite sides of the actuating member are flattened as at **36**, conforming to the shape of the aperture **25** to prevent a rotational movement, but which will permit a sliding movement therethrough.

The contact unit **15** comprises a resilient contact member **40** illustrated in detail in Figs. 3 and 4, which is preferably constructed of flat spring steel readily stamped from sheet stock. The contact member **40** comprises a longitudinal body portion **41** having an integral central tongue portion **42** struck down substantially normal to the body portion and which is to be contacted and abutted by the free end **35** of the actuating member. The tongue **40** may be stamped simultaneously with the formation of the contact member, the recessed portion **43** in the body formed by the depressed tongue accommodates the free end **35** of the actuating member and permits the body portion **41** of the contact member to be longitudinally aligned with the actuating member. The remaining spaced leg portions **44** and **45** adjacent the recessed portion **43** are bent upwardly at **46** and **47** respectively and provided with apertures **48** to receive a rivet **49** for attachment to the supporting plate **20**.

The free end **50** of the contact member is provided with aperture **51** into which is riveted a silver contact button **52**. A counterpart contact button **53** is riveted in drilled aperture **54** of the terminal stud **55** which has a head portion **56** non-rotatably locked in insulating block **57**. Threaded end **58** of the stud **55** extends through insulating blocks **57** and **59** in contiguous relation, which blocks are secured within sleeve **13** by bending over the end of the sleeve at **60** and indenting at **61**. The blocks **57** and **59** are hermetically sealed to the sleeve **13** at **62**. Mounted on the threaded terminal stud are flat washer **63**, locking washer **64** and nut **65** to which is attached and secured a conductor to complete the circuit with the ground connection at mounting flange **18**. A locking nut **66** is set within recess **67** in insulating block **59** to insure a hermetically sealed unit.

The contact member **40** is spring biased to a closed position, as shown in solid lines in Fig. 1, contact buttons **52** and **53** engaged to make the electrical connection. This bias is accomplished by forming the leg portions **46** and **47** at an obtuse angle with respect to the body portion **41** when in an unattached position as shown in Fig. 4.

When the thermal switch is in the closed position, the body portion **41** containing the tongue portion **42** is sub-

stantially aligned along the longitudinal center line of the actuating member **14**.

The thermal switch operates through the differential rate of expansion of the stainless steel sleeve **12** and actuating member **14**. The distance that the contact buttons **52** and **53** are spaced apart as illustrated by the dashed position in Fig. 1 is in direct relation to the temperature range between the normal temperature and the operating temperatures for which the switch has been adjusted in any particular installation.

With the switch set at a given operating temperature, the normal position of the contact member **40** is shown in the dashed line position in Fig. 1 through the abutment of the adjusting member **14** with the tongue portion **42**. The contacts are out of engagement and the circuit is open. The sleeve **12** is always mounted in a position where it is exposed to any temperature change. As the temperature rises above the normal operating conditions the sleeve **12** and actuating member **14** expand, but as the sleeve **12** expands at a faster rate than the actuating member, the actuating member withdraws from the sleeve **13**, starting to release the pressure exerted on the tongue **42** of the contact member. When the temperature reaches the value to which the switch has been set, the actuating member has withdrawn to fully release the resilient contact member, permitting engagement of the contact buttons **52** and **53** to complete the electrical circuit. The actuating member is not in engagement with the contact member and the contact member is free of any external force thereon. The circuit may be wired to indicate a warning or set in alarm.

As the operating temperature lowers, the reverse operation occurs to break the electrical circuit and restore the switch to a normal open condition.

A different construction of our contact member is shown in Fig. 5 in which the contact member **15***a* is provided with a modified tongue portion **42***a* offset or struck down from a position close to the contact button and at an acute angle with the body **41***a* of the contact member. The free end **35***a* of the actuating member **14** may be provided with a groove **68** to receive the free end of the tongue portion **42***a*. With this construction a more accurate control of the contact member is obtained to minimize the vibration, and a larger ratio of movement of the contact member to that of the actuating member is achieved.

The switch may be adjusted at the factory or in the field. Removal of the sealing nut **32** will give access to the adjusting screw **26**. A counterclockwise rotation of the adjusting screw will increase the operating temperature by extending the actuating member further into the sleeve **13**, forcing the contact button **52** further out of engagement with the fixed contact button **53** and thus requiring a greater distance for the contact member **40** to return to the engaging position to make the circuit.

To increase the accuracy to which the operating temperature can be adjusted, we provide a differential thread on the adjusting screw **26**. This is accomplished by using slightly different pitches on the internal and external threads of the adjusting screw. Thus a large angular adjustment of the screw **26** results in an extremely small longitudinal movement of the actuating member **14**.

By the use of our thermal switch we obtain a contact unit that is simple, rugged and economically constructed, that is easily assembled, that is free from calibration difficulties which might be imposed by external vibration and shock; that has a design to permit a compact switch which is hermetically sealed, and which can be adjusted at the factory or in the field through a wide range of operating temperature.

We have thus described our invention, but we desire it understood that it is not confined to the particular forms or uses shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of our invention, and, therefore, we claim broadly the right to employ all equivalent instrumentalities coming within the scope of the appended claims, and by means of which, objects of our invention are attained and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to attain these objects and accomplish these results.

We claim:

1. In a thermal switch having a chamber, a thermostatic element, a contact member, an intermediate contact member operable by said thermostatic element to engage the first contact member, said intermediate contact member comprising a flexible sheet metal stamping having a side with a fixed support and an oppositely positioned moving side provided with a contact, said intermediate member having a plurality of longitudinal slots extending from the side with the fixed support forming outside and intermediate tongues, the outer pair of which is attached to the fixed support, the intermediate tongue being bent to engage the end of the thermostat, causing the intermediate member to be flexed, said thermostatic element causing the intermediate member to open and close the circuit under varying thermal conditions.

2. The intermediate member of claim 1, wherein the free end and contact of the intermediate member extends linearly in the same direction as the longitudinal axis of the thermostatic member when the contacts are engaged.

3. The intermediate member of claim 1, wherein the intermediate tongue and the outer tongues are bent in opposite directions.

References Cited in the file of this patent

UNITED STATES PATENTS

634,911	Richardson	Oct. 17, 1899
1,111,652	Fryling	Sept. 22, 1914
1,123,277	Haagn	Jan. 5, 1915
1,330,892	Moloney	Feb. 17, 1920
1,406,476	Morelli	Feb. 14, 1922
1,483,787	Dixon	Feb. 12, 1924
1,643,575	Clark	Sept. 27, 1927
1,819,271	Sorensen	Aug. 18, 1931
2,183,745	Huber	Dec. 19, 1939
2,211,412	Filko	Aug. 13, 1940
2,496,229	Parkhurst	Jan. 31, 1950
2,550,188	Darling	Apr. 24, 1951