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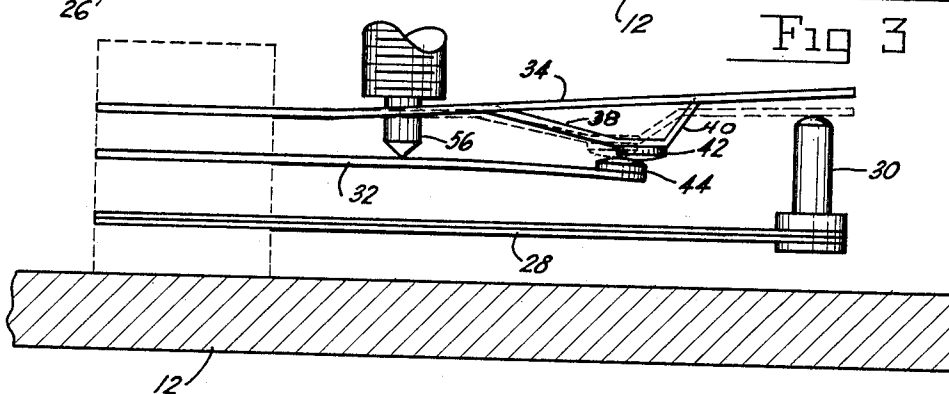
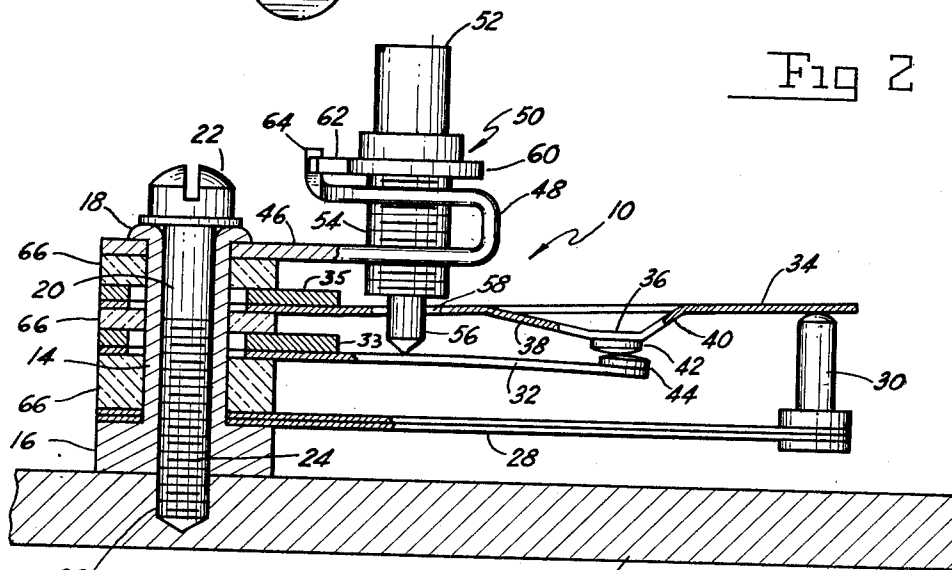
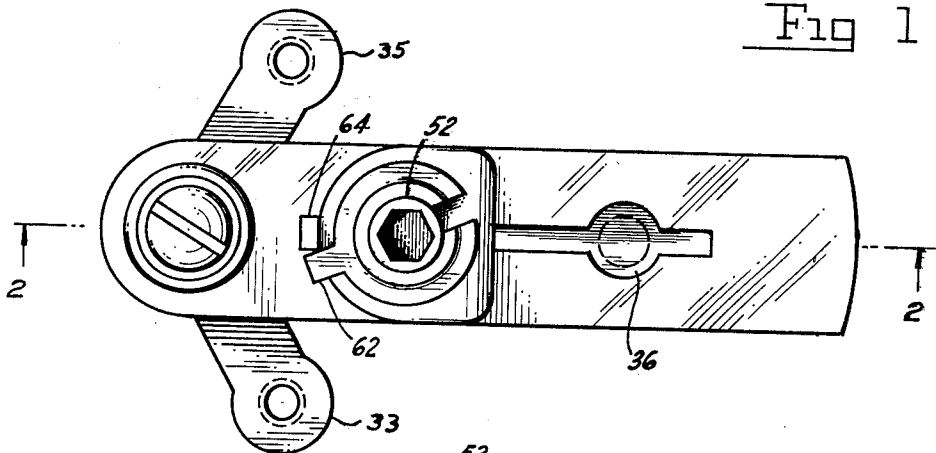
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POSITIVE OPENING AND CLOSING SWITCH WITH WIPING ACTION

Filed Sept. 2, 1953

2 Sheets-Sheet 1



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Fig 4

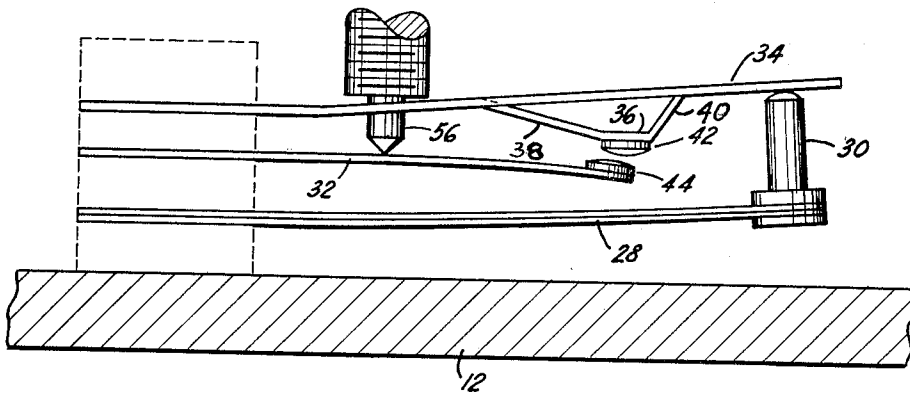
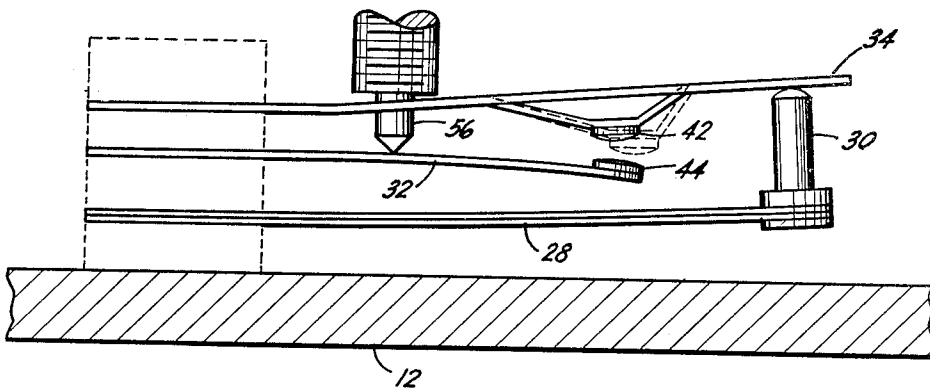


Fig 5



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POSITIVE OPENING AND CLOSING SWITCH WITH WIPING ACTION

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This invention relates in general to electric switches, and pertains more particularly to a switch especially adapted for use in conjunction with the thermoelectric control of appliances and the like.

In the control of heating circuits, and in other instances where the switch contacts are subjected to successive or repetitious make and break conditions, it has been found that the life of the contacts can be prolonged by establishing what is commonly termed a "wiping action." The wiping action or relative movement of the contacts while in engagement is responsible for the effective dislodgment of dust particles that would otherwise prevent good contact. Also, at times a film is apt to form on the contact surfaces and this film causes poor electrical contact without the aforementioned wiping action. In brief, without any wiping action the contacts of an electrical circuit are prone to become pitted, a condition which progresses until the contacts must be replaced.

While the problem of pitting is well known, its economical solution has not been satisfactorily achieved. Accordingly, one object of the instant invention is to provide an electric switch having a wiping action which is obtained without resort to expensive or complicated structure.

Inasmuch as a firm pressural engagement of the contacts also aids in their preservation, mainly due to the lowering of the electrical surface resistance with a concomitant lessening of heating in the contact area, it is an aim of the invention to provide a switch having positive make and break characteristics as well as the above referred to wiping action.

Another object of the invention is to delay slightly the cycling action of the switch contacts. For example, where the invention is applied to a thermal switch, the thermally responsive element is likely to fluctuate in its movements just at the moment of contact or separation which, without employing the proposed arrangement, would cause the contacts to open and close a number of times before a more stable condition is established. This fluttering action in the past has resulted in the drawing of arcs which over a period of time greatly contributed to the deterioration of the contacts. However, by automatically increasing the contact pressure at the moment of engagement, as envisaged by the present invention, this adverse fluttering is avoided. Also the invention further contemplates an accelerated separation of the contacts once the thermal element has permitted opening thereof, thus obviating any objectionable fluttering during this period.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings:

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Figure 1 is a plan view of the invention in the form of a thermal switch;

Fig. 2 is an elevational view, partly in section, corresponding to Fig. 1, the contacts being shown at the moment of initial contact;

Fig. 3 is a view similar to Fig. 2 but with the parts of the switch structure shown in the relative positions they assume after the contacts have been closed for a relatively short interval of time;

Fig. 4 is an operational continuation of Fig. 3, the contacts having just been separated by the thermally responsive element;

Fig. 5 illustrates the switch after the contacts have remained separated for a relatively short period of time.

Referring now in detail to the drawings, the switch has been designated in its entirety by the reference numeral 10 and for illustration purposes has been exemplified as a thermal switch for controlling the temperature of an electrically heated member 12, which may be a portion of an appliance such as an iron or waffle baker.

To produce a unitary switch structure the switch 10 includes a tubular metallic post 14 equipped with a flange 16 at its lower end and a riveted or staked upper end 18. Passing through the bore of the post 14 is a bolt 20 having a head 22 of sufficient diameter to overlap the upper end 18 of the post and a threaded shank 24 engaging a tapped recess 26 provided in the member 12.

Having one end anchored to the tubular post 14 is a bimetallic member 28, the other or free end of which supports an upstanding stud 30. As will hereinafter become apparent, the metals constituting the bimetal 28 are selected so that when the member becomes heated the stud end will deflect upwardly.

Also included as parts of the switch is a pair of resilient metallic contact arms 32 and 34, each provided with an electrical terminal 33 and 35, respectively, adjacent its anchored end. The arm 34 has a portion thereof stamped or punched so as to form an offset contact support 36 and a pair of struts 38 and 40 integral with the support 36 at one end and with the body of the arm 34 at the other end. On the support 36 is mounted one contact 42 and another contact 44 is mounted on the free end of the arm 32. By making the strut 38 of greater length than the other strut 40 the contact 42, as will presently be better understood, is theoretically constrained to traverse a somewhat arcuate path when sufficient current courses through the contacts 42 and 44. In this connection, it will be appreciated that the combined cross-section of the struts 38 and 40 is limited with respect to the magnitude of current intended to pass through the contacts 42 and 44 so that substantial expansion and contraction of the struts will ensue upon engagement and disengagement of the contacts. Although in the preferred arrangement, only two oppositely directed struts are contemplated, as the sole connection between the arm 34 and support 36, it will be recognized that additional struts might be utilized as long as the expansion thereof on one side of the support 36 is greater than that which takes place on the opposite side of said support, for it is by reason of the unequal expansion that two dimensional movement of the contact 42 relative to the contact 44 is obtained.

In order to adjust the switch 10 for operation at various temperatures, a bracket 46 is supported at one end by the tubular post 14, the other end of which is reversely bent at 48 for the purpose of mounting an adjusting screw 50 including a manipulating knob 52, a threaded shank 54 and a lower tip 56 of insulating material extending downwardly through an aperture 58 in the arm 34 into abutting relation with the other arm 32. Also, the screw 50 may include a collar 60 having a radially extending

ear 62 engageable with an upstanding stop 64 on the end 48 to limit rotation of the screw in either direction. By virtue of this arrangement the turning of the knob 52 is instrumental in positioning the contact 44 with respect to the contact 42. For the purpose of insulating the various members 28, 32, 34 and 46 supported on the tubular post 14, these members have disposed therebetween several insulating washers 66.

Assuming a typical operational sequence, attention is first directed to Fig. 2 in which the bimetal 28 has straightened sufficiently to permit the resiliency of the arms 32 and 34 to bring the contacts 42 and 44 together. In this "make" condition current will flow through the struts 38 and 40 and owing to the relatively small cross-section of these struts they will begin to expand due to the heat generated therein by the current. However, since the strut 38 is longer than the strut 40 it will have a greater amount of expansion and the contact 42 will tend to move downwardly and to the right as viewed in Fig. 2. Actually, in the exemplified embodiment, the arm 34 is more resilient so that it moves upwardly once the contacts 42 and 44 have met, but it will be observed by an inspection of Fig. 3 that the movement of the contact 42 to the right has produced a wiping action between the two contacts. For the purpose of ready comparison, the relative position of arm 34 (Fig. 2) has been superimposed upon that of Fig. 3 in phantom outline.

Once the contacts 42 and 44 have remained closed for a time sufficient to permit the current flowing therethrough to heat the member 12, the bimetal 28 will deflect upwardly and in Fig. 4 this deflection has reached the stage where the stud 30 causes the contacts to separate. The interruption of current results in a cooling off of the struts with an accompanying contraction thereof, Fig. 5 illustrating the struts after a short lapse of time which is sufficient to return the struts to their initial length, i. e., the length pictured in Fig. 2, although such period of time has not permitted the member 12 nor the bimetal 28 to cool to the state shown in Fig. 2. Here again, the phantom outline position affords a facile means of comparing the contact movement between Figs. 4 and 5.

From the foregoing description, it can be readily seen that a good wiping action occurs between the two contact positions occupied by the contacts in Figs. 2 and 3, and that once contact has been initially established in Fig. 2, an increase in contact pressure results due to the vertical component of strut expansion, the struts 38 and 40 being arranged at an acute angle with respect to the general plane of the arm 34 to accomplish this end. Of course, the difference in expansion between the two struts is responsible for the horizontal displacement component of the contact 42. From Figs 4 and 5, it will be discerned that the reverse action takes place upon separation of the contacts, there being an accelerated separation of the contacts by reason of the contraction of the struts 38 and 40 after they have initially separated.

It might be specifically mentioned in conclusion that it is within the purview of the invention to utilize struts corresponding to those labeled 38 and 40 having equal lengths but different cross-sectional areas, whereby the electrical resistance is made different by virtue of the different cross-section in contradistinction to the differing lengths as illustrated. In this latter situation the strut having the lesser cross-section and thus greater resistance would heat to a higher temperature and would therefore expand lengthwise more than the other strut to produce the desired wiping action. Still further, in some instances it might be advantageous to have one strut both longer and of less cross-section than the other, thereby providing an even more pronounced wiping action. Also, it is within the contemplation of the invention, although not preferred because of increased manufacturing costs, to

produce struts having different expansion characteristics by utilizing different metals for the struts 38 and 40.

As many changes could be made in the above construction and many apparently widely different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. A contact structure comprising an electrically conductive element, a contact offset from said element, and means mounting said contact for movement relative to said element, said means including a pair of current conducting struts inclined at an angle with respect to said element and capable of unequal lengthwise expansion upon the passage of sufficient current therethrough.

2. A contact structure comprising an electrically conductive element, a contact offset from said element, and means mounting said contact for movement relative to said element, said means including a pair of current conducting struts having different values of electrical resistance to render said struts capable of unequal lengthwise expansion upon the passage of sufficient current therethrough.

3. A contact arm subassembly for a thermal switch, said subassembly comprising an electrically conductive contact arm, a contact offset from the plane of said arm, and means mounting said contact for movement relative to said arm, said means including a pair of current conducting struts of unequal length inclined at an angle with respect to said arm and capable of lengthwise expansion upon the passage of sufficient current therethrough.

4. A contact arm subassembly for a thermal switch, said subassembly comprising an electrically conductive contact arm, a contact support offset from the general plane of the arm, a contact on said support, and a pair of oppositely directed struts joined to the support and said arm, the total cross-section of said struts being limited with respect to the current passing through the contact and one strut being of greater length than the other.

5. A thermal switch comprising first and second contact arms having first and second contacts respectively adapted to engage and disengage each other, thermally responsive means engaging and moving one arm with respect to the other and thereby engaging and disengaging said contacts in response to predetermined temperature changes, the first arm having a contact support on which the first contact is mounted, and a pair of inclined struts arranged at an obtuse angle with respect to each other constituting the sole connection of the contact support to the contact arm and having a cross-section limited with respect to the current passing through the contacts for causing substantial expansion and contraction of the struts by heating and cooling in response to the changes in current carried by the struts on engagement and disengagement of the contacts, one of said struts being longer than the other to cause a greater amount of expansion of said longer strut.

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