

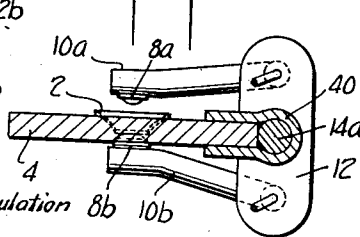
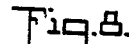
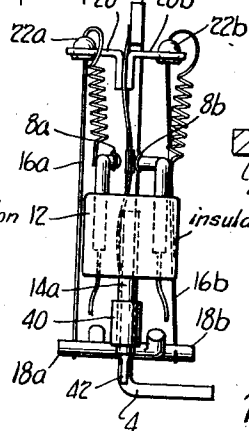
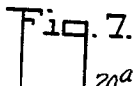
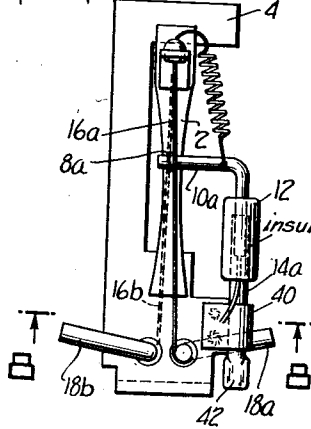
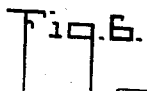
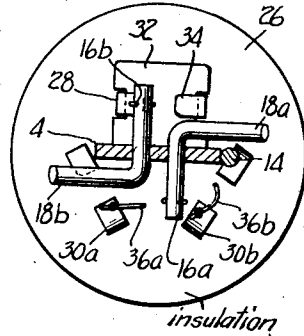
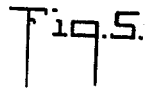
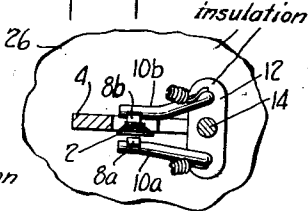
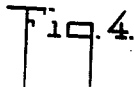
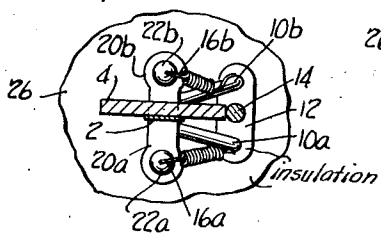
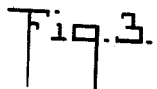
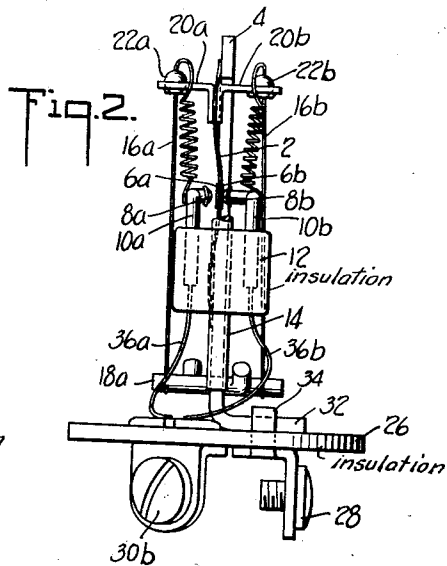
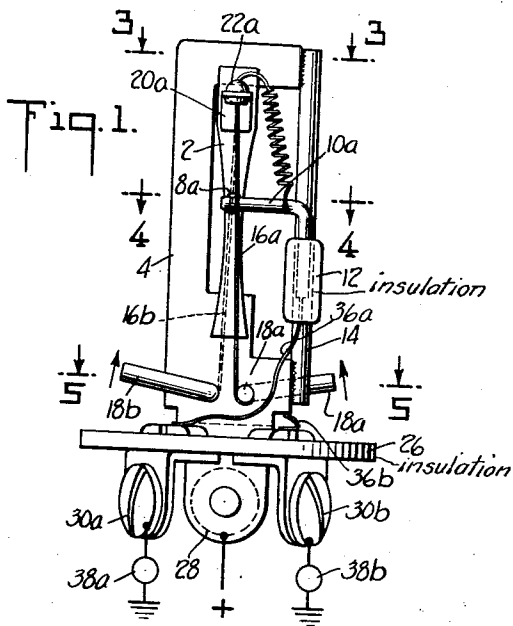
Sept. 23, 1941.

J. SCHMIDINGER
ELECTRIC SWITCH DEVICE

2,256,499

Filed Nov. 24, 1939

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 9.

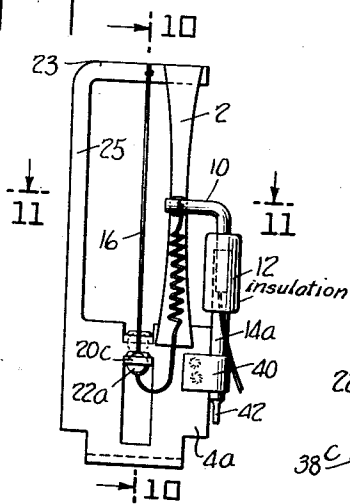


Fig. 10.

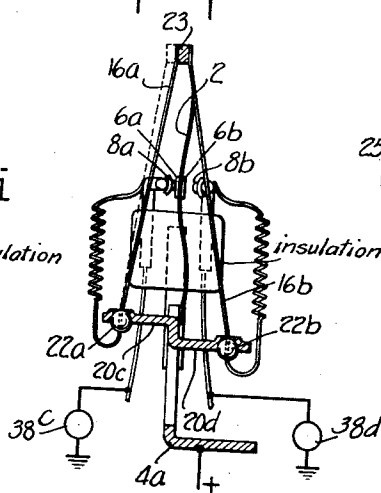


Fig. 11.

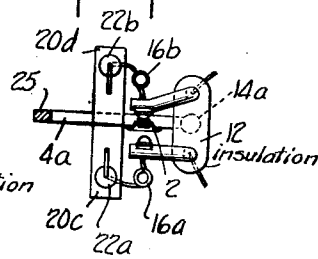


Fig. 12.

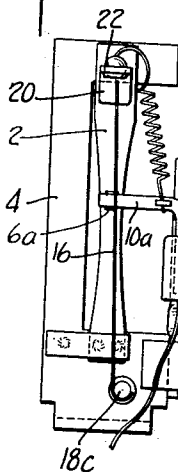


Fig. 13.

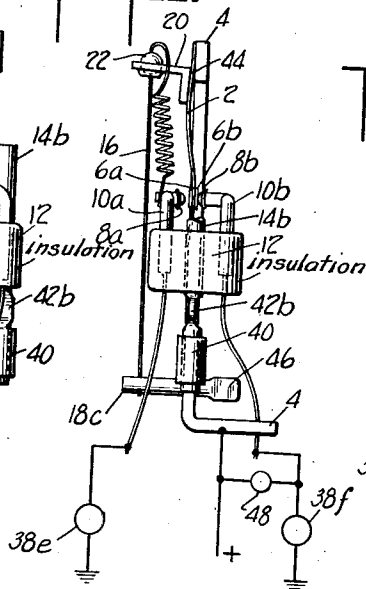
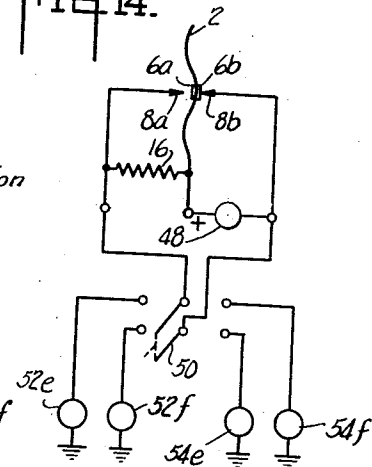


Fig. 14.



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2,256,499

ELECTRIC SWITCH DEVICE

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Application November 24, 1939, Serial No. 305,906

17 Claims. (Cl. 200—113)

The present invention relates to thermo-responsive electric switch devices and particularly switch devices embodying thermally controlled buckling vanes for controlling circuits.

One object of the invention is an improved switch device of the above indicated character which is characterized by its simplicity in construction, adjustability after assemblage and practicability for commercial construction.

A further object of the invention is a device of this character which is particularly adapted for use as a flasher for automobile signal lamps.

Further objects of the invention and the various novel features thereof will become apparent as the description proceeds.

For an understanding of the invention reference may be had to the accompanying drawings of which

Fig. 1 is a side view of a thermo-responsive switch embodying the invention;

Fig. 2 is a view of the switch of Fig. 1 taken at right angles thereto;

Figs. 3, 4 and 5 are horizontal sectional views taken along the lines 3—3, 4—4 and 5—5 respectively of Fig. 1;

Fig. 6 is a side view of a switch embodying another form of the invention;

Fig. 7 is a view of the switch of Fig. 6 taken at right angles thereto;

Fig. 8 is an inverted horizontal sectional view taken along the line 8—8 of Fig. 6;

Fig. 9 is a side view of a switch embodying still another form of the invention;

Fig. 10 is a sectional view of the switch of Fig. 9 taken along lines 10—10 of Fig. 9;

Fig. 11 is a horizontal sectional view taken along the line 11—11 of Fig. 9;

Fig. 12 is a side view representing a further embodiment of the invention;

Fig. 13 is a view of the device of Fig. 12 taken at right angles thereto; and

Fig. 14 is a circuit diagram illustrating one use of the device of Figs. 12 and 13.

The movable element of the new device of Figs. 1 to 5 inclusive comprises a vane 2 which is secured at its opposite ends to upper and lower arms of a generally C-shaped frame 4. The vane 2 is longer than the distance between the points at which its ends are secured to the frame arms and hence its central portion buckles to one side or the other of the plane of the frame. This central portion of the vane 2 is preferably made narrower to weaken the same. Contacts 6a and 6b are secured to opposite sides of the weakened

portion of the vane for cooperation with a pair of fixed contacts 8a and 8b.

Fixed contacts 8a and 8b are carried by arms 10a and 10b respectively mounted in an insulating block 12 of glass or the like which is fused about a support rod 14; rod 14 being welded or otherwise secured to frame 4. The vane 2 is so secured to the frame that it is not under any inherent constraint to either position of equilibrium but its movement from one contact closing position to the other is controlled by the tension of a pair of wires 16a and 16b as hereinafter explained. Wire 16a which is secured at one end to a rod 18a extending laterally from the lower part of the frame 4 extends upwardly through an eyelet in a resilient bracket 20a and then downwardly to arm 10a to which its other end is secured. In order to insulate the wire 16a from the bracket 20a and frame 4, a bead 22a of glass or other insulating material is fused about the wire 16a at the point of emergence from the eyelet in bracket 20a. The bead 22a being slightly larger than the eyelet, rests partially therein and serves as combined anchorage and insulation for the wire.

The wire 16a is so mounted that the length thereof between rod 18a and bracket 20a when cold is under a tension, tending, through the medium of resilient bracket 20a, to constrain the vane 2 into the bowed position indicated in Fig. 2.

Wire 16b is connected and mounted similarly to wire 16a and the tension thereof is made such as to tend to move the vane 2 into the oppositely bowed position, namely into the position where contacts 6a and 8a are in engagement. As shown the lower end of wire 16b is secured to a rod 18b extending laterally from the lower part of frame 4 and the other end of the wire, after passage through an eyelet in resilient bracket 20b, is connected to arm 10b carrying the fixed contact 8b. Bead 22b fused about the wire 16b serves to anchor the wire and to insulate it from the bracket.

In order to adjust the tension of wires 16a and 16b the rods 18a and 18b are rotatably mounted in the frame 4 as shown best in Fig. 5. Each rod, after passage through the frame is bent at right angles to provide a leverage for rotation of the rod. The rods have a relatively close frictional fit within the frame so that the wires may be maintained under tension.

The assembly comprising the frame 4 and parts carried thereby is mounted on a base 26 of insulating material carrying terminals 28, 30a

and 30b on the under side thereof. Terminal 28 is electrically connected with the frame 4 in any suitable manner. For example the frame may have a laterally extending portion 32 and the terminal 28 may have tongues 34 extending through the base 26 and folding over the portion 32 to clamp the frame to the base as well as to connect the frame electrically with the terminal. Terminal 30a is connected, as by a wire 36a, with arm 10a, and terminal 30b is connected, as by a wire 36b, with arm 10b.

The operation of the above described device will now be explained. Assume a source of potential applied to terminal 28, as indicated by the + sign in Fig. 1, and lamps 38a and 38b or other devices to be controlled, connected respectively to terminals 30a and 30b. With the parts as shown in Fig. 2, current will then flow from the source through terminal 28 and frame 4 to the vane 2 and contact 6b carried thereby. Contact 6b being in engagement with contact 8b the current will flow through these contacts, arm 10b, wire 36b to terminal 30b and thence through the lamp 38b to ground or the negative terminal of the source. This current will accordingly light the lamp 38b. At the same time a current will flow from terminal 28 through frame 4, rod 18a, wire 16a, arm 10a and wire 36a to terminal 30a and the lamp 38a to ground. This current, because of the inclusion of the resistance of wire 16a in the circuit thereof, will be less than that through lamp 38b and will be preferably insufficient to cause illumination of lamp 38a. This latter current, however, will heat wire 16a and cause it to expand and reduce its tension upon the bracket 20a and vane 2. As no current flows through wire 16b, the tension thereof is not changed. Vane 2 which is subjected to substantially equal and opposite tensions by wires 16a and 16b when no current is supplied to the device, is thus become subject to unbalanced tensions and consequently the central part thereof snaps over to the opposite position from that illustrated in Fig. 2. In this new position, wire 16a is shunted by contacts 6a and 8a, wire 16b is heated by current flowing therethrough and lamp 38a is lighted while reduced current flows through lamp 38b. Vane 2 remains in this position until the contraction of wire 16a and expansion of wire 16b causes it to snap back into the initial position. The device will thus continue to operate to cause alternate lighting of lamps 38a and 38b so long as the source of potential is connected thereto.

Because of the provision of the two wires 16a and 16b acting oppositely upon the movable element the period of illumination of each lamp will be the same irrespective of voltage changes. This is of particular value when the device is used to control automobile signal lights as automobile battery voltages fluctuate widely. The provision of means for adjusting the tension of the wires is also of value not only for initial adjustment to insure balance, but also for preventing strain in the wires during periods of non use of the device. For example, while the devices are stored on dealers' shelves, the tension of the wires could be released by means of the lever arms of rods 18a and 18b and strain in the wires thus avoided. Lateral adjustment of the position of the fixed contacts can be effected by slightly bending rod 14.

The device of Figs. 6, 7 and 8 differs from that above described in the support means for

the fixed contacts 8a and 8b. The insulating block 12 carrying the arms 10a and 10b is mounted on a support 14a which, instead of being secured at its ends to the frame 4, as is the rod 14 of Fig. 1, is rotatably mounted in a sleeve 40. The sleeve 40 fits snugly about the rod 14a so as to frictionally hold the same against vertical movement, and is welded or otherwise secured to the frame 4. The portion of rod 14a extending below the sleeve 40 is flattened to provide a gripping portion 42 by means of which the rod may be turned to adjust the position of the contact carrying arms. The operation of the device of Figs. 6 to 8 is the same as that of Figs. 1 to 5 and requires no further explanation.

For simplicity, the insulating base and terminal carried thereby have been illustrated only in connection with the first embodiment of the invention. It will be understood, of course, that in each embodiment a suitable insulating base and terminals for the frame and wires are provided.

In Figs. 9, 10 and 11, a relatively simpler constructed device representing the preferred embodiment of the invention is illustrated. In this embodiment of the invention, the separate resilient brackets 20a and 20b are eliminated, and the temperature responsive resistance wires 16a and 16b are insulatedly anchored from eyelets in outstanding arms 20c and 20d near the base of the device. The C-shaped frame 4a is made with reduced and resilient upper arm 23 and reduced side portion 25 and the arms 20c and 20d are stamped out from the lower portion of the frame. With this arrangement, one end of each wire 16a and 16b is secured directly to the resilient upper arm 23 of the frame 4a and the insulating beads 22a and 22b, engaging the eyelets in arms 20c and 20d maintain the wires under tension and insulate them from the frame. The other ends of the wires are connected to arms 10a and 10b as in the embodiments of the invention heretofore described. As in the device of Figs. 6 to 8, the block 12 supporting the arms 10a and 10b is mounted on the rotatable rod 14a for lateral adjustment of the fixed contacts.

Adjustment of the tension of the wires may be conveniently effected by bending the pressed out arms 20c and 20d of the frame 4a.

If a source of electromotive force is connected to the frame and lamps 38c and 38d or other devices to be controlled are connected to the fixed contacts, as indicated diagrammatically in Fig. 10, the alternate expansion and contraction of the wires 16a and 16b shifts the resilient frame arm 23 back and forth from the full to dotted line position indicated in Fig. 10, the expansion and contraction of the wires, being caused as in the device of Fig. 1, by the intermittent shunting of each wire by the closure of first one pair of contacts and then the other. In the position indicated in Fig. 10, with contacts 6a and 8a in engagement, current flows from the source through the frame 4a and vane 2, contacts 6a and 8a to lamp 38c, shunting wire 16a. A reduced current flows from the source through the frame 4a, vane 2, wire 16b to arm 10b and lamp 38d. The consequent contraction of cold wire 16a and expansion of heated wire 16b snaps the vane 2 to the opposite position and swings the frame arm 23 to the dotted line position until the reverse operation occurs.

In Figs. 12 and 13 a device having but one expansible wire, 16, is illustrated. In this em-

bodiment of the invention, the vane 2 adjacent its point of connection with the upper arm of the frame 4 is bent or constrained outwardly, as indicated at 44 (Fig. 13) which gives it a bias toward the position in which contacts 6a and 8a are in engagement. The tension of wire 16, when cold, is such as to overcome this bias and cause the vane 2 to snap into the position indicated in Fig. 13, in which contacts 6b and 8b are in engagement. In this position, if a source of potential is connected to the frame 4, current flows through wire 16 causing it to expand and release its tension. Thereupon the vane snaps back to cause engagement of contacts 6a and 8a with consequent shunting and cooling of wire 16. Wire 16 is mounted and its tension adjusted similarly to wires 16a and 16b of Figs. 1 to 8.

The wire passes through an eyelet in a rigid bracket 20 from which it is insulated by the bead 22 fused thereon, and is connected at one end to contact carrying arm 10a and at the other end to a rod 18c rotatably mounted in frame 4. A flattened portion 46 on the other end of rod 18c provides a gripping means for adjustment of the tension of the wire. Arms 10a and 10b are mounted in the insulating block 12 carried by the vertical rod 14b. Rod 14b is journaled in the sleeve 40 secured to frame 4 and is provided with a gripping surface 42b between the block 12 and sleeve 40.

The device of Figs. 12 and 13 may be advantageously employed in a circuit such as that diagrammatically illustrated in Fig. 13 as including a pilot lamp 48, connected across contacts 6b and 8b, and lamps 38e and 38f connected respectively to contacts 8a and 8b, the source of potential being connected as before to the frame 4. Pilot lamp 48 is so chosen that it will light with but small current therethrough whereas lamps 38e and 38f require substantially the full voltage of the source. Consequently when the contacts 6b and 8b are in engagement, lamp 38f is lighted, pilot lamp 48 is shunted and lamp 38e, because of the inclusion of the resistance wire 16 in its circuit, is not lighted. Upon expansion of wire 16, however, the constraint in the vane 2 causes it to snap over into position to open contacts 6b and 8b and to close contacts 6a and 8a. In this position lamp 38e is lighted, pilot lamp 48 is lighted and lamp 38f, because of the inclusion of the resistance of lamp 48 in its circuit, is not lighted. Thus the pilot lamp flashes simultaneously with lamp 38e. If lamp 38f burns out, the circuit of the pilot lamp is opened and hence that lamp will not flash. If lamp 38e burns out, current will not flow through wire 16, hence the wire will not expand and contacts 6b and 8b will remain in engagement shunting the pilot lamp. Consequently the pilot lamp operates to indicate the condition of the signal lamp circuit; the pilot lamp failing to light if either signal circuit is open.

In Fig. 14 a circuit substantially similar to that of Fig. 13 is diagrammatically indicated. In this circuit the wire 16 and contacts 6a, 6b, 8a and 8b are conventionally shown and all structure but the vane 2 is omitted. A double pole double throw switch 50 is shown with its blades connected to the fixed contacts, its left terminals connected to a pair of lamps 52e and 52f and its right terminals connected to a pair of lamps 54e and 54f. Lamps 52e and 52f might be the left turn signal lamps and lamps 54e and 54f the right turn signal lamps on a truck or passenger car

while pilot lamp 48 might be on the dashboard or otherwise located for visibility by the driver of the car.

The operation of the circuit of Fig. 14 will be readily understood from the description already given of the operation of Fig. 13. When switch 50 is thrown to the left, lamp 52f is lighted when contacts 6b and 8b are in engagement and is extinguished when vane 2 snaps to the other position to light lamp 52e and pilot lamp 48. Similarly when switch 50 is thrown to the right, lamp 54f is lighted in one position of the vane and extinguished when lamp 54e and the pilot lamp 48 are lighted. Thus the flashing of lamp 48 occurs irrespective of the position of the switch and the lamp is extinguished if any of the signal circuits are opened. It thus indicates to the driver whether or not the signal lights are operating.

The invention has now been described in connection with four embodiments thereof and circuits in which the devices may be advantageously utilized have been indicated. In each embodiment of the invention the thermal switch includes a movable element controlled in response to the expansion and contraction of a resistance wire which is supported under tension between the upper and lower arms of a C-shaped frame member. In the devices of Figs. 1 to 8 inclusive, the resilient connections between the wires and vane protect the wires from undue strain or stretching when the device is not in use and both wires are cold. In the device of Figs. 9 to 11 inclusive, the resiliency of the upper frame arm serves the same purpose. In the single wire device of Figs. 12 and 13 the position of the vane when the device is not in use is that in which it is held by the tension of the wire and hence resilient anchorage of the wire is not required. In each embodiment of the invention the resistance wire is insulatedly anchored on the frame by means of a bead of glass or the like sealed thereon and in each embodiment of the invention means are provided for adjusting the tension of the resistance wire. Means have also been provided for laterally adjusting the positions of the fixed contacts cooperating with contacts carried by the movable member and devices having two resistance wires of balanced tension as well as a device with but one resistance wire have been described. Obviously various other arrangements might be employed and various changes in details of construction might be made without departing from the spirit of the invention as defined by the appended claims.

I claim:

1. An electric switch device comprising in combination a frame, a buckling member of spring material operative to two different buckling positions and rigidly fixed at both ends to said frame, a pair of contacts carried by said member, a pair of fixed contacts one positioned to be engaged by one of said first mentioned contacts in one buckling position of said member and the other positioned to be engaged by the other of said first mentioned contacts in the other buckling position of said member, support members for said fixed contacts, a block of insulating material fused about said support members, said block being carried by said frame, and thermoresponsive means controlling said buckling member to cause it to snap from one buckling position to the other.

2. A switch device according to claim 1 where-
in said block is rotatably mounted on said frame

whereby the lateral position of said fixed contacts relative to said buckling member may be adjusted.

3. A switch device according to claim 1 wherein said thermo-responsive means comprises a pair of expansible resistance wires, one of said wires being shunted by said contacts in one position of said spring member and the other of said wires being shunted by said contacts in the other position of said spring member, said wires being under tension and so connected with said spring member that the tension of each when cold, is sufficient to move said member into a position where the other wire is shunted.

4. An electric switch device comprising in combination a frame member having a resilient upper arm and a lower portion, a flat spring member secured to the upper arm and lower portion of the frames with its central portion bowed from the plane of the frame, the lower portion of said frame having arms bent out at right angles to the plane of the frame and each provided with an eyelet near the extremity thereof, a pair of expansible resistance wires each secured at one end to the upper arm of said frame and each passing through an eyelet in one of said arms, fixed contacts positioned on opposite sides of said spring member and each connected to the other end of one of said wires, and insulating beads fused about said wires and engaging the underside of said arms to insulate the wires therefrom and to apply tension to said wires.

5. The device according to claim 4 including an insulating mounting for said fixed contacts and means for rotating said mounting to adjust the lateral position of said fixed contacts.

6. A device of the character described comprising in combination, a buckling member of spring material operative to two different buckling positions of equilibrium and rigidly fixed at both ends, a pair of expansible resistance wires controlling movement of said member from one buckling position of equilibrium to the other, adjustable means for tensioning said wires and resilient means connecting an end of each wire to said member, the tension of said wires acting through said resilient means oppositely upon said member, whereby alternate expansion and contraction of said wires causes said member to snap back and forth from one buckling position to the other.

7. A device according to claim 6 including an electrical circuit having fixed contacts positioned to be engaged by said member in each buckling position and including means for laterally adjusting the position of said fixed contacts.

8. A device of the character described comprising in combination, a buckling member of spring material operative to opposite buckling positions, and rigidly fixed at both ends, an expansible resistance wire controlling movement of said member from one buckling position to the other buckling position, and adjustable means for tensioning said wire, said wire at one end being connected to said member adjacent one end thereof to apply a constraint thereto tending to cause said member to assume one buckling position, and said member being inherently constrained to assume the opposite buckling position upon expansion of said wire.

9. The device according to claim 8 including a pair of fixed contacts positioned to be engaged by said member, said wire being electrically connected across said member and one of said con-

tacts so as to be shunted in one position of said member, and an electrical circuit connected with said fixed contacts whereby when a source of electro-motive force is connected to said member said wire is intermittently connected in said circuit.

10. An electric switch device comprising in combination a frame, a flat spring element having its ends secured to said frame at points less separated than the length of the element so that the element buckles to one or the other side of the plane of the frame, contacts carried by said element and cooperating fixed contacts positioned for engagement with said first mentioned contacts, an expansible resistance wire having one end electrically connected to said frame and its other end connected to one of said fixed contacts, a resilient member secured to said element adjacent one end thereof and provided with an aperture for passage of said wire therethrough, insulated means for anchoring said wire in said aperture, adjustable means carried by said frame for applying a tension to said wire, tending through said resilient member to snap said spring element into position to engage the contact not connected with said wire, and means acting in opposition to the tension of said wire operable to snap said element into the oppositely bowed position when said wire expands.

11. The device according to claim 10 including a rod rotatably mounted on said frame, a block of insulating material fused about said rod and supporting arms for said fixed contacts fused within said block out of contact with said rod whereby the lateral position of said fixed contacts may be adjusted by rotation of said rod.

12. The device according to claim 10 wherein said last mentioned means comprise a second expansible resistance wire having one end connected to that one of said fixed contacts not connected with the first mentioned wire and having its other end electrically connected with said element, whereby when a source of potential is connected to said element the current through circuits connected to said fixed contacts will be intermittently varied as the element shunts first one then the other of said wires.

13. An electric switch device comprising in combination a frame, a buckling member of spring material operative to two different buckling positions and rigidly fixed at both ends to said frame, contacts positioned to be engaged by said member in different buckling positions, thermoresponsive tensioning means controlling said member to cause it to snap from one buckling position to another and means for adjusting the position of said contacts relatively to said member to vary the spacing therefrom.

14. A switch device according to claim 13 including means for varying the tension exerted upon said member by said thermoresponsive means.

15. An electric switch device comprising in combination a frame, a buckling member of spring material operative to two different buckling positions and rigidly fixed at both ends to said frame, a contact carried by said member, a fixed contact positioned to be engaged by said first mentioned contact in one buckling position of said member and to be out of engagement therewith in the other buckling position of said member, a support member for said fixed contact, a block of insulating material fused about said support member, said block being rotatably mounted on said frame whereby the lateral posi-

tion of said fixed contact relative to said buckling member may be adjusted, and thermo-responsive means controlling said buckling member to cause it to snap from one buckling position to the other.

16. An electric switch device comprising in combination, a frame member having a resilient arm at one end, a flat spring member secured to said arm and to the other end of said frame, the other end of said frame having a portion bent out at an angle to the plane of the frame and provided with an eyelet near the extremity thereof, an expansible resistance wire secured at one end to said resilient arm and passing through said eyelet, a fixed contact positioned on one side of said spring member and connected to the other end of said wire, an insulating bead fused about said wire and engaging the under side of said bent out portion of the frame to insulate the wire therefrom and to apply tension to said wire.

17. A device of the character described comprising in combination, a frame, a flat spring element having its ends secured to said frame at points less separate than the length of the element so that the element buckles to one or the other side of the plane of the frame, a pair of expansible resistance wires controlling movement of said element from one buckling position to the other, a pair of resilient members secured to said element adjacent one end thereof, means for insulatedly anchoring the wires to said resilient members, and tensioning means for said wires acting oppositely upon said element through said resilient members whereby excess strain is prevented by the yielding of said resilient members when both of said wires contract, and alternate contraction and expansion of said wires causes said element to snap back and forth from one buckling position to the other.

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