Nov. 21, 1944. E. E. ARNOLD 2,363,280

CIRCUIT CONTROLLER

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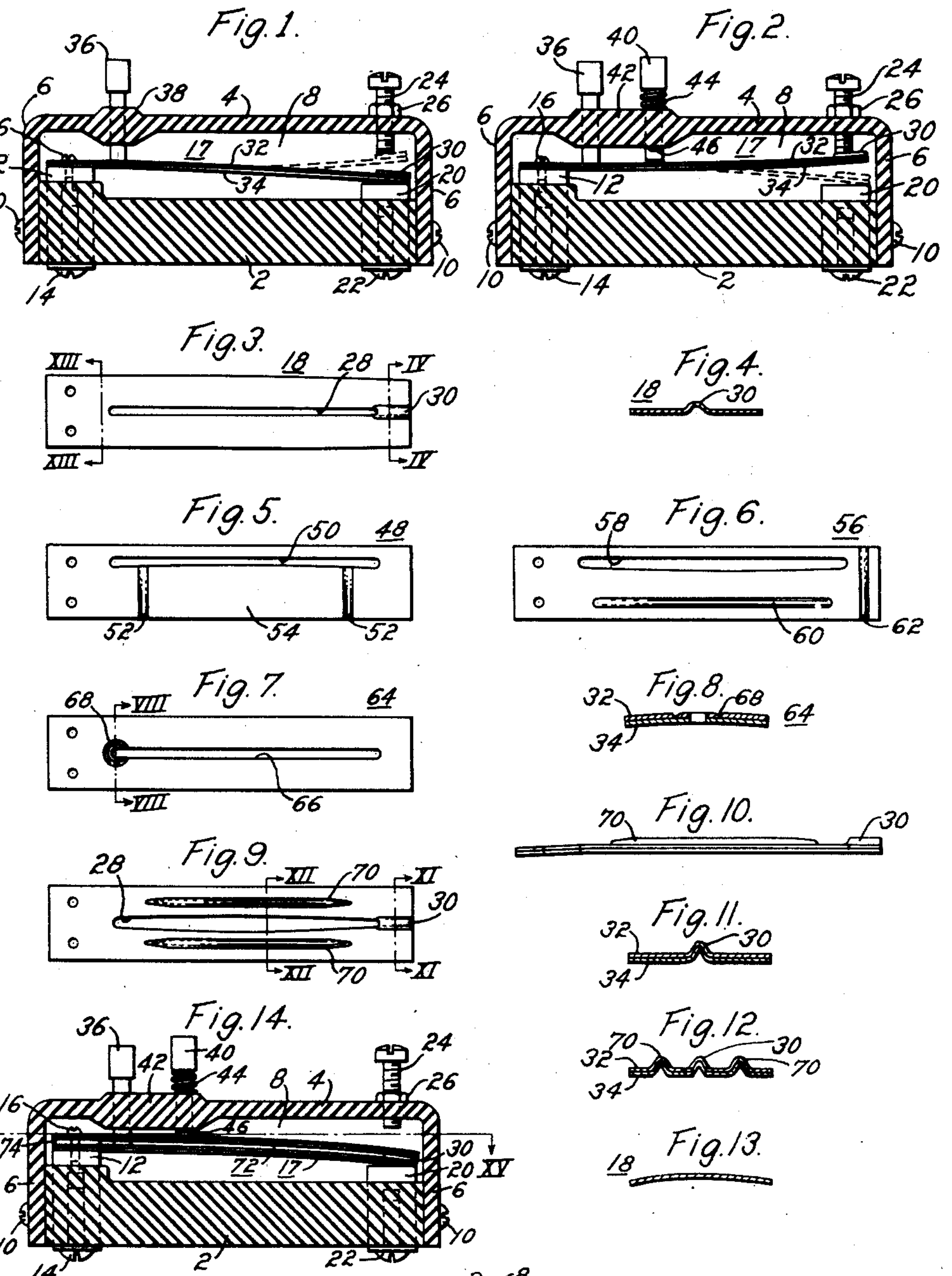

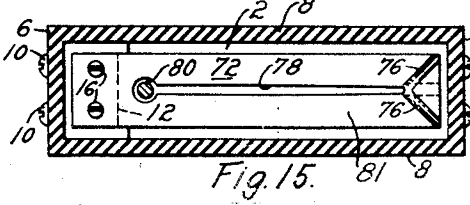

WITNESSES:
Wm. B. Sellers.
G. T. Stratton

INVENTOR
Edwin E. Arnold.
BY
Ralph H. Swingle
ATTORNEY

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2,363,280

CIRCUIT CONTROLLER

Edwin E. Arnold, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

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20 Claims. (Cl. 200—67)

This invention relates generally to electric circuit controllers, and more specifically to snap-acting switches.

In order to obtain a switch which is sensitive to control an electric circuit in response to extremely small movement of an operating member, it has been found that if a resilient plate be stressed in a manner such as to set up an initial strain or deformation in the plate, a sensitive area of the plate is provided, which is sensitive to a relatively small amount of movement to cause relatively greater movement of another portion of the plate and with a snap action. Various means have been proposed for forming switch plates of this type, and one aspect of this invention is concerned with a novel type of resilient switch blade of the foregoing type.

Accordingly, one object of this invention is to provide a novel type of snap-acting switch which is effective to provide relatively large movement of switch contacts in response to small movement of an operating member.

Another object of this invention is to provide a novel type of switch blade.

Another object of this invention is to provide a novel snap-acting element for a switch which is efficient in operation and economical of manufacture.

With a resilient switching element constructed in accordance with this invention, it is possible by controlling the throw of the element to cause the element to remain in the position to which it has been actuated by a force exerted on the sensitive area thereof, or to provide for automatic return of the element upon removal of the actuating force. Furthermore, switch members constructed in accordance with this invention may be of bimetal to obtain operation thereof in response to predetermined temperatures.

Therefore, another object of this invention is to provide a novel snap-acting switch member, the operating characteristics of which may be readily varied.

A further object of this invention is to provide a novel heat responsive, snap-acting switch member.

Another object of this invention is to provide a novel switch of the type described, which is also operable in response to predetermined thermal conditions.

A still further object of this invention is to provide a thermally responsive switch which has different operating characteristics upon thermal operation, and operation by the application of force, respectively.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of preferred embodiments thereof when taken in connection with the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of one embodiment of a circuit controlling means constructed in accordance with this invention;

Fig. 2 is a view like Fig. 1 of a slightly modified form of circuit controller;

Fig. 3 is a plan view of a switch blade similar to that used in the controllers of Figs. 1 and 2;

Fig. 4 is a sectional view of the blade shown in Fig. 3 taken substantially on the line IV—IV thereof;

Fig. 5 is a plan view of a modified form of blade;

Fig. 6 is a plan view of still another modified blade;

Fig. 7 is a plan view of a further modified form of blade;

Fig. 8 is a transverse cross-section view taken substantially on the line VIII—VIII of Fig. 7;

Fig. 9 is a plan view of still another modified form of blade;

Fig. 10 is a side view of the blade shown in Fig. 9;

Fig. 11 is a transverse section view of the blade shown in Fig. 9 taken substantially on the line XI—XI thereof;

Fig. 12 is a transverse section taken substantially on the line XII—XII of Fig. 9;

Fig. 13 is a transverse section view of the blade shown in Fig. 3 and taken substantially on the line XIII—XIII thereof;

Fig. 14 is a longitudinal section view of a circuit controller similar to that shown in Fig. 2 but utilizing a modified blade structure; and

Fig. 15 is a sectional view of the device shown in Fig. 14 taken substantially on the line XV—XV thereof.

In the drawing, there is illustrated in Fig. 1 a circuit controlling device mounted on an insulating base plate **2**, and adapted to be covered by a closure member **4**, having a top wall spaced from base **2**, and integral depending side walls **8** and end walls **6**, which are adapted to be secured to the base, for example, as by screws **10**. The base member **2** and cover **4** are preferably formed of any desired insulating material, such for example, as porcelain, a synthetic resin or the like. Extending through a suitable aperture at one end of base 2 is a supporting block 12 adapted to tightly fit within the aperture to be secured relative to base 2. The block 12 may be of any desired conducting material, such for example, as copper, brass, or the like. Threaded bores open at opposite ends of block 12 for threadedly receiving a terminal screw 14, and securing screw 16, respectively, for securing a conductor thereto, and mounting a switch blade 17 thereon. As shown in Fig. 1, the blade 17 is preferably apertured for the reception of securing screws 16 adjacent one end thereof to rigidly mount this end of the blade on supporting block 12. Adjacent the opposite end of base 2 a similar supporting block 20, also of conducting material, is provided in a suitable aperture through the base, and has the lower end only thereof provided with a threaded bore for receiving a terminal screw 22 for securing a conductor thereto.

Cover 4 is provided with a threaded aperture in opposition to supporting block 20 for receiving a stop screw 24, which, in turn, is provided with a lock nut 26 so that the stop screw may be secured in any desired adjusting position.

Blade 17 is preferably constructed in the same manner as blade 18 shown in Fig. 3, except that blade 17 is of bimetal and blade 18 is not. Accordingly, like reference numerals are used to designate like parts of the blades, and they are constructed so as to be provided with a longitudinally extending substantially central slot 28 terminating short of the ends of blades 17 and 18, with the blade being deformed at the outer end thereof by pressing or otherwise striking the material of the blade outwardly from the plane of the blade, as at 30, and along a line extending between one end of slot 28 and the adjacent end of the blade and in alignment with slot 28. Blade 18 is preferably constructed of a resilient conducting material, and blade 17 is of a bimetallic construction as shown in Figs. 1 and 2, comprising laminations 32, 34, of resilient conducting materials having different coefficients of expansion and intimately secured together as by welding or the like, to form a unitary blade structure.

It will be apparent that by the provision of struck-out portion 30 in blades 17 and 18, the blades are given an initial deformation which tends to draw the outer ends of the portions of the blade on opposite sides of slot 28 towards each other, to thereby buckle the portion of the blade adjacent the inner end of slot 28 and cause the same to assume a concavo-convex form, as shown in Fig. 13. This provides an area adjacent the inner end of slot 28 which is sensitive to pressure exerted in a direction to reverse the curvature of the blade at this point, to cause movement of the outer end of the blades a considerably greater amount than the movement of the pressure exerting means and with a snap action. This property of the blades is taken advantage of in the structure shown in Fig. 1 by providing an operating plunger 36 slidably mounted in an aperture provided in enlarged portion 38 of cover 4.

In the operation of the device shown in Fig. 1 of the drawing, a slight downward movement of operating plunger 36 will cause relatively large movement of the outer end of blade 17, that is, to the dotted line position shown in Fig. 1, wherein the blade is engageable with stop screw 24. It will be seen that the electric circuit through the device extends from terminal screw 14 through supporting block 12, blade 17, conducting support 20, to terminal screw 22. If desired, a conductor may be also secured to stop screw 24 by lock nut 26 so that in effect, a double-throw switch is provided. Also, since the electric circuit traverses blade 17, which is constructed of bimetal, with the lower lamination 34 thereof of a material which has a higher coefficient of expansion than the upper lamination 32, it will be obvious that blade 17 will be operative in response to currents passing therethrough above a predetermined magnitude to automatically move with a snap action to the dotted line position shown in Fig. 1.

Blades 17 and 18, such as described above, when rigidly supported at one end thereof, as in the switch shown in Fig. 1, are capable of movement to two spaced static positions. That is, for example, considering blade 17, this blade is shown in one static position in full lines in Fig. 1, and upon exertion of pressure on the sensitive area thereof adjacent the inner end of slot 28, the curvature of the member will tend to be reversed, and if the outer end of the blade is allowed to deflect far enough, a reversal of curvature will occur and the blade will attain a second static position spaced from the full line position shown in Fig. 1. Stop screw 24 in Fig. 1, is purposely adjusted so that the outer end of blade 17 will not reach its second static position, but when operated to the dotted line position by the force exerted on plunger 36, the blade will automatically return to the full line position shown in Fig. 1, when the force is removed from the plunger.

In Fig. 2, there is illustrated a circuit controlling device which is in many respects like that shown in Fig. 1, and accordingly, like reference numerals will be employed to designate like parts. However, in the construction shown in Fig. 2, stop screw 24 has been adjusted outwardly with respect to cover 4 to permit blade 17 to be moved by force exerted on plunger 36 to its second static position shown in full lines in Fig. 2, wherein the curvature of the blade has been reversed and it is again in a static condition and will remain in this position until manually or otherwise moved back to its first static position, shown in dotted lines in Fig. 2. To this end, a second operating plunger 40 is slidably mounted in a second aperture in cover 4, and is provided with a coil compression spring 44 between the head of plunger 40 and enlarged portion 42 of cover 4, to normally maintain plunger 40 in an outer position, and a stop pin 46 is provided on the inner end of plunger 40 to limit outward movement of the plunger under the influence of spring 44. Plunger 40 is positioned to engage blade 17 outside of the pressure sensitive area thereof adjacent the inner end of slot 28, and it has been found that the plunger 40 will be operative to move blade 17 from the full line position to the dotted line position shown in Fig. 2, provided it engages the blade at any point outwardly of the pressure sensitive area thereof previously referred to.

In view of the foregoing, it can be seen that blade 17 may be operated from the dotted line position to the full line position shown in Fig. 2 by pressure exerted on plunger 36, and that the blade will remain in such an operated position after pressure is removed from plunger 36. In order to move the blade from the full to the dotted line position shown in Fig. 2, it is necessary to depress plunger 40, and when pressure is removed from plunger 40, the blade will remain in its operated or dotted line position shown in Fig. 2. By the same token, blade 17 shown in Fig. 2, is operable automatically in response to currents above a predetermined magnitude to be movable from the dotted line position to the full line position, and after such automatic operation, it will remain in the full line position until restored by a force exerted on operating plunger 40.

From the foregoing, it can be seen that by properly supporting a blade constructed in a manner substantially like blade 17, it is possible to obtain either (1) a circuit controlling member which is manually operable to open the circuit and will automatically reclose the circuit when manual force is removed, and which may also be automatically operable in response to currents above a predetermined magnitude to open the circuit, and when the bimetal blade cools down will automatically reclose the circuit, or (2) a controlling device which is manually operable to both opened and closed circuit positions, and is also operable automatically in response to the passage of currents above a predetermined magnitude therethrough to automatically open the circuit, with a reclosure being effected manually. Blade 18 will obviously be capable of manual operation only, in the manner set forth above.

In Fig. 5, there is illustrated a modified form of blade 48, wherein a slot 50 is provided extending longitudinally of the blade and preferably at one side of the center line thereof, and the blade is deformed at one side of slot 50 by corrugations 52 extending laterally of the side 54 of the blade at one side of slot 50, with corrugations 52 located between the ends of slot 50, and preferably adjacent the ends thereof, respectively. Such a blade construction provided with corrugations 52 obviously will tend to shorten side 54 of the blade and thereby tend to draw the ends of slot 50 downwardly and towards each other, as shown in Fig. 5, to thereby cause a buckling of the blade and provide a curved section thereof substantially like that provided in the blade shown in Figs. 1 to 4 and 13, and to also provide a pressure sensitive area in the vicinity of the curved portion thereof like blades 17 and 18 previously described. The pressure sensitive area of blade 48 will also be located adjacent the inner end thereof so as to be operable substantially in the same manner as blades 17 and 18. To obtain best results, that is, to obtain the desired deformation of blade 48, corrugations 52 should be located intermediate the ends of slot 50, preferably in spaced relation, so as to obtain a greater deformation by the use of slot 50, which permits relative movement of the material of the blade on opposite sides thereof. The modification shown in Fig. 5 differs from those shown in Figs. 1 to 3, in that corrugations 52 may cause an edgewise or lateral distortion of blade 48, whereas corrugation 30 in blades 17 and 18 will not have this effect; also because side 54 of the blade is shortened, the other side of the blade may be longitudinally bowed and the operating force may be exerted on this side of the blade to reverse the curvature thereof to cause operation of the blade. Otherwise, the two blades are operable in substantially the same manner, and blade 48 may be used in a structure such as that shown in Figs. 1 or 2 in place of blade 17, and may be also of bimetal construction like blade 17 if desired.

A further modified form of blade 56 is shown in Fig. 6 of the drawing, wherein a slot 58 is provided within the blade located similarly to slot 50 in blade 48, and a longitudinally extending corrugation 60 is provided in the blade spaced from slot 58 and extending substantially parallel therewith. Corrugation 60 also has the effect of reducing the dimensions of the portion of blade 56 at the same side of slot 58 as corrugation 60, thereby tending to shorten the material at the opposite side of slot 58 to thereby produce a buckling action of the blade and an arcuate section thereof similar to that of blades 18 and 48 previously described. Longitudinal corrugation 60 has the advantage of longitudinally reinforcing blade 56 to stiffen the same to provide a more pronounced snap action. There is also provided in this embodiment of the invention, a transversely extending corrugation 62 preferably provided adjacent the outer end of blade 56, between the outer end of slot 58 and the outer end of the blade. The corrugation 62 is provided to counteract the tendency of a deformation located at one side of the blade slot such, for example, as corrugations 52 in blade 48, or corrugation 60 in blade 56, to cause transverse deformation thereof.

The blade shown in Fig. 6 of the drawing may also be of bimetallic construction like blade 17, and may be used in a structure like those of Figs. 1 and 2, and because of the initial deformation provided by corrugation 60 and the resultant buckled or curved form of the blade induced thereby, especially adjacent the inner end of slot 58, blade 56 will be operable both in response to predetermined current or thermal conditions, and in response to appropriately applied mechanical pressure to operate in the same manner previously described in connection with blade 17.

The blade shown in Figs. 7 and 8 of the drawing is somewhat similar to blades 17 and 18 previously described, in that the blade 64 is provided with a substantially centrally located longitudinally extending slot 66 which terminates inwardly of the ends of the blade. However, to obtain an initial deformation of blade 64 so as to form a pressure sensitive area effective in response to slight movement thereof to produce a relatively large movement of the outer end of the blade, the material of blade 64 on one side thereof adjacent the inner end of slot 66 is preferably deflected outwardly, for example, as by a circular embossing operation, as indicated at 68. This causes relative movement of the material of the blade at opposite sides thereof which is localized at the inner end of the slot, to thereby cause a buckling or curved form of the blade in this area and render at least a portion of this area sensitive to pressure in the same manner as the inner end portions of the blades previously described. The blade 64 may be of bimetallic construction, as shown in Fig. 8, and may be also substituted for blade 17 in the structures of Figs. 1 and 2 and will be operable in substantially the same manner as blade 18.

In Figs. 9 to 12 of the drawing, there is shown a blade quite similar to the blade 18 previously described, and accordingly, like reference numerals are used to designate like parts. The only difference in this blade over that shown in Figs. 1 and 2 is that the blade is provided with additional corrugations 70 at each side of slot 28 extending longitudinally in substantial parallelism with slot 28, intermediate the sides of the slot and the sides of the blade, respectively. These slots 70 have the effect of enhancing the initial deformation of the blade induced by corrugation 30. Since both corrugations 70 tend to remove the material of the blade from the plane of the blade, thereby tending to decrease the width of the portions of the blade at opposite sides of slot 28, and since the corrugations 70 are of less extent than slot 28 and have their ends terminating intermediate the ends of the slot, it is obvious that the material of the blade at opposite sides of slot 28 will be additionally deformed to enhance initial deformation of the blade and the curved section thereof. All of this tends to make the blade shown in Figs. 9–12 more sensitive to pressure, and stiffer longitudinally to enhance the snap action of the outer end thereof both when the blade is actuated, for example, by a pressure applying plunger, such as the plunger 36 shown in Figs. 1 and 2, and also when the blade is automatically actuated by the uneven expansion of the laminations thereof in response to the passage of predetermined currents through the blade to heat the same.

The blade shown in Figs. 9–11 is also capable of being substituted for blade 17 in the structure shown in Figs. 1 and 2, and is actuable in the same manner previously described in connection with these structures both in response to application of pressure to the sensitive area thereof adjacent the inner end of slot 28, and in response to the passage of predetermined currents therethrough.

In Figs. 14 and 15 there is illustrated a circuit controlling structure embodying two blades so related as to give different operating characteristics in response to actuation by a force applying means, and in response to automatic actuation in response to currents above a predetermined value, respectively. Inasmuch as many of the parts of the structures shown in Figs. 14 and 15 are duplicates of those previously described, like reference numerals will be used to designate these similar parts. As is apparent, the structure as a whole is quite similar to that shown in Fig. 2, with the addition of a second blade 72 superposed over blade 17 and secured at its inner end by screws 16, with a spacer plate 74 of conducting material interposed between the inner ends of blades 72 and 17. As shown, the outer end of blade 72 extends into engagement with the outer end of blade 17, and blade 72 is provided with a slot 78 of substantially the same size and positioned in substantially the same manner as slot 28 in blade 17, but the initial deformation of blade 72 is induced by corrugating the blade as at 76, along lines extending angularly with respect to the longitudinal axis of the blade and slot 78, from the outer end of slot 78 to the adjacent outer corners of the blade. The corrugations 76 will have a buckling effect on the inner end of the blade similar to corrugation 30 in blade 17 to produce a blade which is curved in section and operable between two static positions like blade 17.

It will further be noted that the inner end of slot 78 is provided with an enlarged aperture 80 which is considerably larger than actuating plunger 36, so that the plunger will extend freely through blade 72 and will be inoperative to exert any pressure on blade 72. The blades 72 and 17 are preferably supported in such a manner that plunger 36 is operative to move the outer end of blade 17 from the static position shown in Fig. 14 towards the position in which blade 72 would engage adjusting screw 24, but the bias exerted by resilient blade 72 is sufficient to prevent blade 17 from remaining in a static position away from support 20, so that under these circumstances, when blade 17 is actuated by plunger 36, it will be returned into engagement with support 20 by the force exerted by blade 72 on the outer end thereof. However, upon the passage of currents through blades 17 and 72, or upon heating of the blades by any other means to a predetermined temperature, the blades will automatically actuate the outer ends thereof, due to their bimetallic construction, to a position away from support 20 and wherein the outer end of blade 72 engages adjusting screw 24. In this position of the parts, both blades 17 and 72 will have attained their second static positions and consequently will remain in this position even after the blades cool down, and until plunger 40 is actuated to return them to their original position shown in full lines in Fig. 14. Thus it can be seen that in this embodiment of the invention, a circuit controlling structure is provided which is manually operable to interrupt the circuit, and is automatically operable to reclose the circuit when pressure is removed from the actuating means 36, and which in response to predetermined temperatures of bimetal elements 72 and 18 is automatically operable to interrupt the circuit and can only be actuated to reclose the circuit by a second pressure applying means. Although two corrugations 76 are shown in Fig. 15, a blade having characteristics similar to blade 17 will be obtained if only one corrugation 76 is utilized.

It will be noted that in all of the modifications of this invention which have been herein disclosed, a blade member is utilized which comprises a strip of resilient material which may be bimetallic in construction, and further which may be formed in a single operation such as a combined cutting and stamping operation, to permanently form a blade member with a pressure sensitive area, to cause movement of one end of the blade to relatively widely spaced static positions in response to relatively slight movement of an operating member exerting pressure on the pressure sensitive area. Furthermore, by adjustment of the throw of these blades they may be made to automatically return to their original position, or remain in their actuated position to require an additional operation to return them to their original positions. There has also been herein disclosed a structure utilizing blades formed in the above-described manner, wherein the device has inherently different operating characteristics when operated by the application of force, or when operated automatically in response to predetermined current or thermal conditions, respectively.

The blade elements, since they are susceptible of manufacture by a single simple operation, as pointed out above, may be readily economically constructed, and moreover, due to their integral and unitary construction, may be easily duplicated with little variation in operating characteristics between any number of blades. The reason for this is that the blades may be corrugated relatively easily in a stamping machine a predetermined amount, which may be readily accurately determined with such apparatus, to thereby predetermine the operating characteristics of the blade independent of any slight variations which may be made in actually mounting the blades in a circuit controlling structure. This is of considerable advantage, because it is usually necessary to assemble these devices by hand and without a preformed blade the characteristics of which are fixed, it is very difficult to obtain uniformity in the operating characteristics of the blades, especially where the initial deformation is induced during the assembling operation.

Having described preferred embodiments of the invention in accordance with the patent statutes, it is desired that the invention be not limited to the particular embodiments disclosed inasmuch as it will be obvious, particularly to persons skilled in the art, that many modifications and changes may be made in these particular embodiments without departing from the broad spirit and scope of this invention. Accordingly, it is desired that the invention be interpreted as broadly as possible, and that it be limited only by what is expressly set forth in the following claims and by the prior art.

I claim as my invention:

1. Circuit controlling means including an elongated resilient plate member, a generally longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate being bent to form a groove extending from one end of said slot to an adjacent edge of said plate member.

2. Circuit controlling means including an elongated resilient plate member, a generally longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate being deformed to form a groove substantially in alignment with said slot and extending from one end thereof to the adjacent end of said plate member.

3. Circuit controlling means including an elongated resilient plate member, a generally longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate being embossed to form a groove substantially parallel with said slot and extending from adjacent one end of said slot to an adjacent edge of said plate.

4. Circuit controlling means including an elongated resilient plate member, a substantially longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate member being bent to form a groove generally parallel to and of less extent than said slot.

5. Circuit controlling means including an elongated resilient plate member, a substantially longitudinally extending slot in said member terminating short of the ends thereof, the material of said plate member being bent at one side of said slot causing an initial deformation of the opposite side, and said plate member being transversely deformed between one end thereof and the adjacent end of said slot.

6. Circuit controlling means including an elongated resilient plate member, a single generally longitudinally extending slot in said member extending over the major portion of the length of said member but terminating short of the ends thereof, and the material of said plate member being bent to form a groove extending from adjacent one end of said slot to an adjacent edge of said plate member.

7. Circuit controlling means including an elongated resilient plate member, a single generally longitudinally extending slot in said member extending over the major portion of the length of said member but terminating short of the ends thereof, and the material of said plate member being bent to form an area displaced from said plate member and intersecting one end of said slot.

8. Circuit controlling means including an elongated resilient plate member, a single generally longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate member being bent to form a transversely extending groove at one side of said slot.

9. Circuit controlling means including an elongated resilient plate member, a single substantially longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate being bent to form a transversely extending groove at one side of said slot adjacent one end thereof.

10. Circuit controlling means including an elongated resilient plate member, a single generally longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate being bent to form spaced, transversely extending grooves at one side of said slot.

11. Circuit controlling means including an elongated resilient plate member, a single generally longitudinally extending slot in said member terminating short of the ends thereof, and the material of said plate being bent to form spaced, transversely extending grooves at one side of said slot adjacent opposite ends thereof.

12. Circuit controlling means including an elongated resilient plate member, a generally longitudinally extending slot in said member terminating short of the ends thereof, the material of said plate being bent to form a groove substantially in alignment with said slot and extending from one end thereof to the adjacent end of said plate, and said plate being also deformed at least at one side of said slot.

13. Circuit controlling means including an elongated resilient plate member, a generally longitudinally extending slot in said member terminating short of the ends thereof, the material of said plate being bent to form a groove substantially in alignment with said slot and extending from one end thereof to the adjacent end of said plate, and at least one other groove at one side of said slot and substantially parallel therewith.

14. Circuit controlling means including an elongated resilient plate member, a generally longitudinally extending slot in said member terminating short of the ends thereof, the material of said plate being bent to form a groove substantially in alignment with said slot and extending from one end thereof to the adjacent end of said plate, and at least one other groove at one side of said slot and substantially parallel therewith and of less extent than said slot.

15. In a switch, supporting means, a slotted resilient bimetallic member supported at one end thereof on said supporting means, spaced stop means at least one of which is a contact means supported on said supporting means at a position wherein the free end of said blade member is received between said spaced stop means, said member being initially locally deformed in a manner to render at least a portion thereof concavo-convex in section so that the free end of said

member is movable with a snap action between spaced static positions and whereby it is responsive to predetermined temperatures to move from one of said static positions to another, and said deformation creating an area sensitive to pressure for moving the free end of said blade member in one direction by application of pressure to said area to reverse the curvature of said member, means movably mounted on said supporting means for applying pressure to said sensitive area to move the free end of said blade member from said one static position to said other position wherein it is in engagement with said stop means, respectively, thermally responsive biasing means mounted on said supporting means and normally positioned to engage the free end of said blade member when said blade member is at said other static position to return the free end of said blade member to said one static position but being inoperative to do so in response to said predetermined temperatures.

16. In circuit controlling means, supporting means, a snap-acting bimetal element mounted on said supporting means for movement of a portion thereof to different static positions and being responsive to predetermined thermal conditions for automatically moving said portion from one of said positions to the other, force-applying means movably mounted on said supporting means for moving said portion of said element from said one position to said other position, means reacting on said supporting means for normally biasing said element for movement from said other position to said one position, and said last mentioned means being responsive to said predetermined thermal conditions to be inactive to bias said element.

17. In a circuit controlling means, supporting means, a pair of snap-acting bimetal elements mounted in superposed relation on said supporting means, each of said elements having a portion capable of movement to different static positions and responsive to predetermined thermal conditions for automatically moving from one of said positions to the other, force applying means movably mounted on said supporting means for moving one of said elements from said one position to said other position but inoperative to actuate the other of said elements to its other static position, whereby upon the removal of force from said one element, said other element is operable to bias said one element to said one static position.

18. In a circuit controlling means, supporting means, a pair of snap-acting bimetal elements mounted in superposed relation on said supporting means, each of said elements having a portion capable of movement to different static positions and responsive to predetermined thermal conditions for automatically moving from one of said positions to the other, force applying means movably mounted on said supporting means for moving one of said elements from said one position to said other position but inoperative to actuate the other of said elements to its other static position, whereby upon the removal of force from said one element, said other element is operable to bias said one element to said one static position, and a second force applying means movably mounted on said supporting means adapted to actuate said elements from said other static position to said one static position.

19. In a switch, supporting means, an elongated slotted resilient blade member supported at one end thereof on said supporting means, spaced stop means at least one of which is a contact means supported on said supporting means at a position wherein the free end of said blade member is received between said spaced stop means, said member being initially locally deformed in a manner to render at least a portion thereof concavo-convex in cross-section to form an area which is sensitive to pressure for moving the free end of said blade member in one direction by reversing the curvature of said member, whereby the free end of said member is movable to spaced static positions, means movably mounted on said supporting means for applying pressure to said sensitive area to move the free end of said blade member from one static position towards the other static position, and means for adjusting at least one of said stop means to selectively determine the extent of movement of the free end of said blade member to said other static position or to a lesser amount, whereby said blade may be moved to said other static position where it will remain after removal of said pressure, or to a position in advance of said other static position so that it will automatically return to its original position upon release of pressure, depending upon the position of said adjustable stop means.

20. In a switch, supporting means, an elongated slotted resilient blade member supported at one end thereof on said supporting means, spaced stop means at least one of which is a contact means supported on said supporting means at a position wherein the free end of said blade member is received between said spaced stop means, said member being initially locally deformed in a manner to render at least a portion thereof concavo-convex in transverse section to form an area which is sensitive to pressure for moving the free end of said blade member in one direction by reversing the curvature of said member, whereby the free end of said member is movable to spaced static positions, means movably mounted on said supporting means for applying pressure to said sensitive area to move the free end of said blade member from one static position to another, means for adjusting at least one of said stop means to selectively determine the extent of movement of the free end of said blade member an amount equal to the distance between said spaced static positions thereof or less, and another pressure applying means for moving the free end of said blade member from said other static position to said one static position.

EDWIN E. ARNOLD.