

Dec. 31, 1935.

W. E. LAGANKE

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SWITCH

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2 Sheets-Sheet 1

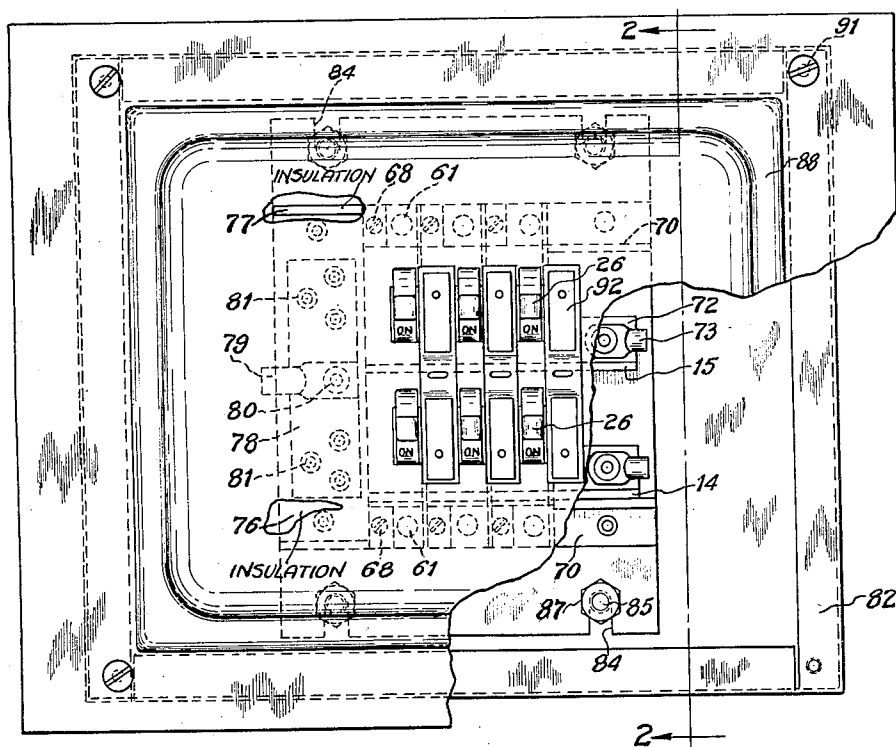


FIG. 1

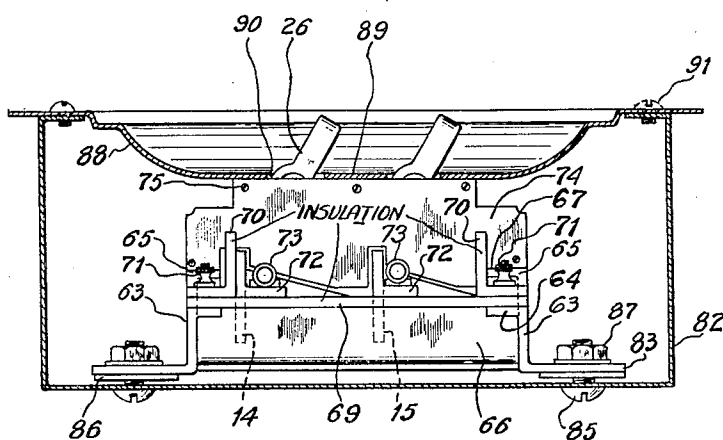


FIG. 2

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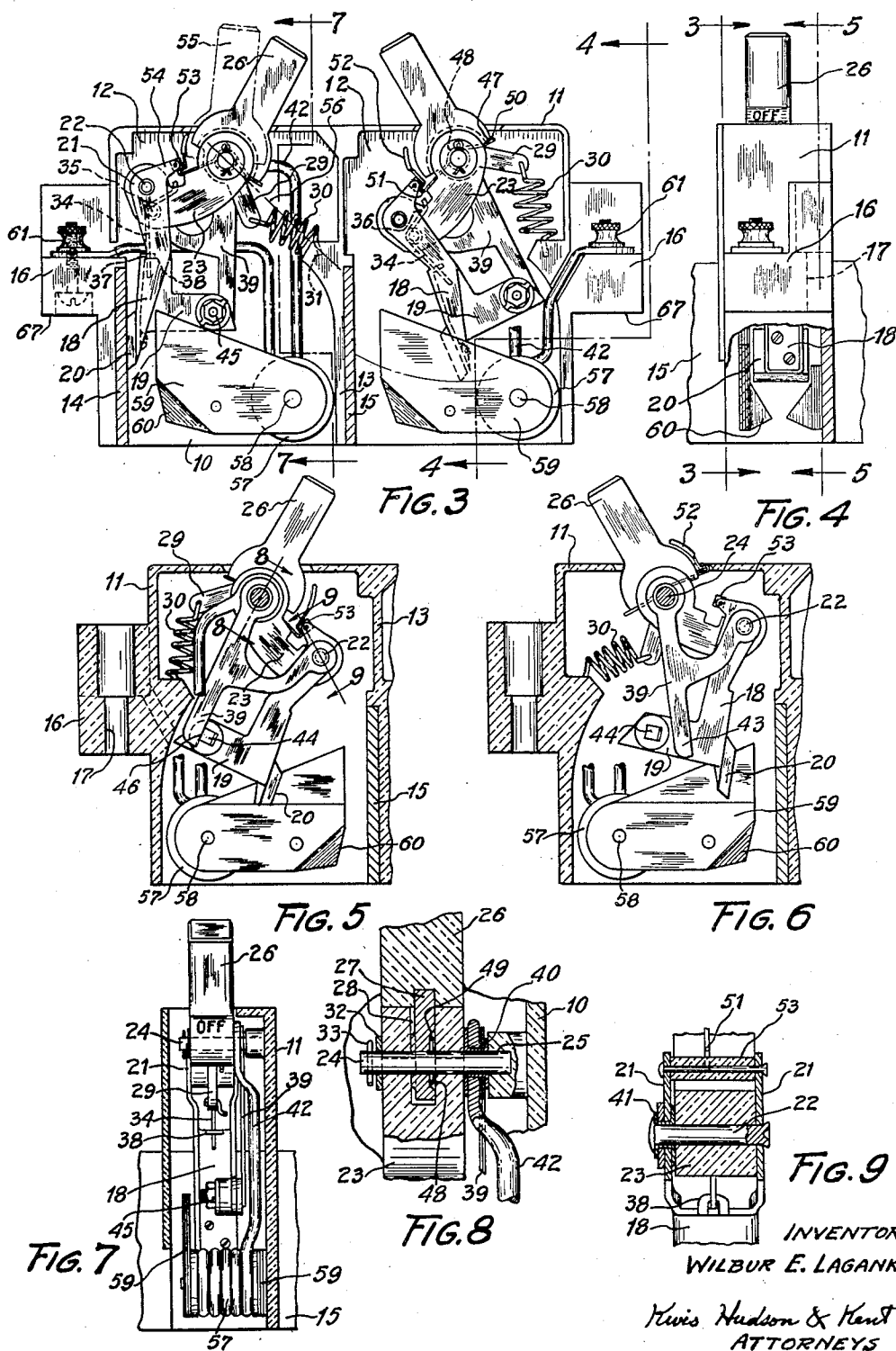
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UNITED STATES PATENT OFFICE

2,025,872

SWITCH

Wilbur E. Laganke, East Cleveland, Ohio

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6 Claims. (Cl. 200—116)

This invention relates to a manually operated make and break switch for use in electrical circuits with provision for automatically breaking the circuit through the switch in the event that an excessive flow of current or an overload on the line occurs.

It is an object of the present invention to provide a switch of the type referred to which is compact and simple in construction, efficient in operation and inexpensive to manufacture.

The switch embodying the present invention may be used as a single or multiple pole switch and is designed particularly for use in connection with panel boards although such use is not limited thereto.

A further object of the invention is to provide a switch in which the circuit is made or broken by the snap action of a movable switch blade, particularly in the breaking of the circuit to reduce the arcing to a minimum.

Another object of the invention resides in providing a blow-out coil for dissipating the arc occurring by the opening of the switch and further to provide a path of low magnetic reluctance.

With the objects above indicated and other objects hereinafter explained in view the invention consists in the construction and combination of elements hereinafter described and claimed.

Referring to the drawings:

Figure 1 is a top plan view of a switch assembly embodying the present invention;

Fig. 2 is a transverse sectional view taken on line 2—2 in Fig. 1;

Fig. 3 is a side elevational view of a twin switch unit showing details of the switch on the left showing the blade in closed position and the switch on the right showing the blade in open position of construction, said view being taken on line 3—3 of Fig. 4;

Fig. 4 is an end elevational view of a unit housing with the lower portion broken away to more clearly show the blow-out coil and taken on line 4—4 of Fig. 3;

Fig. 5 is a rear elevational view of the switch shown on the right side of Fig. 3 and taken on line 5—5 of Fig. 4, illustrating the thermal element in operative position;

Fig. 6 is a view similar to Fig. 5, but illustrating the thermal element in inoperative position;

Fig. 7 is a vertical sectional view on an enlarged scale taken on line 7—7 of Fig. 3;

Fig. 8 is a sectional view on an enlarged scale taken on line 8—8 of Fig. 5; and

Fig. 9 is a sectional view on an enlarged scale taken on line 9—9 of Fig. 5.

In the drawings the switches, indicated generally by the numeral 10, are shown in pairs enclosed in a "Bakelite" housing 11. The housing 11 is substantially rectangular in shape, being open at the near side, as viewed in Fig. 3, and

closed at the far side by walls 12. A vertical transversely extending partition 13 is formed integral with the housing 11 and divides the housing into two separate chambers within which the switches are disposed. The rear walls 12 are cut away in each chamber at the lower forward portion thereof to provide an opening through which bus bars 14 and 15 extend. The housing 11 is further provided with extensions 16 which have openings 17 in their rear sides by which the housing may be attached to a frame later to be described. As the switches are identical in construction and operation, it is believed sufficient to describe in detail the construction and operation of a single switch, as the purpose for grouping the switches in the manner shown will be later more fully explained.

The switch 10 consists of a copper switch blade 18 of channel cross-section with an integral rearwardly extending arm 19. To the lower portion 20 of the blade is riveted and soldered a contact member 20 composed of a composition consisting of copper and carbon or other material which is adapted to engage the bus bar 14 when the switch is moved to its closed position. The switch blade 18 has its sides extending upwardly to provide spaced arms 21, more clearly shown in Fig. 9, and has journaled therein a pin 22 about which one end of a blade holder 23 is pivotally mounted. This blade holder is preferably made of "Bakelite", or other suitable insulating material and has an opening in its opposite end for pivotally supporting the blade holder for movement about a pin 24. The pin 24 in turn has its rear end integrally secured in the housing 10, as indicated by 25. A manually operated handle member 26 is preferably made of "Bakelite", or other similar material, and has embedded and secured therein a metal member 27 provided with a transverse opening through which the pin 24 extends. The end of the blade holder 23 adjacent the pin 24 is cut away at 28 to receive a portion of the metal member 27, as shown in Fig. 8, and the connection is such as to provide for a slight lost motion between the handle member 26 and the blade holder 23, for a purpose to be later described. The metal member 27 has an integral extension 29 upon its lower side to which is connected one end of a spring 30, while the opposite end of the spring is connected in an opening 31 provided in the housing 11, more clearly shown in Fig. 3. A washer 32 is mounted upon the end of the pin 24, while a cotter pin 33 extends through an opening in the end of the pin 24 to maintain the members 26 and 23 in their proper position upon the pin.

The end of the blade holder 23 adjacent the pin 22 is slotted to receive the coils of a spring 34 which is secured against displacement by means of a pin 35 having its opposite ends se-

cured within the blade holder 23. The upper end of the spring 34 is disposed within an opening 36 provided in the blade holder 23, while the lower end extends through and is slidably disposed within an opening 37 provided in an extension 38 formed integral with the blade 18. This spring 34 is so arranged that it normally tends to move the switch blade 18 inwardly about the axis of the pin 22.

A thermally responsive member 39 of substantially inverted h-shaped formation is constructed of bi-metallic metal, so that upon the application of heat thereto there will be a more rapid flexing of the member on one side than on the opposite side. The upper arms of the thermally responsive member are connected by eyelet rivets 40 and 41 to one end of a conductor wire 42 and one of the spaced arms 21, respectively. The ends of the thermally responsive element are copper plated and riveted, in the manner described, to reduce contact resistance. The eyelet rivet 40 is mounted upon the pin 24, as shown in Fig. 8, between the inner end of the blade holder 23 and the adjacent side of the rear wall 12, while the eyelet rivet 41 is mounted upon the pin 22, as shown in Fig. 9, these rivet connections permitting pivotal movement about the axes of the rivets. The depending leg 43 of the thermally responsive member 39 is disengageably connected to the free end of the extension 19 on the switch blade 18 in such a manner as to become disengaged therefrom upon the application of heat beyond a predetermined amount. This connection preferably consists of a detent 44 insulated from the extension 19, but securely mounted thereon by means of a threaded connection 45. The detent is preferably square, as shown in Fig. 5, having a rear abutment 46 with which the lower end 43 of the thermally responsive member 39 engages. The opposite end of the detent 44 is slightly tapered so as to permit the depending arm 43 to pass over the detent into its inner engaging position. With the interengagement between the depending arm 43 of the thermally responsive member and the detent 44 on the extension 19, the switch arm 18 and the blade holder 23 are secured against relative movement about the axis of the pin 22 and against the resistance of the spring 34, thus causing the switch blade 18 and the blade holder 23 to be moved as a single unit.

Should the thermally responsive member 39 be subjected to heat beyond a predetermined amount sufficient to cause it to become disengaged from the detent 44, the tension of the spring 34 will immediately cause the switch blade 18 to be moved about the axis of the pin 22 and simultaneously moving another member 20 out of engagement with the bus bar 14, thus breaking the circuit. To reestablish the connection between the depending arm 43 and the detent 44, it is only necessary to move the switch arm 18 to its maximum open position, in which case the depending arm 43 will be moved behind the detent 44 and into engagement with the abutting shoulder 46.

It is, of course, desirable that some means be provided to indicate when the switch has been automatically opened, by reason of the application of excessive heat to the thermally responsive member, or by an overload upon the line, and, in the present instance, a visual indicating means is preferably employed. This consists of a resilient member in the form of a spring 47 having a looped portion 48 substantially midway between its ends

and disposed within a recess 49 in one of the faces of the member 27, clearly shown in Fig. 8. The looped portion 48 also encircles the pin 24 and has one end 50 abutting against a shoulder upon the under portion of the handle 26. The opposite end extends forwardly beyond the handle portion 26 and is looped back upon itself to provide an extension 51, the free end extending upwardly and being provided with an indicator 52 in the form of an enlarged flattened head, preferably painted red. This offset portion 51 normally engages a "Bakelite" member 53 secured between extensions 54 provided on the arms 21. When the switch blade 18 and blade holder 23 are secured against independent relative movement by means of the depending leg 43 and the detent 44, the indicator 52 is held in invisible position by reason of the fact that the extension 51 is in engagement with the "Bakelite" member 53, thus indicating that the switch is in operating condition. As soon as the leg 43 is disengaged from the detent 44, however, thus causing the switch arm 18 to be moved about the axis of the pin 22, the "Bakelite" member 53 is moved out of engagement with the extended portion 51 and permits the indicator 52 to pass upwardly out of the housing 11, as shown in Fig. 6. The indicator 52, therefore, is quickly detected and conveys the fact that the switch has been automatically opened and must be reset before the switch can again be in operating condition. It will be noted that when the switch is moved to its maximum open position to reset the connection between the arm 43 and the detent 44, that the "Bakelite" member 53 will again engage the extension 51 and maintain the indicator 52 within the housing and out of sight.

The construction of the switch provides for a snap action in the making and breaking of the engagement between the switch blade and the bus bar, but naturally the snap action is much more desirable in the breaking of the circuit in order to eliminate to as great an extent as possible any excessive amount of arcing. This snap action is obtained by reason of the lost motion connection between the handle 26 and the blade holder 23. With the switch in closed position, as shown in the left-hand portion of Fig. 3, the handle 26 may be moved towards the left to open the switch. During this movement the handle 26 moves to the position indicated in dotted lines by 55 before there is any movement whatsoever of the switch blade 18 and blade holder 23. As soon as the handle 26 has been moved to the limit of the lost motion movement, the extension 29 passes beyond the plane, indicated by the line 56, passing through the axis of the pin 24 and the connection 31 in the housing with the result that the compression of the spring exerts a force against the extension 29 and causes the switch arm 18 to move quickly out of engagement with the bus bar 14. The same operation occurs in moving the switch blade 18 to its closed position. The handle member 26 is moved towards the right to the end of the lost motion movement provided and, upon further movement of the handle 26, the extension 29 passes beyond the plane 56 and the spring exerts a force against the extension 29 to cause the switch blade 18 to be quickly moved into engagement with the bus bar 14.

In the lower portion of the housing a blow-out coil 57 is mounted upon an iron core 58. This blow-out coil consists of approximately eight turns in two layers of No. 9 cotton covered enamel wire. This is wound on the steel core which is

insulated from the wire for approximately 2300 volts. This core has laminated metal sides 59 extending forwardly upon opposite sides in the direction of the bus bar 14 and which are disposed upon opposite sides of the switch blade 18. The lower corners are bent inwardly at 60 so as to provide a path of low magnetic reluctance. The coil is so wound that the flash from the opening of the switch is blown out at the bottom of the housing. One end of the coil connects with the conductor 42, while the opposite end of the coil connects with a terminal 61 secured upon the extension 16 of the housing 11. The terminal 61 is connected to one side of the main line, while the bus bar 14 is connected with the opposite side of the main line so that when the switch is in closed position the current will pass from the bus bar 14 through the switch arm 18, through the thermally responsive member 39 to the conductor 42, through the coil 57 and outwardly through the opposite end of the coil to the terminal 61. The circuit may be closed and opened by the manual operation of the handle 26 in the manner previously described and, in the event that an excessive amount of current passes through the thermally responsive member 39 so as to heat the same beyond a predetermined amount, the lower end 43 of the member will be moved out of engagement with the detent 44, thus causing the switch blade 18 to be moved out of engagement with the bus bar 14 due to the tension of the spring 34 with which the switch arm 18 is connected.

Referring particularly to Figs. 1 and 2, the switches 10 are assembled in pairs within the housing 11 and there is illustrated in Fig. 1 three of these housings positioned in abutting relation. These switches are all single pole switches, but may be operated as double pole switches by providing a connecting means pivotally connected to adjacent pairs of handle members 26 so as to be operated in unison.

The bus bars 14 and 15 extend longitudinally of the switch housings 11 in spaced relation and the housings 11 are adapted to fit over the bus bars by reason of the openings provided therein. A metal base 63 is provided upon which the housings 11 are supported and consists of strap iron bent in substantially Z-shape, as shown in Fig. 2 with inwardly extending flanges 64 provided at one level and inwardly extending flanges 65 provided at a higher level. These strap iron members 63 are maintained in assembled relation by metal cross members 66 welded or otherwise secured to the side members 63. The upper inwardly extending flanges 65 engage with the under surfaces 67 of the housings 11 to support the same and are connected thereto by bolts 68 disposed in the openings 17 in the extensions 16. An insulating block 69 extends transversely of the side members 63 and is supported upon the lower inwardly extending flanges 64. Angles 70 of "Bakelite" or other suitable insulating material are positioned at the outer edges of the insulating block 69 with their upright legs extending inwardly, as shown in Fig. 2. The horizontal flanges of the angles and the insulating block 69 are secured to the inwardly extending flanges 64 by means of bolts and thumb screws 71. These angles prevent the gutter wires from coming into contact with the live parts of the panel.

The bus bars 14 and 15, as shown in Fig. 2, are supported at one end upon the insulating block 69 by severing the lower portions of the bus bars and bending the severed portions inwardly

to provide flanges 72. These flanges are secured to the insulating block 69 by bolts also securing terminals 73 which are adapted to be connected to two 220 volt line connections. Between each of the housings 11 and upon the outer side of the end housing, insulating panels 74 are provided and are secured to the respective housings by means of screws 75 to prevent any possibility of electrical leakage between the respective switches.

The opposite end of the frame 63 has an insulating block 76 secured to the upper inwardly extending flanges 67 in a manner identical with that described in connection with the insulating block 69. Also, a pair of "Bakelite" angles 77, or other suitable insulating material, are secured to the insulating bar 76, but the upstanding legs are positioned adjacent the outer edges of the frame, for a purpose, however, identical to that for which the angles 70 are provided. Supported upon the insulating bar 76 is a common bus bar 78 secured thereto by means of bolts and having an outlet terminal 79 bolted or otherwise secured at 80 to the bus bar, as shown in Fig. 1. Disposed on the opposite sides of the terminal 79 are plurality of terminals 81, the number on each side of the terminal 79 corresponding to the number of the switches upon that side of the housing 11. In the present instance three switches are illustrated, consequently there are three terminals 81. These terminals 81 are adapted to be electrically connected with the terminals 61 upon the opposite ends of the switch housings 11, so as to electrically connect each switch with the output terminal 79.

The entire switch assembly is housed within a metal cabinet 82 open at its front. The outwardly extending flanges 83 of the frame 63 are provided with slotted openings 84 to receive the screw threaded ends of bolts 85 secured in the bottom of the enclosure 82. Threaded washers 86 are mounted upon the screw threaded ends of the bolts 85 and directly engage and support the under surface of the flanges 83. These screw threaded washers 86 may be adjusted axially of the bolts so as to raise or lower the switch frame 63 to any desired position. When once adjusted they are secured against accidental displacement by means of nuts 87. The slotted openings 84 permit transverse adjustment of the switch frame 63, thus providing a universal adjustment to properly position the switch within the enclosure 82.

A cover plate 88 is formed with a flat depressed portion 89 having a plurality of openings 90 through which the extended portions of the handle member 26 extend. The outer corners of the cover plate 88 are provided with openings and connected by means of bolts 91 with the upper portion of the enclosure 82. Metal card holders 92 are riveted or otherwise secured to the cover member 88 and are disposed between pairs of switches and adapted to receive and hold cards upon which may be stamped the numbers or names of the associated circuits.

A cover plate of appropriate character may be attached to the top of the cover plate 88 to enclose the handle members 26, if desired.

While I have described the preferred embodiment of the invention, it is to be understood that I am not to be limited thereto inasmuch as changes and modifications may be resorted to without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. In a switch of the character referred to, the combination of a housing, a member pivotally 75

supported in said housing, a contact blade pivotally supported in said housing and movable relative to said member, a thermally responsive member operatively connected to said member and said contact blade for limiting the relative movement therebetween in one direction and releasable when the thermally responsive member is heated to a predetermined degree, means for moving said contact blade relative to said member upon the release of said thermally responsive member, an indicator, means for operating said indicator upon movement of said contact blade relative to said member under the action of the first mentioned means, a handle pivotally supported in said housing and operatively connected to said member by a lost motion connection, and resilient means operatively connected to said handle and said housing for effecting continued movement of said handle after the same has been moved a predetermined amount.

2. In a switch of the character referred to, the combination of a housing, a member pivotally supported in said housing, a contact blade pivotally supported in said housing and movable relative to said member, a spring for continuously urging said contact blade in one direction relative to said member, a thermally responsive member operatively connected to said member and said contact blade for limiting the relative movement therebetween under the action of said spring and releasable when the thermally responsive member is heated to a predetermined degree, a normally invisible indicator, means for moving said indicator into a visible position upon movement of said contact blade relative to said member under the action of said spring, a handle pivotally supported in said housing and operatively connected to said member by a lost motion connection, and a second spring operatively connected to said housing and said handle for effecting continued movement of said handle after the same has been moved a predetermined amount.

3. In a switch of the character referred to, the combination of a housing, a blade holder pivotally supported in said housing, a contact blade pivotally supported by said blade holder, a spring continuously urging said contact blade in one direction about its pivotal connection with said blade holder, a thermally responsive member operatively connected to said blade holder and said contact blade for limiting the relative movement therebetween under the action of said spring and releasable when the thermally responsive member is heated to a predetermined degree, an indicator, means for operating said indicator upon movement of said contact blade relative to said blade holder under the action of said spring, a handle pivotally supported in said housing and operatively connected to said blade holder by a lost motion connection, and a second spring operatively connected to said housing and said handle for effecting continued movement of said handle after the same has been moved a predetermined amount.

4. In a switch of the character referred to, the combination of a housing, a blade holder pivotally supported in said housing, a contact blade pivotally supported by said blade holder, a thermally responsive member carried by said blade holder and projecting adjacent said contact blade, means forming an effective connection be-

tween said thermally responsive member and said contact blade releasable when said thermally responsive member becomes heated to a predetermined degree, means for moving said contact blade about its pivotal connection with said blade holder when said thermally responsive member becomes disengaged, an indicator, means for operating said indicator upon movement of said contact blade relative to said blade holder when said thermally responsive member becomes disengaged, a handle pivotally supported in said housing and operatively connected to said blade holder by a lost motion connection, and resilient means operatively connected to said handle and said housing for effecting continued movement of said handle after the same has been moved a predetermined amount.

5. In a switch of the character referred to, the combination of a housing, a blade holder pivotally supported in said housing, a contact blade pivotally supported by said blade holder, a spring operatively connected to said blade holder and said contact blade for continuously urging said contact blade in one direction about its pivotal connection with said blade holder, a thermally responsive member supported by said blade holder, means for connecting said thermally responsive member with said contact blade releasable when said thermally responsive member becomes heated to a predetermined degree, a normally invisible indicator, means for moving said indicator into a visible position upon movement of said contact blade relative to said blade holder under the action of said spring, a handle pivotally supported in said housing coaxial with said blade holder and operatively connected thereto by a lost motion connection, and resilient means operatively connected to said housing and said handle for effecting continued movement of said handle after the same has been moved a predetermined amount.

6. In a switch of the character referred to, the combination of a housing, a blade holder pivotally supported in said housing, a contact blade pivotally supported by said blade holder, a spring operatively connected to said blade holder and said contact blade for continuously urging said contact blade in one direction about its pivotal connection with said blade holder, a thermally responsive member supported by said blade holder, means for connecting said thermally responsive member with said contact blade releasable when said thermally responsive member becomes heated to a predetermined degree, a normally invisible indicator, means for moving said indicator into a visible position upon movement of said contact blade relative to said blade holder under the action of said spring, a handle pivotally supported in said housing coaxial with said blade holder and operatively connected thereto by a lost motion connection, and a second spring operatively connected to said housing and said handle so that the center line thereof is moved upon initial movement of the handle to opposite sides of a plane through the pivotal axis of said handle and the connection of said spring with said housing after which continued movement of the handle is effected under the action of said spring.

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