June 14, 1938. S. SONKIN 2,120,582

TUBE SIGN CONSTRUCTION

Original Filed Sept. 27, 1932

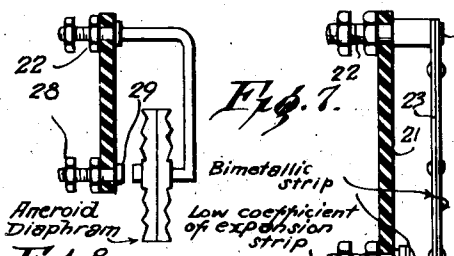


Fig. 8.

Fig. 7.

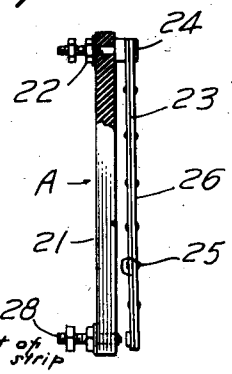


Fig. 2.

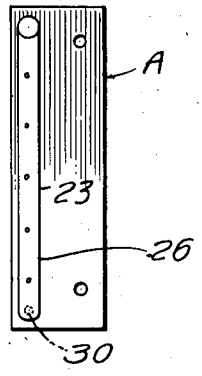


Fig. 3.

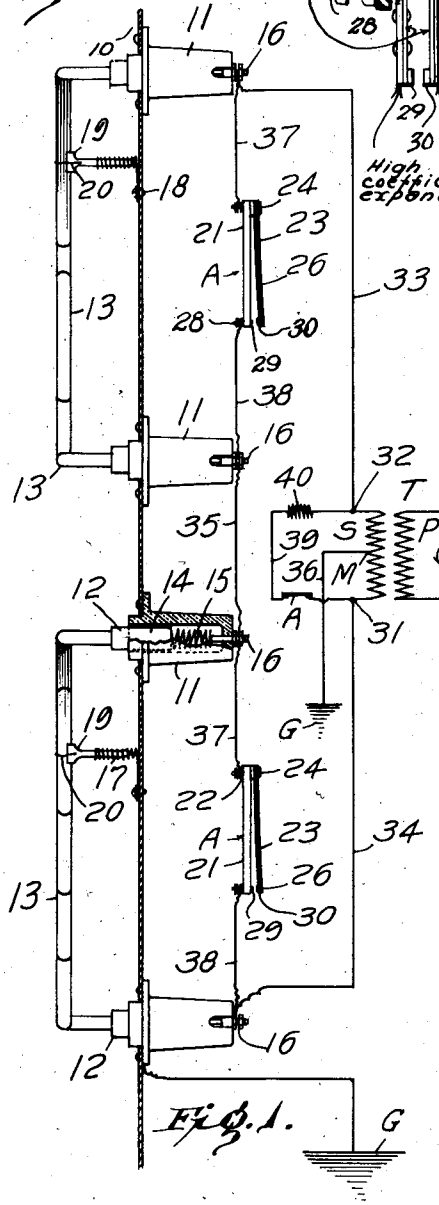


Fig. 1.

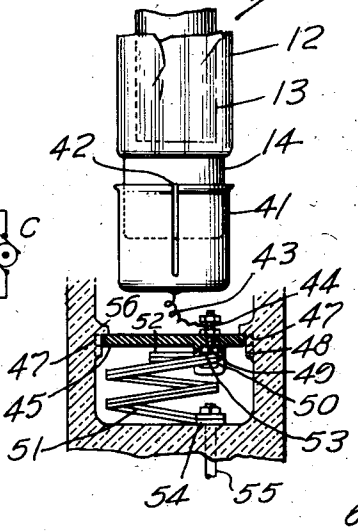


Fig. 4.

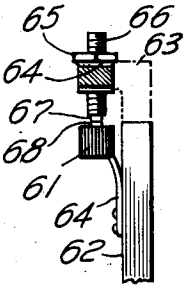


Fig. 6.

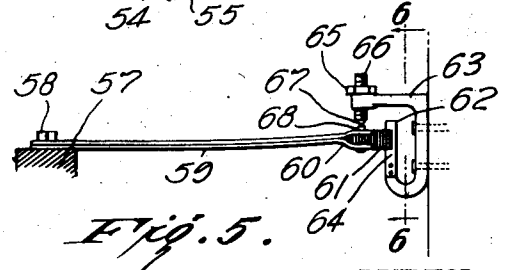


Fig. 5.

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2,120,582

TUBE SIGN CONSTRUCTION

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Original application September 27, 1932, Serial No. 635,090. Divided and this application January 22, 1935, Serial No. 2,883

17 Claims. (Cl. 200—118)

This invention relates to so-called electric tube signs; more particularly, to constructional installation features in wiring and operating the same.

In the operation of so-called electric tube signs, or neon gas signs, comprising gas filled tubes formed into letters or characters, now widely in use and operating under high voltage, serious servicing problems are involved, especially where these signs are exposed to the weather in out-door operation, by reason of failure of the insulation used adjacent the contacts holding separable tube elements. In the large signs comprising separate tubes formed into characters, failure in the insulation at any point very frequently exhibits the entire sign assembly in an objectionable manner, due to flickering, without any indication as to the point of failure, thereby consuming considerable time, labor and expense in its repair or renewal to operating conditions. Maintenance of improperly operating units and the conditions referred to is accompanied by high intensity sparks, particularly adjacent the electrodes of the tubes, which very quickly disrupt these more expensive parts of the sign or the essential parts of the assembly to make replacement and repair an expensive item of cost.

It is therefore an object of my invention to provide an electric tube sign construction; and in connection with the wiring circuit for operating the same, of safety measures which will assure long life and the proper continued operation of the electric sign, assembly or any portion thereof, so that upon failure of the insulation, due to extraneous elements, erosion, perforation, cracking resulting in the breaking down of the insulation, the disruptive action of the short-circuiting resulting from such failure will have the minimum, or substantially no deteriorating effect upon more costly portions of the sign assembly.

It is therefore contemplated by me to include in electric tube signs of the character operating under high potential, and known on the market as neon tube signs, of a safety device which will minimize or eliminate any disruptive tendencies in the operation of the sign, due to failure in any portion thereof, and to further provide an installation which will readily indicate the points of failure, should they occur, so that replacement and repair may be facilitated.

It is still further contemplated by me as an object of my invention to provide in an electrical installation such as that used for operating electric gas tube signs operating under high potential, of a circuit control mechanism which serves to shunt the current flowing through an electric sign or portions of the installation operating under faulty conditions, which may be occasioned by failure of insulation, improper adjustment of contacts or imperfection in any portion of the installation, to eliminate the disruptive effect of "short circuits" through the more fragile or expensive portions of the sign or any element thereof. It is contemplated by my invention to provide in an installation operating under high potential, particularly an electric gaseous tube sign construction of mechanism forming part of the electric circuit, which responds to the heat generated by sparking, to minimize or eliminate the disruptive tendencies of short circuiting, in the more vital parts of such sign installation.

Still further objects of my invention reside in the provision of an installation for use in connection with electric gas tube signs which, under proper operating conditions of the tube elements, and the electrical circuit feeding the same, is inactive, but which upon failure or the development of any defects in the installation, causes the current to be diverted from the defective part or connection, to avoid damaging of more fragile parts, readily susceptible to damage by high potential sparks.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawing, forming a part hereof, in which—

Figure 1 is a fragmentary sectional view and diagrammatic wiring installation showing my invention;

Figure 2 is an enlarged detail, partly in longitudinal section, of a thermal-responsive spark gap switch;

Figure 3 is a plan view thereof;

Figure 4 shows a fragmentary enlarged detail of another embodiment of my invention in association with a socket installation;

Figure 5 is a fragmentary side elevation of another embodiment of my invention;

Figure 6 is a section taken on the line 6—6 of Figure 5;

Figures 7 and 8 illustrate further embodiments of switch elements.

Making reference to the drawing, my invention may be illustrated in connection with an electric gas tube sign in which 10 is a sheet, outer plate or panel of a sign frame work upon which there is mounted insulating sockets 11, spaced at convenient points corresponding to the electrodes 12 of the various tube elements 13. These tube elements may be formed into letters, characters or other representations, in accordance with the

display to be provided. The electrodes 12 are of standard construction and in the illustration, these preferably have a metallic base 14, in contact with a spring contacting member 15, terminating into a binding post 16, in each socket. The electrodes 12, through the exterior contacting base 14, may be positively connected in the sockets 11. Preferably, however, for purposes of effecting best insulating conditions, the contacts 14 are mounted in spaced relationship within the sockets 11 and are held in this spaced relationship from the walls of the sockets by the standards 17, connected to the sheet 10 by suitable fastening means 18. The free ends of the standards 17 are preferably made of insulating material and provided with a tube conforming rider 19, to which the tube is fastened by a twisted wire, as shown at 20.

For the installation as disclosed, I provide a thermal switch A, shown in detail in Figures 2 and 3, and in my preferred form comprises an insulating member 21, one end of which supports a binding post 22, anchoring in spaced relation to the insulating member 21, a bi-metallic heat responsive conductor strip 23, rigidly connected to the binding post 22, as by suitable fastening means, such as a screw 24, though spot welding, brazing or similar rigid fastening means may be employed. The bi-metallic conductor 23 is so positioned that the layer 25 lies innermost and comprises a metal of low coefficient of expansion. The outer layer 26 is disposed away from the insulating member 21 and is of a material which has a relatively high coefficient of expansion, when subjected to heat. These two layers 25 and 26, are riveted or otherwise fastened together, in close contact, to avoid any independent action. As the nature and compositions of the separate layers may be varied depending upon operating conditions, these materials may be varied to suit the individual purchaser. I have found that excellent results may be obtained by making the layer 25 of invar, a nickel-steel alloy, and the layer 26 of brass.

The end of the insulating member is provided with a combined terminal binding post and set screw 28, carrying at the outer end a tip 29 of spark resisting, electrical contacting material. This is disposed oppositely to the free end of the bi-metallic element 23, which also carries on its inner surface, a small contact point 30 of spark resisting electrical contacting material.

Thermal switch A as provided and illustrated in Figures 2 and 3 may be suitably enclosed in some jacket of glass or otherwise, to keep out dirt or dust particles, and may be so installed in the sign assembly as an independent unit wherever desired of which the following is an illustration.

Referring now to Figure 1, a source of electrical alternating current C, serves to operate through a transformer T, the feed being to the primary circuit thereof. From the secondary circuit S, connected with the terminals 31 and 32, there is provided conductors 33 and 34 connected to the most remotely positioned binding posts 16 of the tube elements, and where as in the construction illustrated, a plurality of such tube elements are connected in series, an intermediate conductor 35 serves to electrically connect the intermediate binding posts 16. The sheet 10 is grounded as shown at G, preferably also grounding the transformer at the conductor 36, running to the mid-point 37 of the secondary circuit thereof.

With a circuit as just described, the electrical tube elements 13 are connected in series, though it will be readily understood that these elements may be connected in parallel, in accordance with the necessary potential for operating the electrical gas tubes.

Connected with each pair of terminals 16 of the cooperating electrodes 12, for each of the tube elements, and in parallel with the tube elements, I interpose a thermal switch A, preferably connecting the terminals 22 and 28 by intermediate conductors 37 and 38. As many thermal switches as desired may be incorporated in the circuit just described, as there are separate tube elements, so that each tube element has an independent shunt circuit in which the thermal switch is interposed.

The thermal switch is adjusted so that the gap between the points 29 and 30 is normally open, at normal atmospheric temperatures. The gap between the points 29 and 30 is so adjusted in relation to the tube element 13, in parallel therewith, that under normal operating conditions, the resistance across the gap formed by the points 29 and 30 is considerably higher than the resistance necessary to properly operate the tube elements 13. The gap, however, is so adjusted that the resistance of high potential current across the gap is materially lower than that which may flow through a cracked or impaired insulating socket 11, and the most adjacent section of the panel 10, or in fact, the resistance across the gap 29 and 30 is so adjusted that it is lower than any point of failure where sparking may occur, due to improper mounting, imperfection, shorting caused by moisture, after rain, adjacent the electrodes 12 of the various tube elements.

In operation, any imperfection adjacent the electrodes, due to failure of the insulation between the electrode 12 and any part of the supporting mechanism therefor, which would otherwise, on continued operation, cause a flickering in the sign element, and sparking adjacent the electrodes, will have a disruptive effect upon the electrodes and the insulation. The resistance will therefore be greater than under proper operating conditions. This will result in the current jumping the gap between the contacting points 29 and 30, and the consequent formation of a spark. As a result thereof, the current will flow through the bi-metallic element 23 and the composite strip will be heated. During this action, the movement of the free end of the strip 23 will serve to reduce the spark gap and therefore divert the current through the thermal switch including the conductors 37 and 38, rather than have it flow through the electric tube element 13 and the circuit thereof. As the bi-metallic element 23 is heated to a greater extent, the contact points 29 and 30 are brought into positive engagement, thereby completely diverting the current through the thermal switch. As the spark is reduced, the temperature of the bi-metallic element 23 diminishes, the spark gap 29 and 30 will again be increased.

It will thus be observed, from the operation of the installation as thus provided, any disruptive tendency through the delicate portions of the element is eliminated, as conditions arise which may cause the same to operate improperly.

By the connection of the device as illustrated, especially where a large number of elements constitute the entire sign assembly, only a fragmentary portion of the entire sign assembly will

be thus disconnected, by the thermal switch, leaving the other elements free to operate in the normal way. Should the conditions tending to cause a short circuiting adjacent the electrodes be a temporary one, as by the entrapping of water after rain, upon drying up of the contact adjacent the electrode, the normal resistance at this part will be re-established, and the current may again flow through the tube element, rather than through the thermal switch.

Should conditions arise which actually permanently impair the electrical circuit adjacent the electrodes of the tube elements, the intermittent action caused by the variation of the spark gap between the contacts 29 and 30, particularly where a thermal switch is provided for each tube element as the temperature of the bi-metallic element 23 varies, will serve as an indication for the repair man, to determine which element of the sign assembly requires adjustment, repair or replacement rather than necessitating the inspection of all the elements of the entire assembly.

By having the thermal element control the spark gap, under normal operations, the spark gap may be adjusted for a distance which is considerably in excess of the resistance of the circuit through a tube element 13. The initial spark which may be formed across the gap of the contacts 29 and 30 may, under these conditions, rapidly erode and burn the contact points. However, this effect will be quickly minimized and reduced by the thermal action of the bi-metallic member 23, which greatly reduces the spark gap until intimate contact is made between the points 29 and 30, thereby reducing the erosion effect of the spark.

Under certain conditions of operation where a single continuous tube element constitutes the sign, I may position across the terminals 31 and 32 of the secondary circuit of the transformer, a thermal switch A, through the circuit 39, preferably interposing a resistance element 40. This connection may also optionally be included wherever thermal switches are used for a plurality of sign elements, and when so used, adds a large safety factor to the entire system generally, and specifically to the transformer T.

In the installation previously described, the thermal switch has been described as connected in shunt or parallel with the sign tube elements. I may, however, accomplish desirable operating conditions, to save the deteriorating effect of sparks, by connecting a somewhat similar element in series with each of the conductors feeding the electrodes. For this purpose, as illustrative of such embodiment of my invention, reference will now be made to Figure 4 which shows the electrode end 12 of a tube element 13 formed with a contacting base 14. This is preferably fitted within a tubular sleeve 41, partially split at 42 to make resilient engagement with the base 14. The sleeve 41 has a pigtail 43, soldered thereto and connected with a terminal 44, mounted upon a slidable plate 45, held against rotation within a socket made of insulating material. Forked portions 47 engage a rib 48, to hold the plate against rotation, but permitting sliding movement. The terminal has its lower free end formed with a contact point 49, terminating between the arms of the loop 50. Within this loop, there is positioned a coiled metal spring 51, formed of a bi-metallic couple, the elements whereof have different thermal coefficients of expansion. The upper end 52 of the coiled element 51 is provided with a layer or sheet of heat resisting conducting material 53. The lower end 54 of the coiled element 51 terminates in, and is connected to the binding post 55, located in the end of the socket. The plate 45 is held in resilient engagement with the coil 51, by the abutments 56, formed in the walls of the socket so that in normal operation, the contacts 49 and 53 are held urged against each other, but complete the circuit feeding the tube elements. Should these become eroded causing the formation of sparks at this point, during operation, the sparking action will heat the coil 51, The bi-metallic material, under these condtions, will shift the position of the end of the coiled element, thereby presenting a new portion of the contact 53, mounted thereon, in relation to the contact point 49. This operation will serve to prevent burning out and wear of the contacting portions 49 and 53, thereby permitting the use of less expensive alloys for the contacting material, and avoiding rapid deterioration of these elements.

In Figure 5 I have disclosed another embodiment of my invention, in which a supporting base 57, made of insulating material, supports a terminal or binding post 58, forming part of the electrical circuit. To this terminal there is mounted a bi-metallic strip 59, made of metals having widely varying coefficients of thermal expansion. The free end 60 is bifurcated, and between these furcate portions there is mounted an insulating block 61. This block rides against a loop 62, of the bracket 63, against a spring leaf or latch 64. The bracket carries a terminal 65, serving as a means of connecting a conductor forming part of the electrical circuit. The terminal 65 carries a threaded screw 66, which in turn carries a contact point 67. Oppositely disposed to the contact point 67, and mounted upon the bi-metallic strip 59, is a contacting point 68. In normal operation, the contacting points 67 and 68 are held in spaced relationship. Under conditions wherein sparking may occur between the contacting points 67 and 68, for reasons occurring in the sign tube construction as previously described, the bi-metallic strip 59 will be warped, to urge the contacts 67 and 68 into closer relationship, until final contact is made. In this position, the spring member 64 will snap beneath the block 61, to permanently hold the contacts 67 and 68 in engagement with each other. This form of installation may be mounted at some convenient point in the sign assembly, which may be accessible, so that when repair or replacement is made, the operator will merely have to unlatch the spring leaf latch 64, and permit the bi-metallic leaf to assume its normal position, with the contacts 67 and 68 in spaced relationship, and after alteration, repair or replacement has been made, the sign assembly is again in condition for proper operation.

It will be understood that the length of the bi-metallic elements in the thermal switches, as described, may be made of such size and dimensions as to obtain the requisite deflection and warping for operating conditions experienced with high potential currents necessary to operate high potential apparatus and particularly valuable for operation of electric gas tube signs, and though I have described the contacting points in the bi-metallic switches as disposed upon a relatively fixed point and the metallic strip, respectively, for purposes of magnifying the spark gap, the contacting points may be mounted re-

spectively on two bi-metallic elements operating in opposite directions as shown in Figure 7.

It will further be observed that though I prefer to use the bi-metallic strip for my thermal switch element, other thermally responsive means such as aneroid diaphragm (as shown in Figure 8) may be used with some success and obtain somewhat equivalent operation.

It will thus be observed by the device and installation as described, that electric tube signs may be operated with a large measure of safety, to avoid the destructive effects of high potential currents, due to failure or improper arrangement of any of the parts, with convenience of adjustment, replacement and repair, when necessary, as the thermal switch included in the installation will clearly indicate the points of the assembly requiring attention.

This application is a division of my prior filed application, Serial No. 635,090 filed September 27, 1932.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is—

1. For use with a high potential, electrically operated assembly, a thermally-responsive switch including electrode points normally spaced from each other forming a gap of greater resistance than required for normal operation, such points being mounted upon a member, responsive to current flowing across said gap to urge said electrode points towards each other, said member being free to reassume the initial position upon discontinuance of said current.

2. For use with a high potential, electrically operated gas tube sign, a thermal switch comprising electrode contact points mounted in insulated relationship and normally spaced from each other forming a gap of greater resistance than required for normal operation, one of said points being mounted upon a freely movable bi-metallic strip responsive to the flow of current across the gap formed by said points, to urge the points towards each other, said strip being free to reassume the initial position upon discontinuance of said current.

3. For use with a high potential, electrically operated gas tube sign, a thermal switch comprising electrode contact points mounted in insulated relationship and normally spaced from each other, forming a gap of greater resistance than required for normal operation, one of said points being mounted upon a bi-metallic strip responsive to the flow of current across the gap formed by said points, to urge the points towards each other and upon discontinuance of the same being capable of restoring itself to the original position, an insulating member connected adjacent one of said electrodes, and a latch for holding said electrodes in contacting position.

4. For use in a high potential, electrically operated gas tube sign assembly, a thermal switch comprising connectors mounted in spaced relation and insulated from each other, contact points mounted on said connectors, and an interposed thermally-responsive element for one of said points, operating under sparking conditions across said points, to urge said points in a position having a diminishing electrical resistance during flow of high potential current therethrough and formed of material to independently reestablish the original position.

5. For use with a high potential, electrically operated gas tube sign, a thermal switch comprising external connectors mounted upon an insulating member, one of said connectors including a contact point, the other of said connectors comprising a bi-metallic strip holding a second contact point in cooperative position with said first point, and holding said contact points in spaced relationship, said bi-metallic strip comprising materials of dissimilar thermal-coefficients of expansion, one of said dissimilar materials of said strip being positioned to urge the bi-metallic strip and the contact carried thereby in closer relationship to the other contact point, under operating conditions increasing said temperature of the bi-metallic strip.

6. A thermal switch of the character described comprising an insulating member having connector terminals, contact points connected with said terminals, one of said points being mounted upon a bi-metallic strip formed of metals of dissimilar thermal coefficients of expansion, holding said contact points normally in spaced relationship, forming a spark gap which may be bridged only by high potential current flowing across the gap of the character employed for operating gas tube electric signs, said strip being capable of independently re-establishing its original position.

7. A switch for disconnecting a defective portion of a gas tube sign, comprising a gap circuit connected in parallel with said portion of the sign, said gap circuit including a thermally responsive element for closing the gap upon passage of a high voltage current across said gap to heat said thermally responsive element and independently capable of re-establishing the original gap upon discontinuance of said heating effect.

8. A switch of the character and for the purposes described, having a single circuit therethrough including current conducting parts electrically arranged in series with a gap between two of said parts, one member being a thermal element resiliently responsive to heat to close said gap and upon discontinuance of the heat, independently to open said gap.

9. A switch of the character and for the purposes described, comprising an insulator, terminals connected to said insulator, a circuit contact carried on the insulator at one end thereof and electrically connected to said terminal, a thermally responsive bi-metallic strip mounted on said insulator and electrically connected to the other terminal, said strip having its free end extending into operative relationship, but normally out of engagement with said contact, said strip being connected in relation to said contact and responding to heat to close the contact and independently to open said contact upon discontinuance of the heat.

10. A switch of the character and for the purposes described, including current conducting parts electrically arranged in series with a gap between two of said parts, one part being a thermally deformable element resiliently mounted for independently closing or opening said gap upon heating or cooling of said element, respectively.

11. A switch of the character and for the purposes described and for use in connection with a gas tube sign and arranged for connection across a part of said sign for eliminating the same when defective, said switch including a bi-metallic strip in series with a normally open gap formed by said strip and a cooperating contact, said strip being adapted to close said gap due to heat generated in the gap on the continued passage of a high voltage current used in said sign

and independently capable of re-establishing its original position.

12. A switch of the character and for the purposes described in connection with a gas tube sign, said switch being connected across at least a portion of the sign for eliminating said portion when defective, said switch including a bimetallic strip in series with a normally open gap formed by said strip and a cooperating contact, said strip being adapted to close said gap due to heat in the gap on the continued passage of a high voltage current used in said sign, said strip being independently urged resiliently to the closed gap or open gap position.

13. A thermal switch of the character and for the purposes described for use in connection with a gas tube sign, comprising an insulator member having connector terminals, a freely movable bi-metallic thermally responsive strip connected with one of said terminals, a contact connected with the other of said terminals, said strip carrying a contact cooperating with said first contact and providing an air gap in series with said terminals, said contacts being resiliently urged to the closed position upon passage of high potential current across the gap for eliminating a portion of the gas tube sign when defective and independently serving to resiliently open the gap upon elimination of said defective portion.

14. A switch of the character described and for use with a high potential electrically operated gas tube sign for eliminating a defective portion of said sign, comprising terminal portions including an open gap circuit for connection in parallel with said portion of the sign, said gap circuit including a freely movable bimetallic strip for closing the gap and eliminating the defective portion of the sign upon the generation of heat through said strip.

15. A thermal switch for the protection of apparatus operable by a low current under a high potential, said switch being operable to its closed position by the heat generated by an arc across the gap formed by its normally spaced contacts and comprising a pair of normally spaced contacts of an arc resisting material and forming an arc gap therebetween, means carrying one of said contacts and maintaining the same in fixed position, manually operable means for adjusting the size of said gap, and a composite bimetallic strip fixed at one end and carrying the second contact at the other end, said bar having its metal strip having a low thermal coefficient on the side facing said fixed contact and its metal strip having a high thermal coefficient on the opposite face, so that an arc across the gap normally formed by said contacts will heat said bar and cause the same to move to close the gap and extinguish the arc and the consequent cooling will cause the bar to move to open the gap, thus returning the switch to its normal condition.

16. A thermal switch for the protection of apparatus operable by a low current under a high potential, said switch being operable to its closed position by the heat generated by an arc across the gap formed by its normally spaced contacts and comprising a pair of normally spaced contacts of an arc resisting material and forming an arc gap therebetween, means carrying one of said contacts and maintaining the same in fixed position, and a composite bimetallic strip fixed at one end and carrying the second contact at the other end, said bar having its metal strip having a low thermal coefficient on the side facing said fixed contact and its metal strip having a high thermal coefficient on the opposite face, so that an arc across the gap normally formed by said contacts will heat said bar and cause the same to move to close the gap and extinguish the arc and the consequent cooling will cause the bar to move to open the gap, thus returning the switch to its normal condition.

17. A thermal switch for the protection of apparatus operable by a low current under a high potential, said switch being operable to its closed position by the heat generated by an arc across the gap formed by its normally spaced contacts and comprising a pair of normally spaced contacts of an arc resisting material and forming an arc gap therebetween, means carrying one of said contacts, manually operable means for adjusting the size of said gap, and a composite bimetallic strip fixed at one end and carrying the second contact at the other end, said bar having its metal strip having a low thermal coefficient on the side facing said fixed contact and its metal strip having a high thermal coefficient on the opposite face, so that an arc across the gap normally formed by said contacts will heat said bar and cause the same to move to close the gap and extinguish the arc and the consequent cooling will cause the bar to move to open the gap, thus returning the switch to its normal condition.

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