April 1, 1941. L. R. PETERS 2,236,697

THERMAL SWITCH

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Fig.1.

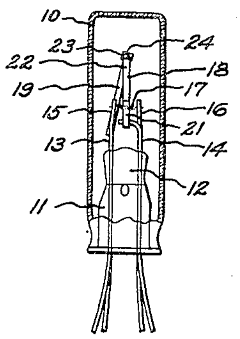

Fig.2.

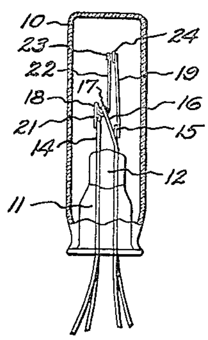

Fig.3.

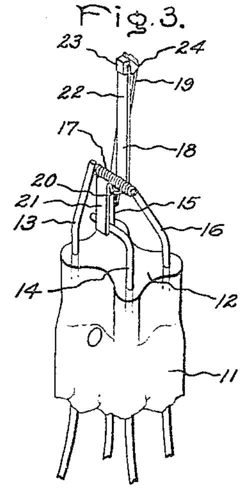

Fig.4.

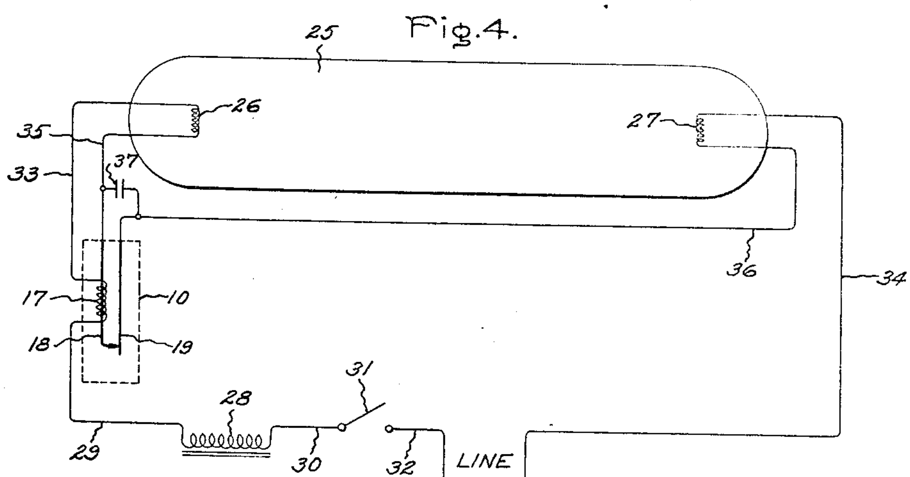

Fig.5.

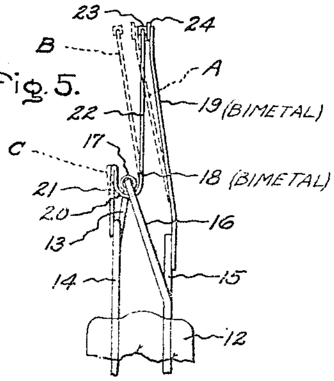

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Fig. 6.

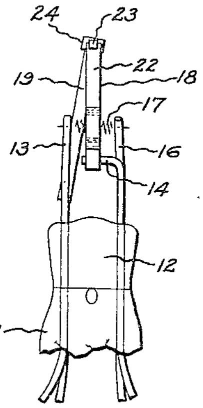

Fig. 7.

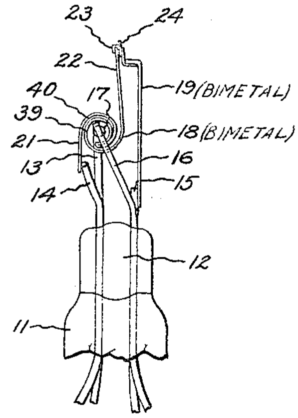

Fig. 8.

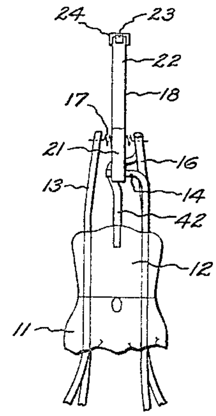

Fig. 9.

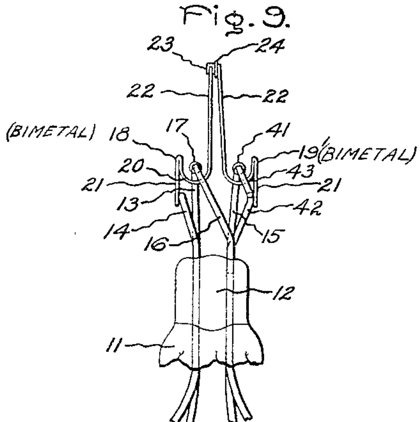

Fig. 10.

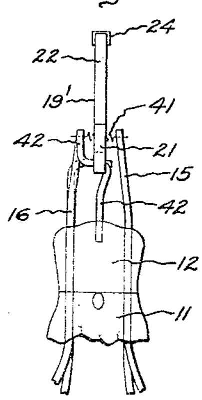

Fig. 11.

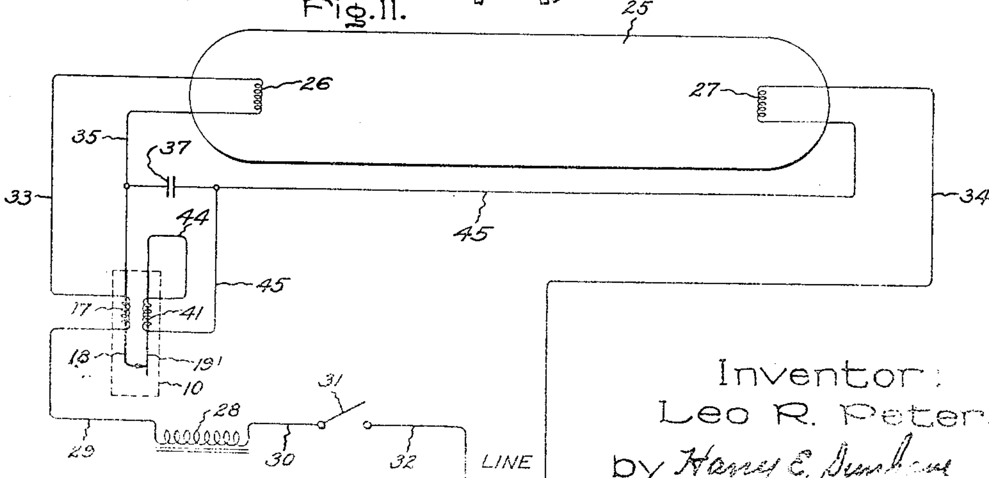

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Fig.12.

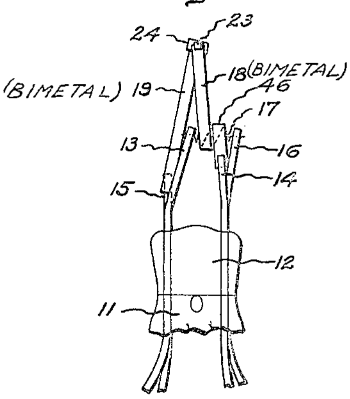


Fig.13.

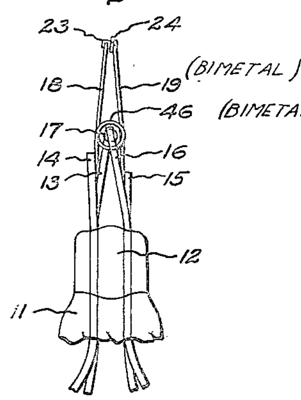


Fig.14.

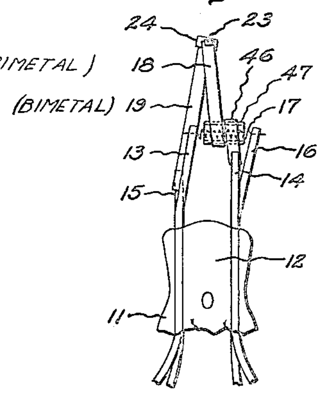


Fig.15.

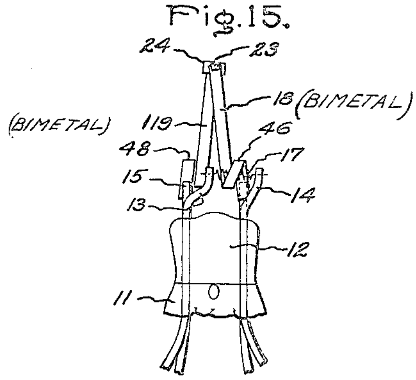
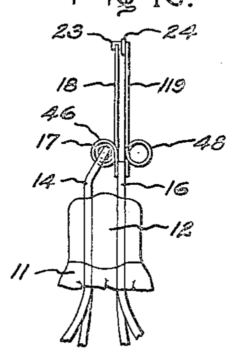


Fig 16.



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Patented Apr. 1, 1941

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UNITED STATES PATENT OFFICE

2,236,697

THERMAL SWITCH

Leo R. Peters, East Cleveland, Ohio, assignor to General Electric Company, a corporation of New York

Application September 3, 1938, Serial No. 228,365

11 Claims. (Cl. 200—122)

My invention relates generally to switches for making and breaking electrical circuits, and particularly to switches of the thermostatic type in which a bimetallic strip is adapted to be flexed by the heat radiated by a heater element connected in the circuit to thereby break the circuit through the bimetallic strip. Still more particularly, my invention relates to a switch of the above type for operating electric discharge lamps and the like.

In the operation of gas-filled electric discharge lamps having thermionic electrodes, it is necessary to provide a suitable starting circuit for the purpose of initiating the arc discharge between the lamp electrodes. Before the arc discharge can take place, the electron emissive substance with which the lamp electrodes are coated must be preheated to a temperature at which it will become sufficiently activated to readily support the arc discharge.

In one type of circuit employed for starting and operating gas-filled electric discharge lamps having thermionic electrodes, one current supply wire of each electrode is connected to one of the terminals of a source of alternating current in series with a choke coil and a main switch. The other current supply wires of the electrodes are interconnected by an auxiliary switch. When the discharge lamp is put into operation, both the main and auxiliary switches are closed and the thermionic electrodes are connected in series through the choke coil to the source of current so that they are traversed by a current by which they are preheated. When these electrodes are preheated to a temperature sufficient to activate the electron-emissive material thereon, the auxiliary switch is opened so as to interrupt the series connection of the electrodes and initiate the arc discharge therebetween. The initiation of the arc discharge is facilitated by the voltage impulse produced in the choke coil due to the opening of the auxiliary switch. During the continuance of the arc discharge, no separate heating current is passed through the electrodes inasmuch as the heating thereof is thereafter effected by the arc discharge current alone.

Where the main switch for operating an electric discharge lamp is to be mounted remote from the lamp itself, it is highly desirable, in order to simplify the wiring arrangement, that the auxiliary switch referred to above for starting lamp operation be mounted either in the lamp fixture itself or in close proximity thereto. In addition, it is also desirable that the said auxiliary switch be automatic in operation so that the arc discharge in the lamp will be automatically initiated upon closure of the main or line switch. Accordingly, one object of my invention is to provide a thermostatic auxiliary switch, simple in construction and positive in operation, for automatically starting and operating electric discharge lamps having thermionic electrodes therein upon closure of the main switch.

Another object of my invention is to provide an efficient bimetallic starting and operating switch for electric discharge lamps which can be manufactured inexpensively and which is extremely compact and of minimum dimensions.

Still another object of my invention is to provide a thermostatic switch of the bimetallic type in which the heat-actuated bimetallic element is disposed around the heater element so as to surround the same to thereby gain maximum utilization of the heat radiated by the said heater element and to readily obtain the desired movement of the bimetallic element.

A further object of my invention is to provide a bimetallic switch with effective temperature compensating means to maintain the switch contacts in their normal positions relative to one another for a protracted period of time following the energization of the switch heater element.

A still further object of my invention is to provide, in a bimetallic switch for starting and operating electric discharge lamps having thermionic electrodes, a positive delayed action feature for prolonging the period of initial heating of the lamp electrodes so that they become sufficiently electron-emissive to support an arc discharge therebetween.

Still another object of my invention is to provide a bimetallic switch having a bimetallic element formed with a portion substantially unaffected initially by the switch heater element whereby a time lag is produced in the movement of such portion, the subsequent movement of such portion thereafter combining with the initial deflection of the bimetallic element to thereby maintain the switch contact members in their operative or heat-actuated relation with respect to one another despite an appreciable drop in the current flow through the switch heater element.

A further object of my invention is to provide a bimetallic switch which will cool rapidly upon de-energization of the switch heater element, thus permitting a recommencement of circuit operations in a relatively short period of time following such de-energization of the switch heater element.

Further objects and advantages of my invention will appear from the following detailed description of species thereof and from the accompanying drawings in which:

Fig. 1 is a front view, partly in section, of a bimetallic switch comprising my invention; Fig. 2 is a side view, partly in section, of the switch shown in Fig. 1; Fig. 3 is a fragmentary isometric view, on an enlarged scale, of the switch shown in Figs. 1 and 2; Fig. 4 is a diagrammatic illustration of a wiring arrangement utilizing a bimetallic switch according to my invention for starting and operating an electric discharge lamp; Fig. 5 is a fragmentary side view, on an enlarged scale, of the bimetallic switch shown in Figs. 1 to 3 with the successive operative positions of the bimetallic switch elements shown in dotted lines; Figs. 6 and 7 are fragmentary front and side views respectively, on an enlarged scale, of a modified form of bimetallic switch according to the invention; Figs. 8, 9 and 10 are front, side and rear views, similar to Figs. 6 and 7, of another modification of my invention; Fig. 11 is a diagrammatic illustration of a wiring arrangement utilizing a bimetallic switch according to the form shown in Figs. 8 to 10 for starting and operating an electric discharge lamp; Figs. 12 and 13 are front and side views, similar to Figs. 6 and 7, of still another modification of my invention; Fig. 14 is a front view, similar to Fig. 12, of another modification of the invention; and Figs. 15 and 16 are front and side views respectively, similar to Figs. 6 and 7, of a further modification of my invention.

Referring to Figs. 1 to 3, the bimetallic switch there shown comprises a sealed elongated container 10, preferably of glass, provided at one end with an inwardly extending stem 11 having a press portion 12. A plurality of current supply or leading-in wires, comprising a front pair 13, 14 and a rear pair 15, 16, extend into the container 10 and have portions thereof sealed in the press portions 12 of the stem or supporting member 11. A heater element 17, comprising a closely coiled wire of suitable refractory material, preferably "Nichrome" wire, is supported by, and connected at its opposite ends to, the lead wires 13 and 16. As is evident from the drawings, the heater coil 17 is so mounted as to extend transversely of the envelope or container 10.

A pair of switch contact members 18, 19 are secured at one end, preferably by welding, to the leading-in wires 14 and 15 respectively. Each of the said contact members 18, 19 consists of a length of bimetallic strip, such as the commercially obtainable bimetal of chrome iron and "Invar," approximately 0.008 of an inch thick, 0.05 of an inch wide, and three-quarters of an inch long. As shown, the bimetallic elements are mounted so as to extend substantially longitudinally of the container 10. The bimetallic element 18 is bent intermediate its ends into a hook or half-loop portion 20, the open end of which preferably faces in a direction parallel to the length of the said element and towards the free or unsupported end thereof. This hooked portion 20 accordingly divides the bimetallic element 18 into two separate leg portions, to wit: a lower or main leg portion 21 and an upper or free leg portion 22. The curved portion of the hook 20 is of slightly larger diameter than that of the heater coil 17, and is so located with respect to the said heater coil as to be concentric therewith, thus partially surounding the same. The bimetallic element 18 accordingly forms the heat-actuated contact member of the switch. The other bimetallic element 19, hereinafter referred to as the spring contact member, is disposed so that the free end thereof engages the free end of the heat-actuable element 18 when the latter is in its normal or unheated position. The actual contact, however, between the two bimetallic elements is through a pair of contacts 23, 24 of a silver alloy, preferably coin silver, provided on the free ends of the members 18 and 19 respectively. As clearly shown in Fig. 5, the spring contact member 19 is so mounted on the leading-in wire 15 as to be flexed from its normal position A (indicated by the dotted lines) by the heat-actuable element 18 when the latter is in its normal or unheated position. The member 19 thus forms a temperature compensating element or device serving to maintain the ends of the two contact members 18, 19 in positive engagement during ambient temperature changes. The amount of flexure of the member 19 from its normal position by the heat-actuable element 18 is in this case so proportioned that the contact between the two members 18, 19 is broken in two to three seconds when a current of one-quarter of an ampere is passed through the heater element 17 and the said members are surrounded by an atmosphere of air.

To obtain rapid cooling of the switch parts upon deenergization of the switch heater element 17, the container 10 is filled with a suitable gas of high heat conductivity, preferably hydrogen or helium, at a pressure of approximately 4 mm. of mercury or thereabouts. I have found that a pressure of 4 mm. of the gaseous filling provides a maximum cooling effect while still affording adequate protection against arc-over. The rapid cooling provided by such a gaseous filling consequently permits operation of the switch in a very short period of time, approximating three or four seconds, following the deenergization of the heater coil 17.

Referring now to Fig. 4, illustrating diagrammatically the manner in which a bimetallic switch according to my invention may be used to start and operate an electric discharge lamp 25 having thermionic electrodes 26 and 27, one end of a choke coil 28 is connected by lead 29 to one end of the heater element 17 of the bimetallic switch 10. The other end of the choke coil is connected by lead 30, a main switch 31, and lead 32 to one side of the line. The opposite end of the heater element 17 is connected by lead 33 to one end of the lamp electrode 26, while one end of the opposite electrode 27 is connected by lead 34 to the other side of the line. The ends of the electrodes 26, 27 opposite to those ends connected to the heater coil 17 and current source are connected to the bimetallic contact members 18, 19 of the bimetallic switch 10, electrode 26 being connected by lead 35 to the bimetallic element 18 and electrode 27 being connected by lead 36 to the bimetallic element 19. The bimetallic elements 18, 19 thus function as a switch for connecting the electrodes 26, 27 in series across the line. A small condenser 37, of approximately 0.05 mfd. capacity, is preferably connected across the switch contact members 18, 19 so as to shunt the same.

As before stated, the heat-actuable bimetallic element 18, in its normal or inoperative position, is in electrical contact with the other or spring bimetallic element 19, thereby interconnecting the lamp electrodes in series across the line. To start lamp operation, the main switch 31 is closed, thus sending current through the heater element 17 of the bimetallic switch 16 and through the series-connected electrodes 26, 27 to thereby heat the same. The heating of the hook portion 20 of the bimetallic element 18 by radiation of the heat from the switch heater coil 17 results in a gradual movement of the upper leg portion 22 of the said bimetallic element towards the position B indicated by dotted lines in Fig. 5. The contact, however, between the two bimetallic elements 18, 19 is not broken during the initial stages of this movement of the element 18 since the element 19, due to the flexure thereof from its normal position A by the element 18, tends to assume the said normal position and so follows the movement of the leg 22. The continued movement, however, of the upper leg portion 22 towards the position B eventually results in the separation of the two bimetallic elements 18, 19 and the braking of the contact therebetween. As previously stated, the two bimetallic elements are so arranged with respect to one another that the period of time required for the two elements to actually separate is approximately three seconds when the current passing through the switch heater coil 17 amounts to a quarter of an ampere. This interval of time, during which the series-connected lamp electrodes 26, 27 are traversed by a current by which they are heated, is sufficiently long to permit the said electrodes to be preheated to arc-sustaining temperature. The interruption of the series connection of the electrodes 26 and 27 by the separation of elements 18, 19 immediately initiates the arc discharge in the lamp. The initiation of this arc discharge is facilitated by the voltage impulse produced in the choke coil 28 by reason of the abrupt interruption of the electrode series connection.

When the arc discharge in the lamp commences, the current flow through the lamp circuit automatically drops to a lower value. Thus, in present commercial electric discharge lamps of the fluorescent type, the current flow drops from approximately 0.5 of an ampere before initiation of the arc discharge to approximately 0.27 of an ampere after the arc discharge occurs, and in some cases to as low as 0.20 of an ampere. Consequently, the intensity of the heating effect of the heater coil 17 decreases a proportional amount. As a result, the upper leg portion 22 of the bimetallic element 18 tends to return or move backwards towards the other bimetallic element 19 and so tends to re-engage the latter, thus shorting the arc discharge in the lamp and interrupting the operation of the same. Such an undesirable condition is obviated, however, by the particular construction of the bimetallic element 18 according to the invention. Thus, by the time the upper leg portion 22 actually separates from bimetallic element 19 during the initial movement of such leg portion, the lower or main leg portion 21 has become sufficiently heated, essentially by conduction of heat from the hook portion 20, to cause a movement of the said main leg portion 21 to the position C indicated by dotted lines in Fig. 5. This subsequent movement of the main leg portion 21 accordingly adds to the deflection of the upper leg portion 22 and tends to neutralize the return movement of such upper leg portion towards the element 19, which return movement occurs when the arc discharge in the lamp commences. The additional movement thus provided by the main leg portion 21 consequently insures the maintenance of the separated relation of the two bimetallic elements 18, 19 and therefore the continuance of the arc discharge in the lamp. The particularly shaped construction of the element 18 accordingly provides a time-delayed compensating arrangement whereby the spaced relation of the switch contact points 23, 24 is maintained despite an appreciable drop in the current flow through the switch heater coil upon the initiation of the arc discharge in the lamp.

When the main switch 31 is opened to discontinue further operation of the lamp, the current passing through the heater coil 17 ceases so that the bimetallic element 18 gradually cools and returns to its normal position. If, in the case of a conventional bimetallic switch, the main switch 31 is closed to restart the lamp before the element 18 has returned to the position where it re-engages element 19, then the very instant element 18 engages element 19 so as to reestablish the circuit through the heater coil 17 and the lamp electrodes 26, 27, the slight reheating of element 18 by the heater coil 17 immediately separates the two bimetallic elements 18, 19 without allowing sufficient time for the electrodes 26, 27 to become adequately preheated to arc discharge-supporting temperature. As a result, the lamp fails to start. This same condition occurs if the main switch 31 is closed exactly at the moment the element 18 has just re-engaged element 19. If the main switch is left closed, the above described action is continually repeated again and again, the element 18 alternately making and immediately breaking the circuit through the electrodes 26, 27 before they have become sufficiently preheated to support the arc discharge in the lamp. To actually restart the lamp, it is necessary to keep the main switch open until the element 18 has returned to a position sufficiently intermediate the position at which it engages element 19 and its normal or unheated position. The contact between the two elements 18, 19 is then maintained, after closure of the main switch 31, for a sufficient length of time to permit adequate preheating of the lamp electrodes.

With a switch constructed according to my invention, and with the starting arrangement shown in Fig. 4, the above-mentioned condition is materially rectified, so that the lamp will start even though the main switch 31 be closed immediately following the opening of the same. The elimination of such an undesirable condition is accomplished by the use of coin silver for the contact points 23, 24 of the elements 18 and 19, together with the condenser 37 connected across the said elements. If, after discontinuation of lamp operation and before the element 18 has re-engaged element 19, the main switch 31 is closed, then the condenser 37 induces a spark of relatively high intensity between the approaching contact points which tends to weld the said contacts and causes them to stick together. Since the interengagement of the two contact points 23, 24 re-establishes the circuit through the heater coil 17 and electrodes 26, 27, the consequent reheating of the bimetallic element 18 tends to separate the same from the other element 19. However, the tendency of the contact points to stick together resists such separation until the force tending to separate element 18 from element 19 is sufficient to overcome the said sticking tendency. Thus, after closure of the circuit through the lamp electrodes 26, 27, a time lag occurs before the said circuit is interrupted. This time lag is of sufficient duration to permit adequate preheating of the lamp electrodes 26, 27 to arc discharge-sustaining condition. Accordingly, when the contact points 23, 24 actually do separate so as to break the series-connection of the lamp electrodes, the arc discharge in the lamp will therefore commence. It is thus evident that the use of coin silver contact points together with the condenser 37 permits rapid and positive restart of lamp operation.

Referring now to the modification shown in Figs. 6 and 7, the bimetallic switch there shown is the same as that shown in Figs. 1 to 3 except for the particular construction of the heat-actuated bimetallic element 18. Thus, instead of the hooked portion 20 surrounding the heater element 17, the element 18 in the modification is formed with a double coil surrounding the said heater element, the double coil consisting of an inner coil 39 and an outer coil 40. As shown, the outer coil 40 is formed as a continuation of the main leg portion 21 of the element 18, while the inner coil 39 is formed by reversely bending the element 18 back upon itself from the end of the outer coil 40, the inner coil 39 thus forming a continuation of the upper or free leg portion 22 of the element 18. The two coils 39 and 40 are so arranged as to be substantially concentric with one another, and are preferably spaced a slight amount.

The method of connecting this modified form of bi-metallic switch in the lamp circuit, and the operating characteristics of the said switch, are the same as that described in connection with the first form of switch. When the main switch 31 is closed, the heating of the inner coil 39 of the bimetallic element 18 by the heater element 17 causes the upper leg portion 22 to bend towards the position B (Fig. 5), the other bimetallic element 19 moving along with element 18 during the first stages of its movement to thereby maintain the contact therebetween. The continued movement, however, of the upper leg portion 22 eventually causes a separation of elements 18 and 19 and the initiation of the arc discharge in the lamp. By the time the leg portion 22 reaches the position B, the outer coil 40 and also the main leg portion 21 have begun to heat up, by conduction of heat from the inner coil 39 and otherwise. Consequently, the resulting movement of the heated outer coil 40, and the main leg portion 21 to position C (Fig. 5), tends to neutralize any return movement of the upper leg portion 22 towards element 19, thus maintaining the separated relation of elements 18, 19 and so insuring the continuance of the arc discharge in the lamp.

The modification illustrated in Figs. 8 to 10 differs from the form of switch shown in Figs. 1 to 3 in the construction of the bimetallic element 19' (corresponding to element 19 in Figs. 1-3) and in the use of a second heater element to actuate the said element 19'. Referring to Figs. 8 to 10, a heater coil 41, similar to the heater coil 17 but of relatively lower wattage, is mounted in a like manner between the leading-in wire 15 and a support wire 42 extending from, and embedded in, the press portion 12 of the stem 11. The bimetallic element 19' is secured to this auxiliary support wire 42 and is provided with a hook or U-shaped portion 43 similar to the hook portion 20 of element 18. The bimetal in element 19' is reversed, however, from that in element 18, so that the hooked portion 43, on heating, tends to open or uncoil instead of closing, as in the case of the hooked portion 20. In this manner, the upper leg portions 22, 22 of the two bimetallic elements 18, 19' move in the same direction and in substantial unison when the said elements are heated by their respective heater coils 17 and 41, thus tending to maintain the interengagement of the two elements. However, because of the difference in wattage of the two heater coils 17 and 41, the latter being of lower wattage than the former, a differential movement of the upper leg portions 22, 22 of the bimetallic elements occurs. In other words, the leg portion 22 of the element 19' does not move as fast as the leg portion 22 of element 18, so that there is a tendency for the said elements to separate. This separation, however, is delayed by so mounting the elements 18, 19' with respect to one another that the element 19' is under a slight spring tension similar to that described in connection with Figs. 1 to 3. The separation of the contact points 23, 24 therefore does not take place the instant current passes through the heater coils 17 and 41, but instead is delayed until the differential of movement between the two bimetallic elements 18, 19' exceeds the amount of spring tension, when separation actually does occur.

Referring to Fig. 11, the circuit employed for starting and operating electric discharge lamps with a bimetallic switch according to the modification of Figs. 8 to 10 is very similar to the circuit shown in Fig. 4, the only difference being the interposition of the heater coil 41 in the circuit connecting the lamp electrodes in series. Thus, as shown in Fig. 11, one end of the heater coil 41 is connected by lead 44 to the bimetallic element 19', while the other end is connected by lead 45 to one end of electrode 27. The operation of this modified form of bimetallic switch in starting and in restarting lamp operation is then the same as that described in connection with the first form of switch.

The modified form of bimetallic switch shown in Figs. 12 and 13 is similar to that shown in Figs. 1 to 3, the only difference being in the construction of the bimetallic element 18. In Figs. 12 and 13, the element 18 is formed with a helical coil 46 surrounding the heater element 17, instead of the hooked portion 20 present in Figs. 1 to 3. This helical coil construction of element 18 does not provide the time-delayed compensating feature characteristic of the previous forms of the invention. Accordingly, care must be taken in adjusting the two bimetallic elements 18 and 19 with respect to one another so that the separation of the said elements is maintained once the arc discharge in the lamp has been initiated, at which time the current flow through the heater element 17 drops to nearly half its former value and in some cases even more.

In Fig. 14, the modification there shown differs from the switch shown in Figs. 12 and 13 only in that the heater element 17 is enclosed within a mass of refractory material, preferably in the form of a cylinder 47 of porcelain or glass, which is in turn surrounded by the helical coil 46 in the bimetallic element 18. The heater element 17 heats this refractory mass 47 which in turn heats the surrounding helical coil portion 46 of the bimetallic element 18. The time required for the refractory mass 47 to heat up accordingly produces a time lag in the heating of the bimetallic element 18. Consequently, the movement of element 18, and resulting separation of the same from element 19, is delayed for a definite interval of time following the closure of the circuit through the heater element 17, thus permitting the lamp electrodes to heat up to arc-supporting temperature.

The construction shown in Figs. 15 and 16 is a slight modification of the switch illustrated in Figs. 12 and 13, the only difference being in the construction of the spring contact element 119 (corresponding to element 19 in Figs. 12 and 13) which in this modification is formed with a helical coil 48 the same as the helical coil 46 in element 18. The two bimetallic elements 18, 119 are therefore exactly alike in construction, thus greatly simplifying manufacture of the switch. A further but inconsequential difference of this form of switch from the previous forms is in the connection of one end of the switch heater element 17 to leading-in wire 14 instead of 16, and the connection of the bimetallic element 18 to leading-in wire 16 instead of 14.

It will be noted that in all the above-described forms of bimetallic switches, the bimetal surrounds the heater coil 17 instead of the latter surrounding the bimetal, as in the case of conventional switches of this type. The disposition of the bimetal around the heater coil provides a definite control over the movement of the bimetal with respect to time and with respect to varying current flow through the heater coil. Thus by suitably shaping the bimetal around the heater coil it is possible to obtain the desired character of movement of the bimetal with respect to time and with respect to varying current flow. The forming of the bimetal around the heater coil also greatly simplifies the manufacture of the switch, since it permits the use of a machine-wound heater coil. Furthermore, such construction permits the use of a higher ratio between the lamp starting and operating wattage input, allowing sufficient time for initiation of the arc discharge in starting the lamp and still maintaining the switch contact members separated, under the decreased current flow existing during lamp operation, so as not to interrupt the continuance of the arc discharge.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating contact members secured at their base ends to said support member, one of said contact members comprising a bimetallic strip so formed as to provide an intermediate portion at least partly surrounding the said heater element in relatively close relation thereto and having its base portion substantially unaffected initially by the said heater element but subsequently deflected, by the heat generated by said heater element, in a direction adding to the deflection of the free end portion of said bimetallic strip.

2. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating bimetallic contact members secured at one end to said support member and normally in engagement with each other at their unsupported ends, one of said bimetallic contact members having an intermediate portion so formed as to at least partly surround the said heater element, and the other of said bimetallic contact members being flexed a slight amount from its normal position by the said one of said bimetallic contact members.

3. A bimetallic switch comprising a support member, a pair of heater elements mounted on said support member, one of said heater elements being of relatively high wattage capacity and the other being of relatively low wattage capacity, and a pair of co-operating bimetallic contact members secured at one end to said support member, one of said bimetallic members having an intermediate portion so formed as to at least partly surround the said high wattage heater element and the other of said bimetallic members likewise having an intermediate portion so formed as to at least partly surround the said low wattage heater element, said bimetallic members being so arranged with respect to one another as to move in the same direction under the influence of like temperature changes therein.

4. A bimetallic switch comprising a container, a heater element mounted within said container, and a pair of co-operating contact members mounted within said container, at least one of said contact members comprising a bimetallic strip having an intermediate portion disposed closely adjacent the said heater element, said container having a filling of a gas of high heat conductivity at a pressure of approximately four millimeters.

5. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating contact members mounted on said support, one of said contact members comprising a bimetallic strip having at least a portion thereof disposed closely adjacent said heater element, said contact members having interengageable contact points of a silver alloy which tend to stick when brought together in a heated condition, and a condenser of relatively low capacity connected across the said contact members and capable, when said contacts are separated and a potential is applied across the condenser, of inducing a spark of sufficient intensity between the contacts to cause them to stick together.

6. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating contact members, one of said contact members comprising a bimetallic strip having an intermediate portion formed to at least partially surround said heater element in relatively close relation thereto and also having a fixed end portion and a free end portion extending in opposite directions a substantial distance away from said intermediate portion, the end of said fixed end portion being secured to said support, the other contact member being arranged to engage with the free end portion of said bimetallic strip.

7. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating contact members, one of said contact members comprising a bimetallic strip having an intermediate portion formed to at least partially surround said heater element in relatively close relation thereto and also having a fixed end portion and a free end portion extending in opposite directions a substantial distance away from said intermediate portion, the end of said fixed end portion being secured to said support, the other contact member also comprising a bimetallic strip secured at one end to said support and extending in the same general direction as said first-mentioned bimetallic strip with its free end arranged to engage the free end of said first-mentioned bimetallic strip.

8. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating contact

members each secured at one end to said support member, one of said contact members comprising a bimetallic strip having a base portion extending from said support member to a position adjacent said heater and an intermediate portion bent back toward said support in the form of a U partially surrounding said heater element and a free end portion extending a substantial distance beyond said heater element, the other contact member also comprising a bimetallic strip extending from said support member in the same general direction as said first-mentioned bimetallic strip with its free end arranged to engage the free end of said first-mentioned bimetallic strip.

9. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating bimetallic contact members secured at their base ends to said support member and normally in engagement with each other at their unsupported ends, one of said bimetallic members being so formed as to provide an intermediate portion at least partly surrounding the said heater element in relatively close relation thereto and having its base portion substantially unaffected initially by the said heater element but subsequently deflected, by the heat generated by said heater element, in a direction adding to the deflection of the free end portion of said contact member, and the other of said bimetallic contact members being flexed a slight amount from its normal position by the said one of said bimetallic members.

10. A bimetallic switch comprising a container, a heater element mounted within said container, and a pair of co-operating contact members mounted within said container, at least one of said contact members comprising a bimetallic strip having an intermediate portion disposed closely adjacent the said heater element, said container having a filling at a pressure of approximately 4 mm. of a gas included within the group consisting of hydrogen and helium.

11. A bimetallic switch comprising a support member, a heater element mounted on said support member, and a pair of co-operating contact members mounted on said support, one of said contact members comprising a bimetallic strip having at least a portion thereof disposed closely adjacent said heater element, said contact members having interengageable contact points of a coin silver alloy, and a condenser of relatively low capacity connected across the said contact members and capable, when said contacts are separated and a potential is applied across the condenser, of inducing a spark of sufficient intensity between the contacts to cause them to stick together.

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