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STARTING SWITCH

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Fig. 1.

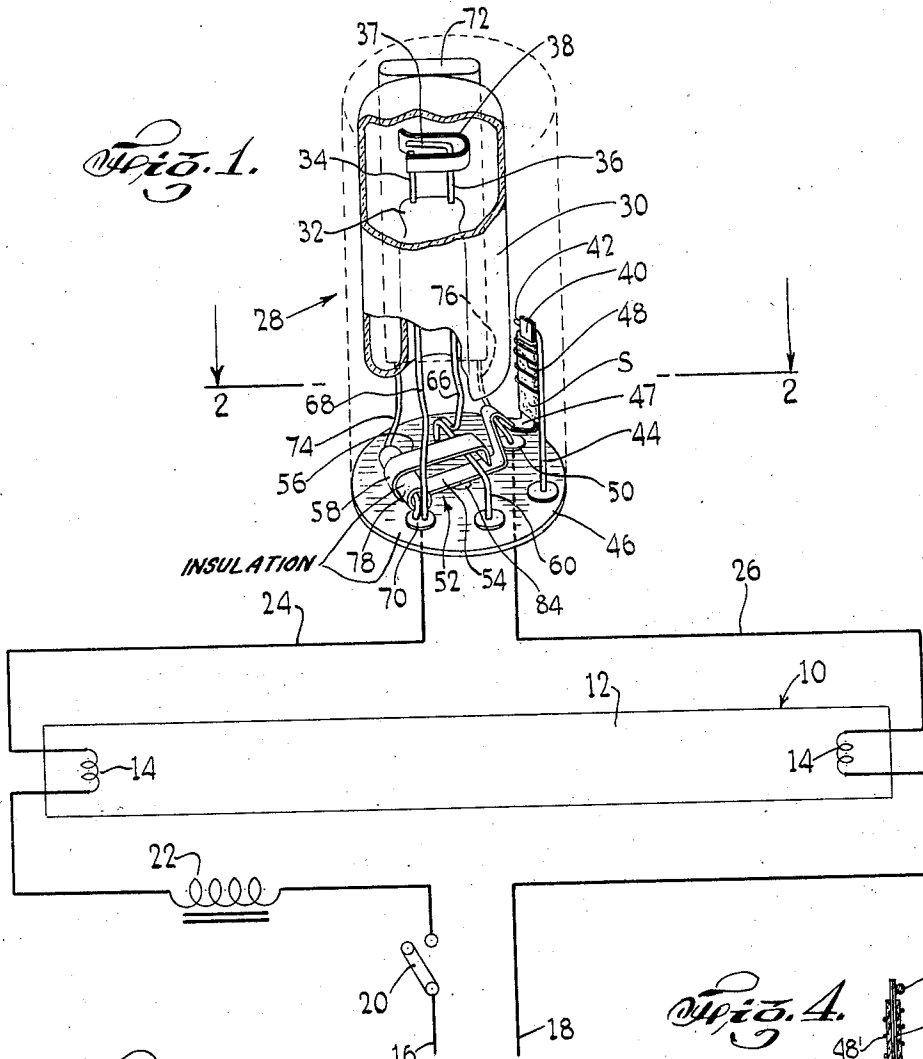


Fig. 2.

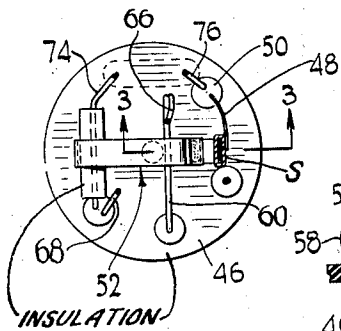


Fig. 3.

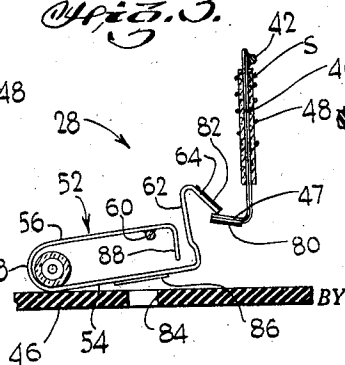
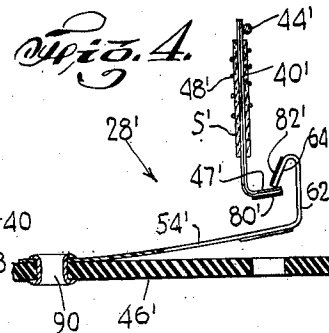


Fig. 4.



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STARTING SWITCH

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This invention relates to starting switches for electric discharge lamps.

Heretofore, if a starting switch, hereinafter referred to as a "starter," did not light a lamp upon its first attempt, it would recycle in a continuing endeavor to start the lamp. This has intermittently raised the electrodes to incandescence, flashed the lamp and caused flickering which is highly disagreeable to the eye.

It is an object of our invention to provide a starter of the character described having a simple, effective and efficient means for limiting the period during which the starter will intermittently attempt to light a lamp. Such a means will hereinafter be referred to as a "temporal limiting" means.

A further object of our invention is to provide for use with a starter, a temporal limiting means of the character described which comprises relatively few and simple parts, is easy and economical to manufacture, is durable and efficient, and not unduly sensitive to or affected by normal variations in ambient temperature or normal variations of resistance, inductance or capacitance in the various elements composing the lighting and starting circuits.

Another object of our invention is to provide for use with such starter, a temporal limiting means of the character described which is adapted to be reset in a novel and simple manner.

Other objects of our invention will in part be obvious and in part hereinafter pointed out.

Our invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the constructions hereinafter described, and of which the scope of application will be indicated in the appended claims.

In the accompanying drawing, in which are shown various possible embodiments of our invention, and wherein like numbers refer to like parts throughout,

Fig. 1 is a schematic circuit diagram for a fluorescent electric discharge lamp, and shows in perspective a starter having a temporal limiting means embodying our invention;

Fig. 2 is a sectional view through the starter, taken substantially along the line 2—2 of Fig. 1 to show more clearly certain of the electrical connections for the temporal limiting means;

Fig. 3 is a sectional view through the temporal limiting means taken substantially along the line 3—3 of Fig. 2; and

Fig. 4 is a view similar to Fig. 3 of a starter

having a temporal limiting means embodying a modified form of our invention.

Referring now to the drawing, and more particularly to Figs. 1 through 3, we have there shown a fluorescent electric discharge tube 10 of a standard type, comprising an elongated, pellucid, vitreous envelope 12 which is internally coated with a suitable luminescent composition such as a mixture of phosphors. The tube is filled with a gaseous ionizable medium at a proper pressure, and the ends thereof sealed off. Two spaced filamentary electrodes 14 are enclosed within the tube. These electrodes may be fashioned from or coated with material which will emit electrons when raised to temperature of or approaching incandescence. A source of electric power is connected to an end of each electrode 14 through lead wires 16, 18, one of which has the usual manually operated switch 20 and the ballast coil 22 series-connected therein. The other ends of the electrodes are connected by leads 24, 26 to a starter 28 having a temporal limiting means embodying our invention. Said starter includes a starting element which comprises an electric means for providing a low impedance path of short temporal duration through the starter 28 and between the two electrodes upon or subsequent to closing of the manual switch 20. Said starting element is further characterized by the fact that after a short period sufficient to heat the electrodes 14 to or near incandescence, the low impedance path is broken or, alternatively, a high impedance path suddenly substituted therefor. As is known, breaking of the low impedance path or sudden insertion of the high impedance path causes a surge potential to be impressed on the electrodes by the ballast 22. If this does not initiate an electric discharge in the lamp 10, the starting element will recycle, that is, the low impedance path will be restored for a short period of time. Insofar as the starting element of the switch is concerned, this action will continue indefinitely if the lamp 10 does not light.

Our invention may be employed with any starting element having at least the foregoing basic characteristics. By way of example, and without in any sense limiting ourselves to same, there is disclosed in Fig. 1 one type of starting element having these characteristics. Said element comprises what is known as a gas glow switch and includes an envelope 30 of insulating material which has been evacuated and filled with a gaseous medium, such as neon, at a low pressure in the range of 10-40 mm. of mercury. An end

of the envelope is retroverted to provide a stem 22 in which there are sealed two lead-in wires 34, 35. One of the wires 36 has its free end 37 bent over to lie in a horizontal plane and provides one electrode. The other wire has welded thereto a U-shaped bimetallic strip 38 which forms the second electrode. Said bimetallic strip is coated with any well known electron-emissive substance, such as potassium. The electrodes, electron-emissive substance and gaseous medium are so constituted, proportioned, and arranged that upon the application of a potential which is substantially the line potential of the lead wires 16, 18 a gaseous discharge will occur between the two electrodes. The heat generated by such discharge will warp the bimetallic strip 38 to such an extent that it will contact the end 37 of the wire 36 thus short-circuiting the starter electrodes and permitting a large current to flow through the lamp electrodes 14. After a short period of time, determined by the characteristic of the particular starting element, the bimetallic strip 38 will cool off to such an extent that it will move away from the electrode 37. If the lamp lights the potential applied to the spaced starter electrodes will not be high enough to initiate glow discharge, due to the voltage drop across the ballast 22. However, if the lamp does not light, the starting cycle will repeat indefinitely, since the potential applied to the lead-in wires 34, 36 after the starting electrodes are open-circuited will suffice to reinitiate glow discharge within the envelope 30 and reheat the bimetallic strip 38 to a point where it will again close the low impedance path between the lamp electrodes 14.

To prevent this unlimited recycling in the event of a lamp failure, as for example if the phosphors are no longer able to fluoresce, we provide, in accordance with our invention, a highly improved means for temporally limiting the period over which recycling attempts are made. Said temporal limiting means includes an electrically conductive, resilient bimetallic strip 40 which is so supported and disposed that upon the application of heat a detent portion thereof will move in a direction having a horizontal component. The strip 40 to this end may comprise a long vertical leg which is welded at its upper end to a short horizontal arm 42 extending from the top of a wire post 44, secured in an insulating disc 46, which comprises the base of the starting switch 28. The lower detent end 47 of the bimetallic strip 40 extends substantially horizontally away therefrom.

Means is provided to heat said bimetallic strip 40. Said means comprises a low resistance wire 48 which is wound around the vertical leg of the bimetallic strip. The heating resistance 48 is connected at one end to a contact pin 50 which extends through the base disc 46 and is adapted to be detachably received in a socket (not shown) such as is commonly provided with fluorescent fixtures in which discharge lamps like the lamp 10 are received. The other end of the resistance 48 is connected to the bimetallic strip 40.

Simple and suitable means is also provided to prevent heat generated in the resistance wire 48 from immediately affecting the bimetallic strip 40. Such means preferably comprises a heat insulating sheath S consisting of a few turns, as for example three turns, of a thin asbestos paper wrapped around said bimetallic strip and over which the resistance wire 48 is wound.

Cooperating with the bimetallic strip 40 is a member 52 of special configuration which is formed from resilient, electrically conductive sheet metal. Said member is so designed that it can be latched in engagement with the detent 47 when the bimetallic strip 40 is cool, will automatically unlatch and disengage from said detent when the bimetallic strip reaches a certain temperature, and will remain disengaged unless the temporal limiting means is manually reset in a manner soon to be described. To this end, said member 52 comprises a pair of substantially horizontal parallel legs 54, 56 spaced vertically and connected by a return bend 58. The upper leg 56 is supported adjacent the end thereof spaced from the bend by a wire bridge 60 mounted on the disc 46. The lower leg 54 has on its free end a right angled upwardly pointing integral finger 62 from whose top edge there extends a downwardly sloping latch 64. The member 52 is so connected to the wire bridge 60 and is so constructed and arranged that the leg 54 is biased towards a position wherein it lies flat against the insulating disc 46. The member 52 is furthermore so constructed that when its lower horizontal leg is urged upwardly the latch 64 will encounter the detent 47 and cam the same towards the right (as viewed from Figs. 1 and 4) until it clears the tip of the latch. The bimetallic strip will then spring back so that when the leg 54 is subsequently released it will be maintained under tension with the tip of the latch 64 resting on the upper surface of the detent (as shown in Fig. 3). In this position, the member 54 carries an electric current (when the starter 28 is functioning) from the lead line 25 and transmitted thereto through the pin 50, resistance wire 48, and bimetallic strip 40. This current is transferred to the electrode 36 of the starter by a lead wire 66. The other electrode 34 of the starter is connected by a lead wire 68 to a base pin 70 which is electrically connected in the socket aforementioned to the wire 24.

A condenser 72, of conventional construction and design, is connected across the two base contacts 50, 70 by lead wires 74, 76.

To aid in compacting the temporal limiting means, the lead wire 74 may be passed between the two legs 54, 56 of the latching member 52. Accidental short circuiting of starter 28 at this point is prevented by covering the enclosed portion of the lead wire 74 in a glass sleeve 78.

The starter operates as follows: When the manually controlled switch 20 is closed, the starter 28 will make an attempt to light the lamp 10. In so doing, and particularly when the starter electrodes 37, 38 are short circuited upon warping of the bimetallic strip 38, a heavy current will pass between the starter and raise the lamp electrodes 14 to incandescence. This current also traverses the series-connected resistance wire 48 whereby the same is caused to generate and emit a predetermined relatively large amount of heat. The emitted heat will warm the asbestos sheath somewhat, but not enough to allow the heat which penetrates therethrough to appreciably warp the bimetallic strip 40. If the lamp 10 does not strike on the first attempt, the starting element of the starter 28 will continue to make attempts to light the same. Each time that it makes such attempt, it will, for a short time, pass a heavy current for heating the lamp electrodes 14, and each time this heavy current will traverse the re-

sistance 48 and liberate more heat. After a certain predetermined period which can be controlled by proper selection of the ohmage and length of the resistance wire, and the quality, thickness, and number of turns of the asbestos paper forming the sheath S, sufficient heat will permeate through the sheet to warp the strip 40 to such a degree that the detent 47 will be withdrawn from under the latching portion 64 of the resilient member 52. When this occurs, the lower leg 54 of said member will spring to its unlatched position against the base disc 46 carrying with it the latch 64, thereby opening the circuit which supplies potential to the starting element so that no further starting attempts can be made.

To prevent accidental closing of this open circuit, which may be caused by deformation of the lower leg 54 due to repeated flexures thereof, insulating coats 80, 82 are applied to the lower surface of the detent 47 and the upper surface of the latch 64. These coatings are of an electrical non-conducting material, such for example as synthetic resin, hard rubber, or lacquer.

To reset the temporal limiting means, an aperture 84 is provided in the base disc 46 directly beneath the lower leg 54, through which aperture a sharp pointed instrument such as a pencil, toothpick, or pin may be inserted to lift said leg 54 when desired and cause the latch portion 64 to reengage the detent 47.

Visual indicating means may also be provided to indicate that the temporal limiting means is in open-circuit position. Such means, because of the special construction of the temporal limiting means, is of extremely simple structure and comprises merely a coating 86 of a bright colored material which will readily be visible through the aperture 84 when the leg 54 is pressed against the disc 46. Said coating will be less distinctly visible when the temporal limiting means is in closed-circuit position (as indicated in Fig. 3).

Further in accordance with the invention, means is provided to limit the upward movement of the lower horizontal leg 54 during resetting of the latch 64. Said means, in keeping with the remainder of the invention, is of extremely simple construction and comprises a downturned flange 88 extending from the free end of the leg 56. The bottom edge of said flange by abutment prevents too great an upward movement of the lower leg 54.

In Fig. 4 there is disclosed a modified form of the invention which differs from the first described form of the invention in that the means for limiting movement of the resilient latching member comprises the bimetallic strip itself. The starter 28' illustrated in said figures may include a starting element such as that described with reference to Figs. 1 to 3. On the base 46' of the starter there is mounted by means of a wire post 44' a bimetallic strip 40' having an out-turned horizontal flange or detent 47' at the lower end thereof, in contrast to the in-turned detent 47 extending from the bimetallic strip 40 shown in the first described form of our invention. The latching member comprises a strip 54' of electrically conducting resilient sheet stock which is anchored to the disc 46' at the end remote from the bimetallic strip 40' by an eyelet 90. The other end of the strip 54' has a vertically extending flange 62' thereon at the tip whereof is a sloping latching element 64'.

The latch 64' and detent 47' of the bimetallic strip 40' are provided with coats of electrically insulating material 80', 82' to prevent accidental closed-circuiting. The bimetallic strip 40' has secured therearound a sheath S' of asbestos on whose outer surface there is wound a helix of resistance wire 48'. The foregoing elements constitute the temporal limiting means of the starter 28' and operate in the same manner as the elements described with reference to the starter 28 except that upward movement of the strip 54' is limited by abutment of said strip with the detent 47'.

It will thus be seen that we have provided devices and a method for employing the same which achieve the several objects of this invention, and are well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim as new and desire to secure by Letters Patent:

1. In a starter for an electric discharge lamp comprising an insulating base, a starting element mounted on said base and an electric circuit for said element: a temporal limiting means for opening or closing said circuit, said means comprising a resilient strip supported on said base, an end of said strip spaced from the point of support having an electrically conductive latch portion movable towards and away from said base, a bimetallic strip supported on said base and having a detent normally in contactive latched engagement with said latching portion, said bimetallic strip being so arranged and constructed that said detent will move substantially parallel to said base and away from said latching portion when said bimetallic strip is heated, a sheath of thermally insulating material encircling said bimetallic strip and an electrically actuated thermal-emissive element encircling said sheath and series-connected in said circuit through said bimetallic strip and said latching portion when these are engaged.

2. A temporal limiting means as set forth in claim 1 wherein a portion of the resilient strip is horizontally disposed and lies flat against the insulating base when the latch and detent are disengaged.

3. A temporal limiting means as set forth in claim 1 wherein a portion of the resilient strip carrying the electrically conductive latch is horizontally disposed and lies flat against the insulating base when the latch and detent are disengaged and wherein an aperture is provided through said base in alignment with said horizontal portion.

4. A temporal limiting means as set forth in claim 1 wherein the resilient strip comprises a U-shaped element, the two legs of which lie above one another and parallel to the base.

5. A temporal limiting means as set forth in claim 1 wherein the resilient strip comprises a U-shaped element, the two legs of which lie above one another and parallel to the base, wherein the upper of the legs is attached to a bridge erected on the base and wherein the lower of the legs extends beyond the upper of the legs and carries the electrically conductive latch portion.

6. A temporal limiting means as set forth in

claim 1 wherein a portion of the resilient strip carrying the electrically conductive latch is horizontally disposed and, when the latch and detent are disengaged, lies flat over an aperture, through which aperture an instrument is adapted to be inserted to urge the latch away from the base and into engagement with the detent and wherein means is provided to limit the movement of the latch portion away from the base.

7. A temporal limiting means as set forth in claim 1 wherein a portion of the resilient strip carrying the electrically conductive latch is horizontally disposed and, when the latch and detent are disengaged, lies flat over an aperture, through

which aperture an instrument is adapted to be inserted to urge the latch away from the base and into engagement with the detent and wherein the bimetallic strip limits the movement of the latch portion away from the base.

8. A temporal limiting means as set forth in claim 1 wherein the latch portion extends away from the resilient strip and slopes downwardly toward the base and wherein the bimetallic strip is spaced away from said resilient strip and the detent extends towards said resilient strip.

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