Feb. 22, 1949. B. R. REINHARDT 2,462,335

STARTING SWITCH FOR ELECTRIC DISCHARGE DEVICES

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Fig. 1.

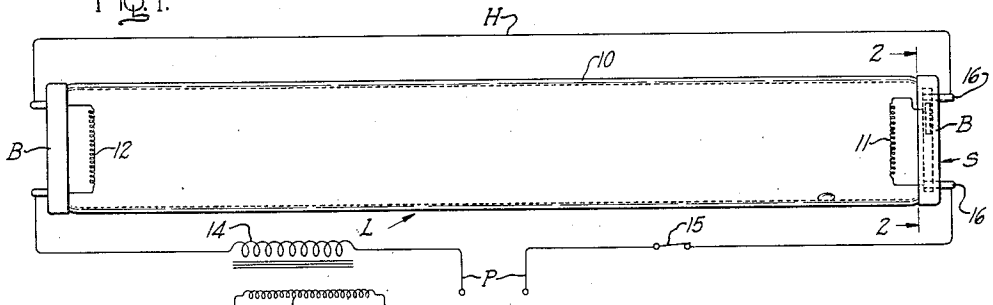


Fig. 2.

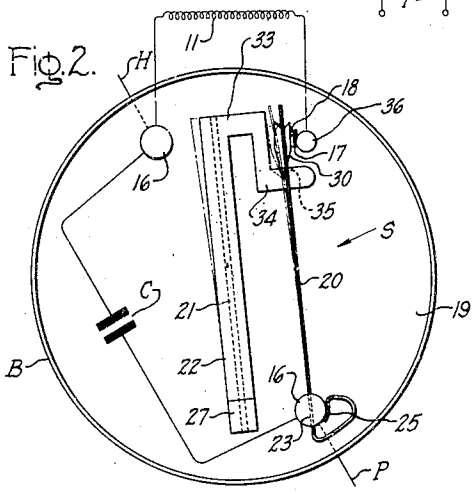


Fig. 3.

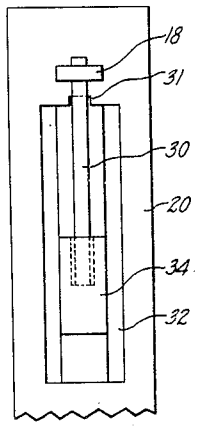


Fig. 5.

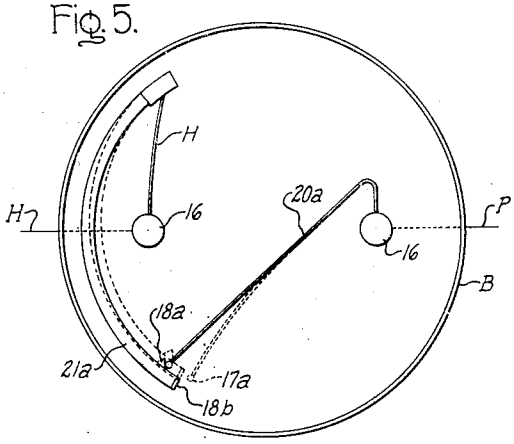
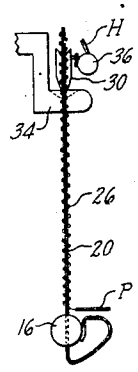


Fig. 4.



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Fig. 7.

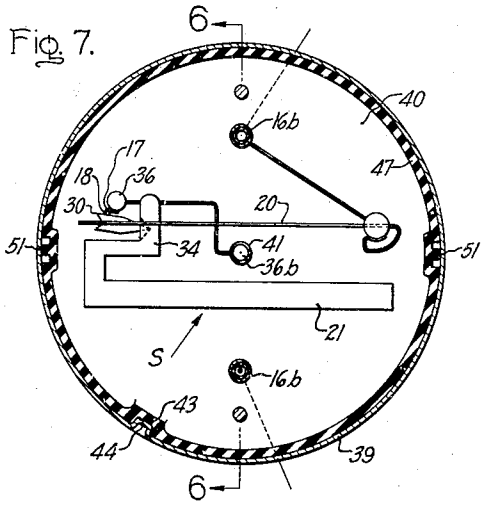


Fig. 6.

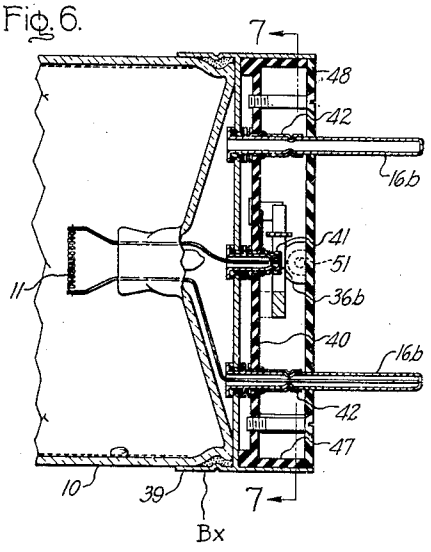
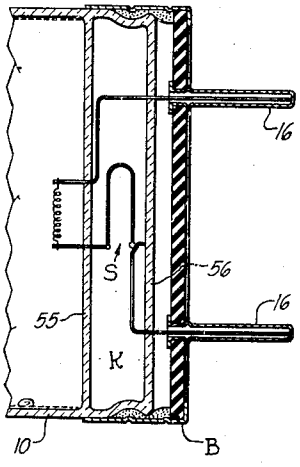


Fig. 8.



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UNITED STATES PATENT OFFICE

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STARTING SWITCH FOR ELECTRIC DISCHARGE DEVICES

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Application December 4, 1941, Serial No. 421,537

15 Claims. (Cl. 315—100)

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This invention relates to the starting of electric discharge devices, and is here illustrated and explained as applied to the starting of a fluorescent lamp. In suitable forms of construction, the invention affords a simple, rugged, durable, and reliable switch mechanism that performs the necessary operations for starting a lamp quite automatically, and can be made to repeat them very promptly if the lamp does not start at the first attempt. The action of the switch can be so arranged that neither the fluorescent lamp nor the switch mechanism need cool off very much in order to bring the restarting function of the device into play, so that the total starting time is minimized.

In carrying out my invention as hereinafter described, thermostats of different characteristics are correlated to coact in controlling the starting circuit, one of these thermostats being relatively more sensitive or fast-acting, and the other relatively less sensitive or slow-acting. By suitable correlation of the thermostats, the circuit can be made and broken at a plurality of positions of one or both of the thermostats, in such a way as to secure modes of operation very favorable for quick starting of a discharge device or lamp under different circumstances. The different characteristics or degrees of sensitiveness of the thermostats may be produced in various ways, including proper design of the thermostatic members, lagging one or both of these members to control their rate of heat-absorption and loss, adjusting or suitably locating the members relative to the heat source(s), or vice versa, adjusting the distances through which the parts move when making or breaking the circuit, etc. The thermostats may be heated in various ways suitably dependent on the starting or operation of the discharge device or lamp whose starting circuit is to be controlled, whether by the heat of the electrodes or of the discharge in the lamp, or by heat otherwise developed due to current flowing in the starting circuit or through the lamp. In some embodiments of the invention here particularly illustrated and described, the thermostats are mounted on a base disc at one end of the lamp envelope, so as to be affected by the heat of the lamp tube or envelope, and in one case a special heater in the starting circuit is also provided. The device may preferably have a snap action, and may embody a differential thermostat combination actuating a snap or toggle mechanism.

Various other features and advantages of the invention will appear from the following description of species or forms of embodiment, and from the drawings.

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In the drawings, Fig. 1 is a general diagrammatic illustration of a fluorescent lamp equipped with my starting switch, suitable circuit connections being diagrammatically illustrated; Fig. 2 is plan view of the lamp base and the switch mechanism, taken as indicated by the line and arrows 2—2 in Fig. 1, with a diagrammatic showing of certain circuit connections; Fig. 3 is a fragmentary side view, at right angles to Fig. 1, one of the parts there shown being omitted; and Fig. 4 is a fragmentary view of certain parts, illustrating a modification.

Fig. 5 is a view similar to Fig. 1, illustrating a somewhat simpler form of switch device.

Fig. 6 is a fragmentary sectional view of one end of a discharge lamp equipped with a readily removable starting switch unit according to my invention; and Fig. 7 is a sectional view at right angles to Fig. 6, taken as indicated by the line and arrows 7—7 in Fig. 6.

Fig. 8 is a view similiar to Fig. 6 showing a starting switch mounted in an end compartment of the discharge envelope itself according to my invention.

Fig. 1 shows an ordinary fluorescent lamp L (of positive column electric discharge type) with a tubular envelope 10 having the spaced-apart, activated thermionic cathodes 11, 12 in its ends, which may be specially heated cathodes of usual coiled filament type, and are shown connected through the usual bipost lamp bases B, B across a power supply circuit P including the usual ballast 14, which also serves as a starting inductance, and the manual make-and-break switch 15. A starting and electrode-heating circuit H is also shown as connectable across the circuit P through the filamentary cathodes 11, 12 and the contact terminal biposts 16 of the lamp bases B, B, under the control of my automatic starting switch S, whose relatively movable contacts 17, 18 are connected to opposite sides of this circuit. As diagrammatically indicated in Fig. 2, the heating circuit H is connected to the bipost 16 at the upper left; the filamentary cathode 11 is connected between this bipost 16 and the switch contact 17 (preferably through another part 36 that carries this contact 17, as explained hereinafter); and the other contact 18 is connected through the thermostatic member 20 (hereinafter described) to the bipost 16 at the lower right, which is itself connected to the circuit P. As indicated by the dotted outline and illustrated in Fig. 2, the switch mechanism S may be mounted on the disc 19 of

one of the lamp bases B, at the side thereof toward the interior of the envelope 10, so that the mechanism (or certain parts thereof) will be heated by the heat of the lamp due to the electric discharge therein between the electrodes 11, 12, as well as by the heat of the corresponding cathode during its preheating period. With this arrangement, the disc 19 of the lamp base B is also the base for the switch mechanism S, which is electrically connected between the cathode electrode 11 and one of the contact terminals 16 projecting outward from the side of the disc 19 remote from the interior of the envelope 10. The switch S is interposed between the base B and the corresponding end of the discharge envelope 10. A condenser or capacitator C is also shown in Fig. 2 as connected across the circuit, between the biposts 16, 16, in parallel with the switch S, to minimize radio interference as well as arcing at the switch contacts, and may sometimes be housed or accommodated between the base B and the end of the envelope 10. However, the switch mechanism S may of course be otherwise conveniently located or arranged to be readily affected by the heat of the discharge or of the cathode(s), and the capacitor C may be otherwise located.

A shown in Figs. 2 and 3, the switch mechanism S comprises thermostats 20, 21 of different degrees of sensitiveness to heat, and preferably of thermally flexible bimetallic strip type. The thermostatic member 20 is shown as a relatively light strip, and hence more quickly responsive to heat, while the thermostatic member 21 is shown as relatively heavy, and hence slower in its response. In addition, the member 21 is shown covered with a thermal lagging 22, which makes it still more sluggish: i. e., it not only heats up very slowly, but also cools off very slowly when heated. The members 20 and 21 are arranged to flex and move laterally parallel with the base B, one end of each being fixedly anchored to it, while the other end is free. As here shown, the strip 20 is a springy bimetal strip which extends through a diametral slot 23 in one of the base biposts 16 and is then bent around and welded to the post at 25, thus anchoring it at one end for resilient flexure either way, giving a spring force for the toggle mechanism hereinafter described. Besides being affected (like the member 21) by the heat of the discharge in the lamp L, the thermostatic member 20 may also be heated by current in the circuit H, either by making this member 20 part of the circuit H, as in Fig. 2, or by providing a heater 26 adjacent or wrapped around this member and connected in the circuit H, as indicated in Fig. 4. The strip 21 has its end 27 fixed to the base in any suitable way.

For operating the switch contacts 17, 18, a rocking toggle member or bar 30 is associated with the free or mobile ends of the members 20 and 21. For this purpose, the end of the member 20 has a fulcrum edge 31 formed by the outer end of a "window" opening 32 therein, which engages in a V-notch in the upper end of the toggle bar 30, while the member 21 carries a laterally shouldered head 33 with a lateral projection 34 that extends into the window 32 and has an obtuse-angled V-depression or seat 35 in which is engaged a knife-edge at the lower end of the toggle bar. Thus the toggle 30 is pivoted at its opposite ends to the mobile ends of the thermostats 20, 21. When the parts are at the right-hand extreme of their range of operating movement, as shown in full lines, the upper end of the toggle 30 may rest against a stop projection or post 36 on the base B. As shown, one of the switch contacts 17 is attached to this post 36, while the other contact 18 is attached to the toggle member 30. Movement of the parts to the left-hand extreme of their range of operating movement, as indicated in dotted lines, may be unstopped, except for lateral engagement of the toggle 30 against the head 33. Obviously, the toggle 30 passes a dead-center between the above-mentioned extremes of movement when the fulcrum or pivot-points at 31, 35, 23 all lie in a straight line.

When the lamp L is cold, the parts of the switch mechanism S occupy their full-line positions in Fig. 2, so that the circuit H is closed through the contacts 17, 18. When the switch 15 is closed to turn on or start the lamp L, as shown in Fig. 1, current flows through the heating circuit H and the cathodes 11, 12 to preheat the cathodes, and also warms or heats the thermostat member 20 until the resulting fixture of member 20 to the left snaps the upper end of the toggle 30 leftward past dead-center and throws the toggle to the left against the side of the head 33. This suddenly opens the heating circuit H, and the resulting voltage kick across the cathodes 11, 12 normally suffices to initiate discharge between them, or, in other words, starts the lamp L. Meanwhile, the thermostat member 21 has heated very little, and has therefore remained very nearly in its full-line position in Fig. 1.

Thermostat 20 is now heated by the operation of the lamp L, even though the current that was previously heating it has ceased: accordingly, the toggle 30 remains in its lefthand position against the head 33. The thermostat 21 now gradually heats from the heat of the lamp L, and the head 33 slowly moves to the left, shifting the lower end of toggle 30 nearly but not quite far enough to snap the lower end of the toggle leftward past dead-center and thus throw the toggle back to the right. Actually, the toggle remains nearly "balanced," so to speak, ready to be very easily thrown to the right.

If, now, the lamp L is shut off temporarily by opening the switch 15, the lamp L and the thermostat 20 very quickly cool, and the thermostat 20 moves to the right enough to snap the upper end of the nearly balanced toggle 30 over and throw it to the right, thus closing the switch S at 17, 18 and putting the heating circuit H in condition to be energized by closing the switch 15. Thus the lamp can be restarted, if desired, almost immediately after it is shut off. If it is not so restarted, both the thermostats 20, 21 cool off, and the switch S meantime remains closed, until eventually the conditions of the original cold start are restored.

It is readily apparent, therefore, that there are two main positions of the thermostats 20, 21 for operating the switch S: one with the thermostat 21 in its full-line position of Fig. 2, and with the thermostat 20 flexed to the left to and just beyond dead-center, but considerably short of its dotted position in Fig. 2; the other with the thermostat 21 flexed to the left to its dotted position in Fig. 2, and with the thermostat 20 at or just beyond dead-center, just a little to the right of its dotted position in Fig. 1. The difference between these positions corresponds to the flexure of the thermostat 21 after it has slowly and fully heated up during the operation of the lamp. Furthermore, if the lamp L should be shut off very soon after starting, before the thermostat 21 has fully heated up and moved to the left all the way to the dotted position in Fig. 2, then

the toggle 30 would only be thrown to the right to open the switch S after it had cooled off and flexed to the right to a position corresponding to the actual position of the thermostat 21, whatever this might be. Similarly, when the lamp L is restarted, after having been shut off, before the thermostat 21 has cooled fully, the toggle 30 will snap past dead center to throw the toggle 30 to the left and open the switch S only when the thermostat 20 has heated and flexed to the left somewhat more than is required for a cold start. In a word, therefore, there are a great variety of correlated positions of the thermostats 20, 21 for throwing the toggle either way and thereby opening or closing the switch S.

It will be seen that the device consists of a few simple parts, easy to fabricate and assemble accurately, and easy to calibrate or adjust for accurate operation exactly as desired. The parts 21 and 36 which fundamentally control the positions of the parts are strong and relatively rigid, and hence not subject to accidental derangement. The contacts 17, 18 on which accuracy of operation depends can be made of silver and may be welded to the relatively rigid, substantial parts 30 and 36, instead of to thermostatic elements whose calibration might be affected by the welding operation. The whole device can be made very rugged against injury or derangement of calibration as a result of mechanical shock. Owing to the snap action, the device is exceedingly dependable as against sticking or other minor impairment of function, and is little affected by such wear as it is subject to, so that it gives reliable operation over a long useful life. Location of the mechanism on the disc 19 of the lamp base B involves no troublesome change in the practical technique of lamp assembly, since one of the leads or wires of the heating circuit H can be inserted and soldered through one of the biposts 16 just as heretofore, and the other can be similarly inserted and soldered through the stop post 36.

The switch mechanism S illustrated in Fig. 5 differs from that of Figs. 1–4 in omitting the toggle features, while nevertheless obtaining a snap action. In this device, both of the laterally flexible conductive thermostatic members 20*a*, 21*a* may be mounted on the disc 19 of the lamp base B for movement parallel thereto. The current of the heating circuit H corresponding to that in Figs. 1 and 2 passes through these more sensitive and less sensitive flexible bimetallic strip thermostats 20*a* and 21*a* in series when the circuit H is closed. The thermostat 20*a* has a contact 17*a* (preferably of silver), at its free end, removed from its anchorage, while the thermostat 21*a* has double contacts 18*a*, 18*b* (also preferably of silver) adjacent and at its free end, removed from its anchorage and on its side that it flexes toward with increasing temperature. The thermostats 20*a*, 21*a* are arranged to flex in different directions, and, as here shown, crosswise of one another. When the lamp is cold, the contact 17*a* on the free end of thermostat 20*a* engages under slight elastic tension against the sloping side of the sloping-sided or wedge-like contact 18*a* on the inner side of the arcuate thermostat 21*a*. As the thermostat members 20*a*, 21*a* are warmed or heated by the current through them and from the lamp cathode 11 or 12 adjacent the corresponding base B, thermostat 20*a* flexes outward, breaking the contact at 17*a*, 18*a* and the circuit H, and starting the lamp. As the lamp warms up, the member 20*a* flexes still further outward, to its dotted position in Fig. 5, keeping the circuit H open. As the thermostat 21*a* is slowly warmed and heated by the heat of the discharge in the lamp, it eventually flexes inward, to the right-hand dotted position shown in Fig. 5, though it attains its extreme position later than does the thermostat 20*a*, owing to its slower response due to its greater mass and its lagging.

If, now, the lamp is temporarily shut off, the thermostat 20*a* quickly flexes back toward its initial full-line position of Fig. 5, engaging the contact 18*b* on the end of the thermostat 21*a* and closing the circuit H so that the lamp can be restarted promptly. If the lamp is not thus promptly restarted, both thermostats 20*a*, 21*a* continue to cool and to unflex, 20*a* always ahead of 21*a* and in contact with it—which results in considerable elastic tension in the springy strip 20*a*—until eventually the end of thermostat 20*a* snaps past contact 18*b* back against the lateral contact 18*a* on thermostat 21*a*. Accordingly, the device is at all times ready for prompt restarting upon closure of the switch 15.

In Figs. 1–3 and 5, various parts and features are marked with the same reference characters as a means of avoiding repetitive description in connection with Fig. 5, a distinctive letter being added where such distinction appears necessary. In both forms of device, the fast-acting or more sensitive thermostat tends to heat and cool rapidly because of its small mass, and may be suitably blacked for the same purpose; while the slow-acting or less sensitive thermostat tends to heat and cool slowly because of its large mass, and may be polished or lagged (or both) to further retard its changes in temperature. In Fig. 5, especially, the more sensitive thermostat 20*a* may have a relatively wide range of movement, while the less sensitive thermostat 21*a* may have a relatively small movement, as is indicated by the full-line and dotted line showings in this figure.

Figs. 6 and 7 show a starter switch unit removably mounted on the end of a lamp tube 10. As here shown, the disc 19*b* of the corresponding bipost lamp base B attached to the tube 10 has a rim or skirt 39 projecting outward around the base biposts 16*b*, 16*b* as well as inward around the end of the tube. There is also another post 36*b* on the disc 19*b*, much shorter than the posts 16*b*, 16*b*, and the cathode 11 is connected between this post 36*b* and one of the posts 16*b*. The switch mechanism S is shown provided with a separate base plate 40 (preferably of insulative material, such as molded plastic) which carries insulatively separated wiping contacts such as longitudinally split sleeves 41, 42, 42, for resiliently and frictionally engaging around all the base posts 36*b* and 16*b*, 16*b*, as well as the switch parts 17, 20, 21, 36, etc., and may have a notch 43 in its outer edge for coacting with a key ridge 44 on the interior of the base rim 39, so as to insure insertion of the plate 40 in the base in correct angular position. The hollow biposts 16*b*, 16*b* may have annular grooves and the split resilient sleeves may have corresponding ridges for yieldingly locking or latching in these grooves. As shown, the base plate 40 has a peripheral rim 47, and a cover 48 (which may be of insulative molded plastic) coacts with this rim (and with the base rim 39) to form a closed protective casing for the switch S, and may be secured to the base by screws. As shown, this cover 48 has a keyway in its edge to accommodate the ridge 44, as

well as holes for the bipost pins 16b, 16b. Two of the contact sleeves (41, 42) are connected as indicated to the switch parts 20 and 17, while the other sleeve 42 serves to hold the device more securely. The base plate 40 with the switch mechanism S and the cover 48 constitute a closed unit, readily removable and replaceable as such. The cover 48 and the casing rim 47 may have peripheral notches and recesses in which radial pins 51, 51 are exposed and accessible, to afford a convenient hold for removing the unit from the lamp base Bx.

In order to dispense with repetitive description, various parts and features in Figs. 6 and 7 are marked with the same reference characters as in Figs. 1–3, a distinctive letter being added where such distinction appears needful.

Thus detachably mounted on the end of the lamp L, the starting switch unit becomes virtually a part of the lamp, and may remain with it from the time it leaves the factory throughout its useful life. At the same time, the switch unit is readily removed from the lamp for test, repair, or replacement, if occasion arises.

Fig. 8 illustrates an arrangement essentially the opposite of Figs. 6 and 7: i. e., the starting switch is built into the lamp and is enclosed in a separate compartment K formed at one end of the envelope tube 10 by a transverse partition 55, such as a septum of glass suitably spaced inward from its outer end wall 56. As here shown, the cathode 11 is mounted at the inside of the partition 55, and one of its leads is sealed through the latter and the tube end 56 and is conencted directly to one of the biposts 16 of the usual base 8. The other cathode lead is sealed through the partition 55 and connected to one terminal of the starting switch S (here diagrammatically represented by a U-bent bimetal strip) whose other terminal is connected to the other base bipost 16. The switch S may be opened to start the lamp by heat due to the initial flow of current through the cathode 11, and subsequently held open by the heat of the discharge in the lamp, as long as the latter is operating.

The partition 55 may be sealed hermetically, thus excluding the discharge atmosphere of mercury vapor and starting gas from the compartment K—which may then be evacuated or provided with a special atmosphere of its own that might even be under more than atmospheric pressure—and excluding any special atmosphere in the compartment K from the discharge space of the envelope 10. This may be desirable, for example, if the switch S is built as a glow-switch. The switch S, of course, may embody a snap action, as already described in connection with Figs. 1–5.

In order to dispense with repetitive description, various parts and features in Fig. 8 are marked with the same reference characters as in Figs. 1–3, a distinctive letter being added where such distinction appears needful.

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

1. A starting switch for a starting circuit of an electric discharge device comprising correlated thermostats, one relatively fast-acting and another relatively slow-acting, responsive to heat always developed when said discharge device is starting and in operation, and toggle switch means for said starting circuit actuated by the heat-responsive movements of said thermostats relative to one another.

2. A starting switch for a starting circuit of an electric discharge device comprising a more sensitive laterally flexible thermostatic member fixed at one end and responsive to heat due to current flow in said starting circuit, as well as to heat due to current flowing through said discharge device, a less sensitive laterally flexible thermostatic member fixed at one end and responsive to heat due to current flow in said discharge device, a toggle member pivoted to the mobile ends of said thermostatic members to be rocked thereby, stop means for said toggle member, and coacting switch contacts for controlling said starting circuit mounted on said stop means and on said toggle member.

3. In a starting switch for a starting circuit of an electric discharge device, the combination with an anchored relatively slow-acting laterally flexible conductive thermostatic member in said starting circuit provided with double contacts removed from its anchorage, and responsive to heat due to current flowing through said discharge device, of an anchored relatively fast-acting laterally flexible conductive thermostatic member in said starting circuit responsive to heat due to current flowing through the latter, as well as to heat due to current flowing through said discharge device, and having at a point removed from its anchorage a contact for coacting with both of said double contacts of said slow-acting thermostatic member, said thermostatic members being arranged to flex in different directions, so that the fast-acting member engages one of said double contacts for a cold start of the discharge device, and engages the other of said contacts for a hot restart of said device.

4. In a starting switch for a starting circuit of an electric discharge device, the combination with a relatively slow-acting laterally flexible conductive thermostatic member in said starting circuit fixed at one end, and provided with double contacts at and adjacent its other end, and responsive to heat due to current flowing through said discharge device, of a relatively fast-acting laterally flexible conductive thermostatic member in said starting circuit responsive to heat due to current flowing through the latter, as well as to heat due to current flowing through said discharge device, said fast-acting thermostatic member being fixed at one end and having at its other end a contact for coacting with both of said double contacts of said slow-acting thermostatic member, and being arranged to flex crosswise of the flexure of the latter, thus engaging one of said double contacts for a cold start of the discharge device, and engaging the other for a hot restart of said device.

5. In a starting switch for a starting circuit of an electric discharge device, the combination with a relatively slow-acting laterally flexible conductive thermostatic member in said starting circuit fixed at one end, and provided with stop contacts at and adjacent its other end, on the side that it flexes away from with increasing temperature, and responsive to heat due to current flowing through said discharge device, of a relatively fast-acting laterally flexible conductive thermostatic member in said starting circuit responsive to heat due to current flowing through the latter, as well as to heat due to current flowing through said discharge device, said fast-acting thermostatic member being fixed at one end and having at its other end a contact for coacting with both of said double contacts of said slow-

acting thermostatic member, and being arranged to flex in a different direction from the flexure of the latter away from both its contacts, with increasing temperature, thus engaging one of said double contacts for a cold start of the discharge device, and engaging the other for a hot restart of said device.

6. The combination with an electric discharge device including a discharge envelope having an electrode therein, and a disc at one end of said envelope having post contact terminals projecting from its outer side, away from the envelope, for making connection to starting and operating circuits for said discharge device, of an automatic switch unit for controlling the starting circuit removably mounted on said disc around said post terminals, and resiliently engaged with the latter.

7. The combination with an electric discharge device including a discharge envelope having an electrode therein, and a disc at one end of said envelope having post contact terminals and a surrounding skirt projecting from its outer side, away from the envelope, for making connection to starting and operating circuits for said discharge device, of an automatic switch unit removably mounted inside said skirt, and provided with a casing wall for coacting with said skirt to protect the switch mechanism, as well as with means for engaging and making electrical connection with one of said post contact terminals.

8. A starting switch for a starting circuit of an electric discharge device comprising correlated laterally flexible thermostatic members, one relatively fast-acting and another relatively slow-acting, responsive to head developed when said discharge device is starting and in operation, said thermostatic members flexing in the same direction when heated; and coacting switch contact means for controlling said starting circuit actuated by said thermostats and held by the latter in circuit-closing positions when said thermostats are in their normal cold positions; with means actuated by said fast-acting thermostat when heated to separate contact means aforesaid and interrupt the starting circuit, and actuated by said slow-acting thermostat when heated to bring about interengagement of contact means aforesaid, as the thermostats cool, before the thermostats return to their cold positions aforesaid.

9. A starting switch for a starting circuit of an electric discharge device comprising laterally flexible thermostats anchored at their ends and flexing in the same direction when heated, and responsive to heat developed when said discharge device is starting and in operation, one of said thermostats being faster-acting than the other, a toggle member extending and pivoted between the mobile ends of said thermostats, in position to be swung past dead-center one way when the thermostats are cold and to be swung past dead-center the other way by flexure of the faster-acting thermostat when heated, and coacting contacts for controlling said starting circuit, one mounted on said toggle member and the other in position to be engaged by the toggle member contact both when the thermostats are cold, and when they have partially unflexed after heating up.

10. In a starting switch for a starting circuit of an electric discharge device, the combination of flexible thermostatic members arranged to flex parallel to one plane but crosswise of one another's flexure, one of said thermostats being faster-acting than the other, and coacting switch contacts actuated by said thermostats for controlling said starting circuit.

11. In a starting switch for a starting circuit of an electric discharge device, the combination of flexible thermostatic members, one relatively fast-acting and another relatively slow-acting, responsive to heat developed when said discharge device is starting and in operation, and arranged to flex parallel to one plane but in different directions, and coacting switch contact means for controlling said starting circuit actuated by said thermostats and held by the latter in circuit-closing positions when thermostats are in their normal cold positions, said fast-acting thermostat moving when heated to separate contact means aforesaid and interrupt the starting circuit, and said slow-acting thermostat moving when heated to bring contact means aforesaid actuated thereby to an intermediate position in the path of contact means aforesaid actuated by the fast-acting thermostat as the latter cools.

12. A starting switch for a starting circuit of an electric discharge device comprising correlated thermostats, one thermally more sensitive and faster acting than the other, said thermostats tending in the same direction under thermal change, toggle means actuated jointly by said thermostats, and shifted both ways past dead center by their movements relative to one another due to their difference in temperature response as aforesaid, and co-acting starting circuit contacts shifted into and out of engagement by movements of said toggle means past dead center as aforesaid.

13. In a starting switch for an electric discharge device, the combination with an anchored relatively slow-acting laterally flexible thermostatic member provided with double contacts removed from its anchorage, of an anchored relatively fast-acting laterally flexible thermostatic member having at a point removed from its anchorage a contact for coacting with both of said double contacts of said slow-acting thermostatic member, said thermostatic members being arranged to flex parallel to one plane but in different directions, so that the fast-acting thermostat engages one of said double contacts for a cold start of the discharge device, and engages the other of said contacts for a hot restart of said device.

14. In a starting switch for an electric discharge device, the combination with a relatively slow-acting laterally flexible thermostatic member fixed at one end and provided with double contacts at and adjacent its other end, on the side that it flexes away from with increasing temperature, of a relatively fast-acting laterally flexible thermostatic member also fixed at one end and having at its other end a contact for coacting with both of said double contacts of said slow-acting thermostatic member, said thermostatic members being arranged to flex parallel to one plane but crosswise of one another's flexure, said fast-acting thermostatic member flexing away from both contacts of said slow-acting thermostatic member with increasing temperature, and engaging one of them for a cold start of the discharge device and the other for a hot restart of said device.

15. A starting switch for a starting circuit of an electric discharge device comprising correlated thermostats, one relatively fast-acting and another relatively slow-acting, responsive to heat

developed when said discharge device is starting and in operation, and co-acting switch contact means for controlling said starting circuit actuated by said thermostats and held thereby in circuit-closing positions when said thermostats are in their normal cold positions, said fast-acting thermostat moving when heated to effect separation of said contact means and interruption of the starting circuit, and said slow-acting thermostat moving when heated to a position which maintains the contact means separated during continued heating of said thermostats but which, upon cooling of the thermostats, results in interengagement of said contact means before the thermostats return to their said normal cold positions.

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