

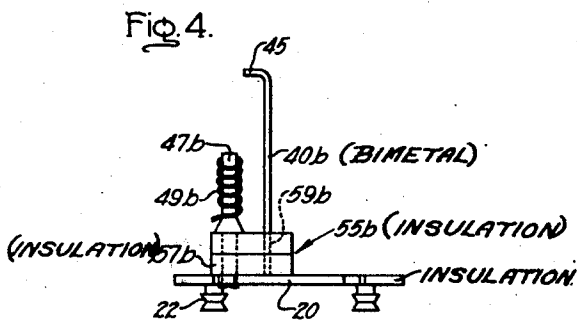
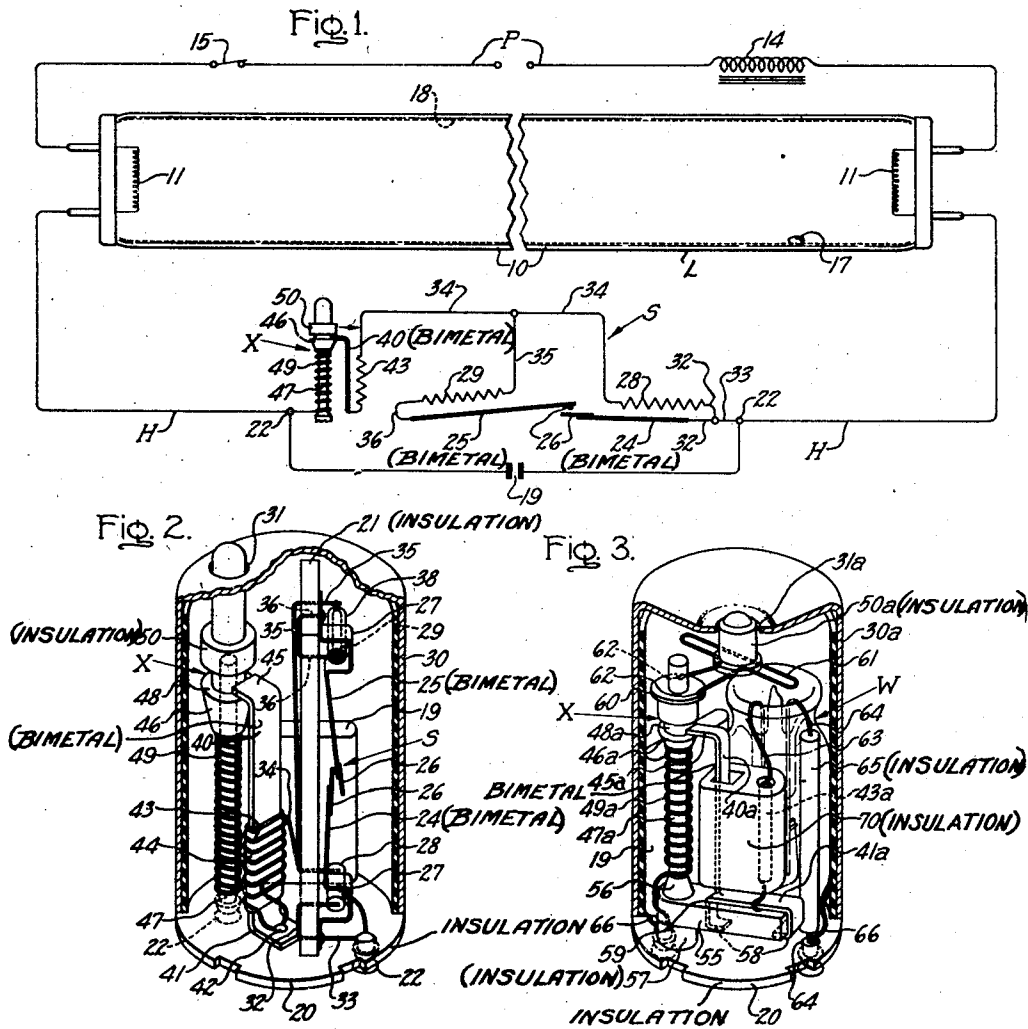
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STARTING CONTROL FOR ELECTRIC DISCHARGE DEVICES

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STARTING CONTROL FOR ELECTRIC
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7 Claims. (Cl. 200-122)

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This invention relates to the control of electric discharge devices, and is especially concerned with the starting of such devices. The invention is very useful in connection with fluorescent tubes or lamps of the positive column discharge type, and is hereinafter explained with particular reference to lamps of this character and their usual starting arrangements, as exemplified in U. S. Patent 1,951,112, March 13, 1934, to Wels, or Patent 2,212,427, August 20, 1940, to Peters, for instance.

Ordinary tubular fluorescent lamps have electrical starting circuits which are energized and broken to start the discharge. Sometimes this has to be done several times before the discharge actually starts. For this purpose, automatic means are commonly provided which will make and break the starting circuit indefinitely until starting is accomplished.

Through deterioration in service or as the result of accident, fluorescent lamps and other discharge devices often or eventually become incapable of starting and normal running, so that the only effect of the automatic efforts to start such a lamp is a continual flashing in it that is very annoying to those in the area that receives the light of the flashing lamp, besides uselessly wearing out the starter device. Usually such incapacity for starting is due to loss of electron emission from one or both electrodes of the lamp, which may result from dissipation or other loss of activating material on which the emission depends. The objectionable flashing of such a lamp goes on indefinitely until the power supply is shut off, or the lamp is removed from the circuit.

The purpose of this invention is to obviate the undesirable flashing of defective lamps without interfering with repetition of the attempts to start as long as there is any reasonable promise of success. This is accomplished by keeping the starting circuit open or rendering the starter ineffective to close the starting circuit after repeated operation of the starter has failed to start the discharge, thus "locking out" the starter, so to speak. I have hereinafter described and explained this "lock-out" as applied in association with several types of automatic starter; but the invention is also applicable in connection with other types of starter. In suitable forms of embodiment such as hereinafter described, the invention affords advantages of simple and rugged construction, durability and reliable performance in service, capacity for flexible and accurate regulation of lock-out time

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to allow proper opportunity for starting the lamp, as desired, and ease and low cost of manufacture. Still other features and advantages of the invention will become apparent from the description of species and forms of embodiment, and from the drawings. This application is a continuation-in-part of application Serial No. 438,208 filed April 8, 1942, by Jack R. Whiteside and Mark A. Townsend, and assigned to the assignee of this application. The present application is made to protect the further invention which I believe to be present in the subject matter set forth in the claims hereof over and beyond the claims set forth in the above mentioned joint application.

In the drawings, Fig. 1 is a diagrammatic view of a fluorescent tube or lamp with circuit connections including the present invention, a mid-portion of the lamp envelope being broken out and omitted; Fig. 2 is a tilted or perspective view of one form of starting switch and lock-out device; Fig. 3 is a tilted or perspective similar to Fig. 2 illustrating the lock-out in connection with a glow-switch, and slightly modified; and Fig. 4 is a fragmentary view similar to Fig. 3 but illustrating a structural modification.

Fig. 1 shows an ordinary fluorescent lamp L of the positive column electric discharge type with a tubular envelope 10 having spaced apart activated thermionic cathodes 11, 11 in its ends, which may be specially heated cathodes of usual coiled filament type activated with coatings of refractory oxides, such as a mixture of alkaline earth oxides including barium and strontium oxides, and are shown connected 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. The envelope 10 may contain a low-pressure atmosphere of starting gas, such as argon at a pressure of 2 to 5 mm. of mercury, and also a vaporizable and ionizable working substance such as mercury. A supply of mercury, which may exceed the amount that will vaporize during operation of the lamp L, is indicated by a drop 17 inside the envelope 10, and an internal coating of fluorescent material or phosphor 18 on the envelope walls is also indicated. A starting and electrode-heating circuit H is shown connected across the circuit P through the filamentary cathodes 11, 11, with a starting switch S included therein, which may be of thermal type. A capacitor or condenser 19 of suitable capacity (e. g., 0.007 microfarad) may be connected across the switch, to minimize radio interference as well as arcing

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when the switch opens and breaks the circuit H. The general mode of operation in starting the lamp L with this circuit arrangement is that when the switch 15 is closed to turn on the lamp L, the switch device S permits flow of current through the circuit H and the cathode filaments 11, 11 in series therein for a sufficient length of time to preheat the cathodes to an adequate emissive temperature, and then suddenly opens the circuit H; and the resulting voltage kick between the cathodes 11, 11 suffices to initiate discharge between them, or, in other words, starts the lamp.

As shown in Fig. 2, the switch device S has as its base an insulative disc 20, and also includes an upright insulative frame plate 21. Underneath the base disc 20 are shown binding post connectors 22, 22 to which the wires of the circuit H are connected, and their reduced shanks extend up through the disc and are headed over to secure them. The switch device S is shown in Figs. 1 and 2 as a thermal switch comprising switch members 24, 25 that are connected to opposite sides of the starting circuit H through the connectors 22, 22 and coact in making and breaking this circuit. The switch members 24, 25 may consist of slender, approximately upright thermostatic bimetal strips coacting as both temperature-responsive elements and current-carrying contact members, and are shown in Fig. 2 as mounted on one side of the plate 21, at opposite ends thereof, to extend toward one another. Contact pieces 26, 26 (as of coin silver wire) are shown welded to the coacting free inner ends of the members 24, 25, and may extend at right angles to one another. The members 24, 25 are shown as bent transversely, channel fashion, near their anchored outer ends, these bends 27, 27 being both turned away from the plate 21. Adjacent the thermostat members 24, 25, about concentric with their bends 27, 27, there are resistance heaters 28, 29 for heating these members. The circuit connections of these heaters will be more fully described hereinafter; for the present it suffices to say that the heater 28 for the member 24 is connected across the circuits H and P in parallel with the members 24, 25, so as to respond essentially to the energization and voltage of the main discharge circuit P during starting, while the heater 29 for the member 25 is connected in the circuit H in series with the members 24, 25, so as to respond to the energization of this starting circuit H and to the current flow therein. The thermostatic switch members 24, 25 may be arranged to flex in the same direction (upward in Fig. 1, and toward the right in Fig. 2) when heated, and vice versa. A sheet metal cover, casing, or can 30 having an insulative lining for its cylindrical wall may enclose the whole device from the base 20 up, and is shown with its end wall apertured at 31. The heater 28, which is preferably of high resistance, has one end connected by a lead 32 and a lead 33 from member 24 to one of the connectors 22, while its other end is normally connected by a lead 34 and other means hereinafter described to the other connector 22. One end of the heater 29 is connected by a lead 35 to the lead 34, while its other end is connected by a lead 36 to the member 25, and is thus also connected through the switch S (when closed) to the connector 22 to which heater 28 is more directly connected. The heater 28, which is subject and responsive to the high ballast output voltage when the switch opens, is preferably of very high resistance, such as 80,000

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to 100,000 ohms, for example, in order to prevent it from seriously lowering the voltage available for starting the discharge. It may also be found advantageous to make the heating resistance 28 of a type having a negative temperature-resistance coefficient, so that it may heat more rapidly and cause the switch member 24 to close more quickly, though this member 24 does not move far enough to close under the normal operating voltage of the lamp. The heater 29, through which flows the cathode preheating current in the starting circuit H when the switch S is closed, is preferably of low resistance, such as 3 ohms, in order to minimize its energy consumption. Any suitable provision may be made to cause the heater 29 to heat the thermostat 25 and to cool off rather slowly, such as enclosing this heater 29 in a "no-nex" glass sleeve 38, so as to give it a high heat capacity. On the other hand, the heating and cooling time of the heater 28 may be minimized, as by blackening it so as to lower its heat capacity.

When the switch 15 is closed for a cold start, line voltage is applied to energize the circuits P, H and the heater 28, and the thermostat member 24 is heated and flexes (upward in Fig. 1, and to the right in Fig. 2) into contact at 26 with the member 25, closing the switch S and fully energizing the circuit H and the heater 29. Closing of the switch S short-circuits heater 28, which is thus de-energized and starts to cool off, as well as thermostat 24. The current flow through the cathode coils 11, 11 and the heater 29 preheats the cathodes and also heats up the thermostat member 25, which flexes (upward in Fig. 1, and to the right in Fig. 2) out of contact with the member 24, breaking the circuit H. This opening of the starting circuit H is a quick, sharp action, giving a maximum voltage kick which is generally effective to start the discharge in the lamp L, if it is a good lamp. When the switch S opens in this manner, the heater 29 and the thermostat 25 are de-energized, and the de-energized thermostat 25 cools and unflexes. The discharge in the lamp L shunts or short-circuits and de-energizes the heater 28 (in view of its high resistance) sufficiently to prevent it from reclosing the switch S. If this cycle of operation of the switch S fails to start the lamp L, it may be repeated one or more times.

In accordance with the present invention, means of control are provided for determining the condition of the circuit H as to continuity in such a way that after reasonable efforts of the starter S to start the main discharge, an open-circuit condition of circuit H that prevents flashing of the lamp L is established and maintained, independent and regardless of any further action or operation of starter S, indeed, the ordinary operation of starter S may be suspended. For this purpose, automatic control means may be employed whose period of operation (as fixed by design and adjustment) is long enough to include whatever number of attempts by starter S may be considered reasonably worth-while, e. g., a period of about a minute under favorable voltage conditions, embracing some five to ten attempts, say. The action of this automatic control need not be an arbitrary matter of fixed adjustment, however, but can be made responsive to the actual attempts of starter S to start the main discharge. As it is the circuit H that is to be opened and kept open, energy from another source than this circuit H is needed. Rather than provide a relay with connections from the

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main circuit P, I may employ an independent mechanical motor or source of energy, such as a spring brought into action in response to the energization and voltage of this circuit during starting.

For this purpose, there is shown in Figs 1 and 2 a self-opening switch X connected in series with the automatic starter S. This switch X comprises as one switch member a straight, approximately upright thermostatic bimetal strip 40 whose laterally bent foot 41 is anchored and riveted to the base 20 at 42. For heating the thermostatic member 40, there is a special heater 43 consisting of fine resistance wire coiled around the member 40 near its foot 41, over a thermo-insulative wrapping of sheet asbestos 44 which slows the transfer of heat to the member 40 and gives it somewhat greater heat capacity, thus retarding the action of the switch X as compared with that of the switch S. The upper free end of the thermostat 40 is bent laterally at 45 to co-act as a latch and contact with a contact and latching head or plunger 46 that is mounted to slide along fixed longitudinal support and guide means in the form of a rod 47 upstanding from one of the connectors 22 alongside the starter S. The head 46 has a conical downward bevel surmounted by an annular latch-engaging contact shoulder 48. Around the upright guide rod 47 there is a switch-opening helical compression spring 49 that acts against the head 46 to yieldingly urge it upward toward the upper apertured casing end. As an operator for the switch X, the head 46 has an insulative shouldered handle 50 that works or moves inward and outward through the hole 31 in the top or end wall of the casing 30.

When the switch X is "set" in closed condition by engagement of latch 45 with head 46 as shown in Fig. 2, it completes the starting circuit H from one connector 22 through heater 43 and automatic starter S to the other connector 22. Normally, when the lamp L controlled by the starter S is a good one, the contact head 46 is held down or retained as shown by the latch 45 of the thermostat 40 that extends along adjacent the rod 47, and the handle 50 protrudes only slightly through the top of the casing 30, as shown in Fig. 2. But when the lamp L is a bad one that cannot be started, the accumulation of heat in the thermostat 40 and its heat-retentive lagging 44 eventually heats up this thermostat 40 until it bends back away from the head 46 and releases it, whereupon the head 46 and the handle 50 fly up until stopped by engagement of the shoulder on the handle 50 with the top of the casing 30, through which the handle then protrudes very conspicuously. This opening of the switch X opens the starting circuit H regardless of the switch S, so that further automatic efforts to start the lamp become impossible until the switch X is reclosed by hand. The switch X can be reclosed and relatched by simply pushing down on the handle or button 50, causing the bevel of the head 46 to force back the thermostat member 40 and latch under its latch 45 at 48.

The device illustrated in Fig. 3 differs from that in Figs. 1 and 2 in the substitution of a glow-switch W of ordinary type for the thermal switch S described above, as well as in certain features of the switch X. Instead of being attached directly to the base disc 20, the thermostat 40a is attached to an insulative part or block 55 that is mounted on the guide and support rod 47a and projects laterally from it. For this purpose, the rod 47a is flanged or shouldered at 56, and its

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portion below the shoulder extends through the part 55 and an insulative spacing washer 57 between the part 55 and the disc 20. Unlike the rod 47 in Fig. 2, the rod 47a is not attached to one of the connectors 22, but is separately and independently riveted through the disc 20. The thermostat foot 41a has tangs 58, 58 that clamp around the portion of the part 55 between its outer end and an opening 59 in it near the washer 57. The latch and contact head or plunger 46a is annularly grooved at 48a above its conical portion to provide a shoulder for engaging the latch 45.

As here shown, the upper end wall of the casing 30a is reentrantly dish-shaped, and its operator-hole 31a is centrally located at the bottom of the external recess. The operator 50a is shown as a separate insulative button loose in the opening 31a and having an annular shoulder to engage behind the edge of the opening and limit protrusion of the button. Owing to the amount of room required in the casing 30a for the glow-switch W, the guide rod 47a is eccentrically located therein, some distance out of line with the axis of the casing and of the hole 31a and button 50a; but the head or plunger 46a has a lateral portion extending under the button to one side of the rod substantially into line with the opening 31a, and preferably engaging the button 50a axially of the latter and square with the button and casing axes, so that there is no eccentric thrust tending to cock or bind the button in its hole 31a. Instead of extending the top flange 60 of the head 46a to a width sufficient for this purpose, the head 46a may be supplemented with a double wire loop 61 having its ends extended laterally across the top surface of the head 46a and bent downward and back to hook through diametrically opposite notches 62, 62 in the flange and under the latter. The wire of the loop 61 is made sufficiently stiff and springy to allow of springing the ends apart to engage them in the notches 62, 62 in this manner, as well as to sustain the end thrust of the button 50a for operating the latch to set it.

As here shown, the glow-switch W and the contacts 45, 46a of switch X are connected between the connectors 22, 22 in series with one another and with the heater 43a for the thermostat 40a, which may be connected between said contacts and the glow-switch. For this purpose, the lower end of the spring 49a (whose upper end engages the plunger 46a) may be connected to one connector 22, one end of the coiled resistance heater 43a may be connected to the thermostat foot 41a and its other end to one glow-switch lead 63, and the other glow-switch lead 64 may be connected (through an insulative sleeve or covering 65) to the other connector 22. The condenser 19 may have its leads 66, 66 connected directly to the two connectors 22, 22, so that it shunts and protects both the serially connected switches W and X, as in Figs. 1 and 2.

As shown in Fig. 3, provision is made to slow the transfer of heat from heater 43a to thermostat 40a and to give the latter greater heat capacity, thus desirably retarding the action of switch X as compared with switch W while at the same time allowing heater 43a to take a wattage adequate to assure operation of switch X even when the voltage at F is low owing to poor supply voltage regulation. For this purpose, the thermostat 40a and its heater 43a are separately enclosed or even surrounded (more or less completely) in thermo-insulatively separated parallel recesses or "bores" in a common thermal insulator 70, which

may be made of ceramic material. This insulator 70 not only slows the transmission of heat from heater 43a to thermostat 40a, but also minimizes loss of heat and consequent variations of operation due to atmospheric temperature changes, besides preventing the heat of the glow-switch W from affecting the thermostat materially. By thus definitely controlling the amount of heat capacity or thermal inertia between the heater 43a and the thermostatic bimetal 40a, it becomes possible to have the heater 43a operate at relatively high wattage without risk of tripping the latch 45 too soon when the supply voltage is relatively high, or of failing to trip it at all when this voltage is relatively low. For example, a 118 volt supply may give 3.5 watts in the heater 43a when the voltage falls to 105 volts and 8.5 to 9 watts when the voltage rises to 130 volts, with definite assurance of adequate opportunity for starting on high voltage and of locking out after a reasonable duration of starting effort on low voltage.

For the convenience of those wishing to use the invention, particulars of a starter such as shown in Fig. 3 suitable for 30-40 watt fluorescent lamps of the usual positive column type are given:

The glow-switch W may be a small commercial glow-switch such as is already in use for fluorescent lamps. The thermostatic member 40a may be a strip of bimetal composed of laminae of Invar, an alloy of 64 per cent iron and 36 per cent nickel, and of chrome iron, an alloy of 75 per cent iron, 22 per cent nickel, and 3 per cent chromium, in equal thicknesses, welded together, and of 0.03 inch total thickness. Above its foot 41a, it may be $\frac{1}{16}$ inch wide, with a height of $\frac{1}{2}$ inch from the top of the foot to the underside of the latch portion 45a, which may project about $\frac{1}{16}$ inch at right angles to the upright portion of the member. The part 55 may be of indurated fiber about 0.1 inch thick. The heater 43a may be a helical coil of about 30 turns of 5.6 mil resistance wire wound 100 turns per inch so as to have a final internal diameter of 0.075 inch, with end legs about 5 mm. long each, giving a total wire length of 157.6 mm., and a resistance of about 12.15 to 13.45 ohms when half of each 5 mm. leg is included between the effective coil connections to the parts 41a and 63. (The resistance wire here referred to is an alloy of nickel 75 per cent, iron 12 per cent, chromium 11 per cent, and manganese 2 per cent.) The thermal insulator 70 may be a block formed out of a commercial steatite ceramic mixture by extrusion, and baked in the usual way. Its dimensions when finished may be $\frac{3}{8}$ inch x $\frac{3}{2}$ inch x $\frac{3}{2}$ inch. It is shown with one long edge rounded to a $\frac{5}{64}$ inch radius and coaxial with a bore of 0.08 inch diameter for the heater 43a, and with a rectangular hole parallel with said bore for the thermostat 40a, this opening being $\frac{5}{64}$ x $\frac{3}{64}$ inch and about $\frac{1}{2}$ inch from the adjacent flat long edge of the block. The thermostat 40a may of course be inserted through its opening in the block 70 before its latch end 45a is bent over as shown in Fig. 3, and this opening allows room for thermal flexure of the part of the thermostat within the block. The ends of the heater coil 43a are sufficiently flexible to let the heater and the whole block 70 move with the flexure of the thermostat, if necessary.

Fig. 4 illustrates a modification as regards the attachment of thermostat 40b at its anchored end. As shown in Fig. 4, the part 55b is of double

the thickness of the part 55 in Fig. 3, thus assuming the character of a block lying directly against the base plate 20; and instead of being made with a bent foot 41 and securing tangs 58, the thermostat 40b consists of a mere strip whose upper end is bent at 45, while its unbent lower end is fitted and secured in a conformative hole 59b in the part 55b with a driving or force fit. While the whole part 55b might consist of a single piece of very thick fiber, its thickness may as shown be provided by making the spacer 57b of the same dimensions as the piece that corresponds to the part 55 in Fig. 3, the two pieces being securely clamped together and to the disc 20 by the rod 47b (which as in Fig. 3 is not attached to any connector 22), and being keyed to one another by the member 40b.

In Figs. 2, 3, and 4, various parts and features are marked with the same reference characters as the corresponding ones in earlier figures, in order to dispense with repetitive description, a distinctive letter being added where such distinction seems desirable.

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

1. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter to be connected in the starting circuit for making and breaking the same, the combination with a casing for said starter having an opening in its end wall, of a base member for supporting said casing, a switch in said casing to be connected in series with said starter for also interrupting the starting circuit, said switch comprising longitudinal support and guide means supported by said base member independently of said automatic starter, a switch contact and latching device slideable along said last-mentioned means, an operator for said device movable inward and outward through the casing end wall opening, a spring for urging said device along the support and guide means toward said end wall, a thermostatic latch having switch contact and latch means for engaging said device and retaining it against the action of said spring, and a heater for connection in series with said automatic starter for heating said thermostatic latch and releasing it in response to heat accumulation during repeated operation of the starter.

2. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter to be connected in the starting circuit for making and breaking the same, the combination with a casing for said starter having an opening in its end wall, of a base member for supporting said casing, a switch in said casing to be connected in series with said starter for also interrupting the starting circuit, said switch comprising longitudinal support and guide means supported by said base member independently of said starter, a switch contact and latching device slideable along said last-mentioned means, an operator for said device movable inward and outward through the casing end wall opening and having a stop shoulder for engaging said end wall to limit protrusion of the operator through the opening, a helical compression spring associated with the guide and supporting means for urging said device toward said end wall, a thermostat extending along adjacent said support and guide means and provided with switch contact and latch means for engaging said device and retaining it against the action of said

spring, and a heater for connection in series with said automatic starter for heating said thermostatic latch and releasing it in response to heat accumulation during repeated operation of the starter.

3. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter for making and breaking the circuit, the combination with a base carrying connectors to be connected to the sides of the starting circuit and a casing for said starter attached to said base and having an opening in its wall opposite the base, of a switch in said casing to be connected between said connectors through said starter for also interrupting the starting circuit, said switch comprising a longitudinal rod upstanding from said base supported by said base independently of said starter, a bevelled and shouldered latch and switch contact head slideable along said rod, an operator for said head movable inward and outward through said casing wall opening, a spring around said rod urging said head away from said base, a thermostat extending alongside said rod anchored at its end adjacent said base and at its other end provided with switch contact and latch means for coacting with the head shoulder, to retain the head against the action of said spring, and also with the head bevel, and a heater for connection in series with said automatic starter for heating said thermostatic latch and releasing it in response to heat accumulation during repeated operation of the starter.

4. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter to be connected in the starting circuit for making and breaking the same, the combination with a casing for the automatic starter having a reentrant end wall with a substantially central opening therein, of a switch in said casing to be connected in series with said starter for also interrupting the starting circuit, said switch comprising longitudinal support and guide means supported by said base independently of said starter, a switch contact and latching device slideable along said last-mentioned means and having a lateral portion extending substantially into line with said casing end wall opening, an operating button for said device movable inward and outward through said opening and having a stop shoulder for engaging said end wall to limit protrusion of the button through the opening, and also having a portion in line with said lateral portion of said device for engaging the same, a spring for urging said device along the support and guide means toward said end wall, a thermostatic latch having switch contact and latch means for engaging said device and retaining it against the action of said spring, and a heater for connection in series with said automatic starter for heating said thermostatic latch and releasing it in response to heat accumulation during repeated operation of the starter.

5. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter for making and breaking the circuit, the combination with a base carrying connectors to be connected to the sides of the starting circuit and a casing for said starter attached to said base and having an opening in its wall opposite the base, of a switch in

said casing to be connected between said connectors through said starter for also interrupting the starting circuit, said switch comprising a longitudinal rod upstanding from said base supported by said base independently of said starter, a bevelled and shouldered latch and switch contact head slideable along said rod, an operator for said head movable inward and outward through said casing wall opening, a spring around said rod urging said head away from said base, an insulative part mounted on and projecting laterally from said rod adjacent said base, a thermostat extending alongside said rod anchored to said part at its end adjacent said base and at its other end provided with switch contact and latch means for coacting with the head shoulder, to retain the head against the action of said spring, and also with the head bevel, and a heater for connection in series with said automatic starter for heating said thermostatic latch and releasing it in response to heat accumulation during repeated operation of the starter.

6. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter to be connected in the starting circuit for making and breaking the same, the combination with a casing for said starter having an opening in its end wall, of a switch in said casing to be connected in series with said starter for also interrupting the starting circuit, said switch comprising longitudinal support and guide means, a switch contact and latching device slideable along said last-mentioned means, an operator for said device movable inward and outward through the casing end wall opening, a spring for urging said device along the support and guide means toward said end wall, a thermostatic latch having switch contact and latch means for engaging said device and retaining it against the action of said spring, a heater for connection in series with said automatic starter for heating said thermostatic latch and releasing it in response to heat accumulation during repeated operation of the starter, and a common ceramic thermal insulator separately surrounding said thermostat and heater, whereby the tripping time of the thermostatic latch is increased relative to the wattage taken by the heater.

7. In starting means for a discharge lamp including a starting circuit that is interrupted to start the discharge in said lamp and also comprising an automatic starter to be connected in the starting circuit for making and breaking the same, the combination with a casing for said starter having an opening in its end wall, of a switch in said casing to be connected in series with said starter for also interrupting the starting circuit, said switch comprising longitudinal support and guide means, a switch contact and latching device slideable along said last-mentioned means, an operator for said device movable inward and outward through the casing end wall opening and having a stop shoulder for engaging said end wall to limit protrusion of the operator through the opening, a spring for urging said device along the support and guide means toward said end wall, a thermostat extending along adjacent said support and guide means and provided with switch contact and latch means for engaging said device and retaining it against the action of said spring, a resistance heater extending alongside said thermostat for connection in series with said automatic starter for heating

said thermostatic latch and releasing it in response to heat accumulation during repeated operations of the starter, and a common thermal insulator enclosing said thermostat and heater in thermo-insulatively separated parallel recesses, whereby the tripping time of the thermostatic latch is increased relative to the wattage taken by the heater.

MARK A. TOWNSEND.

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