

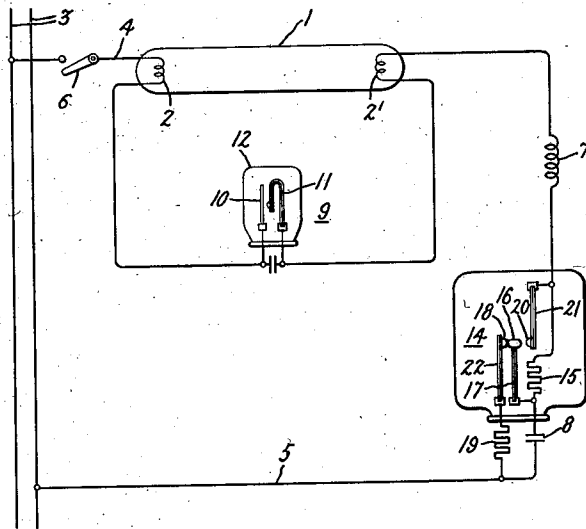
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T. W. FRECH

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ELECTRIC DISCHARGE LAMP CIRCUIT

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Inventor:
Theodore W. Frech,
by *Harry E. Dunham*
His Attorney.

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ELECTRIC DISCHARGE LAMP CIRCUIT

Theodore W. Frech, Cleveland Heights, Ohio, assignor to General Electric Company, a corporation of New York

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4 Claims. (Cl. 176—124)

My invention relates to circuits for electric discharge lamps such, for example, as fluorescent lamps. Such lamps of a well known and commonly used form have electrodes which are constructed and arranged to be heated by current flow therethrough before the discharge in the lamp is started. Because the lamp has a negative temperature-resistance coefficient its connection across a source of current of constant potential is made through a suitable current controlling impedance. The impedance employed may be a resistor but it is preferable in order to avoid unnecessary losses to employ a reactor, or a capacitor, or both. In the latter case, where the net impedance of the lamp circuit is to be capacitive, certain difficulties have been experienced in starting the lamp and in avoiding excessive lamp deterioration. Such difficulties have been apparent particularly with the lamp on the leading current circuit of a two circuit unit comprising a lagging-current circuit and a leading-current circuit both connected to be supplied from the same source and including similar lamps arranged for simultaneous operation. In the copending application of Allen F. Prescott, Serial No. 376,081, filed January 27, 1941, there is disclosed and claimed a circuit by which the above-mentioned difficulties may be avoided, the circuit including means for rendering the capacitor ineffective until after the lamp has been started. My invention is a further development of that disclosed and claimed in the aforesaid application, and it has for its object the provision of an improved circuit which may be operated more economically and the control apparatus therein operated with greater reliability and with greater independence of changing temperature conditions.

My invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the single figure of the drawing which is a circuit diagram illustrating my invention, I represents an electric discharge lamp of the low pressure positive column gaseous discharge type which comprises a transparent tubular envelope having a filling of rare gas, or metal vapor, or both. The metal vapor may, for example, be mercury and if the lamp is of the fluorescent type the inner surface of the envelope may be coated with a suitable phosphor which will fluoresce when an electric discharge is passed through the mercury vapor. The envelope is provided at its ends with suitable electrodes 2 and 2' which are

commonly formed as coils of refractory metal wire such as tungsten coated with a suitable electron emissive material. The lamp, if desired, may employ indirectly heated electrodes of well known form wherein the wire coil serves merely as a heater for the electrodes.

The lamp is connected to be supplied from the source 3, which may be a 60 cycle, 115 volt alternating current lighting circuit, through the connections 4 and 5. In one of these connections, as 4, I have shown the main control switch 6, and in the other connection, 5, I have shown the ballast for the lamp which is represented as comprising the reactor 7 and the capacitor 8, the combined reactance of the reactor and the capacitor being such that the current taken by the lamp is substantially that for which the lamp is designed.

For starting the lamp a starter of any one of various forms may be employed. In the drawing I have represented a starter 9 of the glow discharge type of the character of that disclosed and claimed by the Dench Patent 2,200,443. The starter illustrated comprises the two electrodes 10 and 11 of which the latter comprises a bimetallic element of inverted U-shape having at its free end a contact which is normally spaced from the electrode 10 but which is adapted to engage it when heated by a glow discharge taking place between the two electrodes. Since the contact of the two electrodes short circuits the discharge path therebetween, the electrode 11 immediately begins to cool and after a predetermined time interval breaks contact with the electrode 10. The electrodes 10 and 11 are enclosed in the evacuated envelope 12 and are connected each to an end of the lamp electrodes 2 and 2' whereby during the brief interval in which the electrodes 10 and 11 are in contact with each other they close a series circuit through the two lamp electrodes and the lamp ballast. A heating current, whose value may be approximately twice that of the normal lamp current, flows through the lamp electrodes during that interval which is of the proper length to enable them to become heated to an electron emitting temperature. By the subsequent separation of the starter electrodes a voltage impulse is applied to the lamp to cause the discharge therein to start in the well understood manner.

As in the aforesaid Prescott application, the capacitor is rendered ineffective until the lamp has been started by providing the capacitor with a shunt circuit which is controlled by the switch 14 having the actuating means 15. The switch

is shown having the contact 16 supported on the free end of a bimetallic arm 17, and the member 15 is shown as a resistance heater in thermal relation with the arm 17. The contact 16 normally engages a contact 18 and thus closes the shunt circuit about the capacitor 3. As thus far described the apparatus is like that disclosed by the above-mentioned Prescott application.

It should be mentioned at this point that the thermal switch 14 is small and of light construction, being preferably mounted in an envelope, such for example as that of the starter 9 but filled with air. Under certain conditions I may employ an evacuated envelope containing a predetermined amount of an inert gas for the purpose of controlling the dissipation of heat from the heater and hence the speed of operation of the switch. It has been found that under certain conditions, as for example when a low wattage heater is used, the contact 16 would stick or freeze to the contact 18, the bimetallic arm 17, under the influence of the heater 15, being unable to free the one contact from the other in order to open the shunt circuit. In accordance with one feature of my invention I have provided the resistor 19 in the circuit which shunts the capacitor and is controlled by the switch 14. In apparatus of this character where the capacitor had a value of .05 mf. I have obtained very good results using a shunting resistor which had a value of 8 ohms. The purpose of the resistor in the shunt circuit is to produce a higher time constant of the capacitor-resistor circuit so that sparking at the switch contacts due to the charging and discharging of the capacitor is greatly reduced if not entirely eliminated.

Where the resistance heater 15 is permanently included in the lamp circuit there is obviously a certain constant energy loss at all times during the operation of the lamp. In order to reduce this constant energy loss during the use of the lamp, I have provided the switch 14 with the additional contact 20, a front contact, which connects with the lamp circuit at the opposite end of the resistance heater to that connected with the switch with the result that when the arm 17 supporting the switch is heated by the lamp current, the switch first opens the shunt circuit around the capacitor and then closes a shunt circuit about the resistance heater 15. Although the contacts 16 and 20 continually make and break contact during the operation of the lamp, the resistance heater being thereby alternately shunted and energized, the movement of the contact 16 with respect to the contact 20 is so small that it is invisible to the naked eye. The spacing of the front and back contacts 20 and 18 respectively is such that the amount of movement of the contact 16 is very small, the advantage of which is that the time of reset of the switch in the event of an interruption in the source of current supply, is reduced to a low value.

A further feature of my invention is that the front and back contacts 20 and 18 are mounted on bimetallic arms 21 and 22 respectively which arms are constructed to move the contacts supported thereby in response to an increase in the temperature of the ambient in the same direction as that in which the arm 17 moves its contact 16. As a result of this construction the operation of the switch becomes substantially

independent of changes in the temperature of the ambient.

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

1. In combination, an electric discharge lamp having spaced electrodes therein, ballast for said lamp including a capacitor, means for connecting said lamp and ballast together in series to be supplied from a source of current supply, starting means connected in shunt with said lamp, said electrodes being arranged to become initially heated by current flow through said ballast and starting means, a switch connected to shunt said capacitor, means responsive to the current in said connecting means for opening said switch after a predetermined time delay, and means responsive to the current in said connecting means for subsequently closing a shunt around said switch opening means.

2. In combination, an electric discharge lamp having spaced electrodes adapted to be initially heated by the flow of current therethrough, means for starting the discharge in said lamp, ballast for said lamp including a capacitor, means for connecting said lamp and ballast together in series to be supplied from a source of current supply, a resistance heater in said connection, a circuit arranged to shunt said capacitor, a circuit arranged to shunt said heater, and a switch responsive to said heater for opening said capacitor shunt circuit and subsequently for closing said heater shunt circuit.

3. In combination, an electric discharge lamp having spaced electrodes adapted to be initially heated by the flow of current therethrough, means for starting the discharge in said lamp, ballast for said lamp including a capacitor, means for connecting said lamp and ballast together in series to be supplied from a source of current supply, a circuit arranged to shunt said capacitor, a thermal switch in said shunt circuit, a resistance heater in said connection constructed to take but a small amount of power from the lamp circuit and arranged to cause said switch to open, said switch having a light construction and adapted to be opened by a small actuating force, and a resistor in said shunt circuit operative to increase the time constant for preventing the sticking together of the switch contacts.

4. In combination, an electric discharge lamp having spaced electrodes adapted to be initially heated by the flow of current therethrough, means for starting the discharge in said lamp, ballast for said lamp including a capacitor, means for connecting said lamp and ballast together in series to be supplied from a source of current supply, a resistance heater in said connection, a circuit including a resistor arranged to shunt said capacitor, a circuit arranged to shunt said heater, a switch comprising a movable contact, a rear contact and a front contact, bimetallic means for moving each of said contacts each arranged to move the contact associated therewith in the same direction in response to an increase in the temperature of the ambient, said heater being arranged in thermal relation with the bimetallic moving means of said movable contact and said switch being arranged in response to the effect of said heater to open said capacitor shunting circuit and subsequently to close said heater shunting circuit.

THEODORE W. FRECH.