

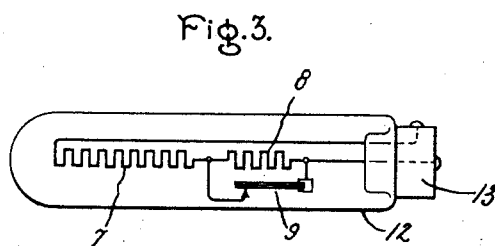
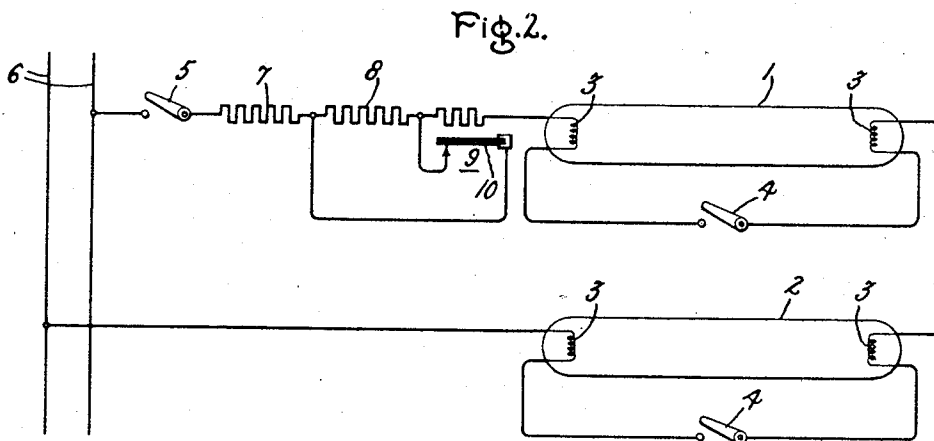
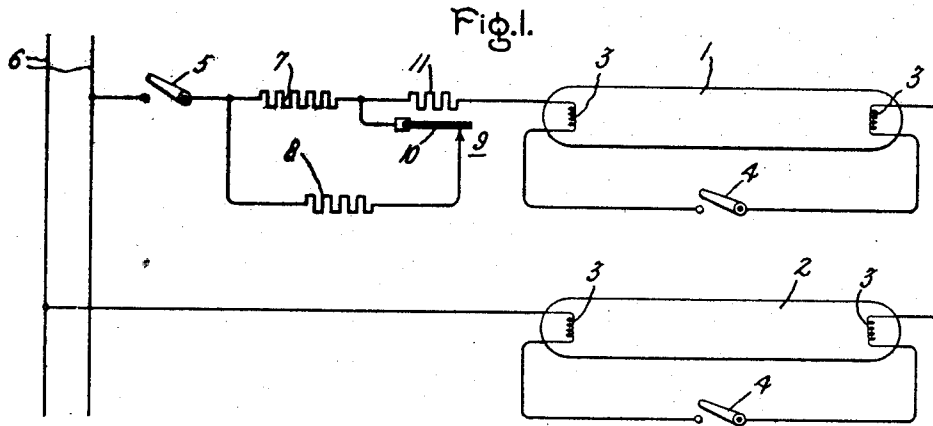
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J. H. CAMPBELL

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CIRCUIT FOR ELECTRIC DISCHARGE DEVICES

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Inventor:
John H. Campbell,
by *Harry E. Dunham*
His Attorney.

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CIRCUIT FOR ELECTRIC DISCHARGE DEVICES

John H. Campbell, Cleveland Heights, Ohio, assignor to General Electric Company, a corporation of New York

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4 Claims. (Cl. 315—309)

My invention relates to circuits for starting and operating electric discharge devices such for example as fluorescent lamps and it comprises a further development of the circuit disclosed and claimed in my Patent 2,266,619, dated December 16, 1941, and assigned to the same assignee as my present application.

Fluorescent lamps of the higher wattages such as lamps of the 100 watt and the 65 watt sizes, have envelopes of large diameter and are provided with large electrodes. As a result considerable time is required after such a lamp starts for its electrodes to reach their final temperature and the gaseous medium, such as mercury vapor, within the envelope to reach its final pressure because of the absorption of heat by the envelope, by the medium therein, and by the leads, etc. The initial lamp current hence is lower and the initial lamp voltage is higher than they are later when the electrodes reach their final temperature and the medium reaches its final pressure. When a resistive ballast is used and when under normal operating conditions the voltage of the lamp or the sum of the voltages of a plurality of lamps in series as in the aforesaid patent is nearly equal to the voltage of the source of supply, difficulty is sometimes experienced in getting the lamp or lamps as the case may be initially to operate. If the lamp operation can be effected initially and continued long enough for the temperature of the lamp electrodes to rise and the pressure of the medium to increase substantially to those values which prevail during normal lamp operation, the voltage of the lamp or lamps will have become so reduced that an adequate difference will exist between the voltage of the source and the voltage of the lamp or lamps.

It is the object of my invention to provide an improved discharge device circuit by which the above-mentioned difficulty may be overcome.

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.

Referring to the drawing, Figs. 1 and 2 are circuit diagrams illustrating two embodiments of my invention and Fig. 3 shows a detail of a combined ballast and switch heater.

In Fig. 1 I have shown two discharge lamps 1 and 2 each having filamentary electrodes 3

which, because of their mass and that of the adjacent parts, do not upon starting immediately reach their final operating temperature but may require considerable time, for example 10 minutes, in order to attain substantially that temperature. It is not necessary, however, for the lamp electrodes to reach their final operating temperature since I have found that even after approximately only one minute of operation the electrode resistance will have so increased that the switch 9 may be opened and, under ordinary conditions, the arc will be maintained. The electrodes are connected in series and between the electrodes of each lamp is the starting switch 4, the switches being adapted to be opened in succession as in the aforesaid patent. The lamps are connected through the control switch 5 to be operated from the source of current supply 6 which, for example, may be a 230 volt lighting circuit supplying either direct or alternating current and in that connection with the source is the ballast for the lamps comprising the resistors 7 and 8 whose operating resistance during the initial operation of the lamps under conditions of low voltage, say 210 volts, and before the switch 9 opens may, for example, be 53 and 400 ohms respectively. When the lamps are initially operated the resistor 8 shunts the resistor 7 but after the lamps have been operating for a time long enough for the temperature of their electrodes to have become substantially constant the circuit of the resistor 8 is opened automatically whereby the effective resistance of the ballast is increased. Various means may be employed for so controlling the circuit of the shunting resistor 8. On the drawing I have shown a preferred means for that purpose comprising the thermal switch 9 having the bimetallic arm 10 and the small resistance heater 11 adjacent thereto and connected to be traversed by the current taken by the lamps.

The resistors 7 and 8 each has a high positive temperature coefficient of resistance and low heat capacity; they may, for example, comprise the tungsten filaments of one or more incandescent lamps, resistive ballast having such characteristics being in accordance with my aforesaid patent.

The resistance of the resistor 7 is such that the lamps are properly ballasted for stable operation by that resistor after they have been oper-

ating long enough for the temperature of their electrodes to have arisen to an approximately fixed point, the switch 9 having opened. The resistance of the shunting resistor 8 is such that during the initial operation of the lamps, namely, before their temperature has arisen to an approximately fixed point and before the switch 9 has opened, the net ballast resistance then is somewhat lower than that of the resistor 7 whereby a greater difference exists between the voltage of the source 6 and the combined voltages of the lamps thereby off-setting the effect of the higher total lamp voltage during initial operation of the lamps. By way of example, the initial combined voltage of the two lamps may be 200 volts whereas the combined voltage of the lamps after the temperature of their electrodes has become approximately constant may be 140 volts. As the temperature of the lamps reaches an approximately fixed point the switch 9 opens thereby increasing the effective resistance of the ballast. By this means I obtain better regulation of the lamps and improve the low voltage starting thereof.

In that form of my invention illustrated by Fig. 2 the resistors 7 and 8 which may have somewhat different values than in the case of the arrangement illustrated by Fig. 1 are arranged in series and the resistor 8 is shunted by the switch 9. The effect of the switch is similar to that in the case of the form illustrated by Fig. 1 since during the initial operation of the lamps while their temperature is increasing and their voltage is accordingly decreasing the switch 9 shunts the resistor 8 so that the total resistance of the ballast is substantially that of the resistor 7; however, when the temperature of the lamp electrodes has become substantially constant the switch 9 opens the shunt circuit about the resistor 8 thereby increasing the effective resistance of the ballast.

Instead of employing a separate heater for operating the thermal switch 9, I may operate that switch from heat given off from the lamp ballast in which case the ballast functions in a twofold manner, namely, that of ballasting the lamps and supplying heat to the thermal member of the switch. In Fig. 3 which illustrates one way in which this may be done the ballast resistors 7 and 8 and the switch 9 are enclosed in the envelope 12 having the base 13 provided with suitable contacts for insertion in a lamp socket. The thermal member of the switch in this case is arranged to receive heat from both of the resistors 7 and 8 and to open the path shunting the re-

sistor 8 after a predetermined time delay as in the form shown by Fig. 2 and maintain it open during the operation of the lamps.

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

1. In combination, a plurality of electric discharge lamps whose initial operating voltages are materially higher than their final operating voltages, means including a resistive ballast for connecting said lamps in a series circuit to be operated from a source of current supply whose voltage is close to the sum of said initial operating voltages, and a thermal switch responsive to the current taken by the lamps for increasing the resistance of the ballast after the operating voltages of the lamps have reduced materially below their initial value so that the sum of the voltage drops across the lamps and ballast substantially equals the voltage of the source.

2. In combination, an electric discharge lamp whose operating voltage reduces as its temperature increases, means including resistive ballast for connecting said lamp to be operated from a source of current the voltage of which is close to the initial operating voltage of the lamp, and a thermal switch having a heater connected to be energized by the lamp current for subsequently increasing the resistance of the ballast so that the sum of the voltage drops across the lamp and ballast substantially equals the voltage of the source.

3. In combination an electric discharge lamp whose operating voltage reduces as its temperature increases, means including a heater together with a plurality of ballast impedances connected in parallel for supplying said lamp from a source of current, and a switch responsive to heat from said heater for opening the circuit of one of said impedances for increasing the impedance of said ballast and so that the sum of the voltage drops across the lamp and ballast substantially equals the voltage of the source.

4. In combination, an electric discharge lamp whose operating voltage reduces as its temperature increases, means including a heater together with a plurality of ballast impedances connected in series for supplying said lamp from a source of current, and a switch connected across one of said impedances and constructed to open in response to heat from said heater for increasing the impedance of said ballast and so that the sum of the voltage drops across the lamp and ballast substantially equals the voltage of the source.

JOHN H. CAMPBELL.