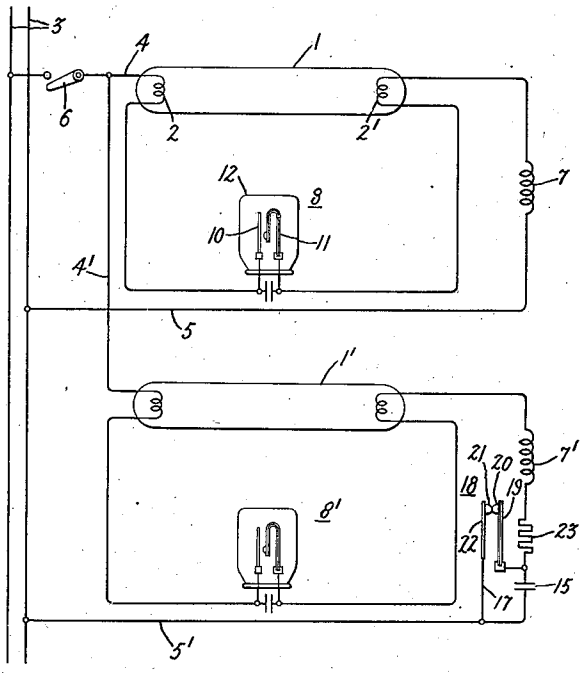
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ELECTRIC DISCHARGE LAMP CIRCUIT

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Inventor:
Allen F. Prescott,
by Harry E. Dunham
His Attorney.

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ELECTRIC DISCHARGE LAMP CIRCUIT

Allen F. Prescott, Lyndhurst, Ohio, assignor to General Electric Company, a corporation of New York

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5 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. Where a reactor or choke coil is used for that purpose, the current taken from the source will lag behind the voltage thereof; similarly, where a capacitor is used for that purpose or where the impedance includes both a reactor and a capacitor and the net reactance is capacitive, the current taken from the source will lead the voltage thereof.

With continued use the lamps have been observed to become somewhat blackened at their ends, sometimes more at one end than at the other depending largely upon the character of the starter employed, and it has been noticed that the degree of the blackening is dependent chiefly on the frequency with which the lamps are started. It has also been noticed that, as a result of successive startings, lamps on leading-current circuits develop blackened ends much earlier in their life than lamps on lagging-current circuits. It has been found that the electrodes of lamps on leading-current circuits are subjected to greater injury, during the starting of the lamps, than are the electrodes of lamps on lagging-current circuits, namely, where capacitors are not used.

It is the object of my invention therefore to provide an improved lamp leading-current circuit with which the above noted objections may be avoided. It is the further object of my invention to provide an improved lamp circuit in which the current is leading during the normal operation of the lamp but is lagging at the time that the lamp is started.

In accordance with my invention I provide means by which the capacitive element in the leading-current circuit of the lamp initially and until after the lamp has started is rendered inoperative so that the lamp circuit becomes in reality a lagging-current circuit. After a predetermined time following the starting of the lamp, however, the capacitor becomes operative so that the lamp which was started on a circuit having a lagging-current operates from then on on a circuit having a leading-current.

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 have shown a lamp arrangement comprising two identical electric discharge lamps connected to be operated simultaneously from the same supply circuit, one lamp being operated on a lagging-current circuit, and the other lamp being operated on a leading-current circuit. The advantages of such an arrangement in avoiding a stroboscopic effect and in obtaining a high power factor are well known.

In the drawing, 1 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 passes 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 electrode.

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 7 for the lamp which is represented as a reactor or choke coil, the reactance of which is such that the current taken by the lamp is 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 8 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 there-

between, the electrode 11 immediately begins to cool and after a predetermined time interval breaks contact with 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.

The lamp 1' is identical with the lamp 1 and the starter 8' is identical with and functions in the same manner as the starter 8. The lamp 1' is connected with the same supply circuit 3 through the connections 4' and 5' it being noted however that the connection 4' is such that the circuit of lamp 1' is controlled by the same switch 6 as controls lamp 1. The ballast for the lamp 1' comprises the reactor or choke coil 7' which may have substantially the same reactance as the reactor 7 and the capacitor 15 connected in series with the reactor 7'. Inasmuch as the lamp 1 is ballasted by inductive reactive means, it is obvious that current taken by the lamp during its normal operation will lag behind the voltage of the source of supply. In the case of the ballast for the lamp 1' where both inductive and capacitive reactance means are employed, the capacitor is so constructed that the reactance produced by it exceeds the reactance of the reactor in series therewith and the net capacitive reactance is of such a value that the current taken by the lamp is that for which the lamp is designed. Moreover, it will be obvious that since the net reactance in circuit with the lamp 1' is capacitive, the current taken by that lamp will lead the voltage of the source of supply. Preferably, the phase angle between the current taken by lamp 1 and the current taken by lamp 1' is approximately 90° whereby the stroboscopic effect of the combined light of the two lamps is reduced to a minimum value and the power factor of the two lamp circuits together is substantially 100 per cent.

Where the two lamps employed are identical and the two starters employed therewith also are identical as in the present case, a condition which is highly desirable for manufacturing reasons, the current which flows through the lamp 1' is somewhat less than the current which flows through the lamp 1. This may be accounted for by the fact that the combination of inductive and capacitive reactance in the circuit of lamp 1' gives to that circuit, to a certain degree, a constant-current property; hence the heating current for the lamp electrodes during the short interval that the starter electrodes engage each other does not rise to as high a value in that lamp as it does in lamp 1. As a result of the lower value of the heating current applied to the electrodes of lamp 1', the starter associated with that lamp may make one or more unsuccessful attempts to start the lamp before the temperature of its electrodes has reached the proper value. Thus the lamp 1' is not only slower than the lamp 1 in coming into operation but by reason of the greater number of attempts to start it it becomes blackened at one or both ends and its electrodes suffer greater injury than do those of lamp 1.

To avoid these difficulties and disadvantages, I have provided means by which the effect of the capacitor in the circuit of lamp 1' is not removed until after the lamp has started. The means which I have illustrated for accomplishing this purpose is the circuit 17 which shunts the capacitor 15 and which is controlled by the switch 18. While a switch of any one of various types may be used, the form of switch illustrated is a thermal switch comprising the bimetallic arm 19 having the contact 20 at its free end which is adapted to engage the contact 21 supported on the flexible arm 22. The switch is constructed to be normally closed so as to close the shunt circuit about the capacitor 15. Arranged in thermal relation with the bimetallic strip 19 is the resistance heater 23 which is shown connected in the connection 5' of the lamp in series with the ballast. The switch 18, including its heater, is so constructed that to effect its opening it requires the heat due not only to the current by which the lamp electrodes are preheated but, in addition, to a certain amount of normal current flow in the lamp circuit after the lamp has started. The time required for the switch to open after the lamp normally starts operating is made sufficiently long to allow the starter to make several attempts to start the lamp if necessary. Since the shunt circuit 17 is closed until after the lamp starts, it will be seen that the lamp 1' always starts on a lagging-current circuit just as lamp 1 does. By the opening of the switch after the lamp has been started, the lamp continues to operate but the lamp current becomes leading instead of lagging. Thereafter the normal lamp current produces sufficient heat to hold the switch open.

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 adapted to be initially heated by the flow of current therethrough and having means for subsequently starting the discharge in the lamp, means having ballasting impedance for connecting said lamp across a source of current supply, said impedance including a capacitor having a low resistance shunt circuit thereacross, and means responsive to the current in said connecting means for opening said shunt circuit after the lamp has been started.

2. In combination, an electric discharge lamp having spaced electrodes adapted to be initially heated by the flow of current therethrough and having starting means connected between said electrodes for interrupting said current flow after a predetermined time delay, means having ballasting impedance for connecting said lamp across a source of current supply, said impedance including a capacitor having a low resistance shunt circuit thereacross, and means responsive to the current in said connecting means for opening said shunt circuit after a predetermined time delay materially longer than said first mentioned time delay.

3. In combination, an electric discharge lamp having spaced electrodes adapted to be initially heated by the flow of current therethrough and having means for starting the discharge in the lamp, means for connecting said lamp across a source of alternating current supply, said means including a reactor and a capacitor, a low resistance circuit bridged across said ca-

pacitor, and means responsive to the current in said connecting means for opening said bridge circuit after said lamp has started.

4. In combination, an electric discharge lamp having spaced electrodes adapted to be initially heated by the flow of current therethrough and having means for starting the discharge in the lamp, means for connecting said lamp across a source of alternating current supply, said means including a reactor, a capacitor and a resistance heater, a short circuit bridged across said capacitor, and a thermal switch responsive to the heat received from said heater for opening said bridge circuit.

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

ALLEN F. PRESCOTT.

CERTIFICATE OF CORRECTION.

Patent No. 2,300,963. November 3, 1942.

ALLEN F. PRESCOTT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 6, strike out "not"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of December, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.