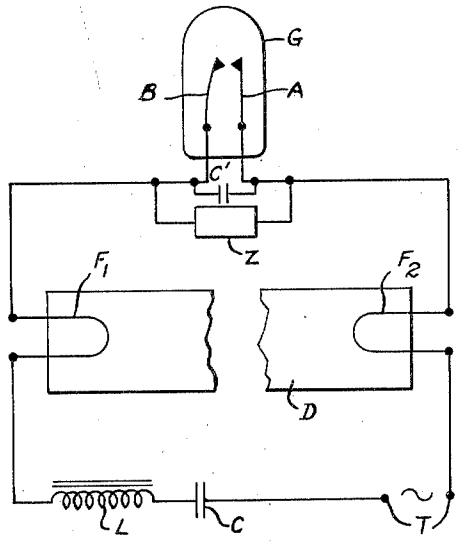
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CIRCUITS FOR ELECTRIC DISCHARGE LAMPS

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CIRCUITS FOR ELECTRIC DISCHARGE LAMPS

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1

The present invention relates to circuits for electric discharge lamps of the type in which there is provided in parallel with the lamp, for starting purposes, a glow switch comprising an envelope containing a suitable atmosphere and two electrodes (which are usually unlike) adapted to make contact with one another under the heating action of a glow discharge between them, and in which the circuit associated with the lamp is capacitive.

One known circuit of this type is shown in the accompanying drawing if the impedance Z be omitted. In this known circuit, the filamentary electrodes F_1 and F_2 of a lamp D are connected to the supply terminals T through a ballast comprising a choke L and a condenser C in series, the impedance of the condenser being greater than that of the choke at the working frequency. A glow switch G having one bimetallic electrode B and one plain electrode A is connected between the lamp electrodes and when the lamp is switched on so that voltage is applied to the supply terminals T a glow discharge takes place between the electrodes A and B of the glow switch G. The heating effect arising from this discharge causes the bimetallic electrode B to bend and make contact with the other electrode A thereby short-circuiting the lamp and heating up the electrodes F_1 and F_2. Since the glow is now extinguished the bimetallic electrode B begins to return to its original position, thus breaking contact with the other electrode. The surge of voltage so produced owing to the presence of the ballast is arranged to be sufficient to cause the main discharge to start between the lamp electrodes. The voltage across the lamp in normal operation is insufficient to restart the glow in the glow switch G. C^1 is a small capacitor of about 0.01 mfd. capacitance to act as radio interference suppressor which is usually connected for convenience across the starter terminals rather than across the lamp terminals.

The time taken for the lamp to start after switching on is to a large extent dependent upon the time taken for the contacts of the glow switch to close and this is largely dependent upon the glow current passing through this glow switch.

It has been found that a glow switch of the design described which has a closing time of one or two seconds in an inductive circuit may have a considerably longer closing time in a capacitive circuit such as that shown, the current in the latter case being considerably less than in the former. This effect is particularly noticeable on the lower range of the 200–250 volt supply circuits. This reduction in current is caused by asymmetry in the glow discharge caused by the use of unlike electrodes A and B and giving rise to a certain degree of rectification which is more marked in the capacitative circuit.

2

For many purposes it is desired to employ glow switches having unlike electrodes in association with capacitive circuits and it is the principal object of the present invention to provide a circuit of the type set forth in which the starting time is reduced.

A further disadvantage that may be encountered in the capacitative circuit, whether the glow switch has like or unlike electrodes, arises in the following way.

When the discharge lamp D is used in a capacitive circuit, as described, and especially when the lamp D is in a grounded metal fitting and the supply voltage is between 200 and 250 volts, there is a tendency for a glow current of several milliamperes to appear between the electrodes F_1 and F_2 in the lamp D when the supply voltage is applied to the terminals T and before the contacts of the glow switch G have closed. Such a glow discharge in the lamp D may develop into the normal arc before the glow switch G has operated and the result is what is known as cold starting. This is harmful to the lamp electrodes F_1 and F_2 unless these are specially designed to withstand cold starting and may result in a reduced life.

It is a further object of the invention to provide means for reducing the tendency to cold start.

According to the present invention, in a circuit of the type set forth there is provided in parallel with the glow switch an impedance in the form of a resistor or an inductive choke or a combination thereof, the value of said impedance being such that the current in the glow discharge in the glow switch is substantially increased thereby. The shunt impedance means serves to counteract the asymmetrical conducting characteristics of the glow switch which are occasioned by the differences in electrode size, shape or composition. The value of the said impedance is preferably made as high as possible consistent with adequate current in the glow discharge in order that the current flowing in the said impedance during normal operation of the lamp may be as low as possible.

The invention will be described by way of example as applied to the circuit of the drawing where the lamp D is an 80 watt fluorescent lamp of known kind 5 feet long and 1½ inches in

diameter, operating from a supply voltage of 200 volts at 50 cycles per second applied at the terminals T. The ballast comprises a choke L of 250 ohms impedance at the working frequency in series with a condenser C of 7 microfarads and therefore having an impedance of about 480 ohms at the frequency in question. With a certain glow switch G having unlike electrodes the closing time is about 10 seconds and the current in the glow switch is about 20 milliamperes.

In one example of applying the present invention to this circuit, a resistor Z of 5000 ohms is connected in parallel with the glow switch G as shown in the drawing. The glow current is thereby increased to about 28 milliamperes and the closing time decreased to about 5 seconds; the total current in the glow switch G and its shunt Z is about 65 milliamperes. When the main discharge in the lamp D is fully established, the voltage across the lamp falls to about 100 volts and the power dissipated in the shunt resistor Z is thus some two watts.

The effect of reducing the value of the resistor, say to 1000 ohms, is to increase the power wastage during normal operation of the lamp without substantially further increasing the current in the glow switch or reducing the closing time. If the value is increased, say to 10,000 ohms, the closing time begins to approach the original value of 10 seconds.

The resistor Z, if of a suitable value such as 5000 ohms, also has the effect of reducing the current in the glow discharge in the lamp D, if such glow discharge should start, and there is consequently less likelihood of the lamp starting before the glow switch G has operated. The tendency to cold start is thus reduced.

In another example of the present invention, the impedance Z is a choke having a reactance of about 9500 ohms at the working frequency and a resistance of about 850 ohms. With this arrangement the current in the glow switch G is increased to approximately 40 milliamperes and the closing time is reduced to about 3 seconds. The total current in the glow switch G and its shunt Z is some 60 milliamperes. When the discharge in the lamp D is in full operation, the current in the choke Z is of the order of 4 milliamperes.

A choke used as the impedance Z although more effective in reducing the closing time of the starter is substantially less effective than a resistor of suitable value in reducing the tendency to cold start.

I claim:

1. A circuit for an electric discharge lamp comprising a discharge lamp provided with filamentary electrodes, an alternating current supply means of a voltage materially greater than

the operating voltage of said lamp and connected to one terminal of each of said electrodes, a reactor and a capacitor interposed between said current supply means and said lamp to render the operating circuit for said lamp capacitive, a glow switch interconnecting the other terminals of said electrodes and comprising a sealed envelope containing a pair of electrodes adapted to make contact with one another under the action of a glow discharge therebetween, and a non-capacitive reactive impedance connected in parallel with said electrodes of said glow switch and having a value such that the current in said glow discharge is substantially increased by counteracting the asymmetrical conducting characteristics of said glow switch.

2. A circuit for an electric discharge lamp comprising a discharge lamp provided with filamentary electrodes, an alternating current supply means of a voltage aproximately twice the operating voltage of said lamp and connected to one terminal of each of said electrodes, a reactor and a capacitor interposed between said current supply means and said lamp to render the operating circuit for said lamp capacitive, a glow switch interconnecting the other terminals of said electrodes and comprising a sealed envelope containing a pair of electrodes adapted to make contact with one another under the action of a glow discharge therebetween, and a non-capacitive reactive impedance connected in parallel with said electrodes of said glow switch and having a value such that the current in said glow discharge is substantially increased by counteracting the asymmetrical conducting characteristics of said glow switch.

3. A circuit according to claim 1 wherein the said impedance is a resistor.

4. A circuit according to claim 1 wherein the said impedance is an inductance.

5. A circuit according to claim 1 wherein the said impedance comprises a resistor and an inductance.

6. A circuit according to claim 1 wherein the electrodes of said glow switch are unlike to the extent of causing a substantial degree of rectification of the current flow therebetween.

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