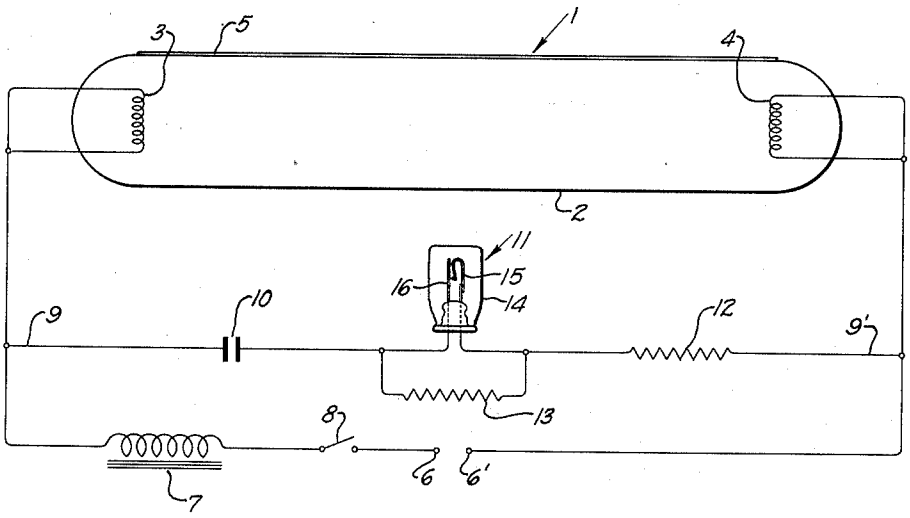
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STARTING AND OPERATING CIRCUIT FOR ELECTRIC DISCHARGE DEVICES

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STARTING AND OPERATING CIRCUIT FOR ELECTRIC DISCHARGE DEVICES

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1 Claim. (Cl. 315—104)

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This invention relates to electrical discharge devices of the type employing ionizable mediums such as gases or vapors, and more particularly to starting and operating circuits therefor.

The present invention relates more particularly to electric discharge lamp circuits of the type comprising an operating or discharge circuit embodying a choke or inductive ballast in series with a lamp across a source of alternating current supply and a starting circuit in parallel with the lamp and embodying a capacitance connected in series with a glow discharge device. The glow discharge device or switch is designed to close on the initial application of the current supply to the discharge circuit and to open upon conduction of the lamp. The values of the inductive ballast and the capacitance are such that when the glow switch is closed they form together a resonant or partially resonant circuit having a resonance frequency between a frequency approximate to that of the supply voltage and three times its value. With such an arrangement the initial voltage across the lamp is relatively large and is arranged to be sufficient to cause an arc discharge to occur between the electrodes of the lamp. When an arc discharge occurs, the voltage drop across the lamp decreases and in turn the voltage drop across the glow switch decreases so that the switch is extinguished, thus disconnecting the capacitance from the operating circuit and eliminating the resonant condition.

In some installations, however, a disadvantage has been noted in that the peak voltage appearing across the glow switch when the discharge lamp is normally conductive exceeds the extinguishing voltage of the glow switch. Thus, the glow switch does not remain open and the starting circuit remains continually energized.

An object of our invention is to provide a new and improved circuit for starting and operating electrical discharge devices.

Another object of our invention is to provide a new and improved means for impressing a starting voltage across the electrodes of an electric discharge device and effectively removing the starting voltage during operation of the electric discharge device.

A further object of our invention is to provide a new and improved means of rendering a glow switch, used in a series resonant starting circuit for starting an electrical discharge device, inoperative upon conduction of the electrical discharge device even though the peak voltage occurring across the electrical discharge device exceeds the extinguishing voltage of the glow switch.

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Further features and advantages of our invention will appear from the following description of species thereof.

For a better understanding of our invention reference may be had to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims. The drawing is a diagrammatic view of an electrical discharge device and a starting and operating circuit therefor incorporating our invention.

Referring to the drawing, we have there illustrated one embodiment of our invention as applied to an electric discharge device 1. The electric discharge device 1, such as a fluorescent lamp, therein illustrated comprises an elongated tubular or cylindrical envelope 2 having sealed into the ends thereof electrodes 3 and 4, each herein illustrated as comprising a coil, preferably in the form of a coiled coil of tungsten wire activated with oxides of alkaline earth metals, such as a mixture of barium or strontium oxides. The envelope 2 contains a gaseous atmosphere, such as a rare gas like neon, argon or mixtures thereof at a pressure of a few millimeters and a small quantity of mercury which, during the operation of the lamp, has a low pressure of the order of 10 microns. The device 1 may be a low pressure positive column lamp of a fluorescent type provided with a suitable phosphor or fluorescent coating. This fluorescent coating upon excitation by the radiation produced by an electric discharge between the electrodes, transforms a shorter wave radiation due to the discharge into longer wave radiation such as radiation within the visible range. For ease of starting a stripe or strip 5 of conductive material which, for example, may be a metallic paint or graphite mixed with potassium silicate, may be applied to the surface of device 1. The starting strip 5 may be connected to one or both of the electrodes.

In accordance with our invention the lamp 1 is connected through input terminals 6, 6' across a suitable power supply circuit which, for example, may be 118 volt, 60 cycle source, for supplying current to lamp 1 through the usual ballast 7 which serves as a starting inductance and is connected in a series circuit between one of the input terminals 6, 6' and one of the output terminals 10, 10'. A manual make-and-break control switch 8 may be used to connect lamp 1 to the power supply. A parallel starting circuit 9, 9' including a capacitance 10 connected in series

with a glow discharge switch 11, and an impedance element 12 shunts lamp 1. A second impedance element 13 is connected across and shunts the glow switch 11. The values of the inductive ballast and the capacitance are such that when the glow switch is closed they form together a resonant or partially resonant circuit having a resonance frequency between a frequency approximate to that of the supply voltage and three times this frequency. For purposes of our application, a partial resonant circuit is one which provides a voltage substantially larger than the supply voltage but has a resonance frequency differing from that of the supply voltage, or from a harmonic thereof. The values of impedance elements 12 and 13 which, for example, may be pure resistances, are such as to prevent glow switch 11 from closing when the discharge lamp or device 1 is conducting.

Glow switch 11, for example, may comprise a glass bulb 14 filled with a rare gas, such as neon or argon, a U-shaped bimetallic strip 15, and a fixed contact or electrode 16. When current flows through starting circuit 9, 9' a glow is produced in switch 11 which actuates the bimetallic strip 15 until it contacts the fixed contact or electrode 16. The glow discharge is extinguished by the bimetallic strip contacting the electrode 16 and thus the bimetal cools and in a very short time the contacts formed by bimetallic strip 15 and electrode 16 disengage each other.

When the entire installation is energized by closing switch 8, current flows through the ballast 7, capacitive reactance 10, glow switch 11, and impedance element 12. The starting circuit 9, 9' forms a series resonant or partially resonant circuit with ballast 7 and impresses a voltage across electrodes 3 and 4 of lamp 1 sufficient to cause an arc discharge to occur therebetween. Once lamp 1 conducts, the voltage drop across ballast 7 and the voltage drop across the impedance element 12 are sufficient to reduce the amplitude of the voltage across the glow switch 11 to a value below the extinguishing voltage thereof. The impedance elements 12 and 13 modify the waveform of the voltage in such a manner that the glow switch 11 remains open thereafter during conduction of lamp 1. This is ensured by arranging that once the glow switch 11 has opened the current flowing through impedance elements 12 and 13 and capacitance 10 is such that the voltage appearing across the impedance element 13 and hence the glow switch 11, is below the striking voltage of glow switch 11.

In one working example of our invention the

stabilizing choke or ballast had a value of 0.8 henry, the capacitance 2 microfarads, resistance 12 had a value of 200 ohms and resistance 13 shunting the glow discharge device had a resistance of one megohm. These circuit constants were used with a supply voltage having a frequency of 50 cycles per second. It will be observed from the above values that the resistance 12 is small in comparison with the impedance of the capacitance 10 at the frequency of the supply, and that the resistance 13 is large in comparison with the impedance of the capacitance 10 at the frequency of the supply.

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

A circuit for starting and operating a gaseous electric discharge lamp having electrodes spaced apart in a sealed envelope, comprising input terminals for connection to a source of alternating current supply of predetermined voltage and frequency and output terminals for connection to the discharge lamp, a series circuit including a ballasting inductance connected between an input and an output terminal, and a parallel circuit including a capacitance, a glow switch and a first resistance all connected in series across said output terminals and a second resistance connected across said glow switch, the values of the inductance and the capacitance being such that when the glow switch is closed they form a resonant circuit, said glow switch having an ionizing potential less than the maximum voltage across said lamp when conducting, and said first and second resistances having values respectively smaller and larger than the reactance of said capacitance at said frequency in order to reduce the potential across said glow switch, when said lamp is conducting, to a figure less than the ionizing potential of said switch, without destroying the resonant condition of said circuit whenever said glow switch is closed.

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