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PLURAL GASEOUS ELECTRIC DISCHARGE DEVICE STARTING CIRCUIT USING AN UNIGNITED DISCHARGE DEVICE AS BALLAST

Filed Feb. 24, 1967

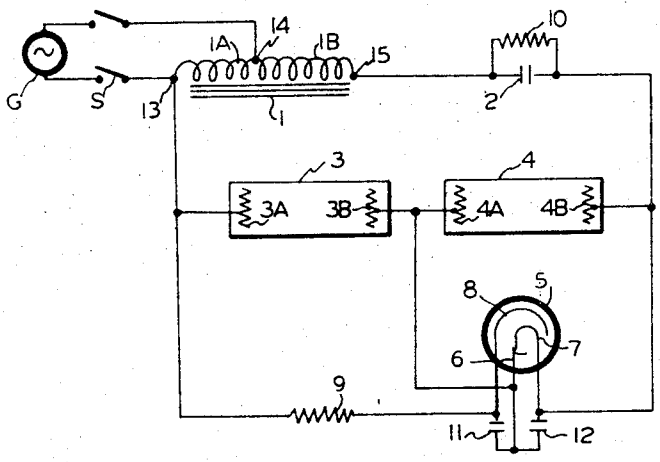

FIG. 1

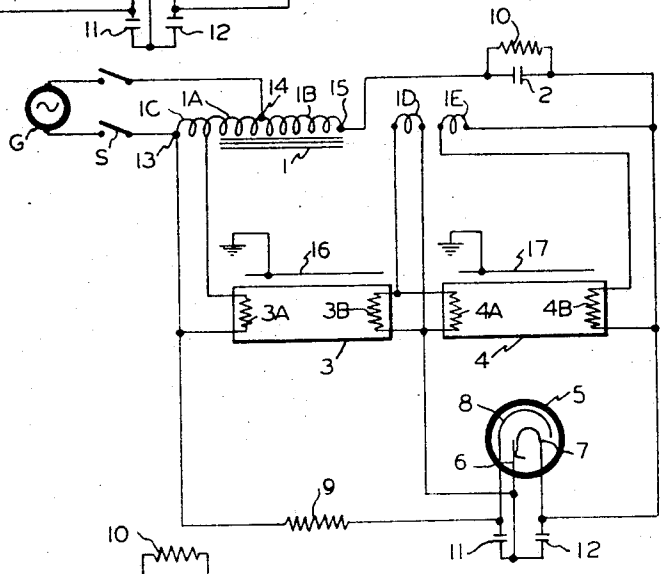

FIG. 2

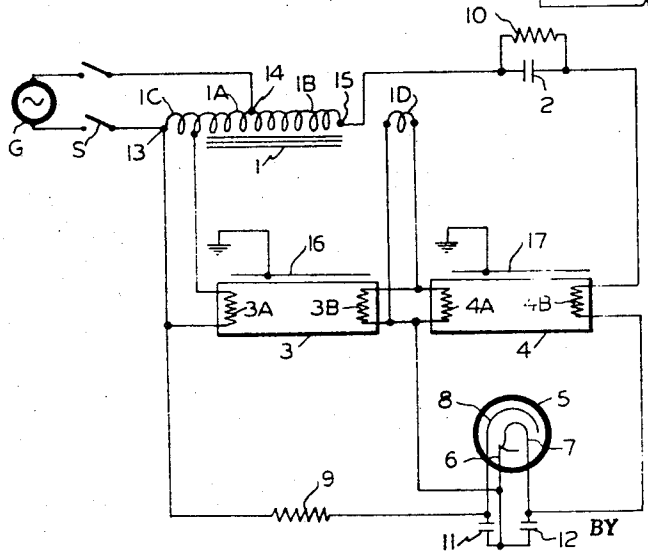

FIG. 3

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PLURAL GASEOUS ELECTRIC DISCHARGE DEVICE STARTING CIRCUIT USING AN UNIGNITED DISCHARGE DEVICE AS BALLAST

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1 Claim. (Cl. 315—189)

ABSTRACT OF THE DISCLOSURE

This invention relates to a circuit for starting two or more gaseous discharge lamps which are connected in series to a voltage source, comprising impedance means connected in parallel to one of said lamps, and a glow switch having normally closed contacts connected in series with said impedance means and in parallel with another of said lamps, said glow switch initially short circuiting said other lamp thereby to enable starting of said one lamp and subsequently upon firing of said glow switch removing said short circuit to cause said other lamp to start.

This invention relates to starting circuits for gaseous discharge lamp systems, and more particularly to improvements in such circuits as disclosed in a copending application for patent Ser. No. 621,737, filed March 6, 1967, by the present inventor and which is incorporated herein by reference.

In the aforementioned application, a pair of gaseous discharge lamps, such as mercury vapor or fluorescent lamps, are connected in series to a voltage source. Across one of the lamps or devices is connected an impedance of relatively high value. Across the other device or lamp is connected a starter switch means comprising a glow switch and a relay operable by the glow switch in such a manner as to first short circuit the other lamp, and subsequently remove the short circuit. Short circuiting of the other lamp causes the entire voltage to be applied to the one lamp, thereby causing it to start. When the glow switch causes the relay to remove the short circuit, the two lamps are connected in series to the voltage source. Since the lamps exhibit negative impedance characteristics immediately upon lighting, once the one lamp is lit, most of the voltage will be placed on the other lamp when the short circuit is removed, thereby causing the other lamp to start.

The glow switch of the copending application comprises a normally open switch which may be closed by a glow discharge in the glow switch. The impedance connected across the one lamp is of sufficient value to enable the glow switch to fire, but is insufficient to cause the lighting of the lamp. Also, the glow switch is connected to a relay which places the short circuit and removes it at the appropriate times.

In the present invention, which has as its object the improvement of the invention of the copending application, the foregoing glow switch and relay are replaced by a single glow switch which comprises normally closed type switch contacts contained within an envelope filled with suitable gas, such as argon or neon. The operation of the present invention is similar to the other invention, with the exception that instead of the glow switch being used to operate a relay which in turn provides and removes the short circuiting of the other lamp, a single normally closed switch is used to initially place a short circuit across the other lamp thereby causing it to start instantaneously. Simultaneously, the voltage is applied to the impedance means connected to the glow switch to cause it to fire. The glow discharge causes the bimetallic contactor contained therein to open the normally closed contacts, and thus remove the short circuit. Thereafter the impedance will be of sufficient value to keep the glow switch tube fired and thus keep the switch open. The lamps and glow switch are turned off by removal of the voltage source.

Thus, one feature of this invention is the provision of a normally closed switch together with a suitable impedance means such as to initially place a short circuit across one lamp and to subsequently remove the short circuit thereby to enable the one lamp and another lamp to be lit in sequence.

The foregoing and other objects and features of this invention will become evident upon consideration of the following detailed description and drawing in which:

FIG. 1 depicts one illustrative embodiment of this invention as used for slim line fluorescent lamps; and

FIGS. 2 and 3 depict other embodiments of this invention as used for rapid start (FLR) type fluorescent lamps.

Referring to the drawings, FIGS. 1, 2 and 3 depict lamp systems similar to those disclosed in the aforementioned copending application, with the exception of glow switch **5** and capacitor **12**. These systems have their elements denoted with similar numerals and letters for convenient identification.

In these figures, there are connected in series circuit discharge lamps or devices **3** and **4** (being slim line fluorescent lamps in FIG. 1 and rapid start (FLR) type fluorescent lamps in FIGS. 2 and 3), each having two electrodes or heaters **3A**, **3B** and **4A**, **4B** (with ground static shields **16** and **17** in FIGS. 2 and 3); transformer **1** having primary winding **1A**, secondary winding **1B**, and terminals **13**, **14** and **15**; and a shunt combination of impedance or resistor **10** and capacitor **2**, both being of suitable values. The transformer has connected to it via switch S, a generator G of suitable type and capacity. Connected in shunt to the first lamp **3** is an impedance **9** of appropriate high value, such as a high resistance, a high capacitance or a high inductance.

As explained in the aforementioned application, the transformer **1** may be of such type that its no-load secondary voltage is relatively small and a leakage pass may be used. The windings **1C**, **1D** and **1E** in FIGS. 2 and 3, are used to provide heating energy to the filaments of lamps **3** and **4**.

Also common to the figures, but only in this invention, there is depicted glow switch **5** which comprises fixed contactor **6** and electrode **8**, and a bimetallic movable contact **7**. The contacts **7** and **8** are coated with barium oxide or other suitable material to provide suitable electrodes for the firing of the tube **5**. Connected to the terminals of the tube **5** are noise suppressor capacitors **11** and **12**, and via leads to impedance **9**, lamp **4**, capacitor-resistor combination **2–10**, and lamps **3** and **4**, all in the manner depicted.

When a suitable voltage is applied between contacts **7** and **8**, a gaseous discharge is caused to occur in the tube **5**. Heat produced from the glow causes contact **7** to move to the right until the normally closed condition is broken. The bias to cause the glow discharge in device **5** is provided by impedance **9**, which is of sufficient value to cause the glow discharge in tube **5** and to also protect the system from excess current in the event contact **7** should accidentally touch element **8**.

The capacitor-impedance combination **2-10** is used to provide static discharge.

The operation of all the embodiments of FIGS. 1, 2 and 3 are similar except for minor differences due to different types of lamps used and the different methods of heating thus required of such lamps. When switch S

is closed, transformer 1 is energized, and a no-load secondary voltage is applied to the series connected lamps 3 and 4. The second lamp is initially short circuited by the normally closed contacts of glow switch 5. Thus, substantially all of the voltage is applied to lamp 3, which is thereby caused to start. Concurrently, voltage is applied via impedance 9 to the glow switch 5, causing it to fire. The glow discharge being of sufficient heat, causes bimetallic element 7 to bend to the right and thus break its contact with contact 6. The speed with which the bimetallic element 7 bends and breaks contacts is sufficiently delayed to enable lamp 3 to start. When the contact between contacts 6 and 7 is broken, the short circuit across lamp 4 is removed. Substantially all of the voltage is now placed across both lamps 3 and 4. Since the lamps are negative resistance type devices, immediately upon lighting, most of the voltage will now be across lamp 4, thereby causing it to start.

In the meantime, glow switch 5 remains fired since voltage is being continually applied thereto. The impedance 9 should be of sufficient value to keep the glow switch 5 fired during the operation of lamps 3 and 4. To extinguish the lamps, switch S is opened. The voltage being taken off glow switch 5, the bimetallic contact 7 thereof is caused to again close its contact with element 6.

In FIG. 1, the lamps used are slim line fluorescent lamps which have opposite electrodes and employ argon gas, a small portion of mercury, and is coated on its inner surface with fluorescent material. In this FIG. 1, as well as in FIGS. 2 and 3, it will be noted that element 7 is bent to form a stop against itself in the event glow switch 5 is overheated.

In one example, two 40 watt slim line fluorescent lamps rated at 600 volts and 0.20 ampere were used. The lamp voltage was about 240 volts each, totalling 480 volts. Thus, the reserve voltage was 120 volts. This reserve voltage acts as a ballast voltage and insures safe operation in the event the line voltage should drop. It was found that in this invention, it was easy to start the lamps with the rated 600 volts because of the short circuiting scheme of the glow switch used.

In FIG. 2, there is depicted a rapid start type (FLR) fluorescent lamp. Its operation is similar to that of the embodiment of FIG. 1, with the exception that instead of the voltage being applied to electrodes 3A, 3B and 4A, 4B, the voltages are taken from windings 1C, 1D and 1E and applied to the filaments 3A, 3B, 4A, 4B of lamps 3 and 4. Otherwise, the starting switch 5, is operated in the same manner as that for FIG. 1.

In FIG. 3, there is depicted an alternative circuit connection for a rapid start type (FLR) fluorescent lamp. The only difference between FIGS. 2 and 3, is the use in FIG. 3 of two filament heater windings 1C and 1D and the direct connection of winding 4B to contact 7 and through capacitor-impedance combination 2-10. In operation, when switch 5 is normally closed, lamp 4 is short circuited through its filaments. This causes preheating of the lamp 4. When glow switch 5 is caused to glow and after sufficient delay the contact between 6 and 7 is broken, and a higher starting voltage is developed across lamp 4, thereby causing it to operate.

In a further embodiment, a thermal switch is substituted for the glow switch 5. A metal filament coil may be connected between the bimetallic element 7 and element 8. The heat produced from the metal filament coil due to electrical current passed therethrough would cause the bimetallic element 7 to move and to open the normally closed contact between elements 6 and 7.

It is to be understood that the foregoing is only illustrative of the principles of this invention and that numerous other changes and modifications would be obvious to one skilled in the art without departing from the spirit and scope of this invention.

What is claimed is:

1. A system for starting at least two gaseous discharge devices which are connected in series circuit with each other, said series connected devices being connectable in parallel circuit across a voltage source, said system comprising

(1) impedance means connected in parallel circuit across one of said devices,

(2) starter switch means comprising a glow discharge tube having a first electrode, a second electrode, and a third electrode, said third electrode being normally in electrical contact with said second electrode and moveable out of contact with said second electrode when said tube is in a glow discharge state,

(3) means for connecting said first electrode to said impedance means,

(4) means for connecting said second electrode to both said impedance means and the interconnection between the series connected devices,

(5) means for connecting said third electrode and the non-series connected terminal of the other of said devices, whereby said electrical contact between said second and third electrodes short circuits said other device thereby to cause said voltage source to start said one device, said impedance means being effective upon connecting of said voltage source to cause a glow discharge in said tube thereby to cause opening of said electrical contact between said second and third electrodes and the placement of both said devices in series circuit with each other and across said voltage source to cause said other device to be started.

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