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STARTING CIRCUIT FOR FLUORESCENT LAMPS

Filed June 19, 1942

Fig. 1.

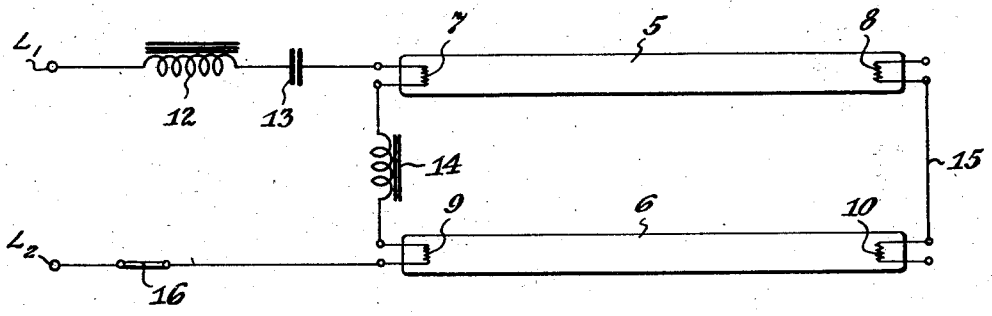


Fig. 2.

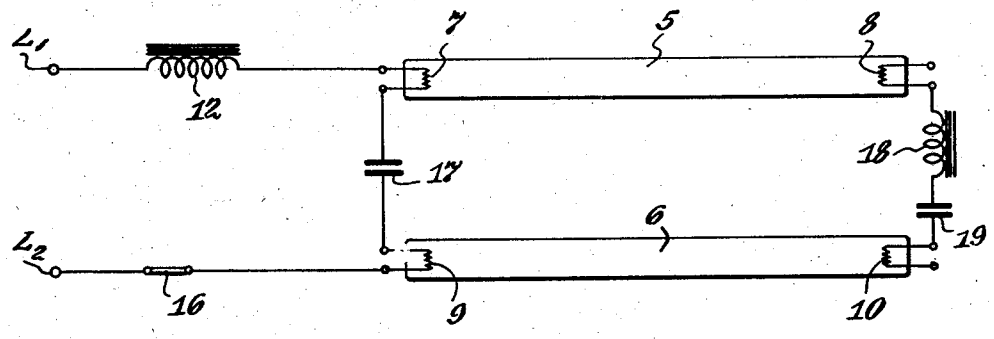
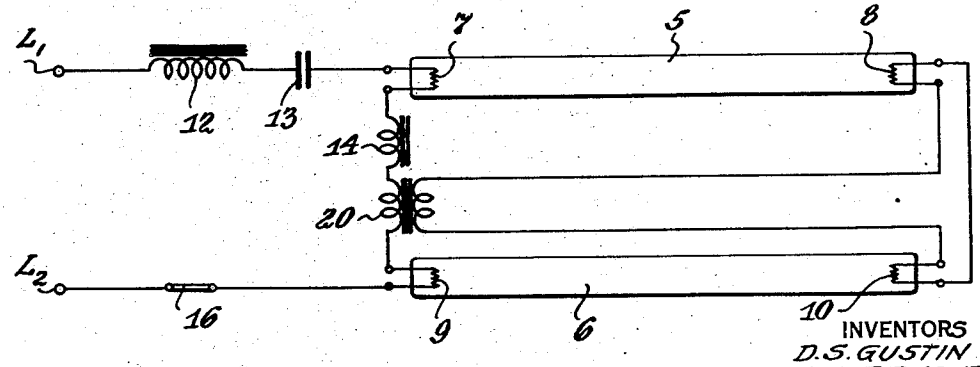


Fig. 3.



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STARTING CIRCUIT FOR FLUORESCENT LAMPS

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5 Claims. (Cl. 315—96)

The present invention relates to gaseous electric discharge lamps and more particularly to a circuit arrangement whereby such lamps may be instantaneously started from a source of supply of the customary domestic potential.

A commonly recognized phenomenon of such discharge lamps is that they require a much higher voltage to initiate a discharge than to sustain the same. Numerous arrangements have been employed in the prior art all of which are subject to various disadvantages such, for example, as the apparatus not having good operating characteristics and the high voltage peaks in many instances very seriously damaging the lamp electrodes.

It is accordingly an object of the present invention to provide a circuit arrangement for gaseous discharge lamps which may be instantaneously started from a source of supply of the customary domestic potential and without causing any damage to the lamp electrodes.

Another object of the present invention is the provision of a circuit arrangement for gaseous discharge lamps wherein the lamps are operated in a series circuit substantially in resonance and in which the lamps are started substantially instantaneously from a source of supply of the customary domestic potential.

Still further objects of the present invention will become obvious to those skilled in the art by reference to the accompanying drawing wherein:

Fig. 1 is a schematic illustration of the starting and operating circuit for gaseous discharge lamps in accordance with the present invention;

Fig. 2 is a schematic illustration of a modification which the starting and operating circuit of the present invention may take, and

Fig. 3 is a schematic illustration of still another modification which the present invention may take.

Referring now to the drawing in detail, a pair of gaseous discharge lamps 5 and 6 of approximately 40 watt size are shown, with the lamp 5 being provided with a pair of filamentary electrodes 7 and 8 and the lamp 6 having similar electrodes 9 and 10. The electrodes 7 and 9 at the end of each lamp are connected in a series heating circuit to the source of supply L1—L2 of the customary domestic potential of 220 volts, which may be directly from the line or from the secondary winding of a transformer, the primary winding of which is connected to a 110-volt line. This circuit extends from one side of the source of supply L1 through an inductance 12 and capacitance 13 to one end of the filamentary electrode 7 and from the opposite end of such electrode through an impedance device such as another inductance 14, to the filamentary electrode 9, and thence back to the opposite side of the source of supply L2. The other remaining electrodes 8 and 10 are connected together by a conductor 15.

The circuit thus formed constitutes a series heating circuit for the filamentary electrodes 7 and 9, as above mentioned, which is at or near resonance with the fundamental frequency of the source, and while the lamps themselves are in series relation with each other and the source of supply L1—L2, they may be said to form a parallel or shunt circuit with respect to the series heating circuit for the filamentary electrodes 7 and 9. Accordingly with inductance of the element 12 being about 0.5 henry, that of element 14 about 2.5 henries, and the capacitance of the condenser 13 approximately 3.0 microfarads, a current of approximately .465 ampere at about 90% normal line voltage flows in the heating circuit, upon closure of the switch 16, which very rapidly heats the filamentary electrodes 7 and 9 to an electron-emitting temperature.

This causes a voltage drop of about 450 volts across the impedance or inductance 14 which voltage is sufficiently high to start a discharge in the series connected lamps 5 and 6. Once the discharge is initiated, which follows almost instantaneously upon heating of the filamentary electrodes, the circuit constants as above mentioned cause a normal lamp current of 0.42 ampere to flow through the lamps at normal line voltage. During operation the entire circuit consumes about 97 watts of which 80 watts are taken by the two 40-watt lamps, the remainder constituting power loss in the circuit. However, this power loss is exceptionally low in comparison with that occurring in other types of circuits and is amply compensated for by the rapidity with which the lamps are started following closure of the line switch.

In Fig. 2 a slight modification of the circuit arrangement of the present invention is shown which differs from that of Fig. 1 in that an impedance device in the form of a capacitance 17 is connected in series with the electrodes 7 and 9 in lieu of the inductance 14 of Fig. 1 and no capacitance is interposed between the source of supply and either of the electrodes 7 and 9. An inductance element 18 and capacitance 19 is, however, connected in series with the electrodes 8 and 10. Upon closure of the switch 16 the fila-

mentary electrodes 7 and 9 are again heated very rapidly and a voltage drop of approximately 450 volts occurs across the capacitance 17 which is sufficient to initiate a discharge in the series connected lamps in the same manner as above described. The inductance 18 limits the lamp current while the capacitance 17 is charging and discharging, since without it the capacitance would be connected directly across the lamps 5 and 6 without any limitation on current flow. By connecting the capacitance 19 in series with the inductance 18 the impedance of the latter is effectively reduced which allows proper lamp current to flow.

The modification of Fig. 3 is practically identical to that of Fig. 1 except that in this latter embodiment not only are the filamentary electrodes 7 and 9 preheated, but also the remaining filamentary electrodes 8 and 10. To heat these latter electrodes a transformer 20 is provided having its primary winding connected in series with the impedance again taking the form of the inductance element 14, while the filamentary electrodes 8 and 10 are connected in series with the transformer secondary. If desired, the inductance element 14 may be dispensed with and a self-inductive type transformer employed which thus serves as an impedance replacing both the inductance 14 and transformer 20. The advantage in preheating both electrodes of each lamp resides in the fact that they can be started at a much lower voltage of approximately 300 volts, using the same circuit constants as above referred to in Fig. 1, and results in longer lamp life due to easier starting and less end blackening from sputtered electron emissive material.

It thus becomes obvious to those skilled in the art that a starting and operating circuit for gaseous discharge lamps is herein provided in which the lamps are started practically immediately upon connection to a source of supply of the customary domestic potential. Moreover, the circuit is substantially a resonant one and wherein the power loss is exceptionally low, thereby increasing the overall efficiency of the system.

Although several embodiments of the present invention have been shown and described, it is to be understood that still further modifications thereof may be made without departing from the spirit and scope of the appended claims.

We claim:

1. In combination, a source of electrical energy, a pair of gaseous discharge lamps having a starting voltage higher than the voltage of said source and each provided with at least one filamentary electrode, means to connect only one filamentary electrode of each lamp in a series heating circuit which is in electrical shunt with the discharge circuit for said lamps comprising an impedance disposed between one of said filamentary electrodes for one of said lamps and the source of supply and a second impedance interconnecting said one filamentary electrode of each lamp and subject to a voltage drop thereacross of sufficient magnitude to initiate a discharge in both said lamps, and means independent of said heating circuit for the said one filamentary electrode for each lamp and connecting the remaining electrode of each lamp together to complete a series connected discharge circuit for said pair of lamps.

2. In combination, a source of electrical energy, a pair of gaseous discharge lamps having a starting voltage higher than the voltage of said source and each provided with at least one filamentary electrode, a series heating circuit for only one filamentary electrode of each lamp which is in electrical shunt with the discharge circuit for said lamps including an inductance disposed between one filamentary electrode of one of said lamps and the source and an impedance interposed between the said one filamentary electrode of each lamp and subject to a voltage drop thereacross of sufficient magnitude to initiate a discharge in said lamps, and means independent of said heating circuit for the said one filamentary electrode for each lamp and connecting the remaining electrode of each lamp together to complete a series connected discharge circuit for said pair of lamps.

3. In combination, a source of electrical energy, a pair of gaseous discharge lamps having a starting voltage higher than the voltage of said source and each provided with at least one filamentary electrode, a series heating circuit for only one filamentary electrode of each lamp which is in electrical shunt with the discharge circuit for said lamps including an inductace disposed between one filamentary electrode of one of said lamps and the source and a second inductance interposed between the said one filamentary electrode of each lamp and subject to a voltage drop thereacross of sufficient magnitude to initiate a discharge in said lamps, and means independent of said heating circuit for the said one filamentary electrode for each lamp and connecting the remaining electrode of each lamp together to complete a series connected discharge circuit for said pair of lamps.

4. In combination, a source of electrical energy, a pair of gaseous discharge lamps having a starting voltage higher than the voltage of said source and each provided with at least one filamentary electrode, a series heating circuit for only one filamentary electrode of each lamp which is in electrical shunt with the discharge circuit for said lamps including an inductance disposed between the said one filamentary electrode of one of said lamps and the source and capacitance interposed between the said one filamentary electrode of each lamp and subject to a voltage drop thereacross of sufficient magnitude to initiate a discharge in said lamps, and means independent of said heating circuit for the said one filamentary electrode for each lamp and connecting the remaining electrode of each lamp together to complete a series connected discharge circuit for said pair of lamps.

5. In combination, a source of electrical energy, a pair of gaseous discharge lamps having a starting voltage higher than the voltage of said source and each provided with at least one filamentary electrode, a series heating circuit for only one filamentary electrode of each lamp which is in electrical shunt with the discharge circuit for said lamps including an impedance disposed between the said one filamentary electrode of one of said lamps and the source and a second impedance interposed between said one filamentary electrode of each lamp and subject to a voltage drop thereacross of sufficient magnitude to initiate a discharge in said lamps, and another impedance independent of said heating circuit for the said one filamentary electrode for each lamp and connecting the remaining electrode of each lamp together to complete a series connected discharge circuit for said pair of lamps.

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