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GASEOUS ELECTRIC DISCHARGE APPARATUS

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Fig. 1.

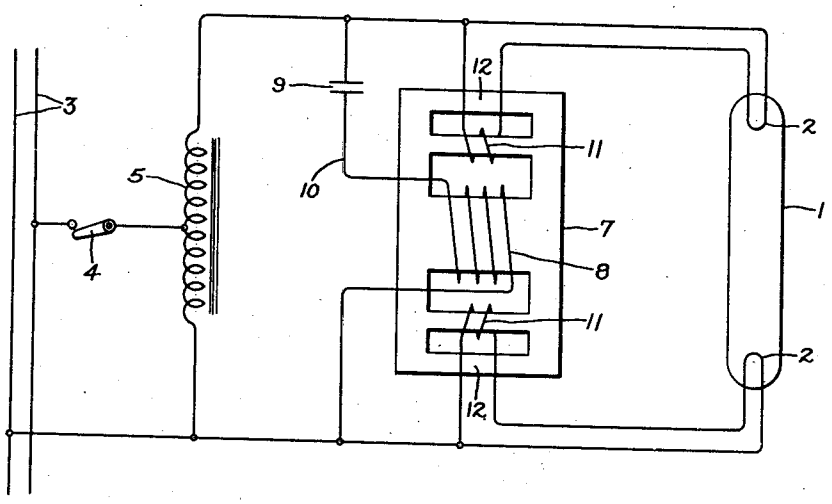
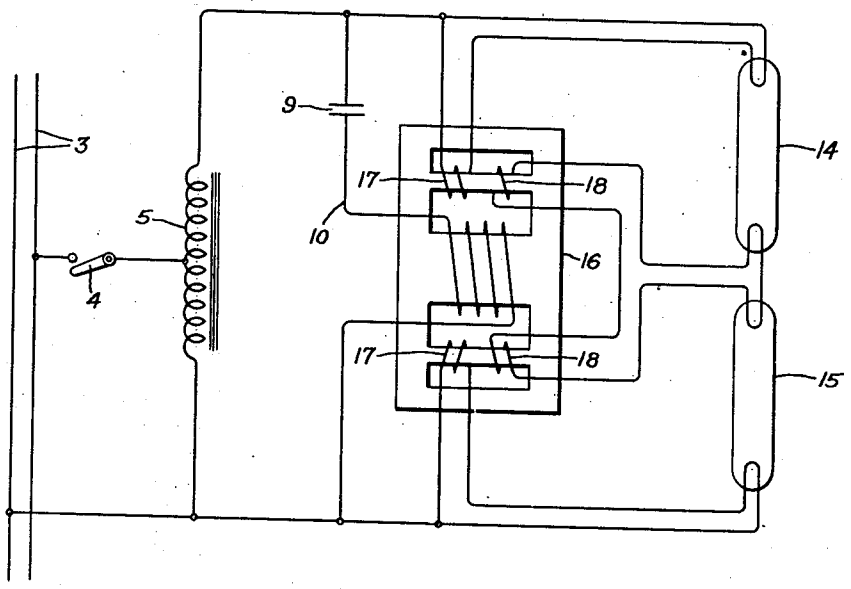


Fig. 2.



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GASEOUS ELECTRIC DISCHARGE APPARATUS

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3 Claims. (Cl. 176—124)

Our invention relates to gaseous electric discharge devices, such as discharge lamps, and to apparatus for operating them from alternating current circuits. It relates particularly to discharge devices which have electrodes that are initially heated to an electron emitting temperature and to apparatus by which the necessary voltage is applied to such a device to cause it to start when the electrodes thereof have reached that temperature, the invention being a further development of the apparatus disclosed and claimed in the Edwards Patent 2,170,448. It is the object of our invention to provide improved apparatus of this character which involves no moving parts, which produces rapid and ample initial heating of the electrodes, and which will have low losses after the starting and during the normal operation of the device.

Our 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.

Referring to the drawing, Fig. 1 is a circuit diagram illustrating one embodiment of our invention, and Fig. 2 is a similar diagram illustrating a modification.

In Fig. 1 the gas filled electric discharge device or lamp 1 having the initially heated thermionic electrodes 2 at the ends thereof is shown connected to the source 3 of alternating current supply such, for example, as a 115 volt lighting circuit through the control switch 4 and the auto-transformer 5. This transformer has high leakage reactance and serves to raise the voltage of the source of supply to that required to effect the starting and subsequent operation of the device.

To supply the electrodes of the device at starting with an adequate supply of current for quickly bringing the temperature thereof to the point of electron emission, and to keep the losses incident thereto at a low value during the operation of the device we have provided the transformer 7 which in the form shown on the drawing is constructed with five legs. The center leg supports the primary winding 8 which in series with the capacitor 9 forms the branch circuit 10 connected in parallel with the device 1; the two intermediate legs support the two secondaries 11 which supply heating current to the electrodes 2; and the two outer legs 12 are unwound and are constructed to saturate with the application of the starting voltage to the branch circuit 10, before the discharge starts in the device. The outer legs being saturated, sufficient flux is forced through the secondaries 11 to cause the rapid heating of the electrodes. The capacitor 9 has such capacitance that it resonates with the primary 8 at the time of saturation of the outer legs at which time the inductive reactance of the primary is at a minimum.

As the electrodes reach the proper heat a glow discharge takes place between the ends of each electrode which with the application of the starting voltage starts the discharge in the device. The discharge having started, the voltage across the device falls to the arc drop voltage. This voltage applied to the branch circuit 10 is insufficient to cause saturation of the outer legs of the transformer and as a result the inductive reactance of the primary immediately rises to such a large value that only a negligible amount of current traverses the branch circuit. Thus the losses during the normal operation of the device are very small. It will be seen that the branch circuit 10 by reason of the saturation of the transformer core is voltage sensitive and non-linear; also by reason of the fact that the capacitor resonates with the primary when saturation occurs the circuit is a non-linear resonant circuit.

While we have shown the device connected to the source of current supply through an auto-transformer, it will be understood that where the voltage of the source is high enough or, converesely, if the starting and arc drop voltages of the device are low enough, the device may be connected directly with the source through a ballast reactor and switch.

Under certain conditions we may dispense with the capacitor 9 and depend entirely upon the non-linear property of the apparatus in the branch circuit to provide the desired quick heating of the electrodes before starting and to keep the losses low during the operation of the device. We prefer, however, to take advantage of the assistance obtainable by making the branch circuit resonant at the starting voltage. Moreover, the capacitor serves to prevent the transformer 7 from loading the auto-transformer whose open circuit voltage would thereby be reduced. The capacitor by neutralizing a part of the leakage reactance of the auto-transformer tends to raise its open circuit voltage.

In the modified form of our invention illustrated by Fig. 2, two electric discharge devices or lamps 14 and 15 are shown arranged in series and each provided with initially heated electrodes. The transformer 16 in this case is similar to the transformer shown in Fig. 1 except that two secondaries are mounted on each of the two inter-

mediate legs. The secondaries 17 are connected separately to supply heating current to the two outermost electrodes, and the other secondaries 18 are connected in series to supply heating current to the two adjacent electrodes. The apparatus shown in this figure functions in substantially the same manner as has been described above in connection with Fig. 1.

We have chosen the particular embodiments described above as illustrative of our invention, and it will be apparent that various other modifications may be made without departing from the spirit and scope of our invention which modifications we aim to cover by the appended claims.

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

1. In combination, a source of alternating current supply, a gaseous electric discharge device connected to be supplied therefrom, said device having electrodes arranged to be supplied with heating current, and means for controlling said heating current comprising a circuit connected in parallel with said device and including a capacitor and inductive reactance means constructed to saturate and to become resonant with said capacitor at the starting voltage of the device and to desaturate and to become non-resonant with said capacitor at the arc drop voltage thereof.

2. In combination, a source of alternating current supply, a gaseous electric discharge device connected to be supplied therefrom, said device having an electrode arranged to be supplied with heating current and a transformer having a primary connected in parallel with said device, a secondary connected to supply said electrode, and a magnetic shunt for said secondary constructed to saturate at the starting voltage of the device and to desaturate at the arc drop voltage thereof.

3. In combination, a source of alternating current supply, a gaseous electric discharge device connected to be supplied therefrom, said device having an electrode arranged to be supplied with heating current and a transformer having a primary connected in parallel with said device, a secondary connected to supply said electrode, a magnetic shunt for said secondary constructed to saturate at the starting voltage of the device and to desaturate at the arc drop voltage thereof, and a capacitor included in said primary connection constructed to resonate with said primary at the time of saturation of said shunt.

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