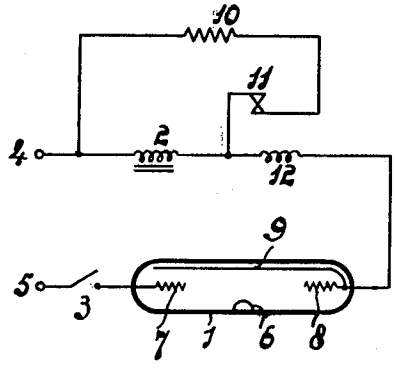
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CIRCUIT COMPRISING AN ARC-DISCHARGE TUBE

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INVENTOR
Ernö Mann
By Fred M Vogel
Agent

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CIRCUIT COMPRISING AN ARC-DISCHARGE TUBE

Ernö Mann, Eindhoven, Netherlands, assignor to Hartford National Bank and Trust Company, Hartford, Conn., as trustee

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3 Claims. (Cl. 315—263)

This invention relates to a starting arrangement for igniting a low-pressure arc discharge tube. In particular, the invention relates to a starting arrangement for a tube of that type employing an auxiliary starting electrode.

The main object of the invention is to reduce the potential necessary for igniting a tube of the foregoing type.

This and other objects of the invention will be best understood from the following description thereof.

According to the invention, the main electrodes and the auxiliary electrode of a low-pressure arc discharge tube are connected in series with an inductor serving to limit current flow through the tube. In order to decrease the igniting voltage of said tube an auxiliary impedance is arranged in parallel with the inductor and is connected across the inductor by means of a relay which is operative above only during the starting cycle of the tube.

In the preferred arrangement, the auxiliary impedance is connected in parallel with the inductor through a magnetic relay whose contacts are normally closed until the relay is energized by current flowing through its winding.

In this arrangement the energizing coil is arranged to open the relay when the tube current exceeds 0.7 times the normal operating current of the tube thereby removing the auxiliary impedance from the circuit.

The value of the auxiliary impedance should be preferably less than about 0.2 times the impedance of the inductor during normal operating current in the tube, and more preferably, between about 0.05 and 0.1 times the impedance of the inductor.

The invention will now be described with reference to the accompanying drawing in which the sole figure shows one form of starting arrangement exemplifying the invention.

Referring to the figure, a low-pressure arc-discharge tube **1** comprises a pair of activated main electrodes **7**, **8** and an auxiliary electrode **9** connected to one of the main electrodes **8** and extending therefrom towards the other main electrode **7**. The tube **1** is connected through a series inductor **2** and a switch **3** to terminals **4**, **5** of a suitable source of potential.

A resistor **10**, connected in series with a magnetic relay **11**, is connected in parallel with the inductor. The energizing coil **12** for the relay **11** is connected in series with the tube. The relay **11** is normally closed when deenergized.

The following specific example will illustrate the invention.

The tube **1** in the drawing is filled with argon and also contains a small quantity of mercury designated by a droplet **6**.

The tube is approximately 120 cms. long and has an internal diameter of about 35 mms. and has main electrodes **7**, **8** which are activated with conventional materials, for example strontium and barium compounds. The auxiliary electrode **9** comprises a strip having a width of about 3 mms. and extends substantially throughout the length of the tube along an inner wall thereof, and consists of a mixture of graphite and enamel with an overall resistance of approximately 2000 ohms.

The inductor **2** has an impedance of about 400 ohms at normal operating current while the resistor **10** has an impedance of about 30 ohms at a current of 25–100 milliamperes. The relay **11** is arranged to open when a current of 300 to 350 milliamperes flows through the energizing coil **12**.

With an alternating voltage of 220 volts across terminals **4** and **5** and switch **3** closed, a glow discharge is struck between the main electrode **7** as a cathode and the auxiliary electrode **9** as an anode. The glow discharge thus developed creeps along the auxiliary electrode **9** until it ultimately reaches the other main electrode **8** which results in a current flow of about 25 to 100 ma. The main electrodes **7**, **8** are heated by the glow discharge until the emission temperature of the active compounds is reached, at which time the glow discharge changes into an arc-discharge, which should occur within half a second after the application of the voltage and results in a current flow of about 250 ma. and finally a steady state arc-discharge current of about 420 ma.

Upon closing the switch, resistor **10** is shunted across the inductor **2** thus greatly reducing the impedance of the combination, thereby allowing a higher voltage to appear across the tube terminals. When the glow discharge has changed into an arc-discharge, the current flowing through the tube **1** rapidly increases. Upon reaching the value of 300 ma., the relay **11** becomes energized thereby breaking the circuit between the resistor **10** and the inductor **2** and permitting the inductor **2** to control the steady state operating current within the circuit. It has been found that the tube described above has ignited with a supply voltage as low as 200 volts within half-a-second.

The magnetic relay **11** has the further advantage that upon an interruption of the supply potential, the relay **11** is de-energized and the resistor **10** immediately reconnected in parallel with the inductor **2**, so that the tube will automatically reignite if the supply potential is once more impressed across the circuit.

While the invention has been described in connection with specific examples and in specific applications, other modifications thereof will be readily apparent to those skilled in the art without departing from the invention as defined in the appended claims.

What I claim is:

1. A circuit arrangement comprising a low-pressure arc-discharge tube having a given operating voltage and adapted to conduct a given value of current upon reaching the arc-discharge condition, said tube including a pair of activated main electrodes and an auxiliary electrode connected to one of the main electrodes and extending therefrom towards the other main electrode for igniting the tube without preheating the main electrodes, a potential source having a voltage greater than said operating voltage, and inductor having a given value of inductance connected in series with the tube and said source, an auxiliary impedance shunting said inductor, and a relay in series with said tube and responsive to the discharge current flowing through said tube to disconnect said auxiliary impedance from the circuit immediately after the discharge current through said tube has achieved a predetermined value.

2. A circuit arrangement comprising a low-pressure arc-discharge tube having a given operating voltage and adapted to conduct a given value of current upon reaching the arc-discharge condition, said tube including a pair of activated main electrodes and an auxiliary electrode connected to one of the main electrodes and extending therefrom towards the other main electrode for igniting the tube without preheating the main electrodes, a potential source having a voltage greater than said operating voltage, an inductor having a given value of inductance

connected in series with the tube and said source, an auxiliary impedance shunting said inductor and having a value lower than about 0.2 times the impedance of said inductor at the given value of current, and a relay in series with said tube and responsive to the discharge current flowing through said tube to disconnect said auxiliary impedance from the circuit immediately after the discharge current through said tube exceeds 0.7 times said given current.

3. A circuit arrangement comprising a low-pressure arc-discharge tube having a given operating voltage and adapted to conduct a given value of current upon reaching the arc-discharge condition, said tube including a pair of activated main electrodes and an auxiliary electrode connected to one of the main electrodes and extending therefrom towards the other main electrode for igniting the tube without preheating the main electrodes, a potential source having a voltage greater than said operating voltage, and inductor having a given value of inductance

connected in series with the tube and said source, a resistor shunting said inductor and having a value between about 0.05 and 0.1 times the impedance of said inductor at the given value of current, and a relay in series with said tube and responsive to the discharge current flowing through said tube to disconnect said resistor from the circuit immediately after the discharge current through said tube exceeds 0.7 times said given current.

References Cited in the file of this patent

UNITED STATES PATENTS

1,298,603	Tower	Mar. 25, 1919
2,094,647	Freitag	Oct. 5, 1937
2,182,609	Bethenod	Dec. 5, 1939
2,266,616	Scott	Dec. 16, 1941
2,462,336	Ruff	Feb. 22, 1949
2,485,398	Mandl	Oct. 18, 1949
2,491,854	Force	Dec. 20, 1949