J. A. ORANGE.

INCLOSED ARC DEVICE.

APPLICATION FILED MAR. 6, 1916.

1,306,559.

Patented June 10, 1919.

Fig. 1.

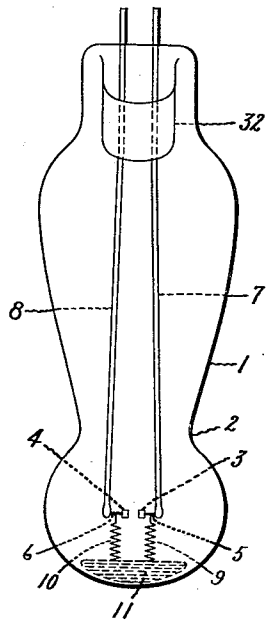


Fig. 2.

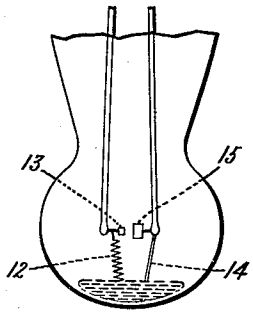


Fig. 3.

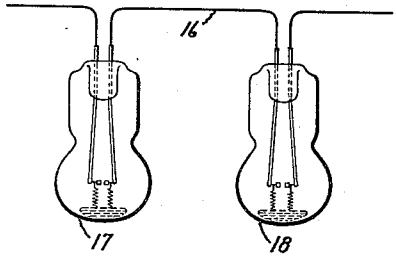


Fig. 4.

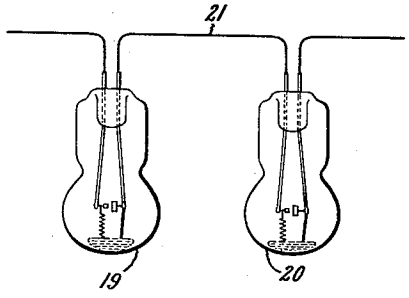
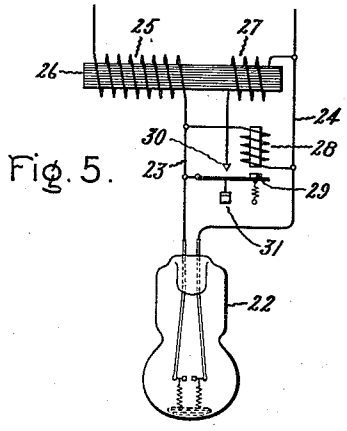


Fig. 5.



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UNITED STATES PATENT OFFICE.

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INCLOSED-ARC DEVICE.

1,306,559. Specification of Letters Patent. Patented June 10, 1919.

Application filed March 6, 1916. Serial No. 82,387.

To all whom it may concern:

Be it known that I, JOHN ARTHUR ORANGE, a subject of the King of Great Britain, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Inclosed-Arc Devices, of which the following is a specification.

The present invention relates to electric arc devices comprising a sealed bulb, containing electrodes of tungsten, or other suitable refractory conducting material, and containing a gaseous medium at substantial pressure. It is the object of my invention to provide automatic means for starting the arc without using high potential devices.

In accordance with my invention, I have provided within the container a starting means comprising a body of easily vaporizable conducting material, for example, mercury, and an electrically heated conductor contacting therewith, electrical connections being provided so that upon passage of current some of the mercury, or the like, will be evaporated until contact between the mercury and a contacting conductor is broken, thereby striking an arc at the mercury surface, which in turn starts the main arc between the refractory electrodes.

In the accompanying drawings, Figure 1 shows one embodiment of my invention in an alternating current lamp; Fig. 2 illustrates a modification for direct current operation; Figs. 3 and 4 show how the devices may be connected in a lighting circuit; and Fig. 5 shows an arrangement for applying the full line voltage upon starting, which is automatically reduced when the arc is operating.

Referring to Fig. 1, the lamp here shown comprises an elongated envelop 1 having an intermediate constriction at 2, giving the effect of two chambers. The electrodes 3, 4 consist of tungsten, tantalum, or other suitable highly refractory material of low vapor pressure. The electrodes preferably are connected to stems 5, 6 of smaller cross-section than the leads 7, 8, which are sealed into the glass stem 32. For, example, with electrodes about 40 to 50 mils in diameter, the stems 5, 6 may have a diameter of about 10 mils, and the leads 7, 8 a diameter of about 30 to 40 mils. The electrodes may be separated a distance of about 30 to 60 mils, depending on the operating characteristics desired. The bulb 1 contains a filling of inert gas, such, for example, as nitrogen or argon, preferably at a pressure of about one-third of an atmosphere.

Connected to the current supply, and conveniently attached to the electrode stems, are conductors 9, 10, preferably coiled, and dipping into a pool of mercury 11. These conductors consist of refractory material, preferably tungsten, molybdenum, tantalum, or the like, and have a resistance adapting them to operate at a temperature high enough to rapidly evaporate mercury upon passage of current so as to break contact of one of the conductors with the mercury, and preferably the contact of both conductors, thereby striking an arc or arcs. An arc between the end of either of the conductors 9 or 10 travels up the conductors and starts an arc between the main electrodes 3, 4. The heat of the arc maintains the part of the container below the constriction 2 filled with mercury vapor in which an arc may be operated at high efficiency.

In a direct current lamp as indicated in Fig. 2, a filamentary conductor, or heater 12, is connected to the cathode 13, and a heavier conductor 14 not materially heated by passage of the heating current completes the electrical circuit, being connected for convenience to the anode 15.

The above described lamps may be operated in a series lighting circuit 16, as shown in Fig. 3, for alternating current lamps 17, 18, and in Fig. 4 for direct current lamps 19, 20 in a series circuit 21. As the individual lamps do not have identical starting characteristics, and do not start at the same moment, a high voltage is impressed successively on the lamps as the contact with the mercury globule is broken and the circuit opened.

An arrangement for still more positively applying a starting voltage higher than the operating voltage is shown in Fig. 5. The arc device 22 is connected by the conductors 23, 24, in series with the transformer primary coil 25 wound on a laminated core 26 common to the secondary coil 27. As the transformer has a high reactance this arrangement is adapted particularly for multiple circuit operation. In shunt with the terminals of the device 22 is a coil 28 which is wound so that a relatively high voltage, say a hundred volts, is necessary to cause it

to pick up its armature 29, but the arc-operating voltage, say 12 volts, is sufficient to cause it to hold its armature. When, for example, the lamp is operated in a 110 volt circuit, and when sufficient mercury evaporates to break the circuit in the lamp, the magnet 28 is actuated, making contact at 30 with the conductor 23 and the free terminal of the secondary coil 27, the speed of response of the armature being adjusted by a dash-pot 31. The coil 27 furnishes a desired lower voltage current, say 12 volts, of correspondingly higher amperage, for operating the device. The arrangement just described is equally well adapted for series operation, but in that case the transformer should not be of high reactance. By the use of the mechanism shown in Fig. 5, it is practicable to operate, for example, a 20 ampere lamp on a 6 ampere series circuit.

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

1. The combination of a container, electrodes of refractory conducting material therein, a quantity of mercury, a refractory conductor connected at one terminal to one of said electrodes and contacting at the opposite terminal with said mercury, and connections for completing an electric circuit through said conductor, the mercury, and a coöperating electrode.

2. An electric arc device comprising the combination of a sealed container, electrodes of tungsten therein, a quantity of mercury, a refractory conductor connected to one of said electrodes and contacting with said mercury, and connections for completing an electric circuit through said conductor and body of mercury.

3. An electric arc device comprising the combination of a container, electrodes of tungsten therein, a filling of gas inert with respect to said electrodes at high temperatures, a quantity of mercury, a refractory conductor connected at one end immediately adjacent to one of said electrodes and at the other end to the mercury, and a second electrical connection to the mercury.

4. An electric arc device comprising the combination of an elongated container, electrodes of tungsten located near one end of said container, a filling of argon, a quantity of mercury adjacent said electrodes when the container is in the operating position, and filaments of tungsten connected, respectively, adjacent said electrodes and having free ends contacting with the mercury.

5. The combination of a sealed container, coöperating electrodes of refractory material therein separated by a space, a quantity of easily vaporizable conducting material, and conductors completing within said container an electrical circuit between said electrodes, said circuit including said conducting material, one of said conductors at least being adapted to be heated to a temperature high enough to rapidly evaporate said material and open the circuit.

6. An electric arc lamp comprising the combination of a container, electrodes of refractory material therein, a quantity of mercury, a refractory conductor connected respectively at one end to each of said electrodes and contacting at the opposite end with said mercury, at least one of said conductors having a length and resistance adapted to evaporate sufficient mercury upon passage of current to break contact with the mercury and strike an arc.

In witness whereof I have hereunto set my hand this 28th day of February, 1916.

JOHN ARTHUR ORANGE.