

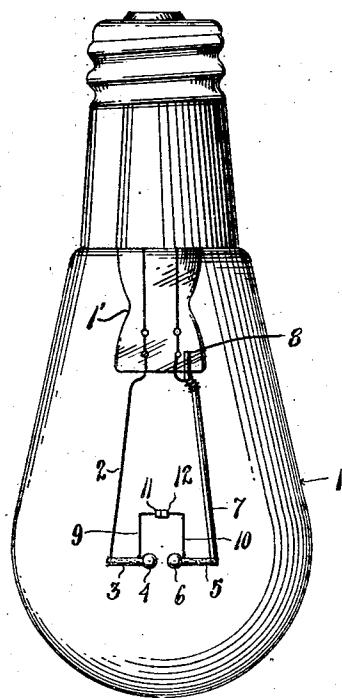
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1,617,635

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ELECTRIC ARC LAMP

Original Filed June 11, 1917



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UNITED STATES PATENT OFFICE.

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ELECTRIC-ARC LAMP.

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The invention relates to electric arc lamps which operate on very low wattages and at the ordinary commercial voltages and will maintain high efficiencies even in the smaller sizes ranging as low as ten or fifteen candle power. To this end, the invention comprises a lamp, involving a container or envelope, preferably adapted for connection in the ordinary incandescent lamp socket, and containing an inert gas, preferably under diminished pressure, and two electrodes, between which the arc is maintained, connected to suitable lead wires, at least one of which electrodes is formed of a mixture of a conductive material and a non-conductive material, such as comminuted tungsten distributed through a body of thorium oxide or zirconium oxide, or a mixture of these refractory oxides, the terminal or arc forming portion of such electrode being formed of a second class conductor, viz, a body which is non-conducting when cold, but which becomes conductive when heated to a high degree, the main portion of the electrode formed of the conductive and non-conductive materials, constituting a ballast resistance for the lamp and also an incandescing body which utilizes the current absorbed by the resistance to generate light in addition to that produced at the arc, the electrodes being associated with a shunt or by-pass normally bridging the terminals and which shunt is adapted to be opened or broken, by suitable means, preferably a thermostat, which operates when sufficient heat is developed, to separate the electrodes to proper arcing distance and also moves the separable contacts of the shunt apart.

In the accompanying drawing, there is shown a lamp embodying the invention and adapted to be applied to an ordinary incandescent light socket.

Referring to the drawing, 1 indicates the globe or bulb of the lamp which is preferably of the form usually employed in incandescent filament lamps, adapted for the usual socket connection, which is exhausted of air and supplied with an inert gas, such as nitrogen, argon or the like, preferably under diminished pressure. The bulb is provided with the usual form of glass neck 1' in which is mounted the usual lead wires, to one of which is connected a conducting and supporting wire 2, to the lower end of which is secured an electrode 3 having a

bulbous or spherical head or terminal 4, opposite which electrode is mounted a second electrode 5, which may be provided with a similar bulbous head or terminal 6, which electrode 5 is preferably mounted on the end 60 of a thermostat 7, anchored in the neck 1' and connected by a suitable conductor 8 to the other lead wire of the lamp. The body portion of one or both of the electrodes 3 and 5 is formed of an intimate admixture of 65 comminuted highly refractory metal, such, for example, as tungsten, and highly refractory oxide, such as oxide of thorium or oxide of zirconium, the metallic constituent being dispersed throughout the body of the electrode and serving as a conductor of high resistance. This admits of an electrode being formed of comparatively large diameter and high resistance, the resistance depending upon the diameter, the length, and the proportion of refractory metal employed. To the end of said electrode 3 is secured a terminal in the form of a ball or other suitable shape made of material which constitutes a 70 second class conductor, such for example, as 75 a mixture of oxides of zirconium, thorium and yttrium, which is non-conducting when cold, but becomes conductive when highly heated. If desired, the electrode 5, and its terminal 6 may be similar in all respects to 80 electrode 3 and its terminal 4, but, if preferred, the electrode 5 may be made of any suitable conductor of proper form, such as a ball or terminal of metallic tungsten or 85 tungsten alloy.

Connected to the conductive portions of the electrodes 3 and 5 are two wires 9 and 10 respectively, which are provided with terminal contacts 11 and 12 of material having a normal low thermionic emissivity such 95 for example as zinc, which are normally in engagement and which together with the conductors 9 and 10 constitute a by-pass or shunt around the terminals 4 and 6 of the electrodes when the lamp is inactive.

The operation of the lamp is as follows: When current is supplied to the lamp, it enters by way of conductor 2, passes through the body of electrode 3, thence through wire 9, contacts 11 and 12, wire 10, electrode 5, 105 thermostat 7 and conductor 8, back to the main. The current passing through the highly resistive metallic constituent of electrode 3 raises the latter to a high temperature and bright incandescence, and if elec- 110

trode 5 is similarly constituted, produces the same effect therein. The heat from said electrodes 3 and 5 raises the temperature of the terminals 4 and 6 to the necessary degree 5 to convert them into conductors, ionizes the gas between the terminals, thereby establishing an arc, and at the same time causes the thermostat 7 to act to move electrode 5 away from electrode 3 to an effective arcing distance and also breaking the circuit through the by-pass or shunt by separating contacts 11 and 12, which latter moves with electrode 5. It will be understood that if electrode 5 is formed of a highly refractory 10 metal or alloy capable of supporting an arc, the preliminary heating necessary to start the operation of the lamp will be effected by means of the opposite electrode 3, the operation being in all other respects similar to that just described. Suitable ballast may be included in series with the lamp, in order to take up the voltage of the arc when starting, although this is not essential. The effect of the lamp as described is the production of a steady, brilliant arc between the electrodes, emitting light of a quality and character closely approximating that of sun light, the lamp operating under an efficiency of a fraction of a watt per candle power. 15 The light of the arc is augmented by the incandescence of the electrode or electrodes due to the passage of the current therethrough, and said electrodes when constituted of the materials as described, serve 20 as light emitters, ballast, heaters and ionizers.

What I claim is:—

1. An arc lamp comprising a container, electrodes therein, at least one of which is formed of a mixture of highly refractory metallic oxide and highly refractory metal which incandesces at the temperature at which platinum volatilizes and having a terminal formed of a conductor of the second class, a normally closed shunt around said terminal in series with the aforementioned electrode, and means adapted to break the shunt when the terminal is heated sufficiently to become conductive.
2. An arc lamp comprising a container, electrodes therein, at least one of which is formed of a mixture of highly refractory metallic oxide and highly refractory metal which incandesces at the temperature at which platinum volatilizes and having a terminal formed of a conductor of the second class, a normally closed shunt around said terminal in series with the aforementioned electrode, and a thermostat adapted to break the shunt when the terminal is heated sufficiently to become conductive.
3. An arc lamp comprising a container, electrodes therein, at least one of which is formed of a mixture of highly refractory metallic oxide and highly refractory metal

which incandesces at the temperature at which platinum volatilizes and having a terminal formed of a conductor of the second class, a normally closed shunt around said terminal in series with the aforementioned electrode, and a thermostat adapted to move one of said electrodes away from the other and break the shunt when the terminal is heated sufficiently to become conductive.

4. An arc lamp comprising a container, rod-like electrodes therein, at least one of which is formed of highly refractory metallic oxide and highly refractory metal which incandesces at the temperature at which platinum volatilizes and having a terminal formed of a conductor of the second class, circuit connections for said electrodes, one of which connections includes a thermostat adapted to separate the electrodes to proper arcing distance, and a separable shunt around the terminal in series with the aforementioned electrode, which is broken by the separating movement of the electrodes.

5. An arc lamp comprising a container, electrodes therein, at least one of which is formed of a mixture of thoria and powdered tungsten, and having a ball-shaped terminal of a second-class conductor, a normally closed shunt around said terminal in series with said electrodes, and a thermostat adapted to separate said electrodes and break the shunt.

6. An arc lamp comprising a base, conductors embedded in said base, rod-like electrodes carried by said conductors, at least one of which is composed of a highly refractory oxide having finely-divided metal uniformly distributed therethrough, a conductive terminal on said electrode, circuit connections for said electrodes including a normally closed shunt around said terminal in series with said electrode, and a thermostat adapted to separate said electrodes.

7. An arc lamp, comprising a container, electrodes therein having terminal portions formed of conductors of the second class, a normally closed shunt around said terminal portions, separable contacts in the shunt circuit, and means including a thermostat adapted to separate the contacts in the shunt when the terminal portions of the electrodes are electrically heated sufficiently to become conductive.

8. An arc lamp, comprising a container, separated electrodes therein having terminal portions formed of conductors of the second class, a shunt around said terminal portions normally closed when cold, separable contacts in the shunt circuit, and means including a thermostat adapted to separate the contacts in said shunt when current passes between said electrodes.

In testimony whereof I affix my signature.
JOHN ALLEN HEANY.

Certificate of Correction.

Patent No. 1,617,635.

Granted February 15, 1927, to

JOHN ALLEN HEANY.

It is hereby certified that error appears in the printed specification of the above-numbered patent requiring correction as follows: Page 1, line 17, for the word "through" read *throughout*, and line 69, for the misspelled word "zinconium" read *zirconium*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of June, A. D. 1927.

[SEAL.]

M. J. MOORE,
Acting Commissioner of Patents.