Aug. 17, 1926. 1,596,747

C. F. LORENZ

ARC INCANDESCENT LAMP WITH SPECIAL ELECTRODES

Filed June 28, 1923

FIG. 1

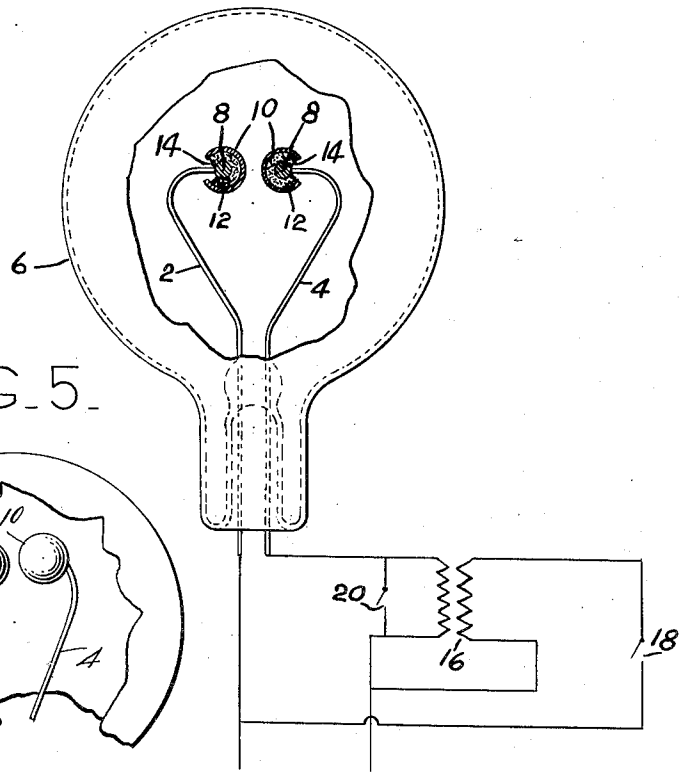


FIG. 5.

FIG. 2.

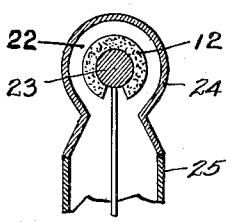


FIG. 3.

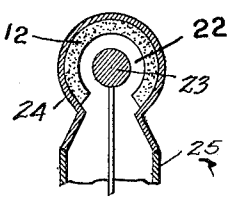
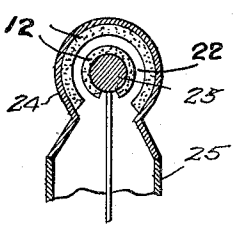


FIG. 4.



INVENTOR
CHARLES F. LORENZ
BY
ATTORNEY

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UNITED STATES PATENT OFFICE.

CHARLES FREDERICK LORENZ, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA.

ARC INCANDESCENT LAMP WITH SPECIAL ELECTRODES.

Application filed June 28, 1923. Serial No. 648,187.

This invention pertains to electric lamps and more particularly to electric lamps of the arc type enclosed in an inert atmosphere.

The invention in some of its aspects, relates to the invention described and claimed in my copending application Serial No. 624,915 filed March 14, 1923 entitled Luminous electrode discharge lamp and assigned to the Westinghouse Lamp Company.

It is necessary in the operation of arc lamps that a ballast resistance be provided in the circuit to stabilize the arc and prevent the current from becoming excessively high. This is due to the characteristic of the arc by which the resistance therein decreases as the current increases. Heretofore, it has been the usual practice to place the resistance outside of the lamp or at least at a point somewhat remote from the electrodes. A large amount of energy is lost however, in such arrangement of the ballast resistance which decreases the efficiency of the arc lamp.

It is an object of the invention to combine a ballast resistance with the electrodes in such a manner that the heat generated by the resistance may be conserved and applied to a useful and novel purpose.

A further object is to reduce to a minimum the blackening of the bulb of the lamp from volatilization of the metallic electrode thereby increasing the life of the lamp and its illuminating efficiency.

Other objects will become apparent from the description, claims and drawing in which:

Fig. 1 is a view of one embodiment of the invention, partly in section, showing a starting circuit; and,

Figs. 2, 3 and 4 are modified forms of electrodes.

Fig. 5 is a fragmentary perspective view of the lamp shown in Fig. 1.

I provide a plurality of composite electrodes having an outer shell, an inner concentric conducting body and a high refractory material having certain resistance characteristics between the shell and the body. This material acts as a ballast resistance in series with the arc and owing to its position, the heat generated in it is conserved, that is the heat is used to help maintain the temperature of the radiating body. Since the voltage drop through the ballast resistance is not lost but is utilized in heating the electrodes, it is obvious that the arc may be operated at a lower current than a similar lamp in which the heat generated in the ballast resistance is not conserved, thus resulting in a substantial increase in efficiency in the operation of the lamp. In arc lamps as hitherto constructed, it has been necessary to operate the arc at a very high temperatue in order to obtain a good efficiency due to the loss through the ballast resistance. With the present construction, an efficiency equal to arc lamps as previously constructed, may be obtained and the arc operated at a considerably lower temperature. It is evident, therefore, that at the same efficiency there will be considerably less volatilization of the electrode material and consequently, a much less deposit thereof on the envelope. Moreover the greater part of all matter volatilized within the outer shell of the electrode will be trapped therein and prevented from blackening the glass bulb.

In a copending application Serial No. 648,186 filed June 28, 1923, entitled Incandescent electric lamp and assigned to the Westinghouse Lamp Company, I have described a light giving body similar in some respects to the single electrodes of the present application and a conducting tube adapted to reduce the blackening of the bulb from volatilized material. In the present case I may reduce blackening of the bulb by volatilization of the electrode material and the ballast resistance material by preventing communication between the ballast resistance and the interior of the electrode with the envelope, for instance, by extending the outer shell of the electrode in tubular form into the neck of the lamp.

To the terminals of suitable leads 2 and 4, sealed within the bulb 6 in any suitable manner, I connect bodies 8 of suitable material, such as tungsten, and position these bodies 8 within shells 10 of like or similar material. Between the body 8 and the shell 10 is a refractory mass 12 which supports the shell 10 from the metallic body 8 and which has a resistance characteristic sufficient to act in place of the usual ballast resistance and is adapted to conserve the heat generated by the passage of current therethrough. The material 12, in addition to functioning as a ballast resistance, may serve as an adapting resistance to make possible operation of the arc from any standard voltage circuit and

should be highly refractory for heating to incandescence. For this purpose, I find a mixture of agglomerate of tungsten powder with thoria, boron, or silicon nitride is suitable, but other material such as granular carbon or carbide having the necessary qualifications may be substituted.

This refractory resistance mass 12 may be agglomerated in any suitable manner and tightly or loosely compacted between the electrodes as desired. This may be done by packing the dry powder in place under suitable pressure. To avoid loss of the material 12, in case it be loosely packed between the electrodes, the surface 14 thereof, exposed between the edges of the shells 10 and leads 2 and 4, may be hardened or coated with suitable material having the same or a greater resistance characteristic to act as a seal.

The type of lamp shown is adapted for operation upon either a D. C. or A. C. source of sufficient potential but as a high E. M. F. is required to start the arc across the gap between the electrodes, I may provide a transformer 16 in series with the lamp. A switch 18 is closed until the high E. M. F. induced in the secondary winding of the transformer starts the arc, as is commonly understood, whereupon it may be opened and a switch 20 closed to short circuit the secondary of the transformer and the operation of the lamp continued directly on the line voltage. The current will be maintained at a definite amperage by the ballast resistance 12 in series therewith and the arc thereby rendered stable. The heat generated in the resistance 12 instead of being wasted as is the case in the usual arc lamp construction, is conducted to the electrode 12 and utilized for the production of light, thus enabling the arc to operate at a lower amperage than if the heat of the ballast resistance was not so utilized.

In Figs. 2, 3 and 4 the electrodes are shown as concentric with one another, similar to those disclosed in my copending application Serial No. 624,915 and have a gaseous space 22 between them. In Fig. 2 the ballast resistance 12 is disposed on the exterior of the inner electrode 23 and the arc takes place directly between the surface of the ballast resistance and the inner surface of the electrode 24. The arc serves to heat the electrode 24 to incandescence and the heat generated in the ballast resistance and in the arc is substantially all transmitted to the electrode 24 for the production of a concentrated light source.

The ballast resistance 12 and the interior of the electrode 24 are enclosed by the tubular extension 25 which may extend to the stem of the lamp or into the neck thereof and thus prevent the deposition of material vaporized from the ballast resistance or from the interior of the electrode 24 on the surface of the bulb.

In Fig. 3 the ballast resistance is shown on the interior of the electrode 24 and in Fig. 4 it is shown on both the electrodes 22 and on the interior of the electrode 24 so that the arc takes place directly between the opposed faces of the ballast resistance. The electrodes in this modification may be considered as composed of a material capable of serving as a ballast resistance for the arc and the metal shell 24 merely as a light radiating body and support for the electrode material.

The lamp described may be evacuated or filled with a gas inert with respect to the electrodes under any desirable pressure and while I have illustrated a certain form which the invention may take, it will be apparent that many modifications may be made within the spirit and scope of the appended claims.

What is claimed is:

1. In an electric lamp an electrode comprising an inner body, an outer shell concentric therewith and forming the active face of the electrode and a resistor therebetween.

2. In an electric lamp, an electrode comprising an inner metallic body, an outer metallic body substantially surrounding said inner body and forming the active surface of the electrode and a fractory material therebetween.

3. In an electric arc lamp, an electrode comprising an inner metallic body, an outer metallic shell substantially concentric therewith and forming the active surface of the electrode and a refractory resistance material therebetween.

4. An electric lamp having a plurality of electrodes at least one of which comprises an inner body, an outer shell concentric therewith forming the active surface of the electrode and a resistance material therebetween.

5. An electric arc lamp having a plurality of electrodes at least one of which comprises an inner metallic body, an outer spherical metallic body substantially surrounding said inner body and a refractory material therebetween.

6. An electric lamp having a plurality of electrodes at least one of which comprises an inner metallic body, an outer metallic shell substantially concentric therewith and a ballast resistance therebetween.

7. In an electric arc lamp, a composite electrode having inner and outer concentric conducting bodies and a substantial body of refractory high resistance material therebetween to stabilize the arc.

8. An electric arc lamp, having a plurality of electrodes one of which at least comprises, an inner conductor, an outer conductor and a ballast resistance therebetween.

9. An electric arc lamp having a plurality

of electrodes at least one of which comprises inner and outer conducting elements and a refractory material therebetween having sufficient resistance to stabilize the arc.

10. An electric arc lamp having a plurality of electrodes one of which comprises a conducting element, a second conducting element adjacent thereto and a resistance material spacing said elements apart and serving to stabilize the arc.

11. An electric arc lamp having a plurality of electrodes one of which at least comprises an inner body, an outer shell concentric therewith and a material serving as ballast resistance positioned between said body and shell.

In testimony whereof, I have hereunto subscribed my name this 26th day of June 1923.

CHARLES FREDERICK LORENZ.