June 11, 1935. M. VOLMER 2,004,680

OPEN ELECTRIC ARC LAMP FOR THE GENERATION OF ULTRA VOILET RADIATIONS

Filed June 24, 1933

Fig. 1.

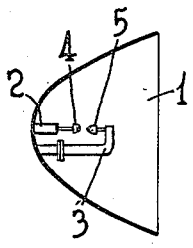


Fig. 2.

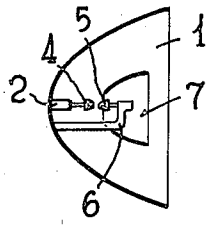


Fig. 6.

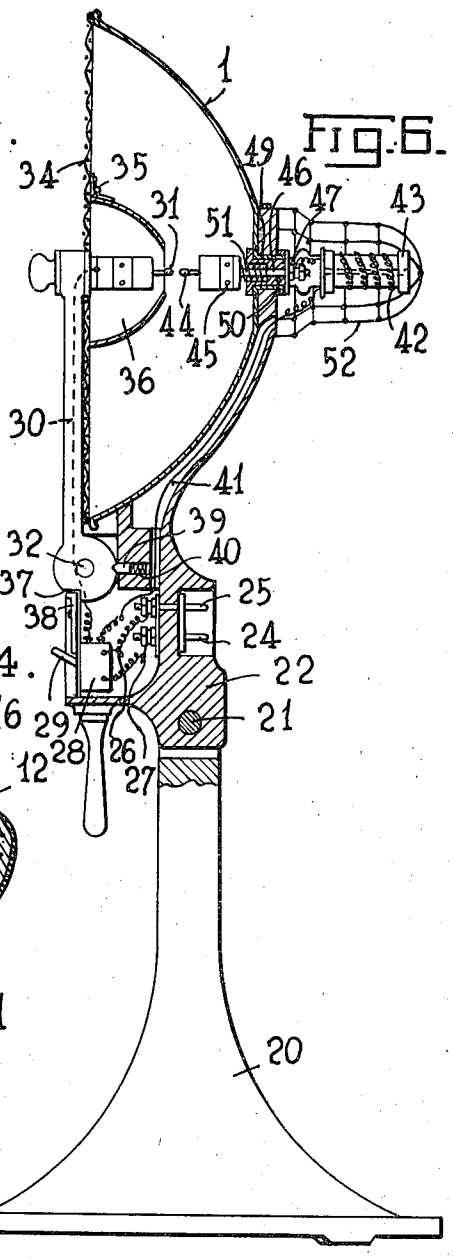


Fig. 3.

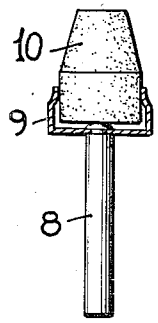
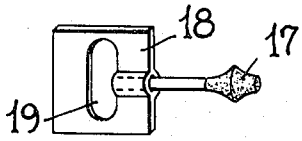


Fig. 4.

Fig. 5.



Inventor

Max Volmer,

By Carl A. Hellmann,

Attorney

Patented June 11, 1935

2,004,680

UNITED STATES PATENT OFFICE

2,004,680

OPEN ELECTRIC ARC-LAMP FOR THE GENERATION OF ULTRA-VIOLET RADIATIONS

Max Volmer, Neubabelsberg-Steinstucken, Germany

Application June 24, 1933, Serial No. 677,454
In Germany January 21, 1932

10 Claims. (Cl. 176—51)

For many purposes a radiation with a large content of ultra-violet rays, as can practically be produced only by electric arcs of the various kinds, is requisite. There are known arcs burning in hermetically sealed vessels, as well as arcs burning in the open air. The hermetically closed lamps depend upon the use of mercury and the alloys thereof which as regards private residences is precarious in view of the risk of fracture of the vessels. Open arc-lamps do not suffer from that drawback and are, moreover, cheaper, but nevertheless they have heretofore not been employed as radiators of ultra-violet rays except to a very limited extent.

A particularly favorable design of an arc-lamp for domestic use comprises according to my invention such short electrodes—about 1 cm. or even less in length—that they and their holders can be housed in the interior of the hollow mirror. As a protection from electric shocks which are to be feared if the operator comes in contact with any one of the current-carrying parts of the lamp, the hollow mirror is provided with a grating at its front. When this grating is being opened as is necessary to permit the insertion of fresh electrodes, there is simultaneously therewith the further supply of the current automatically interrupted.

For the purpose of ignition one of the electrodes is fastened in such a manner that it is axially shiftable which may be effected, for instance, by pressing a finger against it, whereas a spring compressed thereby moves that electrode back into its former position when it is released. An abutment member determines the position of rest of that electrode. It is also possible to make the grating itself elastic so that the electrode fastened to the grating in the middle thereof can be moved into the ignition position by a direct finger pressure. The short electrodes, selected for practical reasons, will in general burn only a short time, but a lamp provided with such electrodes can nevertheless be used for relatively long times of radiation if the electrodes consist of a non-oxidizing or only slowly oxidizing substance, such, for instance, as metal oxids, nitrids, carbids and silicates, which, if desired, may also be mixed with one another, the individual substances and their proportions being then chosen according to the emission of ultra-violet rays in the arc. Substances particularly suitable for the purpose in view are zirconium, magnesium, aluminium, and iron. In many cases the conductivity of these substances is sufficiently great only at relatively high temperatures.

There are, thus, requisite for the electrodes, contact members which are stiff, as well as capable of standing high temperatures. This result is obtained, according to this invention, by firmly connecting the electrodes at the rear with a pin (which may be a hollow pin) consisting of a metal capable of standing the high temperatures as for instance a pin of iron, nickel, or chromo-nickel, and constituting the contact member of the electrode. The metal pin may either carry a small cap which encompasses the rear end of the electrode, or may be inserted into a cavity provided for the reception of the pin in said electrode end. For the final fastening of the pin a cementing substance likewise capable of standing the high temperature and possessing the requisite conductivity at the service temperature is applied to the connecting place. The cementing substance may consist of the same material as the electrodes, if desired with a binding addition, such as water glass or the like. At any rate, it must be capable of yielding so as to prevent severe stresses resulting from the differential expansion of the electrode mass and the contact pin.

In order to permit initiating the arc without any trouble it is generally requisite to combine the electrodes with materials that conduct the electric current also in cold state. A particularly suitable material is carbon which either is applied in any known manner to the electrodes in the form of a thin coating by the thermic decomposition of carbon compounds, or which forms, in the electrodes, axial cores extending from the free end to the metal pin. It is of special importance that the layer of carbon on the free end of the electrode be thicker than at its other portions so that after the ignition the arc can burn between said thicker ends of the carbon layer a few seconds in order to heat the electrode material prior to the complete combustion of the carbon.

The invention is illustrated diagrammatically and by way of example on the accompanying drawing on which Figure 1 is an axial section through an open arc-lamp designed according to this invention. Figure 2 is a similar view showing a modification. Figure 3 is chiefly a side-view, partly in section, of an electrode and the members holding it, this figure being drawn to a greatly enlarged scale relatively to Figs. 1 and 2. Figure 4 is a similar representation showing a modification of Fig. 3 likewise drawn to a greatly enlarged scale. Fig. 5 is a perspective representation of a few details which will be dealt with

fully hereinafter, and Fig. 6 is a vertical section through a complete lamp with certain additional members also fully described hereinafter.

Referring to Figs. 1 and 2, 1 denotes the hollow mirror, 2 and 3 denote the electrode holders and 4 and 5 the electrodes of the same. Fig. 2 is distinguished from Fig. 1 by the added reflector 7. The electrode holder 3 (Fig. 1) is turnable, the electrode holder 6 (Fig. 2), however, is not because it carries also the reflector 7.

In Fig. 3 the members holding the electrode 10 comprise a metal pin 8 and a cap 9 which consists of the same metal as the electrode. In Fig. 4 the metal pin 11 which holds the electrode 12 engages with its end a recess in the bottom face of the electrode and is in contact with carbon 13 filling that recess and forming a core which extends axially through the electrode and terminates at its free end where it is in conductive connection with a layer 15 of carbon covering the free surface of the electrode. The top of this layer is thicker, as shown at 16. The electrode 12 is firmly connected with the metal pin 11 by a body 14 of a cement which is likewise covered with the carbon coating 15.

In order to prevent the transmission of the heat to the electrode holders from becoming too great, the contact pin (8 Fig. 3; 11, Fig. 4) is fastened at the end counter to the electrode in a metal body having a small sectional area and a relatively large surface. Such a body may be formed simply by a small piece of sheet-iron which establishes the connection with the holder arm. The amount of heat transmitted to this arm is very small because the main part thereof is transmitted from the sheet-iron to the air and is radiated. An example of such an arrangement is shown in Fig. 5 in which 17 is the electrode, the holder of which is attached to the small piece 18 of sheet-iron which is provided with a recess 19.

In Fig. 6 which shows a complete lamp with certain additional members, there is arranged in the large reflector 1 a small reflector 36 and both are covered with a common protective grating 34. The small reflector is attached to said grating by means of a hinge 35, and the circuit will be interrupted when the grating is turned downwardly on the pin 32. On this pin is located the vertical arm 33 to which the grating is affixed. In the centre of the small reflector is the electrode 31 which is conductively connected with one end of a wire 30, the other end of which is connected with the switch 28 that can be operated also manually by a lever 29.

In the hub of the arm 33 is a recess 37 which is engaged by the upper end of a vertical bolt 38, the lower end of which contacts with said lever 29 when this is in that position in which the current is switched on. When the grating is turned downwardly, the bolt will be shifted downwardly and will turn the lever 29 whereby the circuit will be broken. When the grating is in its proper vertical position, it is locked by a small pin 39, is subjected to the pressure of a helical compressive spring 40 and engages with its free end a small recess in the hub of the arm 33, as shown. The pin 39 gives way when the arm 33 is compulsorily turned downwardly together with the grating, and the current will then be interrupted, as described.

From the switch 28 runs a wire 41 across a series resistance 42 surrounding the insulating body 43 to the electrode 44 which is located opposite the electrode 31. The series resistance is enclosed in a protective basket 52. The electrode 44 is connected by means of an intermediate piece 45 with a pin 46 to which is attached an abutment member 47. 49 denotes an insulating sleeve and 50 a guide sleeve for the pin 46. 51 is a helical compressive spring inserted between said sleeve 50 and the intermediate piece 45 and which prevents the electrodes from being damaged in case the electrode 31 should be pushed strongly against the electrode 44 when the arm 33 with the grating, the small reflector and the electrode 31 are turned somewhat violently into vertical, operative position.

All the above-described parts are attached to an arm 22 connected with a base or foot 20 by means of a bolt 21 upon which the entire upper mechanism can be turned. 24 and 25 denote the terminals leading to the conductors 27 and 26, for connecting the lamp with the source of current.

I claim:

1. A non-oxidizable electrode for an open arc lamp, comprising a portion made of a mixture of a highly refractory oxid and another oxid which copiously produces ultra-violet rays at the temperature of the arc, a highly refractory metallic rod, one end of said rod terminating within the said portion and the other end projecting freely out therefrom and a coating of conductive material on the said portion, establishing conductive connection with the said metallic rod.

2. A non-oxidizable electrode for an open arc lamp, comprising a portion made of a mixture of zirconium oxid and iron oxid, a highly refractory metallic rod, one end of said rod terminating within the said portion and the other end projecting freely out therefrom and a coating of conductive material on the said portion, establishing conductive connection with the said metallic rod.

3. An open electric arc lamp for generating ultra violet radiation, said lamp comprising a reflector, two electrodes each having a portion made of non-oxidizable material, consisting of a highly refractory oxid and another oxid which copiously produces ultra violet rays at the temperature of the arc, said electrodes being arranged in axial alinement within the reflector, each electrode having a highly refractory metallic rod rigidly secured to one end thereof terminating within said portion and serving as a current supply lead for the electrode, and a conducting coating on each electrode, providing electrical connection between the tip of the electrode and the said metallic rod.

4. An open electric arc lamp for generating ultra violet radiation, said lamp comprising a reflector, two electrodes each having a portion made of non-oxidizable material, consisting of a highly refractory oxid and another oxid which copiously produces ultra violet rays at the temperature of the arc, said electrodes being arranged in axial alinement within the reflector, each electrode having a highly refractory metallic rod rigidly secured to one end thereof terminating within said portion and serving as a current supply lead for the electrode, and a conducting carbon coating on each electrode, providing electrical connection between the tip of the electrode and the said metallic rod.

5. A non-oxidizable electrode for an open arc lamp comprising a portion made of a mixture of refractory oxids, at least one of which copiously emits ultra violet rays at the temperature of the arc, a core of conductive material in said portion,

a refractory metal rod having one end embedded in said portion and extending freely out from said portion at its other end and a conductive coating at the outer end of the core of conductive material and in electrical contact therewith.

6. A non-oxidizable electrode for an open arc lamp comprising a portion made of a mixture of refractory oxids, at least one of which copiously emits ultra violet rays at the temperature of the arc, a core of conductive carbon in said portion, a refractory metal rod having one end embedded in said portion and in contact with the core and extending freely out from said portion at its other end and a conductive coating at the outer end of the core and in electrical contact therewith.

7. A non-oxidizable electrode for an open arc lamp comprising a portion made of a mixture of refractory oxids, at least one of which copiously emits ultra violet rays at the temperature of the arc, a core of conductive carbon in said portion, a refractory metal rod having one end embedded in said portion and in contact with the core and extending freely out from said portion at its other end and a coating of carbon at the outer end of the core and in electrical contact therewith.

8. A non-oxidizable electrode for an open arc lamp comprising a portion made of a mixture of refractory oxids, at least one of which copiously emits ultra violet rays at the temperature of the arc, a core of conductive carbon in said portion, a refractory metal rod having one end embedded in said portion and in contact with the core and extending freely out from said portion at its other end and a coating of carbon on the portion and in electrical contact with the core, said carbon coating being of increased thickness adjacent the core.

9. A non-oxidizable electrode for an open arc lamp comprising a portion made of a mixture of refractory oxids, at least one of which copiously emits ultra violet rays at the temperature of the arc, a core of conductive carbon in said portion, a refractory metal rod having one end embedded in said portion and in contact with the core, said rod extending freely out from said portion at its other end, a mass of inert material forming a support for the inner end of the portion and surrounding an intermediate portion of the rod, and a conductive coating surrounding the portion and the support and in electrical contact with the protruding end of the rod.

10. A non-oxidizable electrode for an open arc lamp comprising a portion made of a mixture of refractory oxids, at least one of which copiously emits ultra violet rays at the temperature of the arc, a core of conductive carbon in said portion, a refractory metal rod made of a nickel-chromium alloy and having one end embedded in said portion and in contact with the core, said rod extending freely out from said portion at its other end, a mass of inert material forming a support for the inner end of the portion and surrounding an intermediate portion of the rod, and a conductive coating surrounding the portion and the support and in electrical contact with the protruding end of the rod.

MAX VOLMER.