H. I. WOOD.

VAPOR ELECTRIC LAMP.

APPLICATION FILED FEB. 14, 1903.

1,006,333. Patented Oct. 17, 1911.

Fig. 2.

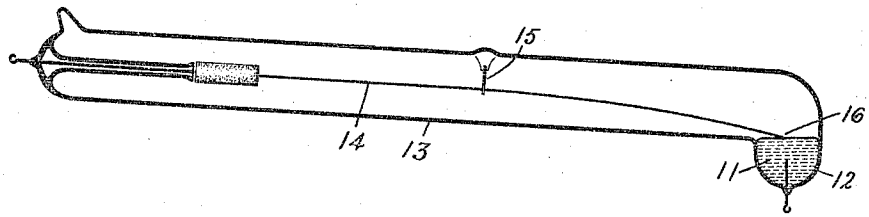


Fig. 1.

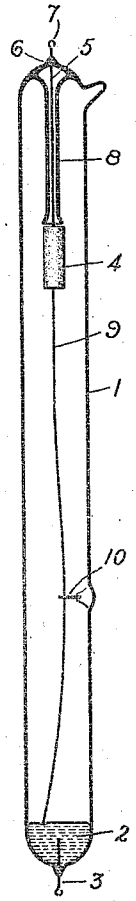
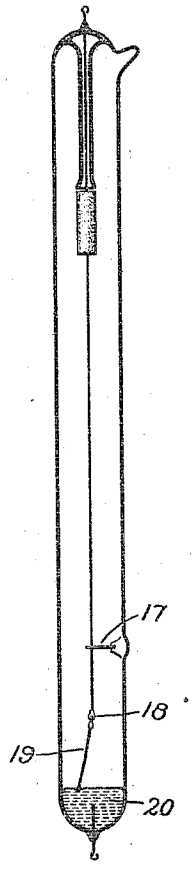


Fig. 3.



Witnesses.

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UNITED STATES PATENT OFFICE.

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VAPOR ELECTRIC LAMP.

1,006,333. Specification of Letters Patent. Patented Oct. 17, 1911.

Application filed February 14, 1903. Serial No. 143,329.

To all whom it may concern:

Be it known that I, HOWARD I. WOOD, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Vapor Electric Lamps, of which the following is a specification.

My invention relates to that type of electric lamp in which electricity passes through a vapor contained within an exhausted envelop, and comprises certain means for starting a lamp of the character mentioned, the novel features of which I have pointed out with particularity in the claims appended hereto.

For a detailed description of my invention, reference is to be had to the following specification taken in connection with the accompanying drawings in which—

Figures 1, 2 and 3 represent by way of illustration some of the various forms which my invention may assume in practice.

As shown in Fig. 1 the envelop of the lamp is a straight glass tube 1, of suitable length, though it is to be understood that the size, shape, length, or other dimensions of the envelop may be widely varied without departing from my invention. At the bottom of the tube is contained a body of mercury 2 forming one of the electrodes with which connection is made by the leading-in conductor 3. The upper terminal of the lamp consists of a cylindrical stick of artificial graphite 4 or if desired this may be replaced by a cylindrical shell of steel or by other suitable material. This electrode 4 is supported by a wire 5 of some length, the upper end of which serves as a leading-in conductor, passing through the walls of the tube as indicated at 6, the outer end forming the lamp terminal 7. The conductor 5 is surrounded by a glass tube 8 depending from the upper wall of the glass envelop 1 and extending down to the electrode 4. This tube 8 prevents the electric discharge within the envelop 1 from extending above the electrode 4, and also serves as a mechanical means for preventing lateral displacement of the electrode.

Electrically connected to the electrode 4 and extending down therefrom is a filament 9 of carbon or other suitable material, which passes very loosely through a guide or supporting ring or loop 10. The lower end of this filament 9 dips lightly into the surface of the mercury electrode 2.

When now, the lamp, after having been very highly exhausted, is connected with a source of electric current, current flows through the lamp by the circuit afforded by the electrodes 2 and 4 which are electrically connected by the filament 9. The contact between the lower end of the filament and the mercury 2 however is such that the current, in passing between the filament and the mercury, flows through a comparatively small volume of mercury. By reason of this flow of current ionized mercury vapor is produced, the effect of which is to cause an electric arc or discharge to flash into existence between the main electrodes 2 and 4, completely filling the tube. The first incipient arc or discharge takes place between the mercury and the lower end of the filament 9, and extends instantly upward along the filament until it reaches the electrode 4, the action however being too rapid for the eye to follow. The arc or electric discharge which then fills the tube affords a path for the current, of much better conductivity than that presented by the filament 9, so that current practically ceases to flow in the filament, as evidenced by the fact that the filament remains black. It is possible that minute arcs are generated between the mercury 2 and the portion of the filament 9 engaged thereby, though according to my present understanding of the action it seems more probable that the initial disengagement of ionized vapor is due to heat developed by the current flowing through the relatively high resistance contact between the lower end of the filament and the mercury.

The localized heating at the end of the filament probably produces enough vapor from the mercury terminal to cause the filament and terminal to be separated by a film of mercury vapor, so that conductive vapor is emitted from the mercury terminal and the device is started.

Instead of arranging the lamp in the vertical position shown in Fig. 1, it may, if desired, be arranged so as to run in a position slightly inclined from the horizontal as indicated in Fig. 2 in which the lamp is of substantially the same construction as shown in Fig. 1 except that the lower electrode consists of a body of mercury 11 contained in a

slight downward extension 12 of the tube 13. The filament 14 is supported by a guide or guides such as 15 so that its free end rests lightly on or projects slightly into the surface of the mercury 11 as indicated at 16. The operation of the lamp is substantially that described in connection with Fig. 1.

In both the arrangements shown in Figs. 1 and 2 the filament makes a sort of yielding engagement with the surface of the mercury so that slight changes in the level of the mercury caused by more or less condensed mercury accumulating in portions of the tube during operation do not interfere with the operative starting relation between the filament and the mercury electrode. Instead of providing a yielding engagement between the filament and the mercury electrode, afforded by the yielding filament, as indicated in Figs. 1 and 2, I may use an arrangement such as shown in Fig. 3 in which the filament is held in a definite central position by means of encircling guides such as 17. The lower end of the filament however is jointed as at 18, the end 19 thus jointed being thus given a certain amount of play to accommodate itself to variations in the level of the mercury electrode 20.

The starting means which I have above described will operate when alternating current is supplied to the lamp though I find that the operation is much more satisfactory with direct current, since with alternating current a disintegration of the lower end of the filament takes place, thus blackening the walls of the tube, which action does not take place to the slightest extent with direct current.

I am thus enabled to produce a lamp which is started on the voltage and character of current on which it runs, by merely closing the switch.

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

1. The combination of an envelop, electrodes therefor, one at least of which is of vaporizable material, and normally conducting means electrically connecting said electrodes permanently and operating when traversed by current to disengage ionized or conducting vapor from said vaporizable electrode.

2. The combination of an envelop, electrodes therefor, and an electric conductor permanently connecting said electrodes and making light contact with one of said electrodes.

3. The combination of an exhausted envelop, a vaporizable electrode, a non-vaporizable electrode, and an electric conductor normally extending between the electrodes and making a relatively high resistance contact with the vaporizable electrode.

4. The combination of an exhausted envelop, a vaporizable electrode therefor, a cooperating electrode, and means for initiating a discharge between said electrodes consisting of a filament lightly touching the vaporizable electrode and extending into electrical connection with the coöperating electrode.

5. In a vapor electric lamp, the combination of a light-transmitting envelop, two cooperating electrodes one at least of which is of vaporizable material, means for impressing upon said electrodes an electro-motive force, and means for initiating a discharge between said electrodes by first causing current of normal voltage to pass, between said electrodes, through a constructed area of the exposed surface of said vaporizable electrode.

6. In a vapor electric apparatus, the combination of an envelop of approximately uniform cross section, an electrode in one end of the envelop. and a coöperating electrode located in the envelop far enough from the other end to form a condensing chamber of considerable length.

7. In a vapor electric device, the combination of an envelop or container, electrodes therefor, and a starting device in normal contact with one of said electrodes, said contact being of poor conductivity whereby, on the passage of current, a center of emission of conductive vapor is formed.

8. In a vapor electric apparatus, the combination of a positive electrode, a liquid negative electrode, an arc starting device in poor contact with the liquid electrode, and means for supplying current through said starting device whereby the poor contact between said device and said liquid electrode results in the production of an arc from the liquid electrode.

9. In a vapor electric device, a positive electrode, a liquid negative electrode, and an arc starting device normally in poor contact with said liquid electrode, whereby upon the passage of current through said device, a local vaporization takes place at said liquid electrode.

10. The combination of an envelop, electrodes therefor. and a starting device consisting of an electric conductor normally making a light contact with one of said electrodes.

11. The combination of an exhausted envelop, a vaporizable electrode therefor, a coöperating electrode, and a filament which normally lightly touches the vaporizable electrode.

12. The combination of an exhausted envelop, electrodes therefor, and a filament in the space between said electrodes and making contact with the surface only of one of said electrodes.

13. In a vapor electric apparatus, the combination of a container, electrodes one at least of which is liquid. a terminal nor-

mally in poor contact with the liquid electrode, and means for supplying current through said terminal, whereby the said current will vaporize the liquid at the point of contact and thereby start an arc.

14. The combination of an exhausted envelop, a vaporizable electrode therein, and means for starting an arc at said electrode, said means including a filament making light surface contact with said electrode.

15. The combination of an exhausted envelop, a vaporizable electrode therein, and means for starting an arc at said electrode, said means including a slender conductor in circuit with said electrode but making poor contact therewith at the surface thereof.

16. In a vapor-tube, the combination with separated terminals between which a conducting vapor exists when the tube is in operation, but a non-conducting and highly resistant interval exists when the lamp has not been started, a stationary auxiliary terminal in normal contact with one of the terminals of the lamp, said contact being of low conductance whereby, on the passage of current, a center of emission of conductive vapor is formed.

17. In a mercury-lamp, the combination with the electrodes thereof for normally operating the lamp, of an auxiliary electrode in contact with one of the electrodes of the lamp before starting, and means whereby the current conducted before starting automatically separates or renders defective the contact of said auxiliary electrode and lamp-electrode, while both remain stationary, whereby the lamp is started.

18. In a vapor-tube, the combination with the positive and negative terminals, of a stationary auxiliary terminal normally in contact with a lamp-terminal, one of said terminals being liquid, means for supplying a current through said auxiliary terminal, and means whereby the passage of said current will vaporize the liquid terminal and thereby break said contact.

19. In a vapor-tube, the combination with a positive and a liquid negative terminal, of a stationary solid auxiliary terminal normally in contact with the liquid terminal, means for supplying a current through said auxiliary terminal, means whereby the passage of said current will vaporize the liquid terminal and thereby break said contact.

In witness whereof, I have hereunto set my hand this 12th day of February, 1903.

HOWARD I. WOOD.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.