P. C. HEWITT.

GAS OR VAPOR ELECTRIC LAMP.

APPLICATION FILED APR. 9, 1904.

1,030,302.

Patented June 25, 1912.

3 SHEETS—SHEET 1.

Fig. 3

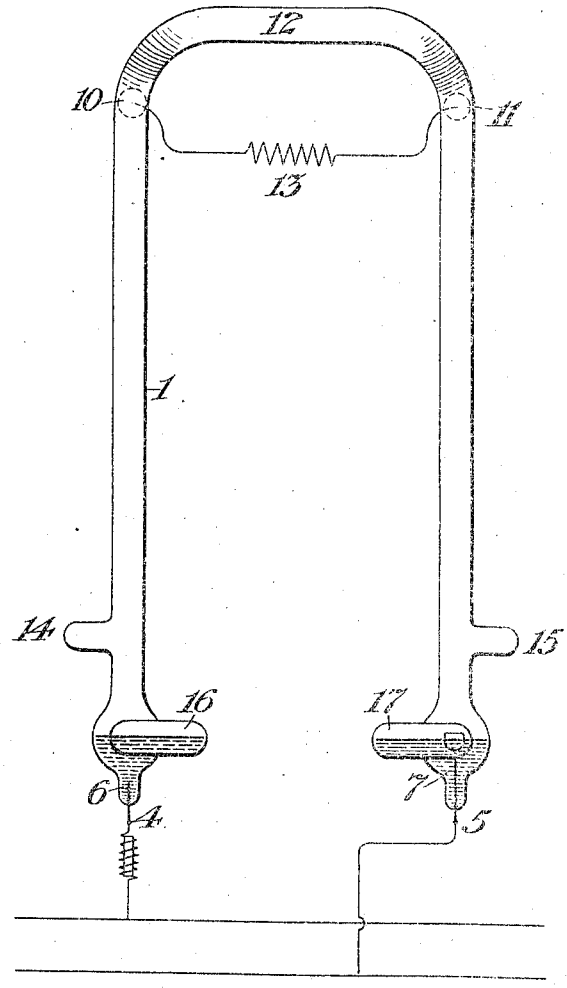
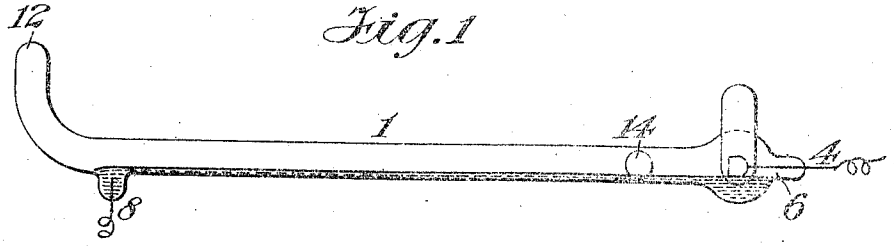


Fig. 1



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3 SHEETS—SHEET 2.

Fig. 2

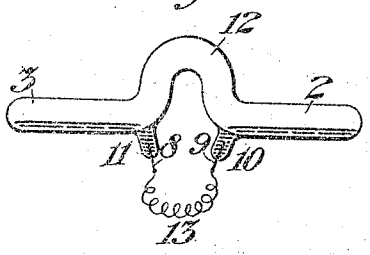


Fig. 4

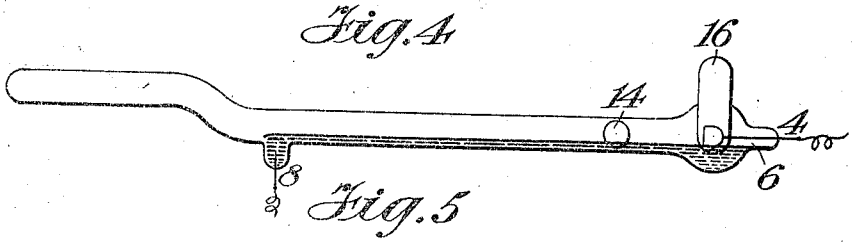
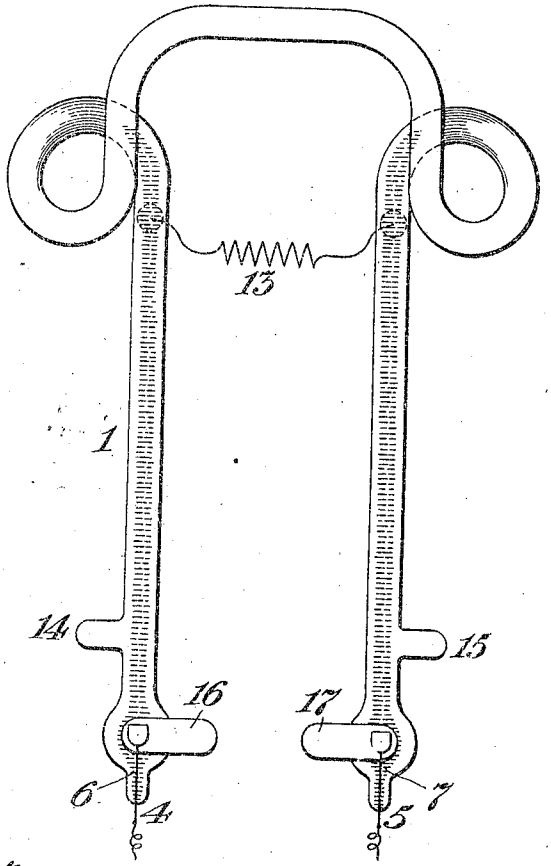


Fig. 5



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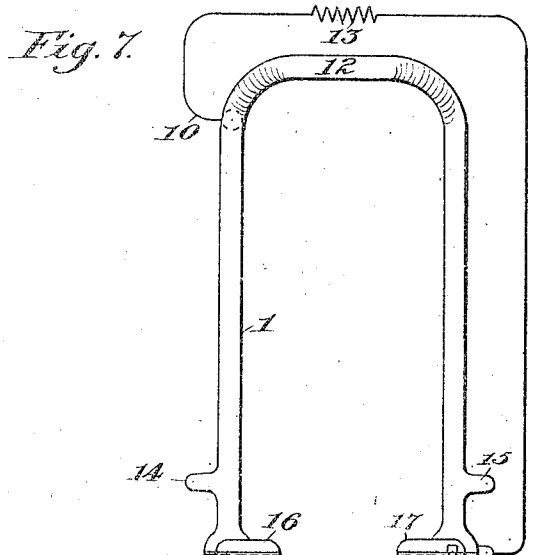
3 SHEETS—SHEET 3.

Fig. 7.



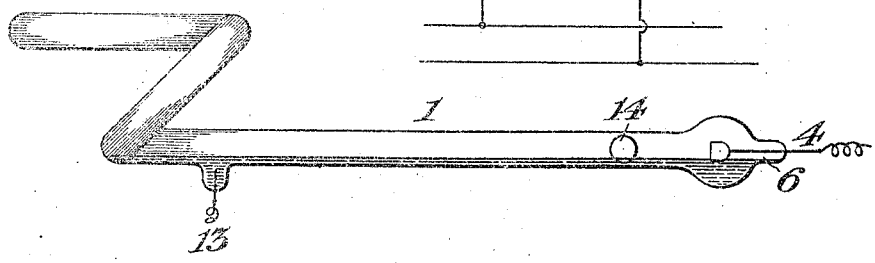


Fig. 6.

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UNITED STATES PATENT OFFICE.

PETER COOPER HEWITT, OF NEW YORK, N. Y., ASSIGNOR TO COOPER HEWITT ELECTRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

GAS OR VAPOR ELECTRIC LAMP.

1,030,302. Specification of Letters Patent. Patented June 25, 1912.

Application filed April 9, 1904. Serial No. 202,286.

To all whom it may concern:

Be it known that I, PETER COOPER HEWITT, a citizen of the United States, and resident of New York, county of New York, State of New York, have invented certain new and useful Improvements in Gas or Vapor Electric Lamps, of which the following is a specification.

The present invention relates to starting devices for gas or vapor electric apparatus, and for convenience the description and drawings will be made to apply to gas or vapor lamps, although it will be understood that the same principles may be applied to gas or vapor electric apparatus employed for any purpose whatsoever. Still further for convenience, the invention will be described as applied to a U-shaped lamp, although the shape of the apparatus need not be confined to those illustrated and described.

In general the invention belongs to that class of vapor electric devices wherein a current may be initially passed through the apparatus by way of a continuous conductor, without regard to the vapor column through which the current is ultimately to pass. This has already been accomplished by providing a path of mercury from one electrode to the other inside the apparatus and, after the current is established through such path, the apparatus has been tilted so as to interrupt the mercury path and cause a flow of current through the vapor, such flow of current being rendered easily possible by reason of the fact that the negative electrode resistance is locally broken down inside the apparatus, after which the flow of current easily takes place to the negative electrode without the application of any abnormal potential to the terminals. In the present instance, the conducting path consists partly of mercury or other conducting fluid, and partly of a resistance conductor. The resistance conductor is introduced between the terminals of two liquid columns, the said columns and the resistance forming a continuous conducting path from one electrode to the other. Indeed, the so-called liquid columns may extend a very short distance from the electrodes, only just far enough so that a rupture can be made inside the apparatus between the terminals of the resistance conductor and the liquid at the electrodes. The rupture of this conducting path takes place when the apparatus is tilted so as to permit the mercury or other conducting liquid to flow away from the terminals of the resistance conductors where they enter the apparatus. It is found that the current, on the rupture of the original circuit as described, will find its way through the mercury vapor and establish a flow of current through the apparatus. This can all be accomplished upon a voltage similar to that which is employed in the actual operation of the apparatus, without the application of any abnormal initial voltage for starting it. The tilting of the apparatus may be accomplished by automatic means or manually as preferred, or as circumstances may dictate. Looked at from another point of view, the resistance conductor described above may be regarded as a shunt-circuit for the original vapor resistance between the ends of the mercury columns or between the electrodes themselves. This vapor resistance, as is well-known, is initially very high at the negative side of the circuit, and requires to be broken down before current will pass through the vapor. Such breaking down occurs when the rupture takes place between the resistance on the negative side and the mercury column on the same side. The resistance being once broken down the tendency for the current to flow through the vapor path is at once made operative and as the mercury column recedes from the terminals of the resistance conductor, the flow continues through the entire vapor path between the electrodes.

My invention will be understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of a mercury vapor lamp in the position which it occupies before starting; Fig. 2 is an end view of the same looking toward the right of Fig. 1; Fig. 3 is an elevation of the lamp in its position of operation; and Figs. 4, 5, 6 and 7 illustrate modifications.

Referring to the drawings, 1 is a U-shaped tube containing columns of mercury, 2 and 3. These columns of mercury in the inactive position of the lamp extend from lead-wires, 4 and 5, respectively, which extend into the respective electrode pockets, 6 and 7, to lead-wires, 8 and 9, extending into pockets, 10 and 11, near the yoke end of the tube 1. At this end, the tube is bent up-

ward as shown at 12, so that the mercury does not pass over the bend, but terminates in the pockets 10 and 11. Between the lead-wires 8 and 9 is mounted a resistance, 13, which in the position illustrated in Figs. 1 and 2, constitutes a conducting continuation of the mercury columns 2 and 3.

The lead-wires 4 and 5 are suitably connected with the poles of an electric source, and when the circuit of the said source is closed, a complete circuit is made through the apparatus, say from the lead-wire 4 to the mercury column 2, the lead-wire 8, the resistance 13, the lead-wire 9, the mercury column 3, and the lead-wire 5.

The apparatus may be provided with trunnions, 14 and 15, on which it can be turned from a substantially horizontal position to an inclined or vertical position, and suitable means may be provided tending to hold it in the position selected for operation.

The circuit having been established through the apparatus by way of the path already described, the apparatus can now be tilted on its trunnions, say, into the position illustrated in Fig. 3, whereby it will happen that a rupture will be made between the mercury columns 2 and 3 and the lead-wires 8 and 9, respectively. The flow of current will now pass through the entire vapor column including the bend 12, from the electrode in the pocket 6 to the electrode in the pocket 7, or vice versa, as the case may be, depending upon which is the positive and which is the negative electrode, so that the entire vapor column will be traversed by current and will become luminous in the case of a lamp or will pass current for other purposes in the case of a vapor converter.

I generally provide supplemental pockets, 16 and 17, near the lower end of the apparatus to receive the excess of mercury which might otherwise be present at the positive and negative electrodes in the operative position of the lamp. The lead-wires 8 and 9 also terminate in pockets, as already described.

With the arrangement described, one of the electrodes may be of solid material and the other of volatilizable material, in which case the solid electrode would be so arranged as to project beyond the mercury in one or the other of the pockets 6 and 7.

Fig. 4 shows a partial view of a modified form of apparatus, the especial feature being that of providing a longer vapor path between the ends of the mercury columns 2 and 3. The bend 12 is here prolonged in the general direction of the legs of the U-shaped tube, whereby the vapor column is lengthened as stated. Instead of forming two liquid columns extending from the electrodes, one terminal of the resistance conductor may be connected directly with one of the electrodes and the rupture of the circuit may take place between the other terminal of the resistance conductor and a column extending from the opposite electrode. This arrangement is illustrated in Fig. 7.

In Figs. 5 and 6 the yoke ends of the U-shaped tube is twisted in the manner indicated in the drawing so that the legs of the U return upon themselves, thereby causing the bend to occupy a higher position when the apparatus is horizontal than the rest of the tube, and limiting the distance to which the columns 2 and 3 extend in a direction away from the electrodes. The resistance 13 is connected as before between the remote ends of the mercury columns, and the action is generally the same as that already described.

In all the illustrated forms of the apparatus, it will be seen that an initial path from electrode to electrode is provided through a resistance conductor. For convenience the resistance is here shown as mainly exterior to the container. Owing to the presence of this initial path for the current, the negative electrode resistance which is usually present in apparatus of this class is broken down as soon as the current is turned on in the circuit including the apparatus.

In a divisional application, filed June 29, 1905, Serial Number 267,526, claims are made upon certain methods of operation disclosed herein.

I claim as my invention:

1. In a vacuum electric apparatus, a suitable container, electrodes therein, a vapor path between the electrodes, the said path being short circuited during the starting operation for a certain distance by liquid conductors at each electrode, and a solid conductor shunting the remainder of the vapor path.

2. In a vacuum vapor electric apparatus, a suitable container, electrodes therein, a vapor path between the electrodes, the said path being short circuited during the starting operation for a certain distance by liquid conductors at each electrode, and a solid conductor shunting the remainder of the vapor path containing a resistance.

3. A vacuum vapor electric apparatus comprising a container, electrodes therein, and an inclosed vapor in combination with a conductor shunting a portion only of said vapor, connections between the terminals of said shunt circuit and the electrodes, and means whereby the container can be moved to rupture the said connection.

4. A vacuum vapor electric apparatus comprising a container, electrodes therein, and an inclosed vapor in combination with a conductor shunting a portion only of the said vapor, the said shunt circuit containing a resistance, connections between the termi-

nals of said shunt circuit and the electrodes, and means whereby the container can be moved to rupture the said connections.

5. A vacuum vapor electric apparatus comprising a pivoted container, electrodes therein, and an inclosed vapor, in combination with a conductor shunting a portion only of the said vapor, the said shunt circuit containing a resistance, connections between the terminals of said shunt circuit and the electrodes, and means for rupturing the connections.

6. A vacuum vapor electric apparatus comprising a pivoted container, suitable electrodes therein, and an inclosed vapor, a shunt circuit traversing a portion of the vapor path between the electrodes but mainly exterior to the container, the said shunt circuit including a resistance.

7. In a vacuum vapor electric apparatus comprising a pivoted container, suitable electrodes therein, and an inclosed vapor, a shunt circuit traversing a portion of the vapor path between the electrodes but mainly exterior to the container, the said shunt circuit including a resistance, and means whereby the shunt circuit may be made and ruptured.

8. A gas or vapor electric apparatus comprising a container, main electrodes therein, and an inclosed gas or vapor, in combination with a shunt circuit bridging the path between the electrodes, such shunt circuit consisting in part of a conducting liquid inside the container, and in part of a circuit containing a resistance.

9. A gas or vapor electric apparatus comprising a container, main electrodes therein, and an inclosed gas or vapor, in combination with a shunt circuit bridging the path between the electrodes, such shunt circuit consisting in part of a conducting liquid inside the container, and in part of an external circuit containing a resistance.

10. In a gas or vapor electric apparatus, a container consisting of a tube having a portion thereof raised above the level of the remaining portion when the apparatus is in a horizontal position, and means whereby the container may be shifted.

11. In a gas or vapor electric apparatus, a container, and a conducting liquid inside the container, the container having a portion which is raised above the remaining portions when the apparatus is in a horizontal position, and means whereby the position of the container may be shifted.

12. In a gas or vapor apparatus, a U-shaped container, the yoke of which is raised above the level of the remaining portion when the apparatus is in a horizontal position.

13. In a gas or vapor apparatus, a U-shaped container, the yoke of which is raised above the level of the remaining portion when the apparatus is in a horizontal position, conducting circuits extending through each leg of the U-shaped container, and means for interrupting the said conducting circuit and starting a circuit through the vapor between the ends of the container.

14. In a gas or vapor electric apparatus, a U-shaped container having pockets at or near the ends of the legs of the U, conducting connections between the said pockets, a resistance between the pockets at adjacent ends near the yoke, the yoke itself being raised above the remaining portions of the U and circuit connections leading to the pockets at the opposite ends of the legs.

15. In a gas or vapor electric apparatus, a container having electrodes at or near its ends, a conducting liquid in contact with each electrode, the container being so shaped that the said conducting liquid occupies a considerable portion of the container at each end, means whereby the conducting liquids in the opposite end portions are prevented from coming into contact within the container, and means for shifting the container to interrupt the continuity of the circuit in each end.

16. In a gas or vapor electric apparatus, a container having electrodes at or near its ends, a conducting liquid in contact with each electrode, the container being so shaped that the said conducting liquids occupy a considerable portion of the container at each end when the container is in a horizontal position, means whereby the conducting liquids in opposite end portions are prevented from coming into contact within the container, and means for shifting the container, in combination with a circuit connecting the conducting liquids.

17. In a gas or vapor electric apparatus, a container having electrodes at or near its ends, a conducting liquid in contact with each electrode, the container being so shaped that the said conducting liquids occupy a considerable portion of the container at each end when the container is in a horizontal position, means whereby the conducting liquids in opposite end portions are prevented from coming into contact within the container, and means for shifting the container in combination with a circuit connecting the conducting liquids, the said circuit containing a resistance.

18. In a gas or vapor electric apparatus, a suitable container, electrodes at or near the terminals thereof, mercury connected with each electrode and adapted to form a column when the apparatus is in a horizontal position, a circuit connecting the mercury columns, and means for shifting the container.

19. In a gas or vapor electric apparatus, a suitable container, electrodes at or near the terminals thereof, mercury connected

with each electrode and adapted to form a column when the apparatus is in a horizontal position, a circuit connecting the mercury columns, such circuit containing a resistance, and means for shifting the container.

20. In a gas or vapor electric apparatus, a suitable container, electrodes at or near the terminals thereof, mercury connected with each electrode and adapted to form a column when the apparatus is in a horizontal position, a circuit connecting the mercury columns, such circuit containing a resistance, means for rupturing the said circuit, and means for shifting the container.

21. In a gas or vapor electric apparatus, a suitable container, electrodes at or near the terminals thereof, mercury connected with each electrode and adapted to form a column when the apparatus is in a horizontal position, a circuit connecting the mercury columns, such circuit containing a resistance, means for rupturing the said circuit within the container, and means for shifting the container.

22. In a gas or vapor electric apparatus, a container, electrodes therein, means for causing the container to assume various positions with relation to the horizontal, a conducting liquid connected with each electrode and adapted to form a column when the apparatus is in a horizontal position, and a pocket near one or both of the electrodes for receiving the excess of conducting liquid when the apparatus is tilted toward or to a vertical position.

23. A vapor device comprising a movable container, main electrodes and a vapor in said container, a solid conductor having terminals within the container and liquid conductors adapted to connect the terminals of the said solid conductor temporarily to the respective electrodes, the said liquid conductors being formed of electrode material.

24. A vapor device comprising a movable container, a vapor and electrodes therein, liquid conductors, each extending from each electrode temporarily to a predetermined point within the container and connections between the said points by means of a solid conductor external to the device the said liquid conductors being formed of electrode material.

25. A vapor device comprising a movable container, a vapor, and electrodes therein, liquid conductors, each extending from each electrode temporarily to a predetermined point within the container and connections between the said points by means of a solid conductor the said liquid conductors being formed of electrode material.

26. A vapor device comprising a U-shaped movable container, electrodes near the ends of the U, liquid conducting extensions temporarily extending from the said electrodes to points nearer the loop of the U, a solid conductor connecting the said points, and pivots or trunnions on the device for permitting the same to be tilted.

Signed at New York, in the county of New York, and State of New York, this 1st day of April A. D. 1904.

PETER COOPER HEWITT.

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WM. H. CAPEL.