

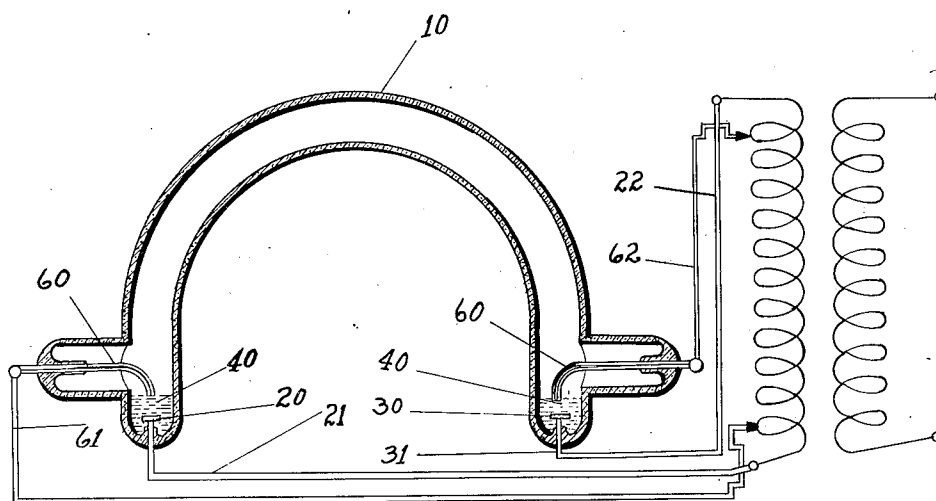
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VAPOR ARC APPARATUS

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VAPOR ARC APPARATUS

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The object of my invention is the provision of an improved starting and operating system for alternating current mercury and other metallic vapor arc lamps, which will be inexpensive both in production and use, and which does not involve the provision of complicated or expensive equipment outside the arc. In general my invention contemplates the production of mechanism which will start a preliminary or small arc, which will then fill the tube cavity with a sufficient atmosphere of ionized vapor to permit the jumping of the main arc. Inasmuch as mercury is largely used in lighting arcs, I will refer to it as a typical ionizable substance.

One embodiment of the invention has been illustrated diagrammatically in the accompanying drawing, but it is to be expressly understood that said drawing is for purposes of illustration only and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

The drawing shows diagrammatically a mercury vapor arc lamp having a vessel of glass, quartz or other suitable substance and embodying a pair of wells each containing a quantity of mercury which when vaporized will permit an arc to strike in the lamp. In lamps of this character, one problem is to get the arc started and unless some starting device is provided it is necessary to tilt the lamp so as to form for an instant a continuous body of mercury extending between two electrodes. Another problem involved with alternating current arcs is to maintain the continuous operation of the arc as the current and voltage reverse. In my improved lamp, I preferably provide auxiliary electrodes which as shown in the drawing are bimetallic members of arcuate or curved form, the outer ends of which are adapted to dip down into the pools of mercury. These bimetallic members may be like any of such devices commonly used in thermostatic controls, in which the shape of a member is adapted to change with a change in temperature, and are adapted to straighten out when heated so that the tips thereof rise out of the mercury. When this takes place, at one or

the other of the main electrodes, a small arc is started between the mercury and the tip, and this arc will quickly fill the lamp with ionized vapor so as to permit the main arc to strike. When the current and voltage reverse, a like operation takes place at the other main electrode, as will be described more fully hereinafter, and thus the main arc is maintained in substantially continuous operation.

For a better understanding of this operation, reference is now directed to the schematic arrangement shown in the drawing. I have shown a lamp, having a vessel 10 of glass or quartz and arc terminals 20 and 30, each located in wells of mercury 40. Bimetallic elements 60 are provided with appropriate terminal connections in each arm of the tube, and dip into the respective pools of mercury. The lead lines 21 and 31, respectively, of the electrodes 20 and 30 are connected to the terminals of a suitable source of alternating current such as a transformer secondary 22. The lead lines 61 and 62 are connected to taps in this transformer secondary, located, respectively, adjacent the terminals to which the leads 21 and 31 are attached, so that between the bimetallic elements 60 there will be a difference in potential very nearly as great as that between the electrodes 20 and 30. This, as explained, will facilitate the operation of the arc, and minimize current leakage between the electrodes and the bimetallic elements closely associated therewith.

In operation, assuming that current is supplied to the transformer secondary 22 and that the upper end of said secondary is the positive end, the electrode 30 will be positive and the auxiliary electrode 60 adjacent thereto will also be positive but at a less potential than the electrode 30 and hence negative with respect thereto. The electrode 20 will be negative and the auxiliary electrode 60 adjacent thereto will also be negative but at a less potential than the electrode 20 and hence positive with respect thereto. Current will accordingly flow from the positive end of the transformer secondary through the lead 31, electrode 30, mercury 40, auxiliary electrode 100

60 and lead 62 back to the transformer secondary, and at the same time will flow from the negative end of the transformer through lead 61, auxiliary electrode 60, mercury 40, electrode 20 and lead 21 back to the transformer secondary. Accordingly both of the auxiliary electrodes will be heated and will straighten out, breaking contact with the mercury. Since the electrode 20 and its pool of mercury are negative with respect to the adjacent electrode 60, a small arc will strike as contact is thus broken between the electrode 60 and the surface of the mercury pool, thus filling the vessel 10 with ionized vapor. Such an arc, however, will not strike at the other end of said vessel since the electrode 30 and its pool of mercury are positive with respect to the adjacent electrode 60. As soon as the vapor in the vessel 10 ionizes, the main arc will strike from the electrode 30 and its associated pool of mercury and auxiliary electrode 60, all of which are at positive potential, to the electrode 20 and its associated pool of mercury and auxiliary electrode 60, all of which are at negative potential.

The potential applied to the various elements now reverses due to a reversal of current in the transformer primary. The tendency now is for the main arc to stop since the current must now travel through the ionized vapor in a reverse direction. In case the voltage across the electrodes 20 and 30 is not sufficient to cause a reversal of the direction of current through the lamp, the arc is sustained normally by the striking of a small auxiliary arc between the auxiliary electrode 60 and the electrode 30, which has now become negative with respect to said auxiliary electrode, and this auxiliary arc maintains the vessel full of ionized vapor until the potential on the electrode 20 builds up sufficiently to again establish the main arc.

These operations take place in succession and result in the maintenance of a substantially continuous arc in the vessel. Since the direction of current through the vessel is continually reversing, there is no tendency for the mercury to accumulate in one or the other of the wells at opposite ends of the lamp. Moreover, once the arc has been started and the bimetallic electrodes 60 have been withdrawn from the mercury pools, they are in the path of the main arc and are kept hot and out of contact with said pools. Hence it will be apparent that the continuous operation is not dependent on the use of bimetallic members and that any suitable type of auxiliary electrode can be substituted therefor provided that the arc is started initially in some suitable way as by tilting the lamp. Moreover, it will be apparent that the lamp may be energized from any suitable source or sources of alternating current other than the specific connections to a transformer secondary shown in the drawing, and that the

connections of each main and its auxiliary electrode may be reversed, so that the greater voltage is applied to the auxiliary electrodes.

It will be understood that various modifications may be made in vapor arc lamps, embodying my invention, without departing from the spirit thereof, and the invention is not restricted to the specific form of lamp shown, nor limited as to the substance used for vaporizing.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a vapor arc apparatus, a vessel, arc electrodes and quantities of vaporizable material in association with each thereof, a bimetallic member contacting with each of said quantities of vaporizable material, a transformer secondary and electrical connections between the terminals of such secondary and said electrodes, and electrical connections between said bimetallic elements and taps adjacent said secondary terminals so as to supply current between said bimetallic elements and the adjacent arc electrodes to heat said elements, said elements when heated by current being drawn away from the surfaces of said vaporizable materials thereby starting preliminary arcs to fill the lamp space with ionized vapor.

2. In a vapor arc apparatus, a vessel, arc electrodes and quantities of vaporizable material in association with each thereof, a bimetallic member contacting with each of said quantities of vaporizable material, a transformer secondary and electrical connections between the terminals of such secondary and said electrodes, and electrical connections between said bimetallic elements and taps adjacent said secondary terminals so as to supply current between said bimetallic elements and the adjacent arc electrodes to heat said elements, said elements when heated by current being drawn away from the surfaces of said vaporizable materials thereby starting preliminary arcs to fill the lamp space with ionized vapor, said elements and electrodes being connected to said secondary at points such that there is a greater difference in potential between said bimetallic elements than between each bimetallic element and the adjacent arc electrode.

3. In alternating current vapor arc apparatus, the combination of a vessel, a pair of arc electrodes and a quantity of vaporizable material in said vessel, a pair of auxiliary electrodes one adjacent each of said arc electrodes, means for supplying alternating current to said arc electrodes, and means for supplying current to said auxiliary electrodes.

4. In alternating current vapor arc apparatus, the combination of a vessel, a pair of arc electrodes and a quantity of vaporizable material therein, a pair of auxiliary electrodes one adjacent each of said arc electrodes,

means for impressing an alternating potential across said arc electrodes, and means for impressing a smaller alternating potential across said auxiliary electrodes.

5 5. In alternating current vapor arc apparatus, the combination of a vessel, a pair of arc electrodes and a quantity of vaporizable material in said vessel, a pair of auxiliary electrodes one adjacent each of said arc electrodes, and means for supplying alternating
10 current to said arc electrodes and auxiliary electrodes from a common source, said auxiliary electrodes being connected to said source at points of less potential than said arc electrodes.

15 6. In alternating current vapor arc apparatus, the combination of a vessel, a pair of arc electrodes each including a quantity of vaporizable material, a pair of auxiliary electrodes one adjacent each of said arc electrodes, and means for supplying alternating
20 current to said arc electrodes and to said auxiliary electrodes, said auxiliary electrodes being connected to sources of less potential than said arc electrodes.

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