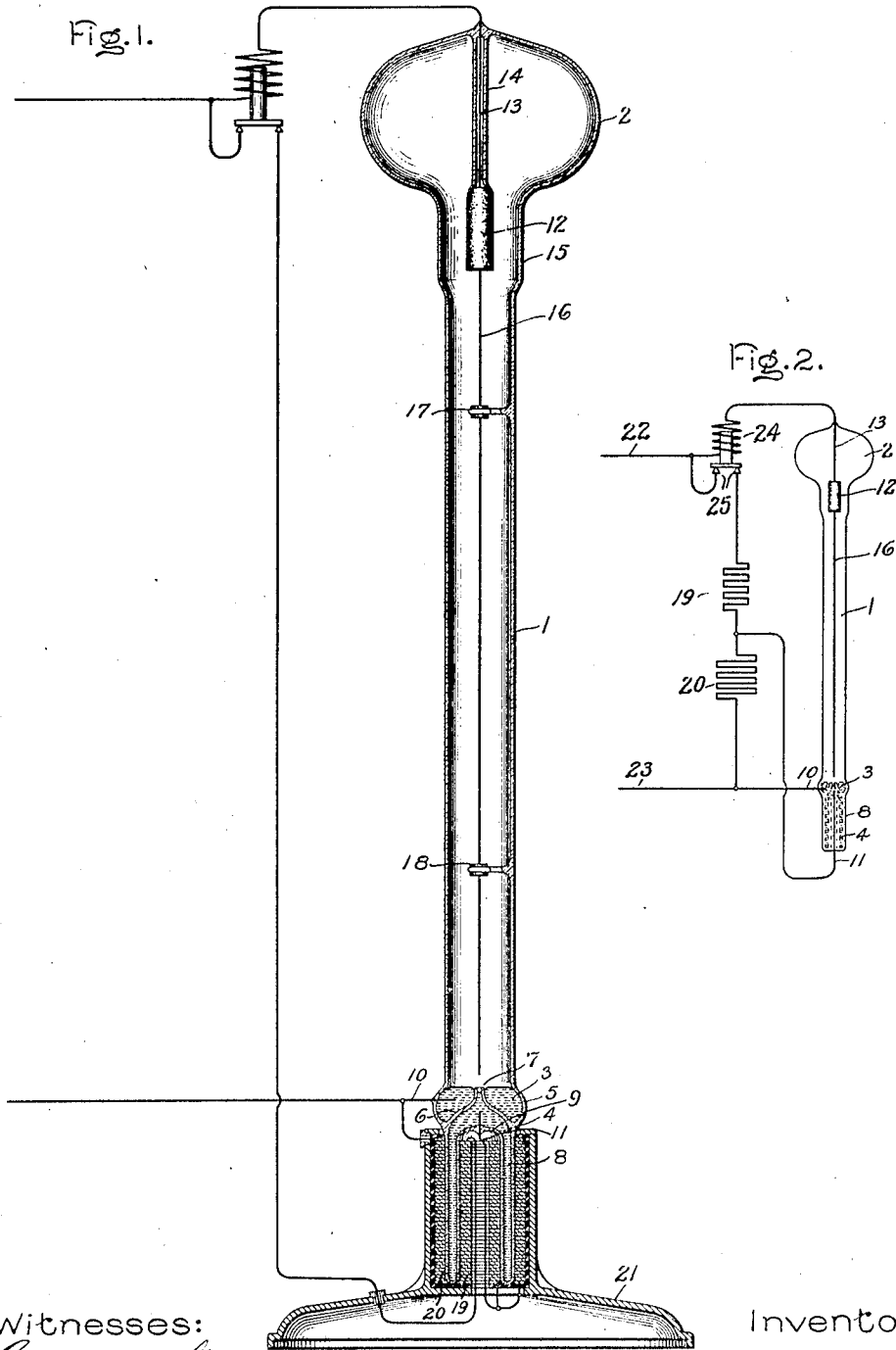


No. 887,642.

PATENTED MAY 12, 1908.

A. McL. JACKSON.
VAPOR ELECTRIC APPARATUS.

APPLICATION FILED DEC. 9, 1903. RENEWED JULY 20, 1907.



Witnesses:

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Att'y.

UNITED STATES PATENT OFFICE.

ALEXANDER McLEOD JACKSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

VAPOR ELECTRIC APPARATUS.

No. 887,642.

Specification of Letters Patent.

Patented May 12, 1908.

Application filed December 9, 1903, Serial No. 184,402. Renewed July 20, 1907. Serial No. 384,761.

To all whom it may concern:

Be it known that I, ALEXANDER McLEOD JACKSON, a subject of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Vapor Electric Apparatus, of which the following is a specification.

My invention comprises certain improvements in vapor electric apparatus in which the flow of current takes place between electrodes contained in an exhausted receptacle.

Those features of construction with which my invention is particularly concerned are useful in connection with vapor electric lamps but it is to be understood that their utility is by no means limited to this one application.

My invention comprises more especially certain improvements in the construction of the envelop and the arrangement of the electrodes therein and comprises also a novel means for starting the arc between the electrodes.

The features of novelty characteristic of my invention I have pointed out with particularity in the appended claims. The invention itself however both as to its details of construction and mode of operation will be better understood by reference to the following description taken in connection with the accompanying drawings, in which

Figure 1 represents a lamp organized in accordance with my invention and Fig. 2 a simplified diagram of circuits of the lamp.

In the drawings the envelop of the lamp consists of a tube 1 of any desired length provided at the top with a bulb 2 constituting a condensing chamber and at the bottom with two compartments containing respectively bodies of mercury 3 and 4 constituting electrodes. The body of mercury 3 is annular in form and is contained between the rounded outer portion 5 of the lower end of the tube 1 and a sort of conical diaphragm 6 integral around its lower edge with the bottom of the portion 5 and at its top or apex provided with a small tubular bore or opening 7 about on a level with the top of the mercury 3. The lower portion of the inclosing chamber for the mercury 4 consists of a tubular extension 8 having re-entrant walls 9 so arranged that the space occupied by the mer-

cury is something of the shape of an inverted cup. Of these two bodies of mercury 3 and 4 the body 3 constitutes the lower main electrode or cathode of the lamp and the body 4 a starting electrode or auxiliary anode. Leading-in conductors at 10 and 11 respectively furnish means for the flow of current between the electrodes and the external circuits of the lamp.

The upper electrode 12 of the lamp is of artificial graphite or other suitable material and is supported from the top of the bulb 2 by means of a conductor 13 loosely surrounded by a glass tube 14 extending down to and flaring over the upper end of the electrode. The electrode is so positioned that it does not lie within the condensing chamber 2 but is held within the mouth of the tube 1 where the tube opens into the condensing chamber. The tube at this point may be enlarged a trifle as at 15 so that the area between the electrode and the wall of the tube will not be too much reduced by the presence of the electrode. The enlargement 15 however is not sufficient to enable the walls of the enlargement to serve as condensing walls for the mercury vapor.

The location of the electrode 12 at the mouth of the tube 1 rather than in the condensing chamber 2 possesses numerous advantages over the location of the electrode in the condensing chamber itself. Thus because of the blast or flow of vaporous particles past the anode, there is practically no blackening of the adjacent walls of the tube. Then again the arc, not being permitted to expand into the large volume of the condensing chamber, is much more stable. This permits the tube, if desired, to be run at a lower current density without instability.

A filament 16 of carbon or other suitable material extends down through carbon-bushed guides 17 and 18 into proximity to the lower electrodes and assists the lamp to start.

The carbon-bushed guides are not of my invention but are the invention and are claimed in an application of John T. H. Dempster, Serial No. 185,771, filed December 19, 1903.

For the purpose of starting I cause an auxiliary starting arc to take place between

the two mercury electrodes 3 and 4 at the bottom of the lamp. To effect this result I provide electric heating means which causes an expansion of the body of mercury 4 and thus causes mercury to flow up through the small tube 7 and overflow into contact with the mercury 3. When this takes place the contact which is exceedingly imperfect at first allows immediate vaporization of the engaging mercury surfaces and the consequent formation of an arc. This arc, immediately upon formation, extends up the tube to the main electrode 12 and in doing so is assisted by the conductivity afforded by the filament 16. The lamp is thus started.

The heating means whereby the lamp is started may, of course, assume a variety of forms. One form however which I find convenient consists of two coils 19 and 20; one surrounding the outside of the tubular extension 8 and one located inside of the extension. These coils are held by a base or stand 21 and form a socket constituting a convenient support for the lamp.

The connections of the coils and of the lamp are indicated perhaps more clearly in Fig. 2. In this figure the supply mains for the lamp are shown at 22 and 23. The main 22 extends to the anode 12 of the lamp and the main 23 to the cathode 3. The heating coils 19 and 20, represented diagrammatically, are connected in shunt with the mains 22 and 23. The auxiliary or starting anode 4 is connected to the junction between these heating coils, though if desired it may be connected to the main 22 through a separate circuit. The present arrangement however is advantageous in that the resistance 19 performs the double function of a heating resistance and of a current-limiting resistance for the circuit of the auxiliary anode.

When current is applied to the lamp it passes at first through the heating resistances. When through the thermal action of these resistances the arc is started as above described, current flows from the main 22 through the resistance 19 to the auxiliary anode 4, thence through the auxiliary starting arc in the envelop, and to the main 23. As soon as this starting arc is formed the main arc in the tube follows and thereby causes current to flow from the main 22 through the envelop 1 to the main 23. This current energizes the magnetizing winding 24 of a cut-out and causes the circuit, both of the heating resistances 19 and 20 and the auxiliary anode, to be interrupted at the contacts 25. The lamp is then in normal operation. As the heating resistances cool and the mercury of the auxiliary anode 4 contracts, the growing depression in the tube 7 which would otherwise exist is filled with mercury vaporized

and condensed in the tube during operation. The lamp is then ready to start again when it becomes necessary.

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

1. The combination of an exhausted envelop, main electrodes therefor, a fluid auxiliary electrode, and means for initially heating said electrodes.

2. As a starting means for vapor electric apparatus, electrodes in proximity to each other, and thermal means for bringing said electrodes into contact.

3. In a vapor electric apparatus, main electrodes, an auxiliary electrode, and a current-limiting resistance in circuit with the auxiliary electrode and located in heat-transferring relation to said auxiliary electrode.

4. The combination of an exhausted envelop or tube provided with a bulb at one end, and an electrode mounted in the mouth of the tube where it opens into the bulb.

5. The combination of fluid electrodes, one surrounding the other, insulating means separating said electrodes, and automatic means for bringing the electrodes into contact.

6. The combination of insulated electrodes, one surrounding the other, and one at least of which is fluid, and automatic means for bringing the electrodes into contact.

7. The combination of main electrodes, an additional electrode, and thermally-operating means for causing an arc to start between said additional electrode and one of the main electrodes.

8. The combination of a sealed envelop consisting of a tube surmounted at one end by a bulb, a vaporizable electrode at the opposite end of the tube, and a non-vaporizable electrode located in the mouth of the tube where it opens into the bulb.

9. In an electric lamp, mercury vapor, employed as a conductor for electric currents, an electrode at the upper end of said lamp, mercury electrode at the lower end of said lamp, and an intermediate arcing electrode, an electric heater adapted to cause a contact between said mercury and intermediate arcing electrode.

10. An electric lamp consisting of a tube, mercury contained in said tube, an electrode situated above said mercury, an electric heater adapted to cause the mercury to make contact with said electrode and form an arc.

11. A lamp for producing light by means of electric energy, consisting of an inclosing chamber, mercury vapor contained therein capable of conducting currents of considerable quantity and moderate electro-motive force, a starting device consisting of mercury, an arcing electrode above said mercury, and

an electric heater, adapted to cause an arc to be formed between said mercury and arcing electrodes.

12. In an electric lamp, an arcing electrode, mercury electrode adjacent to said electrode, an electric heater adapted to cause arcs to form between said arcing electrode and mercury electrode, and a cut-out magnet in circuit with the main tube and adapted to cut out the heater and arcing circuit after the arc has been established in the main tube.

13. An electric lamp consisting of an enclosing chamber, mercury vapor contained therein capable of conducting currents of considerable quantity and moderate electro-

motive force, starting device consisting of mercury, an arcing electrode above said mercury, and an electric heater adapted to cause an arc to be formed between said mercury and arcing electrode, a cut-out magnet in circuit with the main tube and adapted to cut out the heater and arcing circuit after the arc has been established in the main tube.

In witness whereof, I have hereunto set my hand this 4th day of December, 1903.

ALEXANDER MCLEOD JACKSON.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.