

March 7, 1933.

S. S. TORRISI

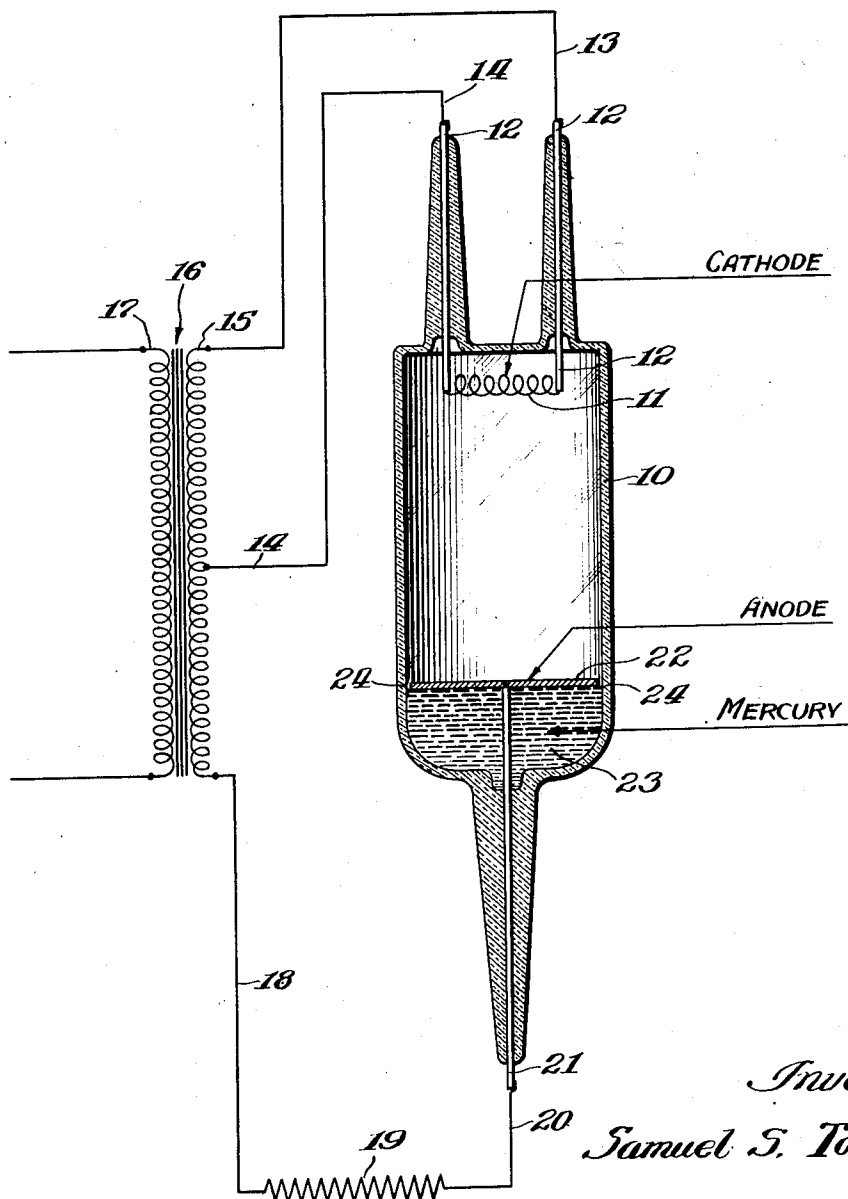
1,900,138

THERAPEUTIC LAMP

Filed July 12, 1928

2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

Fig. 2.

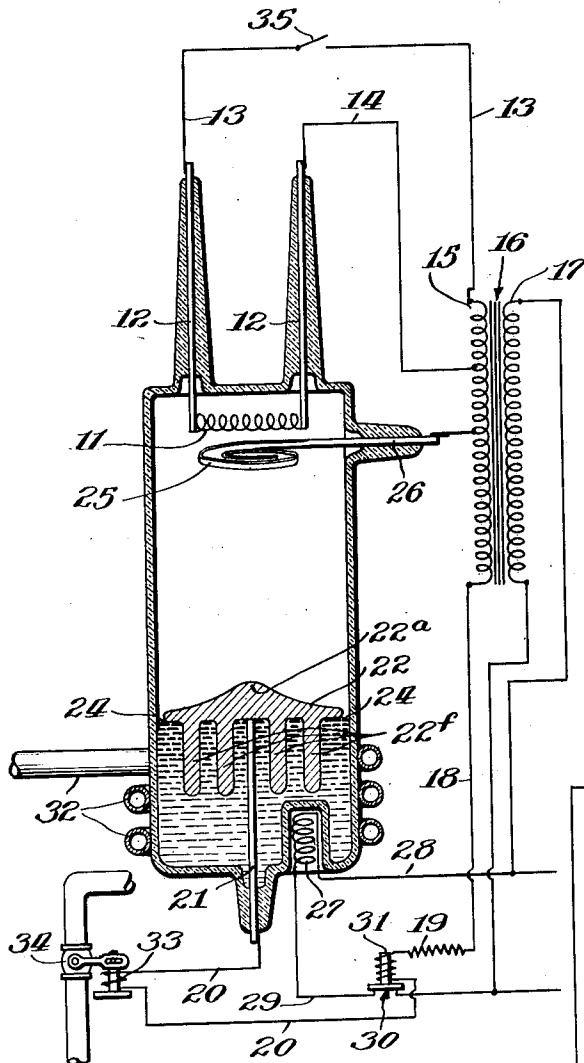
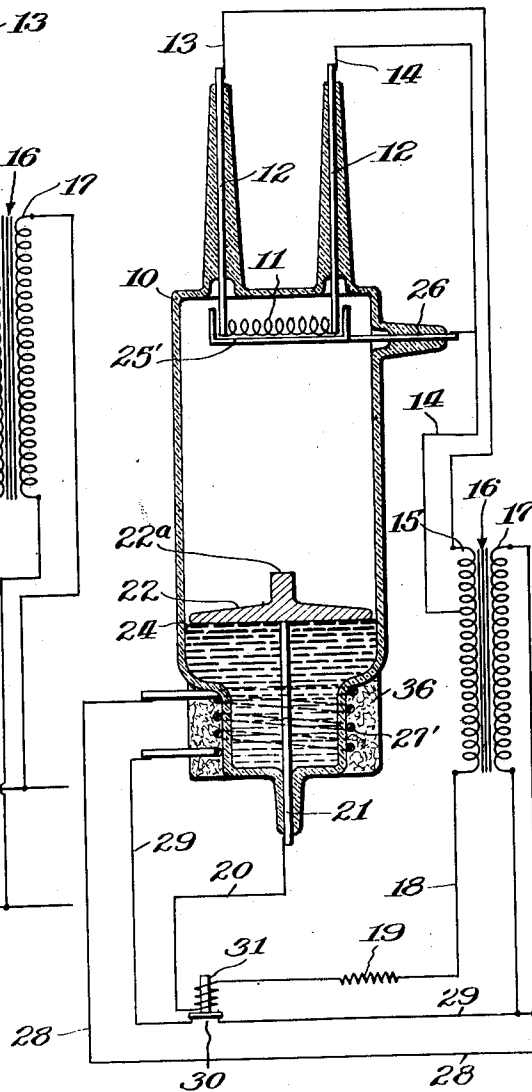


Fig. 3.



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UNITED STATES PATENT OFFICE

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THERAPEUTIC LAMP

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My invention relates to a therapeutic lamp for producing violet and ultra-violet light for medicinal purposes and it pertains more particularly to a filamentary cathode mercury

arc lamp in which mercury amalgams and/or gases such as argon, helium, neon, etc. may supplement the spectra of the mercury to produce the desired light characteristics.

An object of the invention is to provide a mercury arc quartz lamp with a filamentary cathode as distinguished from the "hot spot" or mercury cathode lamp which has heretofore been used. When the mercury forms one electrode of the arc in such a lamp, its action is uncertain and erratic. The temperature drops with each reversal of current, there is constant danger that the arc will fail due to this current drop, the hot spot travels on the surface of the mercury, causing an uneven light, the mercury condenses on the walls of the envelope and obstructs the light produced by the arc and complex and cumbersome means are required to establish the arc. My invention seeks to avoid these difficulties.

A further object of my invention is to provide a means for regulating the vapor pressure of mercury in a quartz lamp and to heat the mercury by heat dissipated from the anode.

A further object is to provide a novel starting means which may act as a supplementary anode in the starting operation and which thereafter acts as a supplementary cathode to take the place of and protect the filamentary cathode.

A further object is to provide a therapeutic lamp with an anode, the geometric construction of which enables it to shield the mercury (thus preventing the arc from striking the mercury and preventing the mercury from acting as a cathode), said anode always operating at a temperature below the electron emitting point, being mounted in heat exchange relation to said mercury and being designed to prevent the arc from traveling.

A further object is to add certain gases and amalgams to the mercury for the double purpose of decreasing the starting voltage and

obtaining the proper spectrum for therapeutic purposes.

A further object is to provide an improved tube structure for therapeutic lamps of this type.

Another object is to provide an improved wiring circuit for operating said lamps.

Other objects may be apparent as the detailed description of my invention proceeds.

In the accompanying drawings, which represent preferred embodiments of my invention,

Fig. 1 is a simple quartz tube with a filamentary cathode;

Fig. 2 is an embodiment provided with an auxiliary electrode, with a shaped anode and with means for regulating the temperature of the mercury in accordance with the current carried by the tube;

Fig. 3 is a modification similar to that described in Fig. 2, wherein the structure of the auxiliary electrode and the mercury heating means are slightly modified.

My invention may be generally characterized as a quartz envelope or tube containing a filamentary cathode which acts as an electron emitter to cause a unidirectional arc current to flow through an ionized vapor, and due to ionization and electron changes in the structure of these vapor atoms cause the generation of ultra-violet and light of other frequencies.

The idea may be more easily understood by referring to Fig. 1, wherein a quartz envelope 10 contains a tungsten filament 11 preferably about .025 inches in diameter and adapted to be maintained at electron emitting temperatures by a current of about 30 amperes at about two volts. The terminals of the filament 11 are connected to lead-in wires 12 which may be of tungsten if a borosilicate seal is used and which may be generally any metal which is wet by the glass and whose coefficient of expansion corresponds to that of the glass used in the seal. The lead-in wires 12 are connected by conductors 13 and 14 to secondary 15 of transformer 16 whose primary 17 is connected to power source (not shown). Conductor 13 is connected to one end of secondary 15 and con-

ductor 14 taps this secondary at a point which will give the desired filament voltage, as is well known to anyone skilled in the art. The other end of secondary 15 is connected by conductor 18 to ballast resistance 19, which is in turn connected by conductor 20 to lead-in wire 21, which is connected to and which supports anode 22. Anode 22 is in heat-exchange relation to mercury 23 and may, if desired, be provided with heat radiating fins 22f for rapidly conducting heat thereto.

The anode 22 may be an iron disc or a disc of any other metal which does not form an amalgam of mercury and which will not be deleteriously affected by the operating conditions and temperatures of the tube. The disc 22 is in thermal contact with the body of mercury 23 whereby the heat from the anode is transmitted to the mercury to increase its vapor pressure, the mercury communicating to the open space in the tube by a narrow annular opening 24 between the quartz envelope 10 and the anode 22.

It is understood, of course, that all deleterious gases are exhausted from the tube before it is finally sealed, and in this step it is well to heat both the envelope and the electrodes to drive out occluded gases. Any gases used to supplement the mercury vapor are introduced after these deleterious gases are exhausted.

If gases are completely exhausted from the tube 10 and the mercury 23 is relatively cool so that it has a low vapor pressure, the starting of the tube must be brought about by the use of high voltages, which may be produced in any conventional manner as by providing a plurality of taps on secondary 15 or by providing an independent starting circuit for the tube. In my preferred embodiment, however, I supplement the mercury by gases such as argon, helium, etc., the pressure of said gases being below 15 millimeters of mercury when the tube is cold. I also contemplate the use of mercury amalgams, such as amalgams of sodium, cadmium, tin, etc., when the particular lines of these metals are desired in the spectra.

It will be apparent that with this gas in the tube when the filament is heated to incandescence (or to electron emitting temperatures) and when a voltage is applied between the anode 22 and the cathode 11, the electrons emitted from cathode will be drawn toward the anode with such velocities that the gas or mercury vapor molecules will be ionized to form a conductive arc. The temperature lag of the hot tungsten filament is very great so that the cathode does not fall below electron emitting temperatures during the reversal of the current in each cycle. This feature is of particular importance in therapeutic mercury arc lamps where an even continuous light is desired.

There will, of course, be a slight interruption of current, i. e. rectification will not be absolute, but this does not deleteriously affect the operation of the lamp. If the anode becomes hot by positive ion bombardment or otherwise, this heat is transferred to the body of mercury 23, which acts as a stabilizer. The tube is preferably designed to have a radiating surface sufficient to maintain a proper mercury vapor pressure in the tube under normal operating conditions and I contemplate the use of heat radiating fins or geometric configurations of glass envelope which will permit proper heat radiation.

In Fig. 2 I have shown a modification of my invention in which heat regulating means are provided, an auxiliary electrode is used and the anode is shaped to centralize the light.

The auxiliary electrode 25 is here shown as a flat coil of tungsten or other refractory metal which is positioned adjacent the cathode 11 and between this electrode and the anode 22. Coil 25 is supported by and connected to a lead-in wire 26 secured in a suitable seal at the side of the tube, said lead-in wire being connected by a suitable conductor to a point on transformer secondary 15.

The body of mercury 23 is provided with an electrical heating element diagrammatically illustrated at 27, one terminal of which is connected to the power source by conductor 28 and the other terminal is connected by conductor 29, a switch 30 being connected in the last conductor. A current relay 31 connected in series with the ballast resistance 19 is adapted to open switch 30 and break the circuit to the heater when the current through the tube reaches the desired value. If desired, the ballast resistance 19 may be wound as a coil and serve as the winding for coil 31.

In order to prevent the tube from reaching excessively high temperatures, I may provide cooling coils 32 adapted to encircle the body of mercury and to pass a cooling fluid such as water in heat exchange relation thereto. The flow of cooling fluid through this coil may be regulated by a thermostatic control (not shown) dependent upon the temperature of the mercury, or it may be regulated in accordance with current conditions in the tube by a current relay 33 adapted to open a valve 34 when the current reaches a certain maximum and to close said valve when the temperature reaches a certain minimum.

The anode 22 in the modification shown in Figure 2 has a raised control portion 22a, which is preferably a surface of revolution and which may be described as an up-turned cone, tip or peak, the lateral sides of which are provided with a gradual slope. The purpose of this formation is to centralize and stabilize the arc to prevent it from traveling, thereby producing a more constant uniform light. The peak may also be cylindrical,

pointed, or of any other shape without departing from the spirit of my invention.

The operation of the device illustrated in Figure 2 is as follows:

5 When power is initially applied, the filament 11 will be heated to incandescence and during the negative cycle will emit electrons. When the filament is negatively charged, the auxiliary electrode 25 will be positive with
10 respect thereto and will therefore attract the electrons and increase their velocities to such an extent that the residual mercury vapor in the tube is ionized, thereby establishing an arc between electrodes 11 and 25. This in-
15 creases the temperature of the tube, which increases the vapor pressure of the mercury and the ionization is thereby gradually built up.

The anode 22 being at a considerably higher potential than auxiliary electrode 25 will
20 exert a strong pull on electrons emitted by cathode 11 and electrons formed during the ionization of the gas or vapor, and the arc soon "strikes" the tip 22a of this electrode and establishes smooth and continuous per-
25 formance. The auxiliary electrode 25 not only serves as an anode to initiate the action due to its proximity to the cathode 11, but it also serves to neutralize the negative space charge within the tube and it thereby in-
30 creases the effective pull of anode 22 which attracts these electrons with a force sufficient to give them a velocity sufficient to ionize the gas or vapor in the tube.

35 When the action is thus established the positive ion bombardment will heat the auxiliary electrode to such an extent that it acts as a hot cathode and an electron emitter. This protects the filamentary cathode 11, and if de-
40 sired, this cathode may be disconnected entirely from the circuit by a switch 35 while the tube is in operation. It may be more desir-
able, however, to leave the filament in the circuit to insure continuity of action.

45 The operation of relays 31 and 33 are apparent from the drawings; if the tube gets too hot and the mercury vapor pressure becomes too high, the current will be varied so as to break the circuit to the heater 27 by
50 opening switch 30. Simultaneously relay 33 will open the valve 34 and permit cooling fluid to flow through coils 32. If the tube gets too cool, the vapor pressure of the mer-
55 cury will decrease and the current will likewise be varied to such an extent that switch 31 will be closed by gravity or by a suitable spring and relay 33 will close the valve to prevent the circulation of cooling fluid.

60 In Figure 3 I have shown still another modification in which the auxiliary electrode 25' is in the form of a refractory metal grid cap surrounding the filament 11 in close
65 proximity thereto. This grid cap functions in the same manner as the auxiliary electrode of Figure 2, except that it is connected directly to conductor 14 instead of being con-

nected to a point on the transformer secondary 15. With this construction the auxiliary electrode 25' will be positive with re-
70 spect to at least a part of the cathode when the latter is negatively charged and will thereby serve to neutralize the space charged and to enable the anode to initiate ionization at a relatively low voltage.

In this modification I have shown an electric heater 27' surrounding the body of the
75 mercury and thermally insulated from the surrounding atmosphere by asbestos or other suitable insulation 36. This heater is connected to the power source by conductors 28 and 29, the latter of which includes a
80 switch 30 actuated by a relay 31 as described in Figure 2.

While I have shown the preferred modification of my invention, it is evident that
85 many modifications and alterations may be made without departing therefrom, and I do not limit myself to the details given except as defined by the appended claims. I claim:

1. A therapeutic lamp comprising a quartz
89 envelope, a filamentary cathode mounted in said envelope, a body of mercury in said envelope, an anode between said cathode and
90 said mercury, said anode substantially covering the mercury to prevent an arc from striking it and causing it to act as a cathode. 95

2. A therapeutic lamp comprising a quartz
envelope, a filamentary cathode in said envelope, an ionizable gas and an anode com-
prising a disc with an up-turned central por-
100 tion for stabilizing and centralizing the arc during the operation of the lamp.

3. A therapeutic lamp comprising a closed
envelope, a vaporizable medium therein, means for heating said vaporizable medium
105 to increase the vapor pressure and means for cooling said medium to decrease the vapor pressure, and means to actuate both of said first named means in accordance with the
current flowing through said lamp.

4. In combination, a quartz envelope, a
110 filamentary cathode, lead-in wires connected to said cathode and sealed in said envelope, an auxiliary electrode in close proximity to
115 said cathode, a lead-in wire and seal for electrically connecting and supporting said auxiliary electrode, an anode spaced from said cathode, a lead-in wire and seal for electrically connecting and supporting said anode, a
120 vaporizable medium in thermal contact with said anode whereby the heat generated by the anode is conducted to said vaporizable material, the geometric configuration of the anode preventing the arc from striking the
vaporizable material, auxiliary means for
125 heating said vapor material, auxiliary means for cooling said material and means for regulating said heating and cooling means.

5. A therapeutic lamp comprising a trans-
parent envelope, a filamentary cathode in the
130 envelope, a vaporizable medium in the en-

velope, a solid anode in the envelope in thermal contact with said medium and between said medium and the cathode, the anode serving as a shield to prevent the arc striking
5 said medium.

In witness whereof, I hereunto subscribe my name this 25th day of June, 1928.

SAMUEL S. TORRISI.

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