May 2, 1933. W. F. HENDRY 1,907,294

ULTRAVIOLET RAY LAMP

Filed Aug. 17, 1927

Fig. 1.

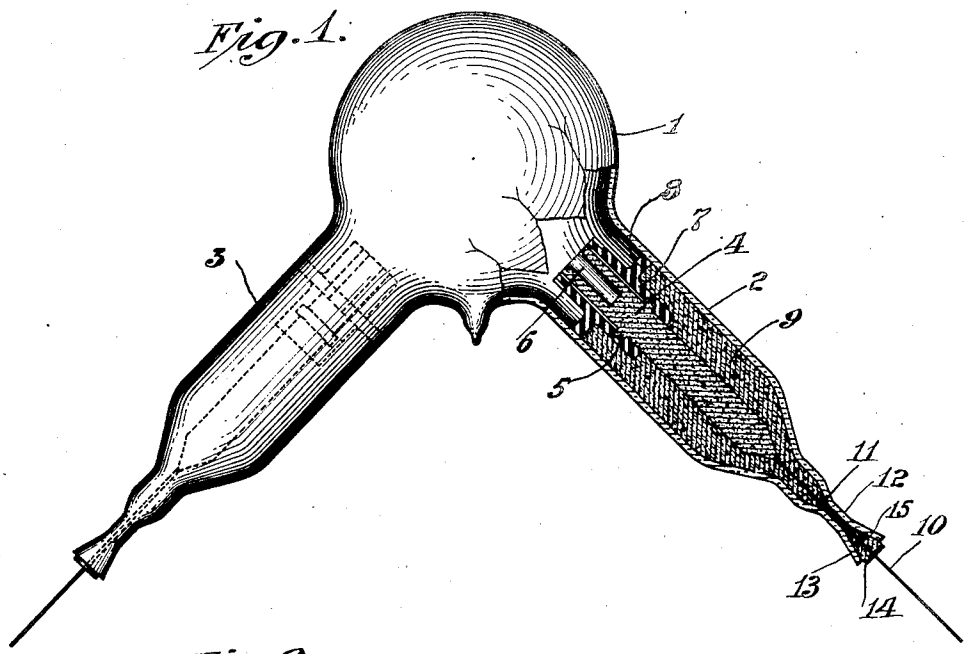


Fig. 2.

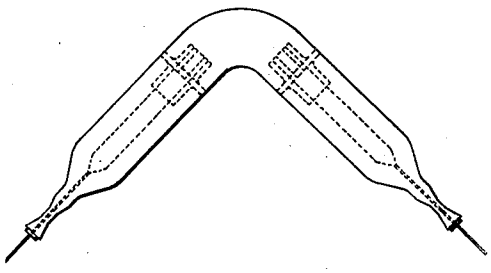
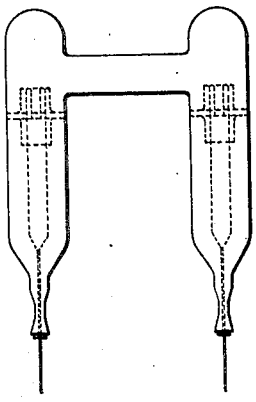


Fig. 3.



W. F. Hendry INVENTOR

BY Pennie & Edmonds

ATTORNEY

Patented May 2, 1933 1,907,294

UNITED STATES PATENT OFFICE

WILLIAM F. HENDRY, OF OSSINING, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MANHATTAN ELECTRICAL SUPPLY COMPANY, INC., OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY

ULTRAVIOLET RAY LAMP

Application filed August 17, 1927. Serial No. 213,592.

This invention relates to devices for producing ultraviolet waves and relates more particularly to mercury vapor therapeutic lamps.

An object of the invention is the provision of a mercury vapor lamp for producing ultraviolet rays, which is capable of being operated at high current density over a long period of time.

Another object is the provision of an envelope of Pyrex glass having a copper wire hermetically sealed thereto.

Heretofore it has been found difficult to construct an ultraviolet ray lamp from boro-silicate glass, such as Pyrex, for the reason that in order to pass any large amount of ultraviolet rays through the walls of a Pyrex glass lamp of the mercury type, it is necessary to run the lamp at high current density. This running of the lamp at high current density results in the heating of the envelope and electrodes to such a high temperature that extreme precautions are necessary in order to protect the seal of the leading-in wire from damage. In spite of the precautions taken to prevent overheating of the seal and leading in wire difficulty has been found in keeping the seal air tight and preventing leakage therethrough. A copper wire cannot be sealed directly to Pyrex glass for the reason that Pyrex melts at a higher temperature than copper and for this same reason many other ordinary wires cannot be sealed to Pyrex.

I have succeeded in obtaining a hermetic seal between Pyrex and a copper lead in wire by providing a cooling means for the glass in the neighborhood of the seal, placing between the Pyrex and copper wire an insert of glass having a lower melting point than copper and by making the union between the last mentioned glass and the copper air-tight through the use of balsam of fir.

These and other objects and advantages of the invention and the manner of obtaining them will be more clearly understood by reference to the following description and accompanying drawing.

In the drawing, Fig. 1 illustrates a tube for producing ultra-violet light, constructed in accordance with my invention. Figs. 2 and 3 illustrate modifications of the tube shown in Fig. 1.

In Fig. 1, reference numeral 1 indicates the tube envelope of boro-silicate glass, such as Pyrex, which has two elongated portions 2 and 3, containing the electrode structures. The electrode structures consist of an electrode 4 which may be constructed of copper, carbon or other electrode material. This electrode comprises an elongated rod having a collar 5 around it at a point near one end and a longitudinal perforation, in the operating end thereof. The rod 4 is surrounded at its operating end by a sleeve 7, of insulating material, such as lava or the like. This sleeve 7 has a groove cut therein, within which groove the collar 5 of the electrode 4 fits. The sleeve 7 entirely surrounds the end of the electrode 4 but does not touch the same, being spaced therefrom a small distance. Integral with the sleeve 7 is a flange 8 which serves to space the sleeve and electrode structure from the wall of the elongated portion of the envelope 2 and to prevent the discharge from passing down around the outside of the shield. This flange should be spaced from the tube wall slightly to allow for expansion. Packed around the entire electrode structure back of the flange on the insulating sleeve is a mass of glass wool 9 which serves to conduct heat from the electrode structure to the wall of the envelope and thence to the atmosphere, and thereby maintain the electrode structure at its proper operating temperature. The electrode structure as described forms a portion of the subject matter of my copending application Serial No. 180,788, filed April 4, 1927, and the operation of the electrodes in this device is substantially the same as disclosed in said application. Current is conducted to the electrode from the outside of the tube by means of a copper wire 10. This wire 10 passes through and is sealed to a plug of glass 11, which is in turn welded within a drawn down tubular portion 12 of the Pyrex glass envelope. In order to provide an air-tight joint between the glass envelope and the wire end connecting

to the drawn down portion 12 of the glass, envelope 1 is slightly flared out at 13 in order to provide a reservoir for a quantity of balsam of fir 15, which is held within the reservoir by a plug 14 of wood or other material thru which plug, wire 10 passes. The balsam of fir sticks to the wire and glass and thereby prevents any leakage of air to the inside of the receptacle. A sufficiently large amount of the balsam is put in the receptacle to maintain a quantity of liquid balsam around the wire for a long period of time in spite of evaporation or solidification of some of the balsam. The glass wool 9 serves to conduct heat away from the electrode structure to the atmosphere before that heat reaches the seal of the leading in wire. Likewise, the reduction in the diameter of the extension 2 of the glass envelope tends to reduce the amount of heat which can be transmitted to the seal. The additional fact that the glass at the sealing point between the leading in wire 10 and the envelope 12 has a relatively small volume with respect to its heat radiating area results in the additional cooling of the seal. The main result of all these features is to keep the temperature of the balsam of fir so low that the balsam does not solidify and thus lose its sealing qualities. These features are important as the balsam serves as an efficient sealing agent only when it is in the liquid state. As an additional precaution against heating of the seal, it might in some cases be desirable to provide an open space between the body of glass wool and the leading in wire seal, the space being evacuated would serve as an effective heat insulator and prevent any appreciable amount of heat from being conducted from the electrode structure to the seal. The entire envelope is exhausted in such a manner that the glass wool and electrode structure is entirely free of air or any other deleterious gases and a small quantity of metallic mercury is deposited within the tube. A tube constructed in accordance with the foregoing description is capable of carrying current of high density and thereby producing a maximum output of ultraviolet rays for therapeutical purposes, due to the fact that the particular electrode structure provides an efficient cooling arrangement which permits the tube to be run at extremely high current density without destructive disintegration of the electrodes and without softening of the glass structure of the tube, allowing the Pyrex glass to pass that portion of the ultraviolet rays which is beneficial to the human body.

While I have mentioned particularly that copper wire can be sealed to boro-silicate glass, such as Pyrex, this type of seal is also useful in joining other kinds of wire to Pyrex or in joining different kinds of wire to quartz or to other kinds of glass. The above described seal is preferably constructed by drawing down a portion of the tubular extension of the envelope 1 and placing within this drawn down portion of the envelope a copper leading in wire 10, which has joined thereto a bead of glass such as that known as 702P and manufactured by the Corning Glass Works. The drawn down portion of the extension of the envelope 1 is thereupon heated to a sufficiently high temperature to permit a further drawing down of the diameter thereof. This further drawing down causes the Pyrex wall to contact with the glass bead around the wire 10 and melt it. The drawing down is continued still further which results in the glass bead being elongated in the form of a plug as shown at 11 in Fig. 1 of the drawing. The heat necessary to soften the wall of the Pyrex envelope and melt the glass bead around the wire 10 has to pass through a layer of Pyrex and a layer of 702P glass before it affects the wire 10. This prevents the wire from attaining a sufficiently high temperature to melt it. While I have found that 702P glass is a particularly advantageous glass to use, other glasses might be used as well, the main requisites being that the glass used for the plug have a lower melting temperature than the leading in wire and that it form a joint with the Pyrex envelope which will not crack upon a change in temperature. The seal is made air-tight, not by its own construction of glass and wire, but by the balsam of fir which is maintained in the reservoir at the end of the drawn down portion of the envelope.

While I have mentioned that this type of seal is particularly adaptable to sealing copper wire to a Pyrex envelope it is to be understood that other wires may be sealed to quartz or other kinds of glass than boro-silicate glass, according to my invention.

It is desirable to use boro-silicate glass, such as Pyrex for an envelope of the ultra-violet ray lamp for the reason that ordinary glass will not pass ultra violet rays sufficiently and furthermore will not stand the high temperature at which it is desirable to operate this type of lamp. I have also found that Pyrex is particularly desirable for use as a violet ray lamp for therapeutical purposes as Pyrex passes only that portion of the spectrum which is beneficial to the human body.

The modifications shown in Figs. 2 and 3 illustrate other forms which my tube may take, and differ from the tube shown in Fig. 1 merely by the particular shape of the envelope and the relative position of the electrodes.

It will be obvious to those skilled in the art that the invention is capable of a variety of modifications and adaptations and that the present disclosure is intended merely to

illustrate its nature without limiting its scope which is defined in the following claims.

What I claim is:

1. A high power ultraviolet ray lamp comprising a boro-silicate glass envelope containing a quantity of mercury and a pair of electrode structures, each of said structures comprising a conducting rod having a cavity in the operating end thereof, a sleeve of insulating material surrounding said rod and spaced therefrom but a slight distance and a packing of glass wool around said electrode structure between the conducting rod and the glass envelope.

2. In a hermetic seal between a glass and a wire having a different coefficient of expansion than said glass, an elongated tube of said glass having welded therein a plug of glass having a lower melting point than said wire, said wire being sealed through said plug, the end of said tube exposed to the atmosphere containing a quantity of balsam of fir.

3. A device for producing ultraviolet rays, comprising a boro-silicate glass tube having a pair of elongated extensions, an electrode positioned in each of said extensions, an insulating sleeve surrounding each of said electrodes but spaced a slight distance therefrom, a packing of glass wool between said electrodes and the walls of said extensions and a quantity of mercury within the said tube.

4. In an ultraviolet ray device, an envelope of boro-silicate glass having a tubular extension, a plug of 702P Corning glass positioned within said extension and welded thereto a copper wire sealed through said plug, and a quantity of balsam of fir in the end of the tubular extension.

5. In a hermetic seal, a boro-silicate glass tube containing a filling of 702P Corning glass and having a lead-in wire sealed through said filling, and a quantity of balsam of fir positioned around the atmosphere end of said wire, and said glass filling.

6. In a seal between a copper wire and a tube of boro-silicate glass operating at high temperature, an elongated tubular portion attached to said envelope, said tubular portion having a further reduction in size forming a tube, said wire being maintained in position in said tube by means of a plug of glass having a lower melting temperature than copper sealed between the wire and the boro-silicate glass tube, said seal being rendered airtight by means of a quantity of balsam of fir positioned in said tube and said wire.

7. In an ultra-violet ray lamp for operating at high temperature, a boro-silicate glass envelope, an extension within said envelope, an electrode positioned in said extension, means for conducting heat from said electrode, a copper wire seated within said extension and a quantity of balsam of fir placed in said extension around said wire.

8. In an electrical discharge device for operating at high temperature, a tube of glass having a relatively high melting point, said tube having an elongated tubular extension, an electrode positioned within said extension, a filling of heat conducting material between said electrode and the wall of said extension, a relatively low melting point lead-in wire for said device said wire being secured in a reduced portion of said extension by means of a glass of relatively low melting point, a quantity of balsam of fir in the outer end of said reduced portion around said wire and means for holding said balsam in position.

9. In a hermetic seal for a lead-in wire for a glass container, a wire sealed through the wall of said container and means for holding a quantity of balsam of fir around said wire at the point of its junction with the said glass.

10. In a hermetic seal for a lead-in wire for a glass container subject to high operating temperatures, an elongated extension on said container, a wire sealed through said extension and means comprising a quantity of balsam of fir positioned around said lead-in wire and covering the glass adjacent to the point where the wire passes through the said extension, for preventing leakage of air around the said wire.

11. In an ultraviolet ray lamp for operating at high temperatures, in combination, a boro-silicate glass envelope having an elongated extension, an electrode positioned within said extension, a packing of fibrous heat-conducting material interposed between said electrode and said envelope within the extension thereof, a wire having a lower melting point and a different co-efficient of expansion than said boro-silicate glass sealed within said extension and connected to said electrode, and a quantity of viscous sealing material disposed within said extension about said wire.

In testimony whereof, I have signed my name to this specification, this 16th day of August, 1927.

WILLIAM F. HENDRY.