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HIGH PRESSURE MERCURY VAPOR ARC LAMP

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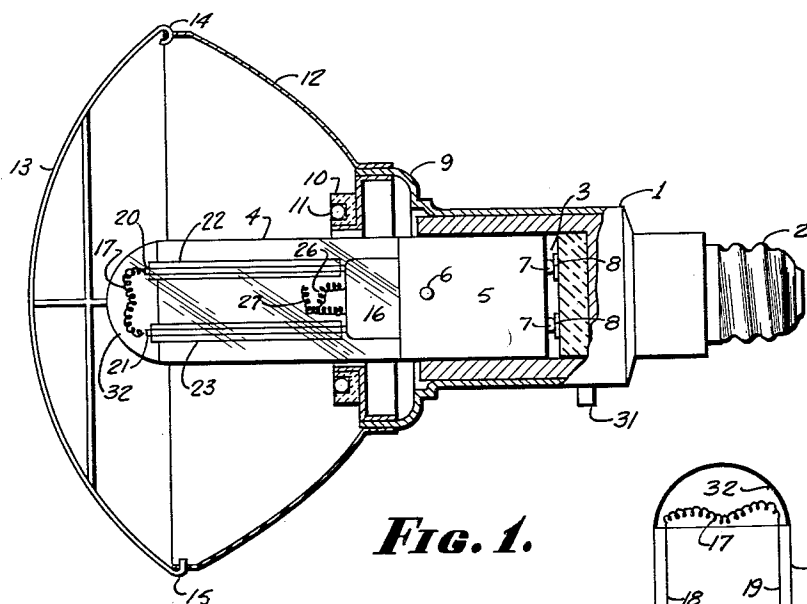


Fig. 1.

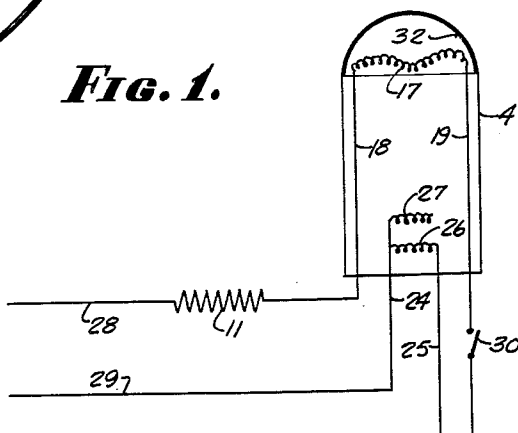
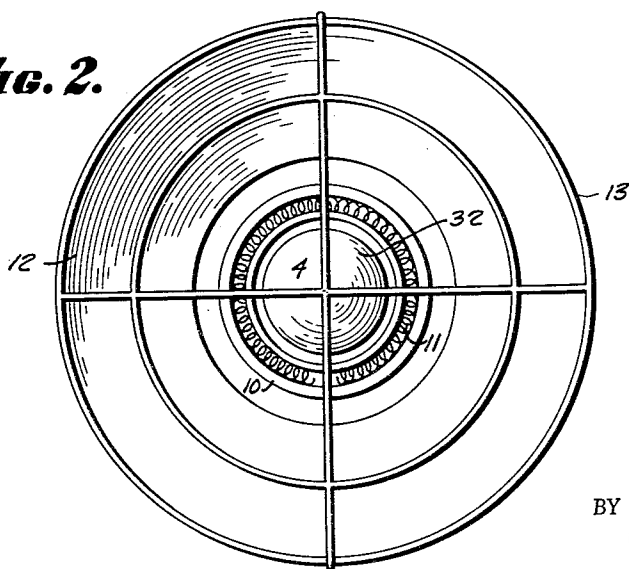


Fig. 5.

Fig. 2.



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HIGH PRESSURE MERCURY VAPOR ARC LAMP
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The invention has to do with arc discharge devices such as are used for generating ultra-violet radiation, and in particular those devices in which an envelope, pervious to ultraviolet radiation, contains a small quantity of mercury, the mercury being kept in a vaporized condition during the operation of the device, thereby generating a pressure within the envelope.

In a common form of such structures, widely used for therapeutic and other purposes, there is an elongated envelope with connections passing through presses at each end. End portions of the envelope are surrounded by ceramic or refractory structures carrying resistance windings, these windings constituting a ballast for the arc discharge. Considerable heat is generated by the ballast means, serving not only to maintain a small quantity of mercury within the envelope in a vaporized condition, but also generating infra-red radiation which is useful therapeutically along with the ultra-violet.

The shape of these devices, as well as the fact that connections are required at both ends, necessitates the use of a rather bulky sheet metal reflector which is generally parabolic in transverse cross section only, but also requires a mounting for the device which is relatively elaborate and is of such nature that the device must either be placed on a flat top support such as a table or the like or must be provided with an adjustable stand. Further, if the envelope should become broken or if the device should otherwise fail in operation, extensive repairs are generally required.

There is a need for a high pressure ultra-violet mercury vapor arc device which is small while being efficient, and which is adapted to be inserted in any screw-in outlet so that it may be used without the provision of elaborate ancillary apparatus. It is an object of the invention to provide such a device.

It is also an object of the invention to provide a high pressure mercury vapor arc device of small size and readily portable, but in which the envelope is immediately renewable as a separate structure.

It is a specific object of the invention to provide an envelope means for high pressure mercury vapor arc devices which has connections at one end only; and in this regard it is an important purpose to provide for the continuous maintenance of the enclosed mercury in a vaporized condition.

These and other objects of the invention which will be set forth hereinafter or will be apparent to those skilled in the art upon reading these specifications are accomplished by that structure and arrangement of parts of which an exemplary embodiment will now be described. Reference is made to the accompanying drawings wherein:

FIGURE 1 is a longitudinal sectional view of the structure of this invention.

FIGURE 2 is an end elevational view thereof.

FIGURE 3 is an exemplary wiring diagram.

The manner in which the objects of the invention are accomplished will be clear from the description of the exemplary structure which follows.

Referring first to FIGURE 1 there is shown a structure having a body indicated generally at 1. A screw-in connection for the application of electrical power to the structure is indicated at 2; but it will be understood that other types of connectors may be used if desired.

The body 1 may be made of spun sheet metal or of other substance capable of withstanding a reasonable degree of heat. It contains a socket 3 which is adapted to receive the end of an envelope structure. The envelope is indicated at 4. In the exemplary embodiment it bears at one end a ferrule 5 adapted to enter the socket 3; and in the preferred form of the invention there will be a pin 6 on the ferrule adapted to enter a groove (not shown) in the socket. Thus the envelope structure is provided with a bayonet-type socket engaging means. The outer end of the ferrule is provided with certain connectors 7 which will engage other connectors 8 mounted on insulating means in the bottom of the socket. In the exemplary embodiment of the structure the ferrule or bayonet end of the connecting means will bear four contacts, insulated from each other and connected to means inside the envelope, while the socket will bear a corresponding number of means 8 for engaging the contactors. More or fewer contacts may be provided for special purposes. It will be understood that other means may be employed for mounting and making electrical contact with the elements inside the envelope such, for example, as the mounting of prongs on the envelope and the provision of socket means in the body 1 for engagement by the prongs. The manner in which the electrical connections are made will hereinafter be more fully described.

The body 1 has an enlargement 9 carrying a ceramic or refractory ring 10 of channel shaped cross section. In the channel of the ring there is located a winding 11 of suitable resistive wire which will serve as the arc ballast and also as a means for generating infra-red radiations.

The body enlargement 9 is surmounted by a reflector 12 in the shape of a paraboloid and made of metal of such character and having such a surface finish that it will be efficient in the reflection of ultra-violet radiation.

The outer and larger end of the paraboloid reflector is preferably provided with a guard 13 to prevent accidental contact of external objects with the envelope. The guard may be of metal mesh fabric or of wire parts welded together. It should be openable or detachable so as to permit the renewal of the envelope structure in FIGURE 1 and end of the wire members is indicated at 14 as passing through a hole in the reflector and curved around so as to form a hinge, the other end of the same wire, as at 15, being bent so that its end may engage resiliently in a hole in the reflector so as to fasten the guard in position.

The envelope 4 may be made of quartz or it may be made of various glasses having the property of transmitting the ultra-violet spectrum or some selected portion of it. These matters are well known in the art and do not constitute a limitation on the invention. The envelope is shown as having a press 16 in which four leads are sealed. Two of the leads extend to a position near the opposite end of the envelope and are interconnected by a filament 17. In FIGURE 3 the leads just mentioned are indicated at 18 and 19. They are made, as will be well understood, of metal having good electrical conductivity and sufficient stiffness to maintain their positions despite any heat generated in the apparatus. In order to prevent the arc from striking to these leads they are insulated throughout their length. One way of doing this is to cover the leads with glass tubes indicated at 20 and 21 in FIGURE 1, which tubes are in turn protected by tubes 22 and 23 of quartz or by quartz beads.

Another pair of leads 24 and 25 (see FIGURE 3) are engaged in the press 16 and are interconnected by a filament 26. While separate electrodes can be provided for the arc, this is not ordinarily done, and the filaments 17 and 26, normally covered with thoria or some other

electron-emissive material are used as the arc electrodes if desired but supplementary electrode 27 which may be referred to as a trigger electrode may be connected to one of the leads 24 or 25.

When the apparatus is started, as will be understood by the worker in the art, the filaments 17 and 26 will be heated, thereby causing their coatings to emit electrons and ionize the gas in the envelope. Since there will be a difference in potential between the supplementary electrode 27 and some portion of the filament 26 (due to the resistance of the filament itself) a small supplementary arc may be formed between members 26 and 27. This speeds up the ionization of the gas in the envelope and "triggers" the main arc.

An exemplary circuit diagram (which may be modified) is shown in FIGURE 3. The leads and interior construction of the envelope have already been described. It will be noted that one of the power lines 28 will be connected through the ballast 11 to a lead of the filament 17 such as the lead 18. The other power line will be connected to a lead of the filament 26, such as the lead 24. It will further be noted that the other lead 19 of the filament 17 and the other lead 25 of the filament 26 are interconnectable by a starting switch 30. This starting switch is preferably a single-throw, single-pole switch biased to an open position as by a spring. Means for operating the switch 30 may be included in the body 1; and a button 31 is shown for that purpose in FIGURE 1. Needless to say, an automatic device might be substituted for the switch 30 but is not necessary in a structure of the character herein illustrated.

When the switch 30 is closed it will be noted that the filaments 17 and 26 are connected in series across the power lines 28 and 29. The filaments thereupon become energized, ionizing the gas in the envelope 4. When the gas has become sufficiently ionized, the opening of the switch 30 as by a release of the button 31 will divorce the filaments 17 and 26 from each other so that an arc discharge will occur between them, the coil 11 serving as the ballast.

As indicated above, the envelope 4 will contain a small quantity of mercury which during the operation of the arc should be in vaporized form. If the envelope were in a position to lose heat rapidly by radiation or otherwise it might be difficult or impossible to maintain the mercury in the vaporized form. Similarly if any part of the envelope operates normally at a temperature below the vaporization point of the metal, condensation of mercury may occur thereat, impairing the efficiency of the arc in generating ultra-violet radiation.

It may be noted in FIGURE 1 that the resistive coil 11 is located in close proximity to the base or ferrule end of the tube 4. The heat generated by this coil during the operation of the device is sufficient to vaporize any mercury contained in the lower end of the tube. The upper or outer end of the tube might constitute a position at which condensation of mercury could occur; but this is obviated in the invention both by locating the filament 17 quite close to the outer end of the envelope and also providing the outer end of the envelope with an inner or outer coating 32 of metal capable of reflecting infra-red and preferably also ultra-violet radiations. This coating may be applied in known ways as by sputtering, vapor deposition, and reduction of metallic compounds in situ; and it may be of any suitable metal including but not limited to silver, aluminum and the like. It is within the spirit of the invention to provide a reflective cap as a separate structure and apply it to the end of the envelope mechanically; but this is not necessary. So long as the substances of the envelope 4 will withstand the heat evolved, a reflector located beyond the end or on the end of the envelope will be found entirely satisfactory.

The reflector concentrates heat derived from filament 17 and from coil 11 at the outer end of the envelope so as

to prevent condensation of mercury thereat. The reflector 12 may also be designed to concentrate a substantial portion of the heat generated in the device upon the envelope including its outer end so as to help in maintaining the desired temperature.

The structure described in this application has the advantage that it may be used in any position and installed temporarily or permanently in any electrical outlet which is available or may be brought into a position of desired use. The device is efficient, and generates large quantities of both infra-red and ultra-violet radiation. The device is sturdy and not subject to breakage in ordinary use; but if the envelope portion of the structure should be broken or if the operating filaments should burn out or if for any other reason the structure should become inoperative, the envelope portion of the device including its ferrule base or other connecting means may be removed from the body 1 and another such structure substituted therein with complete convenience and substantially no time delay.

Modifications may be made in the invention without departing from the spirit of it. The invention having been described in a certain exemplary embodiment what is claimed as new and desired to be secured by Letters Patent is:

1. A high pressure mercury vapor arc device comprising a body, means at one end of said body for connection to a source of electrical power, and a socket at the other end adapted to receive an end of an envelope structure, an envelope structure pervious to ultra-violet radiation and having a press, spaced filament means for the production of a high pressure mercury vapor arc supported by said press, one of said filament means located near the opposite end of said envelope, a reflector on said opposite end, electrical contact means at the first mentioned end of said envelope adapted to coact with the electrical contacts in the socket of the body and connected with said filament means through said press, a resistive wire winding to act as the arc ballast located on the end of said body surrounding said socket, a reflector attached to the socket end of said body, and said envelope structure containing a small quantity of mercury.

2. A high pressure mercury vapor arc device comprising a body, means at one end of said body for connection to a source of electrical power, and a socket at the other end adapted to receive an end of an envelope structure, an envelope structure pervious to ultra-violet radiation and having a press, spaced filament means for the production of a high pressure mercury vapor arc supported by said press, one of said filament means located near the opposite end of said envelope, a metallic reflector on said opposite end, electrical contact means at the first mentioned end of said envelope adapted to coact with the electrical contacts in the socket of the body and connected with said filament means through said press, a refractory ring of channel-shaped cross section housing, a resistive wire winding to act as the arc ballast located on the end of said body surrounding said socket, a paraboloid reflector attached to the socket end of said body, and means for starting an arc in said envelope, said envelope structure containing a small quantity of mercury.

3. The structure claimed in claim 2 wherein the envelope structure is protected by a removable guard affixed to the outer most edge of the paraboloid reflector.

4. The structure claimed in claim 2 wherein the body has a screw-in type connection for the application of electrical power.

5. An envelope structure comprising an ultraviolet pervious envelope containing a small quantity of mercury, a base at one end of said envelope with contacts for the application of electrical power, a press, a filament supported by said press near said one end of said envelope, a second filament supported near the upper end of said

5

envelope on insulated leads from said press, and a metallic reflector affixed to said upper end of the envelope.

6. The structure claimed in claim 5 wherein said envelope is made of quartz.

7. The structure claimed in claim 5 wherein said envelope is made of glass having the property of transmitting at least a selected portion of the ultra-violet spectrum.

8. The structure claimed in claim 5 wherein said metallic reflector comprises a metallic coating applied to the inner surface of the upper end of the envelope.

9. The structure claimed in claim 5 wherein said metallic reflector comprises a metallic coating applied to the outer surface of the upper end of the envelope.

10. The structure claimed in claim 5 wherein said contacts for the application of electrical power include a base on said envelope of the bayonet type.

11. The structure claimed in claim 5 wherein a supplementary triggering electrode is affixed to the filament adjacent the first mentioned end of said envelope.

12. A high pressure mercury vapor arc lamp comprising a body, a screw-in connection at one end of said body for the application of electrical power, a socket at the other end adapted to receive the ferrule base of an envelope structure, said socket having contacts at its bottom, an envelope structure comprising a transparent envelope having the property of transmitting at least a portion of the ultra-violet spectrum, a ferrule base at the lower end of said envelope with bayonet contacts for the

6

application of electrical power so arranged as to coact with the contacts at the bottom of the socket in the body, a press forming part of said envelope, a filament adjacently supported by said press, a second filament supported near the upper end of said envelope on insulated leads extending from said press, a triggering electrode affixed to the first mentioned filament, a metallic reflector at the upper end of the envelope comprising a thin metallic deposit on a surface thereof, a small amount of liquid mercury in said envelope, a refractory ring located on an enlargement of the body at the upper end of the socket and so located as to be near the ferrule of the envelope, said ring having a channel-shaped cross section housing a resistive wire winding to act as the arc ballast, a paraboloid reflector with a surface finish active in the reflection of ultra-violet radiation surmounting said enlargement in the body, a removable guard affixed to the outer most edge of the paraboloid reflector, and a starter switch for said lamp located at the side of said body.

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