

July 9, 1935.

C. H. BRASELTON
HIGH POTENTIAL RADIATOR

2,007,922

Filed Aug. 22, 1930

Fig. 1.

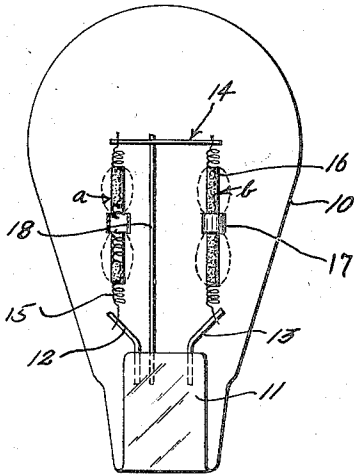


Fig. 1. a

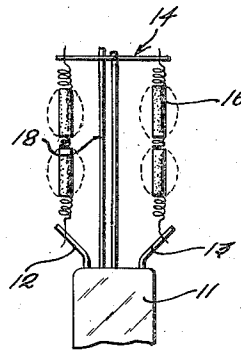


Fig. 2

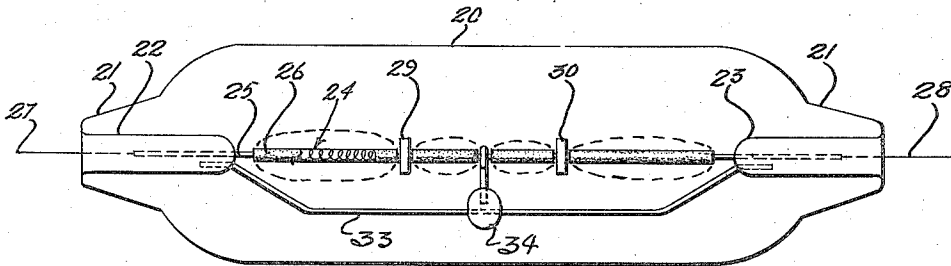


Fig. 3.

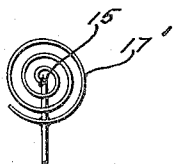


Fig. 4

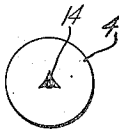


Fig. 5.

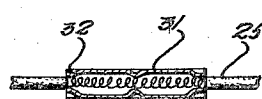
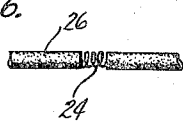


Fig. 6.



INVENTOR

Charles H. Braselton

UNITED STATES PATENT OFFICE

2,007,922

HIGH POTENTIAL RADIATOR

Chester H. Braselton, New York, N. Y., assignor
to Sirian Lamp Company, Newark, N. J., a corporation of Delaware

Application August 22, 1930, Serial No. 476,960

6 Claims. (Cl. 176—1)

This invention relates to energy radiating devices of a type usable in conjunction with abnormally high voltages, or in such devices wherein the component material tends to bring about a shunting or short-circuiting of the radiator.

One of the objects of the invention is to provide an energy radiator which may be employed for relatively high voltages.

Another object of the invention is to provide an energy radiator which will maintain its normal operating state independently of the formation of short-circuiting gases about the radiator.

Another object is to provide an energy radiator which is provided with means for restraining a "spilling over" of current in or about the radiator.

Still another object is to provide an energy radiator which may be of excessive length, and accordingly usable for such purposes as advertising in the manner for which neon gas tubes are now employed.

Further objects will become apparent on consideration of the following description, and in conjunction with the accompanying drawing, in which

Fig. 1 is a elevation of a radiating device in the form of a lamp for furnishing illumination, and provided with my controlling unit;

Fig. 1a is an elevation of a modified form of the invention;

Fig. 2 is a view of a modified form of the invention; and

Figs. 3, 4, 5 and 6 are details of modified forms of the controlling unit, each of which is usable in conjunction with either the modification of Figs. 1 or 2.

In my co-pending application, Serial No. 459,048 filed June 3, 1930, I have described a new form of energy radiator which utilizes an enclosed container filled with an inert gas, and a filament having an electron emitting coating, the balance between gas pressure, voltage, and coating being such as to produce an incandescent filament of relatively low luminosity surrounded by a sheath or pencil of ionized gas which, in accordance with the specified type of gas or gases used, functions as a radiator of definite wave frequency. This radiation may be luminous in the device used for a lamp, or it may be non-luminous, and its primary object may be either emission of luminous radiation, or the emission of energy in the ultra-violet, infra-red, or other regions of the energy frequency ranges.

In accordance with said application, a filament of appropriate resistance, such, for example, as

150 ohms, is coated with various alkaline oxides such as the oxides of barium, strontium, calcium or other materials which have been found to emit electrons densely when heated. The base filament is tungsten or tantalum wire, although other metal conductors may be used. It is not necessary ordinarily that the base material be highly refractory, as the operating temperatures may be relatively low, in many cases not being above that of low red heat.

The filament is preferably coiled and coated with materials as above mentioned, which may be in the proportions of 40 grams of barium carbonate, 40 grams of calcium carbonate, 8 grams of barium nitrate with a binder of sufficient nitrocellulose dissolved in amyl acetate to hold the coating on the wire, and the filament is then mounted on a stem support and sealed in the bulb of the envelope.

The exhaust pump is then connected to the bulb and an oven lowered thereupon to raise the temperature of the bulb and contents to about 400° C., or to as high a temperature as the envelope will stand without softening. Simultaneously electric current is passed through the filament which is heated to red heat of approximately 600° C. The heat and exhausting process is continued until there is no fluorescence when the high tension current is directed against the wall of the bulb, or in other words, until there is practically no more gas inside of the bulb. A vacuum of about one-half of a micron is an approximate limiting value.

The current is then increased through the filament so that the temperature thereof is slowly raised until it is about 800 degrees, or a bright red color, the exhaust operation being continued until the newly emitted gases are removed. The oven is then raised from the bulb and the filament heated to about 1200° C., the pumping being continued until a high vacuum of one-half micron is again obtained.

The pump is then shut off, the current turned off, and about one-half mm. of neon gas emitted to the bulb. The filament current is then turned on and gradually increased until a diffused glow completely fills the bulb. When the discharge is uniform throughout the bulb, which usually occurs in less than ten minutes, the so-called activating process for the filament coating is complete. Should white discharge spots appear on the filament or support rods, it is an indication that the gases or vapors within the bulb have not been completely removed, and the bulb is again exhausted and the whole process of activa-

tion repeated. When the activating process is finally complete, the filament temperature is raised for a moment to about 1400° C., and the pumping operation is again resumed to remove any undesirable gases which may have been thrown off during the activation process.

The filament circuit is then disconnected and the pump turned off and the appropriate amount of gas admitted to the bulb. In one form of my invention I utilize neon and argon gases in the relative amounts of 50 mm. of neon gas, and 150 mm. of argon. Other monatomic gases, such as krypton, helium, or metal vapors such as those of mercury and caesium may also be used. The bulb is then sealed off and a small quantity of magnesium flashed to absorb additional impurities, thus completing the process.

Referring now to the drawing, I have shown an envelope or container 10, to the open end of which a stem 11 is sealed. Supported by the stem are lead-in wires 12 and 13 which connect the external electric circuit to the energy radiator 14. This radiator is formed of a filament 15 of material which may preferably be refractory, as tungsten, and is coated by the electron emitting material 16 in accordance with the disclosure in the co-pending case hereinabove referred to. As shown in Fig. 1, the filament is divided into two sections *a* and *b* supported by the rod 18 and attached upper crossrods, and these sections are divided approximately midway between the ends by a metal thimble or rod section 17, or by merely maintaining this point free of coating. Various other dividing units or elements may be used, such as the shield of spiral wire 17' of Fig. 3, the shield or solid plate 4 of Fig. 4, and the shield or tubular element 31 of Fig. 5. Where separating units are added to the filament 15 the junction may be made by a weld or other means, or in the case of a tube or sleeve, merely by frictional means. The units 17 serve to divide the coated filament into short sections which have a potential drop insufficient to cause a breakdown flow through the gases between the ends of the sections. For the diameter and resistance of the conductor 15 it is desirable that a voltage drop between the ends of the segments does not exceed 40 volts; a range from 20 to 40 volts may be permitted. The diameter of the coil may vary approximately from .012 to .04 inches.

In the illustration of Fig. 1, two sections, *a* and *b*, are indicated. It is, of course, obvious that additional sections, depending upon the potentials employed, may also be used. Where potentials are high, the breakdown potential for the gas may be exceeded, in which case the whole tube becomes luminous in a manner similar to that of a neon tube.

It is desirable to keep below this breakdown potential for the gas as a whole, and at the same time maintain a sufficient voltage which will enable a device of considerable length to be employed, as, for example, for advertising purposes.

In the modification of Fig. 2 a form of energy radiator is shown which is particularly adapted for use with exceptionally high voltages. In this modification the radiating device is in the form of a tube 20, having constricted ends 21 which are sealed to the stems 22 and 23. The stems carry the radiating element 24, which consists of a metal filament 25, having a coating 26 of electron emitting material. The lead-in wires 27 and 28 connect with the filament 25 at its ends. At separated points on the radiator 24 are positioned the spacing units 29 and 30, which units may take

the form of either of the various modifications shown in Figs. 3, 4, 5, and 6 or of other suitable forms. Where activating conductors are necessary, these may take the form of an extra rod mounted in the end supports 22 and 23 and extending parallel to the filament and connected thereto at its midpoint, as indicated at 33 in Fig. 2.

The diameter of the spacing units 17, 29 and 30 may vary, according to the requirements of the particular radiating device, and are dependent, of course, upon the physical dimensions of the radiator, including the size of the envelope and the length of the filament, and are also dependent upon the gas within the container as well as the normal operating voltages to which the device is subjected.

The spacing units, such as 17, above referred to are, conductors, and conducting materials appear to be particularly suited to function for the purposes desired. However, it is understood that conductivity of the units may vary considerably, and in fact in some instances the conductivity may be relatively small; in that case, the units serving only as a barrier for spacing the conductors into segments, and preventing a "spilling over" effect between the segments. The spacing units, moreover, may take the shape of merely a length or segment of the conductor on which no coating has been placed. Where the underlying conductor is merely a closely wound coil of wire the unit then would be an uncoated section of bare wire of the same diameter as that which is coated. Where it is desired that the unit extend laterally the uncoated portion of the filament may be forced outwardly to secure a lateral displacement. The same effect may be obtained by utilizing the bare uncoated sections of the filament as an anchor point for supporting wires which are in turn attached to a support standard adjacent the filament. By winding the support wire about the bare spot or by using a binding metal or solder the joint may be enlarged to secure in a measure a parallel effect. However, as hereinabove mentioned, a mere disconnection in the coating to a bare section of the filament without a lateral enlargement may serve to accomplish the required result. Also the radial diameter of the element 17 may vary. Where it is desired to arrest gas convection movement and to establish a mechanical barrier to discharge between sections, the diameter of the element 17 may be approximately that of the bulb. On the other hand, where a simple break into segments of conductors is desired, a small diameter element may suffice.

The rod 33 hereinabove referred to as an activating rod serves also as a support for the filament 25. Preferably the rod 33 should be insulated at the outer ends to prevent high potential leakage. Either an insulating coating or glass tubing may be used for this purpose. The rod may also be separated by the glass bead 34 to further overcome the possibility of high potential leakage.

While the radiator has been described as utilizing a coating on the metal conductor or coil 15, it is within the confines of this invention to place the coating material within the coil 15 instead of without. For example, a rod or pencil of the oxides of barium, strontium, calcium and the like may be inserted inside of the coil 15, or material in paste form may be pressed into the coil and baked therein to form a rod. Where the coating material is inserted within the coil it is not necessary to coat the heater conductor 15.

In the claims appended hereto the electron

emitting substance is referred to as "coating", and by the term "coating" I do not intend the limitation to an external application of the emitting substance, but use the term as applied to an application of the substance either within or without the heating metal coil. Also in the claims where the term "electron emitting temperature" is used with reference to the coating, it is intended to convey the idea that at such temperature the coating is emitting electrons profusely and densely distinguished from the temperature which electrons are not so emitted.

It is, of course, apparent that the subject matter of my invention may be comprised within various modifications, all of which may be included within the scope of the claims hereto appended.

Having thus described my invention, what I desire to claim is:

1. An energy radiating device comprising an envelope, a support within the envelope, a filament mounted on said support, electron emitting coating mounted on the filament, means for dividing the filament into separate emitting segments, and an ionizable gas within said envelope, said means including a mass of conducting material adjacent the filament.

2. An energy radiating device comprising the combination of an envelope, a support sealed within said envelope, a single continuous current conductor mounted on said support, said conductor including a filament having terminals extending to the exterior of said envelope, a coating of electron emitting material on said filament, and a shield of conducting material surrounding said filament and attached thereto at a point on said filament intermediate the ends thereof, and an ionizable gas within said envelope.

3. An energy radiating device comprising the combination of an envelope, a support sealed within the envelope, a filament mounted on said support, said filament being connected to leading-in wires extending therethrough to a point with-

out the envelope, a coating of electron emitting material on said filament, spaced tubes mounted on said filament and attached thereto, and dividing said filament and coating into a plurality of segments, and an ionizable gas within said envelope.

4. An energy radiating device comprising the combination of an envelope, supporting means within the envelope, a single filamentary conductor mounted on said supporting means and having ends connected to leading-in wires extending therethrough to points without the envelope, and a space dividing member enclosing said filament and extending and radiating outwardly therefrom, whereby the space along the conductor is divided into separated sections.

5. An energy radiating device comprising the combination of an envelope, a support sealed within said envelope, a filament mounted on said support and having terminals extending there- through to the exterior of said envelope, separated sections of electron emitting coating on said filament, a shield of conducting material adjacent and attached to said filament between said sections, and an ionizable gas within said envelope.

6. In an energy radiating device, the combination of an envelope, support means sealed within said envelope, a single metal filament mounted on said support means and having terminals extending therethrough to the exterior of said envelope, separated sections of electron emitting coating on said filament, shielding means for preventing intersection electron emission, and an ionizable gas within said envelope, the resistance of said filament being such with respect to the voltage for which the device is designed that the potential drop along each of said segments when current is flowing therethrough preferably does not exceed 40 volts.

CHESTER H. BRASELTON.