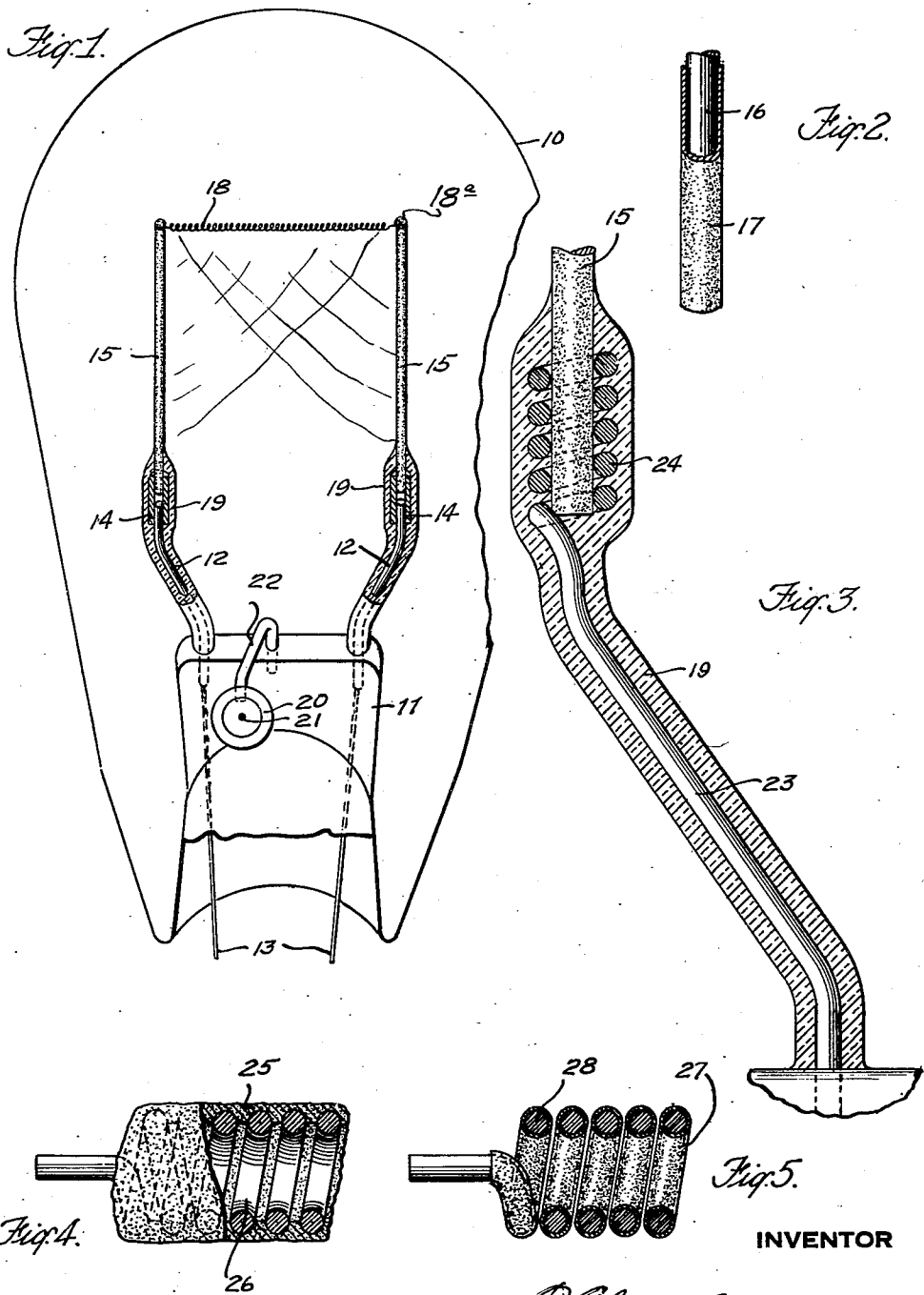


May 5, 1936.

C. H. BRASELTON
ELECTRIC RADIATION DEVICE
Filed May 17, 1932

2,039,772



UNITED STATES PATENT OFFICE

2,039,772

ELECTRIC RADIATION DEVICE

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

Application May 17, 1932, Serial No. 611,811

7 Claims. (Cl. 176—16)

This invention relates to electrical radiation devices including those operating in a vacuum or in the presence of a gas and for the purpose of producing illumination or for other purposes.

One of the objects of the invention is to provide a means to increase the life of such a device.

Another object of the invention is to provide a radiation device in which the radiating element is protected against the formation of overheated spots which usually initiate the burning out of the element.

Another object of the invention is to provide a means in a radiation device to prevent localized discharge or arcing.

Another object of the invention is to provide a discharge lamp in which the discharge is uniformly distributed over the surface of the electrode.

Still another object of the invention is to provide a radiation device in which bombardment occurs only in one direction between certain elements of the device.

Still another object of the invention is to provide a radiation device in which the supporting posts for the radiating element are prevented from becoming overheated.

Other objects of the invention and objects relating particularly to the construction and assembly of the various elements of the device will be apparent as the description of the invention proceeds.

One type of radiating device embodying the invention has been illustrated in the accompanying drawing in which:

Fig. 1 is a side elevational view partly in section of a discharge device embodying the invention;

Fig. 2 is a detail view partly in section of a modified form of one of the supporting posts for the filament of Fig. 1;

Fig. 3 is a greatly enlarged sectional elevational view of a modified form of mounting the support posts for the filament;

Fig. 4 is a greatly enlarged elevational view partly in section of one end of the radiating element of Fig. 1; and

Fig. 5 is a greatly enlarged sectional view of one end of a modified form of the radiating element.

Referring now more specifically to the drawing the invention has been shown as incorporated in a gaseous discharge lamp having the usual electric light bulb or envelope 10 with a centrally located press 11 fused to the lower end of the bulb for supporting the various elements. Two sup-

port rods or leads 12 of nickel or any other desired material are identical in construction and are fused into the press 11 being connected at their lower ends by a pair of wires 13 which form the lead-in wires for the lamp. The support rods 12 extend upwardly a short distance from the press and each may be provided at the upper end thereof with a sleeve 14 which may be formed of nickel or other metal and which is preferably welded to the upper end of the support rod leaving a portion of the sleeve extending upwardly to receive a supporting post 15. These posts 15 may be made of some material having a relatively low electron emission, such as carbon, boron, or metals coated with carbon or boron. In Fig. 1 they are illustrated as being made of carbon while in Fig. 2 a post 16 of nickel or other metal is shown having a carbonized surface 17. Where carbon posts may be preferred they may have their lower ends plated with copper or with copper first and then a layer of nickel, after which they may be welded to the sleeves 14 so that they are securely supported by the rods 12 and there is a good electrical contact between them and the support rods. If desired they may be cemented into the sleeves 14 by means of a conductive cement or paste made of powdered carbon, tungsten, tantalum carbide, or the like with a suitable binder. Such paste is well known in the art for connecting carbon filaments to their supports.

The posts 15 are supported substantially parallel with each other and in the present embodiment of the invention, are shown connected at their upper end by means of a filamentary resistance wire 18 which is preferably provided in the form of a closely wound coil and which may be attached to the ends of the carbon rod 15 by some of the conductive paste 18a referred to above.

The nickel support rods 12 and the sleeves 14 forming connections between the rods and the posts 15 should preferably be coated with an insulating material 19 as far down as the press of the tube so that there will be no possibility of a discharge forming between these support rods and the filament 18.

In constructing a lamp in accordance with the embodiment of the invention shown in Fig. 1 the elements are assembled as indicated in the drawing upon the press 11 and the press is then sealed to the bulb in a well known manner, after which the bulb may be mounted upon an exhaust pump. An oven may then be placed over the bulb to raise the temperature of the bulb and associated parts to from 350° to 400° C. to remove all of the

gases from inside of the bulb. Current may also be run through the filament to raise the temperature thereof to about 600° C. and this heat is continued until a high vacuum of approximately .5 micron is obtained and all the gases have been removed in the envelope as evidenced by no fluorescence when a high tension current from an induction coil is directed against the walls of the bulb. Current may then be increased through the filament and the temperature thereof slowly raised until it is a bright red at a temperature of about 800° C. The pump continues to remove from the envelope any gases which are driven out of the element or the parts.

When no more gas is found in the envelope the oven should be raised and the filament heated to slightly less than 1200° C. for a moment to drive out any occluded gases or vapors which may be present. The pump may then be shut off and an easily ionizable gas such as neon may be admitted until the pressure is between two and twelve millimeters of mercury. The bulb may then be sealed off and is ready for use.

If desired the gas in the device may be rendered more conductive or color effects may be obtained by the inclusion of a metal vapor, such as one of the vapors of mercury, caesium, or rubidium or mixtures of such vapors. In a preferred form of the invention caesium and rubidium vapors may be added to the neon gas in the following manner: 25% of caesium nitrate and 25% of rubidium chloride may be ground up together with 50% of magnesium and a small quantity inserted in the cavity formed between a pair of dished metal plates 20 which may be welded together to form a spherical container having a pin hole 21 in the side thereof. The container may be mounted upon a support rod 22 sealed in the press 11. When the temperature of the container 20 is raised the magnesium is flashed thus liberating caesium and rubidium metal vapor and forming magnesium nitrate and magnesium chloride which compounds are stable at the operating temperatures of the device. The caesium and rubidium vapors condense on the walls of the envelope to be vaporized again when the device is heated in use.

When current is run through the lamp the filament 18 is heated and inasmuch as the current feeds in through the posts 15 one of these posts is always higher in potential than some portion of the filament 18. This is true when either direct or alternating current is used, and in case of the latter the posts alternate in high potential. A large portion of the discharge from the filament 18 will find its way therefore to the posts 15 with the result that these posts will be bombarded and the temperature thereof raised until in some instances they may reach a white heat. However, these posts have a very low electron emission and hence in spite of the bombardment from the filament to the posts there will be very little, if any, emission from the posts to the filament. This fact appears to prevent localization of discharge and destruction of the filament due to arcing and, therefore, gives the lamp a very much longer life. When carbon is used for the posts 15 another advantage arises in that the posts act as a ballast or surge arrester for the lamp. Inasmuch as the carbon has a negative temperature coefficient of resistance the resistance of the posts 15 increase with surges of current which tend to increase the temperature and hence surges of current are prevented from passing through the filament. In the same manner the discharge between the fila-

ment and supporting posts is more or less controlled because as the temperature is raised due to bombardment from the filament the resistance of the supporting posts increases and current flowing through the filament is, therefore, decreased thus decreasing the bombardment.

In Fig. 3, I have illustrated another means for supporting the posts 15. Here the nickel support rod 23 is provided at its upper end with a helical coil 24 into which the end of the carbon post 15 may be slipped and which may be welded or pasted to the end of the post. The nickel rod 23 would preferably be coated with the insulating material 19 shown in Fig. 1.

While a bare coiled filament has been shown in Fig. 1 it may be desirable to coat the filament with any of the well known electron emitting materials such as the oxides of the alkaline earth metals. In such a case the coating may be applied on the outside of the coil as the coating 25 on the coil 26 of Fig. 4 while if desired the construction of Fig. 5 may be used where the coating 27 may be applied to the individual turns of the coil 28. Also the electron emitting material may be incorporated in the metal of the filament as by the use of a thoriated tungsten filament which may be made by treating tungstic acid and thorium nitrate.

The effect of the electron emitting material on the filament is to increase the electron emission and therefore increase the density of the discharge and lower the temperature at which it is initiated. Where the electron emitting material is used the material may be activated during the process of exhausting the bulb by admitting a small amount of an inert gas such as neon at a pressure of about 1/2 mm. of mercury after the bulb has been thoroughly cleared of gases. The current through the filament may then be turned on again which causes reddish spots of discharge to occur on the element or other part of the device which gradually increase in size until a diffused glow appears inside of the bulb substantially filling it and the action tends to activate the electron emitting coating to raise the electron emitting efficiency thereof. This process should take about ten minutes but if white spots appear it is an indication of other gases being present and the envelope should be exhausted again and the process repeated. When the activation is completed the pump may again be connected to the envelope and the gas pumped out until a high vacuum is again produced. The filament current may then be disconnected and the pump turned off and the desired amount of the neon gas admitted after which the bulb may be sealed off.

With the device so far described the discharge is caused to fill the entire bulb. However, it is possible to confine the discharge to the region of the filament by increasing the pressure of the gas. For this purpose I prefer to use a pressure of about 200 mm. of mercury, and argon gas may be mixed with the neon so that there is about 50 mm. of neon and 150 mm. of argon present. When such pressures are used it is desirable to have a filament with a high electron emission in which case a halo of discharge forms around the filament when it is energized, as described in my prior filed patent entitled "Electrical discharge device", issued July 9, 1935, Patent No. 2,007,919. With the discharge thus confined to the region of the filament there is normally little or no bombardment of the support rod from the element but it has been found that

whenever such a lamp with an ordinary support rod burns out there is generally a concentrated discharge between the filament and the support rod. Thus the low electron emitting support rod will tend to prevent such a localized discharge from forming and, therefore, will increase the life of the filament. The distinction between the carbon rod and filament may be defined in terms of their emissivity, that is, the emission per unit of surface area of substance at a common temperature. As so defined carbon has a low, and tungsten a high, emissivity.

While the description has been directed chiefly to gaseous discharge devices it is possible to use the invention with any radiating device, such as an incandescent lamp, with equally good results. In such a lamp the filament is prevented from overheating due to surges of current, as stated above, the supporting posts, when made of carbon, acting as a surge arrester, and also the filament is protected against localized discharges or arcs which tend to burn it out almost instantaneously when once formed. The invention is, therefore, not intended to be limited to any particular type of radiating device as it may be used to good advantage wherever a filamentary wire is raised by a current passing through it or a current is passed through a gas.

Many modifications of the invention may be resorted to without departing from the spirit thereof and I do not, therefore, desire to limit myself to what has been shown and described except as such limitations occur in the appended claims.

What I desire to claim and secure by Letters Patent is:

1. In an electric discharge device an envelope, a resistance filament having high electron emissivity, an elongated support post for one end of said filament, a second similar support post for the other end of said filament, both of said posts being formed of conducting material of a refractory nature having a permanent low electron emissivity, an inert ionizable gas surrounding said filament and posts, electrical leads for said posts, and means to insulate said electrical leads from said gas.

2. In an electrical discharge device an envelope, a filamentary resistance wire within said envelope, a coating of electron emitting material on said filament, conducting means to support the ends of said wire, said means including relatively long rods having a permanent low electron

surface emissivity along their entire length when heated by the resistance wire, electrical connections for said support means, an ionizable gas surrounding said wire and support means, and means to insulate said electrical connection from said gas.

3. In a device of the class described an envelope, a filamentary resistance wire having a high electron surface emissivity, conducting means to support the ends of said wire, said means consisting of rods having a permanent low electron surface emissivity along their entire length when heated by radiation from the resistance wire, and an ionizable gas within said envelope surrounding said wire and support and having a pressure which is less than 50 mm. of mercury.

4. In a device of the class described an envelope, a filamentary resistance wire having a high surface electron emissivity within the envelope, conducting means to support the ends of said wire, said means including carbon rods having a low electron surface emissivity, and neon gas containing a trace of caesium and rubidium vapor surrounding said wire and rod, said gas having a pressure of from 2 to 12 mm. of mercury.

5. In a radiating device an envelope, a resistance filament having high electron surface emissivity, means to support said filament, an inert ionizable gas surrounding said filament and supporting means, said means including an elongated refractory conductor having a permanent surface formed of material which has a low electron surface emissivity, the conductor being in direct contact with said filament.

6. In a device of the class described an envelope, a filamentary resistance wire having high electron surface emissivity, conducting means to support the ends of said wire, said means consisting of rods having a permanent low electron surface emissivity along their entire length, and an ionizable gas surrounding said wire and supporting means and having a pressure of from 2 to 12 mm. of mercury.

7. In a device of the class described a pair of uncoated and elongated carbon support rods, a radiating element having high electron emissivity positioned between and connected to the ends of said rods and in series therewith, an ionizable gas surrounding said element and rods, and an envelope enclosing the rods, radiating element and said gas.

CHESTER H. BRASELTON.