July 9, 1935. C. H. BRASELTON 2,007,926

LIGHT EMITTING UNIT

Filed Oct. 21, 1930

Fig. 1.

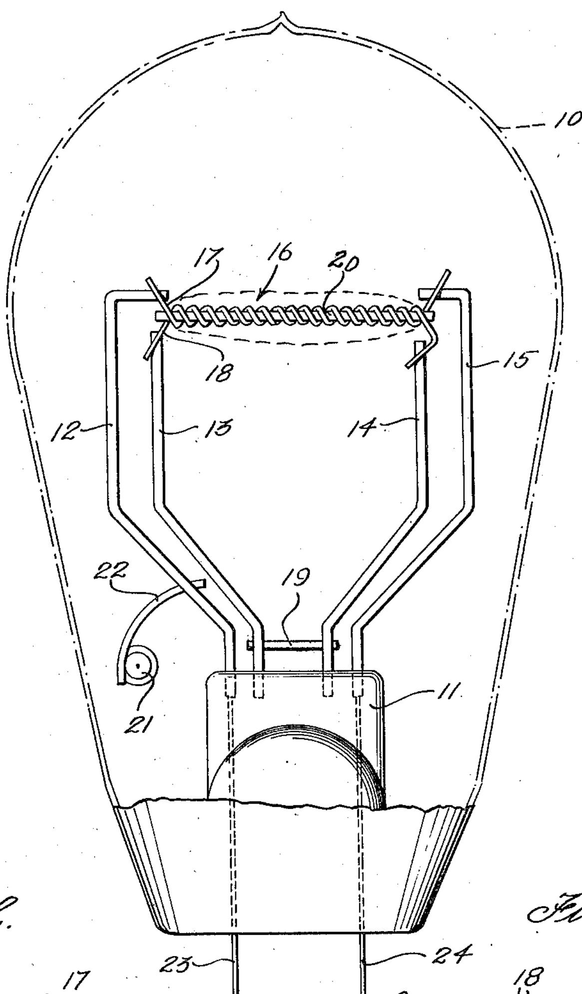


Fig. 2.

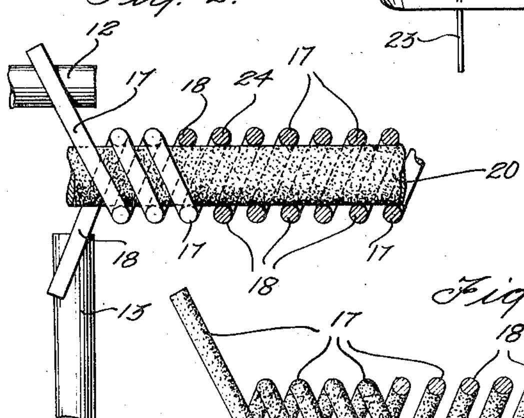


Fig. 3.

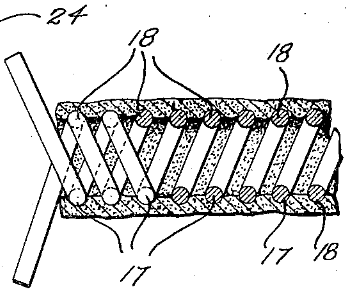
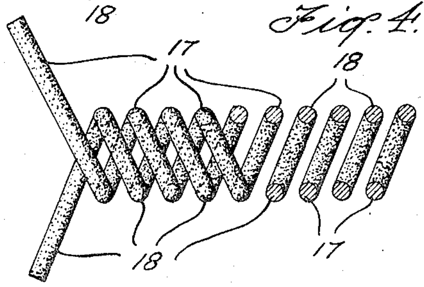


Fig. 4.



INVENTOR

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UNITED STATES PATENT OFFICE

2,007,926

LIGHT EMITTING UNIT

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Application October 21, 1930, Serial No. 490,124

7 Claims. (Cl. 176—1)

This invention relates to electric lamps and particularly to that type of lamp depending for operation upon the ionization of a gas.

One of the objects of the invention is to provide the light emitting element for an electric lamp in which a uniform discharge will be produced throughout the length of the element.

Another object of the invention is to provide a light emitting element for an electric lamp in which the voltage between two adjacent portions of the elements will be sufficient to produce the desired effect but will be less than the line voltage.

Another object of the invention is to provide a light emitting element for an electric lamp which is simple, easily constructed, and inexpensive to manufacture and operate.

Other objects and objects relating particularly to the method of constructing and assembling the various parts will be apparent as the description of the invention proceeds.

Several embodiments of the invention have been illustrated in the accompanying drawing in which:

Fig. 1 is an elevational view of a lamp with my improved light emitting element;

Fig. 2 is an enlarged, longitudinal, sectional view of the element shown in Fig. 1;

Fig. 3 is an enlarged, longitudinal, sectional view of a modified form of the light emitting element; and

Fig. 4 is an enlarged, longitudinal, sectional view of still another embodiment of the light emitting element.

In my application entitled Electrical discharge device, Serial No. 459,048, filed June 3, 1930, an electric lamp is shown and described which has a filamentary coil of resistance wire in contact with electron emitting material and in the presence of an inert gas having a certain pressure below atmospheric. When the coil is energized and the temperature raised above electron emitting temperature, the emission of electrons appears to ionize the region of the gas in the vicinity of the coil with the result that the current flows outside of the coil creating a halo of discharge around the filament which produces an intense illumination. The emission of electrons through a sufficient distance to ionize the gas is probably caused by the drop in potential between adjacent points on two adjacent turns of the coil and as the density of electron emission is somewhat dependent upon the potential difference between the two points a greater effect can be obtained if this potential is increased. It is the purpose of the present invention to increase this potential between two adjacent points on the coil and thereby increase the electron emission.

Referring now more specifically to the drawing the invention is shown as comprising an envelope 10 of glass or other desired transparent material formed integral with the usual press 11. The press may be provided with a plurality of support rods 12, 13, 14, and 15 which may be sealed therein and which may extend upwardly within the envelope spaced from each other in the manner indicated. The light emitting element 16 may be supported between the upper end of the rods 12 and 13 and the rods 14 and 15.

The element 16 may comprise a double coil of wire formed of two coils 17 and 18 which are wound upon the same diameter mandrel and the turns of which are uniformly spaced apart. One way of making the coil would be to simultaneously wind two spaced apart wires upon a mandrel or if desired the coils may be separately wound and then one threaded into the other. One end of the coil 17 may be connected to the support rod 12 which may be bent over at an angle to receive it while the corresponding end of the wire 18 may be connected to the end of the support 13. The opposite end of the coil 17 may be connected to the support rod 14 while the opposite end of the wire 18 may be connected to the support 15 which may be bent similarly to the rod 12 to receive the end of the wire spaced from the end of the other wire. A short connector 19 may be provided to electrically connect the rods 13 and 14 together.

Inside of the coils 17 and 18 I preferably provide a core 20 of electron emitting material which may be any of the materials generally used to increase the emission of electrons such as the oxides of the alkali earth metals or mixtures of such oxides with a suitable binder, and if desired the core might also contain an oxide which is also capable of selective radiation such as calcium oxide. The coils 17 and 18 may be formed of any desired resistance material such as tungsten, molybdenum, tantalum, or nichrome.

The envelope 10 may be filled with an inert gas, preferably one of the monatomic gases such as argon, neon, helium, krypton, xenon, or nitrogen, or mixtures of such gases at a pressure in the neighborhood of 200 mm. of mercury. These gases should preferably be as pure as possible the impurities therein not exceeding one per cent.

With the device constructed as is shown in the drawing the envelope 10 may be connected to a vacuum pump in the usual manner and an oven placed over it to raise the temperature thereof to between 350 to 400° C., or to as high a temperature as the glass will stand without deforming. A current may be run through the filament at this time to raise the temperature to about 600° C. or to a dull red heat to drive out certain occluded gases which are then removed by the exhaust pump. When no more gas appears to be in the envelope, as is evidenced by the lack of fluorescence when high tension current is directed against the walls of the bulb from an induction coil, the current on the filament may be raised to approximately 800° C. when it will be a bright red. This will drive out the binder from the electron emitting material which is in contact with the coils and other occluded gases which may be in the wire. When the envelope appears to be free of gas again the current may be still further raised to slightly less than 1200° C. and the oven may be raised, the pump however being connected all this time to remove all the gases which are driven off.

When no more gas appears to be found in the envelope the current may be disconnected and the pump turned off and a small quantity of inert gas, such as neon gas, at a pressure of approximately ½ mm. of mercury may be introduced into the bulb and the filament current turned on again and gradually increased. Spots of localized discharge will appear on the filament or support wires and will gradually increase until a diffused glow completely fills the bulb. This appears to activate the electron emitting material and should be carried out until the glow completely fills the bulb which should take less than ten minutes.

If white discharge spots appear on the coils or support rods it is an indication that there are more gases or vapors within the bulb and the bulb should again be exhausted and the activation process repeated.

When the activation has been completed the exhaust pump should again be connected to the bulb and the gases removed, the filament having been raised for a moment to about 1400° C. and this step should be continued until a high vacuum of in the neighborhood of .3 micron is obtained. Then the pump may be disconnected, the filament current turned off, and about 50 mm. of neon gas followed by about 150 mm. of argon gas admitted into the bulb, after which the bulb may be sealed off.

It may be desirable to clean up the gases within the bulb which may be done in the usual manner by providing a container 21 with a small piece of magnesium therein. The container may be mounted upon one of the support rods, as the rod 12, by means of a wire 22 and supported in the neck of the bulb where it may be heated after the sealing off process.

A metal vapor may also be introduced into the bulb either to produce color effects or to increase the conductivity of the gas. These vapors may be such as the vapors of mercury, calcium, cæsium, rubidium, or cadmium, and they may be introduced into the bulb by placing a small quantity of a salt such as the choride of the metal in the container 21 adjacent the magnesium. When the magnesium is heated after the bulb is sealed up, as by external bombardment, the magnesium will combine with the chloride of the metal forming magnesium chloride and liberating the free metal which will then condense on the walls of the bulb to be vaporized again when the bulb is heated in use.

In Fig. 3 a modified form of the lighting element is shown in which the coils 17 and 18 are coated over the outer surface thereof with electron emitting material, while a still further embodiment of the invention is shown in Fig. 4 where the coils 17 and 18 are individually coated with the electron emitting material forming spaces between adjacent turns of the coils. If desired the electron emitting material may be incorporated in the wire so that no additional coating need be used. The well-known thoriated tungsten filament which is made by treating tungstic acid and thorium nitrate is an example of such a wire. Where additional emitting material is used the construction shown in Figs. 1 and 2 is perhaps preferred as the core of electron emitting material helps to support the turns of the coils and prevents them from touching one another.

Lead-in wires 23 and 24 may be connected respectively to support rods 12 and 15 and when these leads are connected across an electric circuit current will flow through the lead-in wire 23, the support rod 12, the coil 17, the support rod 14, the short connector 19, the support rod 13, the coil 18, the support rod 15, and out through the lead-in wire 24. This will energize the two coils 17 and 18 and heat the electron emitting material. Inasmuch as both coils are of the same length and substantially equal resistance it will be evident that the potential drop between points on adjacent coils, as the points 24 and 25 on the coils 17 and 18, will be substantially half of the voltage across the lead-in wires 24 and 25. Inasmuch as these coils are in contact with the electron emitting material electrons appear to be driven off from the core adjacent one coil to bombard the other coil with the result that the gas adjacent the coil is ionized and forms a conductive path along the outer surface of the coil and giving a halo of intense illumination surrounding the coils.

While one element has been shown mounted in the envelope 10 it is evident that additional elements may also be provided either connected in series or in parallel and while argon and neon gas have been specifically mentioned in constructing the device any of the inert gases mentioned above may be used and the mixtures of these gases with metal vapors as indicated above also come within the spirit of the invention. A pressure of 200 mm. has been referred to but this pressure may be varied as reducing or increasing it tends to cause the discharge to expand away from the element or contract toward it.

While the device has been shown connected so that current flows in the same direction through the filaments, which may be the preferred form as it makes a uniform drop in potential between adjacent turns of the filament coils, it is to be understood that other means of connecting the elements together may be used, as having adjacent ends connected which will cause the current to flow in opposite directions through the filaments.

It should be noted that a drop of substantially half the line voltage will be uniformly applied between the two filamentary wires throughout the length of the element with the result that the discharge is uniform from end to end.

Many other 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 is:

1. In an electric lamp a light emitting element comprising a double coil of wire wound with the turns of each coil lying on the same cylindrical surface and with one end of one wire electrically connected to the opposite end of the other wire, an electron emitting material in contact with both of said wires, and an ionizable gas surrounding said wires.

2. An electric lamp comprising an envelope, a lighting element having plural coils of filamentary resistance wire, said coils having a common axis and interlocking but separated turns and an end of one wire connected to the opposite end of the other wire, electron emitting material having an emissivity in excess of that from thorium oxide in surface contact with said coils, and an ionizable gas surrounding said coils.

3. An electric lamp comprising an envelope, a lighting element having plural coils of filamentary resistance wire, said coils having a common axis and interlocking but separated turns, one end of one of said coils being connected to the opposite end of the other coil, electron emitting material in surface contact with said coils, and an ionizable gas containing approximately 50 mm. of neon and 150 mm. of argon surrounding said coils.

4. An electric lamp comprising an envelope, a lighting element having plural coils of filamentary resistance wire within said envelope, said coils having a common axis and interlocking but separated turns and an end of one wire connected to the opposite end of the other wire, a core of electron emitting material having an emissivity in excess of that from thorium oxide extending through the centers of said coils and in surface contact therewith, and an ionizable gas surrounding said coils and core.

5. An electric lamp comprising an envelope, a lighting element having plural coils of filamentary resistance wire within said envelope, said coils having a common axis and interlocking but separated turns and one end of one wire connected to the opposite end of the other wire, a core of electron emitting material extending through said coils and in surface contact therewith, and an ionizable gas having a pressure of approximately 200 mm. of mercury surrounding said core and coils.

6. An electric lamp comprising an envelope, a lighting element having plural coils of filamentary resistance wire within said envelope, said coils having a common axis and interlocking but separated turns lying on the same cylindrical surface and connected one to the other, a core of electron emitting material having an emissivity comparable to that of barium oxide within said coils and in surface contact therewith, and an ionizable gas containing approximately 50 mm. of neon and 150 mm. of argon surrounding said core and coils.

7. An electric lamp comprising an envelope, a lighting element having plural coils of filamentary resistance wire within said envelope, said coils having a common axis, approximately equal diameters, and interlocking but separated turns and connected one with the other in series, electron emitting material in surface contact with said coils, and an ionizable gas containing neon and argon surrounding said coils, the pressure thereof being approximately 200 mm. of mercury.

CHESTER H. BRASELTON.