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ELECTRIC DISCHARGE LAMP

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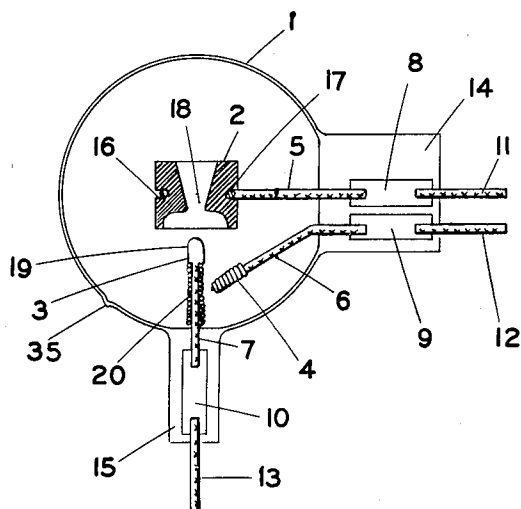


FIG. 1

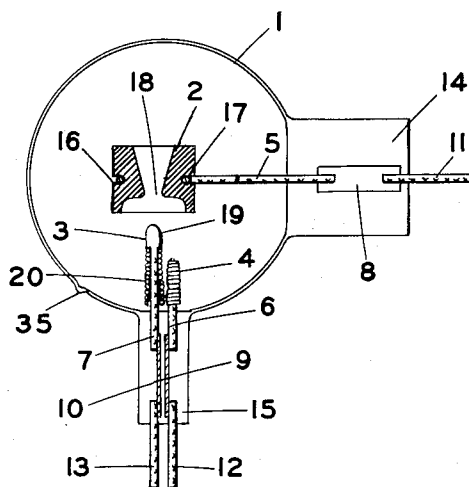


FIG. 2

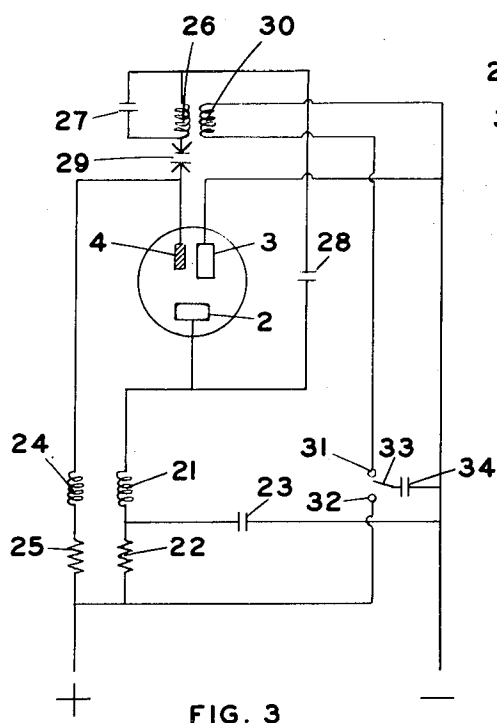


FIG. 3

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1

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ELECTRIC DISCHARGE LAMP

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2 Claims. (Cl. 313—184)

This invention relates to electric gaseous discharge lamps and particularly to such lamps for use in irradiating the photosensitive material used on the face of tri-color television picture tubes during their manufacture.

The light source for such use must be a point source of very small and precise dimensions, must be very stable and must emit sufficient radiation in the useful region, which is generally the ultraviolet region of the spectrum. The present invention attains these objects by the use of a mercury arc having a hollow anode. The minimum inside diameter of the hollow anode is the same as the diameter of the effective electron emitting area of the cathode to be used in the picture tube, and the hollow portion or throat is flared outwardly on each side of the section of minimum diameter.

Other advantages, objects and features of the invention will be apparent from the following specification taken in connection with the attached drawings in which Figure 1 shows one embodiment of a lamp according to the invention; Figure 2 shows a second embodiment; and Figure 3 shows a circuit for operating the lamp.

In Figure 1, the lamp envelope 1, which can be of quartz or of very hard glass, has the anode 2, cathode 3 and starter electrode 4 attached therein to lead-in wires 5, 6 and 7 which in turn are welded to thin molybdenum ribbons 8, 9 and 10 at one end of said ribbons, the other ends being attached respectively to the external lead-in wires 11, 12 and 13. The flat glass presses 14 and 15 enclose the molybdenum ribbons 8, 9, and 10 as shown the presses also enclosing a small length of each of the lead-in wires 5, 6, 7, 11, 12 and 13. Instead of flat press seals, the seals can also be of the type shown in copending application Serial No. 407,017 filed by William W. Burroughs, Jr., on January 29, 1954, or of other suitable type.

The envelope 1 is exhausted and filled with a rare gas or a mixture of inert gases such as argon, krypton and xenon, either singly or in combination, and can also contain a drop of mercury to provide mercury vapor on heating by the discharge. The exhaust tube 35 which connects the lamp to an exhaust during manufacturing is sealed off.

The pressure of the rare gas should be above atmospheric, and preferably about 20 to 30 atmospheres. The sealing of the exhaust tube under such high fill pressure can be accomplished by any manner well-known in the art, or by condensing the xenon out by maintaining a part of the tube at about -107° C. or lower by means of liquid air or the like. In the latter case, extreme care should be taken to avoid igniting or exploding the liquid air by the sealing flame or burner. If desired, the liquid air can be kept a short distance away from the bulb, and the low temperature conducted to the bulb by a metal rod of good heat conductivity, the rod being placed in good contact with the liquid air and with a small portion of the bulb 1.

In some cases, it may be desirable to use a lower rare gas pressure, below atmospheric, to facilitate sealing,

2

and then have only the mercury vapor pressure at several atmospheres during operation.

In Figure 2, the lamp shown is similar to that in Figure 1, except that the auxiliary electrode 4 has its lead-in wires in the press 15 which includes the lead-in wire 5.

The anode 2, which may be made of a refractory conductor such as tungsten, has an annular groove 16 in which a wire length 17 is fitted, said wire being connected to lead-in wire 5. The narrowest part 18 of the hollow throat of anode 2 is spaced from both ends of said anode. From this narrow part 18 the anode flares out on the side nearest to the cathode to receive the discharge. On the side farthest from the cathode the anode can flare out in a conical manner, the included angle of the cone being at least equal to the maximum angle which the photosensitive material subtends at the anode 2. The cathode 3 can be made of tungsten having a head 19 and a section of reduced diameter around which a thorium wire 20 is wound, or can be made in any manner usual in the art for high-pressure cathodes. The molybdenum ribbons 8, 9, and 10 can have a thickness of about 0.0007 inch and a width suitable for carrying the desired amount.

Figure 3 shows a circuit in which the lamp may be operated. The cathode 3 is connected to the negative side of the power line, as shown. The anode 2 is connected to the positive side of the power line through a choke coil 21 and a resistance 22 which act as the usual ballast for a direct current lamp. The condenser 23 may be connected from the negative side of the line to a point between the resistance 22 and choke coil 21 to facilitate starting and to stabilize the operation of the discharge. The auxiliary electrode 4 is also connected to the positive side of the line through a choke coil 24 and a resistance 25, and a high voltage secondary 26, across which a condenser 27 is placed, is connected between the auxiliary electrode 4 and the anode 2 in series with a condenser 28 and a spark gap 29 to facilitate starting. The primary 30, in inductive relationship to the secondary 26, for example by means of a common iron core (not shown), has one of its terminals connected back to the negative side of the line and the other terminal connected to a switch contact 31. The positive side of the line is connected to a switch contact 32 in proximity to contact 31 and to a condenser 34 one of whose terminals is connected to the negative side of the line. The other terminal of the condenser is connectible to either contact 31 or contact 32 by means of a toggle switch arm 33.

In operation the circuit including the lamp is connected to the positive and negative terminals of a power line as shown. This of itself will not be sufficient to start the lamp because the lamp will generally require a starting voltage higher than that of the line. Accordingly, the toggle switch arm 33 is placed in contact with contact 32 thereby charging condenser 34. The switch arm 33 is then shifted from contact 33 to contact 31, thereby discharging the condenser through the primary 30. This induces a high voltage in the secondary 26, which has a larger number of turns than the primary 30. The condenser 27 across the secondary 26 also increases the voltage across the secondary 26 by a transient effect.

This high voltage will then spark across the gap 29, thereby placing the high voltage between the anode 2 and the auxiliary electrode 4, causing a discharge through the gas between these two electrodes. The discharge so started will continue from the line through the resistance 23 in choke coil 24 after the spark across the gap 29 ceases. The cessation of the spark effectively disconnects the transformer 26 from the electrode. When the auxiliary discharge between anode 2 and auxiliary electrode 4 produces sufficient ionization of the gas the main discharge between anode 2 and cathode 3 will then

3

begin. This will drop the voltage between the electrodes 2 and 3 and current will cease to flow to electrode 4. The resistance 25 and the resistance of choke coil 24 should be sufficient to keep the discharge current between the electrodes 2 and 4 considerably smaller than that between main electrodes 2 and 3, and the line voltage should be sufficient to maintain the arc between electrodes 2 and 3 in the proper current, with the resistance 22 and the resistance of choke coil 21 in series with said electrodes.

For a lamp having an operating voltage of about 35 volts, and taking about 30 amperes to give a power input of about 1000 watts, the starting voltage will generally be about 2000 volts, if the gas filling is xenon at about 20 atmospheres pressure and the spacing between the main electrodes about 0.250 inch. The resistance 25 should be great enough to limit the current through auxiliary electrode 4 to about .050 ampere.

The device can be operated from a 110-volt line.

The throat or smallest diameter portion 18 of the anode 2 should have about the same diameter as that of the electron stream at the surface of the cathode which is to be used in the picture tube containing the photosensitive material to be irradiated, and should be placed in approximately the same position as the portion of the cathode from which the electron beam emanates.

An outer envelope can be used around the lamp if desired, to facilitate heating of the discharge, in the manner customary with high pressure mercury lamps. The amount of mercury in the envelope 1 can also be limited

4

to a value sufficient to produce the desired vapor density when completely vaporized, if desired. A suitable vapor density is that corresponding to several atmospheres of mercury vapor pressure under unsaturated conditions.

5 What I claim is:

1. A high pressure arc lamp comprising a sealed envelope, a rare gas therein, a cathode therein, and an anode in proximity to said cathode and presenting a concave surface thereto and having a hollow throat flaring outwardly from said concave surface toward the side of the anode opposite said cathode.

2. A high pressure arc lamp comprising a sealed envelope, a rare gas therein, a quantity of mercury therein, a cathode therein, and an anode close to said cathode and having an opening therein through which light from the discharge can be emitted.

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