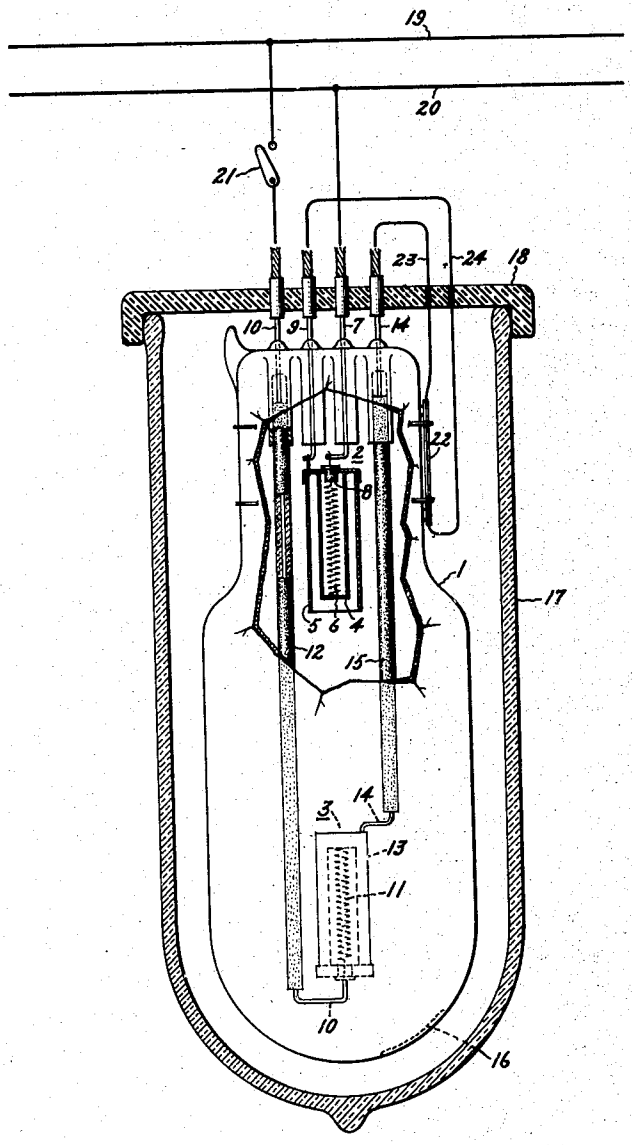
July 20, 1937. A. H. YOUNG 2,087,747

THERMIONIC DISCHARGE DEVICE

Filed Nov. 16, 1932

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Patented July 20, 1937 2,087,747

# UNITED STATES PATENT OFFICE

2,087,747

## THERMIONIC DISCHARGE DEVICE

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Application November 16, 1932, Serial No. 642,882

5 Claims. (Cl. 176—124)

The present invention, while illustrated with particular reference to an electric lamp, is of general application to electric discharge devices containing one or more thermionic electrodes. The invention will be described with particular reference to an electric lamp containing sodium vapor. An electric device of this character, a thermionic electrode, should be allowed to assume its normal operating temperature before the discharge is permitted to occur between the electrodes. Otherwise serious disintegration of such electrode will occur.

It is the object of my invention to provide a simple structure with a simple sytem of connections whereby such a device may be started into operation by a single application of voltage without complicated auxiliary devices. My invention provides a structure and electric connections rendering a vapor lamp of this character suitable for highway lighting or other installation where a minimum of complication and oversight are highly desirable.

As will be pointed out in greater particularity in the appended claims my invention comprises a lamp or other thermionic discharge device containing electrodes which are initially brought into operating temperature by the passage of current while the discharge space between the electrodes is short-circuited by a conductor containing a thermostat. This thermostat is in direct heat-receiving relation to some part of the lamp, as for example, the bulb wall adjacent one of the electrodes, so that when the electrode temperature rises to a value at which the usual emission is obtained the circuit between the electrodes is opened, thereby causing the discharge to operate through the gas.

The accompanying drawing is a side elevation partly in section of a lamp embodying my invention and also indicates circuit connections for such a lamp.

Referring to the drawing the lamp illustrated comprises a somewhat elongated envelope 1 consisting of glass or silica containing electrodes 2, 3 which preferably are similar in construction to permit the lamp to be operated on alternating current. However, my invention is equally applicable to direct current devices. In an alternating current device, the electrodes each comprise a shell 4 of nickel, iron, molybdenum, or a suitable alloy, as is well known. This shell is coated with thermionically active material as for example an oxide of an alkaline earth, preferably barium oxide, as is also well known. The shell preferably but not necessarily is provided with a surrounding heat shield 5. Within the shell 4 is a resistance heater 6 consisting of tungsten, molybdenum, or other suitable refractory metal. This resistance is connected (as shown) at its lower end to the shell 4 and to its upper end to a conductor 7, suitable insulation being provided between the conductor 7 and the shell as indicated at 8. A circuit conductor 9 is joined to the shell structure, both conductors 7 and 9 being sealed into the envelope 1 in the usual manner. The same arrangement is provided for the electrode 3. In this case a conductor 10 is provided leading to one end of the resistor 11 sealed through the envelope 1, this resistor being surrounded by a coating 12 of suitable refractory insulating material, such as alumina or beryllia, throughout substantially its entire length within the lamp to prevent the discharge from the opposite electrode passing directly to the leading-in wire from the electrode 2 instead of traversing the discharge space. The shell 13 of electrode 3 is connected to a conductor 14 which is also surrounded by an insulating sleeve 15 of alumina or beryllia and is sealed into the envelope of the lamp as indicated.

The envelope contains preferably a charge of attenuated gas as for example a gas of the "noble gas" group, such as argon or neon. The pressure of this gas preferably should be within the limits of about 0.2 to 4 millimeters of mercury. Within the envelope 1 there is also a quantity of vaporizable material, such as sodium or other alkali metal, or other metal such as thallium or cadmium as indicated at 16. The lamp is shown as being contained within an outer chamber 17 consisting of glass, or other transparent material, in order to conserve heat generated within the lamp whereby the pressure of the vapor within the lamp is maintained at an operating condition. For the better conservation of heat a double-walled evacuated chamber of the Dewar flask type may be employed as the outer heat conservator. The conductors 7, 9, 10 and 14 are suitably sealed within the cover 18 of the heat conserving jacket 17.

The conductors 7 and 10 are connected to a source of electric mains 19 and 20 from which electric energy for operating the lamp is supplied. One of these conductors preferably is provided with a suitable switch 21 for completing the lamp circuit. It is obvious that this switch may have any desired character and may be either hand operated or electrically operated as is well known. Adjacent the upper end of the bulb and within close heat receiving relation to the bulb is

a thermostat 22 which may be of well known construction and therefore will not be described in detail. The conductors 7 and 14 are connected in circuit with this thermostat by electric wires 23, 24. It will be observed that the circuit 23, 24 including the thermostat 22 is in shunt to the electric discharge space between the electrodes 2 and 3.

When the lamp is put into operation by closing the switch 21 the heaters 6 and 11 are connected in series across the supply mains 19 and 20 and become heated at operating temperature. The heat evolved from these heaters raises the electrode shell surrounding the heaters to an electron-emitting temperature and the heat from the electrodes also causes the sodium or other vaporizable material 16 to be at least partially vaporized. At a predetermined temperature of the electrodes, which ordinarily is about 900° C., the thermostat 22 opens its contacts thereby impressing the voltage of the mains 19 and 20 upon the electrodes 2 and 3. At an electrode temperature of about 900° C. sufficient electrons are emitted to support an arc-like discharge of high luminosity through the vapor or mixture of gas and vapor in the discharge space. The discharge starts immediately at substantially normal current value. For example, the described device may be operated with a space current of about six to seven amperes, the drop of voltage between the electrodes being about 15 volts. The electrode heaters 6, 11 function during operation also as steadying impedances for the arc operating between the electrodes 2, 3. If the operating voltage had been impressed upon the electrodes before the electrodes had assumed their operating temperature, then in that case deleterious disintegration of the electrodes would have occurred. This would have shortened the useful life of the lamp.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. An electric discharge device comprising an envelope, an ionizable material therein, a plurality of spaced thermionic electrodes in said envelope, said electrodes each comprising a shell and resistance heater for said shell, leading-in conductors sealed into said envelope and being connected to said electrodes, a short circuiting conductor connected to each of said electrodes and having a portion of its length external to said envelope, and a thermostat located in heat-receiving relation to one of said thermionic electrodes, and being arranged to open the short circuiting conductor circuit when said thermionic electrode has reached a predetermined temperature.

2. An electric lamp comprising an envelope, a charge of ionizable material therein, a plurality of cooperating thermionic electrodes in said envelope, each of said electrodes comprising a shell coated with thermionically active material and means for heating said shell, one end of said respective heating means being electrically connected to the associated shell, conductors sealed into said envelope and being respectively electrically connected to the other end of said heaters which is unconnected with the associated shells, a thermostat located external to said envelope and in heat-receiving relation to one of said electrodes, and an electrical circuit including the contact members of said thermostat connecting said electrode shells.

3. An electric lamp comprising an elongated envelope, two thermionic electrodes spaced at opposite ends of said envelope, each of said electrodes comprising a shell and a resistance heater therefor, conductors sealed into said envelope adjacent one of said electrodes and connected to opposite ends of the heater for said electrode, a second set of conductors also sealed into said envelope adjacent said electrode and connected to opposite ends of the heater of the second electrode, a refractory coating for said second set of conductors, a circuit connected between said electrodes and thermostatic means for opening said circuit when said electrodes have been heated to an operating temperature.

4. An electrical discharge device comprising a sealed envelope containing an ionizable medium, a plurality of cathodes, an electrical circuit including said cathodes, an anode electrically connected to each cathode, means sensitive to temperature variations disposed in effective relation to a cathode to open said circuit when said cathode reaches an electron emitting temperature and means for impressing a potential between said cathodes and anodes.

5. A lamp of the character described comprising a sealed, transparent, tubular vessel containing an ionizable gas and provided within its ends with electrodes on which electrical potential may be impressed for establishing and maintaining an arc within the tube and a conductor within the tube shunting the arc path between the electrodes and thermostatic means in the conductor adapted to be affected by heat from an electrode to open the shunt connection at a predetermined heat of the electrode.

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