

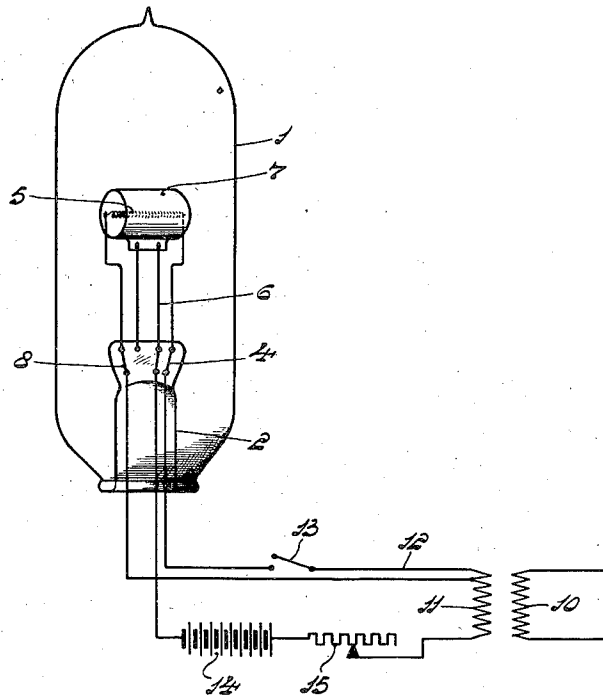
Oct. 27, 1936.

J. BRUIJNES

2,058,950

ARC DISCHARGE TUBE

Filed Aug. 4, 1931



Inventor:
Johannes Bruijnes,

by *N. F. Wundroth*
Att'y.

UNITED STATES PATENT OFFICE

2,058,950

ARC DISCHARGE TUBE

Johannes Bruijnes, Eindhoven, Netherlands, assignor to N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands

Application August 4, 1931, Serial No. 555,120
In France January 10, 1924

5 Claims. (Cl. 250—27)

This invention relates to improvements in arc discharge tubes and more particularly to discharge tubes of the said kind adapted for rectifying alternating currents, and forms a continuation in part of my copending application Ser. No. 736,343, filed Sept. 6, 1924.

It has already been proposed to use in such discharge tubes an incandescent cathode yielding an emission of electrons which is sufficient for the operation of the tube at a temperature materially lower than in the case of electrodes of tungsten. Thus for example electrodes have been used the surfaces of which contain one or more oxides of the alkaline earth metals.

It is also known to use, in arc discharge tubes having an incandescent cathode of the kind described, a gaseous filling consisting of a rare gas and more particularly of argon, the pressure of which may be several centimetres of mercury.

The invention has for its object to improve discharge tubes of the said kind so as to prolong their life without impairing their efficiency.

A discharge tube according to the invention is provided with an incandescent cathode yielding an emission of electrons sufficient for the operation of the tube at a materially lower temperature than electrodes of tungsten, an anode and a gaseous filling consisting of a rare gas or a mixture of rare gases, the pressure of the gas or gases and the distance between the electrodes being such that the tension at the arc is lower than the tension of ionization of the gaseous filling. By the expression "tension of ionization of the gaseous filling" is meant the tension of ionization of the gas that fills the tube or in the case of the mixture of gases the lowest tension of ionization of the latter. The expression "tension at the arc" is to be understood to mean the virtual voltage during the half-period in which the current flows.

The pressure of the rare gaseous filling preferably lies between five millimetres and five centimetres of mercury. Particularly advantageous is a gaseous filling of argon having a pressure between 10 and 20 millimetres of mercury. The distance between the electrodes depends on the nature and the pressure of the gaseous filling. As a rule the distance is rather small. In many cases it may be for example smaller than 1 centimetre.

The incandescent cathode which yields an emission of electrons sufficient for operating the tube at a materially lower temperature than electrodes of tungsten, may consist for example of a wire of platinum nickel or similar metal

having a rather high melting point, the said wire being coated with one or more oxides of the alkaline earth metals. The incandescent cathode may also comprise a body of platinum, nickel or a similar metal the surface of which is alloyed with one or more alkaline earth metals, at least part of the latter being oxidized.

The incandescent cathode may be constructed for example by applying upon a body of a metal such as platinum or nickel, a compound which is decomposed by heat to produce an oxide of an alkaline earth metal. Thus for example barium nitrate may be applied upon the surface of the aforesaid body, said barium nitrate being decomposed by heat into barium oxide and NO₂.

The accompanying drawing illustrates diagrammatically a discharge tube according to the invention serving as a rectifier and also shows the connections for its operation.

The discharge tube comprises a bulb 1 of glass or similar material to which a glass tube 2 is hermetically fused. Leading-in wires 3 and 4 for an incandescent cathode 5 as well as a leading-in wire 6 for an anode 7 are sealed in the clamped portion at the end of tube 2.

The incandescent cathode comprises a rectilinearly suspended coiled wire, for example of nickel, coated with material such as barium oxide or some other alkaline earth metal oxide or mixtures thereof which at a comparatively low temperature emit electrons to a marked extent. Good results are also obtained with an incandescent cathode of nickel the surface of which is alloyed with barium, at least part of which is oxidized. The anode 7 comprises a nickel plate which is cylindrically bent and surrounds the cathode substantially concentrically.

The gaseous filling consists of a rare gas, preferably of argon. The pressure of the said gas and the distance between the cathode 5 and the anode 7 are such that when the arc discharge occurs, the potential difference between the electrodes is lower than the tension of ionization of the gas. In the case of argon the tension at the arc is therefore lower than 15.3 volts. In a special construction in which the pressure of the argon is 15 millimetres and the distance between the electrodes is about 5 millimetres the tension at the arc may be about 5 to 10 volts, for example 6 volts.

Slight additions of other gases or vapours, for example of mercury vapour, sometimes occur in the rare gaseous filling without producing prejudicial effects.

The rectifier according to the drawing may be

used for example for charging a battery 14. In this case the circuit arrangement may be as shown in the drawing, the voltage of the secondary winding 11 of a transformer being supplied between the cathode 5 and the anode 7. The primary winding 10 of the said transformer may be connected to a low voltage commercial supply. In order to operate the tube a switch 13 is closed, the incandescent cathode being thus connected to a portion of the secondary winding 11. When the incandescent cathode has reached the required temperature, an arc discharge occurs between the same and the anode 7, whereupon the switch 13 may be opened. After that the incandescent cathode is maintained at the required temperature under the influence of the arc discharge. A regulating resistance 15 is mounted in series with the battery 14.

The discharge tube according to the invention is particularly adapted for charging small batteries of for instance 2 to 10 volts and operates at a materially higher efficiency than the discharge tubes operating with an arc discharge and having an incandescent cathode of tungsten, and being used for similar purposes.

What I claim is:—

1. In combination, an arc discharge device comprising an envelope, concentrically-arranged cathode and anode within said envelope, said cathode being oxide-coated and surrounded by said anode, the distance between said cathode and anode being less than and of the order of one centimeter, a gaseous filling within said envelope having a pressure less than two centimeters of mercury and sufficiently high to produce an arc discharge in said device upon application of a potential to said cathode and anode, means for heating said cathode, and means for applying an arc discharge sustaining potential to the cathode and anode.

2. In combination, an arc discharge device comprising an envelope, concentrically-arranged cathode and anode within said envelope, said cathode being oxide-coated and surrounded by said anode, the distance between said cathode and anode being less than and of the order of one centimeter, a gaseous filling within said envelope having a pressure less than two centimeters of mercury and sufficiently high to produce an arc discharge in said device upon application of a potential to said cathode and anode, means for

continuously heating said cathode during operation of the device, and means for applying an arc discharge sustaining potential to the cathode and anode.

3. In combination, an arc discharge device comprising an envelope, concentrically-arranged cathode and anode within said envelope, said cathode being oxide-coated and surrounded by said anode, the distance between said cathode and anode, being less than and of the order of one centimeter, a gaseous filling within said envelope having a pressure less than two centimeters of mercury and sufficiently high to produce an arc discharge in said device upon application of a potential to said cathode and anode, means for heating said cathode, and means for applying an arc discharge sustaining potential to the cathode and anode, said potential being less than the ionization potential of said gas.

4. In combination, an arc discharge device comprising an envelope, concentrically-arranged cathode and anode within said envelope, said cathode being oxide-coated and surrounded by said anode, the distance between said cathode and anode being less than and of the order of one centimeter, a gaseous filling within said envelope having a pressure less than two centimeters of mercury and sufficiently high to produce an arc discharge in said device upon application of a potential to said cathode and anode, and means including a transformer for continuously heating said cathode during operation of the device, and for applying an arc discharge sustaining potential to the cathode and anode.

5. In combination, an arc discharge device comprising an envelope, concentrically-arranged cathode and anode within said envelope, said cathode being oxide-coated and surrounded by said anode, the distance between said cathode and anode being less than and of the order of one centimeter, a gaseous filling within said envelope having a pressure less than two centimeters of mercury and sufficiently high to produce an arc discharge in said device upon application of a potential to said cathode and anode, means for heating said cathode, and means for applying an arc discharge sustaining potential to the cathode and anode, said last-mentioned means including a load circuit comprising a series-connected load and regulating resistance therefor.

JOHANNES BRUIJNES.