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VAPOR ELECTRIC TUBE

Filed April 18, 1938

Fig. 1

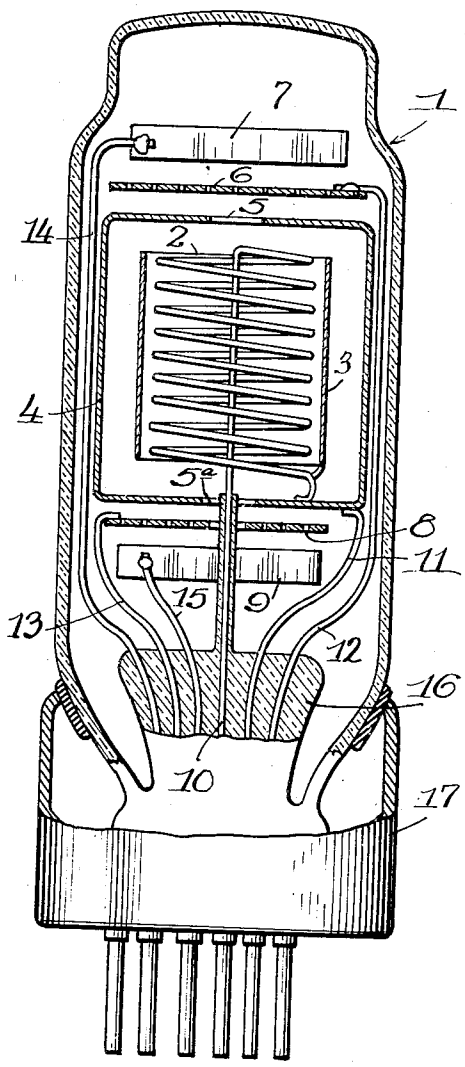
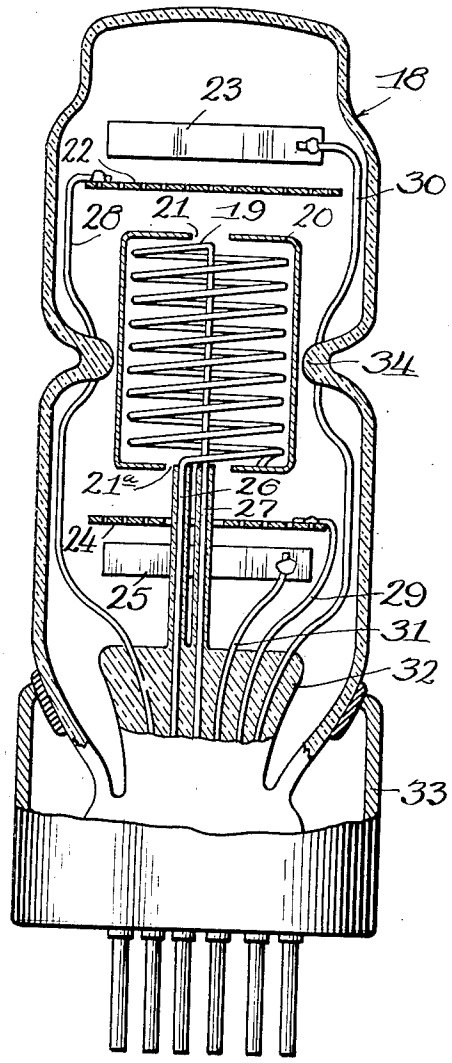


Fig. 2



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VAPOR ELECTRIC TUBE

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3 Claims. (Cl. 250—27.5)

The present invention relates to a vapor electric tube and more particularly to a novel electron discharge device or tube primarily adapted for the controlled generation and/or by-passing of appreciable amounts of electric current of either an alternating, smooth or pulsating nature, when properly excited by an external source of current supply, said tube being suitable for use in inversion, conversion, rectification and control circuits.

One of the objects of my present invention is to provide another embodiment of the electron discharge device disclosed and claimed in my reissue application, Serial No. 183,562, filed January 5, 1938, and comprising a vapor electric tube having a readily ionizable atmosphere, in combination with a common electrode or electron emitting means, and multiple grids and plates associated therewith, all so constructed, arranged, related and positioned in the tube as to permit a free but controlled flow of electrons from the entire extent or effective surface area of the common electron emitting means.

A further object of the invention is the provision of novel construction of vapor electric tube comprising a plurality of plates and grids and a common electron emitting means having a heat shield so constructed and arranged as to control the electron emission to the plates whereby the complete discharge from the common cathode or electron emitting means is made available to one plate at a time while the tube is in operation.

Another object of the present invention is to provide a novel tube of the type disclosed, which tube is constructed and parts arranged so as to be workable under varying operating conditions, voltages, frequency of operation, temperature or power out-put. In this type of tube it is of extreme importance that the parts or tube sections be so designed and positioned as to allow free intercourse of electrons and ions between tube sections, and the entire active surface of the cathode, but with the control ratio of each section not seriously affected while an adjacent section is operating in an ionized condition.

The present tube is particularly adapted for use in circuits for the conversion of direct current into alternating current, or in so-called grid controlled rectification circuits. Under such circuit conditions, stable and efficient operation has been secured with a tube of the type disclosed in which there are provided dual grids and plates with a common cathode or electron emitting means.

Further objects, advantages and capabilities will be apparent from the description and disclosure in the drawing, or are comprehended or inherent in the device.

Fig. 1 is a view in vertical cross section of one form of my novel tube construction.

Fig. 2 is a similar view of an alternate construction of tube.

Referring to Fig. 1 of the drawing which discloses an embodiment of my novel invention, there is disclosed a vapor electric tube having an evacuated bulb 1 containing an ionizable atmosphere including an alkali metal and an ionizable gas, and in which is mounted a common cathode or electron emitting means consisting of an electron emissively coated filament type cathode 2 having an electron emissively coated heat shield 3 on its opposite sides and an enclosing heat shield 4 connected to and substantially encompassing or surrounding the element 2 and shield 3, but provided with opposed openings 5 and 5a of a size permitting the discharge of electrons from substantially the entire effective area of the common emitting means at such times as required in the operation of the tube. Positioned adjacent the opening 5 is a grid 6 and plate 7, while adjacent the opening 5a is located a grid 8 and plate 9. Each element is shown as provided with the necessary lead wires, the filament being connected to a lead wire 10 having its other connected to the shields 3 and 4 and the latter in turn connected to the lead wire 11. Grids 6 and 8 are connected to the insulated lead wires 12 and 13, respectively, while plates 7 and 9 are connected to the lead wires 14 and 15, respectively. All of these leads are preferably insulated where required and are shown as taken out through the press or seal 16 and base 17 of the tube.

In Fig. 2 is disclosed an alternate construction of a tube of the type employing a readily ionizable atmosphere including an alkali metal and an ionizable gas having an evacuated bulb 18 and an electron emissively common cathode or electron emitting means comprising an electron emissively coated filament type cathode 19 having a coated heat shield 20 suitably connected to and substantially surrounding or encompassing the filament. This shield is shown as provided with opposed openings 21 and 21a of a size for by-passing the electrons from substantially the entire effective area of the common electron emitting means. As in the tube disclosed in Fig. 1, a grid 22 and plate 23 are located adjacent the opening 21, while a grid 24 and plate 25 are located adjacent the opening 21a. Also each ele-

ment is provided with the necessary lead wires with the filament connected to the lead wires 26 and 27, and to the shield 20. Grids 22 and 24 are connected to leads 28 and 29, respectively, while plates 23 and 25 are connected to lead wires 30 and 31, respectively. These leads enter through the press or seal 32 and base 33, and may be suitably insulated through any required or desired length thereof. This insulation is particularly desired where the leads pass through or in close proximity to the tube elements.

In the form of the invention shown in Fig. 2, the tube walls are constricted at a point substantially midway of the length of the shield 20 and filament 19 of the electron emitting means. This annular constriction 34 extends inwardly to adjacent the shield 20 to prevent the flow or leakage of stray electrons between the shield and constricted portion of the tube wall during the operation of the tube.

The common electrode or electron emitting means, including the filament and encompassing shield, may be of any type suitable for use with alkali metal vapors. I have secured good results by the use of the oxide coated type and of caesiated metal. The grids and anodes may likewise be of any type or material suitable for the purpose, while the electron emitting means has been found very effective when used with a noble gas filling such as neon, argon, krypton, xenon, or the like.

One tube made for the conversion of direct current to alternating in accordance with the teachings of my applications and with the elements in the same relationship but the tube differing somewhat in physical dimensions had a physical size of about one inch and three-quarters by ten inches. The common cathode heat shield was about an inch and seven-sixteenths in diameter by two inches long with an active slotted cylindrical cathode co-axially mounted in the shield and nearly two inches long by about three-quarters of an inch in diameter. Each end of the heat shield contained a hole three-eighths inch in diameter opposite the end of the hollow cathode in the end plates of the heat shield, all parts of which were composed of nickel about three-thousandths of an inch thick.

The cathode wattage rating was forty watts and this cathode supplied an average current of six amperes emission. The instantaneous sixty cycle peak rating was seventy-four amperes. The grid to cathode drop for this tube was eight volts and the anode to cathode drop about ten volts at normal current. The grids for each of the two sections of this tube were about one and three-eighths inches in diameter while the plates were about one inch in diameter. The grids were spaced about one-quarter inch from the cathode ends and the plates spaced one-quarter inch from their respective grids. The pressure of xenon gas used was of the order of two millimeters of mercury.

The above tube, when excited from a supply source of thirty-two volts direct current at an average plate current of four and one-half amperes, gave an alternating current out-put of over ninety watts at one hundred and twenty volts at about sixty cycles per second, in an inverter designed for similar tubes. Under the operating conditions just described, the tube had a useful life of several thousand hours, and started readily after a few seconds of cathode heating time.

From the foregoing figures, it can be seen that the tubes made in accordance with the present invention are very efficient for pure gas tubes, and that the active unserviced life is far longer than that obtained from other forms of present day inverter mechanisms, such as motor generators or the vibrating reed and contact inverters.

It will be clearly apparent that the novel invention comprehends an efficient and simple structure, a dual gaseous triode, for generating or by-passing appreciable amounts of current flow, in which the complete effective emitting area of the electron emitting means is available for discharge to the tube section controlling ionization at the instant of discharge, and at which instant, the grids prevent simultaneous emission to the plates. The openings in the cathode heat shields are so located and of a size sufficient to permit the complete electron discharge to be supplied to either plate, one at a time, while the spacing of the heat shield with relation to the interior wall of the tube is such as to prevent the flow or leakage of electrons between these members. Such a dual gaseous triode gives far greater stability of performance and uniformity of operation in inversion and rectification systems than may be had with separate tubes, even though closely matched pairs of tubes are employed.

Having thus disclosed the invention, I claim:

1. A vapor electric tube of the type employing multiple grids and plates and a common electron emitting means, comprising a filament and heat shield encompassing the filament and provided with openings so arranged and located as to by-pass and make available the entire electron discharge of the emitting means to one plate at a time, said encompassing heat shield extending closely adjacent the tube wall to thereby prevent leakage of electrons in the space between the shield and tube wall whereby the control ratio of one section is not seriously affected while an adjacent section is operating in an ionized condition.

2. A vapor electric tube of the type employing multiple grids and plates and a common electron emitting means, comprising a filament and heat shield encompassing the filament and provided with openings so arranged and located as to by-pass and make available the entire electron discharge of the emitting means to one plate at a time, said tube being constricted intermediate its ends to a point closely adjacent the encompassing heat shield to thereby prevent leakage of electrons in the space between the shield and tube wall whereby the control ratio of one section is not seriously affected while an adjacent section is operating in an ionized condition.

3. A vapor electric tube comprising an evacuated bulb having a readily ionizable atmosphere, two plates, two grids, and a common electron emitting means including a heat shield, said emitting means mounted intermediate said grids and effectively shielding one tube section from the other, intercommunicating means comprising apertures to permit electron and ion flow through said emitting means, the geometry of said emitting means and heat shield and said intercommunicating means being such that the grid control ratio of one tube section is not seriously affected while the other section is operating in an ionized condition.

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