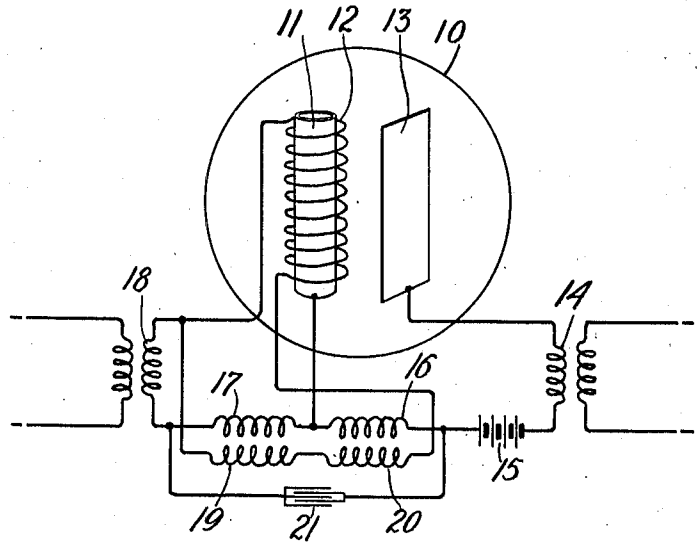
May 25, 1926. 1,586,162

J. C. R. PALMER

ELECTRON DISCHARGE DEVICE

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Inventor:
Joel C.R. Palmer
by J. C. Roberts Atty

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UNITED STATES PATENT OFFICE.

JOEL C. R. PALMER, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRON-DISCHARGE DEVICE.

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This invention relates to electron discharge devices and has as its object an improved method of heating the cathodes of such devices.

This object is attained by surrounding the cathode by a wire helix so connected with both the input and output circuits of the device that some of the energy from the output circuit is supplied to the helix and some to the input circuit whereby the device acts as an oscillator, and the high frequency energy delivered to the helix induces current in the cathode to heat it, thereby rendering it thermionically active.

Referring now to the drawings, the single figure thereof discloses an embodiment of the invention.

Within the enclosing vessel 10 are arranged the cathode 11, the control electrode 12 and the anode 13. The cathode preferably comprises a tube of metal and may be coated on its external surface with a layer of thermionically active material. The control electrode 12 comprises a helix of conducting wire and is so placed as to enclose the cathode 11. The anode 13 is shown in the form of a plate arranged adjacent the cathode and control electrode.

The anode 13 is electrically connected to the cathode 11 through the primary of a transformer 14, battery 15 and inductance 16. The cathode 11 is electrically connected to the helix 12 through the inductance 17 and the secondary of the transformer 18. The terminals of the helix 12 are connected in circuit with the inductances 19 and 20 which are operatively associated with the inductances 17 and 16 respectively so that the circuit comprising them and the helix 12 is inductively connected to both the input and output circuits of the device. A capacity 21 is shunted around the inductances 16 and 17.

In the operation of this device, the cathode 11 is initially heated by current induced therein from high frequency currents supplied to the helix from a source of high frequency (not shown). The cathode becomes thermionically active and a space current is established between it and the anode 13 in the usual manner. There are also set up in the output circuit high frequency oscillations which by means of the inductances 16 and 20, are fed to the circuit including the helix 12, thus supplying current for maintaining induced currents in the cathode 11 to keep it heated. High frequency current is also supplied to the input circuit through the medium of the inductances 19 and 17, thereby feeding back a portion of the output energy to the input circuit to cause the device to oscillate.

Varying potentials may be impressed upon the control electrode 12 through the transformer 18 to modulate the high frequency currents generated by the vacuum tube in the usual manner, the modulated high frequency being delivered to the outgoing circuit through the transformer 14.

This arrangement dispenses with the need of a battery for heating the filament and allows the utilization of the high frequency energy of the output circuit to heat the cathode.

The invention claimed is:

1. In combination, an electron discharge device having a cathode, an anode and a control electrode, said control electrode comprising a wire helix surrounding said cathode, an input circuit and an output circuit, means for supplying alternating current to said helix from said output circuit, and means associated with said cathode and said control electrode for controlling the output of said device in accordance with signals.

2. In combination, an electron discharge device having a hollow cathode, an anode and a control electrode, said control electrode comprising a wire helix surrounding said cathode, an input circuit and an output circuit, means for inductively connecting said helix and said output circuit, and means for impressing a difference of potential corresponding to signaling variations between said cathode and said control electrode.

3. In combination, an electron discharge device having a hollow cathode, an anode, circuit connections between said anode and cathode comprising an inductance, a control electrode comprising a helix surrounding said cathode and in circuit with an inductance operatively related to said first inductance, circuit connections between said control electrode and said cathode comprising an inductance operatively related to said second inductance, and means asso-

ciated with said cathode and said control electrode for controlling the output of said device in accordance with signals.

4. In combination, an electron discharge device having an anode, a cathode, and a control electrode, said control electrode comprising a wire helix surrounding said cathode, an input circuit, an output circuit, said helix being inductively connected to both said input and output circuits, and means for impressing a difference of potential corresponding to signaling variations between said helix and said cathode.

5. In combination, an electron discharge device comprising a cathode, an anode and a control electrode surrounding said cathode, an input circuit and an output circuit, said circuits being inductively connected, means for supplying high frequency current to said control electrode from said output circuit whereby the cathode is heated by induced currents, and means for impressing a difference of potential varying in accordance with signals between said cathode and said control electrode.

6. In combination, an electron discharge device comprising an anode, a cathode and a control electrode, said cathode and control electrode being inductively related to each other, an input circuit, an output circuit, means for supplying high frequency current to said control electrode from said output circuit, and means for impressing a difference of potential corresponding to signaling variations between said cathode and said control electrode.

7. In combination, an electron discharge device comprising an anode, a cathode, and a control electrode, said cathode and control electrode being inductively related, an input circuit, an output circuit, means for supplying high frequency current to said control electrode from said output circuit, and means for impressing a difference of potential corresponding to signaling variations between said cathode and control electrode.

8. In combination, an electron discharge device comprising an anode, a cathode, and a control electrode, said cathode and control electrode being inductively related, an input circuit, an output circuit, said circuits being inductively connected, means for supplying high frequency current to said control electrode from said output circuit, and means associated with said control electrode and said cathode for controlling the output of said device in accordance with signals.

9. In combination, a thermionic tube including an anode and a cathode, means for inductively heating the cathode, an external circuit utilizing said means as an electrode of the tube, and means for controlling said circuit in accordance with signals.

In witness whereof, I hereunto subscribe my name this 24 day of March A. D., 1923.

JOEL C. R. PALMER.