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ELECTRIC DISCHARGE DEVICE

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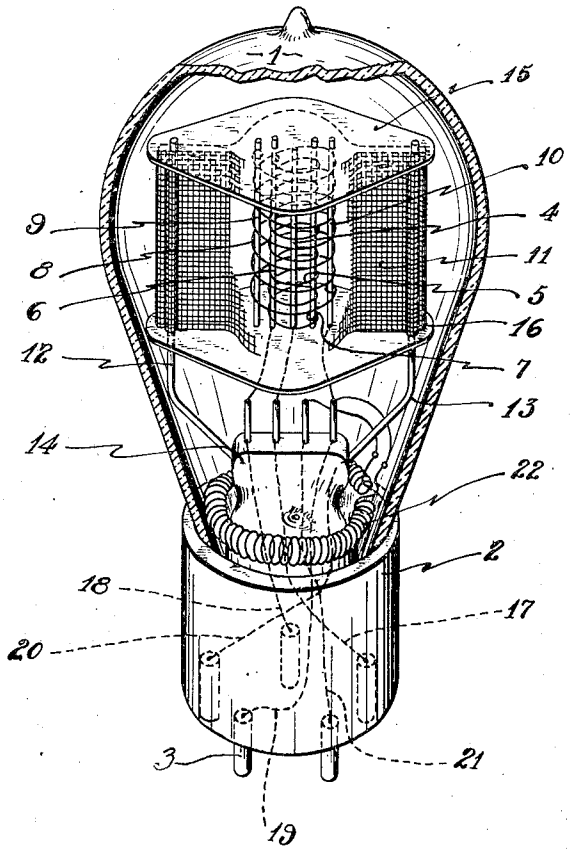

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ELECTRIC DISCHARGE DEVICE

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1 Claim. (Cl. 250—27.5)

This invention relates to electric discharge devices, and more particularly to means for controlling the same.

The principal object of the invention is to provide an electric discharge or wave repeating device provided with means for maintaining its operating temperature within a predetermined range.

Another object of the invention is to provide a wave repeating device of the electric discharge type having means for accelerating the attainment of the normal operating temperature of the device.

In certain types of repeater devices, for example those employing a gaseous or vapor content, under certain conditions it is found that the device does not attain its normal or average operating temperature until after a considerable period of time. This is particularly true where the device is to be used for power purposes.

Accordingly one of the principal objects of the present invention is to provide an adjunct to a wave repeating device of the electric discharge type, whereby the device may be rapidly brought up to its operating temperature independently of the operating temperatures of the electrodes.

While the invention will be disclosed herein as embodied in one specific type of electric discharge repeater, it will be understood that the invention is not limited thereto, but may be utilized in conjunction with any known type of repeating device having either a gaseous or vapor content.

Referring to the drawing, the numeral 1 indicates an envelope of any desired shape which is hermetically sealed and contains a filling of an ionizable material such as a gas or vapor. For example, this filling may comprise neon alone or a mixture of neon with other inert gases, or it may comprise mercury vapor in conjunction if desired, with quantities of an inert gas. The envelope 1 is provided with the usual base 2, which carries the contact prongs 3 for completing the circuit to the various electrodes within the tube. These electrodes comprise a central or rod-like cathode 4, a cathanode 5 in the form of wire helically wound around a pair of metallic uprights 6. The spacing of the turns in the cathanode 5 will depend upon the use to which the device is to be put. For example, greater emission is attained when the spacing between the turns is large as compared with the total area of the cathanode. In other words coarse spacing increases the emission per watt of energy consumed between the cathode 4 and the cathanode.

As one illustrative example, the cathanode may be made of a helically wound wire having a pitch of eight turns per inch, the wire being being approximately 0.005 inch in diameter. Surrounding the cathanode 5 is a control grid 8 which may be of any shape and structure well known in the radio tube art, and while the drawing shows this control electrode in the form of a wire helically wound around the parallel supporting posts 9 and 10, it will be understood that any other form of control grid may be employed, thus this grid may be made out of wire mesh or of foraminous metal instead of a helically wound wire. Surrounding all the previously mentioned electrodes is an anode 11 which may be conveniently made out of wire mesh or other foraminous metal structure. This anode is supported on the parallel uprights 12 and 13 sealed into the press 14. For the purpose of accurately spacing the various electrodes and at the same time completely closing the ends of the grid 8, there is provided a pair of insulating discs 15, 16. While the drawing shows these discs as lozenge shaped, it will be understood that any other type of disc may be employed. These discs are provided with perforations to receive the various supporting rods 6, 7, 9, 10, 12 and 13, as well as to receive the ends of the rod-like cathode 4.

The perforations in the members 15 and 16 through which the various electrode supporting rods pass are as closely fitted to the rods as possible, a drive fit of course being preferable. However, it is merely sufficient to have these perforations so small that no electrons can reach the anode 11 from the cathode-cathanode without passing through the control grid. It will be understood of course that the drawing is merely illustrative in this connection and that any other suitable way of completely closing the ends of the control grid may be employed so as to insure that the control grid exerts its control over all the electrons that are emitted from the cathode-cathanode space. For a further description of this phenomena and spacing, reference may be had to the application Serial No. 542,304, filed June 5, 1931 by John A. Heany and Philip M. Haffcke.

For the purpose of applying the various operating potentials to the electrodes lead-in wires 17, 18, 19, 20, 21 are provided. All these wires are sealed into and pass through the press 14. The wire 17 connects with the cathode 4, the wire 18 connects with the cathanode 5, the wire 19 connects with the control grid 8, the wire 20 connects with the anode 11. An additional lead-in wire

21 is provided for connecting with one end of the coiled heater wire 22. Preferably this heater 22 is made out of suitable resistance wire with the turns insulated from each other, and surrounds the press 14 or is positioned in any suitable place within the base of the envelope 1.

It will be understood, of course that the invention is not limited to the particular form and disposition of the heater 22. Preferably, however, this heater is positioned at a distance from the electrodes so as to more uniformly distribute the heat over the entire tube. That is to say, when the tube is actually operating there is a certain temperature produced in the electrode space which of course is in the upper end of the tube. Consequently by positioning the heater 22 at or near the base of the tube it is possible to regulate the temperature of the heater 22 so as to insure that the overall temperature of the gas or vapor within the tube is substantially uniform. It will be noted that the other end of the heater 22 is connected to the lead-in wire 19 so that current may be passed through the heater 22 to heat the same, it being understood, of course that the current supply for the resistance 22 is preferably adjustable so as to regulate the temperature of the tube.

By means of the auxiliary heater 22 the temperature of the gas or vapor filling within the tube may be brought almost instantly to a point appreciably higher than this filling would reach normally without the heater. In the case of cold cathode tubes, for example tubes of the type disclosed in Heany-Haffcke application Serial No. 542,304, the electrodes are purposely designed of sufficiently large size to reduce the current densities, and therefore require envelopes of materially larger size than are required for vacuum tubes on the same power output.

In tubes of this type therefore since the total loss in the tube is quite small, the time taken for the tube to reach this steady temperature may be appreciable. Furthermore, changes in temperature and the gaseous content of such a tube may cause a change in pressure in the gas or vapor filling. While this temperature variation may not seriously affect the operation of the tube, it is possible to increase the output of the tube and to render it more stable by utilizing the auxiliary heater 22. Furthermore, the heater 22 enables the maximum operating temperature of the tube to be obtained much more readily than where reliance is placed entirely upon the heat distributing properties of the electrodes themselves, thus providing more uniform operating conditions for the tube.

Various changes and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

An electric discharge device comprising an envelope having a bulb-like portion and a reentrant portion, said envelope having a filling of an ionizable medium, a set of electrodes mounted in said bulb-like portion, and a heater coil surrounding said reentrant portion.

JOHN ALLEN HEANY.