Feb. 2, 1926. 1,571,257

H. M. FREEMAN

GRID LEAK

Filed August 18, 1921

Fig. 2.

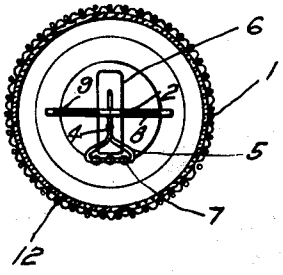
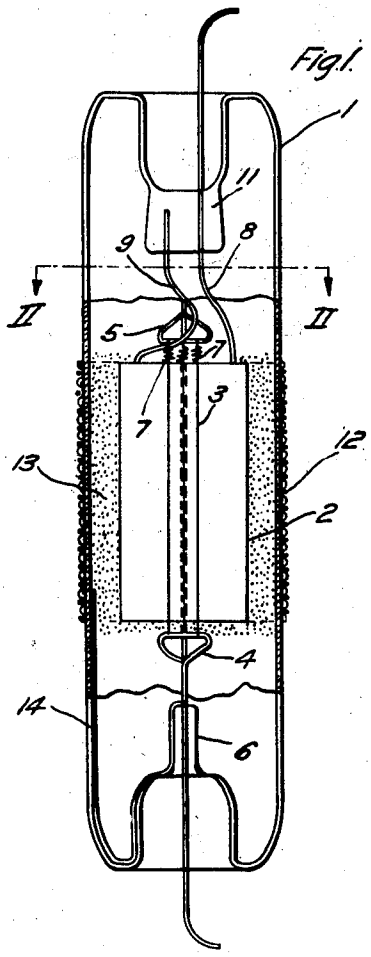


Fig. 1.



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UNITED STATES PATENT OFFICE.

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GRID LEAK.

Application filed August 18, 1921. Serial No. 493,490.

To all whom it may concern:

Be it known that I, HUBERT M. FREEMAN, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Grid Leaks, of which the following is a specification.

My invention relates to evacuated electric devices and more especially to grid leaks which may be employed in connection with such devices.

One object of my invention is to provide a grid leak which is adapted to control the negative charges formed on the inner surfaces of the containing walls of externally controlled tubes.

Another object of my invention is to deposit a metallic film on the inner surface of the containing walls of an externally controlled tube, whereby the walls of the tube may serve as a dielectric of a condenser, the opposite plates thereof being the metallic film and the external control electrode.

Other objects of my invention will be apparent from the following description, when taken in connection with the accompanying drawing and claims.

During the initial evacuation of thermionic tubes and also during the normal operation thereof, it has been found that negative electrostatic charges tend to accumulate upon the inner surfaces of the walls of the tubes.

As may readily be seen, such charges, in the usual type of three-electrode tube, tend to repel the electrons issuing from the filament and, in extreme cases, may result in the complete blocking of the electron emission from the filament.

Considering, more especially, externally controlled oscillator tubes, considerable difficulty has been experienced, heretofore, in initially starting and maintaining such tubes in an oscillatory state. The difficulty is apparently caused by the accumulation of negative electrostatic charges upon the inner surface of the tube, the charges being of such intensity that the tube ceases to function as an oscillation generator.

According to my invention, I provide means whereby the intensity of the negative electrostatic charges upon the inner surfaces of the walls of the tube may be controlled by means of a grid leak suitably disposed within the containing tube.

The desired result may be obtained by depositing a metallic film upon portions of the inner surface of the containing envelope which are opposite the electrodes and then employing a high-resistance element to connect the metallic film and a hot-cathode element within the tube. As may readily be seen, the desired result may also be obtained, without the use of the high-impedance element, by so constructing the tube as to cause the metallic deposit to serve directly as a leak between the walls of the tube opposite the electrodes and the hot cathode.

My invention may best be understood by reference to the accompanying drawing, wherein;

Fig. 1 is a diagrammatic view of an evacuated electric device embodying my invention, and

Fig. 2 is a cross-sectional view of the evacuated electric device taken on the line II—II of Fig. 1.

In the accompanying drawing, I have shown my invention embodied in a specific type of externally controlled tube, though I do not wish to be limited to such an arrangement of elements.

In the drawing, I have shown an evacuated electric device 1 as cylindrical in form and having an anode 2 and filamentary cathodes 3 suitably disposed therein. Opposite terminals of the filaments 3 are supported by means of conducting supports 4 and 5 which are mounted in a press 6. Springs 7 are interposed between one end of the filaments 3 and the supporting member 5 and serve to compensate for the expansion and contraction of the filaments during periods of operation and non-operation.

The plate or anode 2 is disposed longitudinally within the tube and substantially parallel to the plane containing the filamentary elements 3, being supported by means of the conducting supports 8 and 9 which are mounted in a press 11. The stem or press 11 is disposed in an opposite end of the tube 1 to that of the press 6. The conductor 8 may extend through the press 11 to serve as a terminal for the anode 2.

An external control electrode 12, which

for purposes of illustration, has been shown as consisting of metallic gauze, may, if desired, completely surround the tube 1. In any event, it is so disposed that the filamentary cathode 3 lies in a plane intermediate the control electrode 12 and the anode 2.

A metallic film 13, which has been shown as disposed upon the inner walls of the tube immediately adjacent the external control electrode 12, may be connected, by means of a high-resistance element 14, to the filamentary cathode 3. The metallic film 13 may be deposited upon the walls of the tube by any means well known to the art, such, for example, as by providing extra-heavy filaments 3 and then vaporizing portions thereof.

In the operation of my tube, it may readily be seen that the electrodes 12 and 13 serve as opposite plates of a condenser with the walls of the tube functioning as a dielectric. An important advantage of such an arrangement is that it eliminates the separate grid-biasing condenser which is commonly employed in series with the grid to cause the grid to assume a proper negative potential.

The main advantage of my invention, however, resides in the provision of a simple and inexpensive grid leak, whereby the intensity of the negative charges, which are formed upon the inner surface of the walls of the tube, may be adjusted to such value as to cause most efficient operation of the tube.

While I have shown only one embodiment of my invention in the appended drawings, I do not wish to be limited thereby, but I desire that only such restrictions shall be imposed thereon as are set forth in the appended claims.

I claim as my invention:

1. An evacuated electric device comprising an enclosing envelope, main electrodes forming a space-current path therein, a grid for controlling said space current and a grid leak contained within said envelope, said grid leak being of a conducting material of such a resistance that the electric flow therethrough is only sufficient to prevent the accumulation of a sufficient charge to interfere with the action of the device.

2. A three-electrode tube comprising an enclosing envelope, a space-current path, electrodes individual to said space-current path, a grid for controlling said space-current and a grid leak, said grid leak comprising a metallic film deposited upon the containing walls of said envelope.

3. An evacuated electric device comprising an enclosing envelope, an electrode and a grid leak contained therein, said grid leak comprising a metallic film deposited upon the containing walls of said envelope, and a high-resistance conductor electrically connected to said metallic film and to said electrode.

4. An evacuated electric device comprising an enclosing envelope, a space-current path, electrodes individual to said space-current path, a film of metal deposited upon predetermined portions of said enclosing envelope and a high-resistance conductor connecting said film and one of said electrodes.

5. An evacuated electric device comprising an enclosing envelope of non-conducting material, a space-current path, electrodes individual to said space-current patn, a film of metal deposited upon predetermined portions of said enclosing envelope and a high-resistance conductor connecting said film and one of said electrodes.

6. An evacuated electric device comprising an enclosing envelope and a hot cathode, a metallic film deposited upon the containing walls of said envelope and a high-resistance conductor connecting said metallic film and said hot cathode.

7. An evacuated electric device comprising an enclosing envelope, a space-current path, electrodes individual to said space-current path, an external control electrode and a co-operating internal control electrode comprising a metallic film deposited upon the inner surface of the tube, said control electrodes being so disposed that the field of force produced thereby is substantially parallel to said space-current path.

8. An evacuated electric device comprising an enclosing envelope, a space-current path, electrodes individual to said space-current path, an external control electrode, a co-operating internal control electrode comprising a metallic film deposited upon the inner surface of the tube and a high-resistance element electrically connecting said metallic film and one of said first-mentioned electrodes.

9. An evacuated electric device comprising an enclosing envelope, a space-current path, electrodes individual to said space-current path, an external control electrode, a co-operating internal control electrode comprising a metallic film deposited upon the inner surface of the tube and a high-resistance element electrically connecting said metallic film and one of said first-mentioned electrodes, said control electrodes also serving as opposite plates of a condenser.

10. A vacuum tube having a pair of electrodes suitably disposed therein and extending substantially parallel to the axis of said tube, an external control electrode disposed adjacent the walls of the tube and concentric with the axis thereof, a metallic film deposited upon the inner surface of said tube immediately adjacent the portions thereof covered by said control electrode and a high-resistance element for electrically

connecting said metallic film and one of said pair of electrodes.

11. An electronic device including main electrodes forming a space-current path, a grid for controlling said space current, a grid leak and means for utilizing said grid as one plate of a condensive coupling between said grid and said grid leak.

12. An electronic device including main electrodes forming a space-current path, a grid for controlling said space current, a grid leak and means for utilizing said grid leak as one plate of a condensive coupling between said grid leak and said grid.

In testimony whereof, I have hereunto subscribed my name this 16th day of August 1921.

HUBERT M. FREEMAN.