Aug. 4, 1925.

1,548,095

H. S. OSBORNE

VACUUM TUBE TRANSLATING DEVICE

Filed March 3, 1921

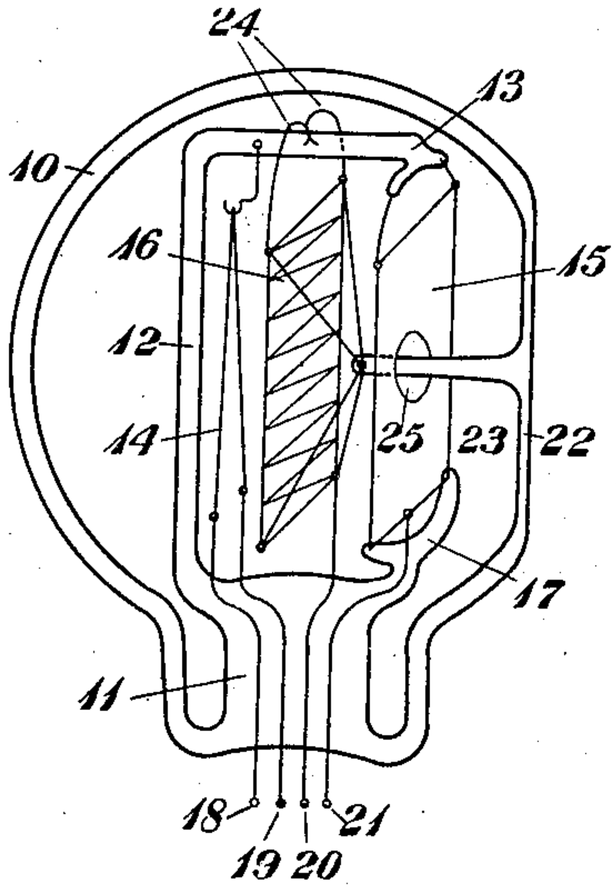

Fig. 1

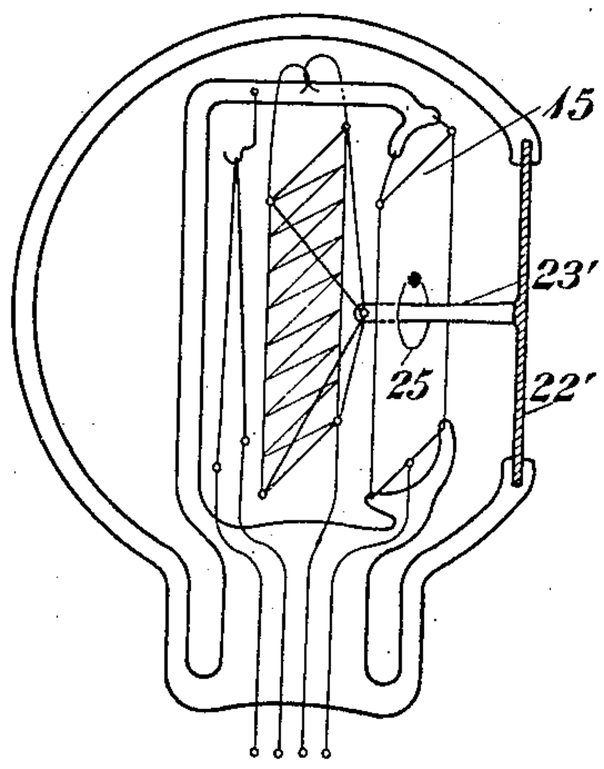

Fig. 2

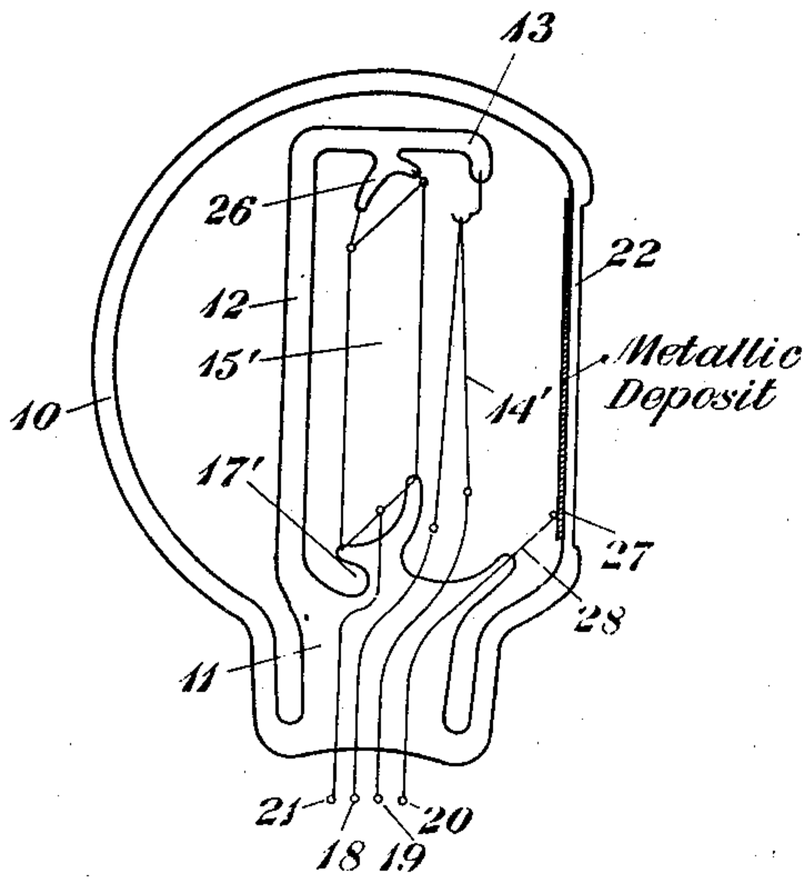

Fig. 3

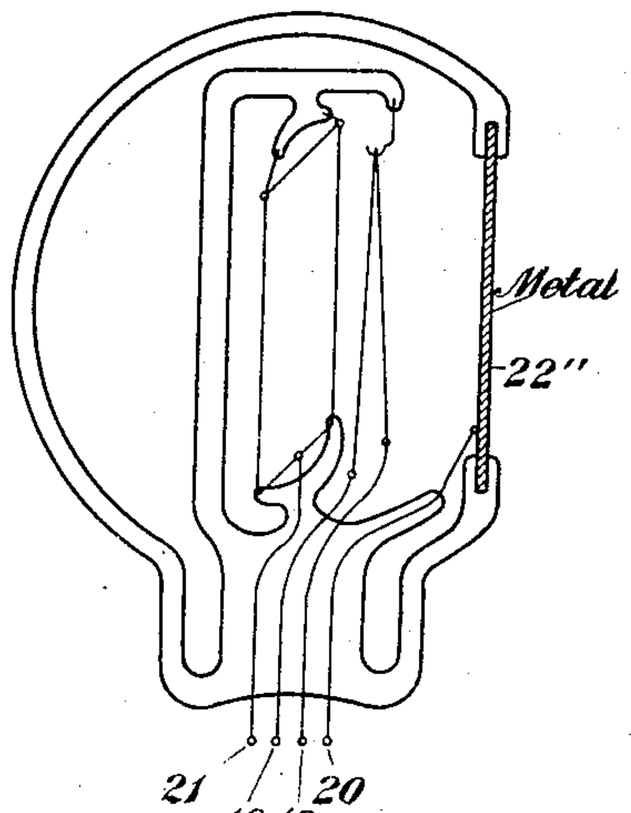

Fig. 4

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By his Attorney

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UNITED STATES PATENT OFFICE.

HAROLD S. OSBORNE, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

VACUUM-TUBE TRANSLATING DEVICE.

Application filed March 3, 1921. Serial No. 449,336.

To all whom it may concern:

Be it known that I, HAROLD S. OSBORNE, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain Improvements in Vacuum-Tube Translating Devices, of which the following is a specification.

This invention relates to translating devices, and more particularly to devices for determining the flow of electric current in a circuit in accordance with independent controlling forces.

One of the objects of the present invention is to produce a translating device which may be used as an amplifier, a generator of oscillations, or as a means for varying the flow of electric current in a circuit in accordance with signals.

These objects, as well as other objects of the invention are obtained by providing a vacuum tube arrangement of the audion type, having a heated filament, a grid and plate electrode, the grid or controlling electrode being movable mechanically in accordance with sound or other vibrations. Preferably, the movement of the grid is controlled by means of a diaphragm, which may form an integral part of the wall of the vessel itself, or may be inserted and sealed in an opening arranged in the wall of the vessel.

The invention may now be more fully understood by reference to the following description when read in connection with the accompanying drawing, Figures 1, 2, 3 and 4 of which illustrate four different embodiments of the invention.

Referring to Fig. 1, 10 designates the wall of an evacuated vessel of the well known audion type. The container formed by the wall 10 (which may be of blown glass) may be exhausted in a manner well known in the art to any desired degree of vacuum. Near the bottom of the vessel is formed a press 11 from which extends a stem 12, having an arm 13 at a right angle thereto for suspending the filament 14, plate 15 and grid 16. The plate 15 is preferably supported both at the top and the bottom so as to be as rigid as possible. Accordingly the press 11 is provided with an extension 17 to which the bottom of the plate 15 is secured, while the upper part of the plate is attached by suitable wires to the end of the arm 13. Conductors 18, 19, 20 and 21 are imbedded in the press and are connected to the three electrodes in the usual manner.

At one side the wall 10 of the vessel is made thin, as shown at 22, and formed into the shape of a diaphragm. An arm 23 extends from the central portion of the diaphragm, and the grid 16 is supported upon the arm 23 so as to be movable with the diaphragm 22. If desired, the grid 16 may be suspended from the arm 13 by means of flexible members 24, which will permit of the mechanical movement of the grid under the action of the diaphragm. The plate 15 may be provided with a perforation 25, so that the arm 23 may pass through the plate to the grid without contacting with the plate.

In operation a suitable source of current may be connected to the conductors 18 and 19 to heat the filament in the usual manner, and a source of space current may be connected between the conductor 21 and either conductor 18 or 19. The potential of the grid may be set to any fixed value desired by connecting the conductor 20 to a suitable potential source. The diaphragm 22 will be set into vibration by sound waves or other mechanical forces and, operating through the stem 23, will vary the spacial separation between the grid 16 and the filament and plate electrodes. This results in changing the coefficient of amplification of the tube in proportion to the sound or other waves affecting the diaphragm, so that the current flow between the filament 14 and plate 15 will be varied accordingly.

Instead of forming the diaphragm 22 as an integral part of the wall of the vessel, a separate diaphragm 22′ may be formed of metal, or other suitable material, and its edges imbedded in the portions of the wall of the vessel surrounding a suitable opening made in the side thereof, as indicated in Fig. 2. The joint between the edges of the diaphragm and the wall of the vessel should be made air-tight by means well known in the art, so that the vacuum within the vessel may be maintained at the desired value. The stem 23′ rigidly attached to the diaphragm 22′ may be made of the same material as the diaphragm, but. if made of conductive material, care should be taken to see that the opening 25 in the plate is sufficiently large, so that there will be no possibility of electrical contact between the

arm 23′ and the plate 13. The operation of this form of the apparatus will be similar to that described in connection with Fig. 1 and need not be further considered.

Fig. 3 shows a modified form of the invention in which the diaphragm itself may be made to function as the controlling electrode or grid. In this case the wall 10 of the vessel may be formed into a diaphragm 22 as in Fig. 1. The press 11 at the bottom of the vessel will be provided with a stem 12, having the arm 13 at right angles thereto as before. In this instance the filament 14′ will be supported at the end of the arm 13, and the plate 15′ will be fixed between a support 26, carried by the arm 13, and a support 17′, carried by the press 11, so that the filament 14′ will be arranged between the diaphragm 22 and the plate 15′. A metallic deposit 27 may be made upon the glass diaphragm 22, and an electrical connection may be made between the metallic surface thus formed and the conductor 20 by means of a wire 28.

In this form of the invention the vibration of the diaphragm 22, in response to vocal sounds or other mechanical forces, will vary the distance between the metallic deposit 27 and the filament and plate electrodes. This will produce corresponding changes in the coefficient of amplification of the tube, so that the space current flowing between the filament and plate will vary in accordance with the sound vibrations.

Instead of forming the diaphragm as a part of the glass wall of the vessel, the diaphragm may be made of conductive material 22″ and imbedded in the walls of the vessel, as shown in Fig. 2, the mechanical construction being similar to that illustrated in Fig. 2. By connecting the conductive material of the diaphragm to the conductor 20 and arranging the circuit connections of the filament and plate as before, the diaphragm itself may act as a grid or controlling electrode, so that as it vibrates in response to voice waves, for example, the coefficient of amplification of the tube will be varied accordingly.

It will be understood that in the drawing the illustrations are merely schematic and are intended to disclose the essential underlying principles without purporting to delineate a form of mechanical construction which must be rigidly adhered to in the practice of this invention. It will also be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. A translating device, comprising an evacuated vessel, electrodes within the vessel between which a discharge current may be caused to flow, an auxiliary electrode for controlling said discharge current, and a diaphragm forming a portion of the wall of the vessel, said diaphragm and said auxiliary electrode being mechanically connected.

2. A translating device, comprising an evacuated vessel, a heated filament and a plate electrode within said vessel, an auxiliary electrode for controlling the flow of current between said filament and plate, and a diaphragm forming a portion of the walls of said vessel, said diaphragm and said auxiliary electrode being mechanically connected.

3. A translating device, comprising an evacuated vessel, a plurality of electrodes within said vessel, a diaphragm forming a part of the walls of said vessel, said diaphragm being constructed, at least in part, of conductive material whereby said diaphragm may function as an auxiliary or controlling electrode.

4. A translating device, comprising an evacuated vessel, electrodes within said vessel, between which a discharge current may be caused to pass, a diaphragm forming a portion of the walls of said vessel, said diaphragm being composed, at least in part, of conductive material whereby said diaphragm may function as an auxiliary electrode for controlling the discharge between the electrodes contained within the vessel.

5. A translating device, comprising an evacuated vessel, filament and plate electrode within said vessel, a diaphragm forming a portion of the walls of said vessel, said diaphragm being formed, at least in part, of conductive material whereby said diaphragm may function as an auxiliary controlling electrode.

6. A translating device, comprising an evacuated vessel, electrodes for said vessel between which a discharge current may be caused to pass, a diaphragm constituting a portion of the walls of said vessel, and conductive material constituting an auxiliary electrode for controlling said discharge current, said conductive material being movable with said diaphragm.

7. A translating device, comprising an evacuated vessel, a heated filament and a plate enclosed within the walls of said vessel, a diaphragm constituting a portion of the walls of said vessel, and conductive material constituting an auxiliary controlling electrode, said conductive material being movable with said diaphragm.

In testimony whereof, I have signed my name to this specification this 2nd day of March, 1921.

HAROLD S. OSBORNE.