A. McL. NICOLSON.

THERMIONIC TRANSLATING DEVICE.

APPLICATION FILED APR. 16, 1915.

1,307,510.

Patented June 24, 1919.

Fig. 1.

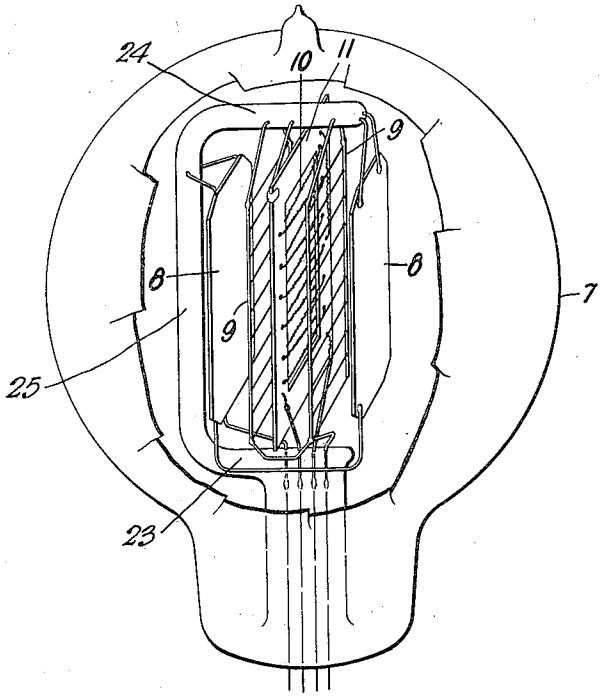


Fig. 2.

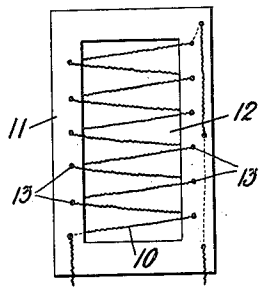


Fig. 3.

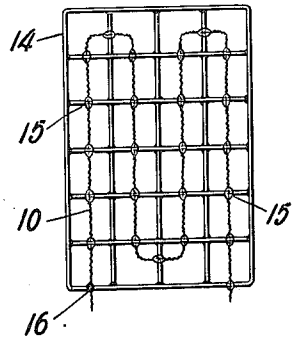


Fig. 4.

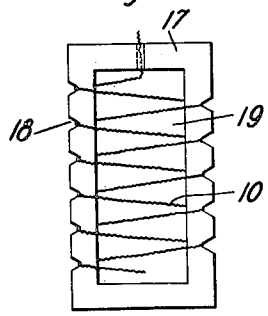


Fig. 5.

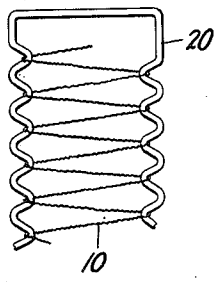
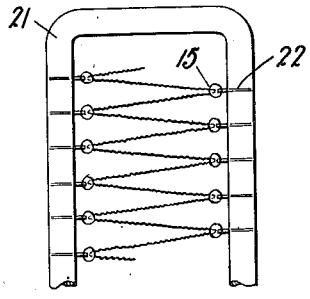


Fig. 6.



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UNITED STATES PATENT OFFICE.

ALEXANDER McLEAN NICOLSON, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTERN ELECTRIC COMPANY, INCORPORATED, A CORPORATION OF NEW YORK.

THERMIONIC TRANSLATING DEVICE.

1,307,510. Specification of Letters Patent. Patented June 24, 1919.

Application filed April 16, 1915. Serial No. 21,917.

To all whom it may concern:

Be it known that I, ALEXANDER McLEAN NICOLSON, a subject of the King of Great Britain, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Thermionic Translating Devices, of which the following is a full, clear, concise, and exact description.

This invention relates to thermionic translating devices and particularly to a mechanical structure for supporting the cathode filament of such devices. Its object is to insure a constant and uniform output of energy therefrom.

Trouble has been experienced in the past in connection with the employment of filamentary cathodes in thermionic vacuum tube devices, due to the fact that the cathode filament when heated, becomes elongated and unless some means is adopted for overcoming it, a lateral displacement or warping of the filament will occur. Inasmuch as the energy output of a thermionic device of this sort is dependent, among other things, upon the distance between the cathode filament and the other electrode members, it follows that any warping of the filament toward or away from the grid member for example, will cause an alteration in the constants of the tube. It has, in the past, been proposed where a filament of loop form has been used, to remedy this defect by providing a resilient support for the apex of the loop which places the filament under a certain amount of tension and takes up any expansion of the loop in such a way as to keep the loop in substantially its initial plane. Such tension on the filament has been found, however, to be undesirable in certain instances, as tending to decrease the life of the filament.

In the present invention, an improved method of maintaining the filament in its initial plane is provided which consists in entwining or threading the filament on a supporting member so that it will be held by the said support at a plurality of points distributed along its length. While this arrangement does not, of course, prevent the linear expansion of the filament it minimizes the effect of such expansion in that it prevents the cumulative warping effect and confines the warping to a plurality of relatively short sections, the result being that the total effective lateral displacement of the filament, due to the warping, is kept within reasonable bounds. The amount of this displacement can be regulated by the number of points at which the filament is directly supported by the supporting member. By thus limiting the lateral displacement of the filament, the output of the tube can be made extremely constant.

The accompanying drawings illustrate some of the ways in which the filament may be supported in accordance with this invention. Figure 1 of the drawings illustrates an audion employing a cathode support of the type in question; Fig. 2 shows in detail the way in which the filament is supported on the supporting member of Fig. 1; Figs. 3, 4, 5 and 6 show other arrangements of filament support which may be employed.

Referring in detail to Fig. 1 of the drawings, 7 is an evacuated glass vessel of the type customarily employed for audion bulbs. 8, 8 are the anode or plate members of the audion electrode arrangement, 9, 9 are the grid or input members and 10 is the filamentary cathode supported, in this instance, on a frame 11 of mica. The way in which the filament 10 is supported on frame 11 is illustrated in Fig. 2. Frame 11 has a central opening 12 and a row of perforations or holes 13 is located on either side of the central opening or window 12. The filament 10 which is preferably made of a twisted platinum ribbon coated with thermionically active material is threaded or laced through the holes 13 in the manner shown. It will thus be seen that the filament is supported in this particular instance at twelve different points in its length and it is therefore divided into eleven parts. As shown in the drawing a plurality of the electrodes are insulatingly supported by the unitary support comprising the parallel portions 23, 24 extending across the ends of the electrodes and at right angles thereto and to the supporting portion 25 which is parallel to the electrodes.

In the modification shown in Fig. 3 the supporting member consists of a frame of oxidized nickel wire 14. The filament 10 is threaded in and out through the meshes of this frame and may, if desired, be supported

on the grid by means of glass or quartz beads 15 which are fused around the filament and the wire of the grid at their point of contact. It has been found that beads of this sort can be employed very satisfactorily and that they can be applied without, in any way, injuring the active coating of the filament. The nickel oxid coating on the wires of the frame 14 serves to insulate the filament from the frame. Where a metal supporting frame is used, as in the case of Fig. 3, it has been found advisable to ground one end of the filament 10 to the frame work 4 as at 16. This is for the purpose of preventing any accumulation of charge on the frame 14 and thus maintaining the filament and its supporting frame work at the same potential. In the modification illustrated in Fig. 4, the supporting framework 17 is made of quartz with notches 18 cut in its outer edges, the filament 10 in this case being zig-zagged in and out of the central opening 19 and supported by the walls of the notches 18 as shown.

In the modification of Fig. 5 an inverted U-shaped support 20 of oxidized nickel wire is used. The legs of this support are spiraled and the filament is wound in and out between the two legs as shown. In a further modification of Fig. 6 the supporting member 21 is of glass. The filament is fastened by means of glass or quartz beads 15 to small oxidized nickel wires 22 which are fused into the legs of the support 21. All the modifications shown have the common property of supporting the filament without tension at a plurality of points along its length in such a manner that the lateral displacement due to linear expansion will not be cumulative but will be distributed among a plurality of relatively short sections, the terminals of which are rigidly held in their initial plane. Furthermore, the lateral displacements of the various sections will not necessarily be in one direction as some of the sections will tend to warp in one direction and some in another. Thus it will be seen that the effective active plane of the filament as a whole will remain at a substantially constant distance from the other electrodes in the tube, thereby insuring constancy and uniformity in the operation of the device as a whole.

What is claimed is:

1. A device of the audion type comprising a thermionic cathode, an anode and an auxiliary electrode, means for supporting said auxiliary electrode, said cathode being filamentary in form, and a planary supporting frame therefor parallel to one of said electrodes and comprising spaced parallel members.

2. In a thermionic translating device, members spaced apart comprising a plurality of filament supporting points, a filamentary cathode supported thereon and vitreous bonds between said filament and its several supporting points.

3. In a thermionic translating device, a metal supporting frame, a filament supported at a plurality of points by said frame, and a conductive connection between one end of said filament and said frame.

4. In a thermionic translating device, an input electrode, a supporting frame having a plurality of upright and transverse members and a filamentary cathode interwoven on said members and contacting therewith at a plurality of points whereby the effective plane of said cathode is maintained at a substantially constant distance from said input electrode.

5. Parallel supporting members, a filamentary thermionic cathode insulatingly supported at a plurality of points thereby, a grid frame at each side of said cathode, and an arbor for supporting said members and said frames.

6. In a thermionic translating device, the combination of a plurality of electrodes, parallel members extending across the ends of said electrodes and insulatingly supporting said electrodes.

7. A thermionic device comprising an evacuated vessel, a press therefor, electrodes within said vessel, wires extending from a plurality of said electrodes, and an insulating member extending substantially parallel to said press and insulatingly supporting said wires.

8. A device of the audion type comprising an evacuated vessel, a press, parallel grids, a frame therebetween and a filamentary electrode wound back and forth on said frame, substantially at right angles to the axis of said press.

9. A device of the audion type comprising an evacuated vessel, a press, parallel grids, a frame adjacent thereto, and a filamentary cathode wound back and forth on said frame, substantially at right angles to the axis of said press.

10. A device of the audion type comprising parallel grids, a support therebetween comprising spaced parallel members, and a cathode extending between said members and supported thereby.

11. A thermionic device comprising an evacuated vessel, a press therefor, cathode and anode electrodes within said vessel, wires extending from said electrodes, and an insulating member extending substantially parallel to said press and insulatingly supporting said wires, said electrodes being arranged between said member and said press.

12. A thermionic device comprising an evacuated vessel, a press therefor, cathode, anode and control electrodes within said vessel, wires extending from said electrodes,

and an insulating member extending substantially parallel to said press and insulatingly supporting said wires, said electrodes being arranged between said member and said press.

13. A thermionic device comprising an evacuated vessel, a press therefor, cathode, anode and control electrodes, wires extending from said electrodes, and an insulating member extending substantially parallel to said press and insulatingly supporting said wires.

14. A thermionic device comprising an evacuated vessel, a press, a support comprising parallel members and a connection therebetween and at right angles thereto, one of said members being fastened to said press and extending substantially at right angles to the axis thereof, cathode, anode and control electrodes extending between said parallel members and supported thereby.

15. A thermionic device comprising an evacuated vessel, a press, a support comprising parallel members and a connection therebetween and at right angles thereto, one of said members being fastened to said press and extending substantially at right angles to the axis thereof, a cathode surface, two grid surfaces and two plate surfaces extending between said parallel members and supported thereby.

16. A thermionic device comprising an evacuated vessel, a press, an arbor connected to said press, and a plurality of electrodes comprising a pair of plate electrode surfaces, a pair of grid electrode surfaces, and a cathode supported by said arbor, said plate electrodes having individual supporting connections to said arbor.

In witness whereof, I hereunto subscribe my name this 14th day of April, A. D., 1915.

ALEXANDER McLEAN NICOLSON.