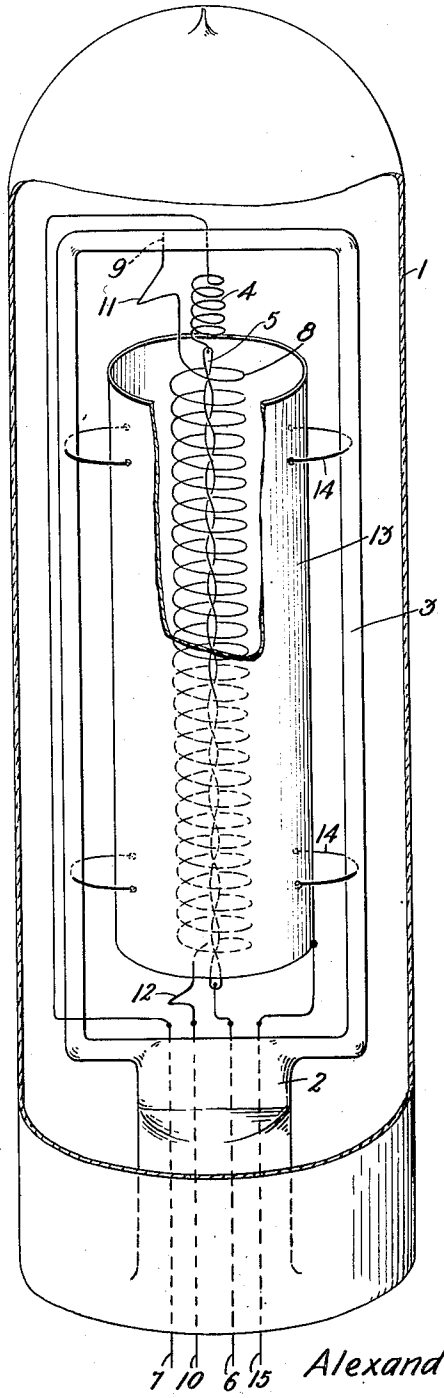
Jan. 8, 1924. 1,480,219

A. McL. NICOLSON

VACUUM TUBE

Filed June 25, 1917



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by J. E. Roberts Atty

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UNITED STATES PATENT OFFICE.

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

VACUUM TUBE.

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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 Vacuum Tubes, of which the following is a full, clear, concise, and exact description.

This invention relates to improvements in vacuum tubes for instance, of the audion type which may be employed as amplifiers, detectors, modulators, oscillators, etc.

An object of the invention is to increase the efficiency of such tubes so that a better control of the electron stream in the tube may be secured. This is done by providing a novel form and space relation of the electrodes. In this case a straight filament is symmetrically surrounded by a helical input electrode which serves as the grid. The output electrode is a cylindrical shell concentric with the grid electrode. The electrons pass in all radial directions from the filament through the interstices of the helical grid to the surrounding cylindrical output electrode. Thus the electrons pass to the output electrode no matter what path they may take from the filament, and all of the electron paths are intercepted by portions of the helical grid, with this arrangement of electrodes, the space current flowing between the filament and ouput electrodes is efficiently controlled by the input potential applied to the filament and grid electrodes.

The invention further resides in the means for mounting the electrodes in the relation above stated.

The invention will be more specifically described in connection with the drawings in which the figure shows an embodiment of the invention.

The audion shown in the drawing comprises an evacuated bulb 1 having the usual squash or press 2 from which rises the glass rod support 3. As shown in the drawing, the squash 2 forms the upper part of a tubular stem which is sealed into the lower end of bulb 1. Sealed in the top of the glass rod 3 is a spring 4 of nickel wire, for instance, to the lower end of which is fastened a filament 5 of twisted platinum wire, which may be coated with an alkaline earth compound in order to increase the thermionic activity of the filament. Current may be supplied to the filament through the leading-in wire 6 connected to the lower end of the filament and through the leading-in wire 7 connected through the spring 4 to the top of the filament. Surrounding the filament is a helical input electrode or grid 8, supported at 9 in the top of the glass rod 3. Electrical connection may be made to the grid 8 by means of the terminal 10 connected to the lower end of the grid. This grid is preferably mounted under axial tension to compensate for any sagging of the grid that might otherwise occur when the same becomes heated under operating conditions. This tension of the grid 8 and also the proper adjustment of this grid with respect to the filament 5 may be secured by kinking the outer terminals of the grid 8 as shown at 11 and 12. Concentrically surrounding the grid and filament is the output electrode or anode 13 which is in the form of an open-ended cylindrical shell. The output electrode 13 is suitably supported by wires 14 which are soldered to the cylindrical shell and which are sealed in the glass rod 3. Electrical connection may be made to the output electrode 13 by means of the terminal 15 electrically connected to the lower end of the electrode 13.

It will be seen from the above that the electrodes may be conveniently mounted and arranged in proper relation to each other before the press is placed in the tube and sealed therein, an advantage which could not be had if the electrode connections were passed through the wall of the tube at separated points.

What is claimed is:

1. A vacuum tube comprising a press, a helical electrode supported from said press, and means for maintaining said electrode under tension in the direction of its axis.

2. A vacuum tube comprising a press, a rod extending thereabove, and a helical electrode connected at one end to said press and at the other end to said rod, and having the axis of its helix extending from said press to said rod.

3. A vacuum tube comprising a press, an electrode, a pair of supports extending there above, and an electrode mounted on said supports and comprising a continuous surface

surrounding said first electrode, said supports being located outside of said second electrode.

4. A vacuum tube comprising a stem for lead wires, a pair of supports extending from said stem, and a cylindrical anode mounted on said supports, said supports being located outside of said anode.

5. A thermionic device comprising a press, a cathode, a grid surrounding said cathode, an anode surrounding said grid, lead wires in said press for said electrodes, and supporting rods outside of said electrodes, said rods, press and lead wires comprising the sole supporting means for said electrodes.

6. A vacuum tube comprising an evacuated envelope, several electrodes supported at their opposite ends respectively within said envelope, and means connected to at least two of said electrodes for maintaining a uniform space relation between the electrodes during expansion of the same under heat.

7. An electron discharge device having an electrode, a grid supported at its opposite ends and means for compensating for expansion of said grid whereby a uniform distance is maintained between said grid and said electrode.

8. An electron discharge device having a cathode, a grid and an anode, means for supporting said grid at its opposite ends and means for compensating for expansion of said grid whereby a uniform distance is maintained between said grid and said anode.

9. An electron discharge device comprising an anode, a cathode, and a control electrode, said control electrode comprising a plurality of elements of wire arranged to form a discontinuous surface, and means to place said elements individually under tension for maintaining the space relation of said electrodes substantially constant.

In witness whereof, I hereunto subscribe my name this 22nd day of June, A. D., 1917.

ALEXANDER McLEAN NICOLSON.