Dec. 15, 1925. 1,565,708

W. R. BULLIMORE

THERMIONIC VALVE

Filed Oct. 11, 1922 2 Sheets-Sheet 1

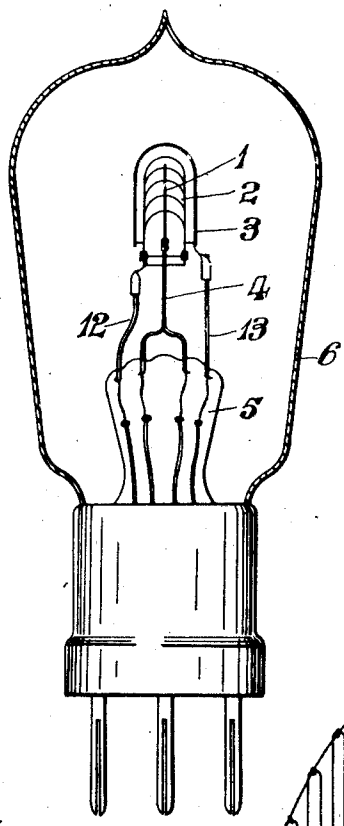

Fig. 1.

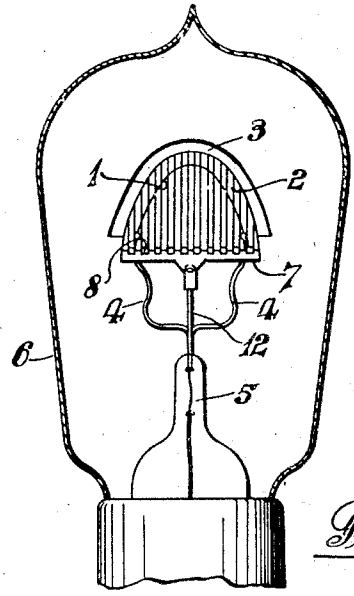

Fig. 2.

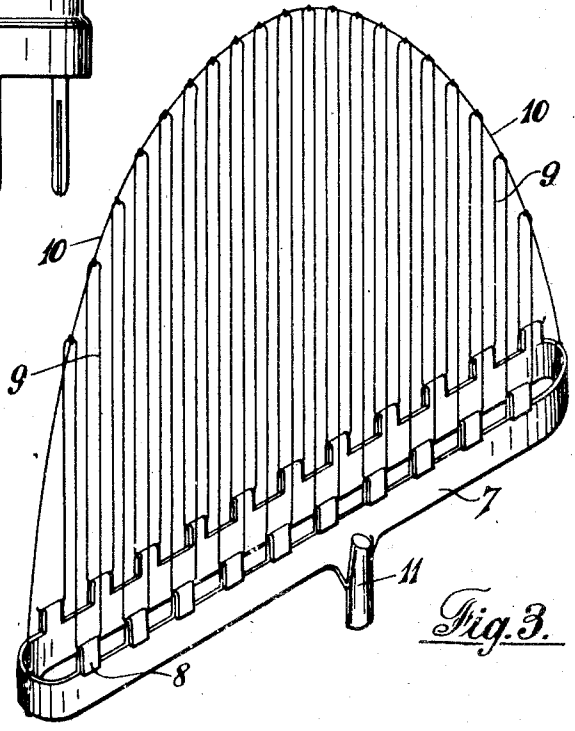

Fig. 3.

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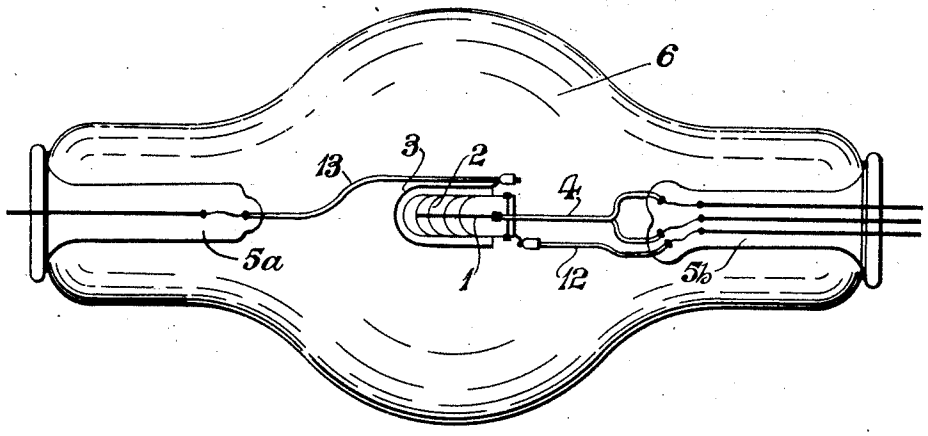

Fig. 4.

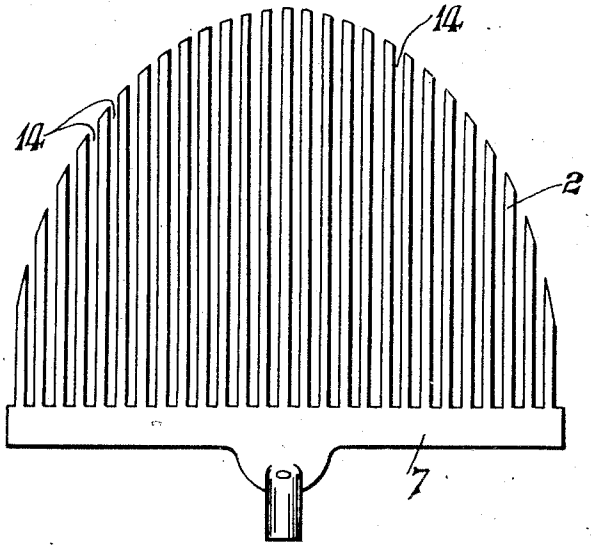

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM RICHARD BULLIMORE, OF LONDON, ENGLAND.

THERMIONIC VALVE.

Application filed October 11, 1922. Serial No. 593,849.

To all whom it may concern:

Be it known that I, WILLIAM RICHARD BULLIMORE, a subject of the King of Great Britain and Ireland, residing at Aberdeen Lane, Highbury Grove, London, N. 5, England, have invented new and useful Improvements in Thermionic Valves (for which I have made application for Letters Patent of Great Britain, No. 17,232, filed June 22, 1922), of which the following is a specification.

This invention relates to improvements in thermionic valves, having more particular reference to those of the three electrode type principally employed for wireless telephony and telegraphy, in which a grid is interposed as a controlling device between a heated filament and an anode.

The object of the invention is to provide a thermionic valve in which a heated filament, a grid electrode and an anode are so assembled as to ensure total utilization of electron emission and preserve during use constant or practically constant interspacing of the electrodes.

In the present invention, correct interspacing of the electrodes is not only maintained, but by the special construction employed, rendered more secure against vibration of the grid or anode, or drooping or sagging of the filament as the result of use. In wireless telephony, considerable stress is laid upon the necessity of eliminating microphonic noises due to vibration of the electrodes and this can only be achieved by rigid mounting of the respective parts and maintenance of such rigidity against considerable movement or vibration external to the bulb or evacuated vitreous container of the valve.

According to the present invention a thermionic valve of the three electrode type comprises an arched filament, an arched grid having flattened sides enclosing the filament and an anode of similar shape to and of larger dimensions than the grid enclosing both filament and grid, all of the electrodes being independently and rigidly supported from one or more re-entrant tubes of a vitreous container. According to the preferred method of construction the grid electrode is formed from a collar having parallel sides and rounded ends and means for securing thereto a number of wire loops the tops of which form an arch concentric with the filament.

Reference will now be made to the accompanying drawings which illustrate by way of example a thermionic valve constructed according to the invention and in which:—

Fig. 1 is an elevation partly in section,

Fig. 2 is an elevation partly in section looking in a direction at right angles to Fig. 1,

Fig. 3 is a perspective view of the grid on an enlarged scale,

Fig. 4 is an elevation showing the application of the invention to a container having two re-entrant tubes and

Fig. 5 is a view of a modified construction of grid.

In the drawings, 1 is the cathode filament, 2 the grid and 3 the anode. The filament is mounted between two conductors 4 in such a manner as to form an arch which may be nearly semicircular or of similar form, but is arranged preferably so that the distance between the terminal ends is less than the height of the arch (see Fig. 2). The filament may consist of a single wire as shown, or of a coiled wire supported in a similar manner. The conductors 4 which are of sufficient rigidity to support the filament are sealed into the re-entrant tube 5 of an evacuated vitreous vessel 6.

Over the filament 1 is disposed the grid electrode 2 which is constructed preferably, as follows:—

A collar 7 of suitable material is disposed substantially below the filament, such collar having parallel sides and curved ends (see Fig. 3). The collar in its unassembled state is formed with castellations on its upper edge which are subsequently bent over to provide hooks 8.

According to one form, the grid mesh is formed as shown in Fig. 3 from a continuous length of wire which is laced alternately under hooks on opposite sides of the grid forming loops 9 which extend over the filament 1 and are of such length that the curvature of the top of the finished grid is concentric with that of the filament. The ends of the grid wires and the loops 9 are permanently secured in place by closing the hooks 8 or by spot welding or by closing the hooks 8 and by spot welding whilst to maintain the loops 9 in parallel positions a bracing wire 10 secured at its ends to the curved end portions of the collar 7 may be employed which being curved concentrically

with the filament 1 preserves the interelectrode spacing. The wire 10 may be looped around the loops 9 at their uppermost points or may be secured thereto as by spot welding. Additional bracing wires may be employed if desired to stiffen the vertical portions of the loops 9. One of the parallel sides of the collar 7 is formed with a lug or socket 11 for attachment to a strong supporting conductor 12 sealed into the re-entrant tube 5.

An alternative method of constructing the grid is to pierce holes in the supporting collar 7 in place of the castellations and to thread the wire forming the loops 9 through such holes and fix them by spot welding or other appropriate means.

According to another form the grid may be made by stamping slots 14 from sheet metal to the form shown in Fig. 5.

Over the grid is disposed the anode 3 which preferably consists in a sheet metal stamping of larger dimensions than the grid 2 but following closely the shape of the latter. The anode is mounted on a support 13 constituting also an electrical conductor and sealed into the re-entrant tube 5.

In an alternative method of construction a vitreous container (see Fig. 4) having two re-entrant tubes 5^a and 5^b from the former of which the anode is supported whilst the tube 5^b supports the filament and grid, may be provided.

In operation it is found that the valve described gives a high electrical efficiency as with the formation and disposition of the electrodes described practically the whole of the electron emission from the filament is utilized and electrification of the glass is reduced to a minimum. Further it is free from microphonic disturbances and the filament and several electrodes maintain their parallelism despite frequent and prolonged use. Moreover, consistent with the results obtained, it is more economical to manufacture and can be produced in bulk with a high degree of uniformity.

I claim:—

1. A thermionic valve comprising a vitreous container, an arched cathode filament, a hollow grid electrode enclosing said filament and having flat sides meeting along a curved edge disposed parallel to said filament, an anode of similar shape to and of larger dimensions than said grid electrode enclosing said filament and grid electrode and means for independently and rigidly supporting all of said electrodes from a re-entrant tube in said vitreous container.

2. A thermionic valve comprising a vitreous container, re-entrant tubes formed therein, an arched cathode filament, a hollow grid electrode enclosing said filament and having flat sides meeting along a curved edge disposed parallel to said filament, an anode of similar shape to and of larger dimensions than said grid electrode enclosing said filament and grid electrode and means for independently and rigidly supporting all of said electrodes from the re-entrant tubes in said vitreous container.

3. A thermionic valve comprising a vitreous container, a re-entrant tube formed therein, an arched cathode filament, a grid electrode having a plurality of wire loops and comprising a collar having parallel sides and rounded ends with means for securing thereto said wire loops, the tops of said loops forming an arch concentric with the filament, an anode enclosing said filament and grid and means for independently and rigidly supporting all of said electrodes from said re-entrant tube.

4. A thermionic valve comprising a vitreous container, a re-entrant tube formed therein, an arched cathode filament, a grid electrode comprising a collar having parallel sides and rounded ends, a series of castellations around the upper edge of said collar, hooks formed on said castellations and wire laced around said hooks to form loops enclosing said filament, an anode enclosing said filament and grid and means for independently supporting all of said electrodes from said re-entrant tube.

5. A thermionic valve comprising a vitreous container, a re-entrant tube formed therein, a plurality of rigid conductors sealed into said container through said tube, a hollow sheet metal anode having parallel sides meeting along an arched edge mounted on one of said conductors, a hollow arched grid electrode mounted within said anode on another of said conductors and an arched filament enclosed by said grid electrode and carried by two of said conductors.

6. A thermionic valve comprising a vitreous container, an arched cathode filament mounted therein, a hollow grid electrode having flat sides meeting along a curved edge disposed parallel to said filament, said grid electrode being formed of looped wires enclosing said filament and a sheet metal anode of similar shape to and of larger dimensions than said grid enclosing both filament and grid.

7. A thermionic valve comprising a vitreous container, a re-entrant tube formed therein, an arched cathode filament, a grid electrode comprising a collar having parallel sides and rounded ends, a series of hooks formed round the edge of said collar, wire laced around said hooks to form a series of loops enclosing said filament, a sheet metal anode of similar shape to and of larger dimensions than said grid electrode enclosing said grid and filament and rigid conductors sealed in through said re-entrant tubes carrying said electrodes in rigid equispaced relationship.

8. A thermionic valve comprising a vitreous container, an arched cathode filament mounted therein, a hollow wire grid electrode enclosing said filament having flat sides meeting along a curved edge disposed parallel to said filament, a sheet metal anode of similar shape to and of larger dimensions than said grid enclosing both filament and grid and means supporting said electrodes in rigid equispaced relationship within said vitreous container.

In witness whereof I affix my signature.

WILLIAM RICHARD BULLIMORE.