July 28, 1925. 1,547,812

W. F. HENDRY

VACUUM TUBE AND METHOD OF MANUFACTURING THE SAME

Filed Sept. 4, 1919

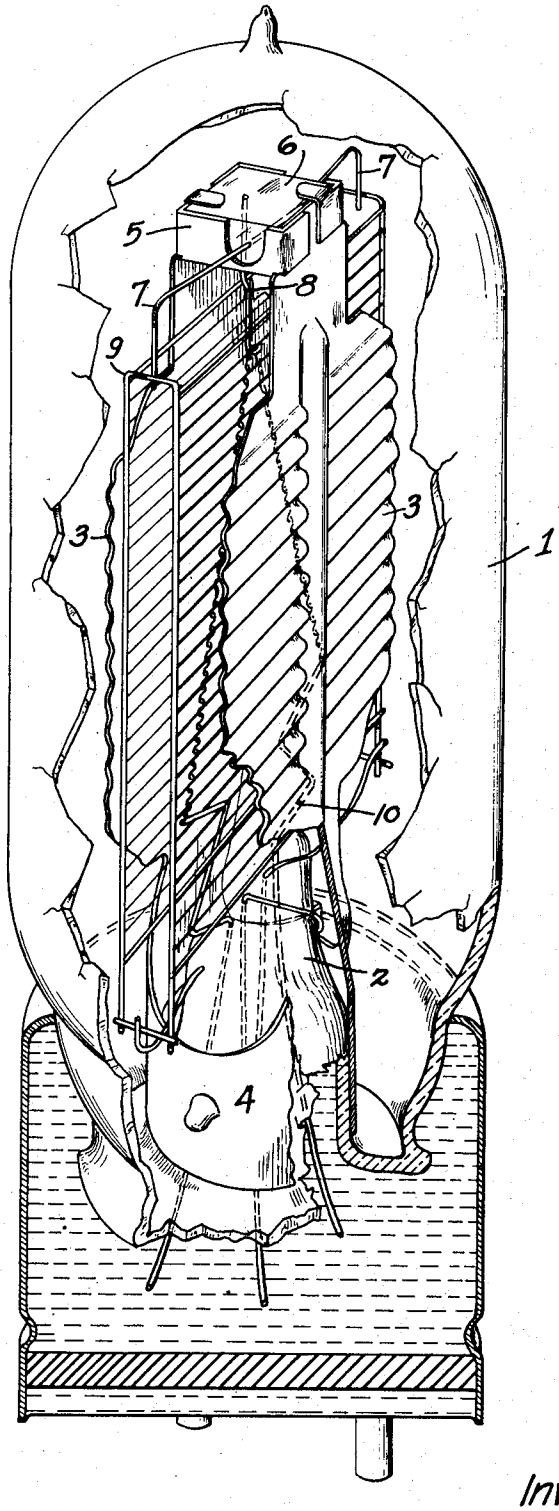


Fig. 1

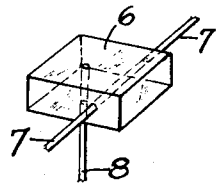


Fig. 2

Inventor
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by J. E. Roberts Atty

Patented July 28, 1925. 1,547,812

UNITED STATES PATENT OFFICE.

WILLIAM FERRIS HENDRY, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

VACUUM TUBE AND METHOD OF MANUFACTURING THE SAME.

Application filed September 4, 1919. Serial No. 321,672.

To all whom it may concern:

Be it known that I, WILLIAM FERRIS HENDRY, a citizen of United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Vacuum Tubes and Methods of Manufacturing the Same, of which the following is a full, clear, concise, and exact description.

This invention relates to a method and apparatus for manufacturing vacuum tubes, and particularly one in which the use of the usual glass cane or stem for the support of the electrodes is avoided.

The object of the invention is the provision of a fusible insulating material in association with the electrode structure, whereby a more intimate and effective connection between the insulating material and the electrode structure can be achieved. One of the electrodes within the evacuated vessel, in conjunction with the insulating material, serves as a supporting unit for the other electrodes within the vessel, and thereby avoids the use of a glass cane or arbor, as a support for the electrode unit.

The invention comprises the provision of a block of glass within the vacuum tube, but spaced apart from the same, and associated with the electrode structure so as to afford means for spacing some of said electrodes and supporting others.

More particularly the use of this glass block in connection with the other electrodes is as follows:

One of the electrodes is connected at one end to a wall of the containing vessel. To the other end of this electrode, the block of glass is connected and from this block of glass, by means of wires inserted therein, the other electrodes are supported, thereby providing a rigid unitary structure which is self-supporting without the aid of glass canes or arbors. This glass block may be formed in any suitable manner, but a preferred manner is to pour molten glass into a mold into which the wires have previously been inserted and allow it to cool. The glass more firmly and intimately grips the wires than other insulation materials into which wires have previously been inserted.

The invention is illustrated in the drawing, of which Fig. 1 represents the preferred form of tube embodying the features of the invention, and Fig. 2 represents a perspective view of the glass block with the wires imbedded therein.

As illustrated, the vacuum tube comprises an evacuated vessel 1 having a glass squash or press 2. An electrode 3, which is shown in the form of a double surface electrode has a collar 4 at its lower end. The abutting ends of the collar 4 are suitably welded together, whereby the electrode 3 is rigidly supported from the press 2. This electrode 3 is shown as provided with reinforcing corrugations and ribs to give it the proper amount of rigidity. This electrode 3 is formed from raw material into an integral blank and then bent around so that the two surfaces of the electrode are arranged in an opposed parallel relation, as shown, with the upper ends disconnected. A metallic box 5 is formed in suitable die members, and is slipped over the ends of the electrode surface 3 to provide a metallic connection and a spacing unit for the surfaces of electrode 3. Within this box 5 is placed a block 6 of glass which has been molded to the proper form, and has imbedded therein wires 7 and 8, these wires serving to support respectively a grid 9 and a filament 10. It is within the scope of my invention that the wires 7 and 8 may be suitably held in place in the box 5, and molten glass be poured into the box around the wires thus forming a very effective union between the wires, the box and the various electrodes, which thereby are more effectively spaced. The grid, plate, and filament are electrically connected at their lower ends to the usual lead-in wires. The specific details of the structure of the tube shown in the drawing and the method of making the double surface electrodes are described in an application, Serial No. 217,565, filed February 16, 1918, in the name of W. F. Hendry, and entitled "Vacuum tubes", and in U. S. Patent No. 1,426,734, dated August 22, 1922, in the name of W. F. Hendry, entitled "Methods of manufacturing audions."

Fig. 2 shows the form of glass block used, and this block may be molded in place after the electrode unit has been assembled. or it may be molded separately. A method and apparatus for separately molding the glass blocks with the wires inserted therein is shown and described in U. S. Patent No. 1,396,759, dated Nov. 15, 1921, in the name

of Jillard and Bracken, entitled "Manufacture of insulating supporting blocks."

The present invention is not confined to the detail of this structure but involves generically the use, in an evacuated vessel, of an insulating block of glass which may be rigidly and intimately associated with one of the electrodes within the vessel and serving to support another electrode without having any direct connection between the glass block and the glass of the vessel itself, —i. e., the glass block is not connected to the vessel by a material similar in properties to itself, as by means of other insulating material such as a glass stem or the like.

What is claimed is:

1. An electron discharge device comprising an evacuated vessel, a plurality of electrodes of which one is an anode, said anode having opposed parallel surfaces, a block of glass supported by one end of said anode to space the surfaces thereof and serving as a support for another electrode, said block of glass being spaced apart from and connected to said vessel only by metallic material.

2. An electron discharge device comprising an evacuated vessel, a plurality of electrodes of which one is an anode, said anode having opposed parallel surfaces which are connected at one end to the vessel, a block of fusible material connected to the other end of said anode to space the surfaces thereof and serving as a support for another electrode, said block being spaced apart from and connected to said vessel only by metallic material.

3. An electron discharge device comprising an evacuated glass vessel, a plate, a grid, and a filament, said grid being between the plate and filament, a block of glass supported by the innermost end of the plate, said block serving as a support for the grid and filament, said block of glass being spaced apart from and connected to said vessel only by metallic material.

4. An electron discharge device comprising an evacuated glass vessel, a plate, a grid, and a filament, a block of glass supported by the plate at the innermost end thereof, said block serving as a support for the grid and filament, and metallic means for supporting said plate from said vessel.

5. An electron discharge device comprising an evacuated vessel, a plate electrode having opposed surfaces, a grid and a filament, said plate electrode being connected to the vessel at its lower end, a block of glass supported by the upper end of the plate electrode to space the surfaces thereof and serving as a support for the grid and the filament, said block of glass being spaced apart and connected to said vessel only by metallic material.

6. An evacuated vessel containing a thermionic unit, comprising a plate electrode having opposed surfaces, a grid and a filament, said plate electrode being connected to the vessel at its lower end, a block of glass supported by the upper end of the plate electrode to space the surfaces thereof and serving as a support for the grid and filament, said block of glass being spaced apart from and connected to said vessel only by metallic material.

7. An evacuated vessel containing a thermionic unit, comprising a plate electrode, a grid and a filament, said plate electrode comprising two surfaces spaced apart in opposed relation and being connected to the vessel at their lower ends, a block of glass carried by the upper ends of said surfaces to space the same, and a plurality of wires imbedded in said block and serving to support the other electrodes, said block of glass being spaced apart from and connected to said vessel only by metallic material.

8. A method of manufacturing vacuum tubes, which comprises connecting a plurality of electrode surfaces to the stem of a tube, joining the other ends of said surfaces within the vessel by a fusible insulating material, embedding supports in said insulating material and mounting other electrodes on said supports.

9. The method of manufacturing vacuum tubes which comprises connecting a plurality of electrodes at one end to the tube, forming a mold section at the other end of said electrodes and pouring a fused insulating material into said section to space and support the electrodes.

10. A method of manufacturing vacuum tubes which comprises forming a block of insulating material having wires embedded therein and projecting therefrom, assembling a plurality of electrodes, associating said block with one of said electrodes and supporting the other electrodes by said wires.

11. The method of manufacturing a multiple plate electrode for vacuum tubes which comprises maintaining electrode plates in proper space relation and applying molten insulating material to said plates, permitting said material to cool to space and support the plates.

12. A vacuum tube having anode, cathode and control electrodes, a block of fusible insulating material supported by one of said electrodes and supporting wires for the other two electrodes projecting into said block.

13. A vacuum tube having anode, cathode and control electrodes, a block of insulating material supported by one of said electrodes, said block being arranged at that end of the supporting electrode remote from the base of the tube, and means carried by said block for supporting the other electrodes.

14. A vacuum tube comprising an inwardly projecting neck, anode, cathode and control electrodes, a block of fusible insulating material, one of said electrodes having an integral portion mounted on and supported by said neck, said block being supported by said last-mentioned electrode at the end thereof remote from said neck, and means for supporting said other electrodes from said block.

In witness whereof, I hereunto subscribe my name this 28th day of August A. D., 1919.

WILLIAM FERRIS HENDRY.