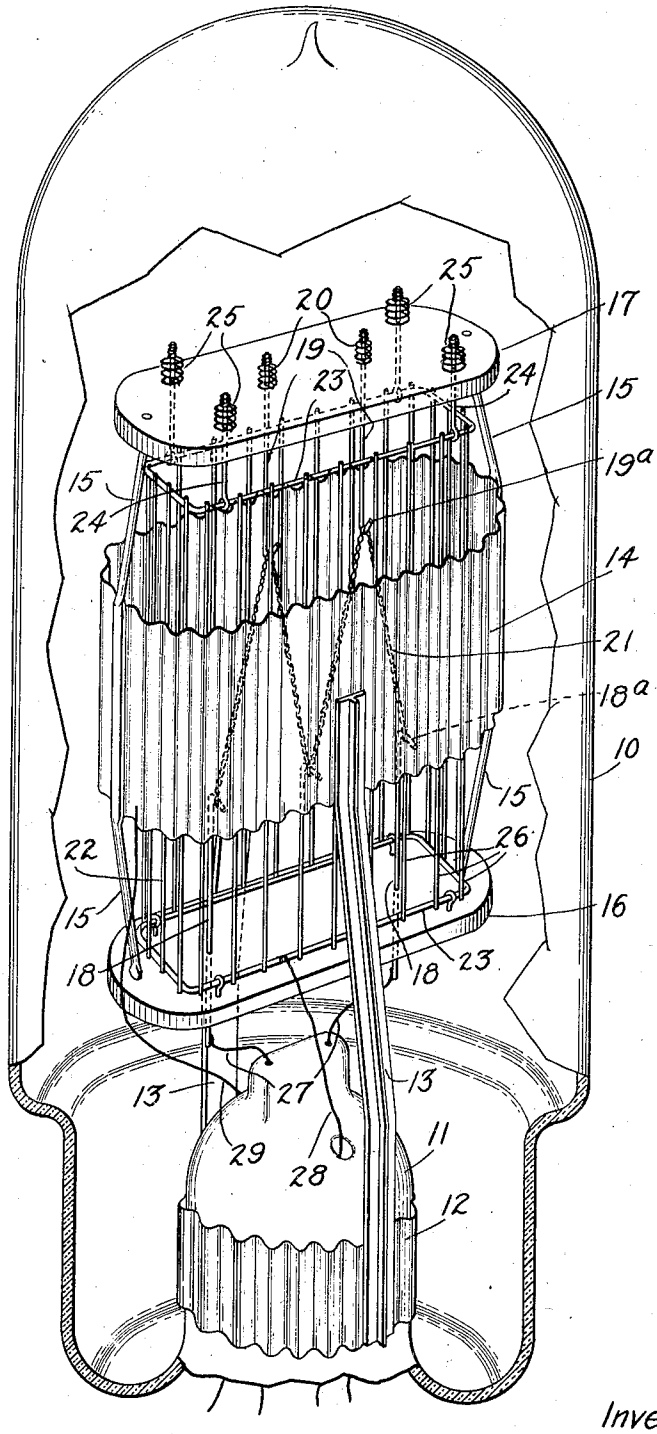
Feb. 9, 1926. 1,572,721

W. G. HOUSKEEPER

VACUUM TUBE

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Inventor:
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by W. C. Beatty Atty.

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UNITED STATES PATENT OFFICE.

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

VACUUM TUBE.

Application filed December 11, 1920. Serial No. 429,923.

To all whom it may concern:

Be it known that I, WILLIAM G. HOUSKEEPER, a citizen of the 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, of which the following is a full, clear, concise, and exact description.

This invention relates to vacuum tubes and pertains more especially to the structure of the grid or control electrodes.

Grids for high power vacuum tubes have hitherto been formed by welding a number of small lateral wires to several heavy frame wires, the frame wires spacing and supporting the lateral wires in proper relative position with respect to the other tube elements. The frame wires have usually extended within the main electron flow between the cathode and anode and where the temperature caused by such flow has been excessive it has been customary to make both the frame and lateral wires of molybdenum or other metal having low vapor pressure under operating conditions. The high temperature necessary to weld together the molybdenum frames and lateral wires results in the crystallization of the molybdenum at the junction points thus producing brittle joints which are apt to fail and destroy the usefulness of the grid.

It is an object of this invention to provide a grid for high power tubes in which the advantageous qualities of molybdenum are utilized without encountering the mechanical disadvantages above outlined.

To accomplish this object the grid is made of somewhat greater over-all length than the cathode and the anode and is composed of iron or nickel top and bottom frames to which are welded molybdenum lateral wires. When the grid is assembled with the cathode and the anode, the arrangement is such that the top and bottom frames of the grid are sufficiently removed from the active part of the tube to prevent them being unduly heated. The welding of the molybdenum lateral wires to the nickel or iron frames can be accomplished at a temperature sufficiently low to prevent crystallization of the molybdenum. The connections between the lateral wires and the frames are tenacious and endure throughout a life equal to that of the other elements of the tube.

This invention will be better understood by having reference to the following specification and accompanying drawing wherein is disclosed a preferred embodiment of the invention.

The vacuum tube comprises a bulb 10 having a re-entrant stem 11 upon which is arranged a metallic collar 12. Mounted on the collar 12 and extending into the interior of the bulb are supports 13 to the upper ends of which is attached the anode 14. Arms 15 extend upwardly and downwardly from the anode 14 and support at their free ends, the blocks 16 and 17 of lavite. Carried by the blocks 16 and 17 are supporting wires 18 and 19, the ends of which extend to the level of the edges of the anode 14, and are bent to provide hooks 18^a and 19^a. The wires 19 extend through the block 17 and are supported on springs 20. The cathode comprises a wire 21 which is swung over the hooks 18^a and 19^a. Interposed between the cathode and the anode and supported by the blocks 16 and 17 is the grid 22, which is of considerably greater over-all length than either the cathode or the anode and which projects beyond both ends of the anode. This grid comprises top and bottom frames 23 of which the latter is rigidly fastened to the block 16 and the former is supported at intervals by the hooks 24 which extend through the block 17 and are mounted on the springs 25. Lateral wires 26 extend between the frames. The top and bottom frames are formed of some material having a low fusing point, such, for example, as iron or nickel. The lateral wires are of a metal having a low vapor pressure and a high volatilization point, such for example, as molybdenum tungsten or the like. The lateral wires are welded to the end frames. Leading in wires 27, 28 and 29 are provided for the cathode, grid and anode respectively.

Because of the relatively low fusing point of the metal of the end frames, the molybdenum wires may be welded thereto without raising them to a temperature sufficiently high to cause crystallization. The arrangement of the grid relative to the anode and cathode is such that the end frames thereof are sufficiently removed from the main electron stream between the cathode and anode as not to be raised to a temperature at which their vapor will prevent operation of the tube. There is, therefore, no danger of the molybdenum lateral wires coming loose from

the end frames, and the grid has sufficient strength to withstand the usage to which it is put.

What is claimed is:

1. A control electrode for vacuum tubes comprising end frames of metal having a relatively low fusing temperature and lateral wires extending between said frames, said wires being composed of a metal having relatively low vapor pressure.

2. A control electrode for vacuum tubes comprising, end frames of metal having a relatively low fusing temperature and molybdenum lateral wires extending between said frames.

3. A control electrode for vacuum tubes comprising nickel end frames and molybdenum lateral wires extending between said frames.

4. A control electrode for vacuum tubes comprising nickel end frames and lateral wires extending between said frames, said wires being composed of a metal having a relatively low vapor pressure.

5. In a vacuum tube, cathode, grid and anode electrodes, said grid electrode being interposed between the other electrodes and comprising end frames of metal having a low fusing temperature and lateral wires joining said frames said wires being composed of a metal having a relatively low vapor pressure point, said end frames being out of the main electron stream between the cathode and anode.

6. In a vacuum tube, cathode, grid and anode electrodes, said grid electrode being interposed between the other electrodes and comprising end frames of metal having a relatively low fusing temperature and lateral molybdenum wires extending between said frames, said frames being arranged beyond the ends of said other electrodes.

7. In a vacuum tube, cathode, grid and anode electrodes, said grid electrode being interposed between the other electrodes and comprising end frames of nickel and lateral wires of molybdenum extending between said frames, said frames being arranged beyond the ends of said other electrodes.

8. In a vacuum tube, grid, cathode and anode electrodes, said grid comprising a pair of rigid end frames and lateral wires extending between said frames, the junction of the frames and lateral wires being out of the main electron stream between said cathode and anode electrodes.

9. In a vacuum tube, a block, members resiliently mounted on said block at intervals, a frame carried by said members, and lateral wires joined to said frame.

10. In a vacuum tube, a block having apertures, members extending through said apertures, a frame carried by said members, resilient means carried by said block and supporting said members, and lateral wires extending from said frame.

11. In a vacuum tube, a block having apertures, members extending through said apertures, coiled springs carried by said block and supporting said members, a frame mounted on said members, and lateral wires extending from said frame.

In witness whereof, I hereunto subscribe my name this 6th day of December A. D., 1920.

WILLIAM G. HOUSKEEPER.