

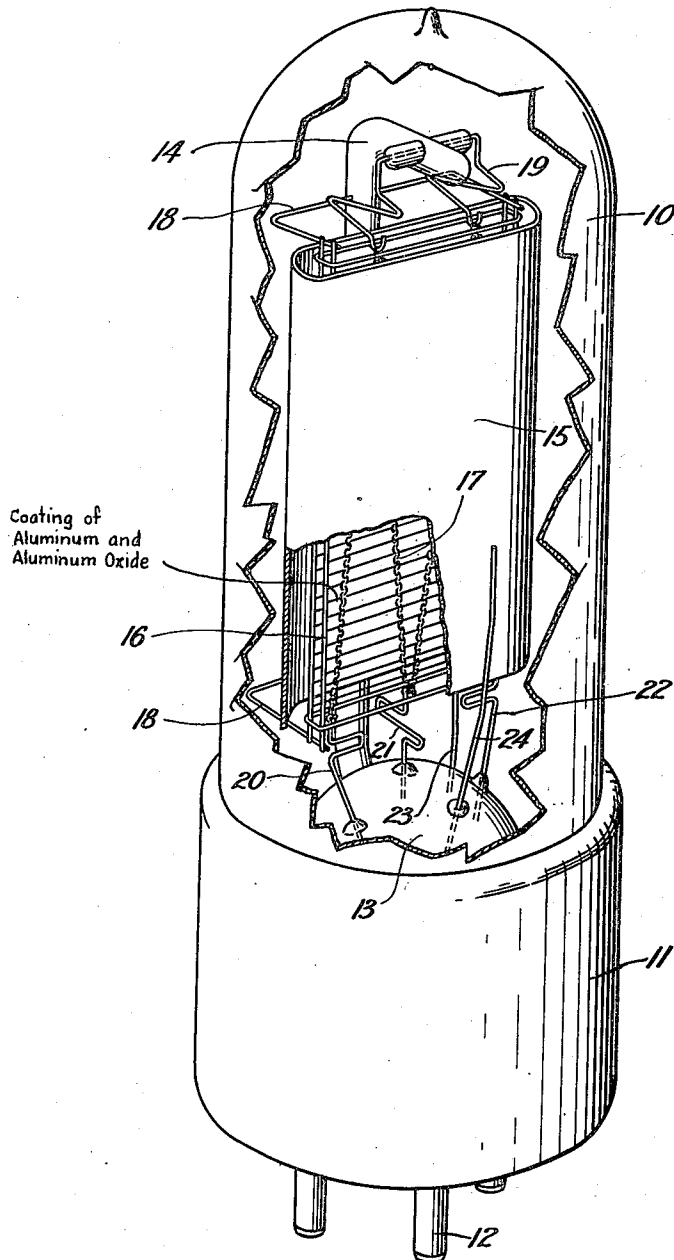
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J. R. WILSON

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ELECTRON DISCHARGE DEVICE

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Inventor:
James R. Wilson
by *E. W. Adam* Att'y.

UNITED STATES PATENT OFFICE.

JAMES R. WILSON, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRON-DISCHARGE DEVICE.

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This invention relates to electron discharge devices and has for an object the prevention of secondary electron emission from the grid of a vacuum tube.

5 In devices of this character provided with a thermionically active coated filament, the high operating temperature of the filament causes particles of the active coating to vaporize, some of which deposit on the grid.
10 This deposit prevents the proper operation of the tube, since the heat of the grid causes the deposit thereon to emit electrons. This grid emission causes a "blocking effect" on the electron stream, thereby paralyzing the
15 continued operation of the device.

This blocking is eliminated in accordance with this invention, by providing on the grid, a coating which combines with the thermionically active particles thrown off
20 the filament to form compounds or compositions which are not thermionically active at the temperature of the grid. In a tube having an alkaline earth oxide coated filament, a coating preferably of aluminum is formed
25 on the grid which completely prevents emission from the grid as it combines with the alkaline earth metals or oxides to form aluminates which are thermionically inactive compounds. A further function of this
30 coating is to aid in cleaning up the tube during operation by fixing the oxygen or other gases within the tube.

Referring to the drawing the single figure illustrates an electron discharge device
35 equipped with a control electrode treated in accordance with this invention.

The electron discharge device as illustrated, comprises an evacuated glass vessel 10, to which the usual base portion 11 is
40 attached. This base portion provides a support for suitable terminals 12. Within the vessel 10 is a glass stem 13 from which an arbor 14 arises. This arbor provides means for supporting an anode 15, a grid 16, and
45 a filament 17 having an alkaline earth oxide coating, preferably formed of barium and strontium oxides. The anode, as shown, is in the form of a flattened cylinder and is supported by suitable wires (not shown) extending from the arbor 14. A wire grid 16
50 is positioned within the anode 15 and is supported from the arbor by wires 18. The cathode or filament 17 is placed within the grid and supported from the upper end of
55 the arbor by the resilient wire hooks 19.

This filament is supported at the lower end by resilient connections 20, 21, and 22, the wires 20 and 22 also acting as the leading-in wires. The wires 23 and 24 are connected respectively to the grid and anode. These
60 wires are sealed to the glass stem 13 and are connected to the terminals 12 in any well-known manner.

In the manufacture and preparation of the electrodes for assembly within the evacuated
65 vessel, the control electrode or grid 16 may be made of any desirable material such as nickel, iron or chromel. The grid, in accordance with this invention, is given a treatment whereby an aluminum coating is
70 formed thereon, which, in the operation of the device, combines with particles thrown off the filament to form a compound or composition which is not thermionically active. As it is somewhat difficult to apply alumi-
75 num alone to the grid, it is coated with a mixture of powdered aluminum and pulverized fused aluminum oxide, the latter product being commercially known as "alundum," and acting somewhat in the nature of
80 a binding. This method of coating is known as calorizing in the metallurgical art. One method of coating the grid in accordance with this invention, is to provide a powdered mixture of approximately 50% alumi-
85 num and 50% of pulverized fused aluminum oxide. This mixture is placed in a nickel box and one or a number of grids are embedded in the powdered mixture. The grids
90 are preferably preglowed before inserting in the powdered mixture to remove surface oxides and occluded gases. After embedding the grids in the powdered mixture the box may be placed in an electric oven and a
95 stream of hydrogen passed over the box for a period of twenty minutes. The heating current is turned on and the material held at a temperature of approximately 850° C. for about one and a half hours. This treat-
100 ment provides a thorough coating of the metal grid and forms a bright hard coating which has a flaky appearance. This coating is substantially non-porous in structure yet highly absorbent as to its gas fixing
105 characteristics.

The calorized grid, when assembled in an electron discharge device performs the ordinary function of a control electrode notwithstanding the hard insulating coating on the grid, while the oxide coating forms an
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insulating wall between the grid and the filament whereby any particles thrown off from the filament will be taken up by the aluminum or aluminum oxide coating to
5 form a compound of barium or strontium aluminate or a composition of these aluminates which is not an emitter of electrons. This arrangement considerably improves the operation of electron discharge devices;
10 since the taking up of active particles by the grid tends to annul the further operation of the control electrode, because that electrode becomes an electron emitter, thereby blocking the electron stream to the anode.
15 Due to the presence of the aluminum, either alloyed with the grid or suspended in the oxide coating, a continuous cleaning up effect is carried on during the operation of the device, since the gases evolved from the
20 electrodes are absorbed by the aluminum which has "getter" properties. This function of the coating considerably increases the life and activity of the filament by fixing the occluded gases and maintaining a high
25 degree of evacuation in the device.

Although a particular mixture of the composition has been disclosed, it is apparent that the coating may be modified to suit various conditions so long as the final coating
30 contains free aluminum. Furthermore,

it is also within the scope of the invention to alloy aluminum with the metal of which the grid is composed.

What is claimed is:

1. An electron discharge device comprising a cathode having a thermionically active coating, a grid and an anode, said grid being coated with a material capable of combining with particles from said cathode to form a thermionically inactive compound
40 and capable of fixing gases evolved within the device.

2. An electron discharge device comprising an alkaline earth oxide coated cathode, a grid and an anode, and a coating on said
45 grid, said coating containing aluminum.

3. An electron discharge device comprising an oxide coated cathode, a grid and an anode, said grid having a coating containing aluminum and aluminum oxide.
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4. An electron discharge device comprising an alkaline earth oxide coated cathode, a grid, and an anode, said grid having a coating capable of combining with said
55 alkaline earth oxides thrown on the grid to form aluminates which are thermionically inactive compounds.

In witness where, I hereunto subscribe my name this 23d day of June, A. D. 1925.

JAMES R. WILSON.