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LE ROY APKER

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COATED GRID FOR ELECTRON DISCHARGE TUBES

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Fig. 1.

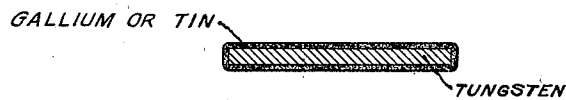
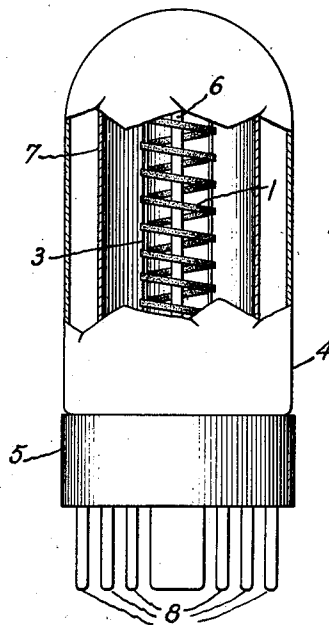


Fig. 2.



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COATED GRID FOR ELECTRON DISCHARGE TUBES

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1 Claim. (Cl. 313—355)

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This invention relates to the control of contact potentials between metals and, more particularly, to the control of contact potentials between the electrodes of vacuum type electron discharge devices.

In the vacuum tube industry, it is important that the operating characteristics of electronic tubes remain substantially constant throughout the life of the tubes. Consequently, the contact potential field existing between the grid electrodes and the cathodes should remain unchanged. This contact potential field exists because of the difference between the work functions used in the grids and in the cathodes. Since the grids and the cathodes perform, in some respects, substantially opposite functions, they are, by necessity, constructed of dissimilar metals having widely separated work functions.

It is well known in the art that evaporation products from thermionic cathodes contaminate the grids and lower the work function thereof. In fact, in a new tube, the work function of the grid is generally lowered to a value near the work function of the cathode and, consequently, the contact potential field between the two is much reduced. It may, moreover, be unstable. To provide a vacuum tube suitable for use, in the manufacturing process the tubes are generally subjected to an aging process which is continued until the work function of the grids is stabilized, and the contact potential between them and the cathodes remains substantially constant thereafter. Aging of a tube is, of course, a lengthy and expensive operation.

Therefore, an object of my invention is to provide a new and improved electrode which will have a relatively constant work function when used in an electron discharge device in which the heretofore mentioned evaporation products are present.

In the attainment of the foregoing objects, I provide a grid structure the surface of which is in the liquid state at the operating temperatures of the tubes. Because a liquid surface is much more active in dissolving evaporation products than a solid surface is, the work function thereof is maintained more nearly constant. Therefore, the contact potential field between the grids and the cathodes is also more nearly constant.

For further objects and advantages and for a better understanding of my invention, attention is now directed to the following description and accompanying drawings, and also to the appended claim. In the drawing, Fig. 1 is a sectional view of a portion of a grid electrode constructed ac-

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cording to this invention; and Fig. 2 is a conventional vacuum type electron discharge device employing this type of grid electrode.

Referring to Fig. 1, a metallic substrate is shown coated with a thin layer of tin. Because the normal operating temperatures of grids in most vacuum tubes is of the order of 300° C., which is above the melting point of tin, a liquid surfaced grid structure may thus be realized. The use of tin as the outer layer of the grid structure has been shown, but any metal having a low melting point and a low vapor pressure at temperatures well above the melting point is applicable. Another such metal is gallium. Both tin and gallium have boiling points near 2000° C., which is, of course, an indication that they have a low vapor pressure at temperatures well below this value. These characteristics of low melting point and vapor pressure are generally necessary to prevent the liquid surface from evaporating during operation of the tube throughout periods of time of the order of thousands of hours, which is a normal life span of a vacuum tube. It is also desirable that the metal used as the substrate have a high cohesive energy to decrease the tendency of the liquid coating to dissolve or diffuse away. One such metal is tungsten.

Referring to Fig. 2, a tin coated metallic grid structure 1 is mounted on grid supports 2 and 3 which are enclosed in a hermetically sealed envelope 4 which is mounted in a base 5. Also enclosed within envelope 4 is a cathode structure 6 and an anode structure 7. Terminals 8 extending from base member 5 permit control of the current and voltage between electrodes 1, 2 and 3. By maintaining the outer portion of grid member 1 in the liquid state, the contact potential between grid 1 and cathode 6, which is of primary concern in the construction of vacuum tubes, may be maintained constant without aging of the tube.

A liquid surfaced grid structure as described herein provides a constant contact potential between the grid and the cathode throughout the life of the tube without an extended and consequently costly process of aging. As a result, an electronic tube employing a grid of this type has operating characteristics which remain unchanged from the time of initial operation throughout the life of the tube. Contact potentials different from those found in ordinary tubes may be obtained, and plate currents may be very small even when positive potentials of one or two volts are applied to the grid. Normally, the low work function of an ordinary grid causes

plate currents to be measurable even at negative applied grid voltages of as much as 1 volt.

While this invention has been described by a particular embodiment thereof, it will be understood that those skilled in the art may make many changes and modifications without departing from the true spirit and scope of this invention. Therefore, by the appended claim, I intend to cover all such changes and modifications which fall within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

In an electric valve, a metallic grid and a thin layer of gallium located thereon to maintain the work function of said grid substantially constant during normal operation of said valve.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,040,530	Pipper	May 12, 1936