Jan. 23, 1951 H. D. MILLER 2,539,096

ELECTRON TUBE AND GRID FOR THE SAME

Filed Sept. 19, 1949

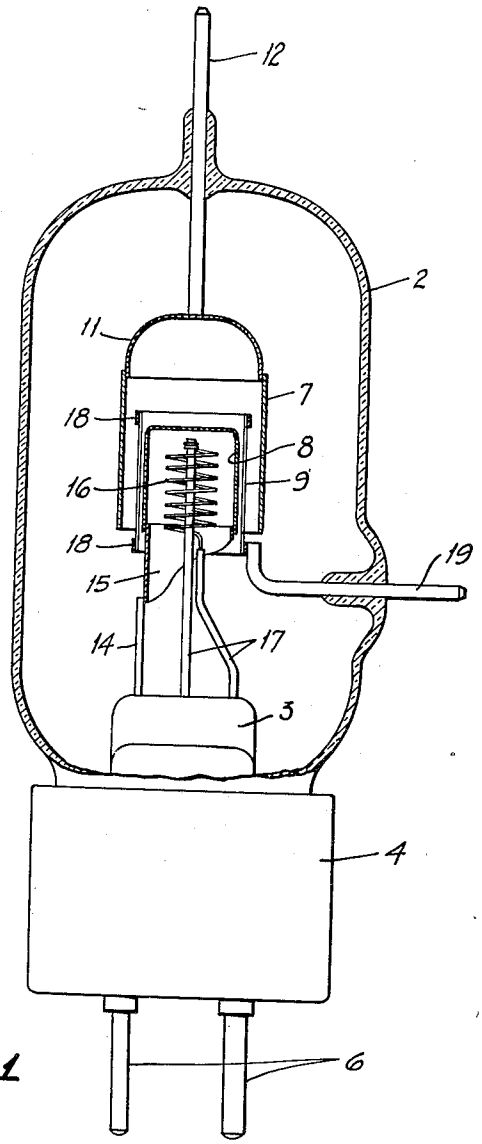

Fig. 1

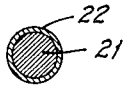

Fig. 2

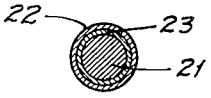

Fig. 3

INVENTOR.
Harold D. Miller
BY Harold E. Smy
ATTORNEY

Patented Jan. 23, 1951 2,539,096

UNITED STATES PATENT OFFICE

2,539,096

ELECTRON TUBE AND GRID FOR THE SAME

Harold D. Miller, San Bruno, Calif., assignor to Eitel-McCullough, Inc., San Bruno, Calif., a corporation of California

Application September 19, 1949, Serial No. 116,449

4 Claims. (Cl. 250—27.5)

1

My invention relates to an improved grid for electron tubes, and more particularly to a grid for tubes having an oxide coated type of cathode.

In electron tubes used for transmission purposes where relatively high electrode temperatures are apt to be involved, the grid of the tube is usually the limiting factor because of primary electron emission from the grid. With tubes having the conventional oxide coated cathode involving a combination of barium and strontium oxides the problem of grid emission is especially bad because of activation of the grid by the active materials such as barium from the cathode. In an effort to alleviate this problem it is common practice to use gold coated grids which helps to suppress primary electron emission from the grid. Such grids can only be operated up to about 500° C., however, because at higher temperatures grid emission develops and also there is sufficient vaporization of gold from the grid to destroy the cathode emission.

The principal object of my invention is to provide a grid material which may be safely operated to higher temperatures without excessive primary grid emission and without danger of destroying the cathode emission.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of my invention. It is to be understood that I do not limit myself to this disclosure of species of my invention as I may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing:

Figure 1 is a vertical sectional view of a tube embodying the improved grid.

Figure 2 is an enlarged cross-sectional view of the improved grid wire; and

Figure 3 is a similar view of a modified grid material.

In terms of broad inclusion, my electron tube comprises a plurality of electrodes including a grid having a core wire of refractory metal, preferably molybdenum, and a surface layer comprising a metal selected from the group consisting of ruthenium and palladium. A modified grid material embodying the invention has an intermediate layer of gold between the core and surface layer. Other electrodes of the tube include a cathode and anode, the cathode being of the oxide coated type.

In greater detail, and referring to the drawing, my tube is illustrated as a triode having a control grid incorporating the improvements of my

2

invention, it being understood that the improvements may be embodied in many different types of tube construction, including multi-grid tubes as well as those having external instead of internal anodes. The tube illustrated comprises a glass envelope 2 having a re-entrant stem 3 and provided with a base 4 with terminal prongs 6.

A plurality of electrodes including an anode 7, cathode 8 and the improved grid 9 are disposed coaxially within the envelope. In the radiation cooled type of tube shown the internal anode 7 is a metal cylinder having a cap 11 connected to a supporting lead 12 which is sealed to the upper end of envelope 2.

The cathode 8 is of the oxide coated type comprising a metal sleeve, say of nickel, surfaced with the conventional barium-strontium oxide coating. A lead 14 sealed to stem 3 carries a bracket 15 which supports the cathode sleeve and provides the conductor for the cathode. This cathode is heated by an inner heater or filament 16 supported by a pair of conductor leads 17 sealed to the stem. These various leads are connected to the terminal prongs of base 4.

From the structural standpoint grid 9 is preferably of the cage type comprising vertical wire bars fastened to end rings 18 and supported by a lead 19 sealed to a side of the envelope. The shape of the grid and its mounting may, of course, be varied depending upon the type of tube structure employed.

My improved grid has its bars made of a composite wire comprising a core 21 of a refractory metal such as molybdenum or tungsten, molybdenum being preferred. The core wire has a surface layer 22 of a metal selected from the group consisting of ruthenium and palladium. I have found that these two metals function to inhibit grid emission in tubes having oxide cathodes when such metals are employed, either singly or in combination, as a surfacing on the grid. The surface layer may be applied to the grid in any suitable manner, as by electroplating. The thickness of this layer is not critical so long as complete coverage of the core wire is obtained.

The improved grid with a surface layer of ruthenium or palladium is very superior to the gold surfaced type in tubes having an oxide coated cathode. Comparative tests show that the improved grid will operate satisfactorily without appreciable grid emission and without harming the cathode emission to temperatures of about 700° C., while similar tubes with a conventional gold surfaced grid fail at about 500° C. This in-

crease of several hundred degrees in the safe grid operating temperature is extremely important when tubes for greater power output and for operation at higher frequencies are involved.

In some types of grid construction where the presence of gold is desired for brazing purposes, I find that the composite wire shown in Figure 3 is very satisfactory, comprising an intermediate layer 23 of gold interposed between the core 21 and the surface layer 22. This type of grid wire also operates satisfactorily at the higher grid temperatures because the surface layer of ruthenium or palladium serves the additional purpose of retarding vaporization of the gold and thereby preventing contamination of the cathode.

I claim:

1. An electron tube comprising an oxide coated cathode and a grid having a core of a metal selected from the group consisting of molybdenum and tungsten and a surface layer of a metal selected from the group consisting of ruthenium and palladium.

2. An electron tube comprising an oxide coated cathode and a grid having a core of a metal selected from the group consisting of molybdenum and tungsten, an intermediate layer of gold and a surface layer of a metal selected from the group consisting of ruthenium and palladium.

3. A grid wire for an electron tube comprising a core of molybdenum, an intermediate layer of gold and a surface layer of ruthenium.

4. A grid wire for an electron tube comprising a core of molybdenum, an intermediate layer of gold and a surface layer of palladium.

HAROLD D. MILLER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,486,436	Rothstein	Nov. 1, 1949

FOREIGN PATENTS

Number	Country	Date
356,436	Great Britain	Mar. 4, 1930