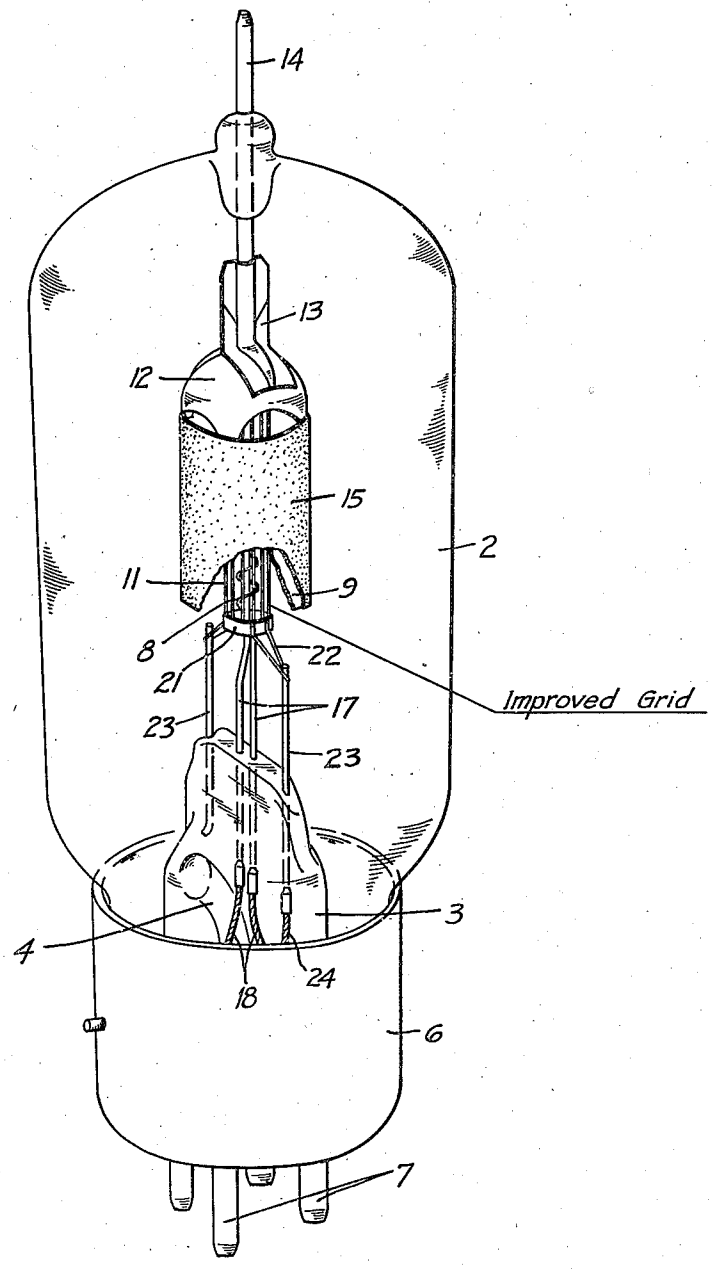
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ELECTRON TUBE AND ELECTRODE FOR THE SAME

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ELECTRON TUBE AND ELECTRODE FOR THE SAME

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1 Claim. (Cl. 250—177)

My invention relates to electron tubes, and more particularly to an improved electrode for such tubes.

The broad object is to provide an electrode, such as a grid, having low primary and high secondary emission and which is characterized by sufficient mechanical rigidity to maintain its position of alignment in the tube.

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 claim.

Referring to the drawing, the figure is a perspective view of a tube embodying the improvements of my invention.

In terms of broad inclusion, my improved electron tube comprises an envelope enclosing a thoriated cathode, a plate, and a grid comprising an alloy of two or more metals one of which is platinum.

In greater detail, and referring to the drawing, the tube chosen to illustrate the invention comprises an envelope 2 of glass or the like having a reentrant stem 3 carrying an exhaust tubulation 4. A suitable base 6 having prongs 7 is cemented to the lower portions of the envelope. The triode illustrated contains a cathode 8, plate 9 and the improved grid 11. Plate 9 has a cap 12 connected by bracket 13 to a lead 14 sealed to the top of the envelope. The plate may be of any suitable material, such as molybdenum or tantalum, and, if desired may be provided with a coating 15 of zirconium or the like to improve the gettering and heat radiating properties.

Cathode 8 is of the thoriated type, preferably a thoriated tungsten filament, comprising a coil welded at top and bottom to a pair of leads 17 sealed to stem 3. Flexible conductors 18 connect the cathode leads with a pair of base prongs. The thoriated cathode is preferred because my improved grid exhibits special non-emission properties in such a combination. It is understood that the filament may assume other shapes than the spiral type illustrated.

Structurally speaking, grid 11 is preferably of the cage type comprising vertical wire bars terminating at a base ring 21 supported by brackets 22 on a pair of rods 23 sealed to stem 3. One of these rods functions as a lead and is connected by conductor 24 to a base prong. The shape of the grid and its mounting means may be varied within wide limits.

The improved grid is made of an alloy of platinum and another metal added to impart special characteristics to the grid. In order that a grid, such as a control grid in a triode, function to best advantage it should, electrically speaking, exhibit low primary and high secondary emission. Primary emission (electrons evaporated by heat) is undesirable because it results in a reverse grid current which not only makes the tube unstable and erratic in its operation, but limits the output and prevents use of the tube in certain kinds of service. On the other hand, secondary emission (electrons knocked out by impinging electrons) is desirable because it adds to the plate current and makes the tube easier to drive. From the mechanical standpoint a grid must be capable of maintaining its position of alignment with respect to the other electrodes. Misalignment of the grid, due to shock or electrostatic forces acting on it in the tube, upsets the critical grid-to-cathode and grid-to-plate spacings, and either changes the tube characteristics or actually shorts out the electrodes. The electrical and mechanical properties go hand in hand; if one is lacking the grid is impractical irrespective of how good the grid might be in other respects.

I have found that a grid made of an alloy comprising a major proportion of platinum and a minor proportion of another metal, such as iridium, has the desired electrical and mechanical characteristics. For example, an alloy comprising about 80% by weight of platinum and about 20% by weight of iridium gives good results. This alloy initially exhibits negligible primary emission and, what is equally important, it does not develop primary emission by contamination with thorium sputtered or otherwise deposited on it from a thoriated cathode. The secondary emission characteristics are good. Furthermore, the alloy is relatively hard and stiff (compared to solid platinum) and while being ductile enough to permit grid fabrication, the resulting grid has sufficient rigidity to resist displacement under mechanical shock and electrostatic stresses set up in the tube. The addition of iridium as a hardening agent to platinum is a very important feature because the improved grid maintains its alignment under conditions where a grid of solid platinum would quickly fail. Furthermore, the vapor pressure of the improved grid material is sufficiently low to prevent evaporation of the metal at normal grid operating temperatures.

Other metals may be added to platinum in place of iridium to accomplish the hardening function and impart the other desired properties.

For example, I have made successful grids of the following alloys: 96% platinum and 4% tungsten; 95% platinum and 5% ruthenium; and 96% platinum and 4% molybdenum. These alloys are listed in the order of preference from the standpoint of a maximum of all the desired properties in the grid. The platinum-tungsten alloy is particularly desirable because of its higher melting point. In all of the examples given it is understood that the percentages may be varied, it being preferred however to keep the added metal in minor proportions compared to the main platinum constituent of the alloy.

It will also be observed that the metals added to the platinum fall in two natural groups of elements, that is, tungsten and molybdenum fall in one group while iridium and ruthenium fall in another group.

I claim:

An electron tube comprising a thoriated cathode and a grid structure having wire bars spaced from the cathode, said wire bars comprising a platinum base alloy with another metal, for inhibiting primary emission on contamination of the grid with thorium, said other metal being selected from the group consisting of tungsten and molybdenum, for hardening the alloy to stiffen said wire bars to maintain their spacing from the cathode.

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