

Jan. 13, 1948.

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2,434,494

GRID STRUCTURE IN ELECTRON DISCHARGE DEVICE

Filed Aug. 14, 1945

Fig. 1.

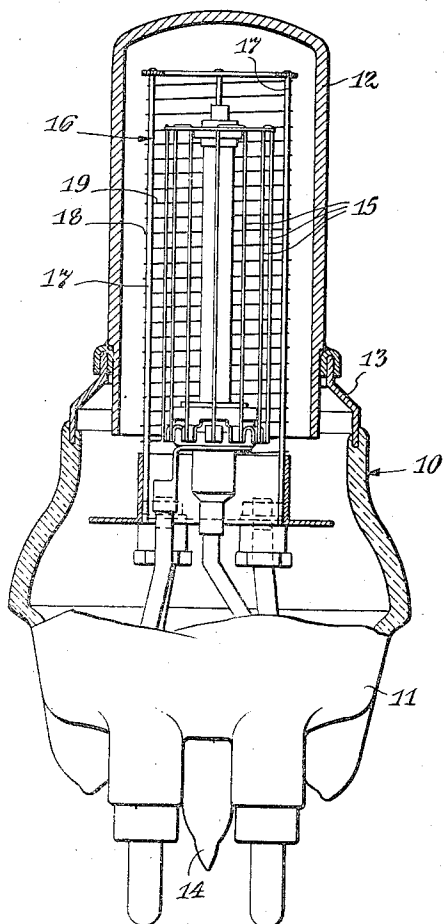


Fig. 2.

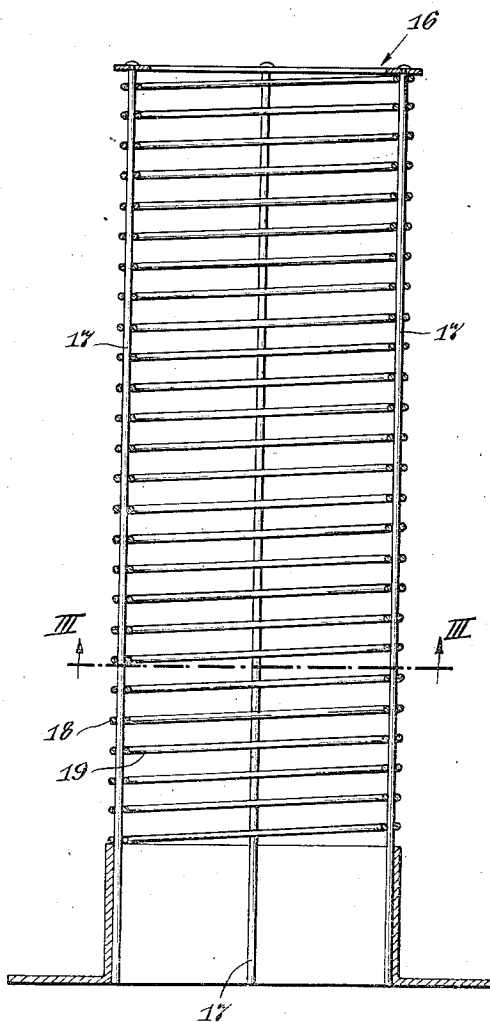
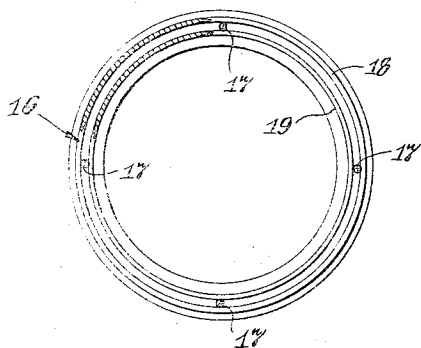


Fig. 3.



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2,434,494

GRID STRUCTURE IN ELECTRON
DISCHARGE DEVICES

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Application August 14, 1945, Serial No. 610,776

2 Claims. (Cl. 250—27.5)

1

This invention relates to electron discharge devices and more particularly to grid structure as employed therein.

In many electron discharge devices of the type having cathode, grid and anode, with or without other electrodes, the maximum power obtainable in use is limited by the maximum grid dissipation, for if this maximum grid dissipation is exceeded, high primary grid emission results, and often the grid wires actually melt or burn up, thus ruining the tube.

The maximum grid power rating has in the past been increased in a number of ways. This has been done by adding cooling fins to the grid and by using grid supports of high thermal conductivity to conduct the heat away. In large tubes the grids have been water cooled. These methods are satisfactory in some cases, but water cooling the grid calls for a very bulky structure.

In tubes designed for high frequency use, a physically small structure must be used in order to keep all the different factors within the tube as small as possible. In electron discharge devices designed for high frequencies, the filament structure must be located very close to the grid in order to keep the electron transit time small between electrodes. Furthermore, in high power high frequency tubes, considerable filament power is necessary in order to obtain the required large filament emission. Since the grid is located very close to the filament, the grid will receive and have to dissipate more heat than if it were located far from the filament.

According to the present invention, an electron discharge device is provided with improved dissipation rating for the grid.

More specifically, an object of the invention is to increase the available dissipating area without detriment to other tube characteristics.

A further object of the invention is to avoid any material increase in electron interception while increasing the dissipating area.

Another object of the invention is to provide a means of increased grid dissipation rating applicable in high power tubes and in large high frequency tubes as well as in small tubes.

Other objects of the invention will appear to those skilled in the art to which it appertains as the description progresses, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is an elevational section of an elec-

2

tron discharge device embodying the present invention;

Figure 2 is an enlarged sectional view similar to Fig. 1, but showing the grid alone; and

Figure 3 is a cross sectional view on line III—III of Fig. 2.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral 10 designates an envelope in general which is here shown as comprising a glass bowl 11 constituting the base with lead-in prongs extending therefrom, and a metallic dome-like portion 12 which also acts as the anode. Suitable sealing means 13 is provided between the bowl and the anode in order that the envelope may be vacuum tight. Evacuation is obtained by way of tubulation 14 which is sealed-off when desired vacuum is obtained in the device. Within the envelope, and coaxial with the anode 12 is an annular series of filament wires 15 which constitute the cathode for the particular device shown. Electrons are emitted from this cathode in use and as usual, those electrons follow essentially radial straight-line paths to the anode.

Between the cathode and anode, coaxial to both, is a grid 16 the construction whereof embodies the essential feature of the present invention. Said grid is comprised of a plurality of equally spaced parallel stays or support rods 17 having a circular grouping or sequence and having the group coaxial to the cathode and anode. Peripherally outward of the group of stays 17 is an outer helix of grid wire 18 the several convolutions of which are spaced apart longitudinally of the stays. Radially inward of the group of stays 17 is an inner helix of grid wire 19 the several convolutions of which are spaced apart longitudinally of the stays and positioned directly opposite to the corresponding convolution 18 of the outer helix. All of said convolutions contact the stays where they cross and are welded or otherwise secured thereat to the stays. The construction obtains a clear path radially through the convolutions of the outer helix for all electrons following radial lines and which have passed the convolutions of the inner helix. Furthermore the relation of the convolutions of the inner helix and outer helix is one of relative closeness in view of the separation being only that of the thickness of the stays. Also, since the convolutions are welded to the stays at surface portions of the stays at opposite ends of diameters of the stays, it becomes impossible for the convolutions to lose alignment radially of the electrodes, and any warping or de-

3

formation of a stay affects convolutions of the outer and inner helices alike.

Presence of two helices with convolutions directly opposite each other, protects the outer helix from most of the electron bombardment to which the inner helix is subjected in use, and protects, to some extent the outer helix from direct radiation of heat from the filament by virtue of the outer helix being in the shadow of the inner one. Direct connection of the helices to the stays at ends of common diameters, obtains a short path for heat conduction from the inner helix to the outer one. A beneficial lowering of the running temperature of the grid is thus obtained.

The grid of the present invention, with convolutions spaced as in a conventional single helix grid, will obtain a much higher amplification factor than the conventional grid. On the other hand, for a given amplification factor, the helices of the grid of the present invention would be wound with less convolutions per unit of length of the grid than for the conventional grid with the same amplification factor. Fewer convolutions per unit of length of the grid results in the grid drawing less grid current when it is driven to a positive potential with respect to the filament. Less grid current results in less power developed in the grid (all other conditions remaining the same) and thus the maximum grid dissipation is effectively greater in comparison to input.

I claim:

1. An electron discharge device comprising co-

4

axial cathode, grid and anode, said grid having a plurality of stays parallel to the axis and grouped in a circular sequence, said grid having inner and outer convolutions attached to said stays at opposite ends of diameters of said stays and thereby offering a continuation of free path for electrons through the outer convolutions as through the inner convolutions.

2. A grid comprising a grouping of a plurality of parallel stays in circular sequence, said grid having inner and outer helices wound on and attached to said stays with the convolutions of the outer helix attached to said stays at ends of diameters of said stays at the opposite ends of which the convolutions of the inner helix are attached to said stays.

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