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ELECTRON TUBE

FIG. 1 is a top view of a cross-shaped component. The component has four arms extending from a central square region. The arms have rounded ends. The central region contains a circular pattern of dashed lines and a central rectangular feature. Various parts are labeled with numbers: 32, 34, 36, 38, 40, 42, 54, 56, 58, 60, and 22.

Fig. 1

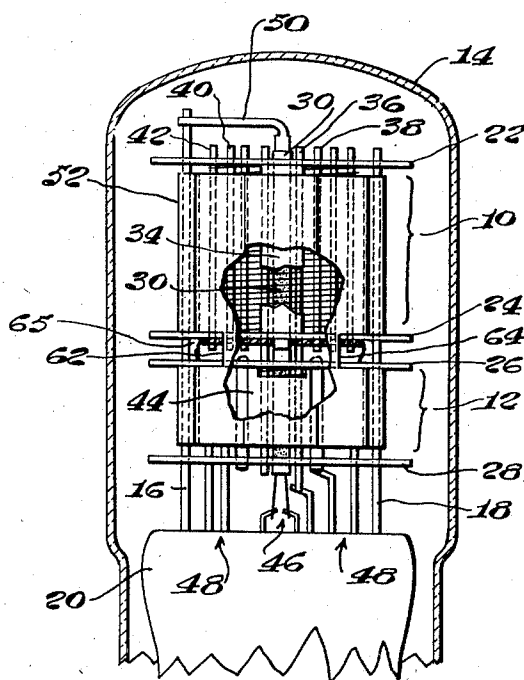


Fig. 2

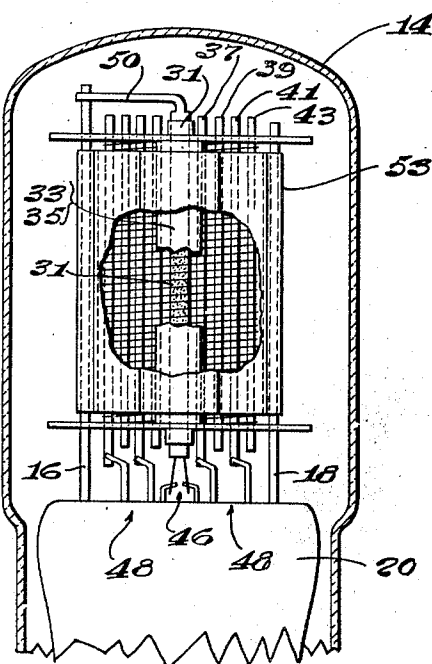


Fig. 3

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ELECTRON TUBE

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This invention relates to an electron tube and more particularly to a radio tube for the conversion or amplification of electrical oscillations.

The invention has for an object to provide a radio tube of novel and improved construction in which provision is made for shielding the various elements of the tube in a novel and simplified manner whereby to obtain improved electrical operation and by which assembly of the tube is simplified.

A further object of the invention is to provide a shielded radio tube of novel and improved construction embodying a plurality of sections in which a single cathode and a grid adjacent thereto are common to both sections whereby assembling operations may be reduced to a minimum and which in operation enables more uniform electrical characteristics to be obtained.

With these general objects in view, and such others as may hereinafter appear, the invention consists in the electron tube and in the various structures, arrangements and combinations of parts hereinafter described and particularly defined in the claims at the end of this specification.

In the drawing illustrating the preferred embodiments of the invention, Fig. 1 is a plan view of a radio tube embodying the present invention; Fig. 2 is a side elevation of a multiple section tube embodying the present invention, a portion of the shield member being broken away to more clearly illustrate the construction; and Fig. 3 is a similar view showing a single section tube.

In general the present invention contemplates a novel electron tube, such as a radio or audio frequency amplifier tube or a frequency converter tube having a novel and improved shielding element associated therewith and preferably surrounding the elements therein whose construction is such as to simplify the construction and facilitate assembly of the tube and which also improves the shielding characteristics of the tube. In accordance with one feature of the invention, the shielding element comprises a composite beam confining plate and a grounded shield formed integrally and adapted to serve both as a beam confining plate for modifying the electron stream between the cathode and the anode to reduce the effect of secondary emission, and also as an electrical shield to substantially confine the electron stream and the electrical field to the space within the confines of the shield. The improved shielding element of the present invention may be used with advantage in any shielded radio tube, herein illustrated in

a converter tube and in an amplifier tube, as a result of which the effect of secondary emission of electrons from the anode is materially reduced, the amplification factor of the tube is substantially increased, and the shielding characteristics of the tube are generally improved.

In accordance with another feature of the present invention, a multiple section shielded tube of novel and improved structure is provided in which the centrally disposed cathode and the grid adjacent thereto are common to both sections whereby mechanical simplicity is achieved both in construction and assembly and wherein the amount of metal required in the production of the tube is reduced to a minimum. As a result of the improved construction of the shielded multiple section tube greater conversion gain may be obtained without loss of stability and more uniform electrical characteristics are achieved. Provision is also made in the construction of the multiple section tube for providing adequate shielding between each section. A further structural feature of the present converter tube permits the signal grid to be connected to a base pin lead thus eliminating the usual metal cap on the glass envelope.

Referring now to the drawing in which two embodiments of the invention are illustrated, Fig. 2 illustrates the invention as embodied in a multiple section converter tube having a multi-element mixer section 10 and a radio frequency oscillator section 12 arranged in tandem and enclosed within the usual evacuated glass envelope 14. The sections are supported upon support wires 16, 18 extending from the glass stem 20 and are electrically insulated from each other by mica spacers or disks 22, 24 and 26, 28. In the illustrated embodiment of the invention, the upper or mixer section of the converter tube comprises a hexode including a centrally disposed cathode sleeve 30, an anode which may comprise two parallel spaced electrodes 32, 34 electrically connected together, and four grids 36, 38, 40, 42. As illustrated in Fig. 2, the cathode sleeve 30 and the grid 36 immediately adjacent the cathode are common to both sections 10, 12 and are supported between upper and lower mica spacers 22, 28. The cathode sleeve 30 may and preferably will be provided with emitting material on its surface separated into two bands, each associated with its respective section. The grids 38, 40, 42 and the anode elements 32, 34 of the mixer section are supported between the mica spacers 22, 24 as shown. The lower or oscillator section of the multiple

section tube is herein illustrated as comprising a triode including the cathode sleeve 30 and grid 36 common to both sections, the latter serving as the coupling between the sections, and an anode 44 supported between the mica spacers 26, 28. As herein shown, the usual heater leads 46 are provided and the various stem lead wires indicated generally by the numeral 48 are connected to the several elements in the usual manner, the connections to the anodes 32, 34 and the grids 38, 40 and 42 of the mixer section being made between the mica spacers 24 and 26. One of the support wires 16, is used as a lead wire, being connected at its upper end to the cathode tab 50.

As illustrated in Fig. 1, a shielding member 52 surrounding the tube sections and supported upon the wire rods 16, 18 is adapted to combine the features of an electronic beam confining plate and the usual grounded outside shield. The shielding member is preferably of general cylindrical form provided with longitudinal recessed portions 54, 56 surrounding the anode electrodes 32, 34 as shown. The shielding member is also provided with two smaller longitudinal recesses 58, 60 arranged to fit over the supporting rods 16, 18 to which the shield may be welded. The shielding member as embodied in a multiple section converter tube, illustrated in Fig. 2, is of particular advantage as a beam confining shield for the mixer section 10 although the shield may and preferably will be extended to surround the oscillator section 12 and the connections to the anodes and grids 38, 40 and 42 of the mixer section as well. When thus employed, slots 62, 64 are provided in opposite sides of the shield to permit portions of the mica spacers 24, 26 to extend beyond the supports.

Provision is also made for shielding the sections one from another and as herein shown, an annular flanged metal member 65 is interposed between the mica disks 24, 26 to form a shield and may be welded to the support wires 16, 18 to provide a ground for the shield. This member is provided with suitable apertures for the anode and grid supporting members of the section 10 of sufficient size to prevent short circuiting the various elements of this section. It will be observed that the intermediate mica disks in which the grid rods and other elements are supported are held in spaced relation by the annular shield member 65 and are disposed adjacent the edges of the slots 62, 64 to form a rigid support for the disks and to simplify the construction of the tube. Thus adequate shielding is provided between each section of the tube.

Referring now to Fig. 3, the invention as therein shown is embodied in an amplifier tube comprising a central cathode sleeve 31, grids 37, 39, 41, 43 and an anode comprising two parallel spaced electrodes 33, 35 electrically connected together. The shielding member 53 is similar in contour to the shielding member 52 illustrated in plan view in Fig. 1, and is provided with the longitudinal recessed portions surrounding the anode members as previously described.

The shield being at the same potential as the cathode in the tubes selected for illustration, electrons are repelled therefrom and crowded into relatively narrow streams as they approach the anodes so as to set up a space charge adjacent the anodes which retards or prevents secondary emission electrons from the anodes from reaching the other elements of the tubes. As indicated in Figs. 2 and 3, the conductors mak-

ing up the grids may be aligned so as to provide unobstructed paths for the electrons between the cathodes and anodes. The grids in the tubes illustrated may be connected in various ways for different purposes, for example, the grid 36 of the tube shown in Fig. 2, which extends axially of the tube and forms a common element in the two sections thereof may be the oscillator grid in a triode section 12 and also serve to couple the oscillator section to the section 10. If the section 10 is used as a mixer, the grid 40 may be the signal or control grid and the grids 38 and 42 may be connected together to form a screen for the signal grid. If remote cut off tubes are desired, the spacing of the grid conductors of one or all, of the grids may vary along the axial length of the grid.

From the above description of the preferred embodiments of the invention, it will be observed that the present structure of a shielded radio tube is such as to facilitate assembly and simplify the construction of the tube and that the shielding characteristics of the tube are materially improved. While the improved shielding member has been herein illustrated and described in a converter tube and in an amplifier tube, it will be apparent that the invention may be embodied in other types of shielded radio or audio frequency electron tubes having more or less elements and being within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. An electron tube comprising a cathode, an anode, a grid, and an integral metallic shielding member surrounding said element, said shielding member having a longitudinally extending recess, said anode being positioned in said recess so that said shielding member serves as a beam confining plate for modifying the electron stream between the cathode and the anode and also as a shield to substantially confine the electrical field within the confines of the shielding member.

2. An electron tube comprising a substantially centrally disposed cathode element, a grid element surrounding the cathode, an anode element comprising a plurality of spaced electrodes electrically connected together and a cylindrical metallic shielding member surrounding said elements, said shielding member being provided with a plurality of longitudinal recesses surrounding said anode electrodes whereby the shielding member may serve both as a beam confining plate and as an electrical shield.

3. An electron tube comprising a cathode element, an anode element, a grid element, wires supporting said elements and a metallic shielding member surrounding said elements, said shielding member having a recess therein, said anode being positioned in said recess so that said shielding member serves as a beam confining plate and as an electrical shield, said shielding member being connected to one of said supporting wires.

4. An electron tube comprising a cathode element, an anode element, a plurality of grid elements, and a metallic shielding member surrounding said elements, said member having a portion spaced from said cathode a greater distance than other portions thereof providing a region in which said member is more distant from said cathode than said other portions, said anode being positioned entirely within said region so that said member serves both as a beam confining plate and an electrical shield.

5. An electron tube comprising a plurality of sections, each section including a cathode, an anode, and a grid element, and a metallic shielding member surrounding said elements, said member having a portion spaced a greater distance from said cathode than other portions thereof providing a region in which said member is more distant from said other portions, said anode being entirely within said region so that said member serves both as a beam confining plate and as an electrical shield.

6. An electron tube comprising a plurality of sections arranged in tandem, each section including a cathode sleeve, a grid element and an anode, said cathode sleeve and said grid element being common to said sections, and a metallic shielding member surrounding said elements, said member having a portion spaced a greater distance from said cathode than other portions thereof providing a region in which said member is more distant from said other portions, said anode being entirely within said region so that said member serves both as a beam confining plate and as an electrical shield.

7. An electron tube comprising a plurality of sections, each section including a cathode, an anode, and a grid element, a metallic shielding member surrounding said elements, said member having a portion spaced a greater distance from said cathode than other portions thereof providing a region in which said member is more distant from said other portions, said anode being entirely within said region so that said member serves both as a beam confining plate and as an

electrical shield, and an annular metallic member interposed between said sections effective to shield one section from another.

8. An electron tube comprising a plurality of sections, including a multi-element mixer section and an oscillator section, said sections being provided with a single cathode element and a grid element immediately adjacent thereto common to said sections, and a metallic shielding member surrounding said elements, said member having a recess therein, said anode being positioned in said recess so that said member serves both as a beam confining plate and as an electrical shield.

9. A shielding member for an electron tube having a cathode element, a grid element and a plurality of spaced apart anode elements electrically connected together, said shielding member comprising an elongated substantially cylindrical metallic member adapted to surround said elements, said shielding member being provided with a plurality of longitudinal recesses adapted to surround said anode elements.

10. A shielding member for a multiple section electron tube of the type wherein the sections are arranged in tandem and each section is provided with a cathode element, a grid element and an anode element, said shielding member comprising an elongated substantially cylindrical metallic member adapted to surround said elements, and an annular metallic member interposed between said sections to shield one section from another.

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