

June 12, 1945.

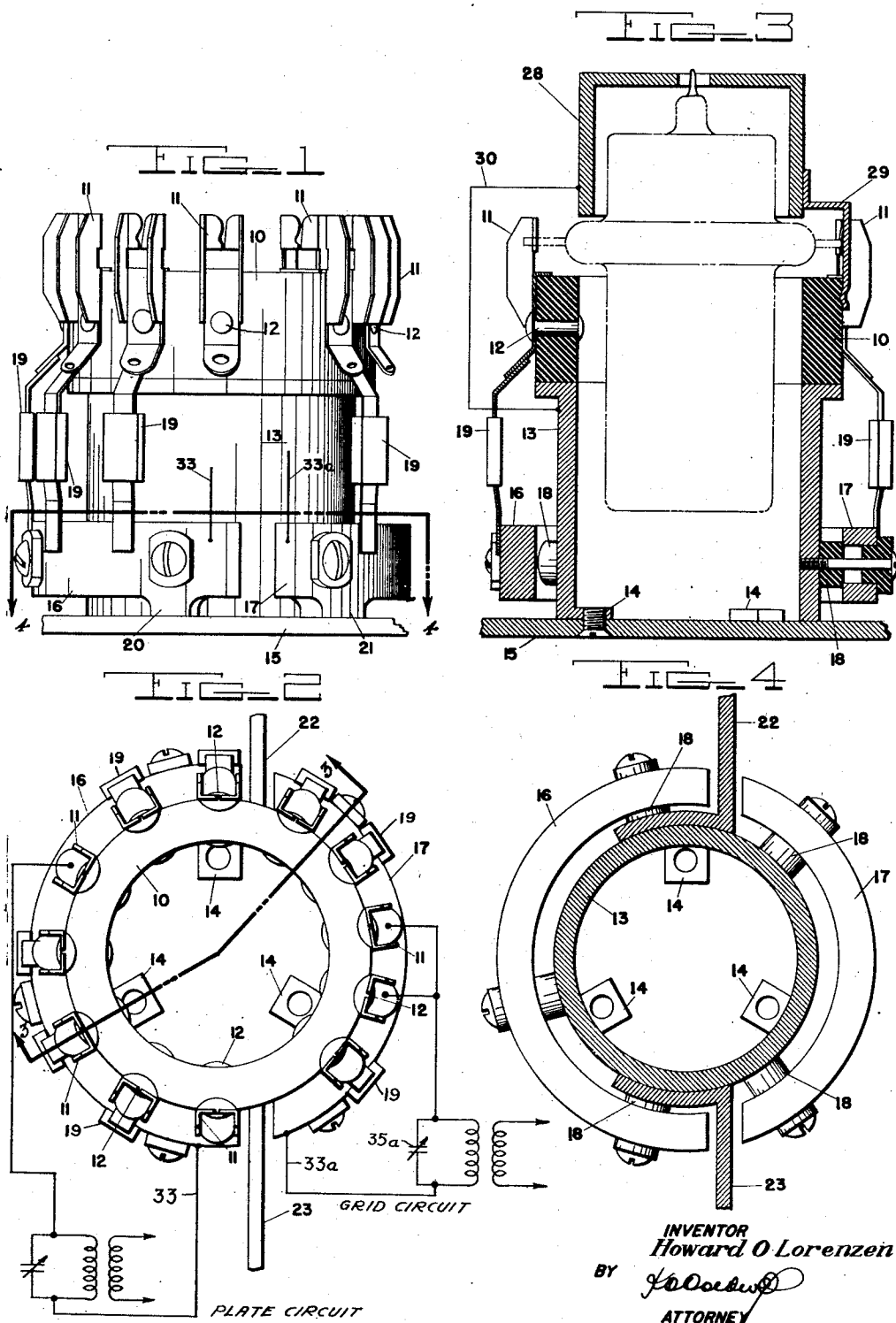
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RADIO TUBE SOCKET ADAPTATIONS

Filed Dec. 19, 1941

2 Sheets-Sheet 1



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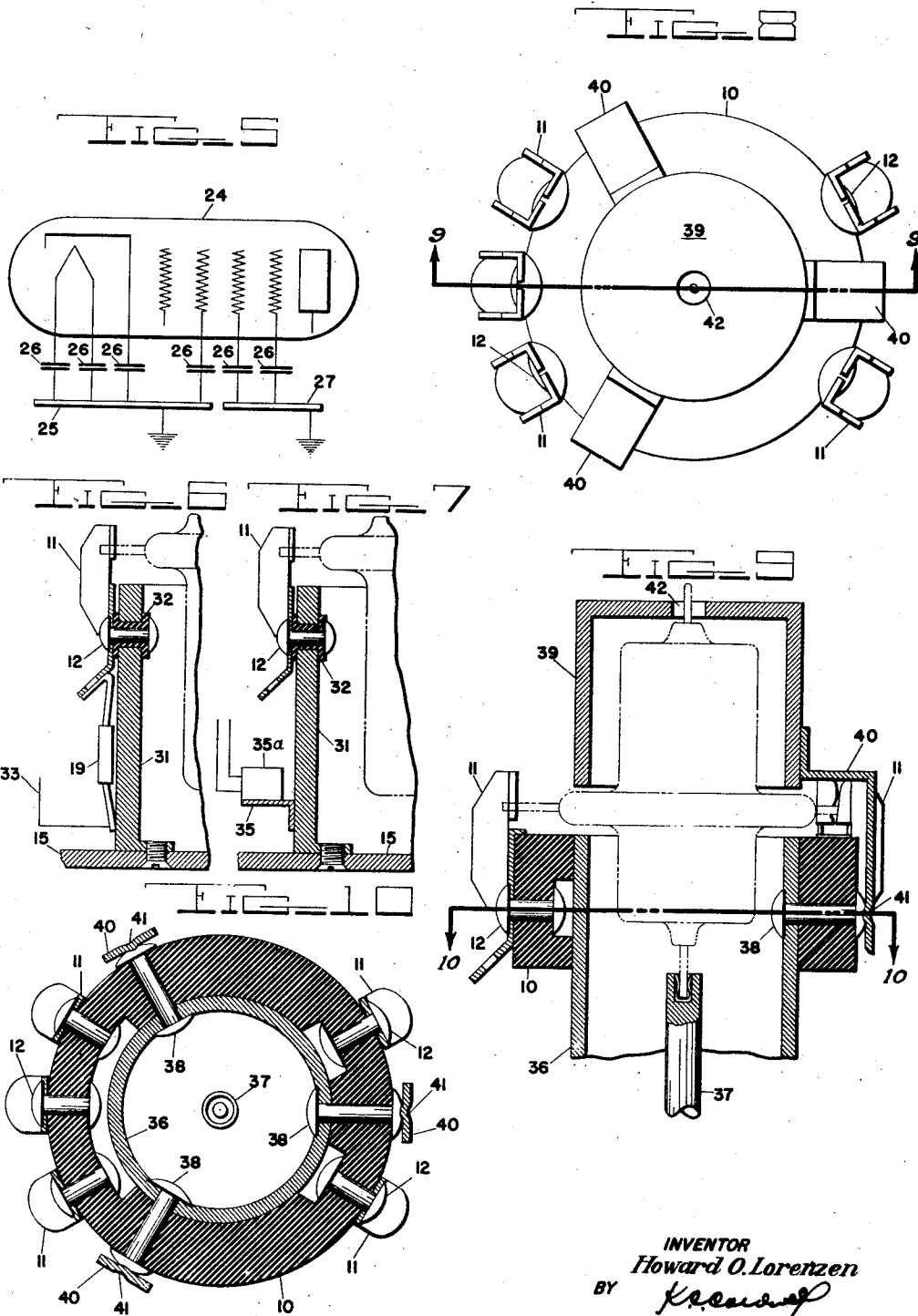
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## UNITED STATES PATENT OFFICE

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## RADIO TUBE SOCKET ADAPTATIONS

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13 Claims. (Cl. 250—16)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to tube socket mountings and electrical circuits associated therewith, and more particularly to mounting means for sockets for tubes of the type having a plurality of terminals protruding radially therefrom in a plane perpendicular to a normal axis thereof.

In the application of Howard O. Lorenzen, Ser. No. 412,224, filed Sept. 25, 1941, for Radio tube socket, a socket for the above mentioned type of tubes is disclosed which comprises a cylindrical member having a plurality of tube terminal supporting members positioned about the outer periphery thereof, being of such construction that a compact tube socket of relatively small overall dimensions is provided. This type of socket is especially advantageous when employed in ultra-high frequency circuits, since the length of the tube terminals and their associated leads are reduced to a minimum. The tube socket disclosed in the aforementioned application not only achieves the foregoing advantages but also is of such character that certain conventional mechanical and electrical arrangements employed in ultra high frequency circuits, in connection with the prior type of tube sockets, may be radically altered, and improved to a high degree, to thus provide ample solutions to the problems relating to ultra high frequency circuits.

It is therefore an object of the present invention to provide a novel tube socket mounting which functions to solve mechanical and electrical problems relating to ultra high frequency circuits.

Another object is to provide a mounting for sockets for tubes of the type having a plurality of terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof which includes a cylindrical metallic member that functions to support the tube socket.

Another object is to provide in a construction of the foregoing character a cylindrical metallic member for supporting the tube socket as well as providing an electrical shield between various electrical circuits associated with the tube.

Another object is to provide novel tube socket mounting means which provides a low impedance path at ultra-high radio frequencies for grounding various electrical circuits associated with the tube.

Another object is to provide novel means in a construction of the foregoing type for mechanically controlling the circulating currents in the various circuits associated with the tube.

Still another object of the present invention is to provide a novel tube socket assembly for

use on the end of a concentric transmission line.

Still another object is to provide adequate tube shielding means in a construction of the foregoing type.

Other objects and features of the invention will become apparent from the following detailed description when considered in connection with the accompanying drawings which disclose several embodiments of the invention. It is to be expressly understood, however, that the drawings are designed for purposes of illustration only and not as a definition of the limits of the invention, reference for the latter purpose being had to the appended claims.

In the drawings, wherein similar reference characters denote similar parts throughout the several views:

Fig. 1 is an elevational view showing a tube socket mounted in accordance with the principles of the present invention;

Fig. 2 is a plan view of the structure disclosed in Fig. 1;

Fig. 3 is a cross-sectional view through line 3—3 of Fig. 2;

Fig. 4 is a cross-sectional view through line 4—4 of Fig. 1;

Fig. 5 is a schematic diagram showing the electrical circuits employed in the structure disclosed in Fig. 1;

Fig. 6 is a cross-sectional view of a further embodiment of the present invention;

Fig. 7 is a cross-sectional view of a still further embodiment of the invention;

Fig. 8 is a plan view of a still further embodiment of the invention;

Fig. 9 is a cross-sectional view through line 9—9 of Fig. 8, and

Fig. 10 is a cross-sectional view through line 10—10 of Fig. 9.

With reference more particularly to Figs. 1, 2 and 3 of the drawings, a tube socket, constructed in accordance with the teachings of the aforementioned application, for thermionic tubes of the type having a plurality of terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof, is disclosed therein including a cylindrical member 10, of suitable insulating material, with a plurality of tube terminal supporting members 11 pivotally secured to the outer periphery thereof by means of rivets 12. The number of tube terminals supporting members 11 are to be equal in number to, and angularly disposed in the same relation as the tube terminals so that the tube terminals may be inserted into members 11 and electrically contacted

thereby with the tube extending into cylindrical member 10, as shown more particularly in Fig. 3.

In order to support the tube socket a cylindrical metallic member 13 is provided, which has one end thereof secured to the lower face of member 10, by any suitable means, while the other end is provided with a plurality of lugs or flanges 14 which cooperate with means to secure member 13 to a stationary member, such as portion 15 of electrical conducting material, such as brass for example, which comprises the chassis of the electrical apparatus with which the tube is associated. As will appear more fully hereinafter, cylindrical member 13 not only provides means for supporting the tube socket but also functions as an electrical shield between various electrical circuits associated with the tube.

In accordance with the principles of the present invention, means are disclosed which function to provide a low impedance path at ultra high radio frequencies for bypassing various electrical circuits associated with the tube to ground and for mechanically controlling the currents circulating in such circuits. As shown in the drawings, with reference to Figs. 1 through 4, a pair of semi-circular metallic members 16 and 17 are secured to the lower end of member 13 and suitably insulated therefrom by means of non-conductive members 18. Members 16 and 17 provide a low impedance path at ultra high radio frequencies through which certain electrical circuits associated with the tube may be bypassed to ground. Such circuits include suitable by-passing means for ultra-high radio frequencies such as condensers 19, each of which is connected between a certain tube terminal supporting member and either member 16 or 17. As will appear more fully hereinafter such circuits also include tuned plate and tuned grid circuits associated with the plate and grid terminal supporting members. In order to control the circulating currents in these circuits, which are present because of common radio frequency impedance between certain elements of the tube and a point of low radio frequency potential, such as portion 15, each of the members 16 and 17 are provided with portions 20 and 21 respectively, each of which extend downwardly a sufficient distance to form an electrical contact with portion 15. It is to be expressly understood that a single circular member may be employed instead of the pair of semi-circular members 16 and 17, or any desired number of separate members may be utilized. Also, the number and position of the extending portions 20 and 21 may vary depending upon the number of members employed, as well as the particular characteristics of the electrical circuits which are to be connected to the point of low radio frequency potential. By utilizing a plurality of members any number of circuits associated with the tube may be isolated from each other; for example, the grid and the grid associated circuits may be connected to the point of low radio frequency potential through semi-circular member 17, by way of lead 33a, while the plate and the plate associated circuits may be connected to semi-circular member 16 through conductor 33, and subsequently connected to portion 15 as shown in Fig. 2. In order to completely segregate the plate and grid circuits and their respective connections to points of low radio frequency potential, a pair of shielding partitions 22 and 23 are provided. As shown more particularly in Figs. 2 and 4, the shielding partitions are secured to cylindrical member 13 and each extend outwardly therefrom in opposite di-

rections between the adjacent ends of semi-circular members 16 and 17, completely segregating the plate and the grid circuits as well as semi-circular members 16 and 17 from each other. Partitions 22 and 23 may constitute a portion of the chassis of the electrical apparatus, or the same may be of such dimensions and shape to completely enclose certain circuits which are associated with the tube.

The foregoing construction is highly advantageous when a vacuum tube is employed which is equipped with multiple cathode, grid and plate terminals. Such a vacuum tube is shown schematically in Fig. 5 wherein envelope 24 encloses a plurality of electrodes, with multiple cathode, grid and plate terminals protruding therefrom. As shown in this figure, the cathode and associated terminals are connected to ground through a common radio frequency impedance path 25, with suitable capacitance 26 provided in each of the connections between path 25 and the cathode terminals. A common radio frequency impedance path 27 is provided for connecting the grid and associated terminals to ground, and in this case suitable capacitances 26 are also provided in the connection between the terminals and impedance path 27. By properly selecting the value of capacitance 26 any desired value of radio frequency impedance adjustment in the low radio frequency potential path may be obtained, with the value of capacitances 26 depending upon the operating frequency of the tube, such as 50 microfarads for example. Fig. 5 is only a schematic showing to illustrate the manner that associated groups of tube elements are by-passed through separate paths of low impedance at radio frequencies to ground.

When it is desired to completely shield the tube a metallic cup-shaped member 28 may be positioned over the upper portion thereof, as shown in Fig. 3. Member 28 is maintained in the position shown by means of a plurality of spring clips 29, secured to the lower portion of member 28, which contact member 10. When it is found desirable, member 28 may be connected to a point of low radio frequency potential through cylindrical member 13, by way of a suitable conductor 30.

Another embodiment of the invention is shown in Fig. 6. In this embodiment a cylindrical metallic member 31 functions to support the tube terminal supporting members to provide electrical shielding means between various electrical circuits associated with the tube, as well as supporting the tube on a portion of the chassis 15. As shown, the lower end of cylindrical member 31 is secured to portion 15, while the other end thereof is provided with a plurality of angularly disposed openings in which sleeves 32 of suitable insulating material are inserted. The tube terminal supporting members 11 are secured to the upper end of member 31 by means of rivets 12 which pass through sleeves 32 and are thus adequately insulated from each other and from member 31 if desired. Cylindrical member 31 is to be of such length that the body portion of the tube which contains the electrodes thereof may be inserted therein and effectively shielded thereby. In this embodiment the various electrical circuits associated with the tubes are by-passed to a point of low radio frequency potential through condensers 19, each of which has one connection with a tube terminal supporting member, and another connection directly to cylindrical member 31. If desired, cylindrical member 31 may also be uti-

lized as a path of low impedance at high radio frequencies to connect other elements of the circuit to the point of low potential 15, to further control the circulating currents in the entire circuit. As shown in Fig. 6, another element of the circuit, such as the plate circuit shown in Fig. 2, is connected to member 31 through lead 33. It is to be expressly understood that a plurality of metallic members may be employed to further control the circulating currents in these circuits in order to segregate certain associated tube currents, such as semi-circular members 16 and 17 shown in Fig. 1. This structure provides a tube socket and mounting therefor that is of comparatively simple design, utilizing a minimum number of elements, and that may be constructed at a relatively low cost.

Cylindrical member 13, cylindrical member 31 or members 16 and 17 also may be utilized for supporting additional circuit elements to thus provide the shortest possible paths of low impedance at higher radio frequencies from such elements to a point of low radio frequency potential as well as providing means for producing a compact circuit arrangement. Such construction as shown in Fig. 7, wherein bracket 35 is secured to cylindrical member 31, at any desired convenient position, and is adapted to support a circuit element, such as a condenser 35a, of the grid circuit shown in Fig. 2 for example. With this arrangement condenser 35a is positioned adjacent member 31 and a short path of low impedance at high radio frequencies to portion 15 is provided.

As heretofore stated, the present invention provides a novel arrangement for mounting radio tubes in concentric transmission lines whereby the latter is utilized as a tuned circuit element. With reference more particularly to Figs. 8, 9 and 10 such a construction is disclosed therein including a concentric line having an outside conductor 36 and a central conductor 37. A tube socket comprising circular member 10 with a plurality of tube terminal supporting members 11 secured to the outer periphery thereof by means of rivets 12, is positioned over and secured to the outer surface of conductor 36 at the end thereof. The inner heads of rivets 12 are recessed in member 10 a sufficient distance to prevent electrical contact between the rivets and conductor 36. However, when electrical contact is desired between supporting members 11 and conductor 36, rivets 12 may extend through and contact the inner walls of conductor 36. In order to positively secure member 10 to conductor 36 a plurality of rivets 38 are provided, each of which pass through member 10 and outer conductor 36. With the foregoing construction, the tube is supported in concentric relation with respect to the conductors of the concentric line thus allowing the tube to extend into outer conductor 36 and allowing the central conductor 37 to electrically contact the plate or grid terminal of the tube. In order to completely shield the tube a cup-shaped metallic member 39 is provided, the diameter of which is to be substantially equal to the diameter of outer conductor 36. A plurality of spring clips 40 are secured to the periphery of member 39, at the open end thereof, and are adapted to contact the outer heads of rivets 38 to maintain member 39 in the position shown in Fig. 8, wherein the tube is completely enclosed, as well as providing means for electrically connecting member 39 to outer conductor 36. Each of the clips 40 are provided with a protruding portion 41, at the lower end thereof, which is adapted to rest in

a recess provided in the rivet heads to adequately maintain member 39 in such position. With this construction, an electrical connection between outer conductor 36 and member 39 is provided, such connection including rivets 38 and clips 40. When the tube employed for tuning concentric lines includes a pair of terminals extending outwardly therefrom at opposite ends thereof and concentrically with the normal axis of the tube, metallic shielding member 39 is provided with an opening 42 in the closed end thereof through which such terminal may protrude.

The present invention thus provides novel tube socket mounting means which functions to support the tube socket as well as providing electrical shielding means for certain electrical circuits associated with the tube. Also, novel means are disclosed by the present invention which provides a path of low impedance at high radio frequencies for grounding such electrical circuits as well as mechanical means for controlling the circulating currents in said circuit. Moreover, a novel mounting for tube socket is also provided which is of such construction that tubes of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof may be utilized for effectively tuning concentric lines.

Although several embodiments of the invention have been disclosed and described in detail heretofore, it is to be expressly understood that various changes and substitutions may be made therein without departing from the spirit of the invention as well understood by those skilled in the art. Reference therefore will be had to the appended claims as a definition of the limits of the invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. In a support for thermionic tubes of the type having a plurality of terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof, comprising a cylindrical member of insulating material, a plurality of supporting members positioned about the periphery of said cylindrical member for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical insulating member, a plurality of metallic members positioned about and insulated from said cylindrical metallic member, by-passing condensers connected between certain of said terminal supporting members and said metallic members, and means connecting each of said metallic members to a point of low radio frequency potential.

2. In a support for thermionic tubes of the type having a plurality of terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof, comprising a cylindrical member of insulating material, a plurality of supporting members positioned about the periphery of said cylindrical member for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical member, a plurality of semi-circular metallic members positioned about and insulated from said cylindrical metallic member, by-passing condensers connected between certain of said terminal supporting members and said semi-circular metallic members, means connecting each of said

semi-circular metallic members to a point of low radio frequency potential, and means electrically shielding said semi-circular metallic members and associated by-passing condensers from each other.

3. In combination with a thermionic tube of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof and a concentric transmission line having outside and central conductors, a cylindrical member positioned on said outside conductor at one end thereof, a plurality of tube terminal supporting members secured to the periphery of said cylindrical member for receiving and electrically contacting said terminals to support the tube in concentric relation with respect to said outside conductor.

4. In combination with a thermionic tube of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof and a concentric transmission line having outside and central conductors, a cylindrical member positioned on said outside conductor at one end thereof, a plurality of tube terminal supporting members secured to the outer periphery of said cylindrical member for receiving said terminals to support the tube within said outside conductor in concentric relation therewith, and a metallic shield for the tube mounted adjacent the end of said outside conductor in concentric relation therewith and electrically connected thereto.

5. In combination with a thermionic tube of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof and having terminals protruding from opposite ends thereof, and a concentric transmission line having outside and central conductors, a cylindrical member positioned on said outside conductor at one end thereof, a plurality of tube terminals supporting members secured to the periphery of said cylindrical member for receiving said radially protruding tube terminals whereby the tube is supported in concentric relation with respect to said outside conductor and whereby one of the terminals protruding from the end of the tube is in concentric relation with respect to said central conductor, and means connecting said central conductor to the last named terminal.

6. In combination with a thermionic tube of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof and having terminals protruding from opposite ends thereof, and a concentric transmission line having outside and central conductors, a cylindrical member positioned on said outside conductor at one end thereof, a plurality of tube terminals supporting members secured to the periphery of said cylindrical member for receiving said radially protruding tube terminals whereby the tube is supported in concentric relation with respect to said outside conductor and whereby one of the terminals protruding from the end of the tube is in concentric relation with respect to said central conductor, means connecting said central conductor to the last named terminal, and a metallic shield for the tube mounted adjacent the end of said outside conductor in concentric relation therewith and electrically connected thereto.

7. In combination with a thermionic tube of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof and having ter-

minals protruding from opposite ends thereof, and a concentric transmission line having outside and central conductors, a cylindrical member positioned on said outside conductor at one end thereof, a plurality of tube terminals supporting members secured to the periphery of said cylindrical member for receiving said radially protruding tube terminals whereby the tube is supported in concentric relation with respect to said outside conductor and whereby one of the terminals protruding from the end of the tube is in concentric relation with respect to said central conductor, means connecting said central conductor to the last named terminal, and a metallic shield for the tube mounted adjacent the end of said outside conductor in concentric relation therewith and electrically connected thereto, said metallic shield having an opening therein through which the terminal protruding from the other end of the tube may extend.

8. In combination with a thermionic tube of the type having a plurality of tube terminals protruding radially therefrom in a plane perpendicular to the normal axis thereof and a concentric transmission line having a plurality of conductors, a cylindrical member positioned on one of said conductors at one end thereof, and a plurality of tube terminals supporting members secured to the periphery of said cylindrical member for receiving and electrically contacting said terminal whereby the tube is supported in concentric relation with respect to said one conductor.

9. In combination, a vacuum tube having a plurality of terminals including plate and grid terminals, a cylindrical member, a plurality of supporting members secured to the outer periphery of said cylindrical member for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical member, a pair of semi-circular metallic members positioned about and insulated from said cylindrical metallic member, each of said semi-circular metallic members providing a path of low impedance at high radio frequencies, means connecting each of said semi-circular metallic members to ground, a pair of tuned circuits each connected to the respectively associated terminal supporting member for said tube, and means connecting said tuned circuits to ground through separate members of said pair of semi-circular members.

10. In combination, a vacuum tube having a plurality of terminals including plate and grid terminals, a cylindrical member of insulation, a plurality of supporting members secured to the outer periphery of said cylindrical member of insulation for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical member of insulation, a pair of semi-circular metallic members positioned about and insulated from said cylindrical metallic member, each of said semi-circular metallic members providing a path of low impedance at high radio frequencies, means connecting each of said semi-circular metallic members to ground, a pair of tuned circuits each connected to the respectively associated terminal supporting member for said tube, means connecting said tuned circuits to separate semi-circular members of said pair of semi-circular members and metallic means shielding each of said semi-circular members and the tuned circuit connected thereto from the other semi-circular member and associated circuit.

11. In combination, a vacuum tube having a

plurality of terminals including plate and grid terminals, a cylindrical member, a plurality of supporting members secured to the outer periphery of said cylindrical member for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical member, a pair of semi-circular metallic members positioned about and insulated from said cylindrical metallic member, each of said semi-circular metallic members providing a path of low impedance at high radio frequencies, means connecting each of said semi-circular metallic members to ground, a pair of tuned circuits each connected to the respectively associated terminal supporting members of said tube, means connecting said tuned circuits to ground through separate semi-circular members of said pair of semi-circular members, and by-passing condensers connected between certain of said supporting members and one of said semi-circular members and between certain others of said supporting members and the other of said pair of semi-circular metallic members.

12. In combination, a vacuum tube having a plurality of terminals including plate and grid terminals, a cylindrical member, a plurality of supporting members secured to the outer periphery of said cylindrical member for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical member, a pair of semi-circular metallic members positioned about and insulated from said cylindrical metallic member, each of said semi-circular metallic members providing a path of low impedance at high radio frequencies, means connecting each of said semi-circular metallic members to ground, a pair of tuned circuits each connected to the respectively associated terminal supporting members of said tube, means connecting said tuned circuits to ground through sep-

arate semi-circular members of said pair of semi-circular members, by-passing condensers connected between certain of said supporting members and one of said semi-circular members and between certain others of said supporting members and the other of said pair of semi-circular metallic members, and metallic means shielding said tuned circuits, said semi-circular metallic members and certain of said supporting members from each other.

13. In combination, a vacuum tube having a plurality of terminals including plate and grid terminals, a cylindrical member, a plurality of supporting members secured to the outer periphery of said cylindrical member for supporting and electrically contacting said terminals, a cylindrical metallic member for supporting said cylindrical member, a pair of diametrically opposed semi-circular metallic members positioned about and insulated from said cylindrical metallic member, each of said semi-circular members providing a path of low impedance at high radio frequencies, a pair of tuned circuits each connected to the respectively associated supporting members of said tube, means connecting said tuned circuits to separate semi-circular metallic members of said pair of semi-circular members, by-passing condensers connected between the members supporting the tube terminals associated with each of said tuned circuits and the semi-circular member connected to corresponding circuits, a pair of metallic shields secured to said cylindrical metallic member each extending outwardly from diametrically opposed sides thereof between said semi-circular members for isolating said tuned circuits and the by-passing condensers respectively associated therewith from each other, and means connecting each of said semi-circular metallic members to ground at adjacent points.

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