Sept. 13, 1960 W. W. EITEL ET AL 2,952,769

ELECTRON TUBE SOCKET

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FIG. 1

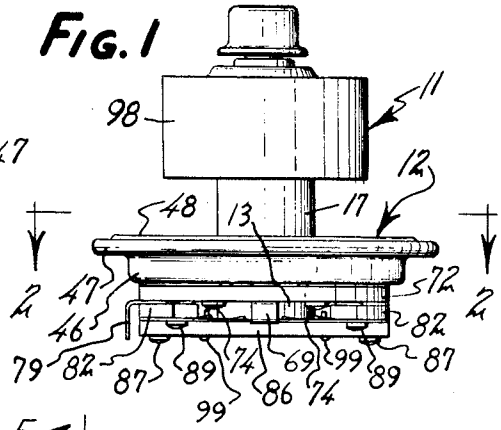
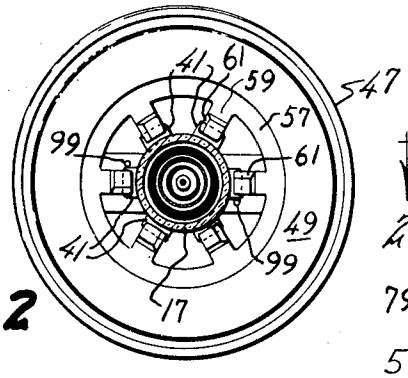


FIG. 2



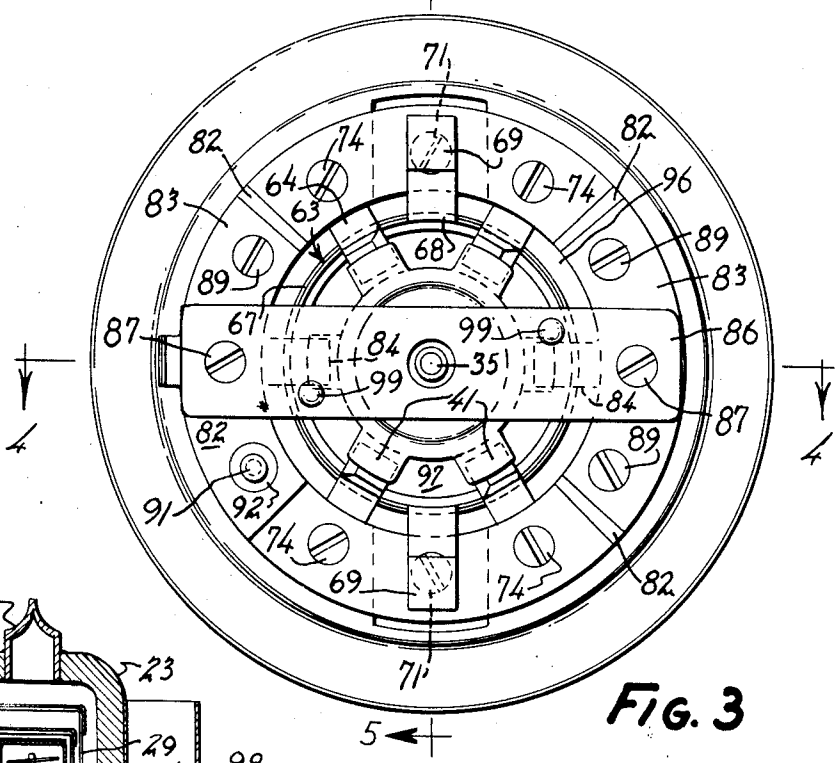


FIG. 3

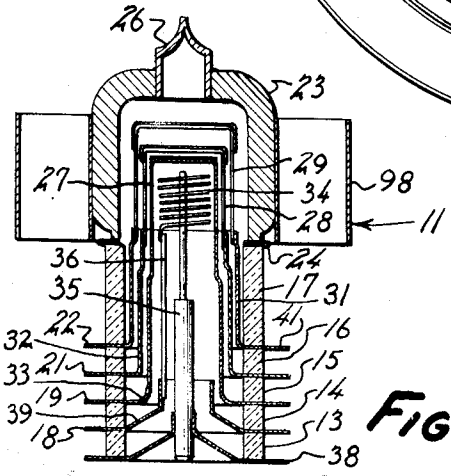


FIG. 9

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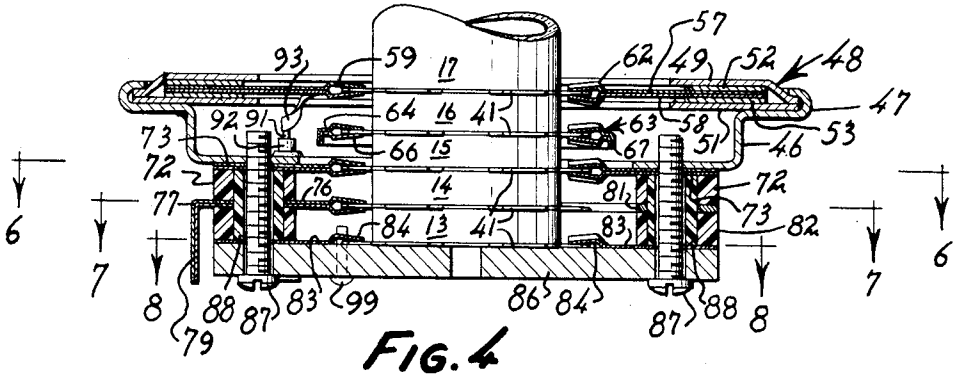


FIG. 4

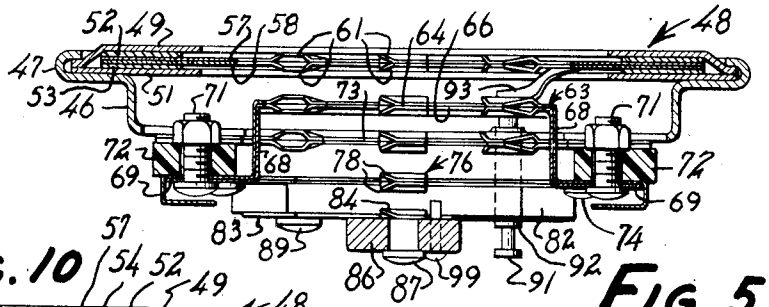


FIG. 5

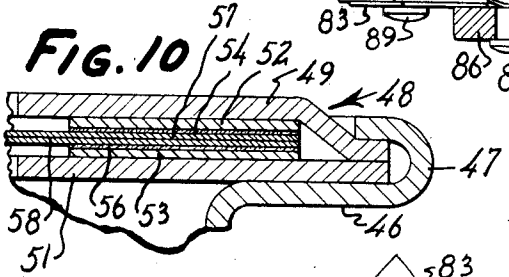


FIG. 10

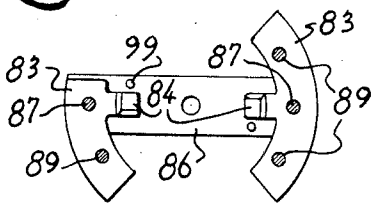


FIG. 8

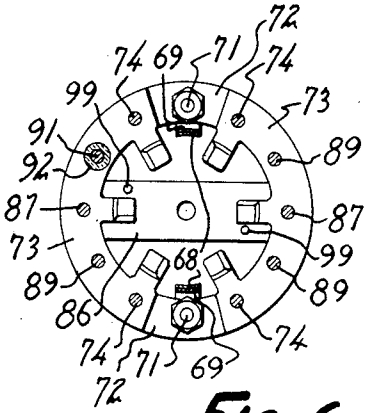


FIG. 6

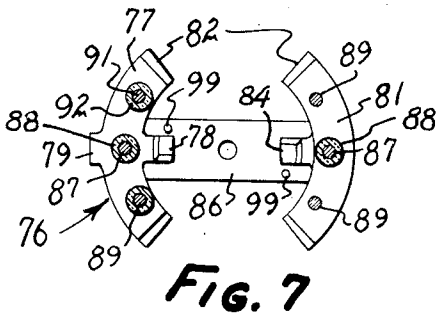


FIG. 7

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ELECTRON TUBE SOCKET

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Filed Feb. 19, 1957, Ser. No. 641,181

8 Claims. (Cl. 250—16)

This invention relates generally to electron tube sockets and more particularly to electron tube sockets of the type adapted to be used with electron tubes of the type having radially extending axially spaced terminal tabs.

In the co-pending application of Jack A. McCullough, George F. Wunderlich and Paul D. Williams, Serial No. 492,892, filed March 8, 1955, there is described an improved electron tube which has an envelope structure comprising ceramic and metallic rings assembled, in a stacked relationship, the metal rings functioning both as electrode supports and as terminal members having radially extending tabs.

In the aforementioned application, there is also described a socket which has contacts complementary to those on the tube so that the tube may be inserted into the socket and rotated to bring the terminals into engagement with the contacts. A spring in the lower portion of the socket presses the tube upwardly whereby the terminals bear against the socket contacts for effective contact.

It is an object of the present invention to provide an improved tube socket of the type having radially extending terminals.

It is another object of the present invention to provide an improved tube socket in which two coacting contact fingers are provided for each terminal tab whereby slight inaccuracies in the relative axial spacing of the tabs and contact fingers are not fatal because at least one contact finger of each pair will make good contact with the associated tab.

It is another object of the present invention to provide a tube socket which includes means for capacitively coupling the screen grid to the cathode.

It is another object of the present invention to provide a tube socket which provides an annular gap between the tube body and the socket body for circulating air past the tube.

It is another object of the present invention to provide a compact and easily manufactured tube socket which has reliable electrical characteristics.

The invention possesses other objects and features of advantage, some of which with the foregoing will be set forth in the following description of the invention. It is to be understood, of course, that the invention is not to be limited to the disclosure of a particular species of the invention, as other embodiments thereof may be adopted within the scope of the claims.

Referring to the drawing:

Figure 1 is a side elevational view showing a tube socket with an electron tube inserted therein;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1 showing a top plan view of the electron tube socket and the tube in section;

Figure 3 is an enlarged bottom view of the electron tube socket with the tube inserted therein;

Figure 4 is a sectional view taken along the line 4—4 of Figure 3;

Figure 5 is a sectional view taken along the line 5—5 of Figure 3 with the tube removed;

Figure 6 is a sectional view on reduced scale taken along the line 6—6 of Figure 4;

Figure 7 is a sectional view on reduced scale taken along the line 7—7 of Figure 4;

Figure 8 is a sectional view on reduced scale taken along the line 8—8 of Figure 4;

Figure 9 is a sectional view of an electron tube of the type shown in Figure 1; and

Figure 10 is an enlarged fragmentary sectional view of a portion of the socket shown in Figure 4.

Referring to Figure 1, an electron tube 11 is shown socketed in a socket 12. The tube 11 may, for example, be a tetrode in the power tube category having high anode dissipation ratings.

A typical tube is illustrated in Figure 9. The tetrode illustrated has an evacuated envelope of generally cylindrical construction having a sidewall comprising five stacked ceramic rings 13, 14, 15, 16 and 17 with four flat terminal rings 18, 19, 21 and 22 sandwiched therebetween. The ceramic envelope is preferably of a high refractive material such as alumina. The rings are metallized at both ends by a suitable metallizing procedure such as molybdenum-manganese powder sintering process. The interposed metal rings are quite thin and have good electrical conductivity. For example, the rings may be made of copper. The sandwiched parts are then brazed together using a high temperature brazing alloy such as copper-gold or the like.

The metallic bonds at the brazed joints form strong mechanical connections and provide a vacuum seal so that the sidewalls of the envelope form a solid impervious cylinder of rugged construction. The rings provide desired lead-in conductors through the envelope.

The external cup-shaped anode 23 is preferably made of copper and forms the upper portion of the envelope. It is supported on the upper ceramic ring 17 and is secured thereto by the sealing flanges 24. The anode 23 preferably also carries the exhaust tube 26. The other electrodes in the envelope include cathode 27, control grid 28, and the screen grid 29. The cathode 27 is preferably of the oxide coated type, and grids 28 and 29 are of conventional wire cage construction. These electrodes are preferably made coaxial and extend upwardly into the anode 23.

The electrodes are mounted on tubular supports which are connected to the inner edge of the associated terminal rings. Thus, the screen grid 29 is carried by the tubular support 31 which is carried by the ring 22. The control grid 28 is carried by the tubular support 32 which is connected to the ring 21, and the cathode 27 is connected to the tubular support 33 which is connected to the ring 19. Preferably, the terminal rings and the tubular supports are formed as an integral part which may be stamped or drawn from a sheet of metal.

A suitable heater is provided for the cathode. Preferably, the heater comprises a heater coil 34 which is supported by a center rod 35 and a side rod 36. The center rod 35 has its lower portion extending through and brazed to a conically shaped lower wall member 38. The wall member has its outer periphery brazed to the lower ceramic ring 13. The side rod 36 is suitably attached to a conically shaped portion 39 of the ring 18.

Referring to Figure 2 the terminal rings have axially extending tabs or terminals 41. Each of the rings has a plurality of such tabs spaced circumferentially about the tube. The tabs for the various rings are arranged above one another in a vertical row.

The tube socket for the above type tube includes a cylindrical metallic shell 46 having a flange 47. The

edges of the flange **47** are rolled over to hold a screen grid by-pass capacitor assembly designated generally by the reference numeral **48**.

The screen grid by-pass assembly includes upper and lower metal plates **49** and **51** which have their outer edges engaged by the rolled over portion of the flange **47**. In contact with the plates are upper and lower metal contact washers **52** and **53** (Figure 10). Upper and lower dielectric washers **54** and **56** are in contact with the washers **52** and **53** respectively. Sandwiched between the dielectric washers are metal screen grid contact rings **57** and **58** respectively. The rings have contact fingers **59** which extend radially inward. The edge portion **61** of the upper finger is bent upwardly, and the edge portion of the lower finger is bent downwardly to form a V-shaped camming surface which guides the tabs **41** on the screen grid ring **22**. The upper and lower fingers have their end portions bent to form a tab accommodating portion **62**. Preferably, the rings are made of beryllium copper or other similar material which has good conductivity and is resilient whereby the end portions of the contact fingers are urged together. Thus, when the tabs **41** are inserted therebetween by rotation of the tube, a wiping contact is made.

As previously described, the complete sandwiched assembly forms a by-pass capacitor which capacitively connects the screen grid to the cylindrical shell **46**. Preferably, the screen grid dielectric washer is made of mica or other suitable dielectric material and has its outer surfaces coated with a layer of conductive material to provide a more intimate contact with the adjacent metallic parts.

The control grid contact assembly **63** comprises upper and lower rings **64** and **66**. The rings are provided with a plurality of spaced contact fingers extending radially inward. The fingers are of the type previously described, the upper contact having its edge bent upwardly and the lower contact downwardly to form a camming surface, and the ends of the fingers being bent to form a tab receiving opening. The contact rings have an outer portion **67** which is bent downwardly. A pair of ribbon-like supports formed integral with each of the rings extend axially downward **68** and then outward **69** where they are engaged by securing means. The supports are located diametrically opposite each other and provide means for making electrical contact with and supporting the control grid contact assembly in spaced relationship with respect to the other contact assemblies.

The lower portion of the cylindrical shell **46** has an internal flange with a pair of segments cut therefrom whereby the securing means **71** employed to hold the control grid contact assembly to the insulating body ring **72** is not in electrical contact with the flange.

A pair of cathode contact segments **73**, each having upper and lower members, are placed in intimate contact with the lower flange. Each of these contact segments carries three radial inwardly extending contact fingers which are adapted to make contact with the cathode tabs or terminals of the electron tube. The contact fingers are formed in a manner previously described with respect to the screen grid and control grid contacts. The insulating body ring **72** which is made of dielectric material, for example a suitable plastic material, is suitably secured to the lower flange of cylinder shell **46**, for example by screws **74** which are threadedly received by the flange.

Axially spaced from the cathode contact assembly is a heater contact assembly **76**. The contact assembly comprises a contact segment **77** having upper and lower members which form inwardly extending contact finger **78** and an outwardly extending lead portion **79**. The contact portion **78** is of the type previously described. A spacer segment **81** is provided diametrically opposite the segment **77** and is of the same thickness as the contact segment.

Insulating spacer segments **82** are located diametrically opposite each other and are placed over the segments **77** and **81**. On the opposite side of the spacers **82** are mounted the heater ground contact segments **83** (Figure 8). The heater contact segments have contact fingers **84** which extend radially inward and which have one edge inclined upwardly to cam the tab between the contact and the tube stop bar **86** which extends diametrically across the socket.

The screws **87** extend through the assembly and engage the cylindrical shell **46**. The screws **87** are provided with insulating sleeves **88** whereby they do not contact the heater contact segment **77**. Actually, an insulating sleeve is really required only in the case of screw **87** at the left of Figure 7 because only that screw **87** passes through heater contact segment **77**, the screw **87** at the right passing merely through the spacer segment **81**. Similarly, screw **89** in contact segment **83**, at the left of Figure 7, is provided with an insulating sleeve. The heads of screws **89** engage contact segments **83**, and at their upper ends these screws are threaded in cylindrical shell **46**. No sleeves are needed for screws **89** in segment **83** at the right of Figure 7 because these screws do not pass through heater contact segment **77**.

A pin **91** provides means for connecting directly to the screen grid. The pin extends axially through the socket and is insulated therefrom. The lower end of the pin extends beyond the surface of the insulating segment **82**. A sleeve **92** insulates the pin from the metallic parts through which it passes. The upper end of the pin is secured to a connecting ribbon **93** which is secured to the screen grid contact ring.

The open construction of the tube socket provides a generally annular space **96** (Figure 3) and wedge shaped spaces **97** between the contact fingers for the circulation of air therethrough. Thus, air may be circulated upwardly past the tube and through the cooling fin assembly **98** formed about the anode **23** of the tube.

The contact fingers are spaced above one another in vertical rows so as to match the vertical rows of tabs **41** on the tube.

To insert the tube within the socket, it is rotated until the tabs **41** are aligned with the spaces **97** formed between the contact fingers. The tube is then lowered downwardly until the bottom wall **38** abuts against the tube stop bar. The tube is then rotated clockwise until the heater contact tabs strike the stop pins **99** mounted on the bar. To remove the tube, it is rotated counterclockwise until the heater contact tabs strike the other side of the pins **99** and then it is withdrawn axially from the socket.

Thus it is seen that a socket is provided in which the contact fingers serve to prevent axial displacement of the socket. The tabs are resiliently held between pairs of co-acting contacts. The axial spacing of the contact tabs and contact fingers is not critical since contact will be made between each tab and one or the other or both of the associated contact fingers. The open construction of the tube facilitates the circulation of air through the socket and past the tube. The tube socket forms part of the electrical circuit providing a screen by-pass capacitor for the tube. The large area abutting contact between the by-pass capacitor shell and the cathode contact segments provides a low inductance connection between the screen grid and the cathode. The general over-all arrangement of the parts provides a compact, easily manufactured and assembled tube socket.

We claim:

1. A tube socket for electron tubes of the type having radially extending axially spaced terminal tabs, said socket comprising a plurality of contact rings, insulating means holding said rings in pairs, said pairs being spaced along a common axis, each of said rings having radially

extending contact fingers, said contact fingers of said rings of each of said pairs being in abutting alignment with each other, said aligned fingers having spaced end portions forming a tab accommodating recess, and edge portions spread apart to form a tab guide.

2. A tube socket for electron tubes of the type having radially extending axially spaced terminal tabs, said socket having a wall structure forming a generally cylindrical body open at both ends, a plurality of contact assemblies having contact fingers projecting toward the inside of said socket, said wall structure comprising insulating means holding said contact assemblies spaced axially of the socket, each of said contact assemblies comprising two metal rings with aligned contact fingers resiliently separable to receive a terminal tab on an electron tube, and a tube stop member attached to one end of said wall structure and extending inwardly thereof.

3. A tube socket for electron tubes of the type having radially extending axially spaced terminal tabs, said socket comprising a generally cylindrical metal shell, a by-pass capacitor assembly carried by one end of said shell, said capacitor assembly including a first contact ring having inwardly extending contact fingers, an inturned flange on the other end of said shell, contact ring segments abutting said flange and having inwardly extending contact fingers, an insulating body ring abutting said contact ring segments, a second contact ring positioned between and spaced from said first contact ring and said contact segments, means attaching said second contact ring to said insulating ring, said flange being recessed adjacent said attaching means and said contact ring segments being spaced apart adjacent said attaching means whereby said contact ring segments and said flange are spaced from said attaching means, insulating spacer segments overlying said body ring, another contact ring segment disposed between said body ring and one of said spacer segments and having an inwardly extending contact finger, additional contact ring segments abutting the other side of said spacer segments, said spacer segments and said additional contact ring segments being spaced apart adjacent said attaching means, and a tube stop bar extending across the end of said socket with its ends overlying said additional contact ring segments.

4. An electron tube socket comprising a cylindrical metallic shell, contact fingers extending radially inward from one end of said shell and electrically connected thereto, an insulating ring mounted on said one end of said shell, a first contact assembly comprising a metallic ring with contact fingers extending radially inward therefrom mounted on the other end of said shell in insulated relation thereto, a second contact assembly comprising a metallic ring with contact fingers extending radially inward therefrom positioned within said shell in spaced relation to the inside thereof, said second contact assembly being supported on ribbon-like supports spaced about the periphery thereof, said supports extending out of said one end of said shell and being mounted on said insulating ring in insulated relation to said shell, said ribbon-like supports providing electrical connections to said second contact assembly, and a third contact assembly comprising a metallic ring segment having a contact finger extending radially inward therefrom, said third contact assembly being mounted on said insulating ring intermediate adjacent ones of said ribbon-like supports.

5. An electron tube socket comprising a cylindrical metallic shell, contact fingers extending radially inward from one end of said shell and electrically connected thereto, an insulating ring mounted on said one end of said shell, a first contact assembly comprising a metallic ring with contact fingers extending radially inward therefrom mounted on the other end of said shell in insulated relation thereto, a second contact assembly comprising a metallic ring with contact fingers extending radially inward therefrom positioned within said shell in spaced relation to the inside thereof, said second contact assembly being supported on spaced ribbon-like supports extending out of said one end of said shell and mounted on said insulating ring in insulated relation to said shell, a third contact assembly comprising a metallic ring segment having a contact finger extending radially inward therefrom, said third contact assembly being mounted on said insulating ring intermediate adjacent ones of said ribbon-like supports, and a fourth contact assembly comprising a pair of metallic ring segments each having a contact finger extending radially inward therefrom and a tube stop bar, said metallic ring segments and said tube stop bar of said fourth contact assembly being mounted at said one end of said shell in insulated relation to said ribbon-like supports and said third contact assembly, said contact fingers of said fourth contact assembly being arranged in diametrically opposed relation and said tube stop extending diametrically across said socket and being in abutting relation to said contact fingers of said fourth contact assembly.

6. An electron tube socket comprising a cylindrical metallic shell, a first contact assembly mounted on one end of said shell and electrically connected thereto, said first contact assembly comprising two pairs of stacked metallic ring segments, each of said ring segments having contact fingers extending radially inward therefrom, the contact fingers of each pair of segments being mutually aligned and said pairs of segments being spaced from each other about the periphery of said one end of said cylindrical shell and each lying in a plane perpendicular to the axis of said shell, a second contact assembly insulatingly mounted on the other end of said shell, said second contact assembly comprising a pair of stacked metallic rings each having a plurality of contact fingers extending radially inward therefrom, each of said contact fingers of one of said metallic rings of said second contact assembly being aligned with a contact finger of the other of said metallic rings of said second contact assembly, said metallic rings of said second contact assembly each lying in a plane perpendicular to the axis of said shell, a third contact assembly positioned within said shell in spaced relation to the inside thereof, said third contact assembly comprising a pair of stacked metallic rings each having a plurality of contact fingers extending radially inwardly therefrom, each of said contact fingers of one of said rings of said third contact assembly being aligned with a contact finger of the other of said rings of said third contact assembly, said metallic rings of said third contact assembly lying in planes perpendicular to the axis of said shell and being spaced from both said first contact assembly and said second contact assembly along said axis, said third contact assembly being mounted on a pair of ribbon-like supports extending out of said one end of said shell between said segments of said first contact assembly, said ribbon-like supports being insulatingly mounted on said one end of said shell.

7. A tube socket for electron tubes of the type having radially extending axially spaced terminal tabs, said socket having a wall structure forming a generally cylindrical body open at both ends, a plurality of contact assemblies, said wall structure comprising insulating means holding said contact assemblies spaced axially of the socket, each of said contact assemblies comprising a pair of metal rings, contact fingers extending radially inward from each of said metal rings, said contact fingers of each of said metal rings being aligned with the contact fingers of the other rings in axially extending rows and the aligned contact fingers of each pair of metal rings being in resiliently abutting relation, said aligned contact fingers of each of said pairs being separable to compressively receive a terminal tab of said electron tube, a stop bar having a width less than the diameter of said socket and extending diametrically across one end of said socket, and means secured to said stop bar and projecting into said socket for limiting rotational movement in either direction, whereby when the end of said tube is placed

in abutting relation to said stop bar and rotated in one direction into contact with said limiting means said tabs are indexed with said rows of contact fingers and each of said tabs is held between the fingers on a contact assembly and when rotated in the other direction into contact with said limiting means said tabs are indexed for withdrawal of said tube from said socket.

8. A tube socket for electron tubes of the type having radially extending axially spaced terminal tabs, said socket comprising a generally cylindrical metal shell having an outwardly extending flange at one end and an inwardly extending flange at the other, a by-pass capacitor assembly mounted on and electrically connected to said outwardly extending flange, said by-pass capacitor assembly comprising a first contact assembly comprising a metal ring with inwardly extending contact fingers, an insulating ring on each side of said first contact assembly and in abutting relation therewith, a pair of metal washers, one of said pair of metal washers being in abutting relation with each of said insulating rings, and clamping means mounting said capacitor assembly on said flange, said capacitor assembly serving to capacitively couple said first contact assembly to said shell, a second contact assembly comprising a metal ring segment with inwardly extending contact fingers mounted in abutting relation to said inwardly extending flange at said other end of said shell, a third contact assembly comprising a metal ring with inwardly extending contact fingers, support means mounting said third contact assembly within said shell in a position intermediate and spaced from said capacitor assembly and said second contact assembly, said support means including insulating material insulating said third contact assembly from said shell, and means including a lead mounted on said shell and insulated therefrom for making a direct electrical connection to said first contact assembly.

References Cited in the file of this patent

UNITED STATES PATENTS

2,323,628	Smith	July 6, 1943
2,377,893	Lorenzen	June 12, 1945
2,405,554	Barbour	Aug. 13, 1946
2,458,390	Larkin et al.	Jan. 4, 1949
2,459,272	Fox et al.	Jan. 18, 1949
2,551,630	Page	May 8, 1951
2,702,376	Brush	Feb. 15, 1955
2,760,177	Hollis et al.	Aug. 21, 1956
2,858,491	Carter	Oct. 28, 1958