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R. C. FOX ET AL

2,459,272

SOCKET

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Fig. 1.

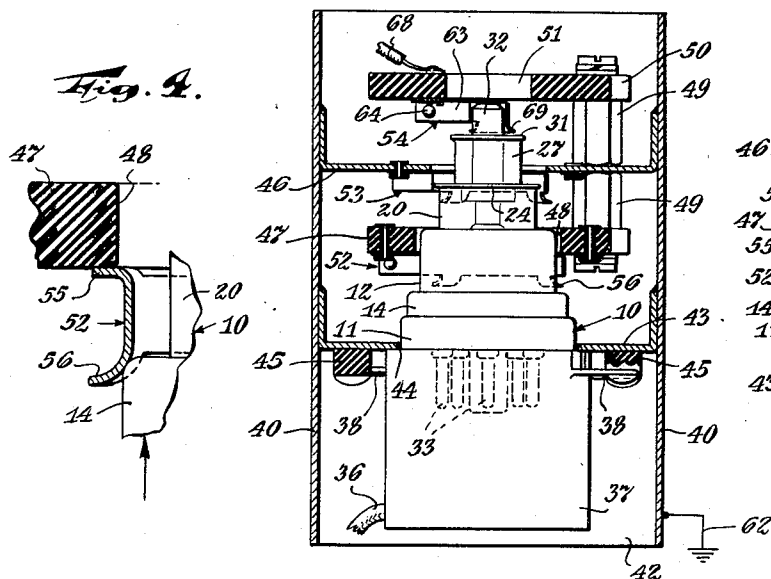


Fig. 3.

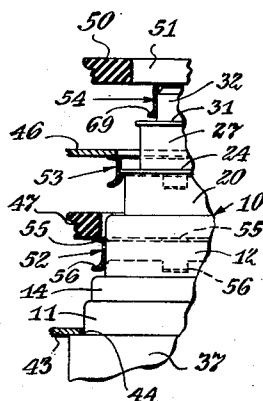


Fig. 2.

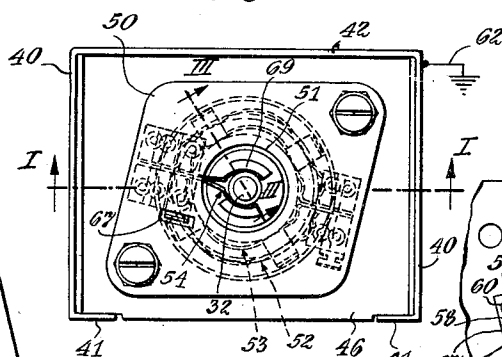


Fig. 6.

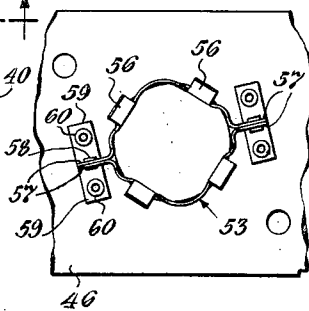


Fig. 5.

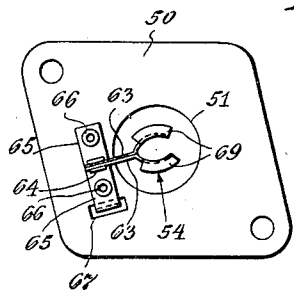
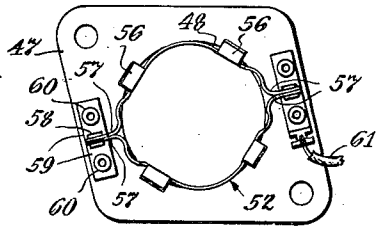


Fig. 7.



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SOCKET

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This invention relates to sockets and more particularly to sockets for disk-seal tubes now well known in the electronic art, the most outstanding of which at present is the so-called "Lighthouse" tube.

The application of "Lighthouse" as the designation for the disk-seal tube to which the present invention has reference, was acquired because of the outer contour of the tube and not because of any illumination derived from the tube or from any use implied by the name. It is, rather, an electronic tube having cathode, grid and anode. It has been described in literature as so constructed that the radio frequency cathode connection, the grid connection and anode connection, each formed as a cylinder, are graduated in size and pyramided on each other, thereby giving a shape inspirational of the name. The construction lends itself advantageously to the use with concentric coaxial lines or other cavity resonator circuits, but provision of an acceptable socket for circuits of "lumped" components has presented problems and difficulties not heretofore satisfactorily solved.

According to the present invention, a socket is provided having improved structure and satisfactory characteristics for inclusion of a disk-seal or "Lighthouse" tube in a lumped circuit.

More specifically, an object of the invention is to provide a socket for the type of tube indicated which will be more sturdy and which will give better electrical contact than sockets heretofore used.

Another object of the invention is to avoid fragile finger contact engagement.

A further object of the invention is to provide adequate support against undesired deformation of the contacting elements.

Yet another object of the invention is to provide a structure which will guide the tube while being inserted and one not requiring visual manipulation in applying a tube thereto.

Again, the invention contemplates provision of a self-alignment of the tube in the several contact devices with allowance for alignment being secured without impairing good electrical contact.

Still further objects of the invention will appear to those skilled in the art to which it appertains as the description progresses, both by

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direct recitation thereof and by implication from the context.

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

Figure 1 is a longitudinal sectional view, as on line I—I of Fig. 2, of our improved socket, showing a "Lighthouse" tube mounted therein;

Figure 2 is a plan of the same;

Figure 3 is a section of a portion of the socket as on line III—III of Fig. 2 and also showing a portion of a tube therein;

Figure 4 is an enlarged sectional view of a part shown on smaller scale in Fig. 3 and showing the tube in process of being seated; and

Figures 5, 6 and 7 are underneath plans of the contact elements and their supports for the anode, grid and cathode external connections respectively.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral 10 designates the electronic tube of disk-seal type and specifically a "Lighthouse" tube. Such a tube is shown and described in an article "Electronics" by E. M. McArthur, Feb. 1945, pages 98-102. Briefly, that tube is constructed with a cylindrical base 11 of insulating material on which the evacuated portion of the tube is mounted which includes a first large cylindrical metallic housing 12 above the base and with a sealed bottom closure and secured by a ferrule 14 overlapping a reduced neck on the base and a flange at the bottom of the housing. There is an end wall, which for convenience of description will be called the first disc, at the forward end of this first cylindrical housing 12 through which the cathode projects axially and with which said cathode has capacitative connection, thereby rendering said first cylinder 12 a high frequency terminal and lead-in for the cathode. Our invention includes provision of a releasable contact element for external engagement with this first cylindrical housing and will be described in a subsequent part of this specification.

Next beyond the first housing 12 of the tube is a second cylindrical housing 20 the cylindrical wall of which is glass having a butt seal on the forward face of the end wall of the first cylindrical housing. The forward end of the cylindrical wall of the second housing 20 is butt sealed against

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the rearward face of a metallic washer-like disc 24 which protrudes slightly beyond the periphery of the cylindrical wall. This washer-like disc 24 will be referred to as the second disc. The tube grid is situated in the opening of said washer-like disc, so that the said second disc is both a support for and a lead-in connection for the grid. Our invention includes provision of a releasable contact element for external engagement with the periphery of this second disc 24 of the second cylindrical housing. In passing, it may be stated that as a matter of interest, the cathode provides a flat emitting surface closely spaced from and in parallelism to the grid, the second disc 24 having a collar-like shield depending into the second housing around the cathode and peripherally of the opening in the second disc.

Next beyond the second housing 20 of the tube is a third cylindrical housing 27 the cylindrical wall of which is glass having a butt seal on the forward face of said second disc 24. The forward end of the cylindrical wall of the third housing 27 is butt sealed against the rearward face of a metallic washer-like third disc 31 the periphery whereof protrudes slightly beyond the periphery of the cylindrical wall. It may now be appropriate to state that each successive disc is of smaller diameter than the one next preceding it, and all of said discs are on a common axis which is the central axis of the tube. Said third disc 31 carries the anode which depends therefrom toward and into the vicinity of the grid, said anode having a plane end closely spaced from and in parallelism to the grid. The forward end of the anode projects through the third disc and provides beyond said third disc at the exterior of the tube an end plug or terminal 32. This end terminal is of course on electrical equality with the third disc and is utilized as the lead-in connection for the anode and for which we provide a releasable external engagement in the construction of our socket.

The base end of the tube is equipped with appropriate lead-in prongs 33 and internal connections thereto for the low potential lines to cathode and cathode heater. A receptacle is provided to fit the prongs and permit detachment of the tube from the feeding line 36 therefor. We prefer to mount that receptacle in a can-like shell 37 next the open end of which we provide diametrically opposite laterally projecting lugs 38. These lugs constitute the means for retaining the tube with said receptacle attached thereto and slung in said shell in place, in the socket of our invention.

Our improved socket comprises a housing, here shown rectangular, having side walls 40 with front flanges 41 longitudinally thereof, a back wall 42 and open ends. These and other details are subject to considerable variation and are described in detail only for purposes of being definite in explanation of the particular showing in the drawing. Spaced upwardly from the open bottom of the housing a distance at least as great as the length of the can-like receptacle-receiving shell 37 is a partition 43 suitably carried by the housing as by being welded to the side walls thereof. The middle of this partition has a hole 44 therein large enough to receive the base of the tube, but not large enough to pass said shell 37. Consequently the inner end of the shell may seat against the lower or rear face of the partition, which therefore acts as a stop and limits insertion of the tube in the socket. Near the hole, at diametrically opposite sides thereof and extend-

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ing in tangential directions are two detents 45 with appropriate lips onto which the lugs 38 projecting from the shell may be engaged by appropriately rotating the shell.

It is recognized by those skilled or partly skilled in the electronic art, that one or another tube electrode, namely cathode, grid or anode is usually grounded. In the present invention, the grounding is shown effected through provision of a second metallic partition 46 extending between and carried by the side walls of the housing in parallelism to the first partition and appropriately spaced therefrom. For purposes of the present illustration, the grid has been arbitrarily selected as the electrode which is grounded, and contacts for the anode and cathode are insulatively carried by the said second partition on opposite sides thereof. Thus, while we show mounting means for contact elements for all three electrode lead-in connections and show the middle one grounded, it is within the scope of the invention, and in practice it is a fact, that the contact element grounded mounting may be positioned appropriately for any one of the three electrode lead-in connections, with the other two mountings carried thereby and insulated therefrom and from each other.

Referring to the specific arrangement shown in the drawing, a yoke 47 of flat insulating material and with an opening 48, preferably circular, therethrough large enough to freely receive the first cylindrical housing of the tube is provided, and for identification purposes will be referred to as the first mounting. Said mounting is connected by spacers 49 to the next mounting (in this showing, the second partition 46) and for uniformity of terms, the said partition will be referred to as the second mounting. Other spacers 49 on the other side of the second mounting support a third mounting 50 of insulative material having a middle opening 51 ample to clear the terminal plug 32 of the tube, said third mounting otherwise conforming to the description of the first mounting or yoke 47.

On the rear or under face of each said mounting is a resilient contact element and these will be identified in the same order as the said mountings, as the first, second and third contact elements 52, 53 and 54 respectively, and the spacing of the several mountings is such that the said contact elements will be in contact with the first cylindrical housing of the tube, the second disc of the second housing and the terminal plug 32 of the third housing of the tube respectively when the tube is in its applied operative position in the socket.

Specifically describing the first contact element 52, the same comprises a band of resilient material situated edgewise with respect to the under flat face of the first mounting 47, and with its inner face in parallelism to the axis of the socket opening. The band has a curved shape to locate the band in the vicinity of the opening 48 of the mounting. The shape, however, is not strictly circular, there being parts of the band which are bent inward to a shorter radial distance from the axis than other parts and less than the radius of the opening. At these parts of the band, which are more proximate to the axis, tabs 55, 56 are provided bent radially outward from the top and bottom edges respectively of the band with the top tabs 55 having extended surface engagement with the mounting and slidable on the said mounting. The lower tabs 56 constitute guiding flares against which the tube housing will engage as

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the tube is inserted, thereby enabling the sliding motion of the tube axially to spread the band diametrically by virtue of the wedging action against the flares. The axial moment of force applied by pushing the tube toward the band is counteracted by the engagement of the top tabs 55, and thus in use, there is no possibility of forcing the band out of place in a direction longitudinally of the tube axis, and spreading movement of the contact element does not substantially disturb the condition of parallelism of the contact element to the axis. The said contact element 52 is appropriately attached to the mounting 47, and according to the specific showing in the drawing the band is made in two sections, one a duplicate of the other and on opposite sides of a diametric plane through the axis. The ends of the band sections are bent outward in said plane, forming flat arms 57, of which corresponding ones of the two sections are juxtaposed flatwise together and secured, as by eyelets 58 or other suitable means. At the edges of the arms 57 next the mounting are provided feet 59 extending from and integral with the said arms in flatwise engagement with the mounting. Eyelets 60 through said feet and mounting are shown for retaining the same assembled. One of said feet 59 may be of greater length than the others, if so desired, and constructed and arranged to receive a lead-in wire 61 soldered or otherwise connected thereto.

The contact element 53 for the second mounting which in this instance is the metallic partition, is in all essentials like the above-described element 52 except smaller in size of opening for tube contact. Also, in this instance, since the element is attached to the metallic partition, direct attachment of a lead-in wire to said element is omitted. The housing is, instead, shown grounded at 62. Otherwise, the above description and reference characters are repeated for this second contact element 53 as given for the first contact element 52.

Because of the smaller size, less spread and shorter leverage involved with the third contact element 54, it is deemed sufficient to attach the same to the mounting at one side of the opening only. As shown, said element 54 is made with two arms 63 held flatwise together by an eyelet 64, each arm having a foot 65 secured flatwise to the mounting by eyelets 66. The end of one foot bends upwardly through an opening 67 in the mounting and has a lead-in wire 68 attached thereat. The juxtaposed arms 63 are edgewise of the under face of the mounting and located in a diametric plane through the axis of opening 51. The ends of the arms protruding into said opening are made arcuate, that is, concave toward each other, for obtaining contact with extended area of the end plug or terminal 32 of the tube. Furthermore the arcuate portions of the arms are provided at their lower edges with tabs 69 which flare downwardly outward enabling introduction of the end plug of the tube wedgingly therebetween.

By way of recapitulation, it may be emphasized that the several openings for the tube in the successive mountings below the anode contact are slightly greater than the diameter of the particular housing portion of the tube which is to be positioned within the opening in assembled relation of the tube to the socket. The arrangement accordingly avoids any possibility of spreading the contact member beyond its inherent resilient capability, and obtains an automatic guiding of

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the tube as the tube is inserted, not necessitating that the operator must see the full length of the tube during insertion in the socket. It is virtually impossible to damage the contacts by any manner of careless insertion or removal of the tube, especially in view of the bracing of the contact elements from the mountings therefor. The shape and character of the contact elements is such that a slight "floating action" is provided which allows the contact elements to align themselves properly to grip the tube housings or discs despite any eccentricities in tube or socket structure. Furthermore, the construction of socket with metallic walls lends itself to grounding the appropriate electrode of the tube, and, in the instance shown, with the grid grounded by partition 46, and the contact mounted directly thereon, the partition will also serve as an electrostatic shield between cathode input and anode output circuits.

We claim:

1. A socket as characterized for support of an electronic tube, comprising a plurality of mountings in spaced parallelism to each other and each having an opening therein, said openings being disposed on a common axis, elongated band contact elements supported at longitudinal edges thereof by and bearing slidably upon said mountings and standing edgewise next said openings, said contact elements being rigid in an edgewise direction thereof and having parts thereof projecting inwardly of the openings and movable radially of the openings by flexing of said elements, whereby axial moment of force applied to an element by introducing a tube into said element toward the opening of the mounting is counteracted in rigid direction of the element by engagement of the element with the mounting and spreading of the element is obtained by the slidable bearing of said element on the mounting and flexing of the element.

2. A socket as characterized for support of an electronic tube, comprising a plurality of mountings in spaced parallelism to each other and each having an opening therein, said openings being disposed on a common axis, elongated band contact elements supported at longitudinal edges thereof by and bearing slidably upon said mountings and standing edgewise next said openings, said contact elements having parts thereof parallel to the axis and rigid in an edgewise direction of the elements and projecting inwardly of and movable radially of the openings by flexing of said elements, whereby axial moment of force applied to an element by introducing a tube into said element toward the opening of the mounting is counteracted in rigid direction of the element parallel to the axis by engagement of the element with the mounting and spreading of the element is obtainable by the slidable bearing of said element on the mounting and flexing of the element.

3. A socket as characterized for support of an electronic tube, comprising a plurality of mountings in spaced parallelism to each other and each having an opening therein, said openings being of successively smaller diameter in the successive mountings and disposed on a common axis, elongated band contact elements supported at longitudinal edges thereof by and bearing slidably upon said mountings and standing edgewise next said openings, said contact elements being rigid in an edgewise direction thereof and having parts thereof projecting inwardly of the open-

ings and movable radially of the openings by flexing of said elements, and said contact elements being successively of smaller tube-receiving size in the same order as the said openings are successively smaller in diameter, whereby axial moment of force applied to an element by introducing a tube into said element toward the opening of the mounting is counteracted in rigid direction of the element by engagement of the element with the mounting and spreading of the element is obtained by the slidable bearing of said element on the mounting and flexing of the element.

4. A socket for a disk-seal tube having surfaces to be contacted of successively smaller diameter, said socket having a plurality of mountings with axially aligned openings therein of successively smaller diameter, each mounting having a contact element attached thereto and movable transversely of and retaining in all positions to which moved substantial parallelism to the axis of the opening of the mounting, each contact element having slidable engagement at an edge thereof with the mounting thereby preventing displacement of said contact element in an axial direction.

5. A socket for a disk-seal tube, comprising a housing having a transverse mounting therein, said mounting having an opening therein, a contact element next to and in part overlapping said opening, said element being resilient and adapted to be spread to the size of said opening, arms in planes perpendicular to said transverse mounting, said arms comprising a part of said contact element and said arms projecting adjacent said mounting away from said opening, and feet parallel to and juxtaposed upon said mounting at the ends of said arms remote from said opening, said feet being secured to said mounting.

6. A socket for a disk-seal tube, comprising a housing having a transverse mounting therein, said mounting having an opening therein, a contact element next to and in part overlapping said opening, said element being resilient and adapted to be spread to the size of said opening, diametrically opposite arms in planes perpendicular to said transverse mounting, said arms comprising a part of said contact element and said arms projecting adjacent said mounting away from said opening, and feet parallel to and juxtaposed upon said mounting at the ends of said arms remote from said opening, said feet being secured to said mounting.

7. A socket for a disk-seal tube, comprising a housing having a transverse mounting therein, said mounting having an opening therein, a contact element next to and in part overlapping said opening, said element being resilient and adapted to be spread to the size of said opening, diametrically opposite arms in planes perpendicular to said transverse mounting, said arms comprising a part of said contact element and said arms projecting adjacent said mounting away from said opening, and feet parallel to and juxtaposed upon said mounting at the ends of said arms remote from said opening, said feet being secured to said mounting, and means securing said arms together in pairs at parts thereof projecting away from said opening and between said opening and said feet.

8. A socket for a disk-seal tube comprising a housing having a transverse mounting therein, said mounting having an opening therein, a contact element next to and in part overlapping said opening in chordal relation to the opening,

said element having tabs on the chordal part and on the edge thereof away from said mounting, said tabs flaring and adapted to be engaged by the tube for spreading said element as the tube is inserted therein.

9. A socket for a disk-seal tube comprising a housing having a transverse mounting therein, said mounting having an opening therein, a contact element next to and in part overlapping said opening, said element having tabs on the edge thereof toward the mounting and at the part thereof overlapping the opening, said tabs having slidable engagement with said mounting and adapted to counteract pressure on the element to which the element may be subjected in applying a tube therein and permitting radial spreading of said element.

10. A socket for a disk-seal tube comprising a housing having a mounting on a transverse plane therein, said mounting having a tube-receiving opening therein and a contact element secured to said mounting, said element comprising an elongated resilient band extending lengthwise in the general direction as and in the vicinity of the edge of the opening and standing edgewise from the plane of the mounting, portions of the length of said band being inward of the opening and other portions of the band being outward beyond the edge of the opening and over the mounting, said band having edgewise support against said mounting.

11. A socket for reception axially therein a disk-seal tube, said socket comprising an axially disposed housing having a mounting therein on a plane transverse to the housing axis, said mounting having a tube-receiving opening coaxial with the housing, and a contact element secured to said mounting, said element comprising an elongated resilient band extending lengthwise in the general direction as and in the vicinity of the opening and standing edgewise from the plane of the mounting, alternate portions of said band being at less distance and intervening portions of the band being at greater distance from said axis than the edge of the opening.

12. A socket for reception axially therein a disk-seal tube, said socket comprising an axially disposed housing having a mounting therein on a plane transverse to the housing axis, said mounting having a tube-receiving opening coaxial with the housing, and a contact element secured to said mounting, said element comprising an elongated resilient band extending lengthwise in the general direction as and in the vicinity of the opening and standing edgewise from the plane of the mounting, alternate portions of said band being at less distance and intervening portions of the band being at greater distance from said axis than the edge of the opening, and curled tabs at edges of said alternate portions of the band.

13. A socket for reception axially therein a disk-seal tube, said socket comprising an axially disposed housing having a mounting therein on a plane transverse to the housing axis, said mounting having a tube-receiving opening coaxial with the housing, and a contact element secured to said mounting, said element comprising an elongated resilient band extending lengthwise in the general direction as and in the vicinity of the opening and standing edgewise from the plane of the mounting, alternate portions of said band being at less distance and intervening portions of the band being at greater distance from said axis than the edge of the opening, and

curled tabs at both edges of each of said alternate portions of the band.

14. A socket for a disk-seal tube comprising a housing having a mounting on a transverse plane therein, said mounting having a substantially circular tube-receiving opening therein and a contact element secured to said mounting, said contact element comprising a resilient band extending lengthwise in the general direction as and in the vicinity of the edge of the opening and standing edgewise from the plane of the mounting, said band having portions more proximate to the opening center than other portions, said more proximate portions being less distance from the center than the edge of the opening and having guiding flares for engagement by a tube inserted therein and through said opening.

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