ELECTRON TUBE AND SOCKET

Original Filed Feb. 24, 1959 2 Sheets-Sheet 2

Fig. 9.

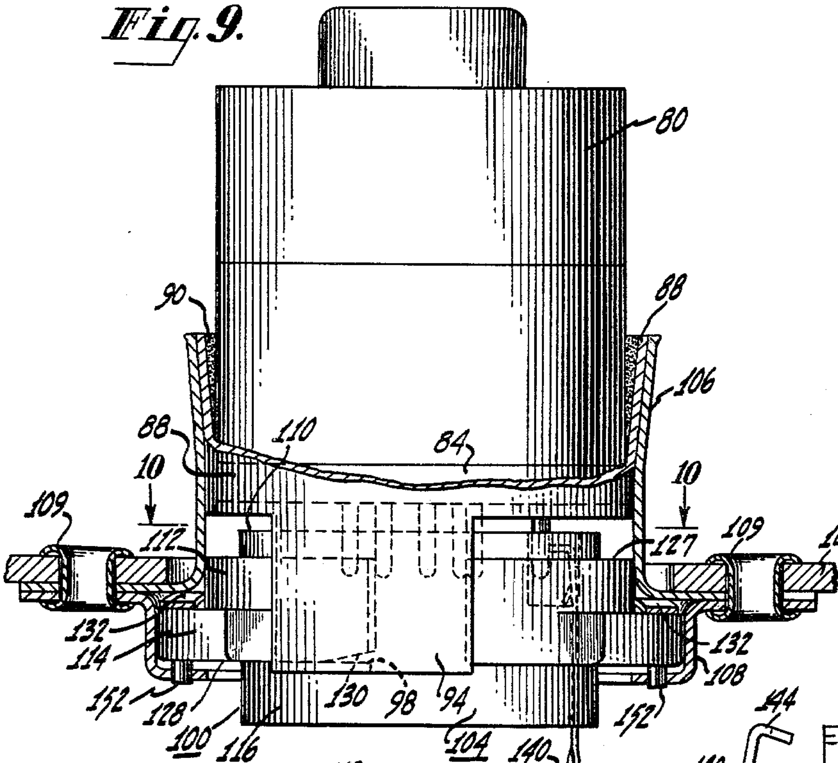
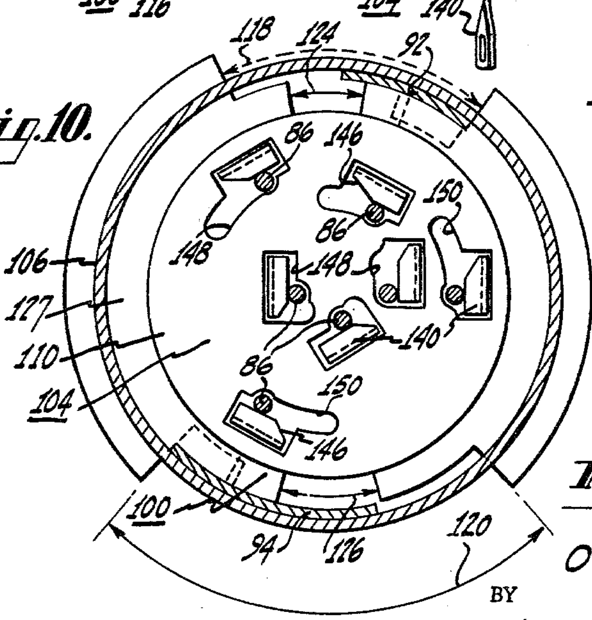


Fig. 10.



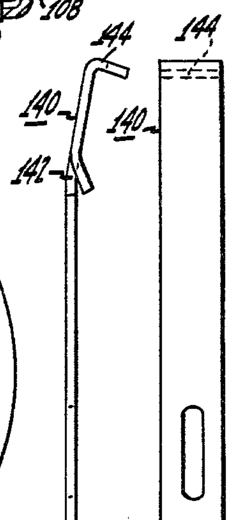


Fig. 13. Fig. 14.

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May 25, 1965 O. H. SCHADE, SR 3,185,954

ELECTRON TUBE AND SOCKET

Original Filed Feb. 24, 1959

2 Sheets-Sheet 1

Fig. 1.

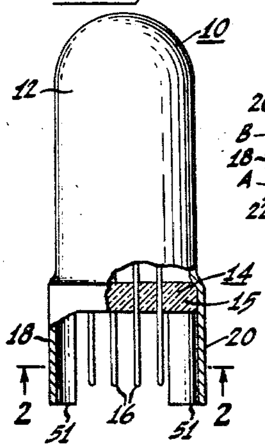


Fig. 2.

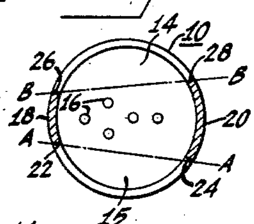
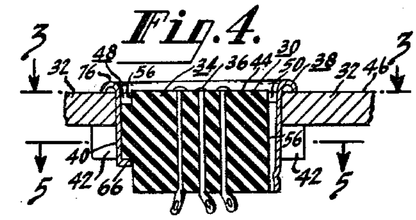


Fig. 4.



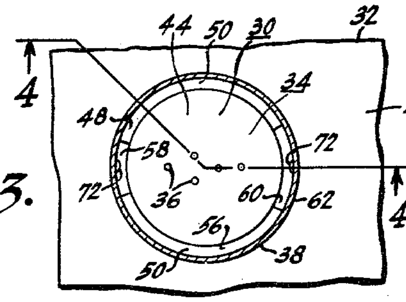


Fig. 3.

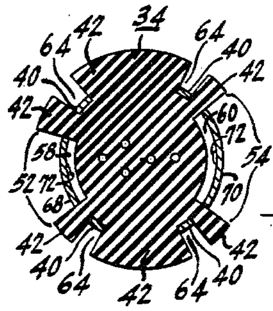


Fig. 5.

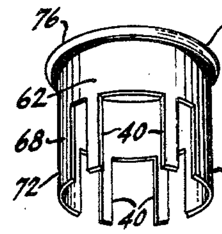


Fig. 6.

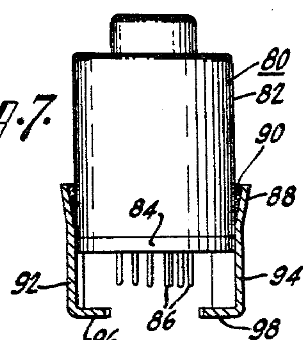


Fig. 7.

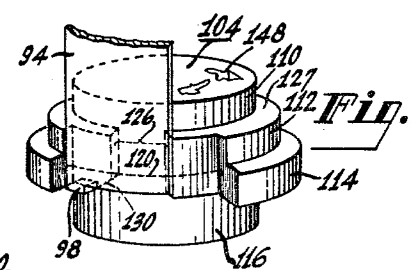


Fig. 11.

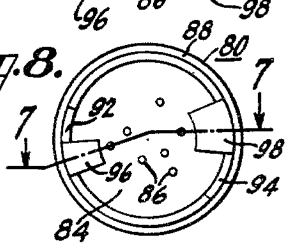


Fig. 8.

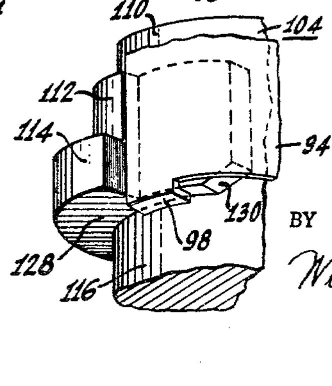


Fig. 12.

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ELECTRON TUBE AND SOCKET

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Original application Feb. 24, 1959, Ser. No. 795,087, now Patent No. 3,051,864, dated Aug. 28, 1962. Divided and this application Jan. 26, 1962, Ser. No. 168,979
5 Claims. (Cl. 339—90)

This application is a division of my copending application, Serial Number 795,087, filed February 24, 1959, and issued as U.S. Patent 3,051,864 on August 28, 1962.

This invention relates to socketing of electron tubes and particularly to electron tube base and socket designs providing self-indexing and heat dissipating features.

The trend towards small size electron tube structures has resulted in designs having relatively small diameter, and hence easily deformable, lead-in prong conductors. Because of this, insertion of such tubes into their sockets is difficult and made even more troublesome if no self-indexing means is provided.

Accordingly, it is an object of this invention to provide a new and improved electron tube base and a socket therefor which are mutually self-indexing.

It is also an object of this invention to provide such an electron tube base in which the indexing means thereof also serves to protect the tube lead-ins from deformation.

Another object of this invention is to provide such an electron tube base-socket combination in which the tube indexing means also serves as a grounding contact for the tube envelope where such envelope is of conducting material.

Still another object of the invention is to provide such an electron tube base-socket combination which also serves to provide a means for conducting heat out of and from the tube.

In accordance with one form of my invention, I provide an electron tube with a base having a planar header member through which a plurality of lead-in prong conductors are sealed to provide a stem. The base includes a pair of transversely arcuate lugs extending longiutdinally from the periphery thereof. One of the lugs is of greater arcuate length than the other to thus provide angular indexing. A complementary socket is provided for receiving the tube.

In one embodiment, the indexing lugs are an integral part of the tube envelope and provide a ground contact. In another embodiment the indexing lugs are provided with bent-over tabs at their ends which upon rotation of the tube co-operate with a tapered surface to pull the tube tightly into a tubular heat sink connector to insure heat conduction from the tube to a heat sink.

In the drawings:

FIG. 1 is an elevation view in partial section of an electron tube according to my invention;

FIG. 2 is a transverse section along lines 2—2 of FIG. 1;

FIGS. 3 and 4 are plan and longitudinal section views respectively taken along line 3—3 of FIG. 4 and line 4—4 of FIG. 3 respectively of a socket according to my invention for receiving the tube of FIG. 1;

FIG. 5 is a transverse section view taken along lines 5—5 of FIG. 4;

FIG. 6 is a perspective view of a part of the socket of FIGS. 3 and 4;

FIG. 7 is an elevation view in partial section of another embodiment of electron tube according to my invention taken along line 7—7 of FIG. 8;

FIG. 8 is a bottom plan view of FIG. 7;

FIG. 9 is an elevation view in partial section of the electron tube of FIG. 7 seated in an accommodating socket according to my invention and connected to a heat sink in the form of a chassis;

FIG. 10 is a transverse section view taken along lines 10—10 of FIG. 9;

FIGS. 11 and 12 are perspective views of co-operating parts of the tube-and-socket assembly of FIG. 9; and

FIGS. 13 and 14 are elevation views of a contact element of the socket of FIG. 9.

In FIGS. 1 and 2 I show an electron tube 10 having a cup-shaped metallic envelope 12 closed adjacent one end thereof by a planar ceramic stem structure 14. The stem 14 includes a header 15 through which a plurality of fine wire lead-in conductors 16 are sealed. The metal envelope 12 includes a pair of integral arcuately shaped lugs 18 and 20 which extend outwardly from the open end of the envelope. Accordingly, the lugs 18 and 20 are arcuate in transverse section as shown in FIG. 2. The lug 18 is made smaller in width (arcuate length) than is the lug 20. For example, in one embodiment of electron tube according to the invention, the lug 18 is made to subtend an angle of 36° while the lug 20 is made to subtend the angle of 60°. In such an electron tube embodiment as illustrated in FIGS. 1 and 2, the lead-ins 16 are positioned such that they are wholly enclosed within the space bounded by the two lugs 18 and 20, i.e., the space defined by the two lugs 18 and 20, and the two planes defined respectively by the adjacent longitudinal edges of different lugs. One of such planes, plane A—A, is defined by lug edges 22 and 24 and the other of such planes, plane B—B, by lug edges 26 and 28. The lugs 18 and 20 are also made to have a greater longitudinal length than are the lead-in conductors 16 and, accordingly, extend below them as shown in FIG. 1. As thus provided, the lead-in conductors 16 are wholly enclosed by the region bounded by the two lugs 18 and 20 and, as such, are protected from deformation by accidental contact with other elements.

Since the two lugs 18 and 20 are made of different width, a complementary socket can be provided for the electron tube 10 which will receive the tube in only one angular orientation. This is accomplished by providing two arcuate recesses in the socket corresponding to the arcuate transverse sections of the lugs 18 and 20. FIGS. 3–6 illustrate such a socket.

In FIGS. 3–6 a socket 30 is shown disposed through an aperture in a metal plate 32 which may for example comprise a radio chassis. The socket 30 comprises an insulator block 34 having a plurality of lead-in contacts 36 therein and a retaining ring 38 for clamping the insulator block 34 to the metal plate 32. The retaining ring 38 is shown in FIG. 6 prior to the legs 40 thereof being crimped over to fix the insulator block 34 to the chassis plate 32.

The insulator block 34 is generally cylindrical in transverse cross section and is provided with an outer rim portion 42 greater in diameter than the aperture in the chassis plate 32 and which, accordingly, abuts one side of the chassis plate 32. The rim 42 is off-set from the surface 44 of the insulator block 34 by an amount substantially equal to the thickness of the chassis plate 32 such that the insulator surface 44 will lie substantially in the plane of the chassis plate surface 46. The purpose of this will be hereinafter explained.

The insulator block 34 is provided with a peripheral recess 48 to produce an annular planar surface 50. The mean diameter of the surface 50 is substantially equal to the mean diameter defined by the two arcuate lugs 18 and 20 of the tube of FIG. 1. The width of the surface 50 is made slightly greater than the thickness of the lugs 18 and 20. Accordingly, electron tube 10 can be seated on top of the insulator block 34 such that the end surfaces 51 (FIG. 1) of the two lugs 18 and 20 are received in the peripheral recess 48 and contact the annular surface 50.

As shown in FIG. 5, the insulator block 34 is provided with a plurality of peripheral cut-outs. A first cut-out 52 subtends an angle substantially equal to the angle subtended by the first lug 18 of the tube 10. A second cut-out 54 subtends an angle substantially equal to the angle subtended by the second lug 20 of the tube 10. The two cut-outs 52 and 54 extend radially inward to the cylindrical surface 56 of the recess 48. Thus, when the tube 10 is disposed with its lugs 18 and 20 in the recess 48 and rotated, it will reach a single angular orientation in which the two lugs 18 and 20 will lie opposite the two cutouts 52 and 54, respectively. In this position and only in this position, the tube 10 can be further extended into the socket to engage the lead-in conductors 16 with the contacts 36 which are disposed in alignment therewith. In its socketed position the lugs 18 and 20 will be received in the spaces 58 and 60 (FIG. 5) defined between the surface 56 and the inner wall of the cylindrical portion 62 of the retaining ring 38. Since the tube lug 18 and its accommodating recess 58 are smaller than the tube lug 20 and its recess 60, the tube can be extended into the socket in only the one angular orientation.

The insulator block 34 is further provided with four equally spaced cut-outs 64 through which the four fingers 40 of the retaining ring 38 are disposed. Thus, as shown in FIG. 4, each crimping finger 40 is bent over as at 66 to retain the insulator block 34 in place.

The retaining ring 38 is also provided with a pair of longitudinally extending lugs 68 and 70 complementary to the lugs 18 and 20 respectively of the tube 10. The retaining ring lugs 68 and 70, however, have an inside diameter substantially equal to the outside diameter of the tube lugs 18 and 20. Thus, when the electron tube 20 is disposed in its socket 30, tube lugs 18 and 20 will lie opposite and in electrical contact with the retaining ring lugs 68 and 70. In order to insure good electrical contact, the retaining ring lugs 68 and 70 are each provided with an inwardly directed boss 72 causing the lugs 68 and 70 to be slightly sprung radially outward when the tube is socketed. Since the socket lugs 68 and 70 are electrically connected to the chassis plate 32, a good ground connection is established to the tube envelope 12.

As previously stated, the surface 44 of the insulator block 34 is preferably disposed coplanar with the upper surface 46 on the chassis plate 32. Thus, if the electron tube 10 is placed half-way over the insulator block 34, i.e., with one of the tube lugs contacting the chassis plate surface 46 and the other of the lugs contacting the insulator block surface 44, the lead-ins 16 of the electron tube will still not contact the lip 76 of the retaining ring 38. Thus, maximum protection of the lead-ins 16 is provided.

In the socket 30 the peripheral recess 48 together with the retaining ring 38 provides an annular channel having two opposed cylindrical surfaces. However, it will be appreciated that only one such cylindrical surface is necessary as a guide for socketing the electron tube 10 and may either be provided as an internal or external cylindrical surface. Thus, if desired, a top portion of the insulating block 34 may be removed such that its upper surface is flush with the surface 50. Alternatively, the entire insulating block 44 may, in effect, be raised partly out of the aperture in the chassis plate 32 such that the surface 50 is substantially flush with the top of the retaining ring 38. In either of these alternatives, a single cylindrical guide surface will be provided. In the first alternative, an internal cylindrical guide surface is provided, and in the second alternative an external cylindrical guide surface is provided.

FIGS. 7 and 8 illustrate a modification of my invention incorporating the feature of a low-resistance thermal connection for heat conduction. In these figures an electron

tube 80 includes a substantially cylindrical envelope 82 closed at one end with a header 84 through which a plurality of lead-in conductors 86 are sealed. The envelope 82 and header 84 may, for example, comprise ceramic members which have been surface metalized and brazed together in vacuum-tight relationship. A metallic, tubular member 88 is disposed around the header 84 and extends along a portion of the envelope 82. The tubular member 88 is flared outwardly along the envelope 82, e.g., at an angle of approximately 5°. Solder or brazing material 90 is disposed in the space between the flared tubular member 88 and the envelope 82 to fix the tubular member 88 thereto in good heat conducting relationship. A pair of arcuately shaped socketing lugs 92 and 94, somewhat similar to the lugs 18 and 20 of the tube 10, extend from the tubular member 88. The socketing lugs 92 and 94 comprise, in effect, a pair of arcuate extending sections of the tubular member 88. The lugs 92 and 94, like the lugs 18 and 20 of tube 10, extend somewhat beyond the ends of the lead-in conductors 86.

For the purpose of locking the tube 80 into an accommodating socket 100, FIGS. 9 and 10, the lugs 92 and 94 are provided with transverse, inturned, ear portions 96 and 98, respectively, at their free ends. For purposes of indexing, as will hereinafter be more fully described, the lugs 92 and 94 are of different arcuate width and their respective ears 96 and 98 are approximately half as wide as are the corresponding lugs.

FIGS. 9 and 10 illustrate the tube 80 seated in an accommodating socket 100. FIGS. 11–14 illustrate portions of the socket 100. The socket 100 is adapted to be fixed to a chassis plate 102 within an aperture therethrough. The socket includes a cylindrical stepped insulating member 104, a flanged tubular heat sink connector 106, and a flanged retaining ring 108. The heat sink connector 106 is dimensioned to receive in a snug mating relation the tapered tubular member 88 of the electron tube 80 and is fixed to the chassis plate 102 by a plurality of rivets 109. As such, a good thermal conduction path is provided from the tube 80 through the tubular member 88 and the tubular heat sink connector 106, which is preferably made of a high thermal conducting material such as copper, to the chassis plate 102.

The stepped insulator block 104 is generally cylindrical and is provided with four different diameter portions 110, 112, 114, and 116, respectively. The portion 114 is of greatest diameter and serves as a rim portion against which the retaining ring 108 abuts to fix the insulator member 104 to the chassis plate 102. The retaining ring 108 is fixed to the chassis 102 by e.g., the rivets 109.

As shown in FIGS. 10 and 11, the insulator block 104 is provided with two peripheral cut-outs 118 and 120 which extend into the portion 112 by an amount substantially equal to the wall thickness of the tube lugs 92 and 94. The cut-outs 118 and 120 have arcuate extents which respectively exceed the arcuate widths of the tube lugs 92 and 94 by a given amount. Within the cut-outs 118 and 120 the portion 112 of the insulator block 104 is further cut away with cut-outs 124 and 126. These two cut-outs correspond respectively in arcuate extent to that of the lug ears 96 and 98. The remainder of the insulator portion 112 provides a planar annular surface top 127. The diameters of the surface top 127 are such that the tube 80 may be seated with the bottoms of the ears 96 and 98 in contact with the surface and the tube 80 freely rotated. In so doing, a single angular orientation of the tube relative to the socket will be reached in which the tube 80 can be extended into the socket with the lug ears moving to adjacent the annular planar under surface 128 of the insulator portion 114. Then by continued rotation of the tube 80 in its socket 100, the ears 96 and 98 will be moved into contact with the surface 128 to lock the tube 80 in the socket 100. In order to facilitate this locking rotation and to provide a firm contact of the tube 80 with the tubular heat sink connector 106, the leading edge of the locking surface 128 is provided with a slight bevel 130. Furthermore, the insulator block 104 is axially spring-biased relative to the tubular heat sink connector 106 by a spring ring 132. Thus, when the locking rotation of the tube 80 is made, the ears 96 and 98 of the lugs 92 and 94 ride up on the beveled surfaces 130 and pull the insulator block 104 upward (as viewed in FIG. 9) toward the tubular heat sink connector 106 against the spring bias to maintain good thermal contact of the tube 80 in the heat sink connector 106.

A plurality of contact terminals 140, as illustrated in FIGS. 9, 10, 13 and 14, are provided in the insulator 104 in orientation corresponding to that of the lead-in conductors 86 of the electron tube 80. Each of the contact terminals 140 comprises a metallic ribbon (FIGS. 13 and 14) which has a slight bend 142 near one end thereof to provide a spring action. Each terminal ribbon 140 is further provided with a flanged end 144 having a bevel 146 at one corner thereof. The flanged ends 144 of the contact terminals 140 are disposed adjacent the upper portion 110 in the insulator 104. A plurality of shaped cut-outs 148 are provided in the surface of the insulator portion 110 for receiving the contact terminal flanges 144 and the lead-in conductors 86 of the electron tube 80. The cut-outs 148 have an arcuate portion 150 suitably arranged so that with the lead-ins 86 therein, the tube 80 may be rotated. Such rotation brings the lead-ins 86 against the bevels 146 into contact with the contact terminals 140. This arrangement after tube rotation is most clearly illustrated in FIG. 10. Such tube rotation is the same which moves the lug ears 96 and 98 onto the bevels 130 to lock the tube in the socket 100. Rotation of the insulator block 104 in the chassis plate 102 during such tube rotation is prevented by pins or embossments 152 in the insulator which engage apertures in the retaining ring 108.

It will be appreciated that according to the tube and socket combination 80–100 a heat sink connector 106 is provided which is an integral part of the socket 100. As such, a safety feature is provided wherein electrical connection of the tube into circuit cannot possibly be made without simultaneously providing a thermal contact through the heat sink connector 106 to the heat sink 102. Accordingly, it is not possible to insert the tube and place the tube in operation wherein it may be heated to excessive temperatures without a removal of such heat.

What is claimed is:

1. An electron tube comprising an envelope, a base including a circular header member and a plurality of lead-in conductors sealed through and extending from said header member in a first direction and a tubular member disposed coaxially around said base in thermal contact therewith, said tubular member being outwardly flared away from said base in a second direction opposite to said first direction and having a pair of oppositely disposed elongated arcuate lugs of different arcuate length extending longitudinally from the periphery of said circular header in said first direction parallel to and beyond the outer ends of said lead-in conductors.

2. An electron tube comprising a cylindrical envelope member closed at one end by a transverse header member, a plurality of lead-in conductors sealed through said header, and a tubular socketing member disposed concentrically around said header, said socketing member being flared outwardly along said envelope in a direction away from said header and having extending tubular wall portions of different arcuate length extending longitudinally in the opposite direction away from said header, each of said extending tubular wall portions having a

transverse ear extending inwardly from the free end thereof.

3. An electron tube comprising an envelope, said envelope including a base comprising a header member, a plurality of lead-in conductor sealed through said header member, and a heat dissipating and socket-indexing means, said last named means including a tubular member disposed around said header and extending along said envelope, said tubular member being in heat conducting relationship with said envelope and header member, said tubular member being flared outwardly away from said header member, said tubular member having a pair of oppositely disposed socketing lugs extending longitudinally therefrom and beyond the outer ends of said lead-in conductors, said lugs having arcuate transverse sections of different arcuate lengths, said lugs having transverse ear portions on their free ends for engaging socket elements to secure said electron tube into a heat conducting socket.

4. An electron tube socket adapted to be fixed within an aperture in a plate, said socket comprising a flanged tubular member disposed axially perpendicular to said plate and extending from one side thereof in an outward flare, an insulator block fixed coaxially relative to said flared tubular member, said insulator block having an annular track surface in the end surface thereof facing the flared end of said tubular member, a pair of openings having arcuate contour cross-section of different arcuate length terminating in said track and extending longitudinally through said insulator block, and a pair of tapered surface portions on the other end surface thereof, said tapered surface portions being longitudinally aligned with portions of said track surface, and a plurality of contact terminals disposed within said insulator block adjacent said end surface facing said tubular member.

5. In combination an electron tube comprising an envelope including a stem, said stem including a plurality of lead-in conductors sealed therethrough in given orientation, and a tubular socketing member concentrically surrounding said stem and fixed thereto, said socketing member being flared outwardly along said envelope and having a pair of elongated indexing lugs of different width extending longitudinally from adjacent the periphery thereof away from said envelope, said lugs having inturned transverse ears at their free ends; and a socket adapted to receive said tube and comprising an insulator block having a planar annular surface dimensioned to receive said tube ears in seating relation, a pair of openings through said insulator block terminating in said annular surface for receiving said tube lugs, a pair of tapered surfaces disposed for mating contact with said tube ears when said lugs are received in said openings, a plurality of openings in said insulation block and a plurality of contact terminals one disposed in each of said plurality of openings in said given orientation for contacting said tube lead-in conductors.

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