Dec. 19, 1961 C. P. WERNER 3,014,197

SOCKET FOR ELECTRON TUBES

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FIG. 1

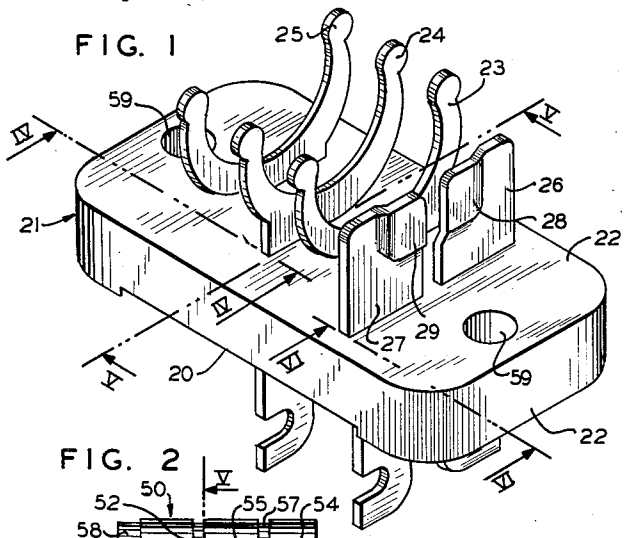


FIG. 3

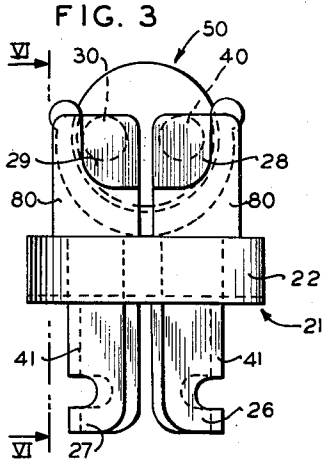


FIG. 2

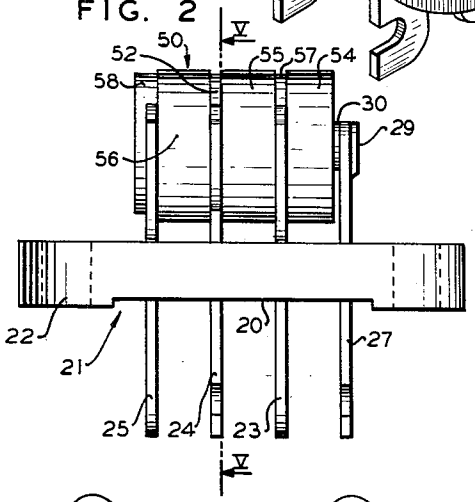
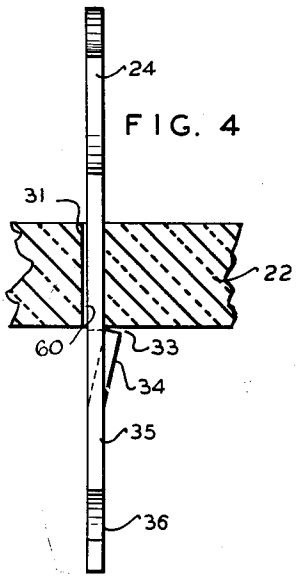


FIG. 4



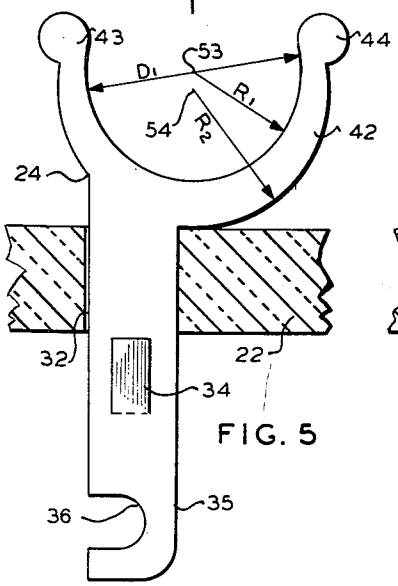


FIG. 5

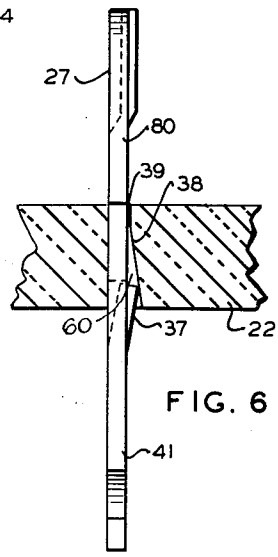


FIG. 6

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FIG. 8

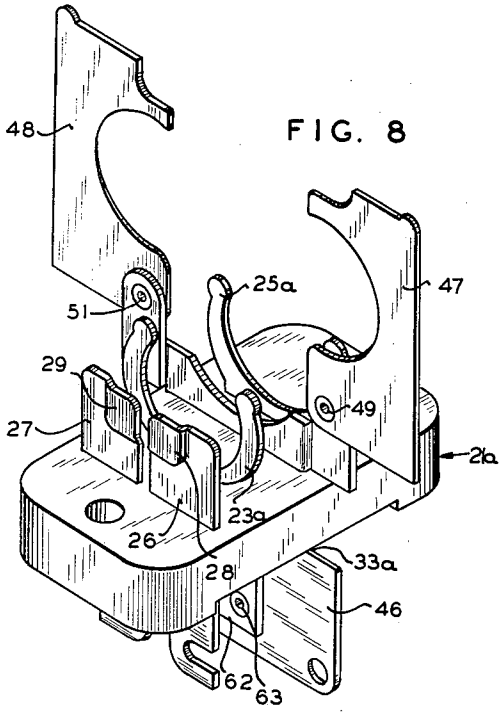


FIG. 7

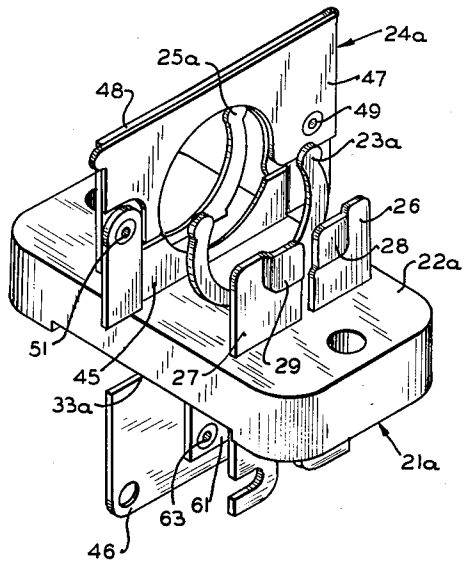


FIG. 9

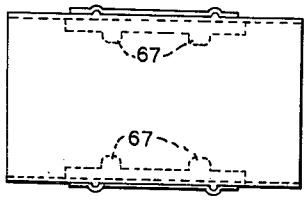


FIG. 10

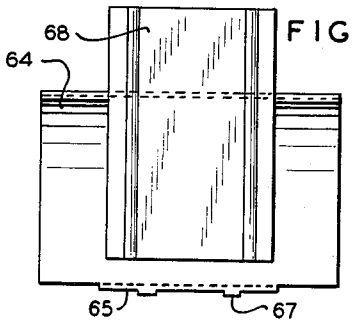


FIG. 25

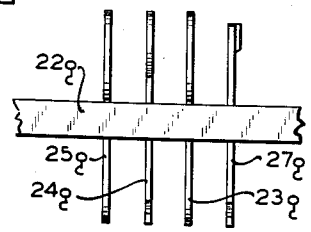


FIG. 11

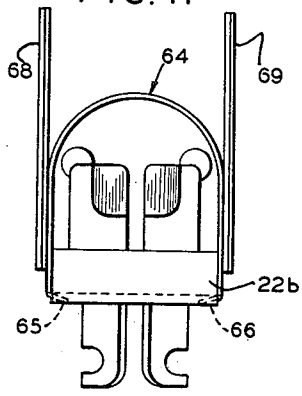


FIG. 12

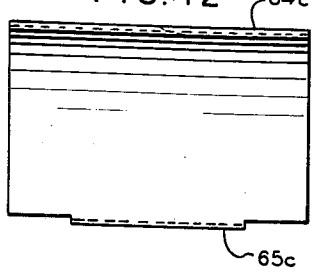
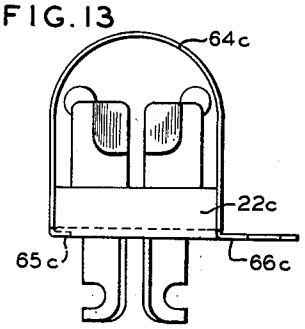


FIG. 13



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FIG. 14

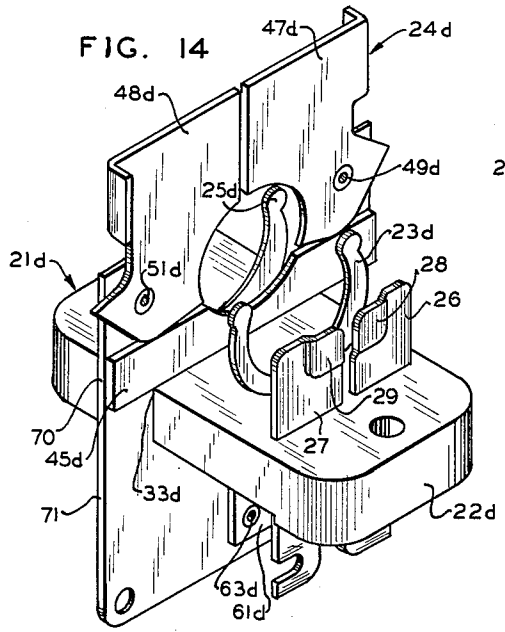


FIG. 15

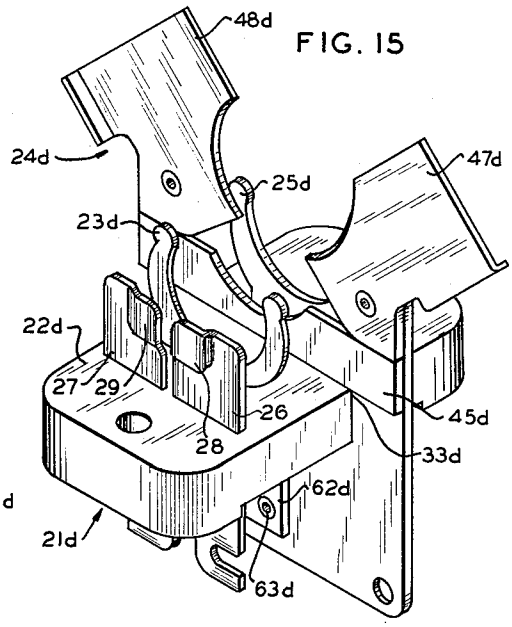


FIG. 16

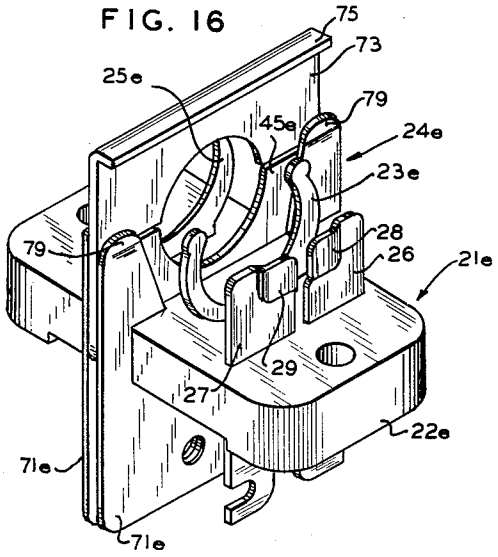
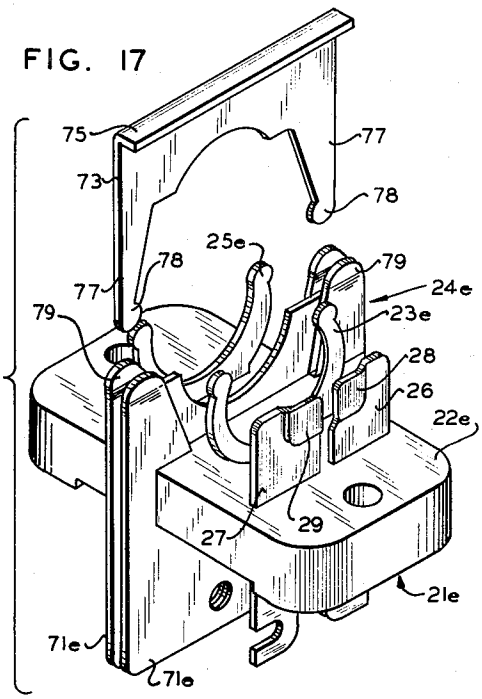


FIG. 17



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FIG. 18

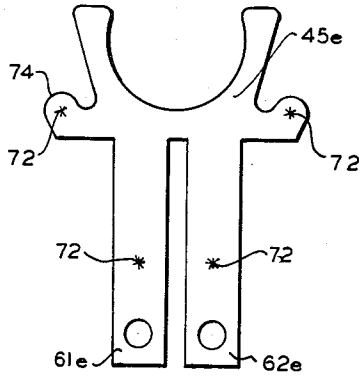


FIG. 19

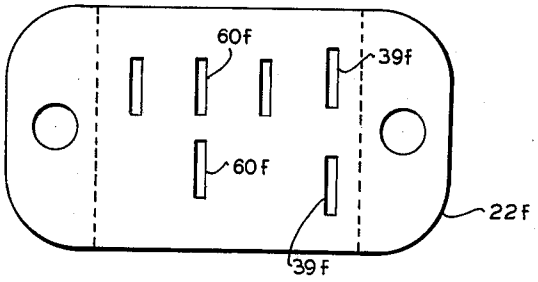


FIG. 20

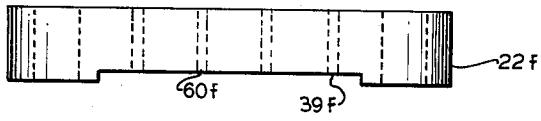


FIG. 21

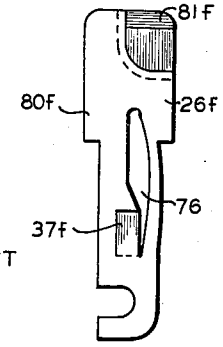


FIG. 23

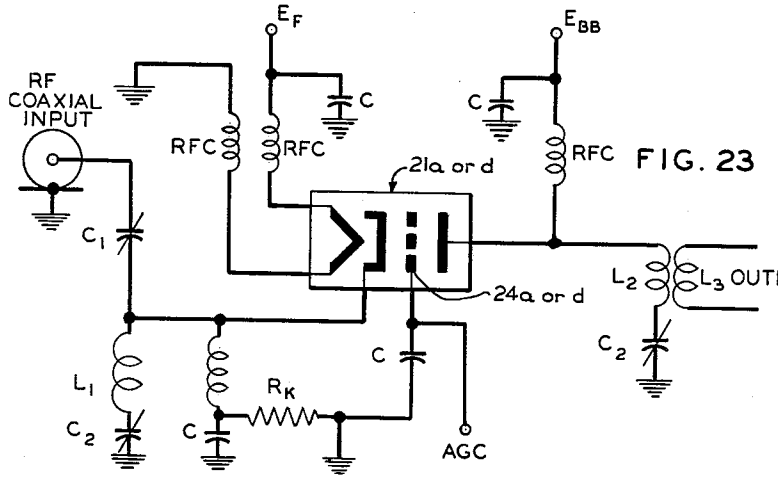


FIG. 22

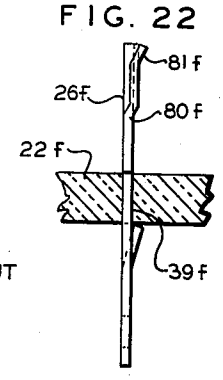
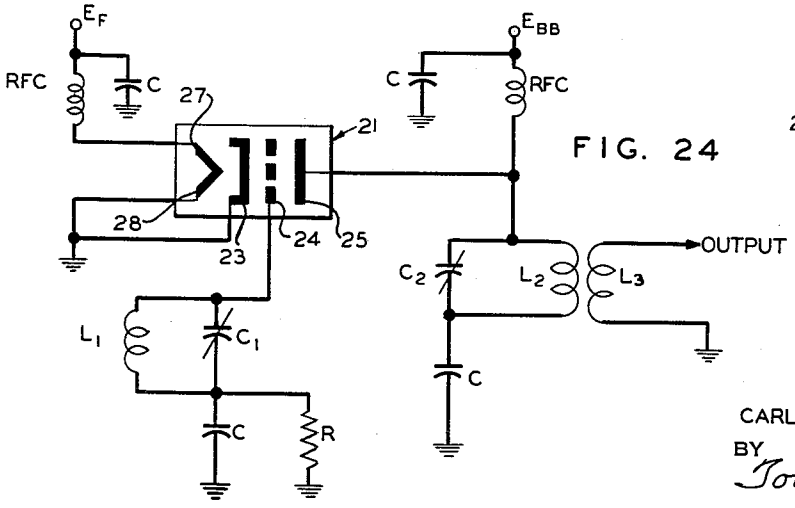


FIG. 24



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United States Patent Office 3,014,197 Patented Dec. 19, 1961

3,014,197

SOCKET FOR ELECTRON TUBES

Carlton P. Werner, Orange, N.J., assignor to Johnsen Design Services, Inc., Hanover, N.J., a corporation of New Jersey

Filed Apr. 9, 1957, Ser. No. 651,730
21 Claims. (Cl. 339—182)

This invention relates to socket devices for electron discharge tubes and, more particularly, to such of a special type having a plurality of axially spaced electrodes in coaxial relation with one another with heater contacts at one end.

The tube for which the embodiments of the present invention are particularly designed in a triode, specifically one of a series of new ceramic-titanium electron tubes. Such tubes are generally of the micro-miniature, ceramic receiving tube type, one designated 6BY4 by the General Electric Company, having been developed as a low-noise, high-mu triode for UHF-VHF television receivers. This one is about 7/16" long and 5/16" in diameter, although I do not wish to be limited to the exact type or exact size.

However, the socket to which the present invention particularly relates is for a tube in which there are three short cylindrical contact elements respectively spaced by ceramic insulators which project beyond the cylindrical surfaces of the electrodes, a third insulator being disposed at one end of one electrode and carrying a pair of button-shaped contacts on an exposed flat face, said contacts being suitable for supplying power to a cathode heater element therein. Thus the tube involves narrow cylindrical contacts for respective connection with the plate or anode, the grid, the cathode, and end button contacts for the cathode heater.

An object of my invention is to provide a socket for a tube of relatively small size, producible at low cost by mass production methods, from which the tube is readily removable, which is easily mounted on a chassis, having excellent shock and vibration resistance, having floating contacts for the cathode, grid, and plate elements of said tube, and fixed contacts for the heater elements thereof, in order to allow for manufacturing variations in the concentricity and diameter of the peripheral surfaces of the tube elements, so that a good electrical contact to said tube elements will be maintained under all conditions.

Another object of my invention is to provide a socket having fixed contacts for the two heater buttons of the tube so that adequate contact pressure will be maintained under all conditions of dimensional tolerances, and in which the tube may be easily inserted and removed.

A further object of my invention is to provide a socket having a relatively large contact area with respect to the cathode, grid and anode elements of the tube, while having such contact area for each of said elements at a minimum in a plane parallel to the adjacent element.

A still further object of my invention is to provide a socket having heater contacts designed to prevent the tube from being inserted in a manner which will short out the heater circuit, and thereby prevent insertion of the tube in any position but the correct one.

An additional object of my invention is to provide a socket having an insulating member made of a material which will withstand normally soft soldering temperatures without softening or distorting, will function under conditions of high humidity, high and low temperatures, which will stand extreme conditions of shock and vibration, in which the material of the insulating member exhibits characteristics of low loss, low dissipation, low dielectric constant, high dielectric strength, and low moisture absorption, and in which the carried contacts are silver plated for high surface conductivity, whereby

it is suitable for operation in circuits carrying current at ultra high frequencies.

Another object of my invention is to provide a socket for grounded grid circuits having the above-mentioned features and, in addition, having a metal shield between the cathode and the anode, said shield being constructed so as to serve as the grid contact as well as the shielding means, in which the grid contact has interlocking leaves which clamp around the periphery of the tube grid element and make relatively large area contact around the periphery of said element, and in which the clamping means of the grid contact assembly will prevent the tube from becoming dislodged under conditions of extreme shock or vibration.

A further object of my invention is to provide a socket for grounded-grid circuit use, in which the clamping means of the grid contact assembly is readily releasible for easy removal of the tube from the socket.

These and other objects and advantages will become apparent from the following detailed description when taken with the accompanying drawings. It will be understood that the drawings are for purposes of illustration and do not define the scope or limits of the invention, reference being had for the latter purpose to the appended claims.

In the drawings, wherein like reference characters denote like parts in the several views:

FIGURE 1 is an isometric view of a preferred embodiment of a socket incorporating my invention.

FIGURE 2 is a side elevational view of the embodiment of FIGURE 1, with an electronic tube held therein.

FIGURE 3 is an end elevational view of the socket and tube shown in FIGURE 2.

FIGURE 4 is a fragmentary longitudinal vertical sectional view on the line IV—IV of FIGURE 1, in the direction of the arrows, showing, as typical of one of the anode, grid and cathode contacts, the grid contact floating in the insulating base.

FIGURE 5 is a fragmentary vertical sectional view on the line V—V of FIGURES 1 and 2, in the direction of the arrows of the contact of FIGURE 4.

FIGURE 6 is a fragmentary longitudinal vertical sectional view on the line VI—VI of FIGURES 1 and 3, in the direction of the arrows, showing the lefthand heater contact, as viewed in said figures, and how it is locked in place with respect to the insulating base.

FIGURE 7 is an isometric view corresponding to FIGURE 1, but showing the interlocking leaf members of the grid contact in closed or engaged position in a modification to make a grounded-grid contact assembly.

FIGURE 8 is an isometric view of the same socket, but from a direction approximately at right angles to that of FIGURE 7, showing the interlocking leaf members of the grid contact in open or released position.

FIGURE 9 is a plan of another embodiment of the invention, in which there is a shield mounted over the socket.

FIGURE 10 is a side elevational view of the embodiment of FIGURE 9.

FIGURE 11 is an end elevational view of the embodiment of FIGURE 9.

FIGURE 12 is a side elevational view of the same socket but with another design of shield mounted thereover.

FIGURE 13 is an end elevational view of the socket and shield of FIGURE 12.

FIGURE 14 is an isometric view corresponding to FIGURE 7, but showing another embodiment of my invention.

FIGURE 15 is an isometric view of the same socket, but from a direction approximately at right angles to that

of FIGURE 14, showing the two pivoted grid contact members in open or released position.

FIGURE 16 is an isometric view corresponding to FIGURE 14, but showing another embodiment of my invention.

FIGURE 17 is an isomeric view of the same socket, but with the upper grid contact member raised above its normal or interleaved position with respect to the lower grid contact members.

FIGURE 18 is an elevational view of a side of the separator or filler member which is sandwiched between the plates forming the lower member of the grounded-grid contact assembly of the embodiment of FIGURES 16 and 17.

FIGURE 19 is a plan of a modified form of base insulator, improved in some respects as compared with that shown in the preceding embodiments.

FIGURE 20 is a side elevational view of the base insulator of FIGURE 19.

FIGURE 21 is an elevational view of a side of a modified form of the righthand heater contact, as viewed in FIGURES 1, 3, 7, 8, 11, 13, 14, 15, 16 and 17 from the opposite direction.

FIGURE 22 is an elevational view from the right of an edge of the form of contact illustrated in FIGURE 21, a fragmentary portion of an associated base insulator being also shown.

FIGURE 23 shows a typical circuit suitable for use with a socket such as shown in FIGURES 7 and 8.

FIGURE 24 illustrates a tuned grid, tuned plate circuit which is typical of one in which could be used the embodiment of the socket shown in FIGURE 1.

FIGURE 25 is a fragmentary side elevational view corresponding to FIGURE 2, but omitting the electronic tube and showing another embodiment of my invention.

Referring now to the drawings in detail and first considering the embodiment of my invention illustrated in FIGURES 1 to 6, inclusive, there is shown a socket **21** comprising a base insulator **22**, desirably thicker at its ends than intermediate thereof, so that the lower surface **20** of its intermediate portion is upwardly offset, as shown most clearly in FIGURE 2. Received in longitudinally-spaced but staggered slots or apertures **60** in said insulator **22** is a series of three longitudinally aligned electrode contacts, here comprising a cathode contact **23** or one adapted to connect with the cathode of a supported tube, a grid contact **24** one adapted to connect with the grid of a supported tube, and an anode contact **25** or one adapted to connect with the anode or plate of a supported tube, and transversely alined heater contacts **26** and **27** or one adapted to connect with the cathode heater of a supported tube. Contacts **23**, **24** and **25** are desirably formed as identical metal stampings. Heater contacts **26** and **27** are desirably formed as left-hand and right-hand metal stampings having the same outline dimensions.

The grid contact **24** of the three identical contacts **23**, **24** and **25** is inserted into the intermediate slot **60** in the base insulator **22** in the opposite direction, that is, after it has been reversed face-to-face, or turned 180° about its vertical axis, as compared with the cathode contact **23** and the anode contact **25**. This reversal approximately doubles the distance separating the stems of any adjacent two of the three contacts **23**, **24** and **25**, thereby correspondingly reducing the capacitance between said stems, while still leaving the bifurcated upper portions uniform, parallel and registering with respect to one another. This arrangement thus results in a very low capacitance between the grid contact and the contacts on either side thereof, that is, the cathode and the anode contact, while at the same time permitting the use of identical metal stamping contacts for lowest possible cost.

The heater contacts **26** and **27** are provided with laterally offset areas here illustrated as upper adjacent corner portions **28** and **29**, for direct left- and right-hand electrical contact, the upper edge portions of which are desirably bent outwardly at an angle of about 20° (as indicated by the reference character **81***f* in FIGURES 21 and 22), to facilitate tube insertion. These offset portions are also longitudinally offset to create adjacent steps in which the heater contact buttons of a supported electron tube or triode **50** are nestingly receivable. The provision of these steps prevents the tube from being inserted in such a manner, such as with one heater button above the other, as would short out the heater circuit.

The following is a description of only one form of electron tube **50** which may be supported in a socket embodying my invention, but is not intended as a limitation on said socket. The General Electric Company is manufacturing a ceramic high-mu triode of parallel plane construction, designed primarily for use as a grounded-grid radio frequency amplifier in combined UHF-VHF television tuners. It is designated as the 6BY4. In such service, at 900 megacycles, the tube exhibits a power gain of approximately 15 decibels and a noise factor of approximately 8.5 decibels with a 10-megacycle bandwidth.

The small size of the 6BY4 makes it particularly suited to compact tuner designs. I have invented the socket here described and claimed, which is one of the special clip or friction type, and is particularly adapted to hold such a tube. The special metal/ceramic construction of the 6BY4 tube makes it possible to operate it at much higher envelope temperatures. It has increased resistance to mechanical shock and vibration, as well as greatly increased physical strength, and produces significantly lower microphonic output.

The embodiment illustrated comprises three ceramic insulators **54**, **55** and **56**, which respectively separate the heater contact buttons **30** and **40** at the righthand end, as viewed in FIGURE 3, from the cylindrical disc cathode contact **57**, the latter from the cylindrical disc grid contact **52**, and the latter from the cylindrical disc plate or anode contact **58**. The ceramic insulators may be .100" thick and .323" in diameter, while the heater buttons may axially project .022" and be .090" in diameter with their centers spaced .120". The relatively thin cathode and grid contacts may each be .025" thick, and the plate contact may be .050" thick. All of said cylindrical cathode, grid and plate contacts may be .285" in diameter.

The cathode contact **23**, the grid contact **24** and the anode contact **25** are floating in the base insulator **22**, as illustrated most clearly in FIGURES 4 and 5. By this it is meant that there is a base side space **31**, which may be .002" as a typical dimension, formed at a side of the contact to allow it to move slightly in the receiving slot **60** in the insulator **22**. There is also a base edge space **32** provided, as illustrated in FIGURE 5, .004" being a typical dimension for this, which allows a corresponding amount of motion transversely of the insulator **22**. Corresponding vertical motion is allowed for by a space **33**, which also may be .004" as a typical dimension. FIGURES 4 and 5, although being specific for the grid contact **24**, also illustrate the construction and connection of the contacts **23** and **25**, but viewed from opposite directions. All of said contacts are, therefore, retained in the base insulator **22** by bending a lanced spring finger **34** out from the stem **35** of the contact at least one material thickness, so as to underlie, and hold the enlarged upper portion of the contact in place on the flat upper surface of, the base insulator **22**. All of these contacts desirably have their stems **35** offset laterally from the bifurcated normally upper portions **42** a distance corresponding with the staggered distance between the slots **60** so that, after insertion in the base, said upper portions will be longitudinally alined and provided with notches **36**, as shown most clearly in FIGURES 4 and 5, for easy connection to associated circuitry.

The heater contacts **26** and **27** are locked securely with no free movement in the insulating base, as shown most clearly in FIGURES 3 and 6, as these are each provided with a head **80**, a stem **41** projecting therebeneath, and a lanced spring finger **37** which is bent from the

stem to press against a tapered surface 38 (except in the embodiment of FIGURES 19 to 22, inclusive) defining a slot or aperture 39 which receives the stem 41 projecting down from the wider head 80 of the heater contact, and thereby holds said head in engagement with the top surface of the insulator 22, and prevents the contact from moving laterally or vertically upward. These contacts, therefore, do not float in any direction, because they snugly fit the slot 39 at its normally upper end.

As will be clear from a consideration of FIGURE 5, the radius R_1 of the inner edge of the bifurcated part here shown as the upper part of the contact 24 which receives the corresponding short cylindrical contact element 52 of the tube 50 when held therein, has its inner end upwardly offset from the inner end 54 of the radius R_2 of the outer edge of said bifurcated part, so that the curved beam 42, so defined, has approximately uniform stress-over-strength characteristics. Such construction makes the bifurcated, nearly semicircular portion 42 of the contact 24 stiffer at its lower section, where it abuts the insulator 22, and more flexible, or of diminishing depth, as it approaches the upper or open rounded ends 43 and 44, which desirably terminate on outwardly offset arcs as illustrated in FIGURE 5.

Now, twice the radius R_1 equals D_1, the inside diameter of the contact 24 which mates with the outside diameter of the corresponding tube contact 52. This diameter D_1 is made slightly smaller than the diameter of the mating tube electrode to create an interference fit, which causes the semicircular portion 42 of the contact 24 to yield or expand when the tube 50 is inserted in it. The contact yields a greater amount at the upper or open ends, where the cross section of the material is less, and a lesser amount at the lower end, where the cross section of the material is greater, thereby permitting the inner surface of the contact to establish a large area, low impedance engagement with the outer periphery of the tube contact 52 when the tube is held therein.

The generally semicircular portions of the contacts 23, 24 and 25 are on an arc slightly greater than 180° so that the distance across the open or rounded ends is less than D_1. As a result the tube 50 when positioned for support, as shown in FIGURES 2 and 3, must be forced past these upper end portions 43 and 44 of all of said contacts, and when past, said tube is held rigidly in place against possible forces of shock or vibration.

Dimensions for the embodiment of my socket previously described which are suitable for the 6BY4 tube are as follows, it being understood that these dimensions are illustrative and not limiting. The base insulator 22 is desirably formed of compression molded material having low dielectric loss for ultra high frequency power and preferably not affected by temperatures up to 400° F.

However, the following specific materials are mentioned as possibilities: For a medium temperature (up to 400° F.) Plaskon Alkyd Molding Compound 446, manufactured by Barrett Division of Allied Chemical & Dye Corporation, may be used. For higher temperatures (up to 500° F.) a glass-filled silicone molding material known as Bakelite GMKA–5004 manufactured by Bakelite Company, a division of Union Carbon and Carbide Corporation; or Dow Corning 301, a similar material manufactured by Dow Corning Corporation, may be used. In the medium temperature range (up to 350° F.) another good selection would be a Diallyl Phthalate known as Diall 52–20–30 and manufactured by Mesa Plastics. All of these are thermosetting plastic material filled with glass fiber for high impact strength.

The next higher temperature range (up to 750° F.) would require a formulation of high-temperature electrical glass and synthetic mica known as Supramica 555 manufactured by Mycalex Corporation of America. Other formulations of high-temperature electrical glass and powdered natural mica, such as Mycalex 410, may also be used in this temperature range.

The highest temperature range (up to 1000° F.) would require a ceramic material. Steatite, chiefly clinoenstatite crystals $MgO.SiO_2$, known as Alsimag 196, could be used. A 95% alumina Al_2O_3, known as Alsimag 614, has a higher impact strength and would be preferred for temperatures up to 1000° F. Either of these materials has a softening temperature above 2500° F., but the socket use would be limited to 1000° F. because of the material used for the spring contacts.

The insulator desirably has an overall length of ⅞", a width of $^{15}/_{32}$", and with a distance of .687" between the holes 59 which are desirably provided for receiving securing means. These holes may be .094" in diameter. The insulator 22 is desirably .140" thick at the apertured end portions and .125" thick therebetween and at the center. The slots for respectively receiving the contacts 26 and 27, 24 and 25, all of which are desirably constructed from beryllium copper about .020" thick heat treated and heavily silver plated, are spaced between centers, in agreement with the spacing of the tube contacts, .125", .125" and .130".

The lateral spacing of the apertures for receiving the contacts 26 anad 27, of course agrees with the spacing of the heater buttons 30 and 40, so that their offset portions are adapted to receive these buttons when properly placed, but not allow the tube to seat when the buttons are not properly placed as, for example, being one above the other. This means that when these contacts 26 and 27 are formed of a maximum width of .172", a stem width of .110", and a height above the stem of .245", the apertures for receiving these stems are positioned with adjacent ends spaced laterally .096", and desirably set .225" from the adjacent end of the base insulator.

The portion desirably offset .015" at an upper corner of each contact, for receiving the corresponding heater button, is .094" wide and .108" deep. This offset portion has a corner rounded about a .050" radius, that is, just a very small amount greater than the radius of the button which is received therein. Other dimensions may be determined by scaling. The upper edge of the offset portion of each of the contacts 26 and 27 is desirably flared slightly outwardly, or toward the adjacent end of the base insulator, for, say, an additional .015", at an angle of approximately 20° to facilitate insertion of the tube 50.

Each of the other contact members, 23, 24 and 25, desirably has similar stem portions so that the stems of all of the contact elements, when assembled, project to a uniform level below the base insulator 22, as viewed in FIGURES 1, 2 and 3. These stems, however, are offset from the center-line of the bifurcated upper portion of the contact, so that their inner edges are desirably about .021" from said center line.

The radius of the inner edge of said bifurcated portion is desirably .135", which, as will be noted, is a trifle less than that of the cylindrical tube contacts to be engaged therein. The radius of the outer surface of the bifurcated or curved beam portion 42 is desirably .172", the center of curvature being, however, offset downwardly about .020". The bifurcations are continued upwardly to a curvature of more than 180°, preferably 216°. Thus the termination of the inner concave curvature occurs at about .042" above the center thereof, where the distance between the prongs has contracted to .260" from the normal diameter of .270". That means that in placing the tube in the socket it has to be forced past these upper portions to spread them .015" before it snaps past them to be resiliently gripped in seated position.

In the modified embodiment of the socket illustrated in FIGURES 7 and 8, the grid contact 24 has been replaced by a grounded grid contact assembly 24*a*, but the socket 21*a* may be otherwise identical with that of FIGURES 1 to 6, inclusive. The grid contact assembly 24*a* is made up of a saddle member 45, a plate member 46, and two cooperating interlocking leaf members 47 and 48, pivoted on the saddle member 45 as at 49 and 51 respectively.

The leaf members 47 and 48 are desirably formed as identical metal stampings, reversed face-to-face as they are assembled, and each desirably of one-half the thickness of the saddle member 45. To insert a tube, the leaf member 47 is swung up and clockwise to the position of FIGURE 8 and the leaf member 48 is swung up and counterclockwise, also to the position shown in FIGURE 8. The tube is then inserted and said sube will be held in its downward or nested position by the holding forces of the cathode contact 23*a* and the anode contact 25*a*, which may be identical with the contacts 23 and 25 of the first embodiment. Then the leaf member 47 is swung about its pivot 49 in a counterclockwise motion and pressed downward over the tube body until it yields and locks over the cylindrical grid contact 52 of the tube 50. Next the leaf member 48 is swung about its pivot 51 in a clockwise motion and pressed downward over the tube body until it yields and locks over the same cylindrical grid contact 52 of the tube.

The diameter of the leaf members 47 and 48 is made for an interference fit with the tube grid contact 52. Moreover the arc of contact is greater than 180° so that the distance across the open ends is slightly less than said leaf member diameter, as in the case of the bifurcated upper end portions of the contacts 23, 24 and 25. As a result, the leaf members will yield and lock around the periphery of the grid contact 52. The plate member 46 is fastened to the two legs 61 and 62 of the saddle member 45, which legs extend downward through slots (such as indicated at 60*f* in FIGURES 19 and 20) in the base insulator 22*a*, as by means of eyelets, rivets or similar fastening means 63, or by spot welding. A space 33*a*, which may be .004" as a typical dimension, is maintained between the upper edge of plate member 46 and the bottom surface of the base insulator 22*a* to permit the grid contact assembly 24*a* to move vertically in the base insulator 22*a*. The two legs of the saddle member 45 are thinner than the slot opening and narrow than the slot width provided in the base insulator 22*a* by typical dimensions of .002" and .004", respectively, like the clearances provided for the contacts 23, 24 and 25 of the first embodiment, to permit the grid contact assembly 24*a* to float in the base insulator.

FIGURES 9, 10 and 11 illustrate a preferred form of a socket embodying my invention but with a downwardly opening shield mounted thereover. The shield 64 is held in position by lips 65 and 66 which extend under the side edges of the base insulator 22*b*. Prongs 67 which extend from the two lips will press against the surface on which the socket is mounted and establish a ground contact for the shield. Two upwardly extending arms 68 and 69 are for the purpose of mounting and demounting the shield 64, which may be done by exerting finger pressure to force the two arms toward each other at their upward ends.

The elasticity of the shield 64 which may be made of a spring tempered steel, for example, will spread the upwardly extending arms when the finger pressure is relaxed, and cause the two lips 65 and 66 to move toward each other.

FIGURES 12 and 13 illustrate a preferred form of a socket embodying my invention but with another design of shield mounted thereover. The shield 64*c* is held in position by a lip 65*c* which extends under one edge of the base insulator 22*c*, and by a lip 66*c* which is provided with a hole for a machine screw or other holding means. The lip 66*c* is held in contact with the surface on which the socket is mounted and serves to establish a ground contact for the shield as well as to retain the shield in position over the socket.

In a modified embodiment of the socket as illustrated in FIGURES 14 and 15, the grid contact has been replaced by a grounded-grid contact assembly 24*d*, but the socket 21*d* may be otherwise identical with that of FIGURES 1 to 6, inclusive. The grid contact assembly is made up of a support member 71, a saddle member 45*d* which unites the upstanding side arms 70 of said support member and between which the base insulator 22*d* fits, and two contact members 47*d* and 48*d* pivoted on said arms 70 at 49*d* and 51*d*, respectively. Contact members 47*d* and 48*d* are identical metal stampings. To insert a tube 50, the contact members are raised from their closed positions as shown in FIGURE 14 to an open position as shown in FIGURE 15. The tube is pressed downward between the contact members 47*d* and 48*d* and as it moves downward contact member 48*d* turns clockwise and contact member 47*d* turns counterclockwise until they reach the closed position shown in FIGURE 14, with the grid contact 52 of the tube securely locked within the periphery created by the curved edge surfaces of the parts 45*d*, 47*d* and 48*d*. The radii of these three curved surfaces are made slightly less than the radius of the grid contact 52 of the tube 50, thereby creating six high pressure areas in contact with the periphery of said grid contact.

The pivots 49*d* and 51*d* are located on a line slightly above the centerline of the opening created by the curved edge surfaces of the parts 45*d*, 47*d* and 48*d*, so that a natural locking force is present when the tube is in position. The saddle member 45*d* has two legs 61*d* and 62*d* which extend through slots in the base insulator 22*d*, and these legs are fastened to the support member 71 by means of eyelets, rivets, spot-welding, or other fastening means 63*d*. A space 33*d*, which may be .004" as a typical dimension, is maintained between the lower edge of saddle member 45*d* and the upper surface of base insulator 22*d* to permit the grid contact assembly 24*d* to move vertically in the base insulator 22*d*.

The two legs 61*d* and 62*d* of the saddle member 45*d* are thinner than the slot opening and narrower than the slot width provided in the base insulator 22*d* by typical dimensions of .002" and .004" respectively, to permit the grid contact assembly 24*d* to float in the base insulator.

Referring now to the embodiment of my invention illustrated in FIGURES 16 to 18, inclusive, there is shown a further embodiment of the socket which provides excellent isolation of the input and the output with respect to each other. Here the grid contact has been replaced by a grounded-grid contact assembly 24*e*, but in which the socket 21*e* may be otherwise identical with that of FIGURES 1 to 6, inclusive. The grid contact assembly 24*e* comprises two relatively-thin (such as about .010" thick) shield plates 71*e*, forming a support member, which are slipped over the ends of the insulator 22*e*. Between the plates 71*e*, after assembly with the insulator 22*e*, is sandwiched a separator or filler and saddle member 45*e* and to which said plates are secured as by being spot-welded in four places, such as those designated 72. The saddle member 45*e* forms a lower contact portion for the cylindrical grid contact member 52 of a tube such as that designated 50, which may be held in said socket and has the same interference fit with respect thereto as the cathode and anode contacts, 23*e* and 25*e*, respectively, thereby insuring a low impedance connection between said tube grid contact element 52 and the grounded potential. Completing the contact assembly is an upper contact element 73 which is loose, in that it is not pivoted or otherwise positively connected to the other members, but is slidable with respect thereto between the position of FIGURE 17 and that of FIGURE 16, to thereby release or hold an associated grid contact member 52 of a tube in place, as in the preceding grounded-grid embodiments.

This loose member 73 has a pair of depending arms 77 desirably formed with arcuately outlined tips 78 which lock over sidewardly-extending arcuately tipped prongs 74 of the filler and saddle member 45*e*, and engages the cylindrical grid contact element 52 of a tube 50 around the top part of its periphery, thereby adding to the shielding. The shield plates 71*e* each have the upper end portions 79 of their upwardly-extending desirably tapered arms flared

away from those of the other shield plate to conveniently guide the top member into position. A flange 75 is desirably provided along the upper edge of the loose member 73 to facilitate holding it during movement to and from tube-contacting position.

The filler member 45*e* desirably has a pair of legs 61*e* and 62*e* which are inserted through slots (such as indicated at 60*f* in FIGURES 19 and 20) in the base insulator 22*e*. After such insertion, the plates 71*e* are sandwiched thereover on opposite sides and spot-welded in place as previously mentioned. The same amount of clearance is desirably allowed between this grounded-grid assembly 24*e* and its insulator 22*e* as there is between the grounded-grid assemblies of FIGURES 7, 8, 14 and 15 and their base insulators 22*a* and 22*d*, so that all are floating to an extent equivalent to that of the grid contact 24 of the first embodiment.

Referring now to the embodiment of FIGURES 19 and 20, there is disclosed a base insulator 22*f* which may correspond with the insulator 22 of the first embodiment, except that there are a pair of slots 60*f* for the grounded-grid contact assemblies of the embodiments of FIGURES 7, 8, 14, 15, 16, 17 and 18, rather than only one slot for a stem 35. As a further change, the slots 39*f* receive the stems of modified heater contacts, the right hand one of which, 26*f*, is illustrated in detail in FIGURES 21 and 22. The left hand heater contact corresponds with the heater contact 27 of FIGURES 1 and 3, except that it is modified to a similar extent like the contact 26*f* is modified as compared to the contact 26.

This heater contact modification involves the provision of a slot 76 desirably about .025" wide and which extends above the lance 37*f* and up into the wide portion of the contact 26*f*. The narrow strip of metal left at the side of this slot adjacent the companion contact (which, although not illustrated, we can call 27*f*, as it corresponds with the contact 27 of the first embodiment,) is bent outwardly, as viewed in FIGURE 21. I thereby broaden the portion of the contact which passes through the insulator 22*f*, that is, through one of the slots 39*f* therein. Being resilient, this bent strip holds the contact from side motion in said insulator.

This improvement also permits the contact to remain tight under conditions of temperature change, in which said contact and insulator expand and contract at different rates. The insulator 22*f* is correspondingly changed, in that the two slots 39*f* have parallel sides rather than being tapered, as shown in FIGURE 6 and indicated by the reference character 38. The lance 37*f*, instead of projecting up into a tapered portion, as viewed in said FIGURE 6, is now formed to abut the bottom surface of the insulator 22*f*, and hold the head 80*f* in contact with the top surface of said insulator, when the contacts are locked in position as viewed in FIGURE 22.

Although the embodiment of FIGURES 19 to 22, inclusive, has been described separately from the preceding embodiments, it will be understood that all of said preceding embodiments may have heater contact prongs, as a preferred alternative, like those of FIGURES 21 and 22, and slots 39*f* like those shown in FIGURES 19, 20 and 22, rather than like those of the first embodiment.

FIGURE 23 illustrates a typical grounded-grid circuit in which disclosed embodiments of the socket would be employed. FIGURES 7 and 8 illustrate one embodiment of the socket for which FIGURE 23 would be a typical circuit. FIGURES 14, 15, 16 and 17 illustrate other embodiments of the socket for which FIGURE 23 would be a typical circuit. FIGURE 24 illustrates a tuned grid, tuned plate circuit which is a typical circuit in which the embodiment of the socket as shown in FIGURES 1 to 6, inclusive, could be used. The sockets illustrated are correspondingly referenced and the circuit lettering is conventional.

Referring now to the embodiment of my invention illustrated in FIGURE 25, there is shown instead of a socket comprising a base insulator separate from associated apparatus, one in which such an insulator is replaced by a terminal board, insulating chassis wall or floor, or any other insulating support member 22*g* of suitable qualities and thickness. Received in said insulator 22*g* is a series of electrode contacts, here comprising a cathode contact 23*g*, a grid contact 24*g*, an anode contact 25*g* and heater contacts 27*g*. Contacts 23*g*, 24*g* and 25*g* are desirably formed as identical metal stampings, as in the embodiment of FIGURES 1 to 6, inclusive. Heater contacts 27*g* are desirably formed as left-hand and right-hand metal stampings having the same outline dimensions, also as in said first embodiment.

The grid contact 24*g* of the three identical contacts 23*g*, 24*g* and 25*g* is desirably inserted into the insulator 22*g* in the opposite direction, that is, after it has been reversed face-to-face, or turned 180° about its vertical axis, as compared with the cathode contact 23*g* and the anode contact 25*g*. This reversal reduces the area which lies in a plane parallel to the planes of the contacts on either side thereof and is in registry therewith. This arrangement results in a very low capacitance between the grid contact and the contacts on either side thereof. However, such reversal is not necessary in this or other embodiments if the device is used only where maintenance of such very low capacitance is not needed. The heater contacts 27*g* are desirably constructed like those of the first embodiment. It will also be understood, that corresponding modification of the other embodiments may be effected, if desired.

Having now described my invention in detail in accordance with the requirements of the patent statutes, those skilled in this art will have no difficulty in making changes and modifications in the individual parts or their relative assembly in order to meet specific requirements or conditions. Such changes and modifications may be made without departing from the scope and spirit of the invention, as set forth in the following claims.

I claim:

1. A socket comprising a base insulator with a plurality of longitudinally-spaced but staggered apertures and a pair of transversely-alined apertures, a plurality of electrode contacts including a plurality of longitudinally-spaced contacts and a pair of transversely-alined contacts correspondingly received in said apertures and supported on said insulator, said longitudinally-spaced contacts having bifurcated upper portions and depending stems laterally offset from said upper portions.

2. The invention as recited in claim 1 in which the longitudinally aligned electrode contacts are formed as identical metal stampings.

3. The invention as recited in claim 2, in which each of the said identical metal stampings forming the longitudinally alined electrode contacts has its bifurcated upper portion formed with an arcuate inner edge subtending more than a semicircle, the radius of said edge being slightly less than that of the cylindrical contact of an electron tube for which designed, whereby in inserting said tube said cylindrical contact snaps past the upper ends of said bifurcated portion, tensing the same to thereby insure a tight fit making good contact.

4. The invention as recited in claim 3, in which the elements forming the bifurcated upper portion of each electrode contact taper from their junction with the contact stem to near their ends to insure the desired expansive action as the tube is inserted.

5. The invention as recited in claim 1, in which the stems of said electrode contacts are held in place in the base insulator by each having a lanced spring finger bent out therefrom so as to underlie the base insulator.

6. The invention as recited in claim 1, in which the electrode contacts are floating in the insulator, by having clearance between their stems both laterally and longitudinally of said insulator, and in which means is pro-

vided on each stem for locking it in place in said insulator with clearance between said locking means and the bottom surface of said insulator to allow for vertical floating action.

7. The invention as recited in claim 1, in which the intermediate of said three electrode contacts is formed as a grid contact assembly suitable for being grounded and made up of a saddle member, a plate member, and two cooperating interlocking leaf members pivoted on the saddle member, said leaf members being formed as identical metal stampings reversed face-to-face as they are assembled, and of approximately one-half the thickness of the saddle member.

8. The invention as recited in claim 1, in which a downwardly opening shield is mounted over the socket, said shield being held in position by lips which extend under the side edges of the base insulator and prongs which extend from the lips to press against the surface on which the socket is mounted to establish a ground contact, and an arm extending upwardly from each side of said shield.

9. The invention as recited in claim 1, in which there is a downwardly opening shield provided for said socket, said shield being held in position by a lip which extends under one side edge of the base insulator and by a lip on the other side of said shield which projects outwardly therefrom and is apertured for receiving holding means.

10. The invention as recited in claim 1, in which each of said transversely-alined contacts has a head and a stem depending therefrom, and a slot is provided in each stem, leaving a strip of metal at one side which is expanded to resiliently hold each contact tight in its base insulator.

11. In combination with a socket as recited in claim 1, an electron tube supported in said socket, said tube comprising a plurality of ceramic insulators which respectively separate two heater contact buttons at one end from a cylindrical disc cathode contact, the latter from a cylindrical disc grid contact, and the latter from a cylindrical plate contact, said cylindrical disc contacts being gripped in the bifurcated upper portions of said longitudinally spaced electrode contacts, and the heater buttons respectively engaging said transversely alined contacts.

12. The invention as recited in claim 1, in which one of said plurality of electrode contacts is formed as a grid contact assembly suitable for grounding and made up of a support member which projects below the base insulator, a saddle member secured to said support member and disposed above said insulator, and a pair of identical metal stampings forming contact members pivoted on side arms of said support member which project above said saddle member.

13. The invention as recited in claim 1, in which one of said plurality of electrode contacts is formed as a grid contact assembly suitable for grounding and made up of a support member which projects below the base insulator, said support member comprising two shield plates with upstanding side portions between which the insulator is slidable, a saddle member sandwiched between said plates and secured thereto, said saddle member forming a lower contact portion for the cylindrical grid member of an electron tube for which it is designed and having a pair of sidewardly extending arcuately tipped prongs, and an upper contact element completing the assembly, slidable between said two shield plates, and having a pair of depending arms formed with arcuately outlined tips which lock over the sidewardly extending arcuately tipped prongs of said saddle member.

14. A socket comprising a base insulator with three longitudinally-spaced but staggered slots and a pair of transversely-alined slots, a plurality of electrode contacts including three longitudinally-spaced identically constructed contacts and a pair of transversely-alined contacts correspondingly received in said slots and supported on said insulator, said longitudinally spaced contacts having bifurcated upper portions and depending stems laterally offset to such an extent with respect to said upper portions, that when the intermediate of said three contacts has its stem inserted in the base insulator, when reversed face to face with respect to the electrode contacts on either side thereof, the upper portions are in proper longitudinal register, whereby because the offsetting increases the distance separating the stems of any adjacent two of said longitudinally-spaced contacts, a very low capacitance is provided between said adjacent electrode contacts, and said transversely-alined contacts having laterally-offset areas for direct left- and right-hand electrical contact, said areas being also offset longitudinally with respect to the insulator to nestingly receive contact buttons of a device used with said socket to prevent the incorrect insertion of such device, but otherwise similarly formed.

15. A socket comprising a base insulator with three longitudinally spaced but staggered slots and a pair of transversely alined slots, a purality of electrode contacts including three longitudinally spaced identically constructed contacts and a pair of transversely-alined contacts correspondingly received in said slots and supported on said insulator, said longitudinally spaced contacts having bifurcated upper portions and depending stems laterally offset to such an extent with respect to said upper portions, that when the intermediate of said three contacts has its stem inserted in the base insulator, when reversed face to face with respect to the electrode contacts on either side thereof, the upper portions are in proper longitudinal register, whereby because the offsetting increases the distance separating the stems of any adjacent two of said longitudinally-spaced contacts, a very low capacitance is provided between said adjacent electrode contacts, and said transversely-alined contacts having laterally-offset areas for direct left- and right-hand electrical contact, said areas being also offset longitudinally with respect to the insulator to nestingly receive contact buttons of a device used with said socket to prevent the incorrect insertion of such device, but otherwise similarly formed, the three longitudinally-alined contacts being floatingly received in the insulator and the transversely-alined contacts being locked securely with respect to said insulator.

16. A socket comprising a base insulator with three longitudinally spaced but staggered slots and a pair of transversely alined slots, a plurality of identically constructed electrode contacts including three longitudinally spaced contacts and a pair of transversely-alined contacts correspondingly received in said slots and supported on said insulator, said longitudinally spaced contacts having bifurcated upper portions and depending stems laterally offset to such an extent with respect to said upper portions, that when the intermediate of said three contacts has its stem inserted in the base insulator, when reversed face to face with respect to the electrode contacts on either side thereof, the upper portions are in proper longitudinal register, whereby because the offsetting increases the distance separating the stems of any adjacent two of said longitudinally-spaced contacts, a very low capacitance is provided between said adjacent electrode contacts, and said transversely alined contacts having laterally-offset areas for direct left- and right-hand electrical contact, said areas being also offset longtudinally with respect to the insulator to nestingly receive contact buttons of a device used with said socket to prevent the incorrect insertion of such device, but otherwise similarly formed and secured to said insulator by having their stems passed snugly through the corresponding insulator appertures, which apertures expandingly taper from the points of entry, locking of said stems being effected, after insertion in the insulator, by bending out lanced spring fingers from the parts of said stems beyond said insulator to engage portions of said insulator defining said tapered apertures, thereby also restraining said contacts from moving laterally and vertically upward.

17. A socket comprising a base insulator with three

longitudinally-spaced but staggered slots and a pair of transversely alined slots a plurality of electrode contacts including three longitudinally-spaced contacts and a pair of transversely-alined contacts correspondingly received in said slots and supported on said insulator, said longitudinally spaced contacts having bifurcated upper portions and depending stems, floating in said insulator by having clearance in the receiving slots both laterally and longitudinally, and means for locking said contacts in place in said insulator with clearance between said locking means and the bottom surface of said insulator to allow for vertical floating action.

18. A socket comprising a base insulator with three longitudinally-spaced but transversely-staggered slots and a pair of transversely-alined slots, a plurality of electrode contacts including three longitudinally-spaced identically constructed contacts and a pair of transversely-alined contacts, said pair of contacts being correspondingly received in said transversely-alined slots and all contacts supported on said insulator, said longitudinally-spaced contacts having bifurcated upper portions and depending stems laterally offset to such an extent with respect to said upper portions that when the intermediate of said three contacts has its stem inserted in the intermediate of said three longitudinally-spaced slots of said base insulator, while reversed face to face with respect to the electrode contacts longitudinally thereof, the upper portions are in proper longitudinal register, whereby because the offsetting increases the distance separating the stems of any adjacent two of said longitudinally-spaced contacts, a very low capacitance is provided between said adjacent electrode contacts, and said transversely-alined contacts having areas laterally-offset from opposite sides for direst left- and right-hand electrical contact, but otherwise similarly formed.

19. A mounting socket for multiple contact electronic units comprising a base insulator with a flat upper surface, a plurality of longitudinally-spaced but staggered apertures between said surfaces and a plurality of identical bifurcated electrical contacts longitudinally alined along, disposed above the top of, and each with a stem therebeneath laterally offset from its bifurcated upper portion to correspond with the aperture staggering and received in said apertures with a lanced spring finger bent therefrom to underlie the bottom surface of said base insulator to hold said bifurcated contact against said flat surface and clearance between said stem and insulator to allow said bifurcated contact to float sufficiently to accommodate eccentricities in the construction without applying lateral loads upon the unit.

20. A socket comprising a base insulator with three longitudinally-spaced but staggered apertures, three longitudinally-spaced flat identically constructed sheet metal contacts, the planes of said sheet metal being parallel to one another, with depending stems correspondingly received in said apertures and supported on said insulator, said longitudinally-spaced contacts having disposed above said insulator, uniform bifurcated upper portions parallel to one another, each formed with an upper edge concavely curved about a horizontal axis to mate with a cylindrical contact of an associated device, and their stems laterally offset to such an extent with respect to said upper portions that when the intermediate of said three contacts has its stem inserted in the base insulator, when reversed face to face with respect to the electrode contacts on either side thereof, the upper portions are in proper longitudinal register, whereby because the offsetting increases the distance separating the stems of any adjacent two of said longitudinally-spaced contacts, a very low capacitance is provided between said adjacent electrode contacts.

21. A mounting socket for multiple contact electronic units comprising a flat elongated base insulator and three electrical contacts bifurcated, identically constructed of flat sheet metal, longitudinally alined with one another, the bifurcated portions disposed above and resting on the top surface of said insulator, mounted in parallel planes, each formed with an upper edge concavely curved about a horizontal axis to mate with a cylindrical contact of an associated device, and with stems laterally offset on alternate of said planes, received in and passing though said insulator.

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