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TUBE HOLDER FOR CERAMIC BUTTON TUBES

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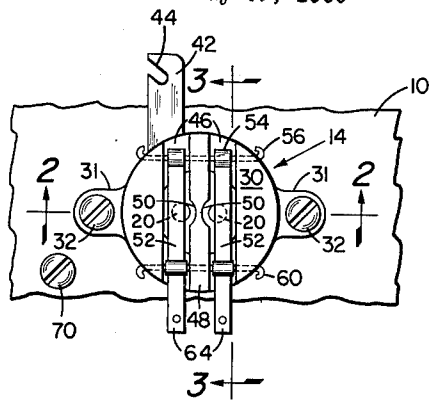


Fig. 1

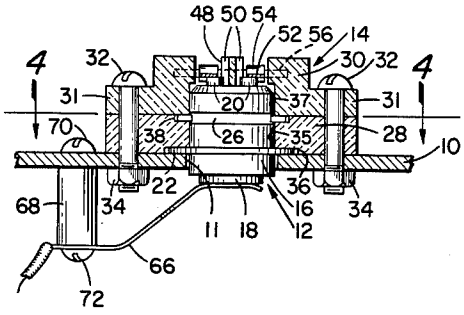


Fig. 2

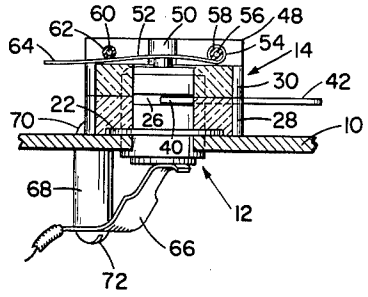


Fig. 3

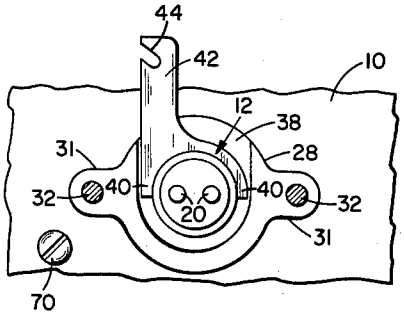


Fig. 4

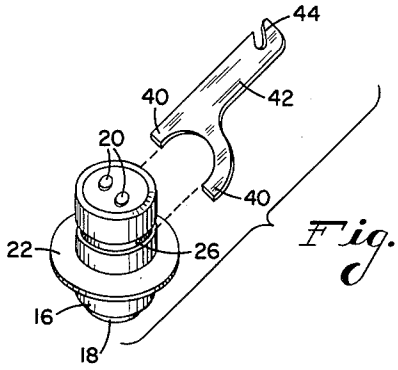


Fig. 5

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TUBE HOLDER FOR CERAMIC BUTTON TUBES

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This invention relates to a socket or holder for an electron tube, and particularly, for an electron tube for high frequency applications.

Tube design has come to be recognized as being of critical importance for high frequency tubes, particularly to reduce interelectrode capacitances and transit time. One early tube design for a high frequency triode utilized an electrode structure that was scaled down physically to reduce transit time, and that had its leads brought out radially from the electrode assembly, instead of through a circle of pins in the base, to reduce interelectrode capacitances. Since the limiting frequency for a given tube, above which operation is not feasible, usually is determined by the transit time, many of the present day conventional high frequency triodes still rely upon close spacing of the elements to reduce transit time. In addition, a high anode voltage is often employed.

Dielectric losses are also an important consideration in tube design. Whenever a dielectric is subjected to the influence of a strong, varying electric field, molecular movements occur that result in heating, and a form of loss occurs that is known as dielectric hysteresis loss. Hysteresis losses in dielectrics ordinarily are proportional to the operating frequency and at high frequencies may become appreciable. When tubes are scaled down physically, the dielectric losses usually are reduced because the insulators, that are required to support the electrodes, are reduced in size, so that less dielectric is disposed in the electric field. Proper positioning of the electrodes, at points of low electric field, and the use of low-loss materials, also assist in reducing dielectric losses.

Dielectric hysteresis losses in the outer envelope are often relatively small except at the seals where the electrode leads are brought out. The heating effect usually is particularly strong at the seals because the electric fields are concentrated. Since each cycle causes a certain amount of heat loss, the amount of heat loss increases as the frequency increases. Moreover, since the electrode leads ordinarily are made from thermally conductive material, they tend to conduct heat to hte seals from the operating portions of the electrodes, thereby increasing the thermal problem. Accordingly, the dielectric envelope material at the seals is usually a low-loss material that is capable of withstanding a large amount of heat without softening or undergoing chemical breakdown.

The use of large diameter leads helps to reduce dielectric hysteresis losses at the seals. If the center of a lead is considered as the point source of the electric field, it can be seen that the dielectric material that surrounds a large diameter lead is disposed at a greater distance from the field source, and therefore is subjected to a lower intensity electric field than would be the case were the lead of smaller diameter.

One type of high frequency tube that has been developed, and that was designed with an awareness of the considerations mentioned above, is the so-called ceramic triode. This tube has a series of ceramic rings that are joined in annular seals to a cathode ring and a grid ring. It is generally cylindrical in shape and has two heater buttons projecting from one of its ends and an anode plate projecting from the other of its ends. The grid lead ring projects radially outwardly between a pair of the ceramic rings that form the envelope, adjacent the anode end of the tube. Two of the other of the ceramic rings that form the envelope are spaced apart to provide an endless groove. The cathode lead is disposed at the bottom of this groove.

This type of tube can be used for extremely high frequency applications. However, one of the difficulties that arises, because of the design of the tube, and the extremely high frequencies at which it is operated, is that it is necessary to make contact with the grid and cathode rings about substantial portions of their circumferences. It has proved to be difficult to do so and at the same time to mount the tube in a socket from which the tube can be removed easily.

One object of the present invention is to provide a practical holder for an electron tube having the structure of the so-called ceramic triode described previously, or a similar structure.

A more specific object of the invention is to provide a practical holder for a tube having the design described, or a similar design, that will permit contact to be made with the cathode and grid lead-in conductors of the tube throughout substantial portions of their respective circumferences, and that will permit removal of the tube from the holder in a simple manner.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

I have devised a relatively simple holder or socket for an electron tube having a design similar to that described for the so-called ceramic triode. This socket comprises two molded plastic or ceramic annuli, one of which seats over the other. The chassis plate, on which the ceramic triode is to be mounted, is formed with an opening of such size that the radially projecting grid ring can rest upon the upper surface of the chassis, while the anode button and adjacent portion of the ceramic envelope project through the opening, in radially spaced relation to the surrounding portion of the chassis. A slot is formed between the confronting surfaces of the annuli to permit insertion of a clip for contact with the cathode ring of the tube. The plastic annuli are bolted to the chassis, and press the grid ring against the chassis for good electrical contact.

A leaf spring is mounted on a post that is secured to the lower surface of the chassis, and is disposed to make contact with the anode button. A pair of leaf springs are mounted on the upper annulus, and are disposed to make contact with the heater buttons respectively.

To remove the ceramic triode from this socket, it is merely necessary to withdraw the clip that makes contact with the cathode ring, and to loosen and remove the hold-down bolts that secure the socket to the chassis.

The details of the structure of this socket will be more readily understood from a consideration of a drawing of one specific embodiment thereof, taken together with the detailed description that follows.

In the drawing:

FIG. 1 is a top plan view of a socket that is made in accordance with one embodiment of this invention, that is mounted on a chassis, and that has a ceramic triode mounted therein, the contact clip being shown in its inserted position to make contact with the cathode ring of the triode;

FIG. 2 is a section taken on the line 2—2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a section taken on the line 3—3 of FIG. 1, looking in the direction of the arrows;

FIG. 4 is a section taken generally along the line 4—4 of FIG. 2, looking in the direction of the arrows, but with the ceramic triode being shown in plan view, and

FIG. 5 is a perspective view of the ceramic triode and

the contact clip, showing by a dotted line the path through which the clip would be moved to make contact with the cathode ring of the triode.

Referring now in detail to the drawing by numerals of reference, 10 denotes a sheet metal chassis on which are mounted a ceramic triode, that is generally denoted by the numeral 12, and its socket, that is generally denoted by the numeral 14.

The triode 12 has a generally cylindrical envelope 16 that is formed from three ceramic rings. An anode button 18 projects from its lower end, and a pair of heater buttons 20 project from its upper end. The grid lead 22 is a flat metallic ring that projects radially outwardly from the envelope, adjacent the lower end of the tube. The two ceramic rings that form the center and upper portions of the envelope respectively are axially spaced apart, to form an endless circumferential groove, and the cathode lead 26 is disposed at the bottom of this groove. The ceramic rings and lead-in conductors of the tube are united in gastight seals to form a unitary structure.

As best shown in FIG. 2, the chassis 10 is formed with an aperture 11 through which the lower end of the triode 12 can project, supported by the grid ring 22, which engages against and is in electrical contact with the upper surface of the chassis 10.

The socket 14 comprises a lower annulus 28 and an upper annulus 30. Both annuli preferably are molded from a synthetic plastic material such as, for example, a phenolic molding resin. Other insulating materials can also be employed for the fabrication of these annuli, such as, for example, ceramic material.

The annuli 28, 30, are formed with ears 31 that have apertures that are aligned when the annuli are assembled to form the socket 14, to receive bolts 32 that project through bores in the chassis plate 10 to secure the socket on the chassis. The bolts 32 are threaded at their lower ends to receive nuts 34.

The annuli 28, 30, are also formed with bores 35, 37 respectively, that align when the annuli are assembled to form the socket 14. The bores 35, 37 are proportioned to receive the tube 12 therein when aligned. The bore 35 of the lower annulus is enlarged adjacent the lower surface of this annulus, to form a recess 36. The recess 36 is proportioned to receive the grid lead ring 22 therein and has a depth that is approximately the same as the thickness of the grid ring 22, to confine the grid ring 22 therein when the socket is bolted to the chassis. The recess 36 is proportioned to assist in centering the tube 12 properly in the aperture 11 in the chassis.

The annulus 28 is formed with a recess 38 in its upper surface (see particularly FIGS. 2 and 4), that opens at one side of the annulus 28. In the assembled socket, this recess 38 provides a slot that communicates with the cathode lead 26, and that is proportioned to receive the bifurcations 40 of a contact clip 42. The contact clip 42 is formed from sheet metal stock and is slidably mounted in the recess 38. The thickness and shape of the clip 42 are such that it can slide readily in the recess 38. Its contact end is formed to engage in the groove in the tube envelope, to make electrical contact with the cathode ring 26 about a substantial portion of the circumference of the cathode ring 26. As shown in FIG. 4, the bifurcations 40 embrace slightly more than one-half the periphery of the cathode ring to detachably snap over the ring. The contact clip 42 is formed at its outer end with a notch 44 for receiving an electrical lead.

The upper annulaus 30 is a unitary molded body having in its upper face a pair of parallel channels 46 that communicate with the bore 37 of this annulus. A bridge portion 48 is formed between the grooves 46 and straddles the bore 37. This bridge 48 is formed with a pair of vertically-extending grooves 50 into which the heater buttons 20 of the tube can project. A pair of leaf contact springs 52 are mounted in the grooves 46 respectively, to engage against and make electrical contact with the

heater buttons 20 respectively. At one side of the upper annulus 30, the ends of the springs 52 are curled back upon themselves as denoted at 54, and are secured about a pin 56. Insulating material 58 is interposed between the pin 56 and the curled ends 54 of the springs. At the other end of the grooves 46, the springs 52 are, respectively, passed under the second pin 60, from which they are insulated by rolls 62 of insulating material that are mounted about this pin. The free ends 64 of the springs 52 project from the respective grooves 46 for connection to electrical leads.

A leaf spring 66 is mounted on a post 68 that is secured to the lower face of the chassis plate 10. This spring 66 is electrically insulated from the chassis, and its free end is disposed to engage against the anode button 18. The post 68 is secured to the chassis plate 10 by an insulated screw 70. The spring 66 is secured to the post 68 by a screw 72.

When the tube is operated as an active component of an electronic circuit, electrical contact with the heater buttons 20 is made through the leaf springs 52, respectively, which engage against the heater buttons 20 resiliently. The leaf springs 52 exert a pressure against the heater buttons 20, and thereby constantly urge the tube downwardly, to press the grid ring 22 against the supporting surface portion of the chassis. Electrical contact with the cathode ring 26 is made by the contact clip 42. The grid ring 22 is pressed against the chassis 10 to provide electrical contact with and to ground the grid of the tube. The leaf spring 66 engages against the anode button 18 to provide electrical contact with the anode. Mounting of the spring 66 on the post 68 provides low anode-to-ground capacity.

The tube can be removed from its socket quite readily, by withdrawing the contact clip 42, then backing the nuts 34 off the hold-down bolts 32, to permit removal of the bolts 32 and thereby to permit removal of the socket structure from the chassis.

This cap-like socket structure has the advantage that it requires a minimum amount of space, has good electrical features, and is easy and simple to assemble and use. Modifications of the preferred embodiment illustrated may be made to accommodate different tube designs, or to improve performance, within the spirit of this invention. For example, a metallic partial ring could be molded in the socket structure to engage the cathode ring 26 of the tube and the ends 40 of the contact clip 42, to make electrical contact with the cathode ring 26 about its entire circumference.

While the invention has been described in connection with a specific embodiment thereof, then, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. A socket for a tube having a cylindrical envelope with an annular lead-in conductor intermediate the ends of the envelope, said socket comprising a block of insulating material, said block having a bore therethrough for snugly telescopically receiving said cylindrical envelope and having a flat planar slot communicating through the side of the block with said bore and substantially coplanar with the plane of said annular lead-in conductor of said tube in said bore, and a flattened simicircular clip reciprocably mounted in said slot to detachably engage said annular lead-in conductor of said tube.

2. An electrical socket structure for detachably mounting an electron tube in an opening in a chassis plate, the tube having a generally cylindrical envelope with spaced

annular lead-in conductors located intermediate the ends of the envelope, one of said conductors being formed with a radially extending flat surface portion on which the tube can be supported in said opening in the chassis plate, said socket structure comprising an insulating member having a central bore formed to telescope over the tube and press against said radially extending surface portion, to hold the tube on the chassis plate, said insulating member being formed with a slot disposed to provide access to another of said annular lead-in conductors, a contact member slidably mounted in said slot for movement into and out of engagement with said other annular conductor and formed to engage and make electrical contact with said conductor about a substantial portion of its circumference, and means for detachably securing said insulating member to said chassis plate.

3. An electrical socket for mounting an electron tube on a chassis, the tube being of the type that has a generally cylindrical envelope and that has a first lead-in conductor in the form of an outwardly-projecting conducting sheet member that has a flat surface portion adapted to engage the chassis, and that has a second peripheral lead-in conductor disposed in parallel spaced relation to said first conductor, said socket comprising an insulating member of cap-like structure having a bore formed to receive the tube envelope, said insulating member being formed with an annular shoulder portion at one end of said bore for engagement against said first lead-in conductor to clamp sai dconductor between said shoulder portion and the chassis, said insulating member also being formed with an opening disposed to provide access to said peripheral lead-in conductor, a contact member, said contact member being reciprocably movable in said opening to permit movement of the contact member into and out of engagement with said periheral conductor, and means for detachably securing said insulating member to said chassis.

4. An electrical socket structure for mounting an electron tube in a hole in a chassis, the tube having a generally cylindrical envelope with a first annular lead-in conductor having a flat radially extending surface portion, and with a second peripheral lead-in conductor in spaced relation to said first conductor, and with a contact button at one end thereof remote from the chassis when the tube is supported in said hole on said surface portion, said socket structure comprising a cap-like insulating member having a bore formed to telescope over the tube, said insulating member also being formed with an opening that is disposed to provide access to said peripheral conductor, a contact member in said opening and movable into and out of engagement with said peripheral conductor, means for detachably securing said insulating member to said chassis, and means mounted in said insulating member for making electrical contact with said contact button and for resiliently engaging said button constantly to urge said first annular lead-in conductor against the chassis.

5. An electrical socket structure for mounting an electron tube on a chassis, the tube being of the type having a generally cylindrical envelope with a first annular lead-in conductor extending radially outward from the envelope for the grid and a second annular lead-in conductor for the cathode in spaced substantially parallel relation with said first conductor, and a pair of heater buttons that project from the end of the tube adjacent the cathode conductor, said socket structure comprising a cap-like insulating member having a central bore to telescopically pass over the tube envelope and to rest on said chassis to hold the tube in an upstanding position on the chassis, said member also being formed with a laterally extending opening to provide access to said cathode conductor, a contact member, said contact member being movable into and out of engagement with said cathode conductor, means for detachably securing said insulating member to said chassis, and a pair of electrically conductive spring members mounted in said insulating member and disposed for making electrical contact with said heater buttons respectively and for resiliently urging said first conductor against the chassis.

6. The socket structure in accordance with claim 5 including a semicircular contact member that is slidably mounted in said opening for snap-on engagement with said annular cathode conductor.

7. The socket structure in accordance with claim 5 wherein said insulating member comprises a pair of superposed annuli with aligned bores to form the mentioned tube-receiving bore, and wherein said opening for the contact member is a slotted recess in one of the confronting surfaces of the superposed annuli.

8. In combination, a chassis plate, the plate having an aperture, an electron discharge device, the device having a cylindrical envelope of insulating material one end of which is received in said aperture, a control electrode lead-in ring intermediate the ends of the envelope and extending radially outward from the cylindrical envelope wall and resting on the chassis plate along the periphery of said aperture, and having a second peripheral lead-in conductor encircling said envelope intermediate one end of said envelope and said lead-in ring, and having a terminal lead-in conductor on one end of the envelope, and an insulating member having a bore to snugly telescope over said envelope and clamp said lead-in ring to said chassis plate, said insulating member also being formed with an opening to provide lateral access to said second lead-in conductor, a contact member reciprocable in said opening, means for detachably securing said insulating member to said chassis, and means mounted on one surface of the chassis for engaging and making electrical contact wtih said terminal lead-in conductor.

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