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DISK SEAL TUBE

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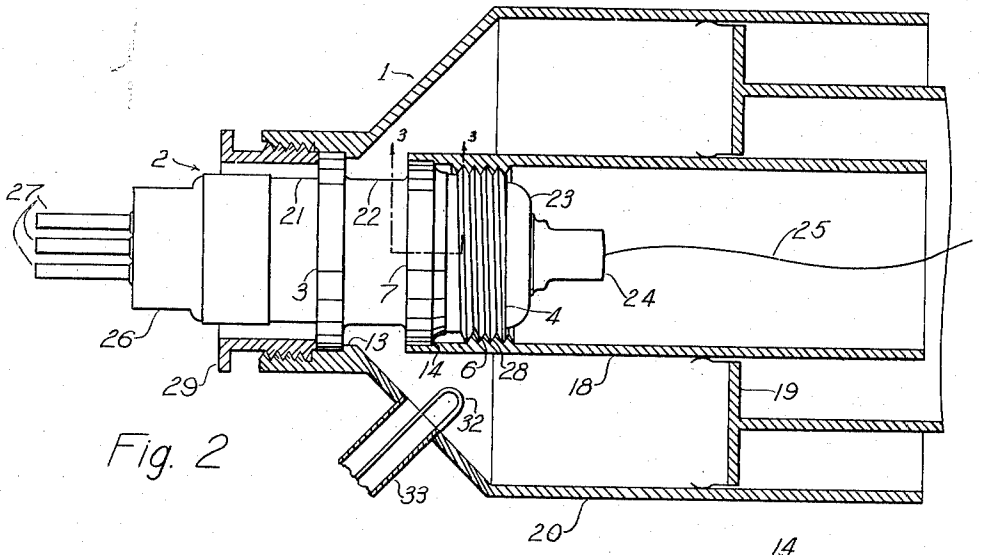


Fig. 2

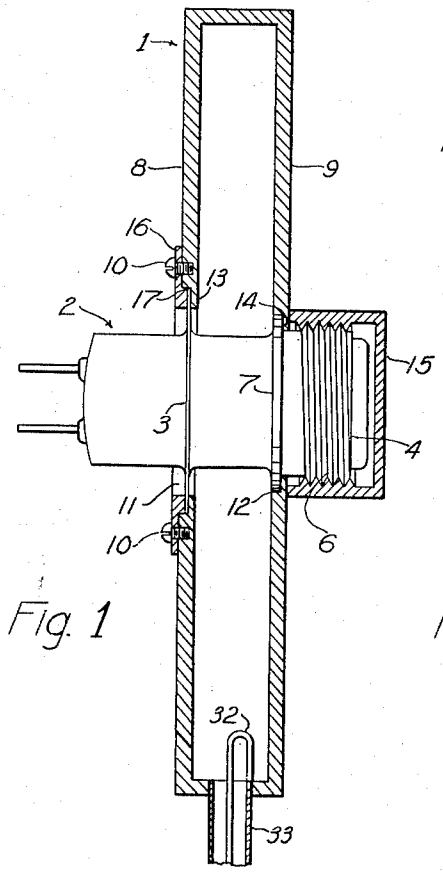


Fig. 1

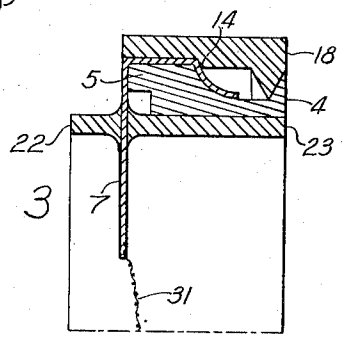


Fig. 3

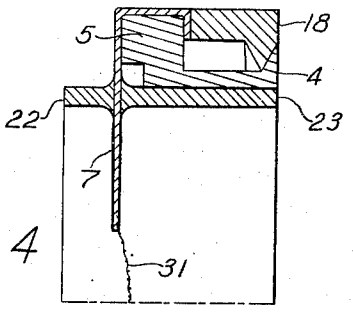


Fig. 4

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DISK SEAL TUBE

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14 Claims. (Cl. 315—5)

1

The invention relates to a tube mounting, particularly to the mounting of tubes of the disc-seal types.

Certain types of electron devices, generally related to the "tron" family, such as the magnetron and klystron, employ electron tubes which are designed to operate in close proximity to cavity resonators and, to facilitate electrical connections thereto, may be constructed with disc-seal electrodes. The mounting of a disc-seal tube within such an electron device has been a delicate as well as a complicated operation, particularly from the standpoint of easy accessibility for repair or replacement purposes.

A principal object of the invention is to provide improved means and method of mounting a disc-seal type tube within the cavity resonator of a cavity type electron device, such as an oscillator, an amplifier, or the like.

Another object is the provision of an arrangement for improving the radio frequency contact between the cavity resonator and means which support the tube within the cavity.

A special object of the invention is the provision of simplified means for clamping the smaller disc shaped connector of a disc-seal tube into the cavity of a resonator.

Other objects of the invention have to do with novel features of construction which will become apparent as the description proceeds.

Fig. 1 is a sectional view of an electron device having a radial cavity resonator in which a disc-seal tube is mounted in accordance with the present invention;

Fig. 2 is a longitudinal sectional view of a different type of electron device having a disc-seal tube mounted in a concentric line cavity resonator;

Fig. 3 is an enlarged fragmentary sectional view taken on the line 3—3 of Fig. 2, showing a sheet metal disc spun over the edges of a shoulder of a collar member; and

Fig. 4 is a similar view showing a preferred form of the construction illustrated in Fig. 3.

In the drawing only sufficient structure is shown of the electron device as is required to illustrate the invention. I have elected to disclose the invention as applied to a magnetron and a klystron in conjunction with a radial cavity resonator and a concentric line resonator, respectively. For the sake of convenience, in describing the two forms of cavity resonators illustrated herein, similar reference characters indicate corresponding parts as far as practical. However, differences in structural characteristics will be pointed out where pertinent to a full appreciation of the invention.

2

Referring particularly to Fig. 1, the reference character 1 designates generally a radial cavity resonator which may be employed with a magnetron. As is well known a magnetron may be a high-vacuum cavity oscillator, and at least one conventional form of a magnetron has a disc-seal tube mounted in the cavity resonator. In the past a split cavity has generally been used in mounting the disc-seal tube within the cavity because such tubes were often made with both discs of the same diameter. Although the provision of one smaller disc would have facilitated insertion into an unsplit (non-segmental) cavity, difficulty would have been encountered in firmly clamping the smaller disc in place. The present invention contemplates primarily means for firmly clamping the smaller disc electrode into the cavity resonator. Under most circumstances this operation is very trying, and any construction which simplifies the operation may be regarded as an advance in the art.

Referring to Fig. 2, there is disclosed an electron device of the concentric line cavity type such as represented by a klystron. This device is also a high vacuum oscillator employing a cavity resonator, but of the type known as a concentric line cavity. The cavity resonators of these two type oscillators, i. e. magnetron and klystron, as herein shown, are of different construction but generally they function similarly. In those respects in which the resonators function differently, they have no bearing on the present invention.

With this general understanding of the application of the present invention, reference may again be had to Fig. 1. The disc-seal tube 2 has a plurality of electrodes (not shown) some of which are provided with radially disposed disc-shaped terminals. According to past practice these terminals were of the same diameter and severally clamped into the inner margin of the cavity resonator. In the present construction one of these terminals comprises a metal disc 3, which is suitably sealed through the envelope of the tube 2, and connected to an electrode thereof. On one end of the tube 2 there is provided an external collar structure 4 having a cylindrical body portion provided with threads 6. A second sheet metal disc 7, which may be copper, is also sealed through the envelope and joined to the collar 4. The manner in which the disc 7 may be spun over the edges of a flange on the collar 4 to improve the radio frequency contact between the

disc and the adjacent conductor of the cavity resonator 1 will be more fully explained hereinafter in connection with Figs. 3 and 4. It will be noted that the terminals comprising the discs 3 and 7 are concentrically disposed and longitudinally displaced along the axis of the tube 1, and are of different diameters, disc 7 being of smaller diameter than disc 3. It will also be noted that the spacing of discs 3 and 7, with respect to each other, must conform to the depth of the cavity resonator. The reason for this latter feature will become obvious as the description proceeds.

It will be noted from the drawing that the cavity resonator 1 is of a one-piece construction. Referring particularly to Fig. 1, the resonator is primarily a flat hollow cylinder having end walls 8 and 9 provided with concentrically arranged circular apertures 11 and 12, respectively. The aperture 11 is of larger diameter than the aperture 12, the aperture 11 being formed on the outer or left hand end wall of the resonator, and the aperture 12 being formed on the inner or right hand end wall thereof. Surrounding the apertures 11 and 12 are shoulders 13 and 14 respectively, formed contiguous to the margin of the said apertures. These shoulders constitute means for concentrically locating the disc-seal tube 2 within the cavity resonator 1, the arrangement being that they act as a bearing surface for the edges of discs 3 and 7. That is to say, the diameters of the apertures 11 and 12 correspond substantially to the diameters of discs 3 and 7, respectively, so that the peripheral edges of said discs are adapted to register with the shoulders 13 and 14, respectively.

The disc 7, being of smaller diameter than the aperture 11 passes easily therethrough, and is adapted to register with the shoulder 14. The disc 7 is retained on the shoulder 14 by means of an internally threaded nut 15, the threads of which engage the external threads 6 on the collar 4. By tightening the nut 15 the disc 7 may be drawn into intimate contact with the shoulder 14. As mentioned above, the copper disc 7 may be spun over the edges of a flange on collar 4 and is thus placed in direct contact with the end wall of the cavity resonator, so that the shoulder 14 abuts against the spun disc 7 rather than directly against the collar 4. By virtue of this construction the radio frequency contact between the disc and the cavity resonator is more positive, and for obvious reasons constitutes an improved connection for the resonator.

The disc 3, in accordance with the construction illustrated in Fig. 1, is retained upon the shoulder 13 by the ring 16 having a depending flange 17 formed upon the peripheral edge of the ring 16. The flange 17 fits snugly into the apertures 11 and is secured in place by screws 10 which pass through holes in the ring 16 and engages suitable threads formed in the outer surface of end wall 8 of the resonator 1. The mounting of the disc-seal tube 2 within the resonant cavity may be accomplished by inserting the smaller end of the tube through the apertures 11 and 12. The nut 15, when tightened, holds the collar 4 in position, and ring 16 when properly positioned with respect to the threaded holes on the adjacent wall of the resonator, secures the disc 3 in place. It is obvious that in accordance with this construction, to remove the tube 2 from the cavity resonator, all that is required is to loosen the screws 10 and the nut 15. This frees the tube 2 of its clamping means and permits the ready withdrawal thereof.

Referring to Fig. 2, it will be noted that the general construction of a cavity resonator of the concentric line type is basically different, although having fundamentally the same operating principles as a radial cavity resonator. A concentric line cavity resonator 1, according to standard construction, embodies an inner conductor 18, an outer conductor 20, and a shorting plunger 19 which is longitudinally slidable between the inner and outer conductors to permit adjustment of the length of the resonator and hence of its resonant frequency.

The electron tube which is illustrated as mounted partially within the resonator 1 is a klystron having an elongated tubular envelope having sections 21, 22, and 23 with discs 3 and 7 sealed between them. These discs serve purposes similar to the corresponding discs in Fig. 1, although of course the electrodes carried by the discs inside the envelope will be of different shapes from those employed in the magnetron. Surrounding section 23 of the envelope is threaded collar 4 provided with threads 6 and joined to disc 7 in a manner which will presently be described.

A lead wire, not shown, for one of the klystron electrodes is sealed through section 23 and connected to top cap 24. A lead 25 for supplying direct voltage to the top cap is schematically shown passing out through the center conductor 18. At the other end the tube is provided with a base 26 having pins 27 connected to other leads sealed through section 21 of the envelope.

When the tube is mounted in the resonator, sections 22 and 23 of the envelope, with disc 7 sealed between them, pass through the open end of the outer conductor 20, the aperture being large enough to admit disc 7 but having a shoulder 13 against which the larger disc 3 abuts when the tube is fully inserted. This insertion is completed by screwing threads 6 of collar 4 into threads 28 provided on the inside of inner conductor 18. The disc 7 may be drawn snugly up against shoulder 14 on the inner conductor 18, while the disc 3 will simultaneously abut against shoulder 13 on the outer conductor. Good contact and low electrical resistance is thus provided between the disc and the resonator.

In this particular embodiment nut 29 with external threads matching internal threads on the outer conductor 20 is provided to hold the disc 3 snugly against shoulder 13 of the outer conductor. When the nut is screwed into the outer conductor it abuts against the disc and forces it against the shoulder with any desired pressure. The specific means for clamping the larger disc 3 forms no part of the invention, it being immaterial whether the device is a threaded nut as in Fig. 2, a clamping ring 16, as in Fig. 1, or any other satisfactory arrangement.

The manner in which threaded collar 4 is joined to disc 7 so that the inner conductor abuts against the disc rather than the collar is shown in the sectional view of Fig. 3 taken along line 3—3 of Fig. 2. Here the threaded collar 4 is shown in section and is seen to have a flange 5 over the edges of which the disc 7 is spun. The inner conductor 18 thus extends along the surface of the disc, while shoulder 14 on the inner surface of the inner conductor abuts against the disc. If the disc is not spun over the flange 5 on the threaded collar, but merely extended along one side of the flange, the inner conductor 18 will touch the flange 5 instead of the disc directly, and currents passing between the

disc and the inner conductor of the cavity will be required to pass from the disc to the collar and thence to the inner conductor of the resonator, traversing two contact surfaces instead of one.

Since the sectional view of Fig. 3 shows a portion of the interior of the tube, grid electrode 31 appears attached to the inner edge of disc 7.

A preferred modification of this construction is shown in Fig. 4. The flange 5 on threaded collar 4 is extended so that the disc spun over the flange forms an outer surface which has substantially the same diameter as the inner conductor 18 of the cavity resonator. The spinning of the disc over the edges of the flange is continued so that the entire end surface of the inner conductor may abut against the disc. A relatively smooth and continuous surface is thus formed for the wall of the cavity resonator. In this case the shoulder 14 is unnecessary and may be omitted.

In the arrangement of Figs. 1 and 2 a coupling loop 32 is provided for transferring radio frequency power from the cavity resonator to a coaxial line 33.

Although I have shown and described particular embodiments of my invention I do not desire to be limited to the embodiments set forth. It is my intention to cover all such modifications as come within the scope of the appended claims.

What I claim is:

1. A mount construction for supporting a disc-seal tube within the resonant cavity of an electron device comprising a cavity resonator having opposing apertures of different diameters formed in the end walls of the resonator, a disc-seal tube having a number of electrodes provided with terminals concentrically disposed along a common axis, said terminals being disc-shaped and substantially corresponding in size and spacing to the arrangement of said apertures, a collar structure secured to said tube for clamping the smaller of said terminals over the smaller of said apertures, and a ring construction for clamping the larger of said terminals over the larger of said apertures, said collar and ring construction being designed to make the tube easily demountable from the cavity resonator.

2. A mount construction for supporting a disc-seal tube within the resonant cavity of an electron device comprising a cavity resonator having opposing apertures of different diameters formed in the end walls of the resonator, terminals adapted to fit said apertures, one of said terminals comprising a threaded collar attached to one end of the tube and having a flange portion, another of said terminals comprising a disc spaced from said collar and corresponding in diameter to the larger of said apertures, means within the cavity resonator for supporting said collar and said disc, and means for retaining said collar and said disc on said supporting means, said retaining means for the disc comprising a clamping ring member, said clamping ring member being mounted exteriorly of the cavity resonator, said retaining means for the collar comprising a nut for engaging the threads on the collar and drawing the flange portion thereof against a shoulder surrounding the smaller of said apertures.

3. A mount construction for supporting a disc-seal within the cavity resonator of an electron device, comprising a cavity resonator having opposing apertures of different diameters formed

in the end walls of the resonator, a shoulder formed contiguous to each of said apertures, a disc-seal tube having a number of electrodes provided with terminals concentrically disposed along a common axis, said terminals being disc-shaped and adapted to register with said shoulders, the spacing of said terminals corresponding substantially to the distance between said shoulders, a collar secured to said tube for clamping the smaller of said terminals onto the shoulder of said smaller aperture, a ring member for clamping the larger of said terminals onto the shoulder of the larger of said apertures, and means for retaining said ring member in engagement with said shoulders.

4. The mount construction set forth in claim 3, wherein the means for retaining the collar in place comprises a nut adapted to engage the threads on the collar and fasten the latter onto the supporting shoulder surrounding the smaller aperture, and the means for retaining the ring member in engagement with the shoulder surrounding the larger aperture comprising a threaded connection between the ring member and the outer end wall of the cavity resonator.

5. A mount construction for supporting a disc-seal tube within the resonant cavity of an electron device comprising a cavity resonator having opposing apertures of different diameter, the larger aperture constituting an entrance to the resonator and the smaller aperture constituting an exit therefrom, a disc-seal tube designed to be inserted in the cavity resonator, said tube having disc terminals adapted to register with said apertures, and means for retaining said terminals in engagement with said apertures, said retaining means comprising an inner clamping member secured to said tube, said inner clamping member including a threaded collar adapted to form a butt seal with a conductive portion of said device.

6. A mount construction for supporting a disc-seal tube within the resonant cavity of an electron device comprising a cavity resonator having opposing apertures of different diameters, the larger aperture constituting an entrance to the resonator and the smaller aperture constituting an exit therefrom, a disc-seal tube designed to be inserted in the cavity resonator, said tube having disc terminals adapted to register with said apertures, and means for retaining said terminals in engagement with said apertures, said retaining means comprising an outer clamping member and an inner clamping member secured to said tube, said inner clamping member including a threaded collar adapted to form a butt seal with a conductive portion of said device.

7. An electron tube including an envelope, a disc terminal sealed through said envelope, and a threaded collar carried by said envelope and connected to said disc terminal for urging said terminal into direct contact with a wall of a cavity resonator.

8. An electron tube including an envelope, a disc terminal sealed through said envelope, and means including a threaded collar for connecting said disc to a cavity resonator, said disc being spun over said collar so that said disc may be placed in direct contact with a cavity resonator.

9. The mount construction set forth in claim 6, wherein the collar structure comprises a threaded cylindrical body member having a peripheral flange portion, and a sheet metal disc

terminal spun over the edges of said flange portion, whereby the center electrode of the resonator abuts against the spun disc rather than against the collar per se.

10. The mount construction set forth in claim 2, wherein the cavity resonator has an entrance of larger diameter than the exit therefrom, said entrance and exit providing the supporting means for the disc and collar, said arrangement making the tube demountable without disassembling the resonator.

11. An electron tube including an envelope, an externally threaded collar surrounding said envelope, said collar having a flange, and an annular terminal sealed through said envelope and beaded over said flange.

12. In combination with the electron tube of claim 11, a high frequency cavity having a shouldered aperture, an interiorly threaded part associated with said aperture, said threaded collar and threaded part being drawn to tighten the beaded-over terminal firmly between said flange and the shoulder of said aperture.

13. An electron tube according to claim 11 including an additional annular terminal of larger diameter than said beaded-over terminal, and on the side thereof opposite the threaded portion of said collar.

14. In combination with an electron tube, an envelope, an externally threaded collar surrounding said envelope, said collar having a flange, an annular terminal sealed through said

envelope and beaded over said flange, an additional annular terminal of larger diameter than said beaded-over terminal sealed through said envelope, said additional terminal being on the side of said envelope opposite the threaded portion of said collar, a cavity having two axially aligned shouldered apertures of different diameters, spaced apart a distance substantially equal to the distance between the terminals of said tube, an interiorly threaded part associated with the aperture of smaller diameter and tightened on said threaded collar to grip the beaded-over terminal firmly between said flange and the shoulder of said aperture, and another collar to press said additional terminal against the shoulder of the other aperture.

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