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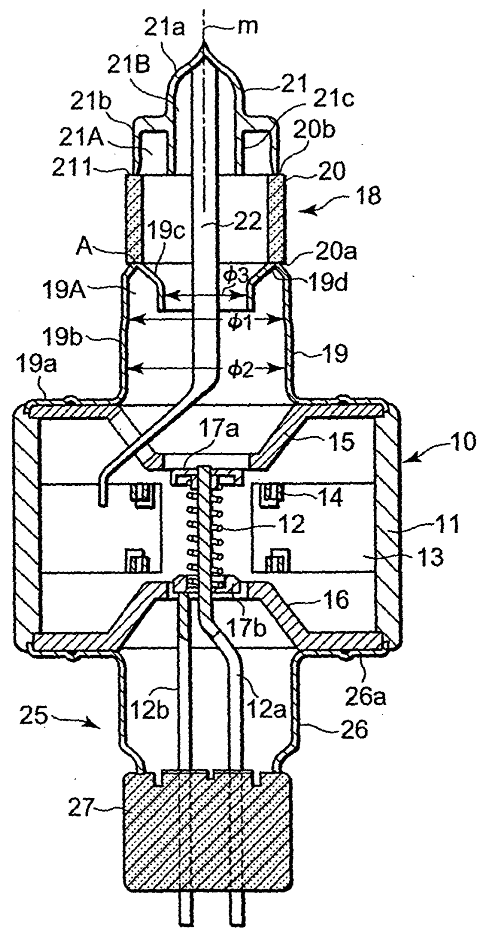
(54) **Magnetron for microwave oven**

(57) A magnetron for microwave oven comprising a metallic sealing member (19) forming a high frequency choke having a cylindrical double wall structural portion, an insulating cylinder (20) joined to the metallic sealing member (19) and an antenna lead (22) passing through the inside of both the metallic sealing member (19) and the insulating cylinder (20), a flat surface (19a) is provided on the annular joining region of the metallic sealing member (19) to the insulating cylinder (20), and further an inside tapered portion whose inner diameter varies gradually and gets dose to the antenna lead (22) is provided on the inner wall structural portion, which becomes a double wall structural portion, of the metallic sealing member (19) as is continuing into the annular flat surface.

FIG. 1a



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Description

Technical Field

[0001] The present invention relates to a magnetron for microwave oven used for microwave heating devices, etc.

Background art

[0002] An example of conventional magnetrons for microwave oven as a microwave source will be explained referring to FIG. 5 showing selectively a cross section of an output portion thereof.

[0003] The output portion 30 is comprised of a metallic sealing member 31, a first metallic ring 32, a second metallic ring 33, an insulating cylinder 34, a third metallic ring 35, a metallic exhausting tube 36 forming an exhausting tube with the third metallic ring 35, etc. An antenna lead 37 extends inside the components mentioned above in the direction of the tube axis m.

[0004] The metallic sealing member 31 is cylindrical as a whole and has a flange portion 31 a expanding in the directions perpendicular to the tube axis m, an outer cylindrical portion 31 b parallel to the tube axis m, a connecting portion 31 c perpendicular to the tube axis m, an inner cylindrical portion 31 d parallel to the tube axis m, etc.

[0005] The first metallic ring 32 has an L-shaped cross section and comprises a disc-like ring portion 32a perpendicular to the tube axis m and a cylindrical portion 32b parallel to the tube axis m. The disc-like ring portion 32a is joined to a connecting portion 31 c of the metallic sealing member 31.

[0006] The second metallic ring 33 has an outer cylindrical portion 33a parallel to the tube axis m, a disc-like ring portion 33b perpendicular to the tube axis m, and an inner cylindrical portion 33c parallel to the tube axis m. The bottom end of the outer cylindrical portion 33a in the figure is joined to the top end of the disc-like ring portion 32a of the first metallic ring 32. The lower end surface of the insulating cylinder 34 is joined to the upper surface of the disc-like ring portion 33b of the second metallic ring 33 in the figure, e.g. a flat surface continuing into an edge portion where the outer cylindrical portion 33a meets orthogonally with the disc-like ring portion 33b. A third metallic ring 35 is joined to the upper end surface of the insulating cylinder 34. The third metallic ring 35 is approximately inversely U-shaped and the lower end portion of the exhausting metallic tube 36 is joined to the inside of the third metallic ring 35. The exhausting metallic tube 36 seals an antenna lead 37 at the top end thereof in the figure.

[0007] Respective neighboring components from the metallic sealing member 31 to the exhausting metallic tube 36 are hermetically joined together with a brazing material (not shown).

[0008] An annular region 31A intervening between the outer cylindrical portion 31 b and the inner cylindrical portion 31 d of the metallic sealing member 31, an annular region 33A intervening between the outer cylindrical portion 33a of the second metallic ring 33, etc. and the inner cylindrical portion 33c, an annular region 35A inside the third metallic ring 35, and an inside region 36A of the exhausting tube 36 form together a $\lambda/4$ type choke (filter) for higher harmonic wave suppressing, which has a cylindrical double wall structural portion.

[0009] The output portion 30 seals up e.g. an anode portion (not shown) and a cathode portion (not shown) therein, and then is evacuated together with the inner space of the magnetron's main body. After they have been evacuated, the exhausting metallic tube 36 is squashed and cut off at the top 36a thereof together with the antenna lead 37.

[0010] For the output portion mentioned above, the insulating cylinder 34 is made of such as a ceramic, and the second metallic ring 33 and the third metallic ring are made of a metal. There is therefore a difference of the thermal expansion coefficient between the both materials. In consequence, an excessive stress acts on the brazed portion between the insulating cylinder 34 and the second metallic ring 33, or on the brazed portion between the insulating cylinder 34 and the third metallic ring 35. That results in occurrence of cracks on the insulating cylinder 34 or occurrence of brazing defect.

[0011] To eliminate such shortcomings, various ideas have been carried out on the material, thickness, shape of edges, etc. of the second metallic ring 33 and the third metallic ring 35 for conventional magnetrons for microwave oven.

[0012] Another example of conventional magnetrons for microwave oven will be explained referring to FIG. 6 and FIG. 7 showing selectively a cross section of an output portion thereof. In the two figures, the same marks are given to the portions corresponding to the portions in FIG. 5, and overlapping explanation will be partly omitted.

[0013] FIG. 6 shows the insulating cylinder 34 and the exhausting metallic tube 36, which are hermetically joined in sequence to the metallic sealing member 31 with e.g. an annular brazing material (not shown).

[0014] In the case of this example, the insulating cylinder 34 is joined to the flat surface of the connecting portion 31 c that continues into the corner where the outer cylinder portion 31 b of the metallic sealing member 31 bends orthogonally toward the connecting portion 31c. The exhausting metallic tube 36 is provided integrally with an outer cylinder portion 41 at the outside thereof and the bottom end 41 a of the outer cylindrical portion 41 in the figure is joined to the insulating cylinder 34.

[0015] The annular region 31A inside the metallic sealing member 31, the inside region 34A of the exhausting metallic tube 36, and the inside region 41A of the outer cylindrical portion 41 of the exhausting metallic tube 36 form respectively a $\lambda/4$ type choke for higher harmonic wave suppressing.

[0016] FIG. 7 is another example of conventional magnetrons for microwave oven, showing selectively a cross section of the output portion thereof.

[0017] In the case of this example, an annular projection 311 is formed on the connecting portion 31 c of the metallic sealing member 31, and the insulating cylinder 34 is joined to the annular projection 311.

[0018] The conventional technologies mentioned above are described in Japanese Laid Open Patent 4-167334, etc.

[0019] The conventional example shown in FIG. 5 has a structure that makes reliability of the brazed portion between the insulating cylinder 34 and the second metallic ring 33, and reliability of the brazed portion between the insulating cylinder 34 and the second metallic ring 35 easy to be ensured. Moreover, it has an excellent advantage of higher harmonic wave suppressing effect because a lot of λ/4 type choke structures are provided and moreover each element component can be fabricated with high precision. However, number of components is so large that productivity deteriorates.

[0020] The conventional example shown in FIG. 6 and FIG. 7 has a small number of components, so that productivity thereof can be improved. However, it is difficult to ensure reliability of the brazed portion between the insulating cylinder 34 and the metallic sealing member 31.

[0021] For example, iron is used as the material of the metallic sealing member 31. Therefore, the thickness of the metallic sealing member 31 cannot be diminished in consideration of mechanical strength. In consequence, as shown in FIG. 6, a large stress is generated at the joined portion of the metallic sealing member 31 to the insulating cylinder 34 when the insulating cylinder 34 is joined to the flat surface of the connecting portion 31c that constitutes the metallic sealing member 31. That results in occurrence of cracks in the insulating cylinder 34.

[0022] As shown in FIG. 7, the structure in which the insulating cylinder 34 is joined to the annular projection 311 of the metallic sealing member 31 makes the joining area of the metallic sealing member 31 to the insulating cylinder 34 so narrow that occurrence of cracks of the insulating cylinder 34 can be suppressed. However this method cannot achieve excellent processing accuracy if the annular projection 311 is fabricated by press working etc. Consequently reliability of the brazed portion deteriorates. Because the annular projection 311 is also a part of the choke structure, higher harmonic wave suppressing effect fluctuates.

[0023] In the conventional examples mentioned above, the choke structural portions of the metallic sealing member 31 or the second metallic ring 32 have approximately a rectangular cross section with one side open, which forms an annular groove. Consequently, the length that is parallel to the antenna lead 37 with a certain constant distance facing thereto is substantially equal to the length necessary for the choke structure and becomes relatively long. Therefore, discharge toward the antenna lead 37 is prone to continuing and then melting of the antenna or melting of the choke takes place.

Disclosure of Invention

[0024] It is an object of the present invention is to resolve the above-mentioned drawbacks and provide a magnetron for microwave oven that has an excellent higher harmonic wave suppressing effect by ensuring reliability of the brazed portion.

[0025] The object is achieved in an aspect of the invention, that is a magnetron for microwave oven comprising: an anode cylinder with a tube axis, having a plurality of vanes arranged radially toward the tube axis; a cathode provided on the tube axis at the center of the anode cylinder; a cylindrical metallic sealing member whose a first end surface having a flange portion is hermetically sealed to one end surface of the anode cylinder; an insulating cylinder whose a first end surface is sealed to a second end surface of the metallic sealing member and whose a second end surface is sealed to an exhausting tube; and an antenna lead whose one end is connected with the vane of the anode cylinder and whose other end is connected with the exhausting tube, and provided along the tube axis, characterized in that the metallic sealing member comprises: a cylindrical external side wall portion; an annular flat surface formed on the second end surface of the external side wall portion; and an internal side wall portion projecting inward from the annular flat surface and forming a double cylinder together with the external side wall portion, the metallic sealing member being joined to the first end surface of the insulating cylinder at the annular flat surface, the width of the annular flat surface in radial direction being smaller than the thickness of the insulating cylinder, and the internal side wall portion forming a tapered portion getting close gradually to the antenna lead along the tube axis from the annular flat surface.

[0026] Further, a tapered portion extending from the annular flat surface can be formed on the external side wall portion of the metallic sealing member.

[0027] Further, the internal side wall portion of the metallic sealing member is formed only of a tapered portion.

[0028] Further, the external side wall portion of the metallic sealing member can be formed as is substantially parallel to the tube axis.

[0029] Further, the internal side wall portion of the metallic sealing member comprises a tapered portion extending from the annular flat surface and a parallel portion extending from the tapered portion and substantially parallel to the antenna lead.

[0030] Further, the width of the annular flat surface is determined in such a manner as fulfilling the following equation:

Wb/Wa = 1.5 to 10,

where Wa is the width of the annular flat surface of the metallic sealing member and Wb is the thickness of the insulating cylinder.

[0031] Further, the internal side wall portion and the external side wall portion forms a choke suppressing a high harmonic wave.

Brief Description of the Drawings

[0032]

FIG. 1 a is a cross section of the magnetron tube for explaining an embodiment of the present invention.

FIG. 1b is a schematic diagram for explaining the joining portion of the metallic sealing member to the insulating cylinder.

FIG. 1c is a partial cross section for explaining the joining portion of the metallic sealing member to the insulating cylinder.

FIG. 2 is a schematic diagram showing a variation of the present invention.

FIG. 3 is a schematic diagram showing another variation of the present invention.

FIG. 4 is a characteristic diagram for explaining the characteristics of the present invention.

FIG. 5 is a selective cross section of the output portion of a conventional magnetron.

FIG. 6 is a selective cross section of the output portion for explaining another conventional example.

FIG. 7 is a selective cross section of the output portion for explaining further conventional example.

(Embodiment)

[0033] An embodiment of the invention will be explained referring to FIG. 1 showing selectively a cross section of the main part thereof.

[0034] The oscillating part 10 generating a high frequency comprises an anode cylinder 11, a cathode 12 positioned on the center of the tube axis in the anode cylinder 11, and a plurality of anode vanes 13 forming a cavity oscillator. The anode vanes 13 are located radially in the direction of the tube axis between the anode cylinder 11 and the cathode 12, and one end thereof is fixed to the anode cylinder 11. Pluralities of the anode vanes 14 are connected alternately together through strap rings 14. Pole pieces 15, 16 are fixed to both opening ends of the anode cylinder 11 on the top and the bottom in the figure, and end shields 17a, 17b are connected with the cathode 12. An output portion 18 is provided above the pole piece 15, and a cathode portion 25 is provided below the pole piece 16.

[0035] The cathode portion 25 is comprised of a flange portion 26a, which is sealed to the bottom end surface of the anode cylinder 11, of a flanged cylindrical metallic sealing member 26 and a cylindrical insulating stem 27 hermetically sealed to the bottom end surface of the cylinder wall constituting a part of the envelope. The cathode 12 is supported by a first cathode lead 12a extending from the end shield 17a and passing through the center of the cathode, and a second cathode lead 12b extending from the end shield 17b on the other end of the cathode. The cathode leads 12a, 12b are supported by an insulating stem 42 and led outward.

[0036] The output portion 18 has a flanged cylindrical metallic sealing member 19 which is a part of the envelope, an insulating cylinder 20, a metallic exhausting tube 21, etc. The metallic sealing member 19, the insulating cylinder 20 and the metallic exhausting tube 21 are hermetically joined together with annular brazing material. In the space inside them, an antenna lead 22 extends in the direction of the tube axis m. The antenna lead 22 is electrically connected with one of the anode vanes 13 on one end. thereof and extends toward the direction of the tube axis on the center of the tube axis passing through the pole piece 15, and the other end thereof is squashed and fixed at the sealed position of the metallic exhausting tube 21.

[0037] The metallic sealing member 19 includes a cylindrical external side wall portion 19b elongating in the extending direction of the tube axis m and a cylindrical internal side wall portion 19c whose top end (the second end surface) is bent inward to form a coaxial double wall having a V-shaped annular groove 19a, elongating in the extending direction of the tube axis m. The double wall forms a higher harmonic wave suppressing choke. The bottom end (the first end surface) of the metallic sealing member 19 is formed by the flange portion 19a expanding to the perpendicular directions to the tube axis m, and the outer periphery of the flange portion 19a is joined to the anode cylinder 11. An annular flat surface 19d perpendicular to the tube axis m is formed on the top end surface (the second end surface) of the metallic sealing member 19, i.e. the annular boundary region between the cylindrical external side wall portion 19b and the cylindrical inner wall 19c, and joined to the bottom end surface (the first end surface) 20a in the figure of the insulating cylinder 20.

[0038] As is shown in FIGs. 1b, c magnifying the proximity of circle A in FIG. 1 a, an annular flat surface 19d is formed at the V-shaped vertex of the annular boundary region between the cylindrical external side wall portion 19b and the cylindrical internal side wall portion 19c, and joined to the bottom end surface 20a in the figure of the insulating cylinder 20 by brazing. The first end surface 20a is metallized in advance.

[0039] On a part of the cylindrical internal side wall portion 19c, which extends from the inner edge d1 of the annular flat surface that is the joining portion of the metallic sealing member 19 to the insulating cylinder 20, the metallic sealing member 19 has a tapered portion 191 whose inner diameter decreases gradually along the tube axis m in the direction of the anode cylinder 11 so as to get close to the antenna lead. The tapered portion 191 is provided as is continuing into the inner edge d1 of the annular flat surface 19d. The end parallel portion 192 thereof is approximately parallel to the tube axis m, and face to the antenna lead 22 at a certain constant distance.

[0040] Outside the joining portion of the metallic sealing member 19 to the insulating cylinder 20, e.g. on a part of the cylindrical external side wall portion 19b, the metallic sealing member 19 has an outer tapered portion 193 whose outer diameter increases gradually toward the anode cylinder 11, so as to continue into the outer edge d2 of the annular flat surface 19d. The outer wall main part 194 thereof is approximately parallel to the tube axis m.

[0041] The maximum diameter of the outer tapered portion 193 in the external side wall portion 19b is set to be greater than the outer diameter of the insulating cylinder 20. The outer tapered portion 193 is connected continuously with the outer wall main part 194. This structure has an effect that protects the insulating cylinder against an external shock. The bottom end surface of the insulating cylinder 20 made of e.g. ceramics in the figure is joined by brazing to the boundary region between the tapered portion 191 and the outer tapered portion 193, for example, to the annular flat surface 19d on the vertex of the V-shaped angle formed by the tapered portion 191 and the outer tapered portion 193. Thanks to formation of these tapered portions 191, 193, brazing filler metal is hard to flow out from the joining surface when brazing is carried out, so that no excess joining portion is formed on the end surface of the insulating cylinder.

[0042] The width Wa of the annular flat surface 19d of the metallic sealing member 19 is set to be smaller than the thickness Wb of the insulating cylinder 20, so that e.g. the bottom end surface 20a of the insulating cylinder 20 is provided with spaces 20a1, 20a2 on the both sides of the joining portion thereof to the annular flat surface 19d.

[0043] In the case of magnetrons for microwave oven, the thickness of the insulating cylinder is 1.5 mm to 2.0 mm. It is desirable that the width of the corresponding flat surface Wa should be 0.2 mm to 2.0 mm. Namely, the ratio Wb/Wa is set to be 1.5 to 10. If the ratio is not more than 1.5, the insulating cylinder is liable to break due to the stress by thermal expansion of the metallic sealing member. If the ratio is more than 10, certainty of hermetic sealing gets deteriorated. It is desirable to design the joining portion between the insulating cylinder and the annular flat surface to be placed at the central portion of the insulating cylinder by means of making the diameter of the circle at the wall center of the insulating cylinder be in agreement with the diameter of the circle at the center of the annular flat surface. That is, the spaces 20a1, 20a2 of the end surface of the insulating cylinder generated on the both sides of the joining portion are set to have the same width together. Thereby, any protrusion out of the edge of the insulating cylinder caused by deviation of the joining portion by fabrication error or occurrence of undesirable strain can be prevented.

[0044] On the other hand, the exhausting metallic tube 21 is joined to the top surface 20b of the insulating cylinder 20 in the figure.

[0045] The exhausting metallic tube 21 has a cylindrical portion 21 a whose top end in the figure is closed, an outer cylindrical portion 21b with an L-shaped cross section and positioned outside the cylindrical portion 21 and sealed with the insulating cylinder 20. The bottom end 211 of the outer cylinder portion 21 b in the figure is joined to the top end surface 20b of the insulating cylinder 20.

[0046] The annular region 19A intervening between the cylindrical external side wall portion 19b and the cylindrical internal side wall portion 19c of the metallic sealing member 19, the annular region 21A intervening between the outer cylindrical portion 21 b and the cylindrical portion 21 a of the exhausting metallic tube 21, and the inner region 21 B of the inner cylindrical portion 21 of the exhausting metallic tube 21 constitute together a λ/4 type high frequency choke which has a coaxial cylindrical double wall structural portion to suppress higher harmonic wave.

[0047] High frequency waves (e.g. 2450MHz) generated by the oscillating portion 10 in operation are extracted through the antenna lead 22 by the construction mentioned above. Radiation of higher harmonic components is suppressed by the aid of choke action of the λ/4 type high frequency choke provided outside the antenna lead 22.

[0048] According to the construction mentioned above, the flat portion 19d whose width is smaller than the thickness of the insulating cylinder 20 is provided on the vertex of the angle interposed by the two tapered portions of the metallic sealing member 19, and the insulating cylinder 20 is joined to the annular flat surface 19d.

[0049] According to this structure, brazing defect, strength defect, etc. are eliminated and reliability can be improved in comparison with conventional structures, e.g. a structure in which the insulating cylinder is joined to the annular flat surface continuing into the comer portion bending at right angles. Compared to an annular projection fabricated by press working, good processing accuracy can be obtained. Because the area of the annular flat portion 19d joined to the end surface 20a of the insulating cylinder is small, occurrence of cracks in the insulating cylinder can be prevented. The whole length of the metallic sealing member and flatness of the brazed portion can also be improved. Because the tapers are formed on the both sides of the annular flat surface 19d, run-over brazing filler metal from the joining portion by brazing does not unnecessarily stick to the surface of the insulating cylinder, so that crack of the insulating cylinder can be further prevented.

[0050] As a numerical example of the structure mentioned above, the thickness Wb of the insulating cylinder 20 is 1.5 mm; the width Wa of the flat portion is approximately 0.3 mm. The thickness of the metallic sealing member 19 is 0.5 mm; the inner diameter thereof is 16 mm at the smallest portion $\phi1$, and 16.5 mm at the largest portion $\phi2$.

[0051] When a choke suppressing the fifth higher harmonic wave and the vicinity is formed on the metallic sealing member 19, the choke length becomes approximately 5.0 mm. If the inner diameter $\phi3$ of the choke is 9 mm and the angle θ of the inner tapered portion 191 to the tube axis m is 45 degrees, the length l of the cylindrical portion 192 facing the antenna lead at a certain constant distance r becomes short, i.e. 2.2 mm to 2.5 mm. As a result, antenna melting or choke melting caused by continuous discharge to the antenna lead 22 can decrease. The angle θ is practically 45 to 100 degrees in consideration of forming the annular flat surface and the choke formation.

[0052] In this case, the choke suppressing the fifth higher harmonic wave and the vicinity is prepared on the metallic sealing member 19. However, it is not limited to the choke suppressing the fifth higher harmonic wave and the vicinity, but the same effect can be obtained when a choke suppressing other higher harmonic waves is provided. The closer the choke gets to the oscillator main body, the greater the high frequency suppressing effect becomes.

[0053] In the above-mentioned embodiment, the inner tapered portion 191 and the outer tapered portion 193 are prepared on the both sides of the flat portion 19d provided on the metallic sealing member 19 respectively. FIG. 2 shows a variation, which is a structure having only one tapered portion 191 on one side of the flat portion 19d and the external side wall portion 19b parallel to the tube axis.

[0054] As shown in FIG. 3, the entire cylindrical internal side wall portion 19c of the metallic sealing member 19 may be formed as a tapered shape.

[0055] Referring to FIG. 4, choke effect will be explained next.

[0056] FIG. 4 shows a simulation result by computer, where the horizontal axis represents frequency (GHz) and the vertical axis represents signal transmission level (V). This simulation is modeled after the output portion of magnetron, and transmission level of a signal at a specified frequency is calculated using a pulse of amplitude 1 as the input signal. The fundamental oscillation frequency is 2.45 GHz. The result of simulation coincides with the action of actual tubes.

[0057] The characteristic P is given by the embodiment of the present invention in which the tapered portion is prepared as shown in FIG.1, and the characteristic Q is given by the case of conventional technologies (e.g. a structure without a tapered portion and having a projection as shown in FIG. 7). The embodiment has a transmission level lower than that of the conventional technology, so that the invention has a higher choke effect. For example, transmission level at the vicinity of the fifth higher harmonic wave (12.25 GHz) has a high choke effect in a wide band in the case of the structure having a tapered portion.

[0058] In accordance with the above-mentioned structure, productivity is improved because number of components for the output portion is small. Furthermore, a magnetron for microwave oven in which reliability of brazed portion between the metallic sealing member and the insulating cylinder and dimensional accuracy are improved can be realized. Additionally, length of the cylindrical portion facing the antenna lead of the metallic sealing member with a certain constant distance is so short that antenna melting or choke melting caused by continuous discharge to the antenna lead can be diminished. Moreover, higher harmonic wave suppressing effect can be obtained over a wide band.

[0059] According to the present invention, a magnetron for microwave oven having improved reliability and dimensional accuracy can be realized.

Claims

1. A magnetron for microwave oven comprising:

an anode cylinder with a tube axis, having a plurality of vanes arranged radially toward the tube axis;
a cathode provided on the tube axis at the center of the anode cylinder;
a cylindrical metallic sealing member having a first end surface with a flange portion hermetically sealed to one end surface of the anode cylinder;
an insulating cylinder having a first end surface sealed to a second end surface of the metallic sealing member and having a second end surface sealed to an exhausting tube; and
an antenna lead having one end connected with the vane of the anode cylinder and having other end connected with the exhausting tube, and provided along the tube axis,

characterized in that the metallic sealing member comprises:

a cylindrical external side wall portion;
an annular flat surface formed on the second end surface of the external side wall portion; and
an internal side wall portion projecting inward from the annular flat surface and forming a double cylinder together with the external side wall portion,
the metallic sealing member being joined to the

first end surface of the insulating cylinder at the annular flat surface, the width of the annular flat surface in radial direction being smaller than the thickness of the insulating cylinder, and the internal side wall portion forming a tapered portion getting close gradually from the annular flat surface to the antenna lead along the tube axis.

2. The magnetron for microwave oven as stated in Claim 1, wherein a tapered portion extending from the annular flat surface is formed on the external side wall portion of the metallic sealing member.

3. The magnetron for microwave oven as stated in Claim 1, wherein the internal side wall portion of the metallic sealing member is formed only of a tapered portion.

4. The magnetron for microwave oven as stated in Claim 1, wherein the external side wall portion of the metallic sealing member is formed as is substantially parallel to the tube axis.

5. The magnetron for microwave oven as stated in Claim 1, wherein the internal side wall portion of the metallic sealing member comprises a tapered portion extending from the annular flat surface and a parallel portion extending from the tapered portion and substantially parallel to the antenna lead.

6. The magnetron for microwave oven as stated in Claim 1, wherein the width of the annular flat surface is determined in such a manner as fulfilling the following equation:

$$Wb/Wa = 1.5 \text{ to } 10,$$

where Wa is the width of the annular flat surface of the metallic sealing member and Wb is the thickness of the insulating cylinder.

7. The magnetron for microwave oven as stated in Claim 1, wherein the internal side wall portion and the external side wall portion forms a choke suppressing a high harmonic wave.

FIG. 1a

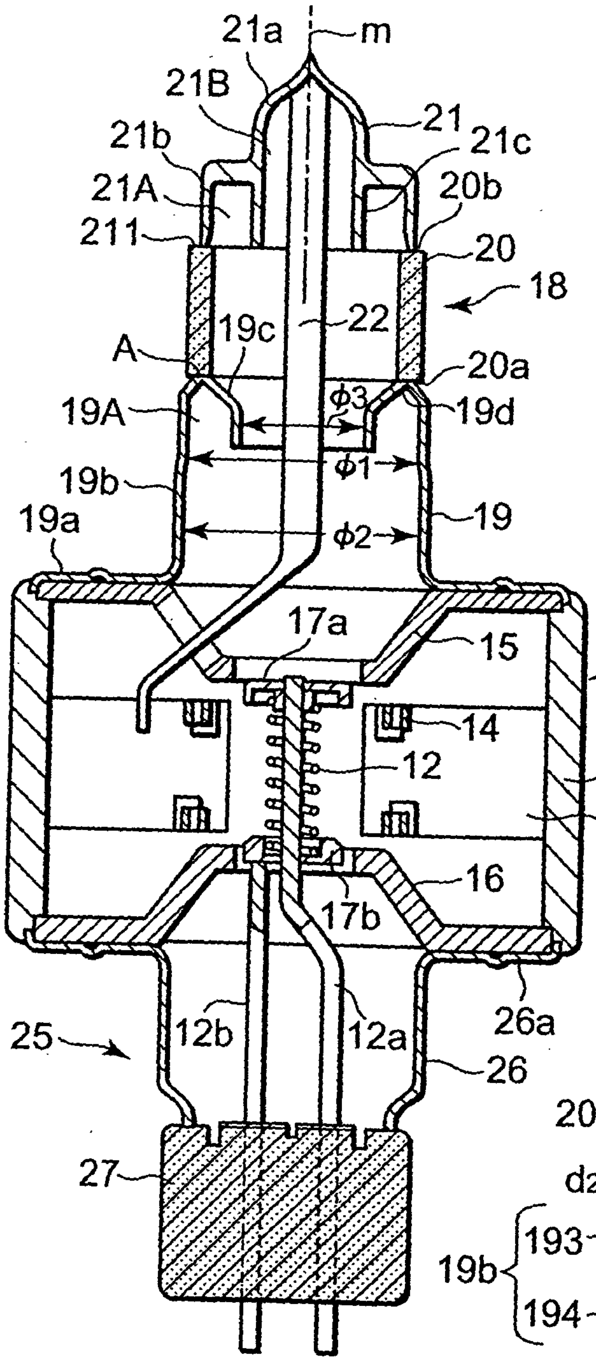

FIG. 1b

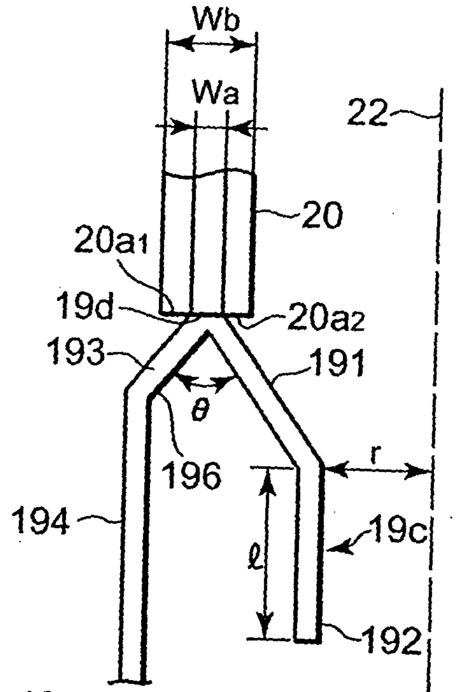

FIG. 1c

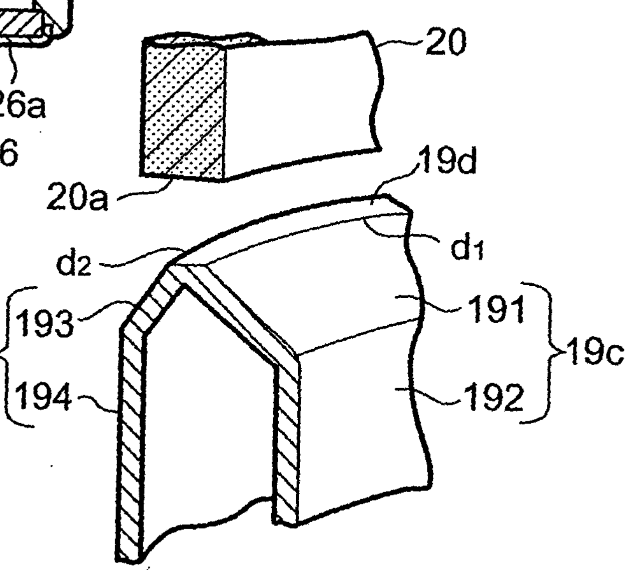

FIG. 2

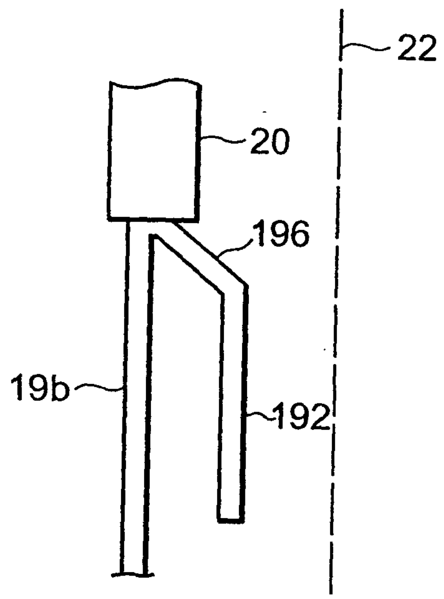

FIG. 3

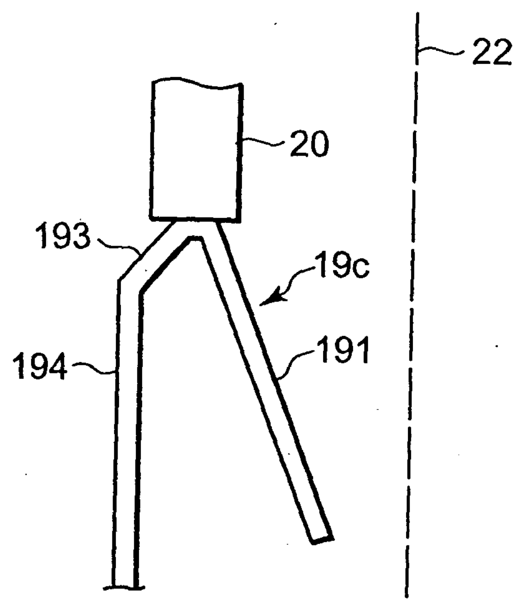

FIG. 4

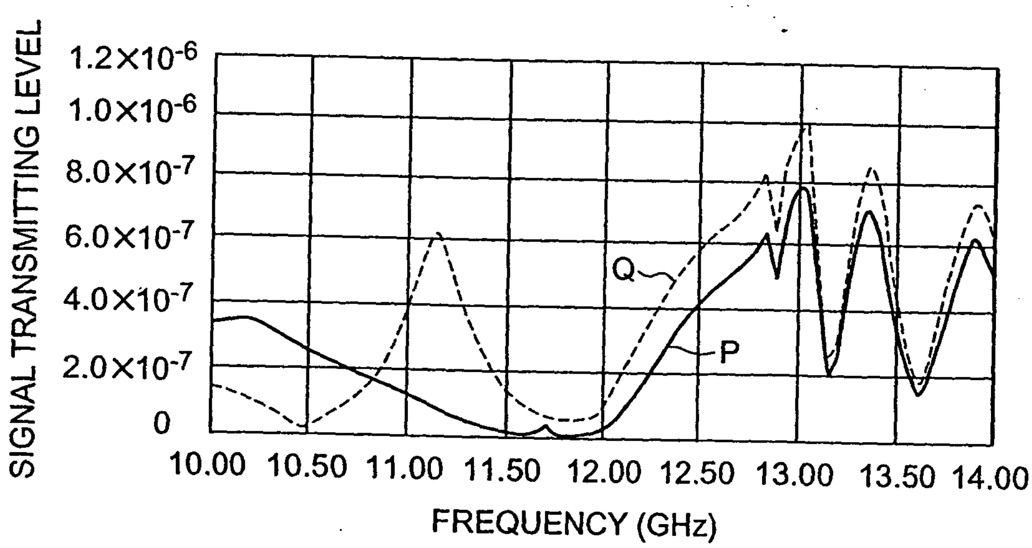

FIG. 5

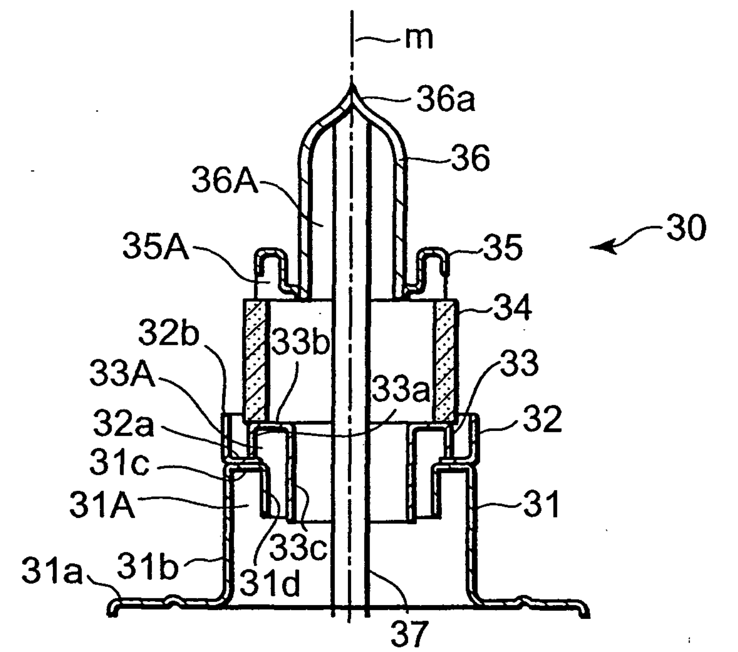

FIG. 6

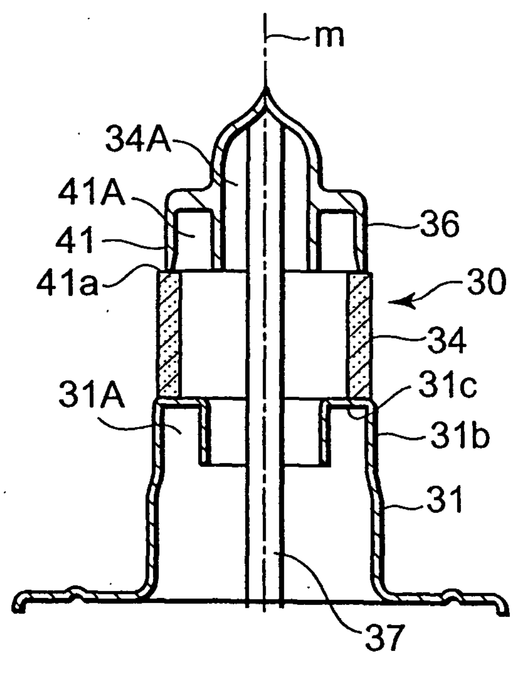

FIG. 7