

Description

This invention relates to a magnetron for use in microwave heating apparatuses of microwave ovens and the like according to the preambles of one of the independent claims 1, 5 or 9.

Figure 19 shows a conventional magnetron used in microwave ovens and the like. The anode cylinder 1 has a number of anode vanes 3 arranged on its interior surface. These anode vanes 3 project toward the cathode 2, forming a resonant cavity. At either opening of the two ends of the anode cylinder 1, a pair of funnel-shaped magnetic pole pieces, first and second magnetic pole pieces 4 and 5, for the converging of the magnetic field are arranged so as to face each other. Flange 8a of the eyelet-shaped metal tube 8 that seals a metal sleeve 6 by means of a ceramic insulating tube 7 covers the first magnetic pole piece 4 so as to seal the opening at one end of the anode cylinder 1. The microwave output conductor 9 that extends from the anode vanes 3 connects to the metal sleeve 6. The cap-shaped microwave output metal terminal 10 is fit over the metal sleeve 6.

On the other end, a pair of cathode supporting bars 11 and 12 pass in an air-tight fashion through a cup-shaped ceramic stem insulator 13, which seals the eyelet-shaped metal tube 14 at that end. Flange 14a of the metal tube 14 covers the second magnetic pole piece 5 so as to seal the opening at the other end of anode cylinder 1. The stem insulator 13 and the pair of cathode supporting bars 11 and 12 are sealed so as to be air-tight by a pair of terminals 15 and 16 provided on the outside surface of the bottom of the stem insulator 13.

Usually, this kind of magnetron has a microwave oscillating function with a fundamental wave of 2450 MHz, and output is picked up through the microwave output terminal 10. However, there is danger of leakage of microwaves to the outside of the tube through the stem insulator 13 the propagation path of the cathode supporting bars 11 and 12.

By connection of an LC filter circuit to the cathode terminals 15 and 16, and by the encasing of this circuit and the stem insulator 13 in a metal shielding case, the leakage of microwaves to the outside of the apparatus is prevented. However, with this kind of construction, a relatively large shielding case and a high potential resisting feed-through-type capacitor are needed, so that miniaturization of the apparatus and lowering of costs become difficult.

As disclosed in Japanese Utility Model Publication No. 52-55967, it is possible to provide a variety of cylindrical choke elements to prevent the propagation of harmonic components through the microwave leakage propagation route that passes from the resonant cavity to the stem insulator through

the cathode supporting bars. However, if a number of cylindrical choke elements are provided inside the tube, it is difficult to achieve miniaturization of the magnetron and lowering of costs of the magnetron.

FR-A-2 276 685 and US-A-3 634 790 show some kinds of chokes to suppress parasitic modes. These chokes are arranged in magnetron cavities, for example, for a tube sender or tube amplifier.

EP-A-0 205 316 and EP-A-0 187 033 disclose magnetrons for microwave ovens comprising a variety of cylindrical choke elements to prevent the propagation of harmonic components through the microwave liquid propagation route that passes from the resonant cavity to the stem isolator through the cathode supporting bars. However, these kinds of magnetrons for microwave ovens including complicated chokes are too large and the miniaturization of these known magnetrons is not possible or is at least difficult.

From GB-A-605 253 a frequency filter for a high-frequency cable is known. This document is not directed to magnetrons for microwave ovens.

It is the object of the present invention to overcome the disadvantages of the prior art. In particular, it is the object of the present invention to propose magnetrons for microwave ovens and the like which are able to prevent leakage in an improved manner of undesired microwaves to the outside and to propose a compact solution for magnetrons for microwave ovens and the like.

These objections are obviated by the magnetrons comprising the features listed in the independent claims 1, 5 and 9.

Useful embodiments are defined by the features mentioned in the subclaims.

According to one aspect of the present invention the advantages according to the present invention can be achieved by a magnetron according to the preamble of claim 1 which is characterized in that the metal tube is provided with at least one circular metal piece having a flange portion perpendicular to the cylindrical axis of the metal tube, and the circular metal piece is provided with at least one hole formed centrally in said flange portion to lead the bars through the hole, and the flange portion is provided with at least one slot formed in said flange portion, each slot having an electrical length corresponding to about 1/2 or 1/4 of the wavelength of the fundamental wave or of any of the harmonic components of the fundamental wave.

According to another aspect of the present invention, the metal tube is provided with a circular metal piece having a flange portion, and the flange portion has a central hole to lead the conductor through the hole and is provided with at least one slot, each slot having an electrical length corre-

sponding to about 1/2 or 1/4 of the wavelength of different harmonic components of the at least one fundamental wave.

According to a further aspect of the present invention, the stem insulator has a disc-shaped portion through which the cathode supporting bars passes, and the disc-shaped portion of the stem insulator has a circular conductive film sealing the space between the circular portion of the stem insulator and the metal tube, where a conductive film is disposed on the disc-shaped portion of the stem insulator resulting in a choke at which the fundamental wave or any of the harmonic components of oscillating microwaves resonate, and the conductive film being connected to the cathode supporting bars.

In a preferred embodiment, the edge of said metal piece is held between said magnetic pole piece and said metal tube.

In a preferred embodiment, the metal piece is an eyelet-shaped metal piece, the flange of which is provided with said slot.

In a preferred embodiment, the metal piece is an eyelet-shaped metal piece, the cylindrical portion of which is provided with said slot.

With this construction, the metal piece forms a choke of the microstrip-line type (that is, the microwave components that would leak toward the stem insulator the propagation path of the cathode supporting bars decay or are reflected by resonance at the slot of the metal piece), resulting in a decrease in the leakage of microwaves to the outside of the tube, so that it is possible to eliminate completely or to miniaturize the LC filter circuit and the shielding case.

Another magnetron of this invention comprises an anode cylinder, a cathode that is disposed within said anode cylinder, a metal sleeve that seals the opening of one end of said anode cylinder by means of a metal tube and an insulating tube, and a microwave output conductor that extends from anode vanes that project toward said cathode from the inside surface of said anode cylinder, said microwave output conductor being connected to said metal sleeve, wherein said metal tube is provided with a circular metal piece that surrounds said microwave output conductor and said metal piece is provided with a slot in which any of the harmonic components of oscillating microwaves resonate.

In a preferred embodiment, the slot has an electrical length that corresponds to about 1/4 or 1/2 of the wavelength of any of said harmonic components.

In a preferred embodiment, the slot is formed into an arc of the circle along the circumference of said disc-shaped metal plate.

In a preferred embodiment, the slot is constituted by a plurality of arc-shaped slots that have different electrical lengths.

In a preferred embodiment, the metal piece is incorporated with said metal tube into one piece.

With this construction, the metal plate forms a check of the microstrip-line type (that is, the harmonic components that are radiated to the outside of the tube the propagation path of the microwave output conductor decay or are reflected by resonance at the slot of the metal piece), so the amount of the said harmonic components that are radiated outside of the tube can be decreased.

Another magnetron of this invention comprises an anode cylinder, a cathode that is disposed within said anode cylinder, a pair of cathode supporting bars, and a stem insulator that seals the opening of one end of said anode cylinder by means of a metal tube, said stem insulator having a disc-shaped portion through which said cathode supporting bars pass and said disc-shaped portion of said stem insulator having a circular conductive film that seals the space between the circular portion of said stem insulator and said metal tube, wherein a conductive film is disposed on said disc-shaped portion of said stem insulator, resulting in a choke at which the fundamental components or any of the harmonic components of oscillating microwaves resonate, and said conductive film is connected to said cathode supporting bars.

With this construction, the choke that is formed by the conductive film resonates together with at least some of the microwaves that leak toward the stem insulator the cathode supporting bars as a propagation path, so that it is possible to cause decay of the microwaves that leak to the outside of the tube. Moreover, because the choke is formed by the conductive film, the spacers needed therefor can be made smaller. Also, because the reflected microwaves are immediately taken into the said metal tube, there is no need for the conventional large shielding case.

Thus, the invention described herein makes possible the objective of providing a magnetron with which miniaturization and lowering of costs can be attained although there are choke elements inside the tube to prevent the leakage of microwaves.

This invention may be better understood and its numerous objects and advantages will become apparent to those skilled in the art by reference to the accompanying drawings as follows:

Figure 1 is a sectional side view showing a magnetron of this invention.

Figure 2 is a perspective view showing a circular metal piece of the magnetron shown in Figure 1.

Figure 3 is a sectional side view showing a portion of another magnetron of this invention.

Figure 4 is a perspective view showing a portion of the circular metal piece of the magnetron shown in Figure 3.

Figure 5 is a sectional side view showing a portion of another magnetron of this invention.

Figure 6 is a perspective view showing a portion of the circular metal piece of the magnetron shown in Figure 5.

Figure 7 is a sectional side view showing a portion of another magnetron of this invention.

Figure 8 is a perspective view showing the circular metal piece of the magnetron shown in Figure 7.

Figure 9 is a sectional side view showing a portion of another magnetron of this invention.

Figure 10 is a perspective view showing the circular metal piece of the magnetron shown in Figure 9.

Figure 11 is a sectional side view showing a portion of another magnetron of this invention.

Figure 12 is a perspective view showing a portion of the circular metal piece of the magnetron shown in Figure 11.

Figure 13 is a perspective view showing a portion of another circular metal piece of the magnetron shown in Figure 11.

Figure 14 is a sectional side view showing a portion of another magnetron of this invention.

Figure 15 is a perspective view showing a portion of the magnetron shown in Figure 14.

Figure 16 is a sectional view of the magnetron taken along line III-III of Figure 14.

Figures 17 and 18 are cross-sectional views each showing another magnetron of this invention.

Figure 19 is a sectional side view showing a conventional magnetron.

Figure 1 shows a magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 only in that the neck portion of the eyelet-shaped metal tube 14 of this invention is provided with a circular metal piece 17 that surrounds the cathode supporting bars 11 and 12. However, as shown in Figure 2, the metal piece 17 has a semicircular slot 18. The slot 18 has an electrical length that corresponds, for example, to about 1/2 or about 1/4 of the wavelength of the fundamental components of the oscillating microwaves. This electrical length is slightly affected by the central hole 19 of the metal piece 17, but a microstrip-line-type choke is formed by this construction, and thus, the fundamental components of leaking microwaves decay or are reflected by resonance at the slot 18.

Figure 3 shows another magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 only in that the neck portion of the eyelet-shaped metal tube 14 of this

invention is provided with a circular metal piece 17a with a slot 18a and a central hole 19a (Figure 4). The metal piece 17a is held between the magnetic pole piece 5 and the metal tube 14. The metal piece 17a or 17 can also be soldered to the surface (metallized surface) of the stem insulator 13 that seals the metal tube 14. It is also possible for the metal piece 17 or 17a to be formed inside of the metal tube 14 in one piece with it. It is also possible to provide a number of pieces like the metal piece 17 or 17a.

Figure 5 shows another magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 only in that the neck portion of the eyelet-shaped metal tube 14 of this invention is provided with an eyelet-shaped metal piece 17b that has a slot 18b in its flange portion and a slot 20 in its central cylindrical portion (Figure 6). The slots 18b and 20 have an electrical length corresponding to about 1/4 or 1/2 of the wavelength of the fundamental components or any of the harmonic components.

Figure 7 shows another magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 only in that the neck portion of the eyelet-shaped metal tube 14 of this invention is provided with a circular metal piece 17c that has a slot 18c in its top plate, and a number of slots 21 and 22 in its side surface (Figure 8). The slots 18c, 21, and 22 have an electrical length selected in the same way as for the slots 18b and 20 shown in Figure 6.

Figure 9 shows another magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 only in that a circular metal piece 23 that surrounds the microwave output conductor 9 is disposed at the neck portion of the eyelet-shaped metal tube 8 and moreover the said metal piece 23 has, as shown in Figure 10, four slots 24a, 24b, 24c, and 24d. The slot 24a has an electrical length La that corresponds, for example, to about 1/4 of the wavelength of the secondary harmonic components; the slot 24b has an electrical length Lb that corresponds, for example, to about 1/4 of the wavelength of the tertiary harmonic components; in this way, each slot has an electrical length that corresponds to about 1/4 of the wavelength of different harmonic components. These electrical lengths are slightly affected by the central hole 24 of the metal piece 23, but a number of microstrip-line-type chokes are formed by this construction.

There can be more than one metal piece 23. In the magnetron of this invention shown in Figure 11, the surface of the smaller end of the eyelet-shaped metal tube 25 constitutes a circular metal piece 25a, and as shown in Figure 12, the metal piece 25a has a central hole 26 and an appropriate

number of slots 26a and 26b.

Figure 13 shows another circular metal piece 250a that is used in the magnetron of Figure 11, instead of the circular metal piece 25a. The circular metal piece 250a has a cylindrical part 250b and an appropriate member of slots 260a and 260b. The cylindrical part 250b that constitutes a central hole of the metal piece 250a has an electrical length that is about 1/4 of the wavelength of any of the harmonic waves, resulting in a choke to stop the radiation of the said harmonic waves.

In the magnetrons of this invention constructed in this way, the metal piece 23, 25a, or 250a can reduce by about 40 dB either one kind or a number of kinds of harmonic components. When a number of such metal pieces are provided in step fashion, it is possible to decrease yet larger amounts of harmonic components. It is also possible for the electrical length of each slot to be the same.

Figure 14 shows another magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 in that the magnetron of this invention comprises a ceramic stem insulator 27 with a cross-sectional shape of a reversed U and a disc-shaped conductive film 29 that is disposed on the disc-shaped portion 28 of the ceramic stem insulator 27. An eyelet-shaped metal tube 14 seals the opening of one end of the anode cylinder 1 by means of the flange of the metal tube 14. The disc-shaped conductive film 29 is soldered so as to be air-tight onto the surface of the smaller end of the metal tube 14. The disc-shaped portion 28 has holes through which the first and second cathode supporting bars 11 and 12 penetrate, and also has, on the inside of the tube 14, a pair of long, thin conductive films 30 and 31 that are prepared by a metallizing treatment in the same way as the conductive film 29. Conductive films 30 and 31 are soldered to the cathode supporting bars 11 and 12, respectively, so as to be air-tight, and in the case of a magnetron that has a microwave oscillation the fundamental wave of which is, for example, at 2450 MHz, these conductive films 30 and 31 have an electrical length L of about 15 mm, which is 1/4 of the wavelength (about 62 mm) of the secondary harmonic components. The conductive films 29, 30, and 31 are placed in the same plane, and a groove 32 is formed in a region that they do not occupy (Figures 15 and 16).

With this construction, the secondary harmonic components that leak the propagation path of the cathode supporting bars 11 and 12 resonate within a choke that is formed by the conductive films 30 and 31, so that leakage of the said harmonic components to the outside of the tube can be prevented. When an LC filter circuit of the well-known type is connected to the cathode terminals 33 and 34, and then they are enclosed by a shielding

case, leakage of the fundamental components or the like to the outside of the apparatus can, of course, be prevented. Moreover, when at least one of the two conductive films 30 and 31 forms a choke the electrical length of which is 1/4 of the wavelength of the fundamental wave or 1/4 of the wavelength of the tertiary harmonic waves, it is possible to prevent leakage of the fundamental components or the tertiary harmonic components to the outside of the tube.

Figure 17 shows another magnetron of this invention, in which a semicircular conductive film 35 is connected to the cathode supporting bar 11, and a conductive film 36 shaped like the letter θ is connected to the cathode supporting bar 12; in this way, two chokes with the electrical length of L_1 and L_2 are formed. In this case, as well, by the formation of chokes the L_1 and L_2 of which are each of an appropriate electrical length (that is, their electrical length is about 1/4 of the wavelength of the fundamental components or any of the harmonic components), it is possible to prevent leakage of microwaves to the outside of the tube in the same way as mentioned before.

Figure 18 shows another magnetron of this invention, which comprises semicircular conductive films 37 and 38 and a circular conductive film 39 that surrounds these films 37 and 38. In this case, as well, the construction of chokes with the electrical length set as described above makes it possible to prevent leakage of leaking microwaves of the desired wavelength to the outside of the tube.

Claims

1. A magnetron oscillating with at least one fundamental wave for microwave ovens and the like, comprising
 - a) an anode cylinder (1),
 - b) a cathode (2) disposed within said anode cylinder (1),
 - c) a pair of magnetic pole pieces (4, 5) disposed one each over the openings of both ends of said anode cylinder (1),
 - d) a stem insulator (13) which seals the opening of one end of said anode cylinder (1) so as to cover said magnetic pole piece (5) at the opening of the end of said anode cylinder (1) with a metal tube (14),
 - e) a microwave output conductor (9) extending from said anode vane (3) to a metal sleeve (6),
 - f) a pair of cathode supporting bars (11, 12) passing through said stem insulator (13) in an air-tight fashion
 characterized in that
 - g) said metal tube (14) is provided with at least one circular metal piece having a



number of slots 26a and 26b.

Figure 13 shows another circular metal piece 250a that is used in the magnetron of Figure 11, instead of the circular metal piece 25a. The circular metal piece 250a has a cylindrical part 250b and an appropriate member of slots 260a and 260b. The cylindrical part 250b that constitutes a central hole of the metal piece 250a has an electrical length that is about 1/4 of the wavelength of any of the harmonic waves, resulting in a choke to stop the radiation of the said harmonic waves.

In the magnetrons of this invention constructed in this way, the metal piece 23, 25a, or 250a can reduce by about 40 dB either one kind or a number of kinds of harmonic components. When a number of such metal pieces are provided in step fashion, it is possible to decrease yet larger amounts of harmonic components. It is also possible for the electrical length of each slot to be the same.

Figure 14 shows another magnetron of this invention, which is different from the conventional magnetron shown in Figure 19 in that the magnetron of this invention comprises a ceramic stem insulator 27 with a cross-sectional shape of a reversed U and a disc-shaped conductive film 29 that is disposed on the disc-shaped portion 28 of the ceramic stem insulator 27. An eyelet-shaped metal tube 14 seals the opening of one end of the anode cylinder 1 by means of the flange of the metal tube 14. The disc-shaped conductive film 29 is soldered so as to be air-tight onto the surface of the smaller end of the metal tube 14. The disc-shaped portion 28 has holes through which the first and second cathode supporting bars 11 and 12 penetrate, and also has, on the inside of the tube 14, a pair of long, thin conductive films 30 and 31 that are prepared by a metallizing treatment in the same way as the conductive film 29. Conductive films 30 and 31 are soldered to the cathode supporting bars 11 and 12, respectively, so as to be air-tight, and in the case of a magnetron that has a microwave oscillation the fundamental wave of which is, for example, at 2450 MHz, these conductive films 30 and 31 have an electrical length L of about 15 mm, which is 1/4 of the wavelength (about 62 mm) of the secondary harmonic components. The conductive films 29, 30, and 31 are placed in the same plane, and a groove 32 is formed in a region that they do not occupy (Figures 15 and 16).

With this construction, the secondary harmonic components that leak the propagation path of the cathode supporting bars 11 and 12 resonate within a choke that is formed by the conductive films 30 and 31, so that leakage of the said harmonic components to the outside of the tube can be prevented. When an Lc filter circuit of the well-known type is connected to the cathode terminals 33 and 34, and then they are enclosed by a shielding

case, leakage of the fundamental components or the like to the outside of the apparatus can, of course, be prevented. Moreover, when at least one of the two conductive films 30 and 31 forms a choke the electrical length of which is 1/4 of the wavelength of the fundamental wave or 1/4 of the wavelength of the tertiary harmonic waves, it is possible to prevent leakage of the fundamental components or the tertiary harmonic components to the outside of the tube.

Figure 17 shows another magnetron of this invention, in which a semicircular conductive film 35 is connected to the cathode supporting bar 11, and a conductive film 36 shaped like the letter θ is connected to the cathode supporting bar 12; in this way, two chokes with the electrical length of L_1 and L_2 are formed. In this case, as well, by the formation of chokes the L_1 and L_2 of which are each of an appropriate electrical length (that is, their electrical length is about 1/4 of the wavelength of the fundamental components or any of the harmonic components), it is possible to prevent leakage of microwaves to the outside of the tube in the same way as mentioned before.

Figure 18 shows another magnetron of this invention, which comprises semicircular conductive films 37 and 38 and a circular conductive film 39 that surrounds these films 37 and 38. In this case, as well, the construction of chokes with the electrical length set as described above makes it possible to prevent leakage of leaking microwaves of the desired wavelength to the outside of the tube.

Claims

1. A magnetron oscillating with at least one fundamental wave for microwave ovens and the like, comprising
 - a) an anode cylinder (1),
 - b) a cathode (2) disposed within said anode cylinder (1),
 - c) a pair of magnetic pole pieces (4, 5) disposed one each over the openings of both ends of said anode cylinder (1),
 - d) a stem insulator (13) which seals the opening of one end of said anode cylinder (1) so as to cover said magnetic pole piece (5) at the opening of the end of said anode cylinder (1) with a metal tube (14),
 - e) a microwave output conductor (9) extending from said anode vane (3) to a metal sleeve (6),
 - f) a pair of cathode supporting bars (11, 12) passing through said stem insulator (13) in an air-tight fashion
 characterized in that
 - g) said metal tube (14) is provided with at least one circular metal piece having a



flange portion (17) perpendicular to the cylindrical axis of said metal tube (14),

h) said circular metal piece is provided with at least one hole (19a) formed centrally in said flange portion to lead said bars (11, 12) through said hole (19a), and

i) said flange portion (17) is provided with at least one slot (18a) formed in said flange portion, each slot (18a) having an electrical length corresponding to about 1/2 or 1/4 of the wavelength of said fundamental wave or of any of the harmonic components of said fundamental wave.

2. A magnetron according to claim 1, **characterized** in that the edge of said circular metal piece (17) is held between said magnetic pole piece (5) and said metal tube (14).

3. A magnetron according to one of claims 1 or 2, **characterized** in that said circular metal piece (17) has a cylindrical portion formed on said flange portion (17).

4. A magnetron according to claim 3, **characterized** in that said cylindrical portion is provided with at least one slot (20; 21, 22).

5. A magnetron oscillating with at least one fundamental wave for microwave ovens and the like, comprising

a) an anode cylinder (1) with anode vanes (3) projecting toward

b) a cathode (2) disposed within said anode cylinder (1),

c) a pair of cathode supporting bars (11, 12),

d) a metal sleeve (6) sealing the openings of one end of said anode cylinder (1) by means of a metal tube (8) and an insulating tube (7),

e) a microwave output conductor (9) extending from said anode vanes (3) and being connected to said metal sleeve,

characterized in that

f) said metal tube (8) is provided with a circular metal piece having a flange portion (23),

g) said flange portion (23) having a central hole (24) to lead said conductor (9) through said hole (24), and

h) said flange portion (23) is provided with at least one slot (24a, 24b, 24c, 24d), each slot having an electrical length corresponding to about 1/2 or 1/4 of the wavelength of different harmonic components of said at least one fundamental wave.

6. A magnetron according to claim 5, **characterized** in that said slot (24a to 24d) is formed into an arc of the circle along the circumference of said circular metal piece.

7. A magnetron according to one of claims 5 or 6, **characterized** in that said slot is constituted by a plurality of arc-shaped slots that have different electrical lengths.

8. A magnetron according to one of claims 5 to 7, **characterized** in that said circular metal piece is incorporated with said metal tube (8) into one piece.

9. A magnetron oscillating with at least one fundamental wave for a microwave oven or the like, comprising

a) an anode cylinder (1)

b) a cathode (2) disposed within said anode cylinder (1),

c) a pair of cathode supporting bars (11, 12),

d) a stem insulator sealing the opening of one end of said anode cylinder (1) by means of a metal tube,

characterized in that

e) said stem insulator having a disc-shaped portion (29) through which said cathode supporting bars (11, 12) pass,

f) said disc-shaped portion (29) of said stem insulator having a circular conductive film sealing the space between the circular portion of said stem insulator (27) and said metal tube (14),

g) a conductive film being disposed on said disc-shaped portion (29) of said stem insulator, resulting in a choke at which the fundamental wave or any of the harmonic components of oscillating microwaves resonate, and

h) said conductive film being connected to said cathode supporting bars.

Patentansprüche

1. Magnetron, das mit zumindest einer Grundwelle schwingt, für Microwellenöfen, u.ä., mit

a) einem Anodenzyylinder (1),

b) einer Kathode (2), die in dem Anodenzyylinder (1) angeordnet ist,

c) einem Paar Magnetpolstücken (4, 5), von denen jeweils eines über den Öffnungen der beiden Enden des Anodenzyinders (1) angeordnet ist,

d) einem Schaftisolator (13), welcher die Öffnung eines Endes des Anodenzyinders (1) abdichtet, um so das Magnetpolstück (5)



- an der Öffnung des Endes des Anodenzylinders (1) mit einem Metallrohr (14) zu bedecken,
- e) einem Microwellenabgabeler (9), welcher sich von einem Anodenflügel (2) zu einer Metallhülse (6) erstreckt, und
- f) einem Paar Kathodenhaltestäben (11), welche luftdicht durch den Schaftisolator (13) hindurchgehen,
- dadurch **gekennzeichnet**, daß
- g) das Metallrohr (14) mit zumindest einem kreisförmigen Metallstück mit einem Flanschteil (17) versehen ist, das senkrecht zu der Zylinderachse des Metallrohrs (14) verläuft,
- h) das kreisförmige Metallteil mit zumindest einer Bohrung (19a) versehen ist, die mittig in dem Flanschteil ausgebildet ist, um die Stäbe (11, 12) durch die Bohrung (19a) hindurchzuführen, und
- i) der Flanschteil (17) mit zumindest einem Schlitz (18a) versehen ist, welcher in dem Flanschteil ausgebildet ist, wobei jeder Schlitz (18a) eine elektrische Länge hat, welche etwa der Hälfte oder einem Viertel der Wellenlänge der Grundschwingung oder einer der Oberwellen der Grundschwingung entspricht.
2. Magnetron nach Anspruch 1, dadurch **gekennzeichnet**, daß der Rand des kreisförmigen Metallstücks (17) zwischen dem Metallpolstück (5) und dem Metallrohr (14) gehalten ist.
3. Magnetron nach einem der Ansprüche 1 oder 2, dadurch **gekennzeichnet**, daß das kreisförmige Metallstück (17) einen zylindrischen Teil hat, der an dem Flanschteil (17) ausgebildet ist.
4. Magnetron nach Anspruch 3, dadurch **gekennzeichnet**, daß der zylindrische Teil mit zumindest einem Schlitz (20; 21, 22) versehen ist.
5. Magnetron, das mit zumindest einer Grundschwingung schwingt für Microwellenöfen, u.ä., mit
- a) einem Anodenzylinder (1) mit von diesem vorstehenden Anodenfahnen (3),
- b) einer Kathode (2), die in dem Anodenzylinder (1) angeordnet ist,
- c) einem Paar Kathodenhaltestäben (11, 12),
- d) einer Metallhülse (6), welche die Öffnungen an einem Ende des Anodenzylinders (1) mittels eines Metallrohrs (8) und einem Isolierrohr (7) abdichtet,
- e) einem Microwellenabgabeler (9), welcher von den Anodenflügeln (3) vorsteht und mit der Metallhülse verbunden ist,
- dadurch **gekennzeichnet**, daß
- f) das Metallrohr (8) mit einem kreisförmigen Metallstück mit einem Flanschteil (23) versehen ist,
- g) der Flanschteil (23) eine Mittenbohrung (24) hat, um den Leiter (9) durch die Bohrung (24) zu führen, und
- h) der Flanschteil (23) mit zumindest einem Schlitz (24a, 24b, 24c, 24d) versehen ist, wobei jeder Schlitz eine elektrische Länge hat, die etwa der Hälfte oder einem Viertel der Wellenlänge verschiedener Oberwellen zumindest der einen Grundschwingung entspricht.
6. Magnetron nach Anspruch 5, dadurch **gekennzeichnet**, daß der Schlitz (24a bis 24d) in einem Kreisbogen entlang des Umfangs des kreisförmigen Metallstücks ausgebildet ist.
7. Magnetron nach einem der Ansprüche 5 oder 6, dadurch **gekennzeichnet**, daß der Schlitz durch eine Anzahl kreisbogenförmiger Schlitze gebildet ist, welche unterschiedliche elektrische Längen haben.
8. Magnetron nach einem der Ansprüche 5 bis 7, dadurch **gekennzeichnet**, daß das kreisförmige Metallstück in dem Metallrohr (8) in einem Stück ausgebildet ist.
9. Magnetron, das mit zumindest einer Grundschwingung schwingt, für einen Microwellenofen o.ä., mit
- a) einem Anodenzylinder (1),
- b) einer Kathode (2), welche in dem Anodenzylinder (1) angeordnet ist,
- c) einem Paar Kathodenhaltestäben (11, 12),
- d) einem Schaftisolator, welcher die Öffnung des einen Endes des Anodenzylinders (1) mittels eines Metallrohrs abdichtet,
- dadurch **gekennzeichnet**, daß
- e) der Schaftisolator einen scheibenförmigen Teil (29) hat, durch welchen die Kathodenhaltestäbe (11, 12) hindurchgehen,
- f) der scheibenförmige Teil (29) des Schaftisolators eine kreisförmige leitfähige dünne Schicht hat, welche den Zwischenraum zwischen dem kreisförmigen Teil des Schaftisolators (27) und dem Metallrohr (14) abdichtet,
- g) eine leitfähige dünne Schicht auf dem scheibenförmigen Teil (29) des Schaftisolators angeordnet ist, was auf eine Drossel



hinausläuft, an welcher die Grundschiwingung oder eine der Oberwellen der Grundschiwingungen in Resonanz kommen, und
h) die leitfähige Schicht mit den Kathodenhaltestäben verbunden ist.

Revendications

1. Magnétron oscillant avec au moins une onde fondamentale pour des fours à micro-ondes et analogues, comprenant

a) un cylindre anodique (1),
b) une cathode (2) disposée à l'intérieur dudit cylindre anodique (1),
c) une paire de pièces polaires magnétiques (4, 5) chacune d'elles étant disposée sur les ouvertures aux deux extrémités dudit cylindre anodique (1),
d) un isolateur de pied (13) qui obture l'ouverture d'une extrémité dudit cylindre anodique (1) de manière à couvrir ladite pièce polaire magnétique (5) au niveau de l'ouverture de l'extrémité dudit cylindre anodique (1) avec un tube métallique (14),
e) un conducteur de sortie hyperfréquence (9) qui s'étend depuis ladite cloison d'anode (3) vers un manchon métallique (6),
f) une paire de barreaux supports de cathode (11, 12) traversant ledit isolateur de pied (13) d'une manière étanche à l'air, caractérisé en ce que
g) ledit tube métallique (14) est muni d'au moins une pièce métallique circulaire ayant une partie plateau (17) perpendiculaire à l'axe cylindrique dudit tube métallique (14),
h) ladite pièce métallique circulaire est munie d'au moins un trou (19a) formé au centre dans ladite partie plateau pour guider lesdits barreaux (11, 12) dans ledit trou (19a), et
i) en ce que ladite partie plateau (17) est munie d'au moins une fente (18a) formée dans ladite partie plateau, chaque fente (18a) ayant une longueur électrique correspondant environ à la moitié ou au quart de la longueur d'onde de ladite onde fondamentale ou de l'une quelconque des composantes harmoniques de ladite onde fondamentale.

2. Magnétron selon la revendication 1, caractérisé en ce que le bord de ladite pièce métallique circulaire (17) est maintenu entre ladite pièce polaire magnétique (5) et ledit tube métallique (14).

3. Magnétron selon l'une des revendications 1 ou 2, caractérisé en ce que ladite pièce métalli-

que circulaire (17) a une partie cylindrique formée sur ladite partie plateau (17).

4. Magnétron selon la revendication 3, caractérisé en ce que ladite partie cylindrique est munie, d'au moins une fente (20 ; 21, 22).

5. Magnétron oscillant avec au moins une onde fondamentale pour des fours à micro-ondes et analogues, comprenant

a) un cylindre anodique (1) avec des cloisons d'anode (3) faisant saillie en direction d'
b) une cathode (2) disposée à l'intérieur dudit cylindre anodique (1),
c) une paire de barreaux supports de cathode (11, 12),
d) un manchon métallique (6) obturant les ouvertures d'une extrémité dudit cylindre anodique (1) au moyen d'un tube métallique (8) et d'un tube isolant (7),
e) un conducteur de sortie hyperfréquence (9) s'étendant à partir desdites cloisons d'anode (3) et étant relié audit manchon métallique,

caractérisé en ce que

f) ledit tube métallique (8) est muni d'une pièce métallique circulaire ayant une partie plateau (23),
g) ladite partie plateau (23) a un trou central (24) pour guider ledit conducteur (9) dans ledit trou (24), et
h) en ce que ladite partie plateau (23) est munie d'au moins une fente (24a, 24b, 24c, 24d), chaque fente ayant une longueur électrique correspondant environ à la moitié ou au quart de la longueur d'onde de composantes harmoniques différentes de ladite au moins une onde fondamentale.

6. Magnétron selon la revendication 5, caractérisé en ce que ladite fente (24a à 24d) est formée en arc de cercle suivant la circonférence de ladite pièce métallique circulaire.

7. Magnétron selon l'une des revendications 5 ou 6, caractérisé en ce que ladite fente est constituée par une pluralité de lentes en forme d'arc qui ont des longueurs électriques différentes.

8. Magnétron selon l'une des revendications 5 à 7, caractérisé en ce que ladite pièce métallique circulaire est incorporée audit tube métallique (8) pour ne former qu'une seule pièce.

9. Magnétron oscillant avec au moins une onde fondamentale pour un four à micro-ondes ou analogue, comprenant



- a) un cylindre anodique (1),
- b) une cathode (2) disposée à l'intérieur dudit cylindre anodique (1),
- c) une paire de barreaux supports de cathode (11, 12), 5
- d) un isolateur de pied fermant l'ouverture d'une extrémité dudit cylindre anodique (1) au moyen d'un tube métallique, caractérisé en ce que
- e) ledit isolateur de pied présente une partie en forme de disque (29) par laquelle passent lesdits barreaux supports de cathode (11, 12), 10
- f) ladite partie en forme de disque (29) dudit isolateur de pied comporte une couche conductrice circulaire obturant l'espace entre la partie circulaire dudit isolateur de pied (27) et ledit tube métallique (14), 15
- g) une couche conductrice est disposée sur ladite partie en forme de disque (29) dudit isolateur de pied, résultant en un piège au niveau duquel résonnent l'onde fondamentale ou l'une des composantes harmoniques d'ondes hyperfréquence oscillantes, et 20
- h) en ce que ladite couche conductrice est reliée auxdits barreaux supports de cathode. 25

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