

CLAIMS

5 -1- A device for generating a plasma of significant extension along an axis by electron cyclotron resonance ECR from a gaseous medium and comprising at least two coaxial waveguides (4) each formed of a central conductor (1) and of an external conductor (2) to bring microwaves into a treatment chamber, characterized in that at least the two electromagnetic wave injection guides (4) are combined with a magnetic circuit (21-22) elongated in one direction, said
10 magnetic circuit surrounding the waveguides (4) by creating a magnetic field capable of achieving an ECR condition close to said waveguides.

15 -2- The device of claim 1, characterized in that the magnetic circuit has, close to the waveguides, two poles (21-22) of opposite polarities (31-32) to form a magnetic trap for electrons.

20 -3- The device of claim 2, characterized in that the first pole (21) forms a first line surrounding the waveguide(s) (4), while the second pole (22) forms a second line, surrounding said first line (21).

-4- The device of claim 1, characterized in that the central conductor (1) of each waveguide is provided with fittings capable of protecting the opening of said guide and of behaving as antennas.

25 -5- The device of claim 4, wherein the central conductor (1) has a concentric disk (5) of larger diameter than the opening of the waveguide (4) to protect the inside of said guide, which is positioned as closely as possible to the ECR area, and is topped with a rod (6) arranged in coaxial alignment with the central conductor (1).

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-6- The device of claim 4, wherein the central conductor is ended by a plate (7) elongated along the longest axis of the magnetic circuit, one of the ends at least of said plate being provided with fittings (8) to be placed in contact with the surface of the source in order to create a short-circuit, the width of the plate (7) being larger than the opening of the waveguide (4).

-7- The device of claim 6, characterized in that the width of the plate (7) is constant along its entire length.

-8- The device of claim 6, characterized in that the width of the plate (7) decreases as the distance from the central conductor (1) increases, and with respect to said at least one side of said conductor (1).

-9- The device of any of claims 1-8, characterized in that the treatment chamber comprises a body (10) with a cooling circuit (11), said body (10) comprising a housing for the assembly of the elongated magnetic circuit formed of the first line of magnets (21) according to the first polarization and the second line of magnets (22) according to an opposite polarization and surrounding the first line (21), which surrounds the waveguides (4) assembled in holes formed across the thickness of the body (10), the first and second lines of magnets are connected by a ferromagnetic plate (23), the body and the magnetic system being separated from the plasma by a shield (12).

-10- The device of any of claims 1-9, characterized in that the central conductor (1) is a cylindrical rod centered with respect to the external conductor inserted in the body (10) with a good electric contact, a dielectric window (3) being placed inside of the guide (4) under the opening which is covered with the disk topped with the rod to be used as an antenna.

-11- The device of any of claims 1-9, characterized in that the central conductor is a cylindrical rod centered with respect to the external conductor inserted into the body (10) by forming a good electric contact, a dielectric window (3) being placed inside of the guide (4) under the opening, which is covered with the elongated plate (7) along the axis of the injectors, said elongation being asymmetrical with respect to the central conductor for a waveguide located at a rounded end of the magnetic circuit, the elongation being only in the direction of the opposite end, symmetrical with respect to the central conductor for a waveguide located in the linear portion of the magnetic circuit, each elongated portion being provided with the fitting (8) used as a short-circuit.

CLAIMS

-1- A device for generating a plasma having an extension along an axis by electron cyclotron resonance ECR from a gaseous medium and comprising at least two coaxial waveguides each formed of a central conductor and of an external conductor to bring microwaves into a treatment chamber, wherein at least the two waveguides are combined with a magnetic circuit elongated in one direction, said magnetic circuit surrounding the at least two waveguides by creating a magnetic field capable of achieving an ECR condition close to said at least two waveguides, wherein the magnetic circuit has, close to the at least two waveguides, two poles of opposite polarities to form a magnetic trap for electrons, and a first pole of the two poles forms a first line surrounding the at least two waveguides, while a second pole of the two poles forms a second line, surrounding the first line.

-2- The device of claim 1, wherein the central conductor of each waveguide is provided with fittings protecting an opening of said waveguide and behaving as antennas.

-3- The device of claim 2, wherein the central conductor has a concentric disk of larger diameter than the opening of the waveguide to protect an inside of said waveguide, which is positioned close to an ECR area, and is topped with a rod arranged in coaxial alignment with the central conductor.

-4- The device of claim 2, wherein the central conductor is ended by a plate elongated along a longest axis of the magnetic circuit, one end at least of said plate being provided with fittings to be placed in contact with a surface of a source in order to create a short-circuit, a width of the plate being larger than the opening of the waveguide.

-5- The device of claim 4, wherein the width of the plate is constant along an entire length of the plate.

-6- The device of claim 4, wherein the width of the plate decreases as distance from the central conductor increases, and with respect to said at least one side of said conductor.

-7- The device of claim 1, wherein the treatment chamber comprises a body with a cooling circuit, said body comprising a housing for assembly of the elongated magnetic circuit, said circuit comprising a first line of magnets according to a first polarization and a second line of magnets according to an opposite polarization and surrounding the first line, the magnetic circuit surrounds the at least two waveguides assembled in holes formed across a thickness of the body, the first and second lines of magnets are connected by a ferromagnetic plate, the body and the magnetic circuit being separated from the plasma by a shield.

-8- The device of claim 7, wherein the central conductor comprises a cylindrical rod centered with respect to the external conductor inserted in the body with a good electric contact, a dielectric window being placed inside of the waveguide under the opening which is covered with a disk topped with a rod to be used as an antenna.

-9- The device of claim 1, wherein the central conductor comprises a cylindrical rod centered with respect to the external conductor inserted into the body by forming a good electric contact, a dielectric window being placed inside of the waveguide under the opening, which is covered with an elongated plate along an axis of injectors, said elongation being asymmetrical with respect to the central conductor for a waveguide located at a rounded end of the magnetic circuit, the elongation being only in a direction of an opposite end, symmetrical with respect to the central conductor for a waveguide located in a linear portion of the magnetic circuit, each elongated portion being provided with the fitting used as a short-circuit.