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(54) **MAGNETRON**

MAGNETRON

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- **PATENT ABSTRACTS OF JAPAN vol. 8, no. 190**
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Description

The present invention relates to microwave electronic devices, particularly, to a magnetron.

Known in the art is a magnetron (US,A, 3109123), comprising an anode, and, a cathode which has a portion of its surface made in the form of disks with sharp edges with a plurality of thin wires arranged thereon to concentrate the electric field. For the same purpose the magnetron is provided with screens of a special shape which are fed by different potentials relative to the cathode core. The magnetron cannot however be excited solely by the presence of sharp edges and a plurality of wires as these features fail to provide the necessary autoelectronic emission and an electric discharge process is therefore necessary. Besides, it is not possible to obtain a stable field emission in the process of magnetron operation as the shape of the sharp edges changes and the so-called coefficient of shape factor is impaired, resulting in a decrease in electric field intensity.

There is also known a magnetron (FR,A, 1306999) comprising an anode and a cathode, with the cathode arranged coaxially inside the anode and made in the form of a rod whose surface is provided with alternating elements enabling primary and secondary emissions. Beside, the elements ensuring the primary and secondary emissions in the magnetron are provided on the cathode surface in the form of alternating stripes of emission-active substances providing, respectively, for the primary and secondary emission.

In this case, the value of the electric field intensity is not indicated on the elements ensuring the primary emission, which is necessary for field excitation of the magnetron. Calculations of the electric field on the cathode for the millimeter and centimeter-band magnetrons with the anodic voltage ranging from units of kilovolts to several dozens of kilovolts testify that the value of the electric field intensity does not exceed $5 \cdot 10^5$ V/cm, whereas the value of the electric field intensity required for the field emission should be in the order of 10^7 V/cm at minimal efficiency of the emitting element. So, the electric field intensity of $5 \cdot 10^5$ V/cm is not sufficient for the cold emission and, therefore, a coating in the form of stripes or rings, parallel or perpendicular to the cathode axis and intended for the emission of electrons, cannot ensure the field emission necessary for initiating the magnetron. The presence of two different coatings ensuring the emission of electrons in a cold state and the secondary electron emission cannot be stable during the time of the magnetron operation as the active substance is transferred from the cathode to the anode and vice versa and, as a result, a homogeneous mixed coating is formed all over the surface of the cathode. So, the field (cold) excitation of the magnetron is not ensured. In the case of probable field excitation of the magnetron caused by electric discharge processes, the cathode surface coated with emission-active substances rapidly deteriorates as a result of its bombardment by negative

ions. Thus, the given magnetron does not ensure an instantaneous firing (with the first pulse) without preliminary heating-up of the cathode and without transmission of an input (exciting) signal, and cannot be reliable and durable.

Document US-A- 3297901 discloses a magnetron according to the preamble of claim 1.

The present invention resides in providing a magnetron whose design and production technology, as well as respective selection of compatible materials of the elements ensuring the primary and secondary emission would allow instantaneous firing (with the first pulse) without preliminary heating-up of the cathode, increasing the service life and improving reliability of the magnetron proper and of the switching device in which the magnetron operates, owing to the provision of the electric field intensity, necessary for obtaining the field emission sufficient in value for exciting the magnetron.

According to the present invention there is provided a magnetron comprising an anode and a cathode installed coaxially in the anode and made in the form of a cylindrical rod provided with alternating primary-emission and secondary-emission elements arranged on it, wherein the secondary emission element is made in the form of at least one cylindrical bush of an emission active material, characterized in that the primary-emission element is made in the form of at least one flat disk of a refractory metal having a thickness ranging from fractions of micron to several micron and provided with a central hole, the primary emission and secondary emission elements being installed coaxially so that the external diameter of the flat disk exceeds the external diameter of the cylindrical bush by a value ranging from 0.1 to 0.2 of the interelectrode gap value and the end faces of the adjacent flat disk and cylindrical bush adjoin each other.

Several embodiments are set out in the dependent claims.

Such an arrangement of the flat disk with respect to the cylindrical bush ensures sufficiently high concentration of the electric field on the disk edge owing to coefficient β of the shape-factor and thus reliable excitation of the magnetron. The central hole provided in the flat disk and coaxial installation of the disk and cylindrical bush provides for a uniform projection of the primary-emission element over the surface of the secondary-emission element all around the circumference. If the external diameters of the primary-emission elements are made larger than those of the secondary-emission elements by a value greater than 0.2 of the interelectrode gap value, the primary-emission element finds itself outside the space charge cloud and deteriorates. Besides, an unstable operation of the magnetron in the form of sparking takes place. If the projecting portion of the primary-emission element is less than 0.1 of the value of the interelectrode gap, the preset value of the electric field intensity required for obtaining the field emission cannot be ensured.

Thus, the embodiment of the primary-emission and secondary emission elements in the predetermined form and from the predetermined materials, and the provision of the electric field intensity necessary for obtaining the field emission sufficient in value, ensure the magnetron excitation and its instantaneous firing (with the first pulse) without preliminary heating-up of the cathode also the magnetron service life is increased and reliability is improved, as well as reliable operation being provided for of the transmitting device in which the magnetron is utilized.

It is advantageous that the primary-emission element should be made in the form of five flat disks and the secondary-emission element, in the form of four cylindrical bushes manufactured from an emission-active material.

The presence of a great number of flat disks decreases the distance between them and reduces the electric field intensity due to mutual shunting of adjacent flat disks.

It is expedient that the end faces of each cylindrical bush be in the form of a truncated cone whose smaller base adjoins the end face of the respective flat disk and the greater base diameter serves as the external diameter of the cylindrical bush.

As the secondary-emission elements adjoin on two sides the end faces of the primary-emission elements, an annular groove is formed with the end faces made in the form of a truncated cone. The annular groove decreases the screening effect of the secondary-emission element, thus increasing the electric field intensity.

It is also advantageous that the end faces of the adjacent flat disk and cylindrical bush should adjoin each other through a flat cylindrical protective washer made of a thin refractory metal foil, the thickness of the flat cylindrical protective washer being at least five to ten times greater than that of the flat disk.

The presence of protective washers makes it possible to eliminate deterioration of the primary-emission elements caused by mechanical and chemical effect on them of the secondary-emission elements. In this case, the protective washer manufactured from a superfine foil of a refractory metal, whose thickness is at least five to ten times greater than the thickness of the flat disk, ensures reliable protection of the disk against deterioration due to physicochemical processes taking place at the point of contact of the flat disk and the cylindrical bush.

It is advantageous that the primary-emission element should be manufactured from one of refractory metals, such as Ta, Nb and W.

The use of one of refractory metals Ta, Nb, W for manufacturing the primary-emission element makes it possible to stabilize the field emission.

It is advantageous that the primary-emission element should be manufactured from tungsten-and-tantalum alloy.

The use of alloys of refractory metals for the primary-

emission elements makes it possible to stabilize the field emission and ensure their stable shapes.

The present invention makes it possible to attain an instantaneous initiating ; (with the first pulse) of the magnetron without preliminary heating-up of the cathode, to increase the service life of the magnetron and improve its reliability, as well as reliability of the transmitting device in which the magnetron operates owing to the provision of the electric field intensity necessary for obtaining the field emission sufficient in its value for the magnetron excitation. The present invention enables filamentless magnetrons to be constructed with the field excitation in two- and three-centimeter and millimeter bands for high-frequency pulses of different power. These magnetrons are characterized by their instantaneous settling (first pulse readiness), high reliability and durability exceeding ten thousand hours, a possibility of fast change from the small pulse ratio mode to the great pulse ratio mode and vice versa, and a high economical efficiency due to the absence of the power consumption in the filament circuit. The use of such magnetrons in transmitting devices makes it possible to essentially simplify their circuits and decrease their overall dimensions and weight, since approximately fifty radio components are excluded from their circuits.

The present invention will now be further described, by way of example, with reference to the accompanying drawings wherein:

Fig. 1 is a general, longitudinal sectional view of a preferred embodiment of a magnetron, its working part, comprising one primary-emission element and one secondary-emission element, constructed according to the present invention;

Fig. 2 is a general, longitudinal sectional view of a further embodiment of a magnetron, its working part, comprising one flat disk and two cylindrical bushes, constructed according to the present invention;

Fig. 3 is a general, longitudinal sectional view of a further embodiment of a magnetron, its working part, comprising five flat disks and four cylindrical bushes constructed according to the present invention;

Fig. 4 is a longitudinal sectional view of a magnetron section illustrating the components of the elements ensuring the secondary emission, whose end faces are shaped as a truncated cone;

Fig. 5 is a longitudinal sectional view of a magnetron section illustrating one flat disk and the components of two secondary-emission elements whose end faces have the shape of a truncated cone, and protective washers and

Fig. 6 is a general, longitudinal sectional view of a further embodiment of a magnetron, its working part, comprising three flat disks and two cylindrical bushes adjoining each other through protective washers, constructed according to the present in-

vention.

A preferred embodiment of a magnetron constructed according to the present invention is illustrated in Fig. 1 of the accompanying drawings and comprises an anode 1 (Figure 1) and a cathode installed coaxially inside the anode and made in the form of a cylindrical hollow rod 2 with primary-emission and secondary-emission elements, arranged on its surface, their end faces adjoining each other. A primary-emission element is made in the form of at least one flat disk 3 provided with a central hole and made of a superfine foil of a refractory metal. In the given case, the primary-emission element is made in the form of one flat disk 3 having the thickness ranging from fractions of a micron to several microns and manufactured by stamping or an electroerosion method. A secondary-emission element is made in the form of at least one cylindrical bush 4 manufactured from an emission-active material and installed coaxially with the disk 3 and rod 2. In the given case, the secondary-emission element is made in the form of one cylindrical bush 4. The secondary-emission elements may be impregnated cathodes or cathodes based on metals alloys including platinium group metals, such as Pt, Ir, Os, Ru, Rh, Pd with admixtures of activators in the form of one or several elements of alkali-earth metals (Ba, Sr, Ca). Two focusing screens 5 are arranged on, and coaxially with the hollow cylindrical rod 2, which may be made of molybdenum or other refractory metal or their alloys. One focusing screen 5 is installed on the side of the cylindrical bush 4 and the other focusing screen 5 is located on the side of the flat disk 3.

The external diameter of the disk 3 is greater than that of the cylindrical bush 4 by the value ranging from 0.1 to 0.2 of the value of the interelectrode gap.

Figure 1 also illustrates:

- h- the height of projection of the primary-emission element edge over the surface of the secondary-emission element;
- d - the external diameter of the secondary-emission element;
- D - the diameter of the anode 1.

Schematically shown by dotted lines is the electric field concentration on the thin edge of disk 3.

Used as a functional section of the primary-emission element is its thin edge projecting over the surface of the secondary-emission element by height h. The height h is determined on the basis that it should be equal to or less than the effective size of the synchronous space charge cloud in the magnetron over the surface of the cylindrical bush 4 made of an emission-active material, and it is expressed by the formula:

$$h \leq \frac{d}{2} \left(\sqrt{\frac{1}{1 - 2 \frac{\omega_1}{\omega_2}}} - 1 \right) \quad (1)$$

where d is the external diameter of the secondary-emission element; ω_1 and ω_2 are the angular synchronous and cyclotron frequencies, respectively, with

$$\omega_1 = 2 \pi \frac{f_0}{n}$$

where f_0 is the generated frequency,

n is the number of the oscillation mode (for the "π"-type $n = \frac{N}{2}$ where N is quantity of magnetron resonators), and

$$\omega_2 = \frac{e}{m} B,$$

where e and m are, respectively, the charge and mass of the free electron and

B is the induction of the static magnetic field.

Values h in magnetrons of different designs usually constitute from 0.1 to 0.2 of the value of the interelectrode gap which is equal to $\frac{D-d}{2}$ where D is the diameter of the magnetron anode and d - the external diameter of the secondary-emission element.

The design of the magnetron working part illustrated in Figure 2 is similar to that illustrated in Figure 1, the only difference being that the magnetron shown in Figure 2 comprises two secondary-emission elements whose end faces adjoin the end faces of the disk 3. Besides, the focusing screens 5 are installed on the side of the other end faces of the secondary-emission elements.

Illustrated in Figure 3 is the working part of a magnetron comprising five flat disks 3 and four cylindrical bushes 4 whose design is similar to that of the working part of the magnetron shown in Figure 1. The only difference consists in that one focusing screen 5 (Figure 3) is installed on the side of the last disk 3. Thus, the primary-emission element can be made of several disks 3 depending on the type and design of the magnetron and also on the excitation current value. In the case when several disks 3 are installed, minimal distance between them, with a purpose of reducing their mutual screening, is determined as

$$\ell = (4 - 6) h \quad (2),$$

where h is the height of the projecting edge of the disk 3 whose value is found from the formula (1). If this condition is observed, the starting current can be reduced by no more than 10% its maximum value representing a sum of currents of separate disks 3 without consider-

ation of their mutual screening. The presence of five and more disks 3, if the longitudinal sizes of the anode 1 and, consequently, of the cathode allow this, makes it possible to essentially improve the reliability of the magnetron field excitation.

Shown in Figure 4 is a section of a magnetron working part demonstrating the end faces of the cylindrical bush 4 made in the form of a truncated cone whose smaller base adjoins the end face of the disk 3. In this case, the diameter of the larger base of the cone is an external diameter of the bush 4.

Figure 5 illustrates a section of the magnetron working part whose design is similar to that of the section shown in Figure 4. The only difference consists in that the end faces of the adjacent flat disks 3 (Figure 5) and bushes 4 adjoin each other through the flat cylindrical protective washer 6, each washer 6 being made of a thin foil of a refractory metal. The thickness of the washer 6 exceeds that of the disk 3 at least five to ten times. The washers 6 are made preferably of 15- to 30 μm thick tungsten.

The design of the magnetron working part illustrated in Figure 6 is similar to that of the magnetron working part shown in Figure 1. The only difference consists in that the magnetron represented in Figure 6 comprises three disks 3, two bushes 4 and four washers 6. Besides, the screens 5 are installed on the side of the first and the last disks 3 and the washers 6 are installed between the adjacent disk 3 and bush 4. The washers 6 are installed with a purpose of protecting the disks 3 from possible deterioration as a result of chemical and physical interaction with the material of the bushes 4. For example, if a tantalum foil is used as a primary-emission element and a palladium-barium alloy, as a secondary-emission element, the protective washer 6 made of tungsten can be installed.

The magnetron of the present invention operates as follows:-

An anodic voltage is applied between the single-wire lead-in and the magnetron body (the lead-in and body are not shown in figures). The magnetron excitation current is ensured by the field emission from the primary-emission element edge directed towards the anode 1. The field emission is caused by the strong electric field created by the applied anodic voltage (the difference in potentials between the cathode and anode 1). The electrons emitted by said element, accelerating and changing the direction of their movement under the action of the microwave electromegnetic field, get partially on the secondary-emission element and expell the secondary electrons which in their turn, multiplying in an avalanch-like manner, ensure the main operating current of the magnetron.

Operation of the magnetrons shown in Figures 2 to 6 is similar to that of the magnetrons illustrated in Figure 1.

Thus, the present invention makes it possible to ensure an instantaneous starting of the magnetron with the

first pulse without preliminary heating-up of the cathode owing to the provision of the electric field intensity required for obtaining the field emission sufficient in its value for excitation of the magnetron.

Industrial Applicability

The present invention can be used in radars, aircraft, sea ships, spacecraft, rockets, etc.

Claims

1. A magnetron comprising an anode (1) and a cathode installed coaxially in the anode and made in the form of a cylindrical rod (2) provided with alternating primary-emission and secondary-emission elements arranged on it, wherein the secondary emission element is made in the form of at least one cylindrical bush of an emission active material, characterized in that the primary-emission element is made in the form of at least one flat disk (3) of a refractory metal having a thickness ranging from fractions of a micron to several microns and provided with a central hole, the primary emission and secondary emission elements being installed coaxially so that the external diameter of the flat disk (3) exceeds the external diameter of the cylindrical bush (4) by a value ranging from 0.1 to 0.2 of the interelectrode gap value and the end faces of the adjacent flat disk (3) and cylindrical bush (4) adjoin each others
2. A magnetron, as claimed in claim 1, characterized in that the primary-emission element is made in the form of five flat disks (3), and the secondary-emission element is made in the from of four cylindrical bushes (4).
3. A magnetron as claimed in any of claims 1 and 2, characterized in that the end faces of each cylindrical bush (4) are shaped as a truncated cone whose smaller base adjoins the end face of the corresponding flat disk (3) and the diameter of the greater base is the external diameter of the cylindrical bush (4).
4. A magnetron as claimed in any of claims 1 and 2, characterized in that the end faces of the adjacent flat disk (3) and cylindrical bush (4) adjoin each other through a flat cylindrical protective washer (6) made of a fine foil of a refractory metal, with a thickness of the flat cylindrical protective washer (6) being at least five to ten times greater than the thickness of the flat disk (3).
5. A magnetron as claimed in Claim 3, **characterized** in that the end faces of the adjacent flat disk (3) and

cylindrical bush (4) border on each other through the flat cylindrical protective washer (6) made of a fine foil of a refractory metal, and the thickness of the flat cylindrical protective washer (6) is at least five to ten times greater than the thickness of the flat disk (3).

6. A magnetron as claimed in any of Claims 1 and 2, **characterized** in that the primary-emission element is made of one of refractory metals, such as tantalum, niobium or tungsten.

7. A magnetron as claimed in Claim 3, **characterized** in that the primary-emission element is made of one of refractory metals, such as tantalum, niobium or tungsten.

8. A magnetron as claimed in Claim 4, **characterized** in that the primary-emission element is made of one of refractory metals, such as tantalum, niobium or tungsten.

9. A magnetron as claimed in any Claims 1, 2, 5, 7, 8, **characterized** in that the primary-emission element is made of tungsten-and-tantalum alloy.

10. A magnetron as claimed in Claim 3, **characterized** in that the primary-emission element is made of tungsten-and-tantalum alloy.

11. A magnetron as claimed in Claim 4, **characterized** in that the primary-emission element is made of tungsten-and-tantalum alloy.

12. A magnetron as claimed in Claim 6, **characterized** in that the primary-emission element is made of a tungsten-and-tantalum alloy.

Patentansprüche

1. Magnetron, enthaltend eine Anode (1) und eine in dieser koaxial angeordnete Katode, die als zylindrischer Stab (2) mit auf dessen Oberfläche angebrachten abwechselnden Elementen ausgebildet ist, welche eine Primär- und eine Sekundäremission sicherstellen, wobei das für die Sekundäremission sorgende Element in Form mindestens einer zylindrischen Buchse aus einem emissionsaktiven Material ausgeführt ist, dadurch gekennzeichnet, daß das die Primäremission gewährleistende Element als mindestens eine Flachscheibe (3) aus hochschmelzenden Metall mit einer Dicke im Bereich zwischen Bruchteilen eines Mikron und mehreren Mikron ausgebildet und mit einer zentralen Bohrung versehen ist, daß die für die Primär- und Sekundäremission sorgenden Elemente gleichschüssig angeordnet sind, derart, daß der Außendurch-

messer der Flachscheibe (3) den Außendurchmesser der zylindrischen Buchse (4) um eine Größe überschreitet, die sich in den Grenzen von 0,1 und 0,2 der Größe des Elektrodenabstandes befindet, während die Stirnseite der Flachscheibe (3) und der zylindrischen Buchse (4), die benachbart liegen, aneinander stoßen.

2. Magnetron nach Anspruch 1, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, in Gestalt von fünf Flachscheiben (3) ausgeführt ist, während das Element, das für die Sekundäremission sorgt, in Form von vier zylindrischen Buchsen (4) ausgebildet ist.

3. Magnetron nach einem beliebigen der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß die Stirnseiten jeder zylindrischen Buchse (4) als Kegelstumpf gestaltet sind, der mit seiner kleineren Grundfläche an die Stirnseite der jeweiligen Flachscheibe (3) anschließt, während der Durchmesser der größeren Grundfläche der Außendurchmesser der zylindrischen Buchse (4) ist.

4. Magnetron nach einem beliebigen der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß die Stirnseite der Flachscheibe (3) und der zylindrischen Buchse (4), die benachbart liegen, über eine flache zylindrische Deckscheibe (6) aus einer dünnen Folie hochschmelzenden Metalls aneinander anstoßen, wobei die Dicke der flachen zylindrischen Deckscheibe (6) zumindest um das Fünf- bis Zehnfache größer als die Dicke der Flachscheibe (3) ist.

5. Magnetron nach Anspruch 3, dadurch gekennzeichnet, daß die Stirnseiten der Flachscheibe (3) und der zylindrischen Buchse (4), die benachbart liegen, über eine flache zylindrische Deckscheibe (6) aus einer dünnen Folie hochschmelzenden Metalls aneinander anstoßen, wobei die Dicke der flachen zylindrischen Deckscheibe (6) zumindest um das Fünf- bis Zehnfache größer als die Dicke der Flachscheibe (3) ist.

6. Magnetron nach einem beliebigen der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einem der hochschmelzenden Metalle Tantal, Niob, Wolfram besteht.

7. Magnetron nach Anspruch 3, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einem der hochschmelzenden Metalle Tantal, Niob, Wolfram besteht.

8. Magnetron nach Anspruch 4, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einem der hochschmelzenden Me-

talle Tantal, Niob, Wolfram besteht.

9. Magnetron nach einem beliebigen der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einer Legierung von Wolfram und Tantal besteht.
10. Magnetron nach Anspruch 3, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einer Legierung von Wolfram und Tantal besteht.
11. Magnetron nach Anspruch 4, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einer Legierung von Wolfram und Tantal besteht.
12. Magnetron nach Anspruch 6, dadurch gekennzeichnet, daß das Element, das für die Primäremission sorgt, aus einer Legierung von Wolfram und Tantal besteht.

Revendications

1. Magnétron comportant une anode (1) et une cathode, disposée coaxialement à l'intérieur de celle-ci et réalisée sous forme d'une tige cylindrique (2) sur la surface de laquelle sont disposés des éléments alternés, qui assurent les émissions primaire et secondaire, l'élément qui assure l'émission secondaire étant constitué par au moins une douille cylindrique en matériau actif émissif, caractérisé en ce que l'élément qui assure l'émission primaire est constitué par au moins un disque plat (3) en métal réfractaire dont l'épaisseur est comprise entre des fractions de micromètres et plusieurs micromètres et pourvu d'un trou central, les éléments qui assurent l'émission primaire et secondaire étant montés coaxialement de façon que le diamètre extérieur du disque plat (3) soit supérieur au diamètre extérieur de la douille cylindrique (4) d'une valeur comprise dans les limites de 0,1 à 0,2 de la valeur de l'écartement des électrodes et les faces extrêmes du disque plat (3) et de la douille cylindrique (4) adjacents se joignent l'une à l'autre.
2. Magnétron, selon la revendication 1, caractérisé en ce que l'élément qui assure l'émission primaire est constitué par cinq disques plats (3) et l'élément qui assure l'émission secondaire est constitué par quatre douilles cylindriques (4).
3. Magnétron, selon l'une quelconque des revendications 1 et 2, caractérisé en ce que les faces extrêmes de chaque douille cylindrique (4) sont réalisées sous forme d'un cône tronqué qui s'applique par sa petite base à la face extrême du disque plat (3) cor-

respondant et dont le diamètre de la grande base est le diamètre extérieur de la douille cylindrique (4).

4. Magnétron, selon l'une quelconque des revendications 1 et 2, caractérisé en ce que les faces extrêmes du disque plat (3) et de la douille cylindrique (4) adjacents se joignent l'une à l'autre par l'intermédiaire d'une rondelle plate cylindrique protectrice (6) en une feuille mince d'un métal réfractaire, l'épaisseur de la rondelle plate cylindrique protectrice (6) étant supérieure à celle du disque plat (3) au moins de cinq à dix fois.
5. Magnétron, selon la revendication 3, caractérisé en ce que les faces extrêmes du disque plat (3) et de la douille cylindrique (4) adjacents se joignent l'une à l'autre par l'intermédiaire de la rondelle plate cylindrique protectrice (6) en feuille mince d'un métal réfractaire, l'épaisseur de la rondelle plate cylindrique protectrice (6) étant supérieure à l'épaisseur du disque plat (3) au moins de cinq à dix fois.
6. Magnétron, selon l'une quelconque des revendications 1 et 2, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un des métaux réfractaires tels que le tantale, le niobium ou le tungstène.
7. Magnétron, selon la revendication 3, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un des métaux réfractaires tels que le tantale, le niobium ou le tungstène.
8. Magnétron, selon la revendication 4, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un des métaux réfractaires tels que le tantale, le niobium ou le tungstène.
9. Magnétron, selon l'une quelconque des revendications 1, 2, 5, 7, 8, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un alliage de tungstène et de tantale.
10. Magnétron, selon la revendication 3, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un alliage de tungstène et de tantale.
11. Magnétron, selon la revendication 4, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un alliage de tungstène et de tantale.
12. Magnétron, selon la revendication 6, caractérisé en ce que l'élément qui assure l'émission primaire est réalisé à partir d'un alliage de tungstène et de tantale.

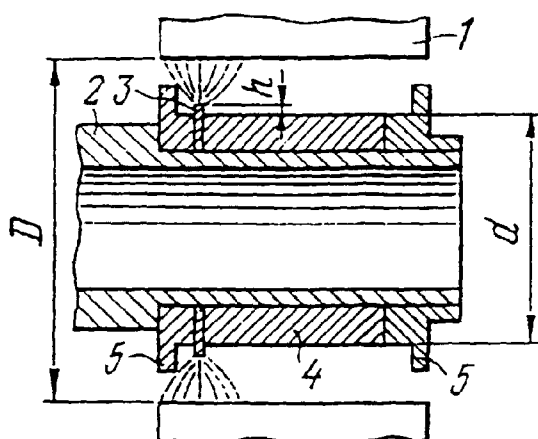


FIG. 1

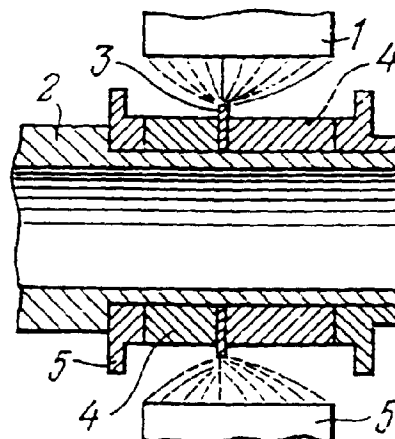


FIG. 2

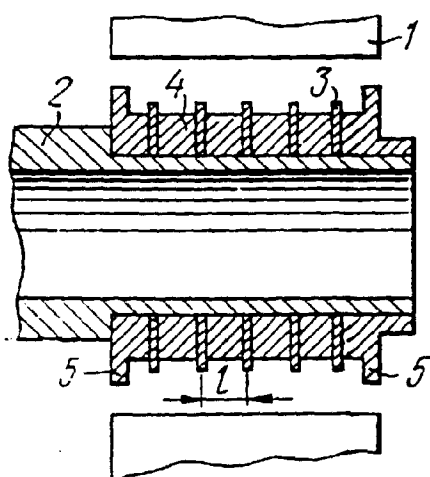


FIG. 3

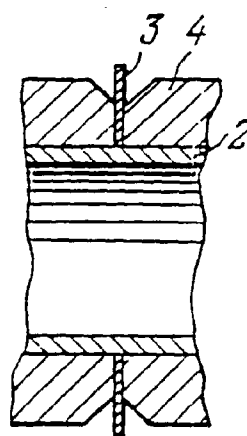


FIG. 4

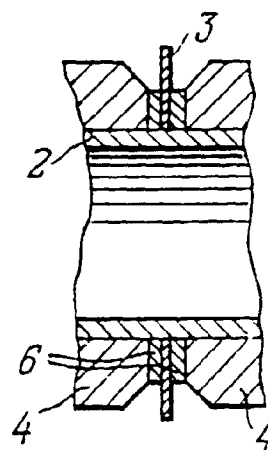


FIG. 5

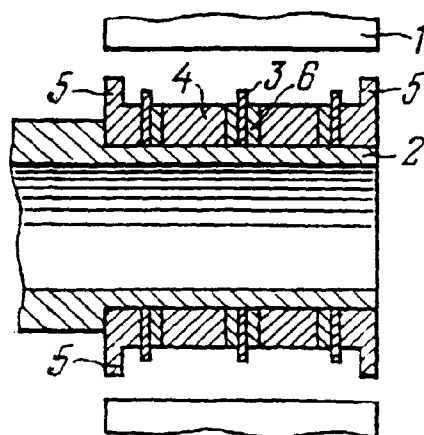


FIG. 6