Oct. 18, 1955 K. POSTHUMUS 2,721,295

MAGNETRON

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Fig. 1

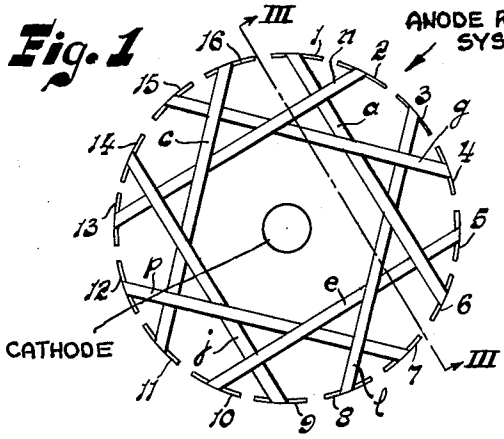
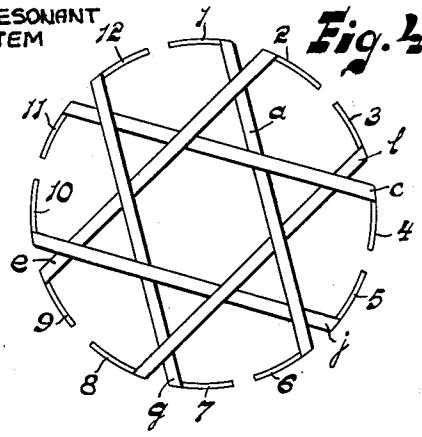


Fig. 4



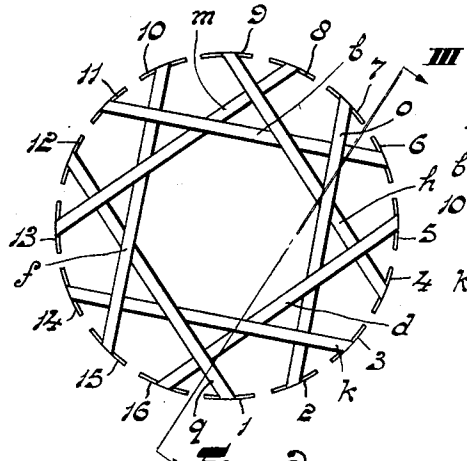


Fig. 2

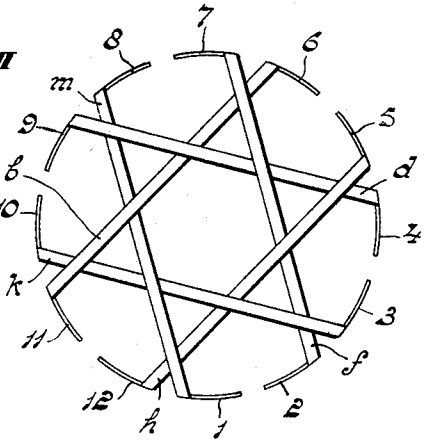


Fig. 5

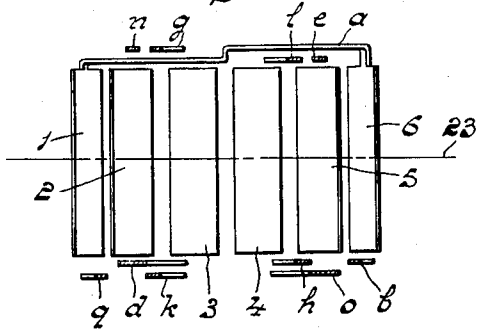


Fig. 3

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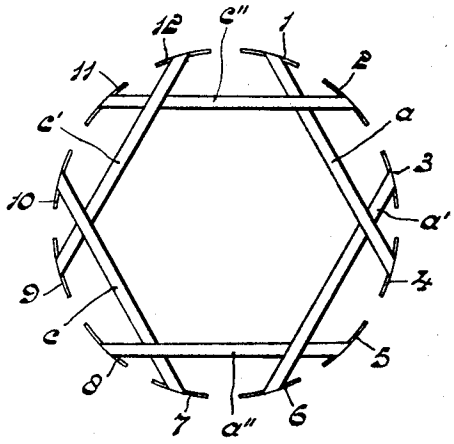

Fig. 6

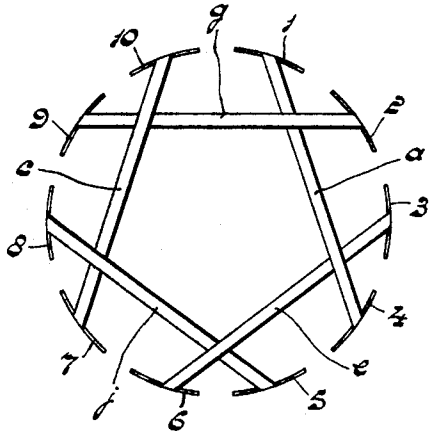

Fig. 8

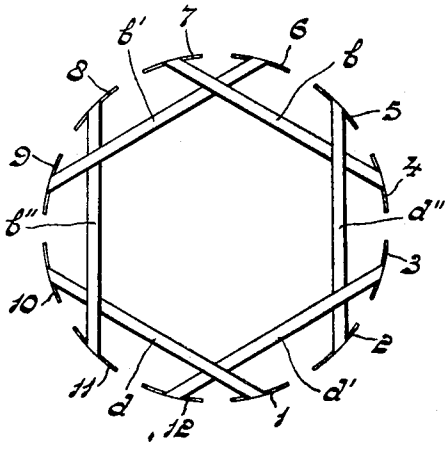

Fig. 7

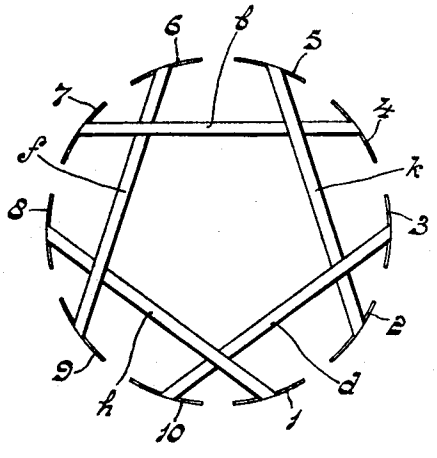

Fig. 9

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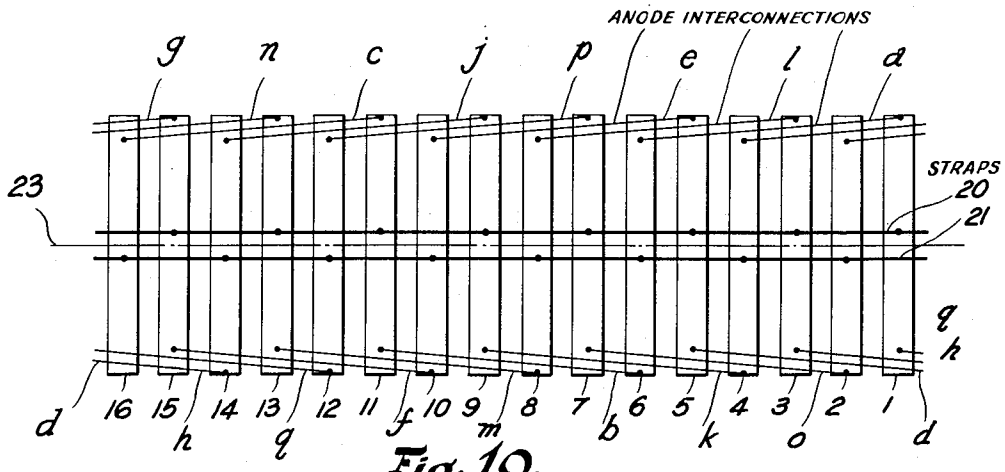

Fig. 10.

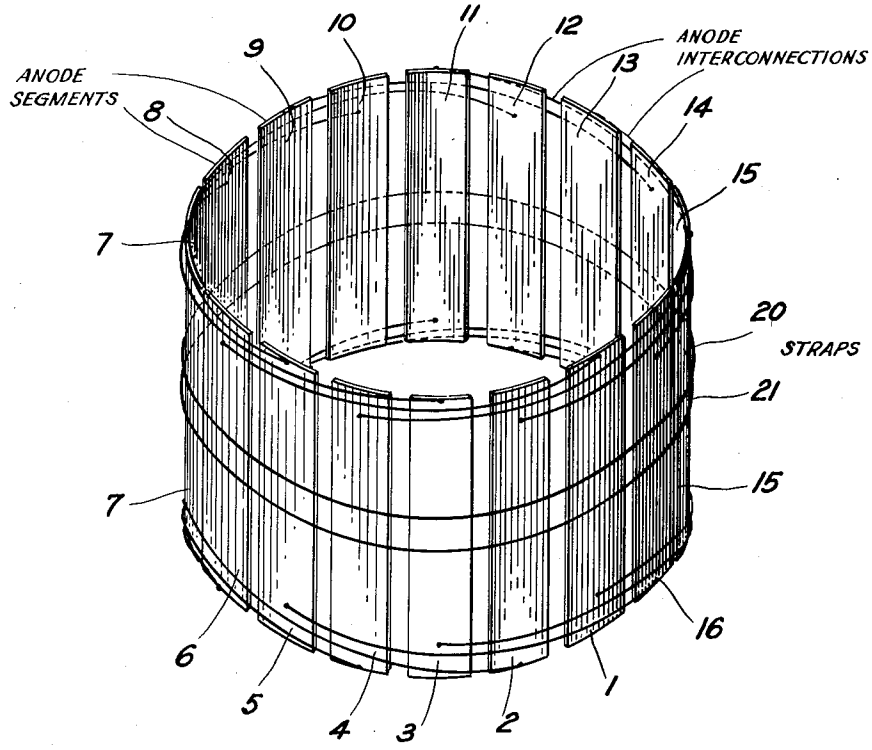

Fig. 11.

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MAGNETRON

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Application September 18, 1953, Serial No. 381,060

Claims priority, application Netherlands October 29, 1952

7 Claims. (Cl. 315—39.69)

This invention relates to magnetrons of the type comprising a resonator system constituted by a plurality of interconnected, circularly-grouped anode segments.

The chief object of the invention is to provide a magnetron of the foregoing type in which the connections between the anode segments are much simpler and more symmetric.

A further object of the invention is to provide a magnetron in which a greater frequency stability is attained, and in which less spurious modes occur, giving the tube a higher output.

According to the invention, the magnetron comprises a resonator system constituted by an even number of anodes or anode segments grouped to define a circular cylinder and interconnected by filamentary, strip-shaped or tubular conductors. The conductors, of which the same number are provided as the number of anodes present, interconnect anodes which, taken along the circumference of the cylindrical anode system, differ in ordinal number from one another by an odd number larger than one and smaller than half the number of anodes present. The conductors are provided alternately at the two ends of the cylindrical anode system and have a length equal to about half the wavelength of the oscillations for which the magnetron was designed. The conductors may be constituted by substantially rectilinear elements disposed at right angles to the axis of the anode system, or, alternatively, the conductors may be constituted by elements extending slightly helically on the outer side of the anode system. If the number of anodes present is not divisible by the difference in ordinal number between two interconnected anodes, in principle, a continuous assembly is obtained, constituted by anode segments and their mutual connections. If, however, the number of anodes present is divisible by the difference in ordinal number, a plurality of systems is obtained of which each is constituted in accordance with the above-described invention by anodes and their associated conductors, and the number of which is equal to the difference in ordinal number between interconnected anodes.

In order to obtain an assembly which is as symmetrical as possible in the case of rectilinear as well as helical conductors, the system of connections is preferably built up in the following manner. At the upper end of the magnetron, the conductors starting from anodes provided with odd numbers begin closer to the equatorial or central plane of the magnetron and terminate farther from the equatorial plane on an anode with an even number differing from the starting anode by the desired higher ordinal number. At the lower end of the anode system, the conductors on the anode segments with even number begin closer to the equatorial plane and terminate slightly farther from the equatorial plane on anodes with odd numbers which differ by the desired ordinal number. The foregoing applies both to total numbers of anodes which are divisible by the ordinal number difference and those which are not divisible. In addition, if the number of anodes is divisible by the difference in ordinal

number, it is preferable that the even and odd anode segments should also be interconnected or strapped in the well-known manner. This may best be effected by the use of two conductive rings surrounding the anode system in the vicinity of the equatorial plane and connected alternately to each of the anodes.

The invention will now be described with reference to the accompanying drawing in which:

Figs. 1 and 2 are a plan view and a bottom view, respectively, of the anode system of a magnetron according to the invention;

Fig. 3 is a sectional view of the anode system shown in Figs. 1 and 2;

Figs. 4 and 5, 6 and 7, and 8 and 9 are plan views, respectively, of opposite ends of anode systems having different numbers of anodes and differences in ordinal numbers interconnected in accordance with the invention;

Figs. 10 and 11 are a developed view and a perspective view, respectively, of a magnetron oscillatory system having 16 anodes interconnected in accordance with the invention.

Referring now to the drawing, Figs. 1, 2 and 3 are a top, bottom, and sectional view, respectively, of a magnetron having sixteen anodes and an ordinal number difference of 5. In the sectional view of Fig. 3 the conductor which extends parallel to the cross-section, namely between the anode segments **1** and **6** is shown in full, whereas for the other conductors, only the cross-section is shown, the remainder of the path being indicated as broken off. The anode segments are numbered from 1 to 16, and the conductors by the letters *a* to *q*, excluding the letter *i*.

Starting from the anode **1**, the assembly constituted by anode segments and conductors is traversed successively in the following arrangement:

1 *a* 6 *b* 11 *c* 16 *d* 5 *e* 10 *f* 15 *g* 4 *h* 9 *j* 14 *k* 3 *l* 8 *m* 13 *n* 2 *o* 7 *p* 12 *q* 1. The conductors *a* to *q* are constituted by substantially rectilinear strips having a central slight bend. All the strips are identical, and are of a length of a half wave length.

In Figs. 4 and 5, the magnetron has 12 anode segments and an ordinal number difference of 5. The system of conductors and anode segments are traversed successively in the following manner:

1 *a* 6 *b* 11 *c* 4 *d* 9 *e* 2 *f* 7 *g* 12 *h* 5 *j* 10 *k* 3 *l* 8 *m* 1.

In Figs. 6 and 7, the magnetron has 12 anode segments and an ordinal number difference of 3. In this case, since 12 is divisible by 3, there are three systems of anodes and mutual connections, which are traversed as follows:

1 *a* 4 *b* 7 *c* 10 *d* 1
3 *a'* 6 *b'* 9 *c'* 12 *d'* 3, and
5 *a''* 8 *b''* 11 *c''* 2 *d''* 5.

In Figs. 8 and 9, the magnetron has 10 anode segments and an ordinal number difference 3, the resonator system being cyclically traversed as follows:

1 *a* 4 *b* 7 *c* 10 *d* 3 *e* 6 *f* 9 *g* 2 *h* 5 *j* 8 *k* 1.

In Figs. 10 and 11, the same reference numerals are used as in Figs. 1, 2 and 3, the difference being that the conductors approach the equatorial plane **23** during the cyclic traversal instead of being directed away therefrom as in Figs. 1, 2 and 3. The well-known strapping connections provided alternately between alternate anodes are indicated by **20** and **21**, respectively. These latter connections are such that the points of connection are, as much as possible, located symmetrically with respect to the helical connections *a* to *q*. As may be seen from the drawing, the connections on top and on the bottom are right-handed and left-handed, respectively.

The resonant system of the invention affords the ad-

vantages of simplifying the connections between the anode segments, improving the frequency stability of the magnetron, increasing the power output, and decreasing the time for building up oscillations.

While I have described my invention in connection with specific embodiments and applications, other modifications thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A magnetron resonator system comprising an even number of anode segments grouped to define a circular cylinder and the same number of conductors interconnecting said anode segments, each of said conductors interconnecting anodes which differ in ordinal number by an odd number larger than one and smaller than half the number of anodes, the conductors being alternately disposed at opposite ends of the cylindrical anode system.

2. A magnetron resonator system as claimed in claim 1, in which at one end of the magnetron the conductors commence at anodes with odd numbers closer to the equatorial plane of the cylindrical anode system and terminate farther from the equatorial plane on an anode with an even number corresponding to the desired higher ordinal number, and at the other end of the anode system the conductors commence from anode segments with even numbers closer to the equatorial plane and terminate farther from the equatorial plane on anode segments with odd numbers which differ by the desired ordinal number.

3. A magnetron resonator system as claimed in claim 2 in which the conductors are each constituted by substantially rectilinear elements disposed at right angles to the axis of the cylindrical anode system.

4. A magnetron resonator system as claimed in claim 2 in which the conductors are each constituted by elements extending slightly helically on the outer side of the anode system.

5. A magnetron resonator system as claimed in claim 1 in which the quotient of the number of anodes and the difference in ordinal number between two interconnected anodes includes a fraction, and the conductors constitute a single continuous assembly.

6. A magnetron resonator system as claimed in claim 1 in which the number of anodes is divisible by the difference in ordinal number and the conductors constitute a number of coherent systems of anodes and associated connections equal to the difference in ordinal number.

7. A magnetron resonator system as claimed in claim 1 in which additional strapping conductors are provided by which the anode segments on the outer side are alternately connected together.

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