April 19, 1938. W. ESPE 2,114,339

MAGNETRON

Filed Oct. 1, 1936

Fig. 1

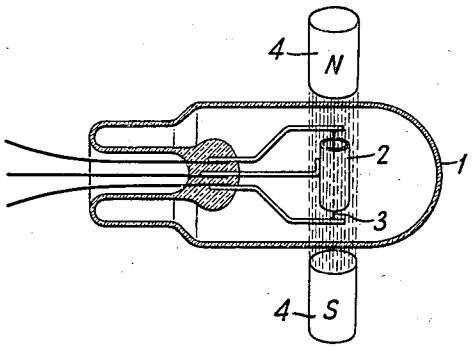


Fig. 2

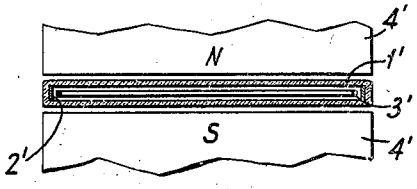


Fig. 3

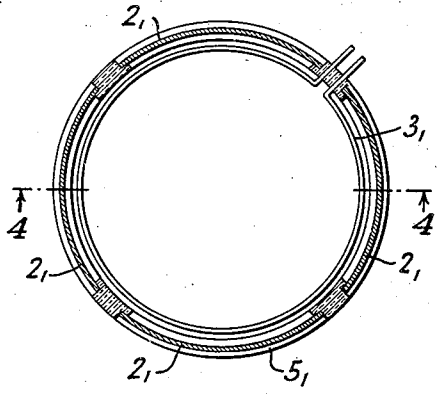


Fig. 6

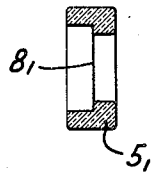


Fig. 4

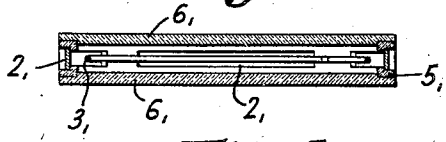


Fig. 7

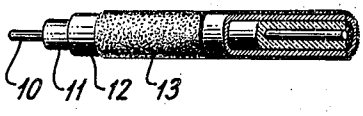
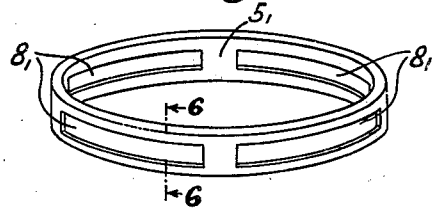


Fig. 5



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UNITED STATES PATENT OFFICE

2,114,339

MAGNETRON

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Application October 1, 1936, Serial No. 103,481
In Germany September 20, 1935

3 Claims. (Cl. 250—27.5)

My invetion relates to electron discharge devices, more particularly to improvements in so called magnetrons in which the electrode system is placed in a magnetic field.

Short and ultra-short waves can be generated by means of two-electrode tubes consisting of a cathode for the electron source and an anode both of which electrodes are subjected to the influence of a magnetic field co-axial with the anode and cathode. The shape given to the tube envelopes used for this purpose have the disadvantage that the poles of the magnet cannot be arranged conveniently so that the distance between them is relatively small for the purpose of insuring a magnetic field of maximum homogeneity.

The principal object of the present invention is to provide an electron discharge device of the magnetron type in which the magnetic field has improved characteristics.

According to the invention the electron discharge device intended in particular for the generation of short or ultra-short electric waves and controlled by a magnetic field, is provided with an envelope, the axial dimension of which is smaller than its diameter. Further according to the invention the cathode is formed as a ring around whose outer edge are disposed one or several anodes. It might be preferable to dispose the anodes or anode in the interior of the ring.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself, will best be understood by reference to the following description taken in connection with the accompanying drawing, in which Figure 1 is a schematic view of a conventional type of magnetron. Figure 2 is a vertical section of a magnetron made according to my invention. Figure 3 is a transverse section of another form of magnetron made according to my invention. Figure 4 is a vertical section along line 4—4 of Figure 3. Figure 5 is a perspective of an element of Figure 4. Figure 6 is a vertical section along line 6—6 of Figure 5, and Figure 7 is an enlarged partial perspective view partly in section of an indirectly heated cathode which can be used with my invention.

Referring to the drawing in Figure 1, the conventional magnetron comprises an envelope 1 containing the usual anode 2 coaxial with the filament cathode 3 and the electromagnets 4 for producing the electromagnetic field parallel to the cathode and anode and perpendicular to the movement of the electrons from the cathode to the anode.

The differences between a conventional magnetron and a magnetron according to my invention may be seen by referring to Figures 1 and 2 illustrating in schematic manner both types of magnetrons. In Figure 2 the flat drum shaped envelope 1' of the discharge device contains the anode plate 2' which may be subdivided into several parts or segments and the annular cathode 3'. It is evident that with a construction of this type for discharge vessels the magnetic field produced by poles 4' must be incomparably stronger and more homogeneous than in arrangements according to Figure 1. The cathode and anode have a comparatively small transverse section and lie parallel to the flat sides of the envelope.

In Figure 3 is illustrated a section in radial direction through another form of magnetron made according to my invention in which the anode 2_1 consists in this case of four parts that enclose the cathode ring 3_1. The anode plates may be inserted in a ceramic ring 5_1, for instance by soldering.

Figure 4 shows an axial section through the discharge device shown in Figure 3, the ceramic ring 5_1 being closed by the two covers 6_1 which may be of ceramic to form the envelope containing anode plates 2_1, and cathode 3_1. The connection of ceramic ring with the two covers may be accomplished by any of the soldering processes for ceramic parts known in the prior art. It may suit the purpose best to make several successive solderings in stage and use soldering materials having different melting points. In the first soldering a solder of high melting point would be used, and in the subsequent ones soldering materials with correspondingly lower melting points.

Figure 5 merely illustrates the ceramic ring with window-like pockets or recesses 8_1, in which are positioned and to which are attached the anode plates 2_1 in Figures 3 and 4, for instance by soldering. It is recommended to use as a material for the ceramic ring as well as for covers 6_1 of Figure 4 a ceramic substance of small dielectric phase difference, for instance Calit or Calan. Also quartz would be suitable for this purpose.

Figure 6 is a section, magnified for the sake of clarity, through the ceramic ring of Figure 5 along line VI—VI. This illustration furnishes an example of the manner of inserting anode plates 2 in the ceramic ring.

Annular cathode 3_1, which is shown in detail in

Figure 3, may of course also be developed as in indirectly heated cathode as shown in Figure 7 and covered with a highly emissive substance, for instance with an alkaline earth oxide for improving its emissive qualities. The heater wire 10 is insulated by coating 11 and inserted in a sleeve 12 coated with emissive material 13. There exist a number of further possibilities for the construction of the individual parts of the discharge system according to the invention. Thus for instance ceramic ring 5_1 and one cover 6_1 may be made of one piece and the vessel may be closed by soldering the second cover after introduction of the electrode system.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

What I claim as new is:

1. An electron discharge device having a flat drum shaped envelope which comprises a ring of ceramic material provided with rectangular recesses and plates for closing the ends of said ring, a ring shaped cathode within said envelope and coaxial therewith and anode segments fitted into the recesses in said ring for receiving electrons from said ring shaped cathode, said anode segments being soldered in position in said ceramic ring.

2. An electron discharge device having a comparatively flat drum like envelope, which comprises a ceramic ring provided with rectangular recesses and plates for closing the top and bottom of said ring, a ring like cathode within said envelope coaxial with said envelope, anode segments positioned within said recesses and soldered to said ceramic ring, said plates being soldered to said ceramic ring to form the envelope, and means for producing a magnetic field perpendicularly to the plates closing the ends of said ring and in the space between the cathode and the anode segments.

3. An electron discharge device having a comparatively flat drum like envelope which comprises a ceramic ring provided with rectangular recesses and plates for closing the top and bottom of said ring, a ring shaped indirectly heated cathode within said envelope coaxial with said drum shaped envelope for emitting electrons, anode segments positioned within said recesses and soldered to said ceramic ring for receiving electrons from said cathode and means for producing a magnetic field perpendicularly to the plates closing the ends of said ring and to the path of the electrons moving from the cathode to the anode segments.

WERNER ESPE.