June 3, 1952 E. C. S. MEGAW 2,599,270

MAGNETRON

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Fig. 1b.

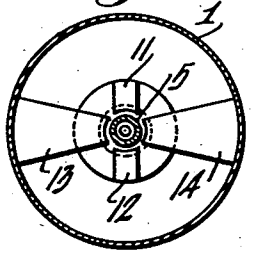


Fig. 1a.

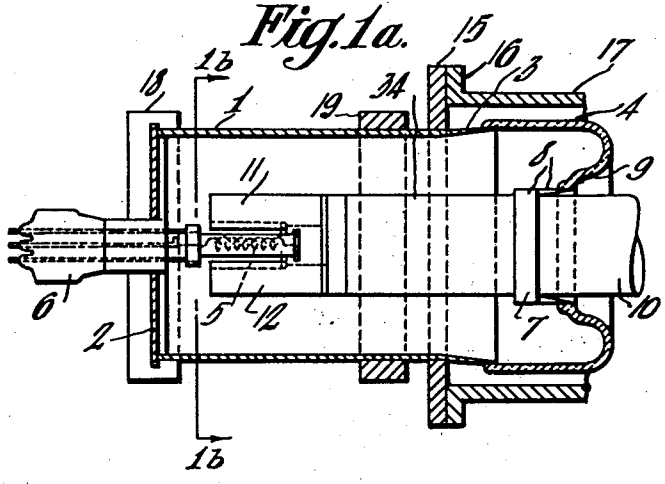
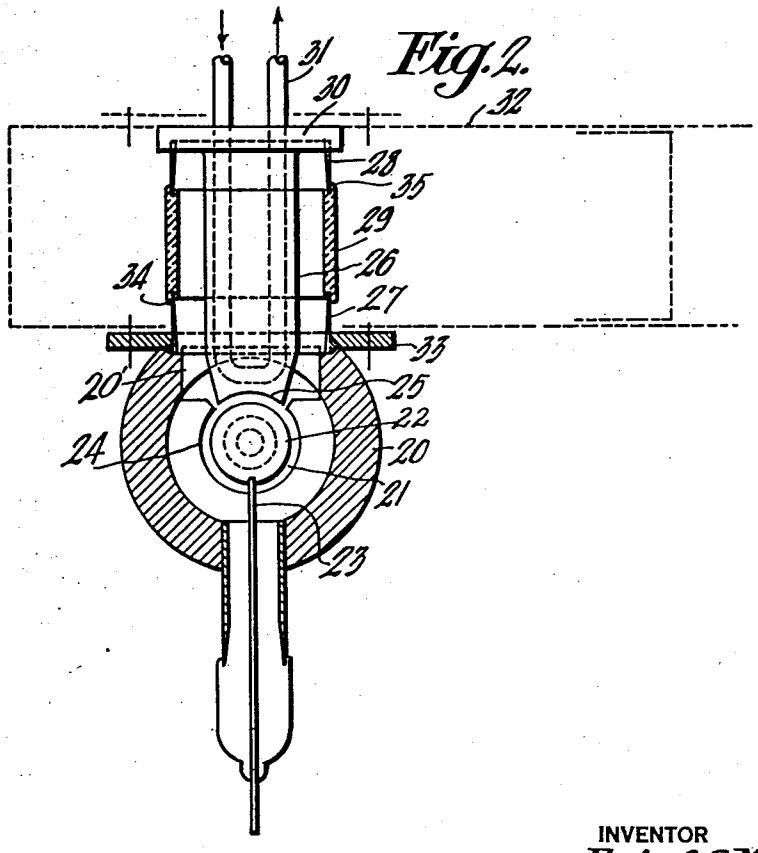


Fig. 2.



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MAGNETRON

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6 Claims. (Cl. 315—39)

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This invention relates to magnetrons of the type wherein a single cathode cooperates with a plurality of anodes. Two anodes are to be counted as separate if the impedance between them is considerable at any frequency at which the magnetron is adapted to operate. The invention relates also to combinations of a magnetron with impedance elements that form a generator or amplifier or modulator of electric oscillations. Its object is to improve magnetrons of this type for operation at very high frequencies, and especially to adapt them for connection to transmission lines or wave guides in such a way that a wide tuning range is obtainable without excessive high frequency losses.

Hitherto in magnetrons of this type the anodes have usually been arranged symmetrically with regard to the cathode, that is to say, so that the anodes can be grouped in pairs whose mean potential difference from the cathode is substantially constant and does not oscillate. We have realized that this arrangement is not necessary for efficient operation, and that, if it is abandoned, it becomes easier in some cases to attain the object of the invention.

According to one aspect of the invention, in a said combination of a magnetron of the type specified with impedance elements, the said cathode and anodes are contained in a conducting casing which nearly surrounds them and therefore preferably forms the greater part of the wall of the evacuated envelope containing them; some of the said anodes (preferably half of them) are connected to the said casing through impedance elements, preferably a transmission line, having considerable impedance at the normal operating frequency, while others of the said anodes (preferable the other half) are connected to the said casing so that at the said frequency the amplitude of the oscillating voltages between them and the casing is considerably less than the amplitude of the oscillating voltage between the first said anodes and the casing.

According to another aspect of the invention, in a magnetron of the type specified one group of the said anodes is conductively connected to, and is preferably integral with, the conducting casing aforesaid in stating the first aspect of the invention, and another group is conductively connected to, and is preferably integral with, a conductor forming with the said casing a transmission line, for example a co-axial line, capable of being continued outside the said evacuated envelope by a similar line.

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Two embodiments of the second aspect of the invention will now be described, by way of example with reference to the drawing accompanying the provisional specification, in which Figure 1 shows one embodiment in axial section at (*a*) and in cross section at (*b*), the anodes being arranged symmetrically as above defined, and Figure 2 shows the other embodiment in cross section, the anodes being unsymmetrical in this example.

In Figure 1, the copper casing consists of the cylinder 1, terminated at one end by the plate 2 and at the other end by the feather edge 3 sealed to the glass tube 4. The indirectly heated cathode 5 of standard form is introduced along the axis of the cylinder 1 by the glass seal 6 entering through a hole in the plate 2. A solid copper rod 34, coaxial with the cylinder 1, bears a collar 7 with a feather edge 8 sealed to a glass tube 9 integral with the glass tube 4, so that the tubes 4 and 9 with the collar 7 and the outer part 10 of the rod 34 form a member hermetically closing the open end of the cylinder 1 and constituting with it the wall of an evacuated enclosure.

Two of the anodes are copper pieces 11, 12 integral with and projecting from the inner end of the rod 34 toward but spaced from the plate 2. The other two anodes 13, 14 are projections from the inner surface of the cylinder 1. As shown in (*b*) these anodes face towards the cathode in four directions at right angles, with the anodes 13, 14 lying between the anodes 11, 12, and their inner faces constitute most of a cylinder surrounding the cathode.

The outer surface of the cylinder 1 carries a flange 15, to which can be clamped the terminal flanges 16 of a tube 17 surrounding the outer part 10 of the rod 34. The members 10 and 17 form the inner and outer members of a co-axial line continued within the evacuated enclosure by the rod 34 and cylinder 1. 18, 19 represent the poles of a magnet establishing a magnetic field in the space between the cathode and the anodes.

In the second embodiment (Figure 2) the conducting casing is a cylindrical copper block 20 similar to those used in known "copper-block" magnetrons. It is perforated by a hole 21 in which lies the cylindrical cathode 22, and has recesses at either end through whose walls enter the leads and supports 23 for the cathode. The recesses are closed by terminal plates (not shown). One anode 24 is a cylindrical portion of the wall of the hole 21. The other anode is the end 25 of a copper rod 26 which extends

through an aperture 20' in the cylindrical wall of block 20. The concave end face of rod 26 lies in the cylinder of which the said cylindrical wall portion forms a part. The rod 26 extends coaxially through a tubular member made up of collars 27, 28, between which is a glass tube 29 to whose ends the feathered edges 34', 35 of the collars are sealed. The rod 26 is supported from the plate 30 attached to the outer collar 28 and closing the outer end of the side tube. The inner collar 27 is attached to the magnetron block 20 by means of the flange 33 which surrounds the aperture 20'. 31 is a tube through which a coolant is circulated to cool the rod 26.

The rod 26, block 20 and collars 27, 28 form a coaxial transmission line, interrupted by the glass tube 29, so that, if the tube 29 is contained in a wave-guide 32, fixed to the magnetron by the flange 33 on the collar 27, energy can pass between the magnetron and the wave-guide through the glass tube 29.

What is claimed is:

1. A magnetron comprising a conducting casing including a block having a hole therein, an elongated conducting rod coaxially mounted in insulated relation with respect to said casing and forming therewith a coaxial transmission line, said rod extending into and terminating within said block, and a pair of anodes within said casing, one being constituted by a cylindrical portion of the wall of said hole in said block and the other being constituted by the end of said rod, which end lies substantially in the cylinder of which said cylindrical wall portion forms a part.

2. A magnetron according to claim 1, wherein said cylindrical wall portion extends around substantially more than half of said cylinder.

3. A magnetron according to claim 2, wherein a cathode of cylindrical shape is disposed in said hole with its axis coincident with that of said cylinder.

4. A magnetron comprising an annular conducting block closed at each end and having an aperture formed through the side wall thereof, the cylindrical inner wall of said annular block

constituting a first anode, a tubular conducting member sealed to said block around said aperture and extending outwardly therefrom, an elongated second anode extending in spaced relation through said tubular member and said aperture and having a cylindrical end face defining with said inner wall a cylindrical cathode space, said inner wall extending around substantially more than half of said space, means supporting the said second anode in insulated, coaxial relationship with said tubular conducting member and block comprising a dielectric ring member sealed between said second anode and said tubular member, and a cylindrical cathode supported coaxially in said cathode space, said second anode and said tubular conducting member forming a coaxial output terminal for said magnetron.

5. A magnetron comprising a conducting block having a cylindrical hole therein and a cylindrical aperture through the side wall of said block and intersecting said hole, an elongated conducting rod coaxially mounted in said aperture in insulated relation to said block and forming with the wall of said aperture a coaxial transmission line, said rod extending into and terminating within said block in a concave end surface which lies in the cylindrical surface of said hole, said concave end surface and the cylindrical wall of said hole constituting a pair of anodes for said magnetron.

6. A magnetron according to claim 5, wherein said block forms the greater part of the wall of an evacuated envelope containing said anodes.

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