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MAGNETRON ANODE SUPPORT

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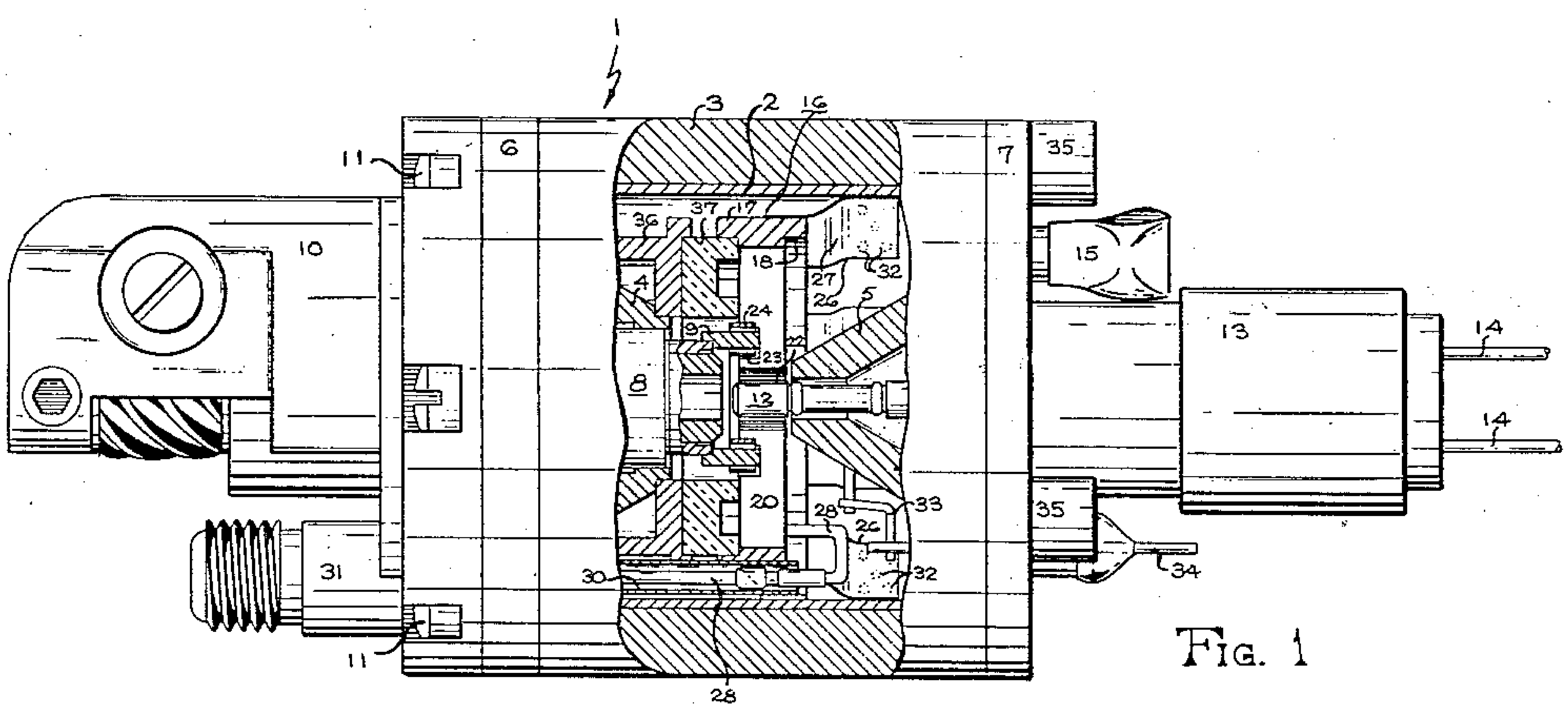

Fig. 1

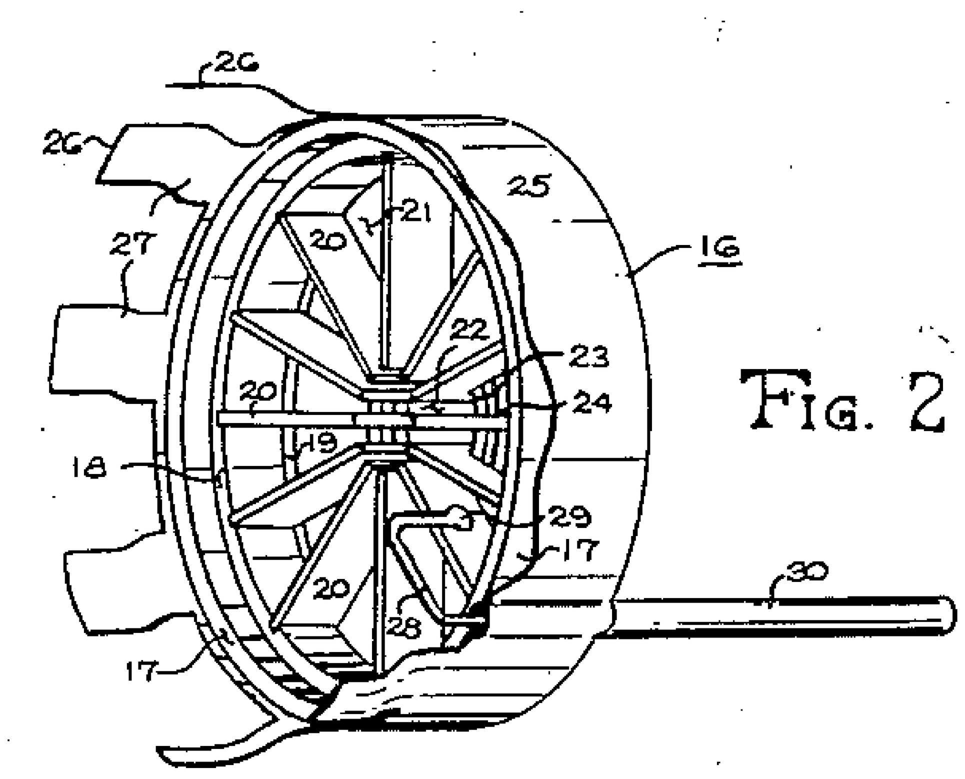

Fig. 2

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MAGNETRON ANODE SUPPORT

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4 Claims. (Cl. 315—39.77)

The present invention relates to electron discharge devices of the magnetron oscillator type and in particular to improved mounting structure for the anode member of such devices.

Magnetron oscillator devices have been described in detail in the text "Microwave Magnetrons" vol. 6, Radiation Laboratory Series, McGraw-Hill Book Co., Inc., New York 1948 and "Radar Systems and Components" pp. 56–237, D. Van Nostrand Co., New York 1949. Generally such devices comprise a multicavity resonator type anode electrode either forming a part of the tube envelope or secured directly to the inner walls of an envelope member. Such anode electrodes commonly define a central opening with a cathode electrode positioned therein. Since the spacings between the electrode members are extremely critical, variances in the mechanical tolerances of the envelope or anode will result in difficulty in the concentricity alignment of the cathode and tuning structures. A further problem exists in prior art magnetron fabrication in that brazing of the anode member requires high heat which may lead to release of occluded contaminating gases harmful to tube operating performance.

In certain applications, for instance radar controlled guided missiles, it is necessary for the magnetron to reach a stabilized operating condition in as short a time as possible. An additional requirement for such magnetron devices is that of mechanical rigidity to be able to withstand high shock and vibration conditions.

The present invention has for its primary object the provision of a novel and improved magnetron anode support structure.

Another object is the provision of an improved magnetron anode support which simplifies fabrication and accurate control of anode-cathode electrode spacing.

A further object is to provide a ruggedized magnetron anode support which facilitates attainment of the stabilized operating frequency condition in a shorter time than prior art structures.

Briefly the invention attains the aforementioned objects by means of a support assembly girdling the anode electrode with a plurality of tabs extending from the assembly at one end. After positioning of the anode assembly by means of appropriate jigging introduced into the envelope through one of the magnetic pole piece, the tabs are secured to the envelope walls. In this manner the anode electrode is spaced from the envelope with an annular gap therebetween. This permits the anode electrode to reach operating temperature faster than prior art magnetrons where large metallic masses contact this electrode and act as heat conductors.

Other features, objects and advantages will be evident after consideration of the following detailed description and reference to the drawing, in which:

Fig. 1 is a plan view partly in section of a device embodying the improved structure of the invention; and

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Fig. 2 is a perspective view of the embodiment of the invention.

The illustrated tube 1 in Fig. 1 is a miniaturized lightweight magnetron designed for operation in the C-band frequency range between 5400–5900 megacycles. Conventional magnetron construction is employed and structure not claimed in the present invention will only be described briefly.

Cylindrical body member 2 is surrounded by a permanent magnet 3. Inner pole pieces 4 and 5 are supported within member 2 by end plates 6 and 7. Centrally disposed within pole piece 4 is a tuning member 8 with a tuning ring 9 constructed in accordance with the teachings of patent applications of Richard S. Briggs, Serial No. 606,722 filed August 28, 1956, now U. S. Patent No. 2,834,916, and Serial No. 577,025 filed April 9, 1956, now U. S. Patent No. 2,838,712. The tuning control mechanism 10 is secured to end plate 6 by means of screws 11. Cathode electrode 12 is positioned axially within pole piece 5 with supporting structure 13 extending beyond end plate 7. Leads 14 provide for connection to the external cathode voltage supply means. Exhaust tubulation 15 is tipped off and sealed after the device has been evacuated.

In accordance with the present invention I provide an anode assembly 16 which is mounted in a novel manner without direct contact with body member 2. The electrode concentrically surrounds the cathode and is supported by the structure which is shown in Fig. 2.

Anode electrode 16 is of the so-called "strapped" type employing the capacitive "cookie-cutter" method of tuning. A metallic ring 17 provided with shoulders 18 and 19 has a plurality of radially disposed vanes 20 to define resonant cavities 21 each opening into a central cavity 22. Inner and outer straps 23 and 24 respectively form a parallel capacitor with the tuning ring 9 extending therebetween for varying the capacitance. I next provide a support assembly comprising a metallic collar member 25 having a plurality of tabs 26 with substantially 45° angular bends 27 at an intermediate point. The support assembly may be fabricated from a poor heat conducting metal such as nickel or Kovar having a thickness of .005 inch and is brazed or soldered around anode ring 17.

According to the method of assembling the illustrative embodiment the anode assembly may be accurately positioned by means of an alignment jig introduced into the device through pile piece 4 prior to mounting of the end plate 7 and pole piece 5. In the illustrative embodiment I have provided an insulating spacer ring 37 mounted on collar 36 which is in turn secured to end plate 6 to also facilitate positioning of the anode. After alignment, tabs 26 are spot welded as at 32 to body member 2. It will be noted that the anode assembly may now be mounted without brazing or soldering according to prior art construction. Further with the support structure disclosed, the anode is thermally isolated from the body of the device by means of a gap between these two members. It is thus possible for the magnetron anode to reach equilibrium between operating temperature and operating frequency much faster than prior art magnetrons wherein the large metallic masses surrounding the anode provide a cooling effect on the ambient heat of this electrode. Mechanically, the support structure disclosed provides both axial and radial rigidity to thereby withstand high shock and accelerations associated with airborne applications.

To complete the overall magnetron tube an output coupling loop 28 is secured to one of the vanes 20 as at 29 and extends through a tubulation 30 to a connector 31 for connection to the circuit of the system incorporating the device. A getter 33 may also be provided with an external connection **34**. Studs **35** in end plate **7** provide for mounting of the tube in an appropriate radar system.

While a specific embodiment has been described various modifications will occur to those skilled in the art, such as changes in the number or geometry of the support tabs, as well as changes in the overall collar member **25** configuration to coincide with the anode electrode shape. The appended claims, therefore, should be interpreted to include all modifications or alterations as fall within the spirit and scope of the invention as defined.

What is claimed is:

1. A magnetron oscillator device comprising an envelope, a cathode axially positioned within said envelope, a multicavity anode concentrically disposed around said cathode by means of a support assembly, said support assembly comprising a metallic collar member secured to the outer peripheral walls of said anode, said collar member having a plurality of tabs extending axially therefrom at one end, said tabs being secured to said envelope walls at spaced points to thereby provide an annular gap between said anode and envelope.

2. A magnetron oscillator device comprising an envelope, a cathode axially positioned within said envelope, a multicavity cylindrical anode concentrically disposed around said cathode by means of a support assembly, said support assembly comprising a metallic collar member having a thickness of .005 inches secured to the outer peripheral walls of said anode, said collar member having a plurality of tabs extending axially therefrom at one end, said tabs having 45° angular bends at an intermediate point, the ends of said tabs being secured to said envelope walls at spaced points.

3. In a magnetron device having an envelope, anode and cathode, a support structure for said anode comprising a collar member of a thin strip of a poor heat conductive metal with a plurality of tabs extending axially at one end thereof, said collar member being secured to the anode peripheral walls and said tabs being adapted to position said anode within said envelope with an annular gap completely encircling said anode.

4. A magnetron anode comprising a cylindrical wall member having a plurality of radially disposed vanes defining cavity resonators therebetween, a metallic collar member joined to the outer peripheral walls of said wall member, said collar member having a plurality of tabs extending axially therefrom at one end, said tabs having 45° angular bends at an intermediate point thereof, a metal tubulation extending axially from the other end of said collar member, an output coupling conductive wire joined to one of said vanes and extending through said tubulation.

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