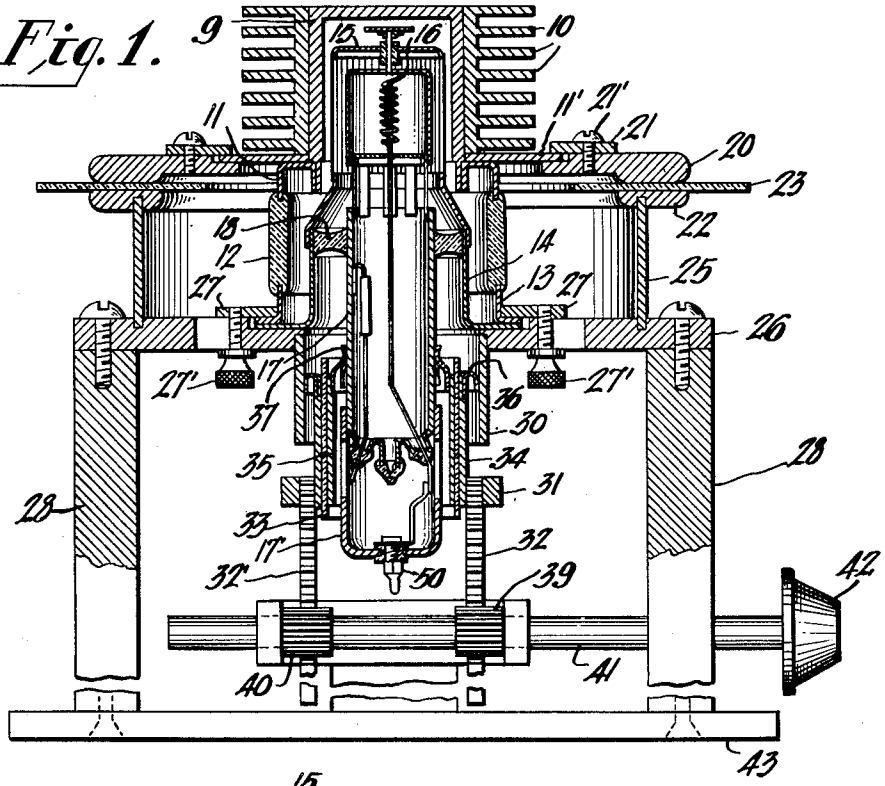
July 13, 1948. R. P. STONE 2,445,237

ELECTRON DISCHARGE DEVICE AND ASSOCIATED CIRCUIT

Filed July 28, 1944 2 Sheets-Sheet 1

Fig. 1.



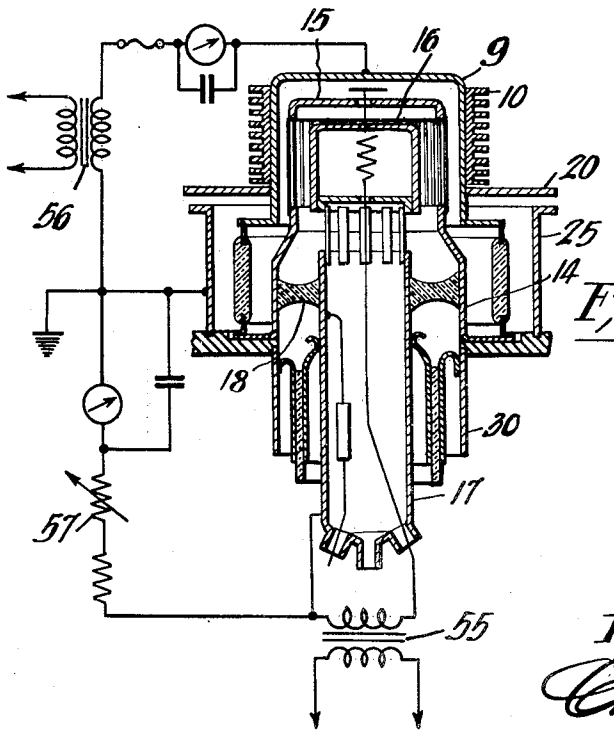


Fig. 2.

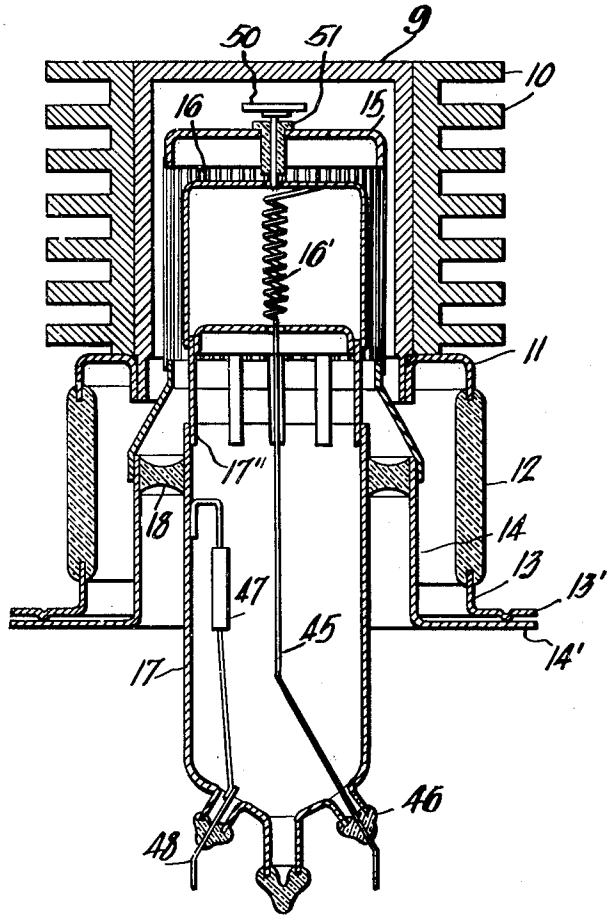
Inventor
Robert P. Stone
Charles McClair
Attorney

July 13, 1948. R. P. STONE 2,445,237

ELECTRON DISCHARGE DEVICE AND ASSOCIATED CIRCUIT

Filed July 28, 1944 2 Sheets-Sheet 2

Fig. 3.



INVENTOR
Robert P. Stone
BY Charles McClair
ATTORNEY

Patented July 13, 1948 2,445,237

UNITED STATES PATENT OFFICE

2,445,237

ELECTRON DISCHARGE DEVICE AND ASSOCIATED CIRCUIT

Robert P. Stone, Griggstown, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application July 28, 1944, Serial No. 547,009

7 Claims. (Cl. 250—27.5)

1

My invention relates to electron discharge devices and associated circuits, more particularly to such devices useful at very high frequencies.

An object of my invention is to provide an electron discharge device and associated circuit particularly suitable for high frequency operation and capable of delivering large amounts of power.

Another object of my invention is to provide an electron discharge device which can deliver large amounts of power at high frequencies, but which is nevertheless small and compact, has few parts, and lends itself readily to manufacture.

A further object of my invention is to provide such a device having a low internal reactance which permits the use of a large external circuit, that is a device which will function at higher frequencies with an external circuit and thus permit tuning over a considerable range.

A more specific object of my invention is to provide an electron discharge device in which the electrodes although closely spaced are firmly and rigidly supported with respect to each other.

A further object of my invention is to provide an electron discharge device having electrode leads and supports which will merge into high frequency circuits of the cavity resonator type so that the internal reactances may be coupled smoothly to the external reactances which complete the circuit and thus reduce radio frequency losses and spurious modes of oscillation to a minimum.

A further object of my invention is to provide a cavity resonator circuit in which the circuit has comparatively large dimensions while permitting operation at very high frequencies.

A further object of my invention is to provide improved means for connecting the terminals of an electron discharge device to a cavity resonator circuit.

A further object of my invention is to provide a tube and compact circuit operable in a fundamental quarter wavelength mode, thus decreasing the stored energy and permitting faster starting, such as required for pulse work, thus increasing the efficiency of the circuit for this type operation.

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 longitudinal section of an electron discharge device and its associated circuit made accordingly to my invention, Figure 2 is a longitudinal section of a schematic diagram of the tube and circuit shown in Figure 1 and associated voltage sources, Figure 3 is a longitudinal section of the electron discharge device shown in Figure 1 and made according to my invention.

2

As shown in Figure 1 the electron discharge device is provided with an envelope comprising the inverted cup-shaped anode 9 having the radiating fins 10 and a collar 11 of U-shaped transverse section sealed to a collar 12 of insulating material, preferably glass, which is in turn sealed to the collar 13 welded to the collar member 14, which supports the grid 15 within the anode and surrounds the indirectly heated cathode 16 provided with the tubular lead and support 17 and having extension 17'. A seal 18 between the collar 14 and the cathode lead support 17 is positioned within the collar 14 at a point remote from its seal to the collar 13 for purposes to be described.

An output cavity resonator is coupled between the anode and the grid and includes the isolating condenser having upper plate 20 supporting thereon a plurality of segmental clips 21 slidable radially to and away from the flange 11' on the anode. These clips or contacts are retained in place by the screws 21'. The top plate 20 of the output resonator is insulated from the lower plate 22 by means of the insulating ring 23, preferably of mica. The bottom plate is supported by means of the conducting collar-like member 25 supported by the plate 26, which is in turn clamped to the grid collar and flange by means of a plurality of conducting segments or contacts 27 slidable radially and which may be retained in position by means of the screws 27'. The output resonator and tube are supported by means of the support elements 28 mounted on the plate 43. A conventional output coupling loop, not shown, may be used to take power out of the output resonator.

The input cavity resonator includes the collar 30 coaxial with and surrounding the cathode lead and support 17. A tuning condenser extending between the collar 30 and tubular lead 17 includes the concentric collar-like elements 34 and 35 insulated from each other by means of the insulating collar 33, preferably of mica. The inner element 35 is provided with spring fingers 37 contacting cathode lead 17. The outer element 34 is provided with contacting spring fingers 36 contacting the inner wall of collar 30 or grid collar 14. The grid collar 14 forms a continuation of the outside tubular member of the input cavity resonator, which is in the form of a coaxial line

circuit, the cathode tubular lead 17 forming the inner conductor.

The condenser may be moved axially along the collars 36 and 14 and tubular lead 17 by means of the rack and pinion 32, 32', 39 and 40 attached to the extensions 31 on the outer condenser collar 34. The pinions 39 and 40 are mounted on the shaft 41 adjusted rotatably by dial knob 42.

The tube made according to my invention is shown in greater detail in Figure 3. Cathode 16 is provided with a heater 16' and is supported from tubular extension 17 by means of the conducting rods or tabs 17'' to minimize heat conduction to the cathode lead and support 17. The getter 47 has one lead 48 extending through and insulatingly sealed through the tubular member 17. One side of the cathode heater 16' is connected to the cathode on the inside and the other lead 45 is insulatingly sealed through the tubular member at 46. The collar 13 is provided with flange 13' and collar 14 with flange 14' which are welded together to provide a hermetically sealed envelope for the electron discharge device shown in Figure 3. Plate-like member 50 connected to the cathode extends through and is insulated from grid 15 by insulating tubular member 51 which centers the cathode and grid. Member 50 provides capacity feedback between anode and cathode.

In Figure 2 I show schematically the electron discharge device and associated circuit of Figure 1 with means for applying the various voltages, the heater voltage being supplied by transformer 55, and the circuit for applying the pulse voltage to the anode 9 grid biasing voltage indicated at 56 and 57, respectively. It is preferable to make the inside diameter of member 36 and the inside diameter of grid collar 14 the same as shown in Figure 2, to permit the condenser to enter within collar 14 to the seal 18.

Due to the compactness of the circuit arrangement and the unusual construction employed in my tube permitting the grid collar to form part of the input resonator and the shorting condenser to be moved within the tube, I am able to operate my device in a fundamental quarter wave mode. This decreases the amount of stored energy in the input resonator and permits faster starting which is required for pulse work. This also increases the efficiency of the circuit.

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 cathode, grid and an anode, said anode being cup-shaped and forming part of the envelope of the device, said grid and cathode being positioned within said cup-shaped anode, said cathode having a tubular lead and support extending from said envelope, said grid having a collar surrounding said tubular lead and having one end fixed to said grid and its other end insulatingly sealed to the open end of said anode, and a seal between said collar and said tubular lead within said collar at a point remote from the anode sealed end, and a collar-like member surrounding said tubular lead and electrically connected to said grid collar and extending said grid collar, and a shorting condenser mounted for axial movement between said member and said tubular lead, said tubular lead, member and condenser providing a coaxial line cavity resonator.

2. An electron discharge device having a cathode, grid and an anode, said anode being cup-shaped and forming part of the envelope of the device, said grid and cathode being positioned within said cup-shaped anode, said cathode having a tubular lead and support extending from said envelope, said grid having a collar surrounding said tubular lead and having one end fixed to said grid and its other end insulatingly sealed to the open end of said anode, and a seal between said collar and said tubular lead within said collar at a point remote from the anode sealed end, and a collar-like member surrounding said tubular lead and electrically connected to said grid collar and extending said grid collar, and a shorting condenser mounted for axial movement along and between said collar-like member and said tubular lead, said shorting condenser comprising a pair of coaxial conducting collars and insulating means separating said collars, the inner ends of said collars being provided with contacting fingers contacting the outside of said tubular lead and the inside of said collars.

3. An electron discharge device having a cathode, grid and anode, said anode being cup-shaped and forming part of the envelope of the device, said grid and cathode being positioned within said cup-shaped anode, said cathode having a tubular lead and support extending from said envelope, said grid having a collar surrounding said tubular lead and having one end fixed to said grid and its other end insulating sealed to the open end of said anode, and a seal between said collar and said tubular lead within said collar at a point removed from said anode sealed end, a cavity resonator coupled between said anode and the end of the grid collar sealed to said anode and having a flange transverse to the longitudinal axis of said device, and a collar extending from said flange oppositely from said grid collar and surrounding said tubular lead, and a shorting condenser mounted for axial movement between said collars and said tubular lead, said tubular lead, collars and condenser providing a coaxial line cavity resonator.

4. An electron discharge device having an envelope, a cathode and another electrode mounted within said envelope, said other electrode having a collar sealed at one end to said envelope and the inside surface of said collar forming an outside portion of said envelope, said cathode having a tubular lead extending from said envelope within and coaxial of said collar, and a seal connected between the inside surface of said collar and tubular lead at a point remote from the end of the collar sealed to the envelope.

5. An electron discharge device having an envelope including a cup-shaped anode having an open end, an insulating collar sealed to the open end of said anode, a cathode and grid within said anode, said cathode being provided with a tubular lead and support extending from said envelope, said grid being provided with a collar coaxial with and surrounding said tubular lead, and a seal between the end of said grid collar remote from said grid and the insulating collar sealed to the open end of said anode, and a second seal between said cathode tubular lead and

the inside of said grid collar at a point remote from the end of the grid collar sealed to said insulating collar.

6. An electron discharge device having an envelope including a cup-shaped anode having an open end, an insulating collar sealed to the open end of said anode, a cathode and grid within said anode, said cathode being provided with a tubular lead and support extending from said envelope, said grid being provided with a collar coaxial with and surrounding said tubular lead, said grid collar having one end fixed to said grid and its other end provided with a flange transverse to the axis of said tubular cathode lead sealed to the insulating collar, and a second seal between said cathode tubular lead and the inside of said grid collar at a point remote from the end having said flange.

7. An electron discharge device having a drum-shaped cathode, an elongated tubular lead for said cathode, and conductors of small transverse section connected between said drum-shaped cathode and the tubular lead, a cup-shaped grid surrounding said cathode and provided with a collar extending away from said

cathode and surrounding said tubular lead and having an outwardly extending flange transverse to said tubular lead, a cup-shaped anode surrounding said cathode and grid and an insulating collar sealed between the open end of said cup-shaped anode and the flange of said grid collar, and a second seal within said grid collar at a point removed from said flange, said tubular lead and said grid collar comprising part of the envelope for said electron discharge device.

ROBERT P. STONE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,287,845	Varian et al.	June 30, 1942
2,353,742	McArthur	July 18, 1944
2,400,753	Haeff	May 21, 1946
2,402,600	Chevigny et al.	June 25, 1946
2,404,363	Chevigny	July 23, 1946
2,405,763	Sloan	Aug. 13, 1946