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ARRANGEMENT FOR MODULATING GROUNDED GRID AMPLIFIERS

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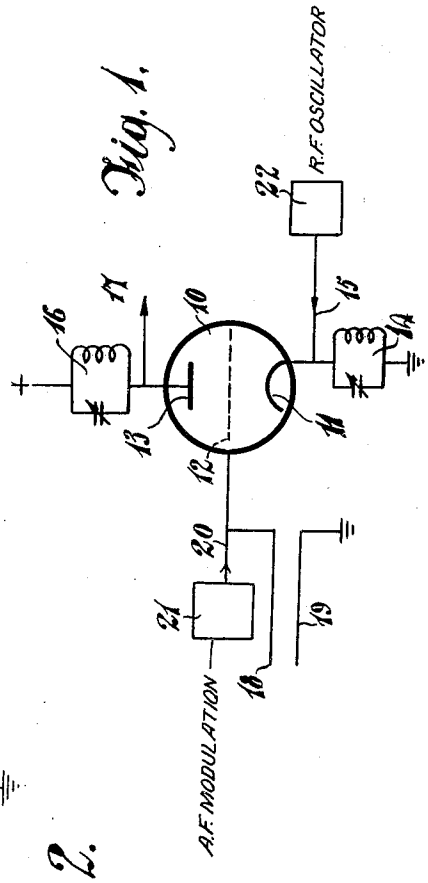


Fig. 1.

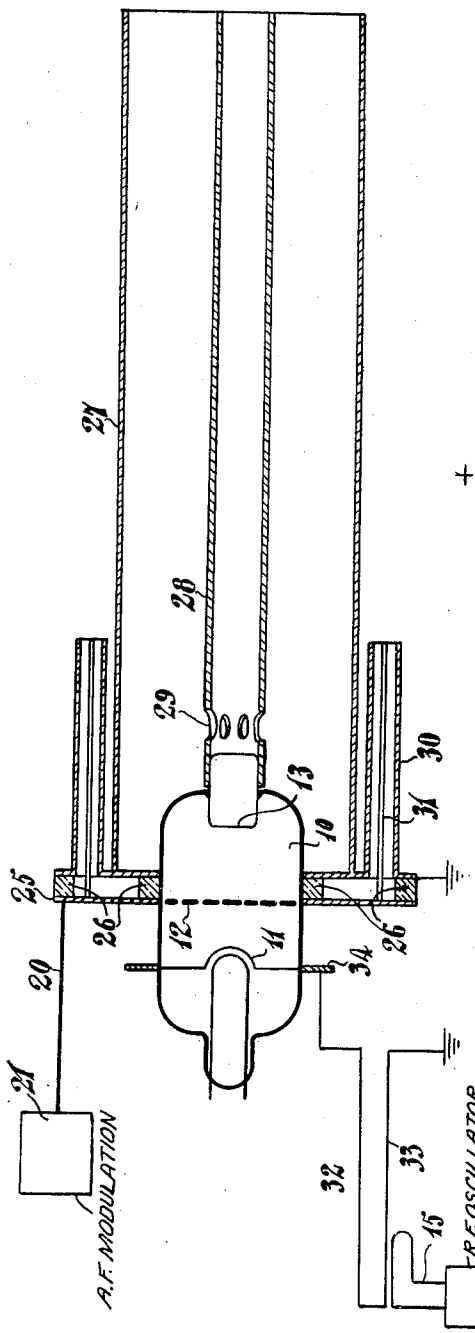


Fig. 2.

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ARRANGEMENT FOR MODULATING GROUNDED GRID AMPLIFIERS

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In grounded grid triode amplifiers, the grid has to be maintained at earth potential so far as the radio frequencies are concerned and the present invention has for an object to provide a circuit whereby modulating potentials can be fed to the grid while still maintaining it at earth potential with regard to radio frequencies.

According to one aspect of the present invention, the grid of a grounded grid triode is coupled to earth through an open ended transmission line which is resonant at the radio frequency at which the valve is intended to operate, for example a quarter wave line. The quarter wave line effectively maintains the grid at earth potential so far as the radio frequencies are concerned. Modulating potentials may be fed to the grid of the valve.

The invention may be applied to short wave transmitters in which the carrier frequency is amplified by a grounded grid triode. The modulation to be transmitted is then applied to the grid of the valve, the grid being coupled to earth through the quarter wave transmission line. The quarter wave line has an impedance inverting property such that if one end is open circuited, the impedance across the other end will be zero. The modulation may comprise a television waveform or a part of a television waveform or an audio frequency or may consist of pulses or stepped potentials to control the output power from the valve.

The invention further consists in apparatus comprising a triode amplifying valve having a cathode, a grid and an anode, and at least one resonant circuit associated with the valve, wherein the grid is coupled to earth through an open ended transmission line resonant at said frequency whereby the grid is maintained substantially at earth potential with regard to oscillations at that frequency.

The present invention also consists in radio transmitting apparatus comprising a radio frequency oscillator, a grounded grid triode amplifying valve having a cathode, a grid and an anode, means for applying the output from said oscillator to said cathode, an open ended transmission line resonant at the frequency of said oscillator between said grid and earth to maintain said grid at earth potential with respect to the radio frequency oscillations applied to the cathode, means for applying a modulating potential to said grid, and means for feeding the modulated radio frequency oscillations at said anode to a transmitting antenna.

A feature of this invention consists in including in the anode circuit of the valve a coaxial

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line, the inner conductor of which is connected to the anode and the outer member to earth.

According to a further aspect the present invention consists in radio transmitting apparatus comprising a triode amplifying valve having a cathode, a grid and an anode, means for applying a radio frequency carrier to the cathode, an annular disc connected to the grid and surrounding the valve, a second annular disc surrounding the valve insulated from the first annular disc and connected to earth, at least one co-axial open ended transmission line resonant at the carrier frequency and comprising inner and outer members connected to said annular discs, an inner tubular member connected to the anode and an outer tubular member co-axial with the inner tubular member and connected to the earthed annular disc, said inner and outer members forming a transmission line resonant at the carrier frequency.

In order that the invention may be more fully understood reference will now be made to the accompanying drawings in which—

Figure 1 is a circuit diagram of a short wave radio transmitter incorporating a grounded grid amplifier according to this invention.

Figure 2 is a somewhat diagrammatic section of a constructional embodiment of the grounded grid amplifier.

Referring to Figure 1; a valve generally indicated by the reference 10, has a cathode 11, grid 12 and anode 13. Connected to the cathode 11 is a resonant circuit 14 which is shown as comprising inductance and capacitance. A radio frequency carrier at the resonant frequency of the circuit 14 is fed to the cathode 11 through a connection 15 from an oscillator or driver 22. In the anode circuit there is a further tuned resonant circuit 16 from which output may be taken from the connection 17 which leads to the transmitting antenna. The valve is intended to operate under grounded grid conditions and this would normally involve the connection of the grid directly to earth but in accordance with the present invention the grid is coupled to earth by an open ended transmission line resonant at the operating frequency and comprising two conductors 18 and 19 each a quarter wavelength long at the operating frequency, the conductor 18 being connected to the grid and the conductor 19 being connected to earth. By this means the grid 12 is maintained substantially at earth potential with regard to oscillations at the operating radio frequency but the grid 12 is not earthed by the transmission line in respect of other lower

frequencies such for instance as direct current or audio frequency oscillations. In consequence, if a modulating potential is applied from a modulator 21 to the lead 20 connected to the grid 12 the output from the valve 10 is modulated.

As shown in Figure 2, the triode valve 10 is constructed with the grid 12 extending in the form of a conducting annular disc 25 which surrounds the valve envelope. This disc 25 is spaced by insulating spacers 26 from the end of a metal cylinder 27 constituting the outer element of a concentric line in the output circuit of the valve, the inner element 28 of the line being connected directly to the anode 13 of the valve 10. This inner element 28 may be tubular and may be provided with apertures 29 at its end adjacent the valve for enabling a stream of air to be blown therethrough for cooling the anode 13. Disposed parallel to the output concentric line 27, 28 is a second concentric line, the outer element 30 of which is in electrical connection with the outer cylindrical member 27 of the output concentric line 27, 28 and the inner element 31 of which extends from the surrounding disk 25 connected with the grid 12. The length of this second concentric line 30, 31 is a quarter of the wavelength at which the valve is intended to operate and therefore being open ended, it effectively maintains the grid at earth potential for radio frequencies. In the construction shown in Fig. 2 two such quarter wave lines are shown, but more than two may be used if desired. The cathode 11 is connected to a disc 34 which is connected to earth through a quarter wave line 32, 33, the ends of which are bridged. The radio frequency drive or input is applied to the cathode 11 through the lead 15 from an oscillator or driver 22, and the modulating voltage to the grid 12 through the lead 20 from a modulator 21. The oscillator or driver 22 and modulator 21 may each include one or more valves.

It is to be understood that where reference is made to quarter wave resonant transmission lines these lines may, if desired, be made an odd multiple of a quarter wavelength long.

While particular embodiments have been described with reference to the accompanying drawings, it is to be understood that various modifications may be made without departing from the scope of the invention.

I claim:

1. An electric circuit comprising a triode electronic valve having a cathode, a grid and an anode, means for applying radio frequency oscillations to the cathode, means for taking output from the anode, and an open ended transmission line, resonant at the same frequency as that of the applied oscillations, connected to the grid to maintain it substantially at earth potential with regard to oscillations at that frequency.

2. An electric circuit comprising a triode electronic valve having a cathode, a grid and an anode, a resonant circuit connected to the cathode, means for applying radio frequency oscillations to said circuit at its resonant frequency, a resonant circuit coupled to the anode and resonant at the same frequency as that of the cathode circuit, and an open ended transmission line connected to the grid and resonant at the same frequency as the resonant circuits coupled to the cathode and anode.

3. A circuit according to claim 2, comprising also a modulator connected to the grid to supply modulating potentials thereto.

4. An electric circuit comprising a triode electronic valve having a cathode, a grid and an anode, means for applying a radio frequency carrier to the cathode, a co-axial transmission line associated with the anode and resonant at the carrier frequency, at least one open ended quarter-wave transmission line resonant at the same frequency as the applied carrier connected to the grid, and a modulator for applying modulating potentials to the grid.

5. A circuit according to claim 4, wherein each open ended transmission line connected to the grid is a co-axial transmission line.

6. Apparatus comprising a triode electronic valve having a cathode, a grid and an anode, means for applying a radio frequency carrier to the cathode, a resonant circuit associated with the anode resonant at the carrier frequency, an open ended transmission line resonant at the carrier frequency connected to the grid and coupling the grid to earth, and means for applying a modulation potential to the grid.

7. Apparatus comprising a triode electronic valve having a cathode, a grid and an anode, an annular member surrounding the valve connected to the grid, a resonant circuit coupled to the cathode, means for applying a radio frequency carrier to the resonant circuit coupled to the cathode, an open ended transmission line connected to the grid and coupling the grid to earth to maintain it substantially at earth potential with regard to oscillations at the carrier frequency, and a resonant circuit associated with the anode and resonant at the carrier frequency.

8. Radio transmitting apparatus comprising a radio frequency oscillator a grounded grid triode amplifying valve having a cathode, a grid and an anode, means for applying the output from said oscillator to said cathode, an open ended transmission line resonant at the frequency of said oscillator coupled between said grid and earth to maintain said grid at earth potential with respect to the radio frequency oscillations applied to the cathode, means for applying a modulating potential to said grid, and means for feeding the modulated radio frequency oscillations at said anode to a transmitting antenna.

9. Radio transmitting apparatus comprising a triode amplifying valve having a cathode, a grid and an anode, means for applying the radio frequency carrier to the cathode, an open ended transmission line connected to the grid and coupling it to earth to maintain the grid substantially at earth potential with regard to the carrier frequency, means for applying a modulating potential to the grid, a co-axial resonant circuit including a tubular inner member connected to the anode and a tubular outer member connected to earth, said inner member being apertured adjacent to the anode, and means for circulating cooling air through the tubular inner and outer members of the transmission lines associated with the anode.

10. Radio transmitting apparatus comprising a triode amplifying valve having a cathode, a grid and an anode, means for applying a radio frequency carrier to the cathode, an annular disc connected to the grid and surrounding the valve, a second annular disc surrounding the valve insulated from the first annular disc and connected to earth, at least one co-axial open ended transmission line resonant at the carrier frequency and comprising inner and outer members connected to said annular discs, an inner tubular member connected to the anode and an outer tubular member co-axial with the inner tubular

member and connected to the earthed annular disc said inner and outer tubular members forming a transmission line resonant at the carrier frequency.

11. Apparatus according to claim 10 comprising a plurality of open ended transmission lines resonant at the carrier frequency around the disc connected to the grid.

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