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TRANSMISSION LINE OSCILLATOR

Filed Nov. 28, 1945

Fig. 1.

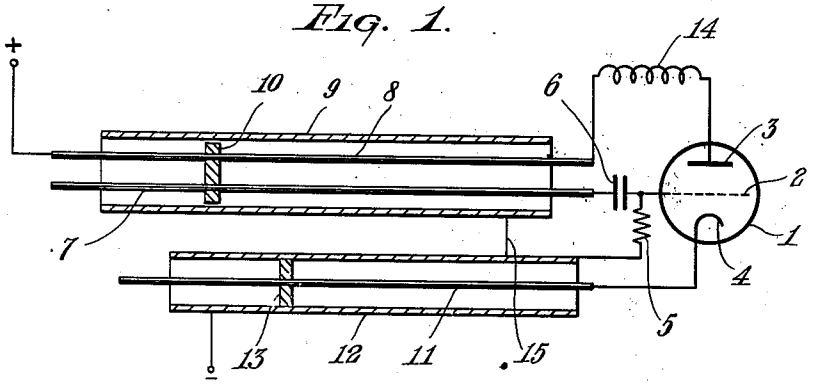


Fig. 2.

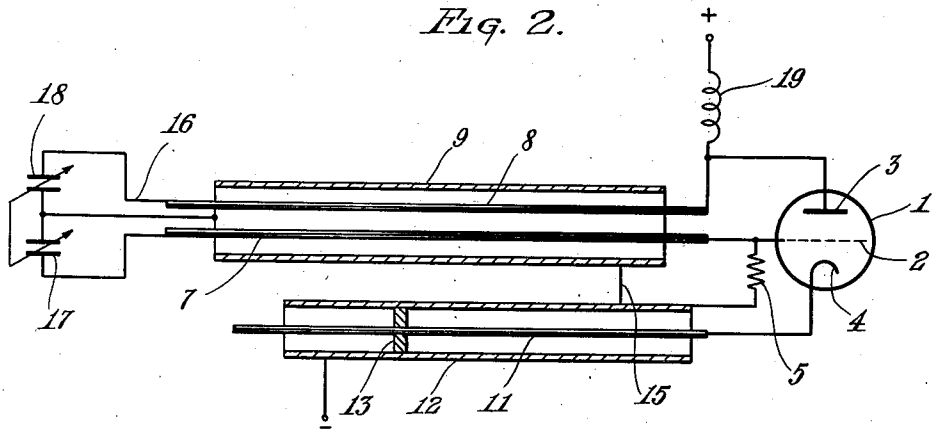
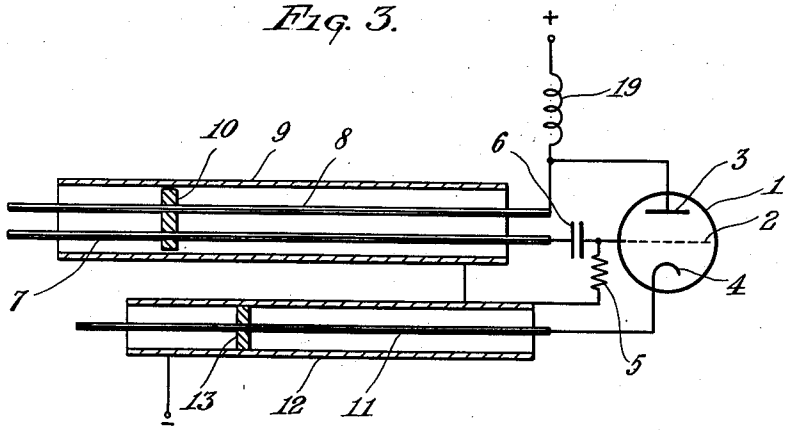


Fig. 3.



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TRANSMISSION LINE OSCILLATOR

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7 Claims. (Cl. 250—36)

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The present invention relates to electric oscillator circuits particularly for use at ultra-high frequencies in which the oscillations produced have their frequency determined wholly or partly by transmission line systems.

One known circuit arrangement of this type uses a triode valve, or a valve connected to operate as a triode, with the anode and grid connected respectively to points at or near the ends of a symmetrical two-conductor transmission line enclosed in a conducting sheath, the cathode of the valve being connected to a single-conductor transmission line enclosed in a conducting sheath, the said sheaths of the two transmission lines being connected together and if necessary being earthed. The word "connected" as used herein is to be understood as implying in its results a junction which is effective electrically at least for the operating frequency of the circuit. The frequency at which the circuit oscillates may be adjusted in known manner by varying the effective length of the two-conductor transmission line. The intensity of oscillation may be adjusted by varying the effective length of the single-conductor transmission line.

The object of the present invention is to increase the frequency range obtained with adjustment of the effective length of the two-conductor transmission line for a fixed setting of the effective length of the single-conductor transmission line.

According to the invention the two conductors of the two-conductor transmission line are arranged to be electrically unbalanced with respect to the conducting sheath enclosing them. This result may be achieved either by geometrical asymmetry, in that for example the two conductors have unequal cross-sections and/or are disposed asymmetrically with respect to the conducting sheath enclosing them, or by purely electrical asymmetry, or by a combination of both.

As an example of electrical asymmetry, in an arrangement in which adjustment of frequency of the oscillator circuit is achieved by having two ganged variable condensers or inductors connected each between the conducting sheath of the two-conductor transmission line and a point on one of the two conductors, so that the effective length of the said transmission line may be varied, the two variable condensers or inductors are electrically unequal.

In another form of the invention a condenser or inductor having appreciable reactance at the frequency of operation of the circuit is inserted between one of the said two conductors and the corresponding electrode of the triode valve.

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In order that the invention may be better understood, reference will now be made to the accompanying drawing in which:

Fig. 1 shows a circuit arrangement including a reactance between one of the conductors and the anode

Fig. 2 shows a circuit arrangement including ganged variable condensers between the two conductors and the conducting sheath.

Referring first to Fig. 1, the triode valve referred to above is shown by 1, its grid, anode and cathode being denoted by 2, 3 and 4 respectively. The grid is joined to a grid leak 5 and condenser 6 which serve to produce automatic bias when the triode is generating oscillations. Condenser 6 will have negligible reactance at the oscillation frequency. A two-conductor transmission line has two conductors 7, 8 arranged preferably symmetrically with respect to a conducting sheath 9. Conductor 7 is joined to the condenser 6 as shown while conductor 8 is connected by way of inductance 14 to anode 3. The cathode 4 is joined to the single conductor 11 contained in conducting sheath 12. Sheaths 9 and 12 are connected together as shown schematically by lead 15. Conducting bridge 10 controls the effective length of the two-conductor line 7, 8 and therefore the operating frequency of the oscillator circuit. Bridge 10 in this example should not contact with sheath 9. A positive potential may be applied to the anode 3 at the end 16 of conductor 8. Conducting bridge 13 across the conductor 11 and sheath 12 controls by its position in known manner the intensity at which the circuit oscillates. The negative pole of the source providing the above-mentioned positive potential is connected to sheath 12 as shown.

The inductor 14 is arranged to have appreciable reactance at the operating frequency of the oscillator circuit with the object of providing the unbalance of the two-conductor transmission line 7, 8 referred to earlier which constitutes the present invention. The value of this inductance is best obtained by experiment.

Using the circuit described above with reference to Fig. 1, it has been found that a larger frequency range may be covered by adjustment of bridge 10 for a given fixed position of bridge 13 without the oscillator ceasing to oscillate, or oscillating at an insufficient intensity, than when the inductor 14 is removed.

In the modified circuit of Fig. 2, the inductor 14 and the bridge 10 are omitted, but electrically unequal ganged condensers 17, 18 are connected between the sheath 9 and the two conductors 7 and 8 respectively, and an impedance 19 which

is high at the operating frequency, e. g. a radio-frequency choke, is provided in the positive lead to the anode but not between the anode 3 and the conductor 8.

In the circuit of Fig. 3, a transmission line electrically unbalanced with respect to the sheath is obtained by disposing conductors 7 and 8 of like diameter asymmetrically with respect to sheath 9. The circuit is otherwise identical with that of Fig. 1 except that inductor 14 is omitted.

I claim:

1. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, said conductors being in an electrically unbalanced relationship with respect to said sheath, and a single-conductor transmission line comprising a conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath.

2. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, said conductors being in an electrically unbalanced relationship with respect to said sheath, a single-conductor transmission line comprising a conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath, and means to adjust the effective length of the conductors of said two-conductor transmission line to adjust the frequency of the oscillation generator.

3. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, said conductors having identical diameters and one conductor being spaced at a greater distance from the sheath than the other conductor to produce an electrically unbalanced relationship with respect to said sheath, a single conductor transmission line comprising a conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath, and means to adjust the effective length of the conductors of said two-conductor transmission line to adjust the frequency of the oscillation generator.

4. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, a variable reactor connected between said first conductor and said sheath, a second variable reactor connected between said second conductor and said sheath, one of said reactors having a value greater than that of the other of said reactors and said reactors being mechanically coupled together to maintain said conductors in an electrically unbalanced relationship with respect to said sheath, and a single-conductor transmission line comprising a third conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath.

5. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, a variable capacitor connected between said first conductor and said sheath, a second variable capacitor connected between said second conductor and said sheath, one of said capacitors having a value greater than that of the other of said capacitors and said capacitors being mechanically coupled together to maintain said conductors in an electrically unbalanced relationship with respect to said sheath, and a single-conductor transmission line comprising a third conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath.

6. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, a reactor interposed between said first conductor and said anode to maintain said conductors in an electrically unbalanced relationship with respect to said sheath, a single-conductor transmission line comprising a conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath, and means to adjust the effective length of the conductors of said two-conductor transmission line to adjust the frequency of the oscillation generator.

7. An oscillation generator circuit arrangement comprising an electron discharge device having a cathode, a grid and an anode, means to apply operating potentials to said discharge device, a two-conductor transmission line comprising a first conductor coupled to said anode, a second conductor coupled to said grid and a sheath surrounding said conductors, an inductor interposed between said first conductor and said anode to maintain said conductors in an electrically unbalanced relationship with respect to said sheath, a single-conductor transmission line comprising a conductor coupled to said cathode and a second sheath surrounding said third conductor and coupled to said first sheath, and means to adjust the effective length of the conductors of said two-conductor transmission line to adjust the frequency of the oscillation generator.

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