

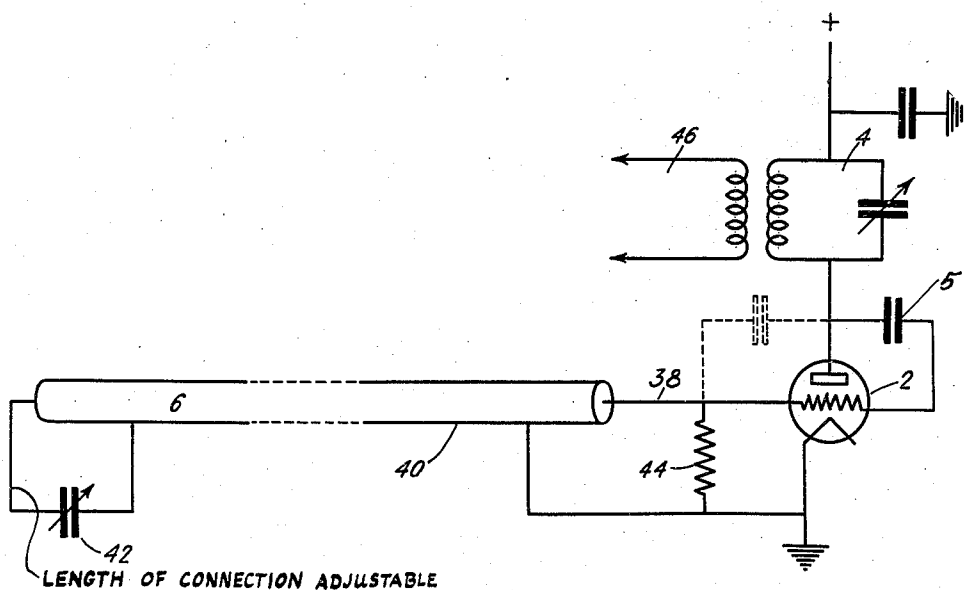
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OSCILLATORY CIRCUIT

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2,138,161

OSCILLATORY CIRCUIT

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Original application May 1, 1931, Serial No. 534,255, now Patent No. 2,017,093, dated October 15, 1935. Divided and this application March 19, 1935, Serial No. 11,896. Renewed October 5, 1937. In Australia April 18, 1932

24 Claims. (Cl. 250—36)

This invention is a division of my copending application Serial No. 534,255, filed May 1, 1931, which has issued as United States Patent No. 2,017,093, dated October 15, 1935, and relates to high frequency circuits, particularly to oscillatory circuits and concentric frequency control transmission lines therefor.

In my United States Patent No. 1,945,546, granted February 6, 1934, I have described a system employing a resonant transmission line for frequency control whereby the frequency of oscillations generated by the generator is maintained constant. The frequency controlling action of the line may be attributed to the fact that the line forms the equivalent of a sharply tuned resonant circuit whose reactance changes rapidly with change of frequency and which change or reactance may be utilized to keep the frequency of an oscillator relatively constant.

One of the objects of the present invention is to provide an improved frequency control transmission line and/or circuit.

A further object of my present invention is to provide an improved form of resonant line associated with an electron discharge device oscillator which line shall be radiationless and free from pick-up of extraneous alternating current energies which might affect the operation of the oscillator.

According to the present invention, the resonant line is a low loss, radiationless affair, made of an inner conductor and, preferably, a concentric hollow outer conductor whereby standing waves on the conductors (out of phase) neutralize each other, thereby preventing radiation. The line is a low loss affair and has uniformly distributed inductance and capacity and consequently may be employed for maintaining to a high degree of constancy the frequency of oscillations generated by an electron discharge device system. The line has the effect of a sharply tuned resonant circuit and therefore its reactance changes rapidly with change in frequency, and it is this characteristic which is utilized to keep the frequency of the oscillator constant. The resonant frequency of the line is determined chiefly by the length of the line, and for this reason it is important that the length be kept constant in order to maintain a high degree of frequency stability.

Other objects, as well as features and advantages, will appear in the subsequent detailed description which is accompanied by a single drawing showing an oscillation generator circuit equipped with the improved concentric frequency

control transmission line in accordance with the principles underlying the invention.

The single figure of the drawing illustrates a frequency controlled oscillator employing a concentric, radiationless conductor in accordance with the principles of the invention.

Referring to the drawing, the long line 6 is made up of an inner conductor 38 and an outer concentric conductor or pipe 40 both being joined together for radio frequency currents by blocking condenser 42. The long line, as shown, is connected across the grid to cathode resistor 44, whereby it exerts a controlling effect upon the frequency of oscillations generated. It should be understood that resistor 44 may have a choke coil in series and a condenser in parallel with it for biasing purposes. Also, the condenser 42, or the length of connections to it may be made variable for obtaining exact adjustment of frequency, or, if desired, the line may have a slidably adjustable section, like a trombone to serve the same purpose. By virtue of the concentric arrangement of the resonant line, radiation or pick-up from other sources is prevented. The inherent capacity of electron discharge device 2 is indicated by the dotted lines, and, if this is insufficient to start oscillations, it may be supplemented by a capacity 5 connected in parallel to the anode and grid of tube 2. As indicated, output energy may be taken from a circuit 46 inductively coupled to the tuned output circuit 4 of electron discharge device oscillator 2. Obviously, any of the other well known methods of coupling may also be used.

Line 6 is preferably made at least a plurality of half wave lengths long at the operating frequency.

What is claimed is:

1. An oscillation generator comprising an electron discharge device having a cathode and a pair of cold electrodes, said cold electrodes being regeneratively coupled together, an output circuit having inductance and capacitance connected between one of said cold electrodes and said cathode, and a frequency stabilizing circuit connected between said other cold electrode and said cathode, said frequency stabilizing circuit comprising a linear tube, and a linear conductor within said tube, and adjustable means coupling said tube and conductor together at points removed from the points of connection of said stabilizing circuit to said cathode and last cold electrode for adjusting the frequency of said generator.

2. An oscillation generator comprising a multi-electrode device having an anode, a cathode and

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a control grid, a resistance connected between said control grid and cathode, a circuit having inductance and capacitance connected between said anode and cathode, and a frequency stabilizing circuit connected to said cathode and control grid, said frequency stabilizing circuit comprising a straight metallic tube, and a coaxial conductor within said metallic tube, said tube and conductor being at least a plurality of half wave lengths long at the frequency of the generator.

3. An oscillation generator comprising a multi-electrode device having anode, cathode and grid electrodes, a circuit having inductance and capacitance connected between said anode and cathode electrodes, a straight, metallic tube connected to said cathode electrode, and a substantially straight conductor lying within said tube connected to said grid electrode, said tube and conductor being at least a plurality of half wave lengths long at the frequency of the generator.

4. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a circuit having inductance and capacitance connected between the anode and cathode, a resistance connected between the grid and cathode, a straight metallic tube connected to said cathode and to ground, and a substantially straight conductor lying within said tube connected to said grid, said tube and conductor being at least a plurality of half wave lengths long at the frequency of the generator.

5. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a circuit having inductance and capacitance connected between said anode and cathode, a resistance connected between said grid and cathode, said cathode being grounded, a straight metallic tube, means grounding said tube, a substantially straight conductor lying within said tube, and means for connecting said conductor to said grid, said tube and conductor being at least a plurality of half wave lengths long at the frequency of the generator.

6. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a tuned circuit comprising an inductance shunted by a condenser connected between said anode and cathode, a resistance connected between said grid and cathode, a frequency stabilizing means comprising a straight cylindrical metallic tube connected to said cathode, a straight conductor lying within said tube connected to said grid, and a condenser connecting the end of said conductor removed from said grid to said cylindrical metallic tube.

7. An oscillation generator comprising a multi-electrode device having anode, cathode and grid electrodes, a tuned output circuit having inductance and capacity connected between said anode and cathode electrodes, a hollow metallic tube connected to said cathode electrode, a substantially straight conductor lying within and spaced from said tube connected to said grid electrode, a reactance connecting the end of said conductor removed from said grid to said tube, and a feedback capacity coupled between said anode and grid.

8. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a tuned circuit comprising an inductance shunted by a condenser connected between said anode and cathode, a resistance connected between said grid and cathode, a frequency stabilizing means comprising a straight cylindrical metallic tube connected to said cathode, a straight

conductor lying within said tube connected to said grid, and a condenser connecting the end of said conductor removed from said grid to said cylindrical metallic tube, said tube and conductor being at least a plurality of half wave lengths long at the operating frequency.

9. A system in accordance with claim 6 characterized in this that said last condenser is variable for obtaining exact adjustment of the frequency of said oscillation generator.

10. An oscillation generator comprising an electron discharge device having an anode, cathode and grid, a tuned output circuit coupled to said anode, and a frequency stabilizing circuit coupled to said grid and cathode, said stabilizing circuit comprising a pair of long, coaxial, concentric conductors of unvariable length at least a plurality of half wave lengths long at the operating frequency.

11. An oscillation generator comprising an electron discharge device having a cathode and a grid, a frequency stabilizing circuit comprising a pair of coaxial concentric conductors at least a plurality of half wave lengths long at the frequency of the generator, connections from said grid and cathode to points on said conductors substantially near one of their adjacent ends, and variable means for coupling said conductors together at points substantially near their other adjacent ends for adjusting the frequency of the oscillation generator.

12. An oscillation generator comprising a multi-electrode device having anode, cathode and grid electrodes, a tuned circuit having inductance and capacitance connected between said anode and cathode electrodes, a metallic tube connected to said cathode electrode, and a straight conductor lying within said tube and connected to said grid electrode, said tube and conductor being at least a plurality of half wave lengths long at the frequency of the generator, and adjustable means coupling said tube and conductor together at points removed from the points of connection thereof to said cathode and grid electrode for adjusting the frequency of said generator.

13. An oscillation generator comprising an electron discharge device having anode, cathode, and grid electrodes, a tuned output circuit coupled between said anode and cathode, and a frequency controlling circuit in the form of concentric inner and outer straight conductors having a length such that said conductors control the frequency of said oscillation generator, one of said conductors being coupled to said cathode and the other to said grid.

14. An oscillation generator comprising an electron discharge device having anode, cathode and grid electrodes, a tuned output circuit coupled to said anode and cathode, and a frequency controlling element in the form of a pair of coaxially arranged parallel straight conductors, each at least a plurality of half wave lengths long at a desired operating frequency, said conductors being coupled to said grid and cathode.

15. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a tuned circuit connected between said anode and cathode, a resistance connected between said grid and cathode, a frequency stabilizing means comprising a straight cylindrical metallic tube connected to said cathode, a straight conductor lying within said tube connected to said grid, and a condenser connecting the end of said conductor removed from said grid to said cylindrical metallic tube.

16. An oscillation generator comprising an

electron discharge device having a cathode and a grid, a frequency stabilizing circuit comprising a pair of coaxial concentric conductors, connections from said grid and cathode to points on said conductors substantially near one of their adjacent ends, and means for coupling said conductors together at points substantially near their other adjacent ends for adjusting the frequency of the oscillation generator.

17. An oscillation generator comprising an electron discharge device having anode, cathode, and grid electrodes, a tuned output circuit coupled between said anode and cathode, and a frequency controlling circuit in the form of a pair of coaxially arranged, parallel, straight conductors, one of said conductors being coupled to said cathode and the other to said grid, and means for adjustably coupling said conductors together.

18. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a circuit having inductance and capacity connected between said anode and cathode, a frequency stabilizing means comprising a straight cylindrical metallic tube connected to said cathode, a straight conductor lying within said tube, a connection near the cathode connection to said tube from said inner conductor to said grid, and means capacitively coupling the ends of said conductor and tube removed from said grid and said cathode connections.

19. An oscillation generator comprising an electron discharge device having anode, cathode, and grid electrodes, a high frequency output circuit connected to said anode and cathode, a frequency controlling circuit in the form of a pair of coaxially arranged inner and outer straight conductors, said inner and outer conductors being coupled at adjacent ends to said grid and cathode, and means capacitively coupling said conductors together substantially at the other adjacent ends.

20. An oscillation generator comprising a multi-electrode device having anode, cathode and grid electrodes, a tuned output circuit having inductance and capacity connected between said anode and cathode electrodes, a hollow metallic tube connected to said cathode electrode, a substantially straight conductor lying within and

spaced from said tube connected to said grid electrode, a reactance connecting the end of said conductor removed from said grid to said tube, and a capacity between said anode and grid for establishing feed-back.

21. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a circuit having inductance and capacity connected between said anode and cathode, a resistance connected between said grid and cathode, a frequency stabilizing means comprising a straight cylindrical metallic tube connected to said cathode, a straight conductor lying within said tube connected to said grid, and a condenser connecting the end of said conductor removed from said grid to said cylindrical metallic tube.

22. An oscillation generator comprising an electron discharge device having a cathode and a grid, a frequency stabilizing circuit comprising a pair of inner and outer coaxial conductors, connections from said grid and cathode to points on said conductors substantially near one of their adjacent ends, and variable means for coupling said conductors together at points substantially near their other adjacent ends for adjusting the frequency of the oscillation generator.

23. An oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, a tuned circuit connected between said anode and cathode, a frequency stabilizing means comprising a straight cylindrical metallic tube connected to said cathode, a straight conductor lying within said tube connected to said grid, and a condenser connecting the end of said conductor removed from said grid to said cylindrical metallic tube.

24. An oscillation generator comprising an electron discharge device having anode, cathode, and grid electrodes, a tuned output circuit coupled between said anode and cathode, and a frequency controlling circuit in the form of a pair of coaxially arranged inner and outer straight conductors, said inner conductor being coupled to said grid and said outer conductor coupled to said cathode, and means for adjustably coupling said conductors together.

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