May 8, 1934. J. B. DOW 1,957,446

OSCILLATOR SYSTEM

Filed Feb. 13, 1931

FIG. 1

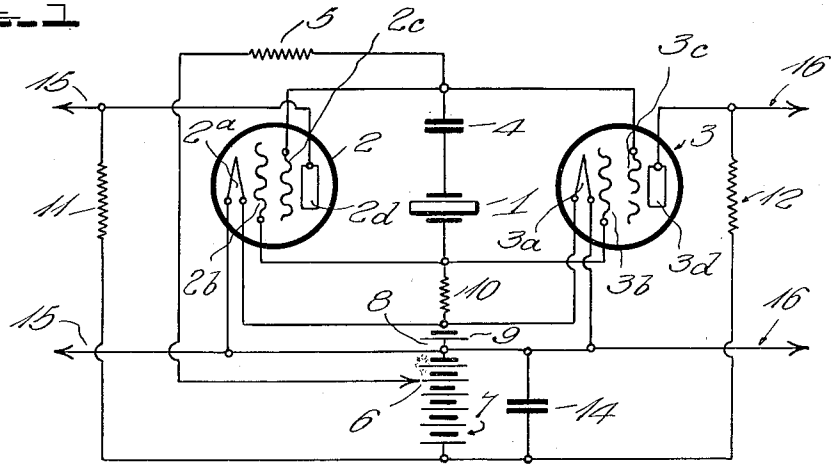


FIG. 2

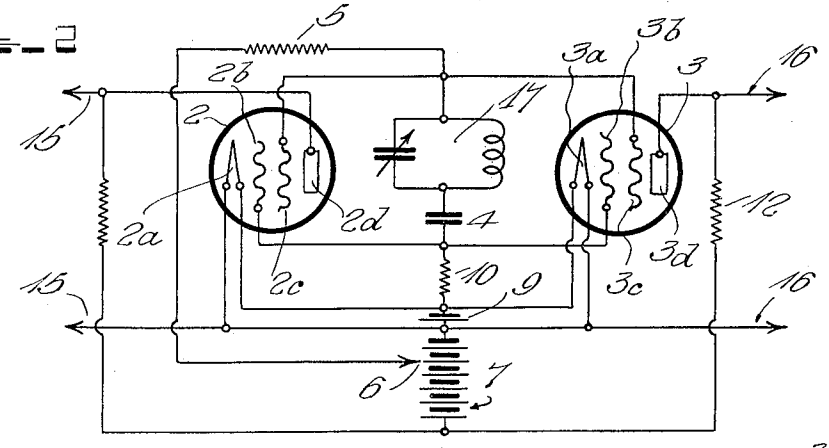
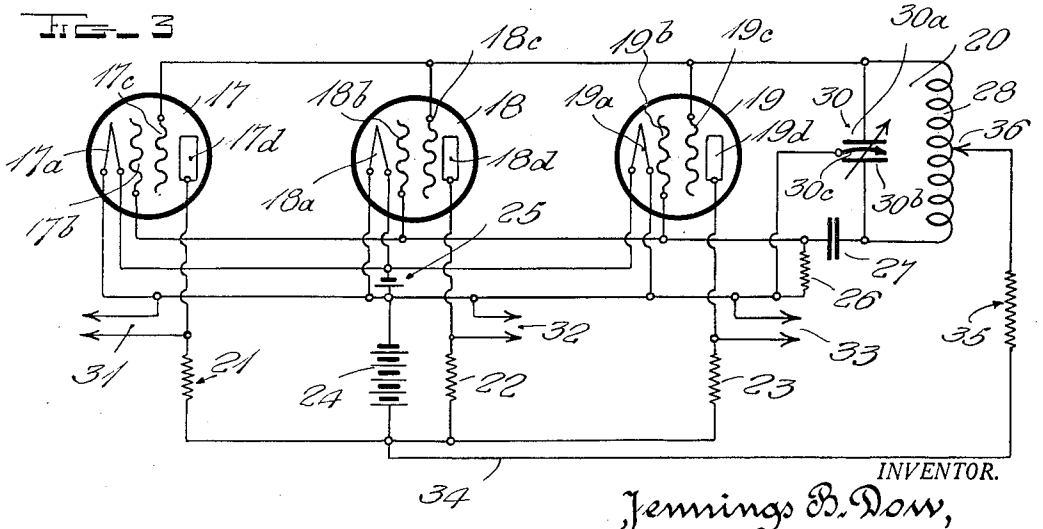


FIG. 3



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OSCILLATOR SYSTEM

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12 Claims. (Cl. 250—36)

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My invention relates broadly to oscillator systems and more particularly to a control system for a multiplicity of signaling circuits.

One of the objects of my invention is to provide a circuit arrangement for an oscillator system for coordinating the operation of a multiplicity of signaling channels.

Another object of my invention is to provide a circuit arrangement for an oscillator system having means for transmitting constant frequency oscillations to a multipicity of circuits from a common electromechanical vibrator.

Still another object of my invention is to provide a circuit arrangement which may be employed as an excitation source for a multiplicity of signal transmitters which may be tone modulated for multiplex transmission on one or more frequencies differing from the exciting frequency by amounts equal to the frequencies of modulation.

A further object of my invention is to provide a circuit arrangement for a high frequency oscillator in which a single frequency may be established and subsequently multiplied to desired harmonic frequencies for operation of signaling channels simultaneously under control of the same master oscillator system.

Other and further objects of my invention reside in the circuit arrangement for an oscillator system with multiple feed circuits extending therefrom as set forth more fully in the specification hereinafter following by reference to the accompanying drawing, in which:

Figure 1 diagrammatically shows an oscillator system controlled by a piezo-electric crystal in accordance with the principles of my invention; Fig. 2 illustrates a modified form of oscillator circuit constructed in accordance with my invention; and Fig. 3 illustrates a further modification of the oscillator system of my invention wherein energy may be delivered to a large number of channels without reaction upon the oscillator circuit.

My invention provides means in which a single frequency determining element such as a piezo-electric crystal or a resonant circuit may control several independent sources of radio frequency energy. Among the important applications of the multiple output oscillator circuit of my invention are the following:

(*a*) The excitation of several radio transmitters from a single frequency source, the various transmitters being subsequently tone modulated for multiplex transmission on one or more frequencies differing from the exciting frequency by amounts equal to the frequencies of modulation.

(*b*) The excitation of several radio transmitters from a single frequency source, the exciting frequency being subsequently multiplied to the exact harmonic frequencies required in the various transmitters.

Referring to the drawing in detail, reference character 1 designates a piezo-electric crystal element which controls the circuits of two electron tubes which I have represented at 2 and 3. The electron tube 2 includes a cathode 2*a*, a control grid 2*b*, an inner anode 2*c* and an outer anode 2*d*. The electron tube 3 contains a similar arrangement of elements, that is, cathode 3*a*, control grid 3*b*, inner anode 3*c* and outer anode 3*d*. The piezo-electric crystal element 1 connects through a blocking condenser 4 in the circuit extending between the control grids 2*b* and 3*b*, and the inner anodes 2*c* and 3*c*. The inner anodes 2*c* and 3*c* are maintained at a suitable potential by virtue of their connection through the impedance 5 to the point 6 in the high potential source 7, the negative side of which is connected to the cathode circuit at the point 8 as shown. The cathodes of each of the tubes are heated from a source of potential shown at 9. A resistance 10 is provided connected between the cathode circuit and the control electrode 2*b* and 3*b* for impressing the required bias potential upon the control grids. The output circuits of each of the tubes are completed through impedances indicated at 11 and 12 connected to the source of potential 7 as shown. The impedances 11 and 12 may be in the form of resistance, inductance or resonance circuits. I have generally found that it is desirable to make the impedances 11 and 12 inductive. The source of potential 7 which supplies energy for the inner anodes 2*c* and 3*c* by connection 6 and for the outer anodes 2*d* and 3*d* is shunted by means of by-pass condenser 14. The output feeders for deriving oscillations from the oscillation system under control of piezo-electric crystal element 1 are shown at 15 and 16. In lieu of the piezo electric-crystal element 1 I may employ any other form of electromechanical vibrator, the oscillations of which are sustained in the associated electron tube circuits. In Fig. 2, I have shown a resonance circuit 17 connected to the oscillator system for determining the frequency of oscillation of the system and the frequency of the oscillating current delivered at terminals 15 and 16.

In Fig. 3 I have shown an oscillator system by which constant frequency oscillations may be supplied to a plurality of separate feed circuits. I have illustrated electron tubes 17, 18 and 19

having their inner anodes 17c, 18c and 19c connected together to one end of the resonant circuit 20. The opposite end of the resonant circuit 20 is connected to the control grids 17b, 18b and 19b of electron tubes 17, 18 and 19 through the condenser 27. The outer anodes 17d, 18d and 19d of the several tubes each connect through the impedance elements 21, 22 and 23 to the source of potential shown at 24, the opposite side of which connects to the cathode circuit as shown at 25. A connection 34 is taken from the source of potential 24 through the impedance 35 to the midpoint 36 of the inductance 28 for regulating the potential supplied to the inner anodes 17c, 18c and 19c. The cathode circuit including cathodes 17a, 18a and 19a is energized from source 25. The control grids 17b, 18b and 19b are biased through resistance 26. The resonant circuit 20 includes the inductance 28 and the split stator condenser 30 having fixed plates 30a and 30b connected to the opposite ends of inductance 28 and movable plate 30c variable in spacial relation with respect to plates 30a and 30b for adjusting the frequency of oscillation to the desired value.

I have illustrated the feed circuits extending from the oscillator system at three separate positions of the circuit, that is at 31, 32 and 33 between a point in the output circuit of each electron tube and the common cathode circuit for all of the electron tubes. The frequency of oscillation of the electron tube systems is determined by the adjustment of the resonance circuit 20. Resonant circuit 20 in cooperation with the control grids 17b, 18b and 19b and the inner anodes 17c, 18c and 19c control the flow of electrons to the outer anodes 17d, 18d, and 19d and thereby the radio frequency current pulsations in the several output circuits 21, 22 and 23 and the associated feed circuits 31, 32 and 33. As the output circuits are not only independent of one another but form no part of the circuit in which the conditions for oscillation are satisfied, variable loading conditions in any of the several output circuits may be made to have little or no effect upon any other portion of the system.

While I have described my invention in certain preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims. The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In an oscillating electron tube circuit comprising a plurality of electron tubes each containing a cathode element, a control grid element and an anode element, common circuits between similar elements of each tube, a frequency determining means connected between two of the said common circuits, an auxiliary anode element associated with the electron stream of each tube and means for deriving energy from each tube, said means comprising independent circuits disposed between said auxiliary anode element of each tube and the common circuit connecting said cathode elements.

2. In an oscillating electron tube circuit comprising a plurality of electron tubes each containing a cathode element, a control grid element and an anode element, circuits common to similar elements of each tube, a frequency determining means connected between the circuit common to the said control grid elements and the circuit common to the said anode elements, an auxiliary anode element associated with the electron stream of each tube and means for deriving energy from each tube, said means comprising independent circuits disposed between said auxiliary anode element of each tube and the common circuit connecting said cathode elements.

3. In an oscillating electron tube circuit comprising a plurality of electron tubes each containing a cathode element, a control grid element and an anode element, circuits common to similar elements of each tube, an electromechanical vibrator arranged between the circuit common to said control grid elements and the circuit common to said anode elements, said cathode and anode elements being connected to selected sources of electric energy for the generation of oscillations, each of the said electron tubes containing a second anode element, means for deriving energy independently from each tube, said means comprising independent circuits disposed between each of said second anode elements and said common circuit connecting said cathode elements and means for maintaining the said second anode element of each tube at a suitable positive potential with respect to the cathode.

4. In an oscillating electron tube circuit comprising a plurality of electron tubes each containing a cathode element, a control grid element, and an anode element, circuits common to similar elements of each tube, a resonant circuit arranged between the circuit common to said control grid elements and the circuit common to said anode elements, the said combination being so arranged and connected to suitable sources of electric energy as to generate oscillations, each of the said electron tubes containing a second anode element, means for deriving energy independently from each tube, said means comprising independent circuits disposed between each of said second anode elements and said common circuit connecting said cathode elements and means for maintaining the said second anode element of each tube at a suitable positive potential with respect to the cathode.

5. A source of high frequency energy comprising suitable sources of supply potential, a plurality of electron tubes having cathode, control grid, screen-like anode and second anode elements, a single frequency determining means common to all of said tubes, oscillation generating means comprising said cathode, control grid and screen-like anode elements of each tube and their circuit connections to said sources of supply potential and to said frequency determining means, and means for deriving high frequency energy from each of said tubes, said means comprising an independent circuit extending between each of said second anode elements and said oscillation generating means.

6. In an oscillator system, a plurality of electron tubes each having a cathode, an anode and at least two other electrodes, an independent output circuit connected with the anode of each tube respectively, a single means common to all of said tubes for sustaining continuous oscillations of a constant frequency in each of said tubes, said means being connected in parallel to corresponding electrodes other than the anodes of the respective tubes, and a source of energy for actuating said tubes.

7. In an oscillator system, a plurality of electron tubes each having a cathode, an anode and

at least two other electrodes, an independent output circuit connected with the anode of each tube respectively, a single means common to all of said electron tubes and including a piezo-electric device for sustaining continuous oscillations of a constant frequency in each of said tubes, said means being connected in parallel to corresponding electrodes other than the anodes of the respective tubes, and a source of energy for actuating said tubes.

8. In an oscillator system, a plurality of electron tubes each having a cathode, an anode and at least two other electrodes, an independent output circuit connected with the anode of each tube respectively, a single means common to all of said electron tubes and including a resonant circuit for sustaining continuous oscillations of like phase and of a constant frequency in each of said tubes, said means being connected in parallel to corresponding electrodes other than the anodes of the respective tubes, and a source of energy for actuating said tubes.

9. In an oscillator system, a plurality of electron tubes each having a cathode, an anode and at least two other electrodes, an independent output circuit connected with the anode of each tube respectively, means including a resonant input circuit for sustaining continuous oscillations of a constant frequency in each of said tubes, said means being connected in parallel to corresponding electrodes other than the anodes of the respective tubes, and a common source of energy for actuating said tubes, said source having an impedance connection to a suitable point in said resonant input circuit.

10. In an oscillator system, means for coordinating the operation of a multiplicity of signaling channels, in combination with a corresponding multiplicity of electron tubes each having an independent output circuit connecting respectively with one of said signaling channels, said means comprising a single device common to said multiplicity of tubes for sustaining continuous oscillations of like frequency and phase in each of said tubes, the said tubes having parallel connections between corresponding electrodes other than the anodes thereof, and a connection between one of said parallel connections and each of said signaling channels.

11. In an oscillator system, means for transmitting constant frequency oscillations to a multiplicity of circuits, in combination with a corresponding multiplicity of electron tubes, each having an independent output circuit connecting respectively with one of the first said circuits, said means comprising a piezo-electric device common to said multiplicity of tubes adapted to sustain continuous oscillations of like phase and frequency in each of said tubes, the said tubes having parallel connections between corresponding electrodes other than the anodes thereof and a connection bewteen one of said parallel connections and each of said first mentioned circuits.

12. In an oscillator system, a plurality of signaling channels each adapted for tone modulation at a frequency which is an harmonic of a fundamental frequency common to all of said channels, in combination with a corresponding plurality of electron tubes each having an independent output circuit connecting respectively with one of said signaling channels and means for coordinating the operation of said signaling channels and for supplying oscillations of said fundamental frequency thereto, said means comprising a device common to said plurality of tubes for sustaining continuous oscillations of like frequency and phase in each of said tubes, the said tubes having parallel connections between corresponding electrodes other than the anodes thereof and a connection between one of said parallel connections and each of said signaling channels.

JENNINGS B. DOW.