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MODULATION

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Fig. 1

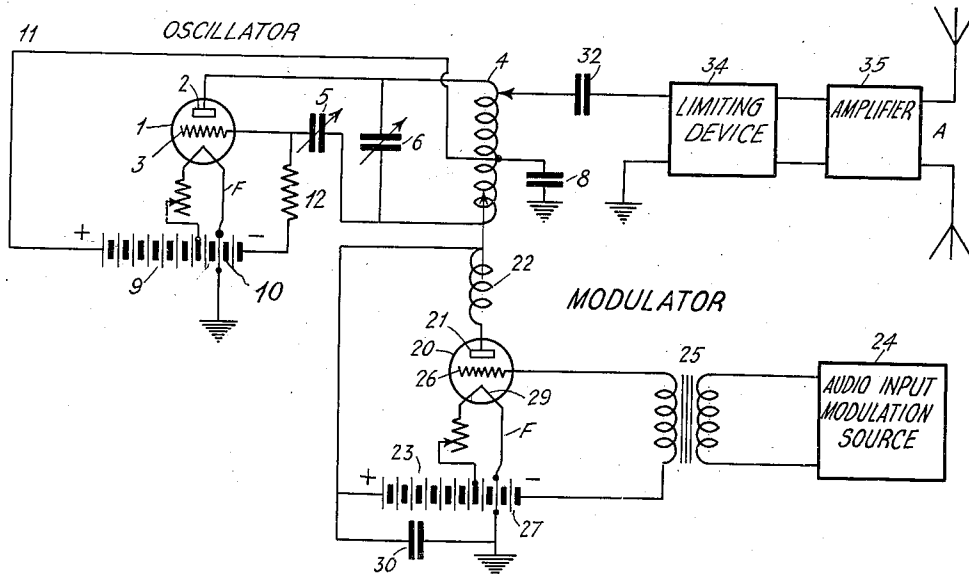
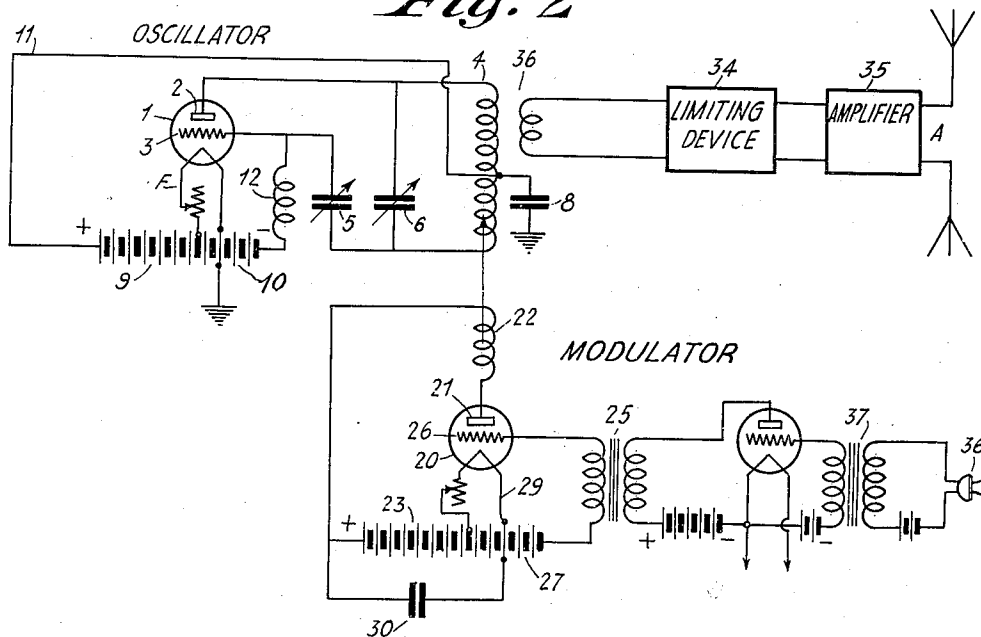


Fig. 2



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MODULATION

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1 Claim. (Cl. 179—171)

This invention relates to signalling and more in particular to signalling by oscillations the frequency of which is altered in accordance with the amplitude of the signals.

5 More in detail, this invention relates to a new and improved means of producing high frequency oscillations by means of an oscillation generator and for producing signal oscillations which determine the frequency of the oscillations generated
10 by the high frequency generator.

In one form of my invention this is accomplished by providing a thermionic oscillator having coupled input and output circuits. The output circuit of this generator is conductively coupled through a capacity to an amplitude limiter
15 so that the amplitude of the oscillations produced by the generator may be held at a constant value by the amplitude limiter. Signal modulations are impressed on the input circuit of a second thermionic tube. The output circuit of the last named
20 tube includes an inductance which is inductively coupled to the inductances in the input and output circuit of the thermionic oscillator generator. The oscillator is biased to a point such that continuous oscillations are produced. The normal
25 bias applied to the grid of the second tube is such that a current of predetermined intensity will flow in the plate circuit thereof. A part of this current will be rectified current resulting from current induced from the oscillator circuit windings
30 into the inductance in the plate circuit of the second tube. The oscillator will then generate oscillations at frequencies determined by the amount of current transferred from the oscillator inductance to the inductance in the plate circuit of
35 the second tube. When modulated signals are applied to the input circuit of the second tube, the characteristics thereof will vary in accordance with the nature of the modulating signals. The current in the plate circuit of the second tube will
40 consequently vary in accordance with the nature of the modulating signal. The resistance of the plate cathode circuit will change. This will result in corresponding changes in the amount of
45 rectification of the current induced from the oscillation inductances into the inductance in the plate circuit of the second tube. These changes result directly in a change in the effective inductance
50 of the oscillator circuits, and will cause a change of frequency in the oscillations generated by the oscillator. The frequency generated by the oscillation generator will vary substantially inversely as the inductance of the oscillator circuits
55 changes. In this manner any signal amplitude modulation impressed on the input circuit of the

second tube will result in frequency modulation of the oscillator. In practice, there may be some amplitude modulation of the oscillations generated in the oscillator. This effect is taken care of
5 by the amplitude limiting device connected with the output of the oscillation generator.

In the modification, the output of the oscillation generator is inductively coupled to the amplitude limiter. In both modifications signal frequencies applied to the input circuit of the second
10 tube may be amplified or not as necessity requires.

The circuit arrangement and the operation of my invention in its broadest aspect is as set forth above. For purposes of detailed illustration,
15 specific embodiments of my invention will be set out more in detail hereinafter.

In setting forth more in detail the present invention, reference will be made to the attached drawing throughout which like reference characters indicate like parts, and in which:

Figure 1 shows one embodiment of the invention; while

Figure 2 shows a modification of the arrangement in Figure 1.

Referring more particularly to the drawing, 1
25 indicates a thermionic oscillation generator having an anode 2, and a control electrode 3 connected through an inductance 4 and a variable capacity 5 in a well known manner to produce
30 sustained oscillations. The inductance 4, shunted by a variable condenser 6, forms the tank circuit for the oscillation generator 1. The frequency of the oscillations normally generated by 1 is determined by the inductance 4 and variable capacity 6. The circuits between the anode 2 and
35 cathode F and grid 3 and cathode F are completed by blocking condenser 8 and ground as shown. The necessary biasing potential is applied to the control electrode 3 by means of a battery 10 connected to the electrode 3 through a choking inductance 12. Direct current potential is supplied to the anode circuit of the oscillation generator by a conductor 11, the source 9 to the center tap on inductance 4.

The oscillator as shown is for purposes of illustration since, obviously, any oscillator known today can be used. For example, the tuned grid, tuned or untuned plate oscillator. With this type oscillator the modulator is associated with the
50 grid circuit.

The modulator tube 20 includes an anode 21 connected through an inductance 22 with a source of high potential 23 shunted by a bi-pass condenser 30. Inductance 22 is inductively coupled
55

as indicated with the inductance 4. The modulating frequencies from a source 24 are impressed through a transformer 25 on the input circuit of tube 20. Biasing potential is supplied to the control electrode 26 from a source 27 connected in series between the control electrode and the filament 29. The condenser 30 prevents any audio or high frequency oscillations induced from inductance 4 into inductance 22 from reaching the direct current potential source. The modulation source may include amplifiers. The frequency and amplitude of the modulating oscillations produced in 24 may be of any value.

The tank circuit of thermionic oscillator generator 1 is conductively coupled through blocking condenser 32 to an amplitude limiting device 34. This amplitude limiting device forms no part of the present invention and need not be described in detail herein. The amplitude limiting device should be such that the amplitude of the modulated signals fed thereto from the tank circuit may be maintained constant over the frequency range covered by the generator.

The operation is as follows: The oscillator generator 1 and the modulator tube 20 are energized. The oscillation generator 1 is producing oscillations at a frequency predetermined by the elements in the tank circuit 64. No modulating energy is being impressed on the input circuit of the modulator 20. The biasing potential applied to the control electrode 26 of modulator 20 by source 27 is such, however, that current of predetermined intensity flows between the anode cathode impedance of 20. The tube 20 under these conditions is conductive to a certain extent. Oscillations are being produced by the generator 1 and are induced from the inductance 4 in the tank circuit thereof to the inductance 22 in the anode cathode circuit of modulator 20. These oscillations induced in 22 will cause rectified current to flow in the anode cathode circuit of tube 20. Under these conditions, the effective inductance of 4 and 22 will be such that a certain frequency will be generated by the oscillation generator 1. Now assume that modulating frequencies of varying amplitude are impressed on the input circuit of tube 20. These amplitude modulations flowing in the input circuit thereof will vary the potential applied normally to the control electrode 26. This will result in variations at signal frequency in the impedance of tube 20. The intensity of the current flowing in the anode cathode circuit including the inductance 22 of tube 20 will vary in accordance with the above changes. Since part of this current represents the current induced from 4 to 22 which has been rectified, the amount of currents which may be induced from 4 to 22 will vary also in accordance with the variations in signal frequency. This results in corresponding changes in the effective inductance of the inductance 4 in the tank circuit of 1. The frequency generated by 1 depends in part on the inductance of the output circuit thereof and said frequency will vary substantially inversely as the inductance in 4 varies. Therefore, when signal amplitude modulation is applied

from 24 to the input circuit of 20, frequency modulation of the oscillator 1 will result. The tank circuit is conductively connected through a blocking condenser 32 to the amplitude limiting device 34 in order that in the event some amplitude modulation of the frequency generated by 1 results, it may be taken care of or eliminated to the degree necessary by the amplitude limiter 34. The output of the limiting device 34 is fed to an amplifier and/or frequency multiplier 35 and from 35 to a radiating system A or other load circuit.

The modification shown in Figure 2 is substantially the same as the modification shown in Figure 1. In Figure 2, however, the tank circuit inductance 4 is inductively coupled to the inductance 36 in the input circuit of the limiting device 34. Furthermore, in this modification, the source of signal modulations, indicated as microphone 36, is connected through the transformer 37 to a modulation frequency amplifier 38 having its output circuit connected to the primary winding of the transformer 25.

Although for purposes of illustration I have set forth in detail the arrangement and operation of several modifications of my invention, it will be understood that I do not wish to be limited thereby except as marked out in the claim appended hereto.

Having thus described my invention and the operation thereof, what I claim is:

In a system for producing frequency modulated energy, the combination of an oscillator tube having an anode, a cathode, and a control electrode, an impedance and a source of potential connected in series between said control electrode and cathode for polarizing said control electrode to a suitable operating potential, a parallel tuned circuit comprising an inductance coil and a variable condenser connected in parallel, a connection between one terminal of said parallel tuned circuit and said anode, a variable condenser connecting the other terminal of said parallel tuned circuit to said control electrode, a by-passing condenser connecting an intermediate point of said inductance coil to said cathode, means for energizing the anode of said tube, whereby oscillations are set up by said tube at a frequency dependent upon the tuning of said parallel tuned circuit, and, a circuit for varying the frequency of said parallel tuned circuit, said frequency varying circuit comprising a second vacuum tube having a plate, a grid, and a filament, a coil connected between said plate and filament, said coil being magnetically coupled to said coil of said parallel tuned circuit, a low frequency circuit interconnecting the grid and filament of said last named tube, and, a source of low frequency currents coupled to said last mentioned circuit whereby variations in the current flowing through said last mentioned vacuum tube varies by virtue of the varying current flowing through said coil connected between the plate and cathode of said last named tube, the inductance of said parallel tuned circuit and hence the frequency of the oscillations produced by said oscillator tube.

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