

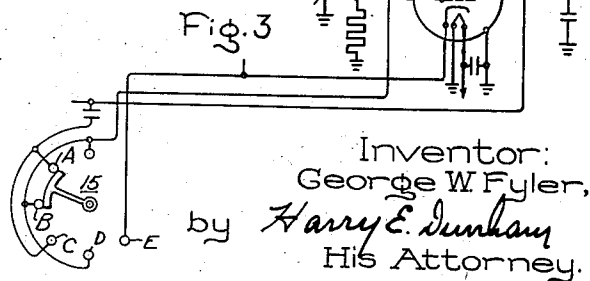
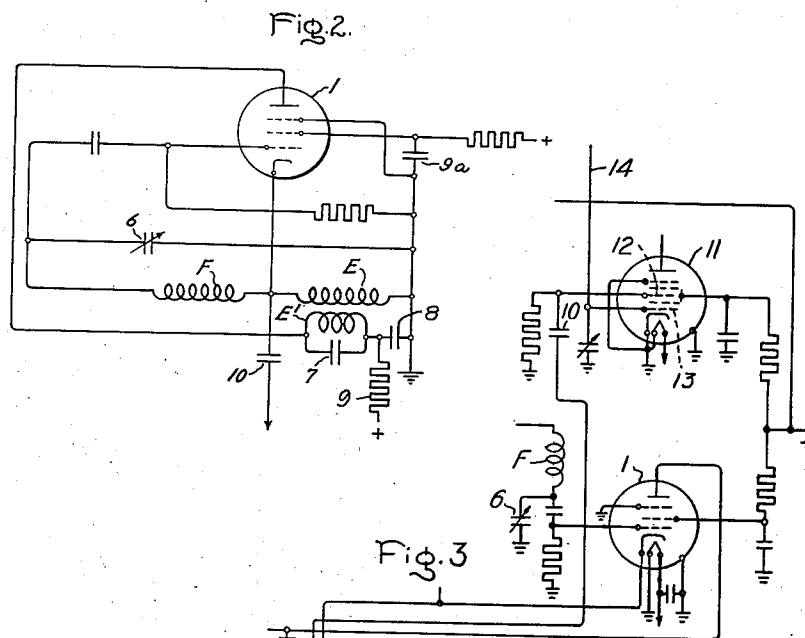
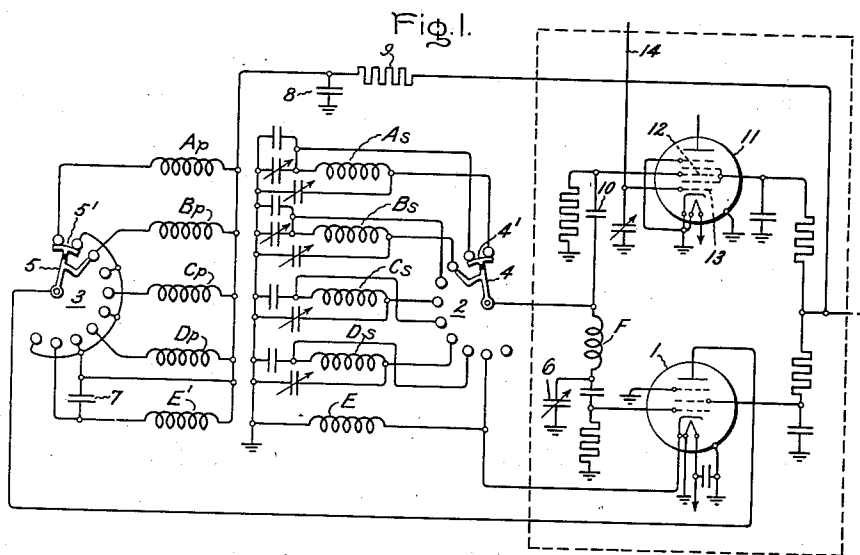
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OSCILLATION GENERATOR

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OSCILLATION GENERATOR

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My invention relates to oscillation generators and it has for one of its objects to provide an oscillation generator which is adapted for operation over a broad range of wave lengths.

5 A further object of my invention is to provide an oscillation generator adapted for operation over a number of different frequency bands including an extremely short wave band and in which the circuits necessary to effect the desired
10 changes from one band to another are considerably simplified.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 represents an embodiment of my invention; Fig. 2 represents conventionally the oscillation generator of Fig. 1 during one of its conditions of operation; and Fig. 3 represents a modification of the arrangement
25 shown in Fig. 1.

Referring to Fig. 1 I have indicated at 1 therein an electron discharge device provided with a unipotential cathode, an anode, and three grids. This electron discharge device is provided with
30 circuits whereby it is adapted to generate oscillations in any one of a plurality of frequency bands in accordance with the position of a switch 2, 3. This switch comprises a pair of movable armatures 4 and 5 each of which operates over a bank of contacts. The armature 4, in the position shown, in the drawing is adapted to connect
35 the grid of the electron discharge device to ground through an oscillating circuit B_s. If it be moved in a counter-clockwise direction over the space of two of its contacts it connects the grid to ground through an oscillating circuit C_s. Similarly if it be moved further in a counter-clockwise direction it will connect the grid to ground through oscillating circuits C_s and D_s and in its
40 ultimate position connects the grid to ground through a coil E. The oscillating circuits A_s, B_s, C_s, and D_s shown on the drawing may correspond to four different bands over which the oscillator operates when used, for example, in a
45 broadcast receiver of the superheterodyne type to produce the heterodyne electromotive force. The tuning condenser 6 whereby the frequency at which these oscillating circuits may be tuned to any desired frequency in each of the different
50 bands is connected between ground and the grid

of the discharge device and hence effectively in shunt with the oscillating circuit.

The anode of the discharge device is similarly connected through coils A_p, B_p, C_p, and D_p by means of the switch 3 which is operated in
5 unison with the switch 2, each of these coils corresponding respectively to one of the oscillating circuits and being coupled inductively to the coil of the respective oscillating circuit. Similarly in the ultimate position of the switch 5
10 the anode of the discharge device is connected through a circuit comprising coil E' and a condenser 7, in parallel, and condenser 8 to ground or through resistance 9 to the source of anode operating potential.

The band of frequencies to which the elements A_p and A_s correspond may be a band below the broadcast frequency range. Elements B_p and B_s may correspond to the broadcast band. The elements C_p and C_s and similarly D_p and D_s correspond respectively to higher frequency bands,
20 whereas the coils E and E' correspond to a band of very high frequencies, as for example a range extending from 18 to 70 megacycles. It will be observed that each of the armatures 4 and 5 is provided with a blade 4', 5' respectively, which is insulated from the remainder of the armature as shown and which engages two adjacent con-
25 tacts so that when the switch is adjusted for operation in the B band the coil A_p and the coil of oscillating circuit A_s are short circuited, and similarly when the switch is adjusted for operation in each of the other bands the coil in the band next lower in frequency is short circuited.

The oscillating circuit for the short wave band
35 corresponding to coils E and E' comprises the coil E, which is permanently connected between ground and the cathode, and in addition it comprises a coil F, which is permanently connected between the control grid and the arm of the switch 4. These coils are permanently in circuit
40 during operation of the oscillator in each of the other bands but their inductance is so small that they have no detrimental effect upon operation of the generator in those bands.

It will be observed that when the switches 2 and 3 are adjusted for operation in the A, B, C, or D band, the oscillations are produced by reason of feed-back through coils A_p, A_s, B_p, B_s, etc. in the conventional manner, the tuning being in
45 the grid circuit. When the switches 2 and 3 are adjusted for operation in the E band then the circuit is substantially that shown in Fig. 2 in which the reference characters of Fig. 1 are applied to corresponding elements of Fig. 2. It will
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be seen that the coil F is connected between the grid and cathode, the coil E between the cathode and ground, and the coil E' between the anode and ground, this coil being coupled to coil E. It will also be seen that the suppressor grid, adjacent the anode, is connected to ground and that the screen grid is connected through the usual bypass condenser 9a to ground.

Now if we consider that the impedance of the circuit E', 7 is small, or negligible, it will be seen that the circuit is substantially that commonly known as a Hartley oscillator except that the anode operates at ground potential for oscillations when switches 2 and 3 are adjusted for operation in the E band. In this case the screen grid and anode operate as a single electrode. The tuning condenser 6 completes the oscillating circuit since it is connected directly across the two coils E and F in series, that is, directly between the anode and grid.

This circuit arrangement produces very satisfactory operation in the higher frequency portion of the short wave band but it has been found that by reason of the large capacity of condenser 6, which is chosen for use in all of the bands, some difficulty is encountered in producing satisfactory operation in the lower frequency portion of the short wave band E due to the losses in the circuit 6, F, E. That is, the high circulating current through the coils E and F cause sufficient damping of the oscillating circuit to tend to render the oscillation generator unstable. It has been found, however, that this difficulty can be completely avoided by use of the circuit E', 7 in the anode circuit of the oscillator. This circuit is tuned to a frequency near, and preferably somewhat below the lowest frequency in the band, and its inductance E' is coupled to the coil E in such a way that as the frequency is reduced the impedance of the circuit E', 7 to the frequency at which the oscillator operates increases, electromotive force is supplied from the anode circuit through the coupling between coils E' and E to the oscillating circuit thereby tending to support the generation of oscillations. In this way it has been found that very stable operation may be obtained over the entire frequency band and by these means the band may be very broad and may include the entire range between 18 and 70 megacycles or even more.

It will be observed that during this operation the cathode is connected to an intermediate point on the oscillating circuit and thus oscillates above ground potential. The output circuit from the oscillator may thus be connected directly to the cathode as by a condenser 10. Referring now again to Fig. 1, this condenser 10 is shown as comprising a coupling member between the oscillator and a suitable grid electrode 12, for example, of the first detector 11 of the superheterodyne receiver in which the oscillator may be employed. A second grid 13 of this detector may be connected through conductor 14 to a portion of the receiver in which signals to be heterodyned are received. Thus during operation in this short wave band the grid 12 of the first detector 11 is connected effectively to the cathode of the oscillator. With switches 2 and 3 adjusted for operation in any other band, however, this same connection amounts to a connection to the grid of the oscillator since in all of the other bands the cathode is at essentially ground potential. This is by reason of the negligible impedance of coils E and F in the other bands.

If desired the modification of the invention il-

lustrated in Fig. 3 may be employed whereby the grid of the first detector 11 is connected to the anode of the oscillator in the A, B, C, and D bands and to the cathode in the E band. This operation is effected by an additional switch 15 which is operated in unison with the switches 2 and 3. Only so much of the remaining portion of the system is indicated in Fig. 3 as is necessary to render this operation clear from an inspection of the drawing. It will be seen that the movable element of the switch bridges adjacent contacts of its respective bank to effect the desired connections.

In the arrangements of Fig. 1 for operation in the A, B, C, and D bands the primaries A_p, B_p, C_p and D_p of the feed-back coils are untuned and their action is dependent upon close coupling with the respective secondaries and upon an anode capacity which is not too great in the frequency range in which the system is to operate. This anode capacity and the capacity between detector grid 12 and ground practically defeat satisfactory operation of these circuits at frequencies in the higher portion of the E band. It has been found, however, that with the circuit as described for use in the E band and as depicted in Fig. 2 very satisfactory operation may be had throughout the E band even though this band extends from 18 to 70 or more megacycles.

While I have shown particular embodiments of my invention it will of course be understood that I do not wish to be limited thereto since different modifications both in the circuit arrangement and in the instrumentalities employed may be made, and I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

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

1. In combination, an oscillation generator comprising an electron discharge device having an anode, a cathode and a grid, an oscillatory circuit tunable over a range of frequencies, means to cause said discharge device to support oscillations in said oscillatory circuit, said oscillations being unstable in a certain portion of said range, and means including an oscillatory circuit separate from said first-named oscillatory circuit connected between said anode and cathode fixedly tuned to a frequency near said portion of said range and coupled to said first-named oscillatory circuit.

2. The combination, in an oscillation generator, of an electron discharge device having an anode, a cathode and a grid, an oscillatory circuit tunable over a range so wide that unstable operation is produced in a portion of said range, and an oscillatory circuit tuned to a fixed frequency near said portion of said range where said unstable operation occurs, said first-mentioned circuit being connected between said anode and said grid through said second-mentioned oscillatory circuit said second-mentioned circuit being coupled to said first-mentioned circuit thereby to increase said stability of operation in said portion of said range.

3. The combination, in an oscillation generator, of an electron discharge device having an anode, a cathode and a grid, an oscillatory circuit connected between said anode and grid, said circuit being tunable over a range so wide that unstable operation is produced in a portion of said range, and means to increase the feed-back of energy from said anode to said oscillatory circuit when said oscillatory circuit is tuned in

said portion of said range to an extent sufficient to render said operation stable, said means including an oscillatory circuit connected between said anode and cathode tuned to a frequency near said portion of said range and coupled to said first-named oscillatory circuit.

4. The combination, in an oscillation generator, of an electron discharge device having an anode, a cathode, a control grid and a screen grid, an oscillatory circuit connected between said screen grid and control grid, an intermediate point thereon being connected to said cathode, said circuit being tuned to a frequency so wide that operation of said oscillation generator tends to be unstable in a portion of said range, and a tuned circuit connected between said anode and cathode and coupled to said oscillatory circuit, said last-named circuit being tuned to a frequency near said portion of said range whereby stable operation is produced throughout the entire range.

5. The combination, in an oscillation generator arranged for operation at a plurality of frequencies, of a switch for connecting said oscillation generator to operate at either of said frequencies, said oscillation generator comprising an electron discharge device having a cathode connected to ground through a coil adapted for operation at one of said frequencies, a grid connected to ground through a connection comprising a second coil adapted for operation at said one frequency, said connection further comprising said switch and an oscillatory circuit adapted for operation at a second frequency, said switch being arranged to disconnect said oscillatory circuit

from said grid and to connect the terminal of said second coil remote from said grid to said cathode, and means including a third electrode in said discharge device to cause oscillations of either frequency to be produced in accordance with the position of said switch, said frequencies being sufficiently different that said cathode is at substantially ground alternating potential during operation at one of said frequencies and at substantial alternating potential during operation at said other frequency.

6. The combination, in an oscillation generator arranged for operation at a plurality of frequencies, said oscillation generator including an electron discharge device having an anode, a cathode and a control grid, of a feed-back coil adapted for operation at one frequency having a primary winding adapted to be connected between said anode and cathode and a secondary winding adapted to be connected between said grid and cathode, means to connect said control grid during operation at said one frequency to one extremity of said secondary winding through a first coil adapted for operation at a second frequency and to connect said cathode during operation at said one frequency to the other extremity of said secondary coil through a second coil adapted for operation at said second frequency, and means to disconnect said feed-back coil during operation at said second frequency from said grid and anode and to connect said grid to said cathode during operation at said second frequency through said first coil and said anode to said cathode through said second coil.

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