Jan. 28, 1941. C. J. BOERS 2,230,216

HIGH FREQUENCY OSCILLATION GENERATOR

Filed Feb. 17, 1938

Fig. 1

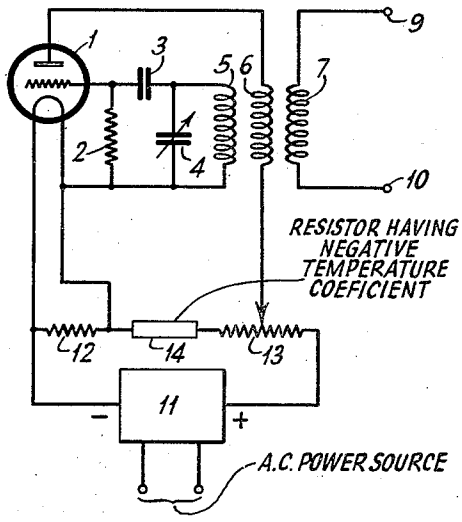


Fig. 2

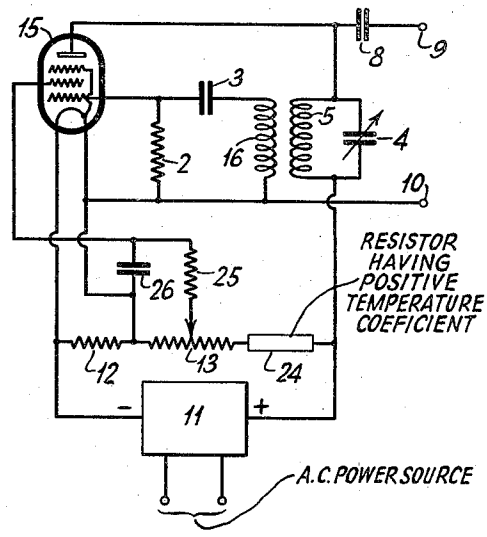
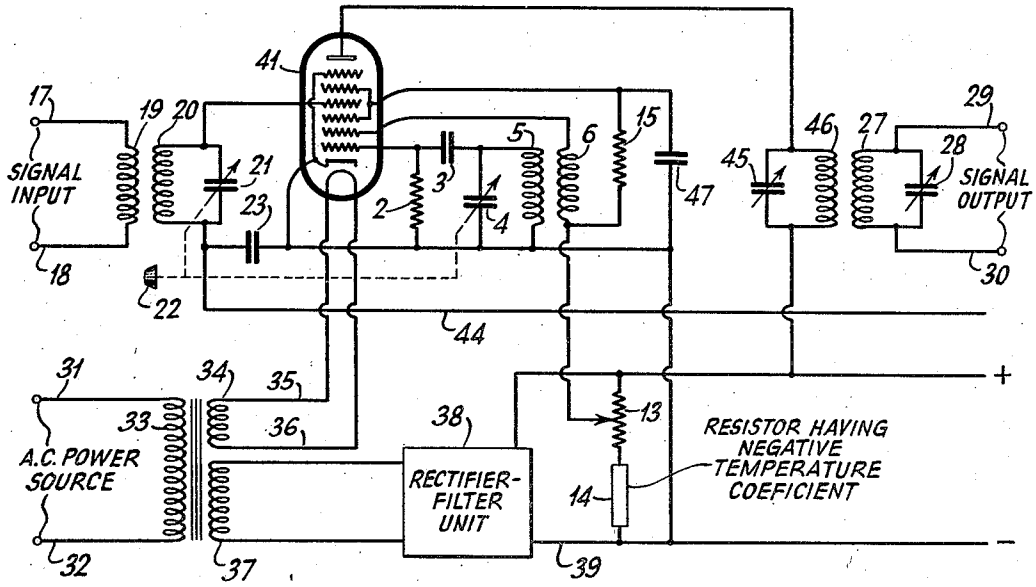


Fig. 3



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HIGH FREQUENCY OSCILLATION GENERATOR

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5 Claims. (Cl. 250—36)

This invention relates to a circuit for generating ultra-high frequency oscillations in which the supply voltages, that is to say, the direct or alternating voltage used for heating the cathode and the direct voltages supplied to the other electrodes of the oscillator valve or valves are derived from a common source of voltage, for instance, a commercial supply whose terminal voltage is subject to variations.

When generators of ultra-high frequency oscillations are energized from commercial power sources, they are subject to the disadvantage that the frequency of the oscillations generated varies materially under the influence of variations of the supply voltage. This disadvantage occurs particularly with superheterodyne receiving circuits for very short waves. In such case a variation of the frequency of the oscillations set up locally produces an intermediate frequency which differs from the frequency to which the intermediate frequency amplifier is tuned. This leads to a distorted reproduction and in the case of an intense variation of the supply voltage the intermediate frequency produced may even fall entirely outside the transmitting range of the intermediate frequency amplifier so that the receiving circuit requires to be retuned or in the case of rapid variations the reception becomes wholly impossible.

The invention has for its object to obviate this disadvantage. According to the invention, for this purpose the percentage fluctuations of the direct voltage which is supplied at least to the positive electrode closest to the cathode of the oscillator valve or valves are decreased to such an extent that the frequency of the oscillations produced is substantially independent of the terminal voltage of the commercial power source.

The invention is based upon recognition of the fact that when a variation occurs in the power supply voltage the resultant variation in the frequency of the ultra-high frequency oscillations is due to a variation of the space charge adjacent the control grid of the oscillator valve. A variation of this space charge brings about a variation in the control grid-cathode capacitance and the latter gives effect to a variation in the tuning of this oscillatory circuit.

An increase in the direct or alternating voltage serving for heating the cathode results in an increased emission and thus in an increase in density of the space charge between the control grid and the cathode so that the control grid-cathode capacity increases. In contra-distinction to this an increase in the direct voltage of the positive electrodes that are arranged behind the control grid causes the electrons to be conducted away more rapidly from the region of the control grid. Hence there is a decrease in the value of the control grid-cathode capacitance. In the case of an identical percentage variation in the heating voltage and in the voltage of the positive electrodes, the influence of the last mentioned voltage will be dominant, so that an increase in the terminal voltage of the power source results in a decrease in the control grid-cathode capacitance.

According to the invention, means are provided for limiting the percentage fluctuations in the direct current potential supplied at least to the first of the positive electrodes beyond the control grid. These fluctuations then exert an influence on the space charge which is equal and opposite to the influence of the heating voltage fluctuations. Under these conditions the control grid-cathode capacitance is made independent of the terminal voltage of the power supply source. Hence the frequency of the oscillations produced is rendered substantially constant.

According to one embodiment of the invention the direct voltage for one or more of the positive electrodes is derived from a potentiometer connected in series with a resistor whose value depends to a large extent on the current or voltage supplied. This resistor is connected between the terminals of a direct current source whose voltage is dependent upon the terminal voltage of the said power supply.

In order that the invention may be clearly understood and readily carried into effect a few embodiments thereof will now be described more fully with reference to the accompanying drawing, in which

Figure 1 illustrates diagrammatically the use for purposes of the invention of a simple circuit having therein an oscillator tube of the triode type;

Fig. 2 shows a modified circuit arrangement in which a pentode tube is employed; and

Fig. 3 shows still another circuit arrangement including a multi-electrode tube which is useful both for generating oscillations and for deriving a beat frequency with respect to the fundamental frequency of the generator, and of an incoming signal.

Fig. 1 shows a circuit for generating ultra-high frequency oscillations. An oscillator valve 1 has its control grid connected via a leak resist-

ance 2 to the cathode and via a grid condenser 3 to an oscillatory circuit formed by a tuning condenser 4 and an inductance coil 5. The anode circuit includes a feed-back coil 6. The oscillations produced are supplied to the terminals 9 and 10 by means of a coil 7 coupled to the coils 5 and 6. Any suitable load may be connected to the terminals 9 and 10. The anode voltage and the cathode supply voltage are derived from a direct current source 11, across the terminals of which lies a potentiometer 13 in series with a resistor 14 having a negative temperature coefficient. The cathode heating circuit is connected to terminals of the resistor 12 for obtaining a suitable filament voltage. An increase in terminal voltage of the source 11 increases both the filament voltage and the voltage set up across the resistive elements 13 and 14. The control grid-cathode capacity of the tube 1 whose value depends on the space charge set up adjacent the control grid is connected in parallel with the oscillatory circuit 4, 5 so that a variation of the said space charge results in a detuning of the oscillatory circuit.

According to the invention, means are provided for avoiding fluctuations of the space charge between the control grid and the cathode as well as fluctuations of the frequency of the oscillations generated. In order to obtain this result the cathode-to-anode circuit is made to include a portion at least of the potentiometer 13 and the temperature dependent resistor 14. When the output voltage from the source 11 increases, the current that flows through the resistance 14 also increases so that the value of this resistance decreases and that part of the voltage which is supplied to the anode of the tube 1 decreases. The anode voltage consequently exhibits lower percentage fluctuations than the heating voltage. If the potentiometer 13 is correctly adjusted the influence of the heating voltage fluctuations on the space charge is just balanced by the influence of the anode voltage fluctuations.

The circuit shown in Fig. 2 is distinguished from that shown in Fig. 1 by the use of a pentode discharge tube as the oscillator. In addition in this circuit arrangement the oscillatory circuit 4, 5 is included in the anode circuit and the feed-back coil 16 in the control grid circuit. Thus, the control grid-cathode capacity is connected not directly but via the transformer winding 16 in parallel with the oscillatory circuit 4, 5. The oscillations generated are supplied via a coupling condenser 8 to output terminals 9 and 10. The screen grid of the valve 15 is connected via a condenser 26 to the cathode and via a resistance 25 to a point on the potentiometer 13.

Although the circuit shown in Fig. 1 comprises a resistance 14 having a negative temperature coefficient, Fig. 2 shows the use of a resistance 24 having a positive temperature coefficient. In this case the resistance 24 is connected to the positive terminal of the source 11. In case of an increase of the voltage from this source the current passing through the resistance 24 will increase. This results in an increase in the value of this resistance so that the voltage which is supplied to the screen grid of the valve 15 decreases. The operation is consequently identical with that of the circuit shown in Fig. 1.

Since fluctuations of the anode voltage can exercise only a very slight influence on the space charge adjacent the control grid, it is not necessary to take measures for limiting the anode voltage fluctuations. The anode of the valve 15 is, therefore, connected directly to the positive terminal of the source 11.

Fig. 3 shows part of a superheterodyne receiving circuit to which the invention is applied. The mixing valve 41 serves both for generating local oscillations and for the frequency transformation of the received oscillations. This tube comprises successively an indirectly heated cathode, an oscillator control grid, an oscillator anode, a screening grid, a second control grid, a second screening grid, a suppressor grid and an anode.

The received high-frequency oscillations are fed via terminals 17 and 18 to an inductance coil 19 coupled to an inductance coil 20 which by means of a condenser 21 is tuned to the frequency of the received oscillations. The condenser 21 is operated jointly with the condenser 4 by a common tuning control 22. Means are provided (though not shown in detail) for causing the frequency to which the circuit 20, 21 is tuned always to differ by a constant amount from the frequency to which the circuit 4, 5 is tuned. The end of the oscillatory circuit 20, 21 which is remote from the second control grid is connected by a condenser 23 to the cathode. The second control grid has supplied to it via a conductor 44 a variable negative bias for automatic volume control. The anode circuit of the valve 41 includes an oscillatory circuit 45, 46 which is tuned to the intermediate frequency and is coupled to a second oscillatory circuit 27, 28, the intermediate frequency oscillations generated being derived from the terminals 29 and 30.

The terminals 31 and 32 are connected to a commercial alternating current source. The primary 33 of the supply transformer is connected to these terminals. The secondary winding 34 is connected via conductors 35 and 36 to the heater of the cathode of the valve 41. The second secondary winding 37 is connected to a rectifier 38 which also contains the usual means for smoothing the voltage of its rectified output current.

The percentage fluctuations of the direct voltage which is supplied to the oscillator anode and the screen grids are decreased by means of the series combination of a potentiometer 13 and a resistance 14 having a negative temperature coefficient down to the desired value in a manner similar to the circuit shown in Fig. 1. Since the anode voltage exercises substantially no influence on the space charge adjacent the control grid, the anode is connected directly to the negative lead 39.

I claim:

1. A circuit for generating oscillations comprising a discharge tube having a cathode, an anode, and an oscillation-exciting electrode, a direct current potential source having a potentiometer connected across its terminals and connections from suitable points on said potentiometer to each of the electrodes in said tube for operating the same, means in said potentiometer for causing the incidental fluctuations of direct current voltage which is supplied to said oscillation-exciting electrode to be decreased in relation to the fluctuations of the potential difference between the cathode and anode, said means being constituted by a resistor having an ohmic value which is highly sensitive to voltage variations across its terminals and having a tap for fixing the extent of such decrease in such man-

ner that the frequency of the oscillations generated is made substantially independent of said voltage fluctuations.

2. In combination with a high frequency oscillation generator comprising a discharge tube having a hot cathode, and cold electrodes, a power supply system having alternating current input terminals and direct current output terminals, a potentiometer connected across the output terminals, a resistor having an ohmic value which is highly sensitive to voltage variations across its terminals and constituting part of said potentiometer, means for feeding operating potentials from said power supply system to certain electrodes of said tube at least in part through said resistor and a remaining portion of said potentiometer, and a cathode heating circuit connected to said power supply system, said potentiometer having a tap which provides compensation between the respective values of the potentials in the heating circuit and in said means such that the frequency of the oscillations generated is substantially uninfluenced by variations in the alternating current potential applied to the input terminals of said power supply system.

3. A device in accordance with claim 2 and further characterized in that said resistor has a negative temperature coefficient and constitutes an intermediate portion of said potentiometer.

4. A device in accordance with claim 2 and further characterized in that said resistor has a positive temperature coefficient and is connected between the tap on said potentiometer and the positive output terminal of said power supply system.

5. A device in accordance with claim 2 and further characterized in that said discharge tube is a pentode having a screen grid connected in series with said resistor and the tap on said potentiometer.

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