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MIXING CIRCUIT IN SUPERHETERODYNE RECEIVERS

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Fig. 1

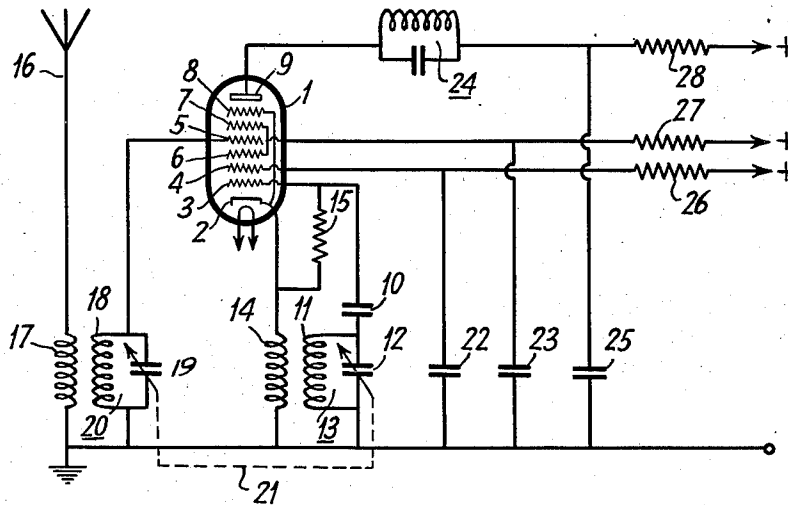
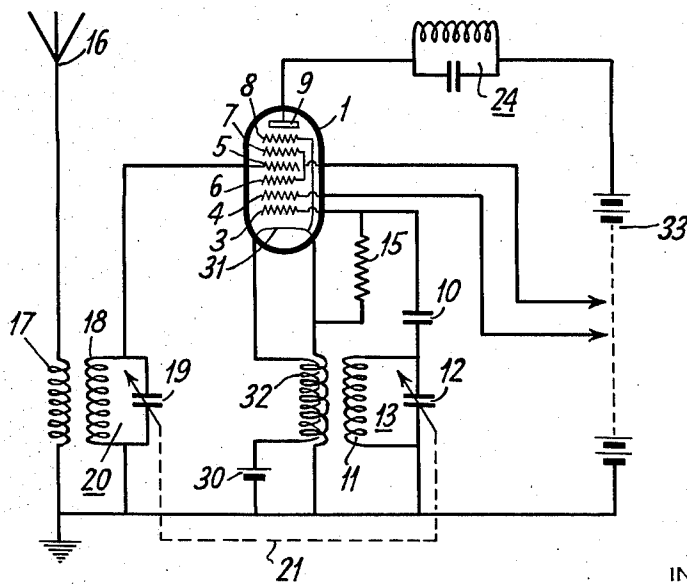


Fig. 2



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MIXING CIRCUIT IN SUPERHETERODYNE RECEIVERS

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2 Claims. (Cl. 250—20)

This invention relates to a superheterodyne radio receiver comprising a mixing valve having a low cathode emission in which the local oscillations are set up and in which the oscillator control grid is nearer the cathode than the control grid to which the received oscillations are fed.

In such a mixing valve the two electrodes next to the cathode generally act as the oscillator control grid and the oscillator anode for setting up the local oscillations.

In this case, the flow of electrons emitted by the cathode is solely controlled by the voltage effective at the oscillator control grid.

Part of this flow of electrons passes to the electrode of the mixing valve which acts as the oscillator anode. In the well-known circuit arrangements a feedback current or voltage for maintaining the local oscillations is obtained from the circuit connected to this electrode.

For stable oscillation, particularly with short-wave reception (15 to 50 meters), it is essential that the feedback current or voltage variations due to a given potential variation at the oscillator control grid should have a sufficiently high value. Expressed in other words this means that the mutual conductance of the part of the mixing valve which acts as the oscillator tube should be sufficiently high.

This mutual conductance has a close relation with the intensity of the flow of electrons emitted by the cathode and depends in addition on the part of the total flow of electrons which flows to the oscillator anode.

In mixing valves having a low cathode emission the mutual conductance of the part that acts as the oscillator tube is small, which, in the case of higher frequencies, may entail difficulties in connection with the setting-up of the local oscillations.

The intensity of the total flow of electrons that can be emitted by a cathode depends on the power supply to this cathode.

Particularly in the case of battery receivers it may be advisable to minimize the power supply necessary for the valves. In consequence the cathode emission is small so that in such a mixing valve a satisfactory stable oscillator action is not ensured.

The invention has for its object to obviate the above-mentioned difficulties.

According to the invention, this object is achieved by obtaining the feedback current or voltage for setting up local oscillations from a circuit which has the current of all positive electrodes of the mixing valve passing through it.

For this purpose, the cathode conductor of the mixing valve includes a feedback coil and care is taken that all positive electrodes are practically at earth potential for the oscillator frequency since the cathode conductor has passing through it the entire flow of electrons to be emitted by the cathode, which flow is controlled solely by the oscillator control grid and in consequence only contains the oscillator frequency.

The use of the entire cathode current for the feedback has the effect of substantially increasing the mutual conductance of the part of the mixing valve which acts as the oscillator tube.

When the mixing valve has a directly heated cathode the cathode conductor preferably includes a feedback coil constituted by two bifilar-wound wires serving for the supply of the cathode heating current.

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

Fig. 1 shows a mixing circuit to which the invention is applied.

Fig. 2 shows a mixing circuit of a battery receiver in which use is made of a bifilar feedback coil.

Referring to Fig. 1, 1 designates a mixing valve comprising an indirectly heated cathode 2, an oscillator control grid 3, a grid 4 acting as the oscillator anode, a signal control grid 5 to which the received oscillations are fed and which is surrounded by two screening grids 6 and 7, a suppressor grid 8 connected to the cathode 2 and an anode 9.

The oscillator control grid 3 is connected to earth with the interposition of a condenser 10 and an oscillator circuit 13 comprising an inductance 11 and a tuning condenser 12. The cathode 2 is earthed via a coil 14 coupled to the coil 11.

A resistance 15 unites the cathode 2 with the oscillator control grid 3.

The oscillations received by means of an antenna 16 are transmitted by an antenna coil 17 to an oscillatory circuit 20 which comprises an inductance coil 18 and a tuning condenser 19, which is tuned to the signal frequency and which feeds the received oscillations to the signal control grid 5. The two variable condensers 12 and 19 are ganged, as is indicated by a dotted line 21. Well-known means ensure that there is a constant frequency difference between the oscillatory circuits 13 and 20.

The grids 4, the grids 6, 7 and the anode 9

are earthed respectively with the interposition of a condenser 22, a condenser 23 and the series combination of an intermediate frequency circuit 24 having a negligible impedance for the oscillatory frequency and a condenser 25. With the interposition of resistances 26, 27, 28 the said electrodes are supplied with positive voltages received from a supply source whose negative terminal is connected to earth. This supply source is not shown in detail on the drawing.

The oscillator control grid 3 controls the flow of electrons which is emitted by the cathode 2, is distributed over all the positive electrodes of the mixing valve 1 and then flows back to the cathode 2 through the coil 14 which serves for the feedback.

Owing to the fact that the entire cathode current serves for feedback a high mutual conductance is obtained. The difference frequency set up in the mixing valve 1 is supplied to the intermediate frequency circuit 24 to which the remaining part (not shown) of the receiver is coupled.

The signal control grid 5 has a low capacity relatively to the cathode 2 through which the oscillator voltage is transmitted to the circuit 20 due to the presence of the coil 14. This voltage is, however, very low and moreover the circuit 20 is not tuned to the oscillator frequency so that the probability of radiation is very low.

Referring to Fig. 2 similar parts are designated by like reference numerals.

In the circuit arrangement shown in Fig. 2, which corresponds essentially with that of Fig. 1, use is made of a mixing valve having a cathode 31 which is heated directly by a battery 30. The two conductors for the cathode 31 include a bifilar-wound coil 32 which is coupled to the inductance 11 of the oscillator circuit and which serves for keeping up the locally generated oscillations.

As an alternative, use may be made of a simple coil in one of the cathode conductors and a choke coil in the other but the solution indicated is better and cheaper.

The grid 4 and the grids 6 and 7 are directly connected to tapplings of an anode battery 33. The anode 9 obtains a positive voltage from this battery with the interposition of an intermediate frequency circuit 24. The negative terminal of the battery 33 is connected to earth.

The invention permits of mixing valves having a very low cathode supply energy being used in battery receivers. The cathode supply current of such a tube amounts, for example, to 25 ma. and the cathode supply voltage, for example, to

1.4 volts. In this case the cathode emission is, for example, 3 ma.

What I claim is:

1. In a superheterodyne receiver, an oscillator-modulator circuit including an electron discharge tube provided with a cathode of low emission and an output anode, said electrodes having interposed therebetween in the order named an oscillator grid, an oscillator anode, a screen grid and a signal control grid, a feedback inductance connected between cathode and ground and being the sole impedance in said cathode circuit, a circuit tuned to locally-generated oscillations connected through a condenser between the oscillator grid and ground and coupled to the cathode inductance, a grid leak resistance directly connected between cathode and oscillator grid, a circuit tuned to the incoming frequency connected to the signal grid, a circuit tuned to the resulting intermediate frequency connected to the output anode, means for impressing positive potentials on the oscillator anode, screen grid and output anode which are maintained at ground potential as far as the oscillator frequency is concerned, the arrangement being such that the feedback voltage developed across the cathode inductance is derived from the currents of said positive electrodes and is controlled solely by the oscillator grid.

2. In a superheterodyne receiver, an oscillator-modulator circuit including an electron discharge tube having a low emission cathode, an output anode and a plurality of grid electrodes interposed therebetween, a feedback inductance directly connected between the cathode and ground and being the sole impedance in said cathode circuit, a circuit tuned to locally-generated oscillations connected through a condenser between the first grid from the cathode and ground and coupled to the cathode inductance, a grid leak resistance directly connected between cathode and oscillator grid, tuned to the incoming frequency connected to the fourth grid from the cathode, a circuit tuned to the resulting intermediate frequency connected to the output anode, means for impressing positive potentials on the second, third and fifth grids and on the output anode, means for maintaining said positive potential electrodes at ground potential as far as the oscillator frequency is concerned, the arrangement being such that the feedback voltage developed across the cathode inductance is derived from the currents of positive electrodes and is controlled solely by the first grid.

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