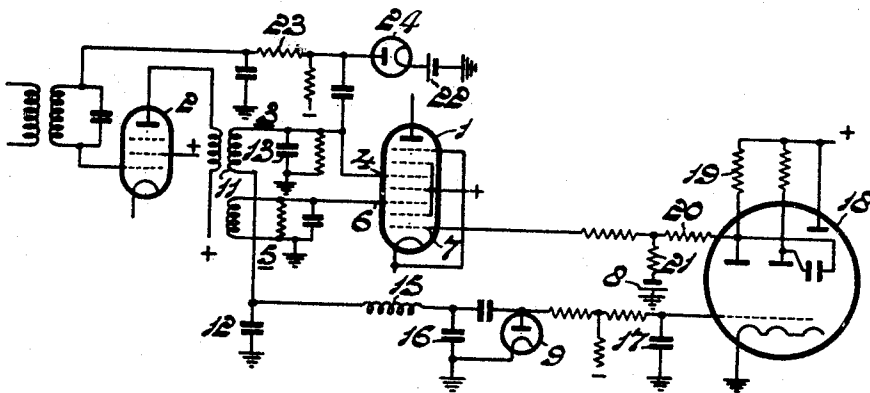


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CIRCUIT-ARRANGEMENT FOR SILENT TUNING
IN FREQUENCY-MODULATION RECEIVERS
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CIRCUIT-ARRANGEMENT FOR SILENT TUNING IN FREQUENCY-MODULATION RECEIVERS

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3 Claims. (Cl. 250—20)

The invention relates to a circuit-arrangement for silent tuning in a frequency-modulation receiver, comprising a frequency demodulator to demodulate the incoming signal, a source of cut-off voltage to cut off the frequency demodulator if the incoming signal remains below the required level, and a rectifier coupled with an input circuit of the frequency demodulator to produce a control-voltage for the release of the frequency demodulator if the signal exceeds this level.

Use is particularly made of a mixing detector, to operate as the frequency demodulator.

The term "mixing detector" is to be understood to mean a mixing tube having two control grids and combined with two coupled circuits tuned to the central frequency of the incoming signal, to which the oscillations to be demodulated are supplied and each circuit of which is respectively connected to one of the two control-grids. A low-frequency oscillation which is, on a first approximation, proportional to the frequency of the incoming signal, is obtained from the anode circuit of the mixing tube. A preferred embodiment of a mixing detector is that in which signal voltages of such high values are supplied to the control-grids of the mixing tube that the tube has a saturation characteristic curve for the signal voltages and, hence, operates not only as a demodulator but also as a limiting element.

In order to produce the control-voltage to release the receiver, it is advantageous to have the said rectifier preceded by a circuit tuned to the central frequency of the incoming signal and having a high circuit quality to which the signal is supplied so that a small detuning of the receiver entails a great variation of the control-voltage. The impedances of the usually slightly over-critical coupled circuits of the mixing detector then have too small a variation with frequency for the voltages across these circuits to furnish, upon rectification, a sufficiently sensitive control-voltage. Use is therefore made of a separate circuit having a high circuit quality.

If, in general, a third circuit having a high circuit quality is coupled undercritically with one of the two input circuits of the mixing detector, it has been found that the impedances of these input circuits as a function of frequency become asymmetrical, that is to say, that an appreciable second harmonic distortion occurs across the output of the mixing detector. This is due to the fact that coupling of either of the two input circuits with the said third circuit is attended with coupling of the other circuit with this third circuit, which results in the said asymmetry.

The distortion of the demodulation characteristic curve is avoided in that, according to the invention, either of the two input circuits of the frequency demodulator, more particularly a mixing detector, is connected to a point of constant potential through a comparatively large capacitor which, together with an inductance and a second capacitor, form a resonator circuit having high circuit quality, the voltage of which is fed to the said rectifier to produce the said release voltage.

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In order that the invention may be more clearly understood and readily carried into effect, one embodiment will be described in detail with reference to the accompanying drawing.

Referring to the single figure of the drawing, 1 designates a mixing tube; a pre-amplification tube; 3 and 5 two coupled circuits tuned to the central frequency of a frequency-modulated incoming signal, connected to the control grids 4 and 6, respectively, of the mixing tube 1. An incoming signal is supplied subsequent to amplification in the tube 2 to the circuit 3, which is inductively coupled with the anode circuit of the tube 2, and to the circuit 5, which is coupled with the circuit 3, respectively, the phase shift between the voltages across the circuits 3 and 5, respectively, varying with the frequency of the incoming signal. The tube 1 combined with the circuits 3 and 5 thus operates as a mixing detector for the incoming signal and, particularly if the signal across the circuits 3 and 5 is sufficiently high, it also operates as a limiting element.

If the voltage across the circuits 3 and 5 is excessively low, either due to false tuning or due to the absence of a transmitter, the remainder of the receiving channel is suppressed with the use of a cut-off voltage source 8 included in the circuit of the first control-grid 7 of the mixing tube 1. The cut-off is released at a sufficient strength of the incoming signal by rectifying this signal with the use of a rectifier 9 and by supplying it, subsequent to amplification in the tube 18, to the control-grid 7 of the tube 1 with a polarity opposite to that of the cut-off voltage source 8.

A frequency-modulation receiving circuit-arrangement having silent tuning with the use of a cut-off voltage source is known per se (French patent specification No. 925,979), in which with the two circuits of a frequency demodulator is coupled a third circuit having a high circuit quality, the rectified output voltage of which releases the cut-off produced by this voltage source, when the incoming signal has reached the required value. However, it is found that in this case invariably an asymmetrical demodulation characteristic curve occurs, which, in accordance with the basic idea of the invention, is to be attributed to the fact that an inductive coupling of a third circuit having a high circuit quality with one of the two input circuits of the demodulator is invariably attended with a coupling with the other circuit. This asymmetrical demodulation characteristic curve results in second harmonic distortion.

According to the invention capacitive "feed" coupling is used and the bottom side of the inductance 11 of the circuit 3 is connected through a comparatively large capacitor 12 of, for example, 3000 pfs., to a point of constant potential, for example, ground, whereas this capacitor 12, together with an inductance 15 and a second capacitor 16, constitutes a circuit having a high circuit quality. The voltage across this circuit, more particularly the voltage across the second capacitor 16, is supplied to the said rectifier 9, after which the rectified output voltage is supplied through a smoothing filter 17 to the grid of a tuning indicator tube 18, the anode resistor 19 of which has produced across it an amplified voltage which, subsequent to voltage division through resistors 20 and 21, releases the cut-off produced by the source 8 when the incoming signal is of sufficient strength.

So that a strong transmitter, upon reception, even in the event of false tuning, will not produce a low-frequency signal across the anode circuit of the tube 1, provision is made of an auxiliary rectifier 24 comprising a threshold voltage source 22 which becomes conductive when the voltage across the circuit 3 exceeds some predetermined value and supplies, subsequent to filtering

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with the use of a filter 23, a voltage to the grid of tube 2 which counteracts a further increase of the incoming signals beyond this maximum value.

What I claim is:

1. In a frequency modulation receiver, a silent tuning device responsive to an applied frequency modulated signal, said tuning device comprising a frequency demodulator for demodulating said signal, said demodulator having first and second resonant input circuits therefor, means to supply a cut-off voltage to said demodulator having a magnitude at which said demodulator in the absence of a signal above a predetermined level is normally inoperative, a tuned network of relatively high circuit quality with respect to the circuit quality of said first and second resonant input circuits and resonant to the central frequency of said frequency modulated signal, said network including first and second capacitances and an inductance, said first capacitance having a relatively high value and being coupled between one of said demodulator input circuits and a point of constant potential, means including a rectifier coupled to said network to develop a control voltage dependent on the level of the applied signal, and means to supply said control voltage to said demodulator to counteract said cut-off voltage to an extent releasing the demodulator in the condition wherein said signal exceeds said predetermined level.

2. A tuning device as set forth in claim 1 wherein said means to develop a control voltage includes a tuning

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indicator electron ray tube having a control grid coupled to said rectifier, the control voltage being obtained from the output of said tube.

3. In a frequency modulation receiver, a silent tuning device responsive to an applied frequency modulated signal, said tuning device comprising a frequency demodulator for demodulating said signal, means to supply a cut-off voltage to said demodulator having a magnitude at which said demodulator in the absence of a signal above a predetermined level is normally inoperative, a tuned network and resonant to the central frequency of said signal including first and second capacitances and an inductance, said first capacitance being coupled between an input of said demodulator and a point of constant potential, means including a rectifier coupled to said network to develop a control voltage dependent on the level of the applied signal, and means to supply said control voltage to said demodulator to counteract said cut-off voltage and release the demodulator in the condition wherein said signal exceeds said predetermined level.

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