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SELECTIVE RADIO RECEIVING SYSTEM

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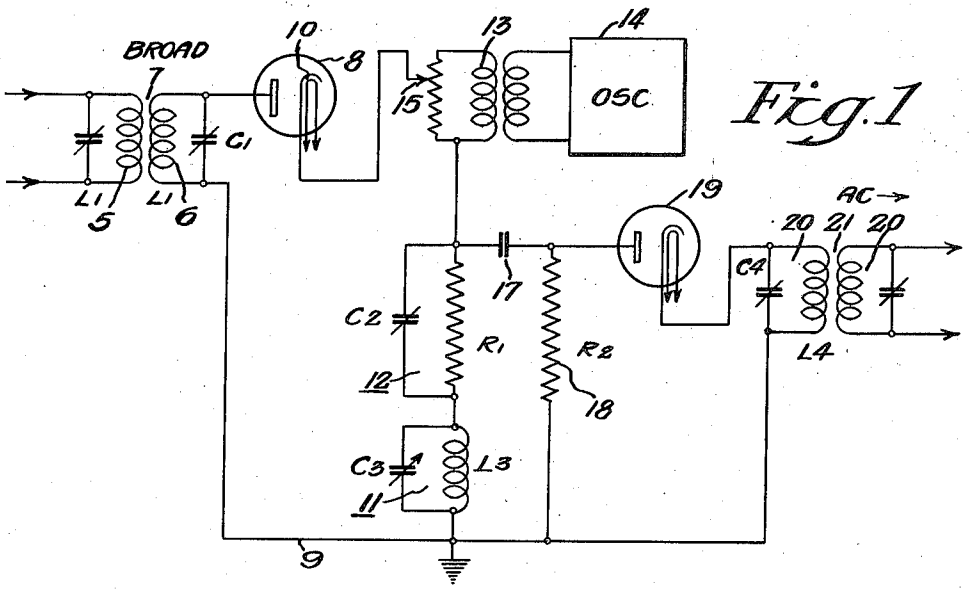
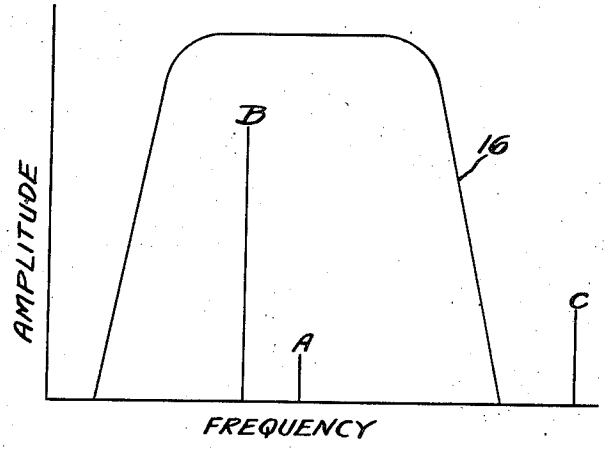


Fig. 1

Fig. 2.



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SELECTIVE RADIO RECEIVING SYSTEM

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Application April 30, 1936, Serial No. 77,254

4 Claims. (Cl. 250—20)

The present invention relates to a selective radio receiving system of the type disclosed in my copending application, Serial No. 77,253, filed April 30, 1936, for Selective radio receiving systems, and has for its object to provide means for reducing the effects of interference in a radio receiving system provided with a single diode rectifier type of limiter in connection with broadly tuned signal input circuits.

In limiting radio interference from static and undesired signal waves in connection with a limiter circuit, selectivity must be obtained, otherwise two signals on differing adjacent channels will be received at the same time.

The present invention relates specifically to a receiving system employing a limiter wherein the signals are limited by an oscillator at the beat frequency between the oscillator and the incoming signal on the principle that oscillator voltage is equal to or less than the incoming signal voltage, whereby the output beat frequency between the two input voltages may have an amplitude dependent only upon the amplitude of the smaller of the input voltages, which is the oscillator voltage.

In accordance with the invention, a signal limiter circuit is preceded by broadly tunable signal receiving circuits for supplying signals thereto and is followed by a second rectifier of the diode type which is interposed between the limiter circuit and selectively tuned circuits for imparting selectivity to the receiving system.

The invention will be better understood from the following description, when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing, Fig. 1 is a schematic circuit diagram of a receiving system circuit embodying the invention, and

Fig. 2 is a curve showing the relation between the frequency ranges and amplitudes of voltages applied to the limiter circuit forming part of Fig. 1 and the over-all selectivity of the receiving system preceding the limiter circuit.

Referring to Fig. 1, 5 is a tuned intermediate frequency output circuit which is coupled to a tuned input circuit 6 through a coupling transformer 7 to apply signals in a broad frequency band to a diode rectifier device 8. The diode rectifier circuit includes the input circuit 6 which is connected to ground through a lead 9 and to the cathode 10 through a tuned impedance 11 and a second impedance 12. Also included in the circuit, adjacent to the cathode, is a coupling coil 13 for an oscillator 14 having a variable tap connection 15 for varying the oscillator voltage applied to the series rectifier circuit.

The adjustment of the contact 15 is such that the oscillator voltage may be maintained at a predetermined value with respect to the incoming signal voltage, and the frequency of the oscillator is such that it lies outside of the frequency response range of the intermediate frequency amplifier and the tuned circuits 5 and 6. This response characteristic is indicated in Fig. 2 by the curve 16 and, in relation thereto, it will be seen that the oscillator voltage which is represented in amplitude and frequency by the line C lies outside of the response range of the receiving circuits. An interference voltage is indicated by the line B in frequency and amplitude, and a received signal wave in amplitude and frequency is indicated by the line A.

In the presence of an interference wave B, the signal corresponding to BA, the beat frequency between B and A, and the signal corresponding to BC, the beat frequency between B and C, will appear in the output circuit of the limiter across the impedances 11 and 12, and in the present example the impedance 11 is tuned to the beat frequency BC while the impedance 12 is responsive to the beat frequency BA. The two impedances in series are coupled to a coupling capacitor 17 and a coupling resistor 18 with a second diode rectifier 19 in circuit with which is a sharply tuned output circuit 20 coupled through a transformer 21 with a second sharply tuned output circuit 22.

The circuits 20 and 22 are tuned to an intermediate frequency resulting from the beat between the desired signal and the oscillator frequency C, and the rectifier 19 serves to remove the interference component B for the reason that the incoming signal, as explained in the copending application referred to, and the oscillator beat frequency signal tend to modulate the beat frequency between the incoming signal and the interference signal, and the output strength is dependent upon the strength of the oscillations derived from the oscillator 14 and controllable by the means 15.

The present circuit, therefore, includes a beat heterodyne limiter including a diode rectifier which may be subject to interference from strong local signal cause. Broad circuits are used in the receiving system which, otherwise, would block the operation of the limiter, not by saturation but by modulating the desired signal. Since the desired signal is then modulated, it cannot be

received and, accordingly, a second demodulator 19 of the diode rectifier type is directly connected with the limiter circuit, as shown, for the purpose of maintaining the signal output in the presence of interference. The second rectifier or demodulator is then provided with sharply tuned output circuits which are responsive to the new intermediate frequency resulting from the beat between the intermediate frequency in the circuits 5 and 6 and the local oscillator frequency derived from the source 14, which is the beat frequency AC.

In this system, the selective circuits 20 and 22 are depended upon to remove the audio frequency beat signals and other interference which results from the operation of the limiter circuit in conjunction with the rectifier 19. With this arrangement, the adjacent channel selectivity is maintained although receiver circuits ahead of the limiter are broadly tuned to have an over-all response of the nature of the curve 16.

Both rectifier devices are preferably diodes for the reason that it is desirable that both should produce straight line rectification. In the output of the detector 8, there will be two substantially signal wave frequencies, one being AB; the difference between B and A and the magnitude of AB will be proportional to A and independent of B. The other frequency will be BC, as has been pointed out, and will be the difference between B and C, with the magnitudes thereof proportional to C. The desired signal AC is present in the circuits 20 and 22 whether B is present or not. This is possible only when the rectifiers 8 and 9 are substantially straight line detectors. Other frequencies which may be present in the output of the detector 8 may be neglected, as they are at best only second order magnitude.

It is also desirable that the impedances 11 and 12 in the output circuit of the rectifier 8 maintain sufficiently high impedance to both the signals AB and BC, that both voltages therefrom are impressed upon the second rectifier 19.

If the band pass width of the curve 16 is in the order of 50 kilocycles, for example, it is possible that the impedance 12 may be utilized to offer the necessary impedance to both AB and BC.

I claim as my invention:

1. In a radio receiving system having broadly tunable receiving circuits, the combination of diode rectifier means connected therewith, means for introducing heterodyne limiter oscillations into said circuit, diode output impedance means broadly tunable to the beat frequency of an interference wave and said oscillations, and an interference wave and a received signal wave, demodulator means including a second diode rectifier coupled to said impedance means, and an output circuit for said second diode rectifier including an output coupling means sharply responsive to the beat frequency of the received signal wave and said oscillations.

2. In a superheterodyne radio receiver system, the combination with an intermediate frequency amplifier output circuit, of means for broadly tuning said circuit, a diode rectifier device connected therewith, means for applying oscillations in circuit with said rectifier to provide a heterodyne signal limiter action with said rectifier, an output circuit for said rectifier including coupling means broadly responsive to a beat frequency resulting from a desired signal, and an interference signal and oscillations from said oscillator, a diode rectifier connected with said output impedance means, said rectifier having an output circuit sharply responsive to the beat frequency resulting from a received carrier wave and said oscillations.

3. A radio receiving system, including in combination, broadly tunable signal receiving circuits terminating in a diode rectifier circuit adapted for heterodyne signal limiter action and including a diode rectifier device, oscillator coupling means in said circuit adjustable to apply oscillations of predetermined amplitude thereto, impedance output coupling means in said circuit responsive broadly to the beat frequency of an interference wave and said oscillations, and an interference wave and a received signal wave, a second diode rectifier coupled to said last named coupling means, and an output circuit therefor including tuned transformer coupling means sharply responsive to the beat frequency of the received signal wave and said oscillations.

4. In a radio receiving system having broadly tunable receiving circuits, the combination of rectifier means connected therewith, means for introducing heterodyne limiter oscillations into said circuit, rectifier output impedance means broadly tunable to the beat frequency of an interference wave and said oscillations, and an interference wave and a received signal wave, demodulator means including a second rectifier coupled to said impedance means, and an output circuit for said second rectifier including an output coupling means sharply responsive to the beat frequency of the received signal wave and said oscillations.

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