

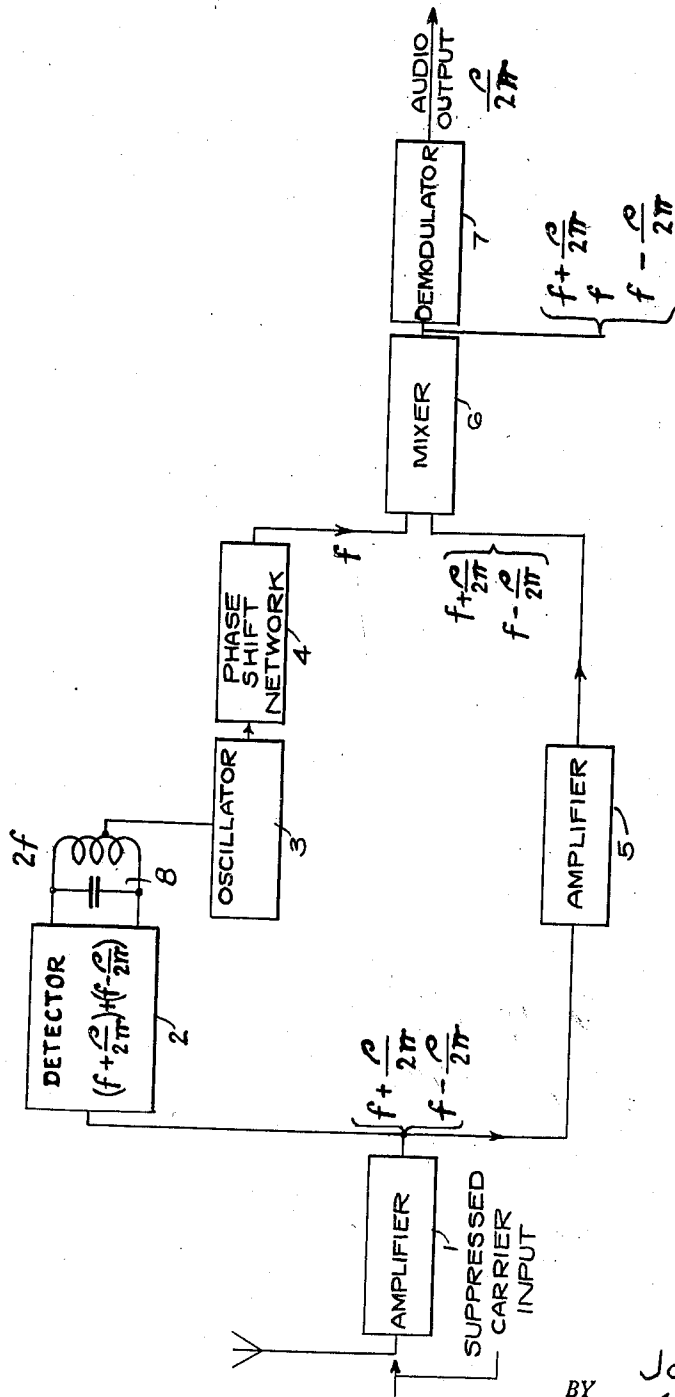
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SIGNAL RECEIVING SYSTEM

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SIGNAL RECEIVING SYSTEM

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My invention relates broadly to suppressed carrier signalling systems and more particularly to a receiving system for suppressed carrier transmission embodying a novel method of providing for restoration of the carrier for demodulation of the signal.

One of the objects of my invention is to provide a suppressed carrier receiving system, having a local oscillator producing a wave of carrier frequency, with means for controlling the frequency of the oscillator directly from the received signal.

Another object of my invention is to provide a method of restoring the carrier in a suppressed carrier signal wave by mixing the received wave and a locally generated wave controlled in frequency by selected components in the received wave.

A further object of my invention is to provide a receiving system for suppressed carrier transmission which operates efficiently and produces a signal of improved clarity due to direct control of the oscillation employed to restore the carrier in the signal for demodulation.

A still further object of my invention is to provide a suppressed carrier receiving system having a dual channel portion one side of which includes a selective circuit for deriving high frequency components from the received wave, an oscillator controlled in frequency by the selected components, and a phase correcting network, the output of this channel being mixed with the full signal complement in the output of the other channel for restoring the suppressed carrier for subsequent demodulation of the signal.

Other and further objects of my invention reside in the system as hereinafter more fully set forth, with reference to the accompanying drawing which shows in diagrammatic form the essential features of my invention.

My invention concerns a method of demodulation which when used to demodulate suppressed carrier transmission results in an audio frequency signal of high quality. In any double side band suppressed carrier system, when the carrier is reintroduced at the receiver, extreme care must be taken in order to insure that the reintroduced carrier is in phase with, or 180 degrees out of phase with the initial carrier. If this condition is not maintained, serious distortion of the signal wave occurs in all types of demodulators. My invention particularly deals with a method of obtaining and maintaining the correct carrier phase for reintroduction and demodulation.

In amplitude modulated radio frequency systems, the signal is made up of three components, namely, the carrier, the upper side band and the lower side band. The side band frequencies are displaced equal amounts from the carrier frequency, and in suppressed carrier transmission they are located at points in the frequency spectrum that are equally above and below the original carrier frequency. For example: Suppose that a 100,000 cycle carrier is modulated by a 2,000 cycle source. The frequencies present are 100,000—2,000, 100,000, and 100,000+2,000. These are respectively, the lower side band, the carrier and the upper side band. In a suppressed carrier system the frequencies would be 100,000—2,000 and 100,000+2,000 cycles.

The demodulation arrangement for suppressed carrier reception in the system of my invention provides for the passage of the side band frequencies into a detector. It is known that in the output of such a device, when two frequencies, A and B, are impressed on the input, the following frequencies appear:

A, which is the lower side band 100,000—2,000, or 98,000;
B, which is the upper side band 100,000+2,000, or 102,000;
A+B, which is 200,000;
A—B, which is 4,000;
2A, which is 200,000—4,000, or 196,000;
2B, which is 200,000+4,000, or 204,000.

Of particular interest is the frequency A+B which is equal to twice the original carrier frequency. The load in the plate circuit of the detector is resonated at twice carrier frequency, the principal voltage occurring across the system being at exactly twice the frequency of the original carrier. It should be noted that this is true regardless of the actual value of the modulating frequency.

My invention further contemplates an oscillator operating at substantially carrier frequency, and controlled by the source of twice carrier frequency derived as above described. This locally generated carrier, controlled at exactly the same frequency as the original carrier, is then introduced at proper phase into the receiving system along with the signal to reconstruct the original amplitude modulated wave which may then be demodulated by ordinary means.

The drawing is a block diagram of the receiving system. The suppressed carrier transmission is

received in the antenna, consisting of frequencies

$$f + \frac{\rho}{2\pi}$$

5 and

$$f - \frac{\rho}{2\pi}$$

and amplified in the high frequency amplifier at 1. Part of the amplified output is utilized for detection in the detector 2, the output circuit of which includes resonant circuit 3 tuned to $2f$, twice the carrier frequency. This output of the detector is utilized to control the frequency of an oscillator 3 at the frequency f of the carrier, and a phase shifting network is provided at 4 to adjust the phase of the current fed into the mixer 6 to its proper relation in respect to the carrier components in the received wave.

20 The remainder of the output of the amplifier 1 is passed into the amplifier 5 and thence directly to the mixer 6. The function of the mixer is to reconstruct an amplitude modulated wave, the side band frequencies being obtained from the output of amplifier 5, and the carrier at proper phase from the output of the phase shifter 4. After mixing, a conventional demodulator 7 of the type used for amplitude modulated waves, is utilized to convert the high frequency input into low frequency (audio) signals.

30 I have described my invention in its essential elements and the combination thereof in a preferred arrangement in accordance with my invention. I desire it to be understood that various modifications may be made in the basic arrangement illustrated and any suitable apparatus may be employed in the respective units. I intend no limitations upon my invention except as are imposed by the scope of the appended claims.

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

45 1. The method of restoring the carrier in a suppressed carrier signal wave for demodulation which comprises producing a local oscillation at the frequency of the carrier wave, deriving com-

ponents of twice the carrier frequency from the received wave, controlling the frequency of the local oscillation by said components of twice the carrier frequency, and mixing the local oscillation and the received wave for reconstructing the original amplitude modulated wave. 5

2. In a system for receiving a double side band suppressed carrier transmission, means for deriving a controlling wave at twice carrier frequency from the sum of the side band waves, a local oscillator having a connection from said means for control by the said controlling wave and operative to deliver an oscillation at carrier frequency, means coupled with said oscillator for adjusting the phase of said oscillation in synchronization with the suppressed carrier transmission, and means for combining said oscillation and the double side band transmission for reconstructing the original amplitude modulated wave. 20

3. In a system for receiving a double side band suppressed carrier transmission, a detector circuit supplied with the double side band transmission for producing a component of twice carrier frequency, an oscillator operative to deliver an oscillation at the carrier frequency, and means interconnecting said detector circuit and said oscillator for utilizing the component of twice carrier frequency for controlling the frequency of the oscillator at carrier frequency for combination with the double side bands to reconstruct the original amplitude modulated wave. 30

4. In a system for receiving a double side band suppressed carrier transmission, an oscillator, means having a connection to said oscillator and supplied with a portion of the suppressed carrier transmission for obtaining by coaction of the side band frequencies a controlling wave for controlling the frequency of the oscillator, said oscillator being operative to provide a current at carrier frequency, and means supplied with said current at carrier frequency and said double side band transmission for reconstructing the original amplitude modulated wave for purposes of demodulation. 45

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