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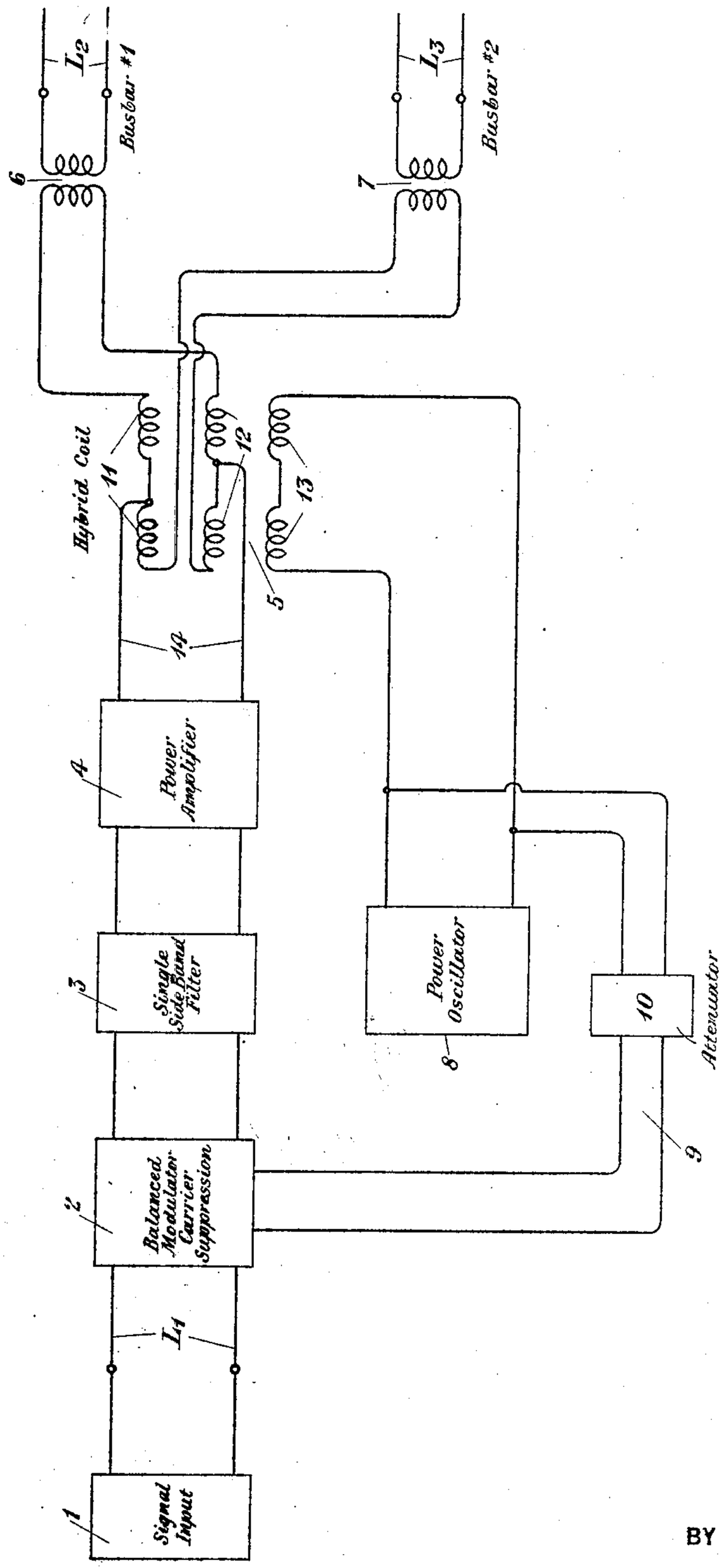

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BROADCAST TRANSMISSION SYSTEM.

Application filed November 5, 1925. Serial No. 67,145.

This invention relates to broadcast transmitting systems and particularly to a system of that type characterized by a novel means for conserving the energy range of the power amplifiers of the transmitter.

Heretofore it has been customary in systems in which it is desirable to supply the carrier together with one or both of the side bands sent out from a broadcast transmitter, to amplify both the carrier and the side band or side bands by means of the power amplifier connected between the modulator and the antenna or other transmission circuit. It has been found in the usual type of system that by suppressing the carrier in the modultor and by amplifying only one of the side bands, the power amplifier is capable of handling much more side band energy than is practicable where the carrier and both side bands are amplified.

This invention resides in a system characterized by the employment of the power amplifier for the amplification of a single side band and further characterized by the reapplication of the carrier to the transmission circuit, that is, the antenna or transmission line in such a way as to eliminate its detrimental effect upon the amplifier or modulator of the system.

The invention will be clearly understood from the following description when read in connection with the attached drawing showing schematically a form of embodiment of the invention.

In the drawing the signal input circuit L_1 may be connected with any type of terminal circuit 1 in which is produced the signal which is intended to modulate a carrier frequency and to be transmitted over the system. The line L_1 is connected with the input side of a balanced modulator of the type characterized by the suppression of the carrier frequency. This suppression modulator may be of the well-known type disclosed in the patent to Carson, No. 1,343,307, dated June 15, 1920. The output side of this modulator 2 is connected with the band filter 3, which is intended to transmit a single side band which will be impressed upon the input side of the power amplifier 4. The output side of this amplifier is connected across the midpoints of two of the windings of the hybrid coil 5. Two corresponding terminals are connected with the transformer 6, of which the secondary winding is connected with the distributing line L_2. In like manner, two other corresponding terminals of the same windings of the hybrid coil are connected with the transformer 7, the secondary of which is connected with the distributing line L_3. The third winding of this hybrid coil is connected with the output side of the power oscillator 8. By adjusting the line L_2 to have the same impedance as the line L_3, the hybrid coil will be balanced so that energy of the carrier frequency coming from the power oscillator 8 will flow over the lines L_2 and L_3, but will not produce any effect upon the output circuit of the power amplifier. This feature of a balanced hybrid coil is so well known as not to require further description. A circuit 9 is bridged across the output circuit of the power oscillator 8 and serves to supply oscillations of the carrier frequency to the balanced modulator 2. An attenuator 10 is connected to the circuit 9 in order to control the magnitude of the carrier energy supplied to the said modulator. Having in mind the foregoing description of the apparatus shown in the circuit of the drawing, the manner in which it functions to carry out the invention is as follows: Oscillations of the carrier frequency produced by the oscillator 8 will be impressed upon the circuit 9 and thereby upon the input side of the modulator 2. The magnitude of the energy supplied over the circuit 9 will be controlled by the attenuator 10. Signals from the source 1 will modulate the carrier frequency within the modulator 2. Owing to the type of circuit employed, the carrier frequency will be suppressed and the two side bands of frequencies will appear in the output side thereof. One of these bands will be transmitted by the filter 3, the other band being suppressed. The selected band will be amplified to the required degree by the power amplifier 4 and will be impressed across the midpoints of the windings 11 and 12 of the hybrid coil 5. Assuming that the impedance of the circuits L_2 and L_3 is the same, one-half of the energy of the side band will pass through the transformer 6 to the line L_2, and the other half through the transformer 7 to the line L_3. Simultaneously, oscillations of the carrier frequency will be impressed upon the windings 11 and 12 and will likewise flow over

the lines L_2 and L_3 together with the side band frequencies. As stated hereinbefore, the oscillations of the carrier frequency which are impressed by the winding 13 upon the windings 11 and 12 will not flow over the circuit 14 into the output side of the power amplifier 4 because of the balanced condition of the windings 11 and 12 produced by the equal impedances L_2 and L_3.

It will accordingly be seen that by eliminating the carrier frequency from the power amplifier 4, the amplifying power of this device is utilized solely in raising the side band frequencies to the required level for transmission over the lines L_2 and L_3. It will furthermore be seen that by employing a balance hybrid coil, the effect of the power oscillator upon the output side of the amplifier 4 is eliminated. Furthermore the employment of one distributing circuit to balance the other results in the complete utilization of the output energy of the system instead of distributing only one-half of it, as occurs in a system in which the distributing circuit is balanced by an artificial network.

While this invention has been disclosed as embodied schematically in a particular form, it is, of course, to be understood that the invention is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a broadcast system the method which consists in modulating a carrier by a signal frequency, selecting one of the side bands, transmitting this over a plurality of circuits, and simultaneously applying the carrier to said circuits in such manner that it will not react upon the side band translating circuit.

2. In a broadcast system the method which consists in modulating a carrier by a signal frequency, selecting one of the side bands, amplifying the said side band and transmitting it over a plurality of circuits, and applying the carrier to the said circuits in such manner that it will not react upon the side band translating circuit.

3. In a broadcast system, the method which consists in generating a carrier frequency current, modulating a portion of said current by a signal frequency, selecting one of the side bands resulting from such modulation, amplifying the selected side band to the degree required for transmission, transmitting it over a plurality of circuits, and applying the remainder of said carrier frequency current to said plurality of circuits in such manner as not to react upon the side band translating circuit.

4. In a broadcast system, the combination with a modulator of a source of signaling voltage, a source of carrier voltage connected with said modulator, means to select one of the side bands produced by said modulator and to suppress other frequencies, means to amplify the selected side bands, a plurality of transmission circuits, and means to connect the said amplifying means and the said source of carrier voltage to said transmission circuits, the said connecting means preventing reaction of the carrier voltage upon the said amplifying means.

5. In a broadcast system, the combination with a balanced modulator adapted to suppress the carrier frequency, of a source of signaling voltage, a single side band filter connected with the output side of said modulator, a power amplifier connected with said filter, a plurality of transmission circuits, a hybrid coil connecting said amplifier with said transmission circuits and a power oscillator producing a carrier voltage connected with said modulator and with said hybrid coil in such manner as to prevent reaction of said carrier voltage upon the power amplifier.

6. In a broadcast system, the combination with a balanced modulator in which the carrier frequency is suppressed of a source of signaling voltage, a power amplifier, a single side band filter connecting said modulator with said amplifier, a plurality of transmission circuits, a hybrid coil connecting said amplifier with said transmission circuits, a power oscillator producing a carrier frequency connected with said modulator and with said hybrid coil, and means to control the amount of carrier energy applied to said modulator.

7. In a broadcast system, the combination with a plurality of lines over which material is to be broadcast, of a source of said material, the said source comprising a side band production circuit, a source of carrier current and a hybrid coil connecting said circuit and said source with the said lines, one-half of the group of said lines balancing the other half with respect to said circuit and said source, so that the entire energy of said circuit and of said source is applied to said lines.

8. In a broadcast system, the combination with a broadcast production circuit of a plurality of lines over which a side band is to be broadcast, a source of production of carrier current also to be distributed to the said lines and means connecting the said lines with the said broadcast production circuit and said source of carrier current in such way that the full energy of the broadcast production circuit and the source of carrier current will be applied to said lines without causing interference between said circuit and said source.

In testimony whereof, I have signed my name to this specification this 2nd day of November 1925.

CHARLES H. FETTER.