Dec. 8, 1936. H. CHIREIX 2,063,582

TRANSMITTER

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Fig. 1

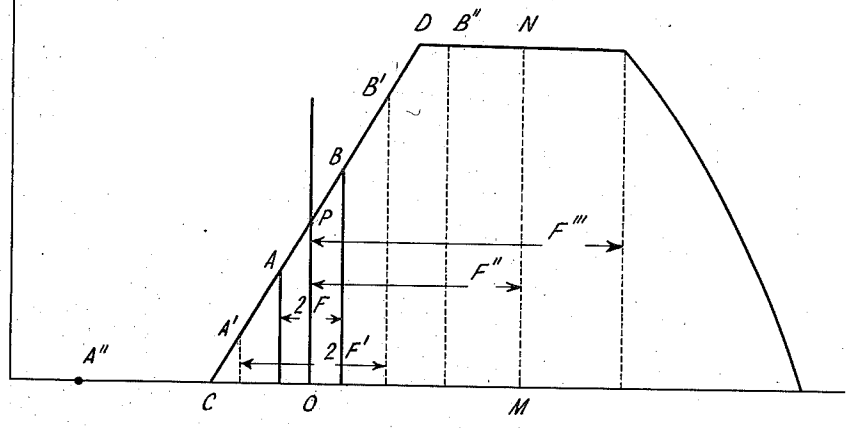
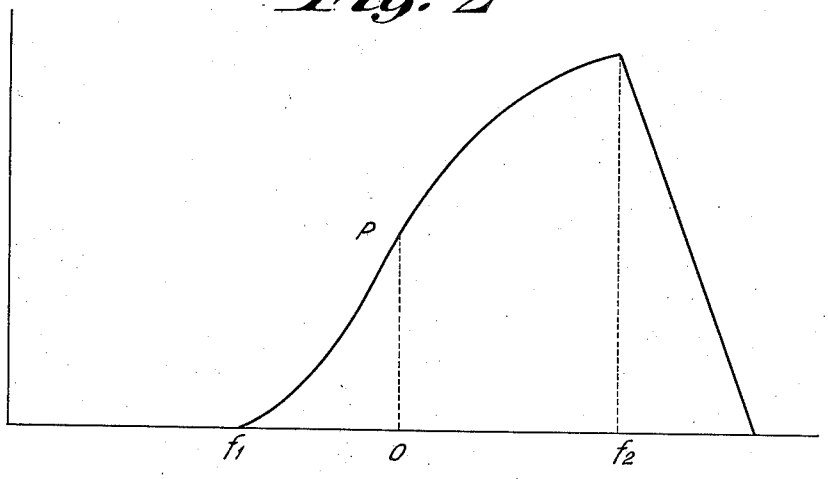



Fig. 2



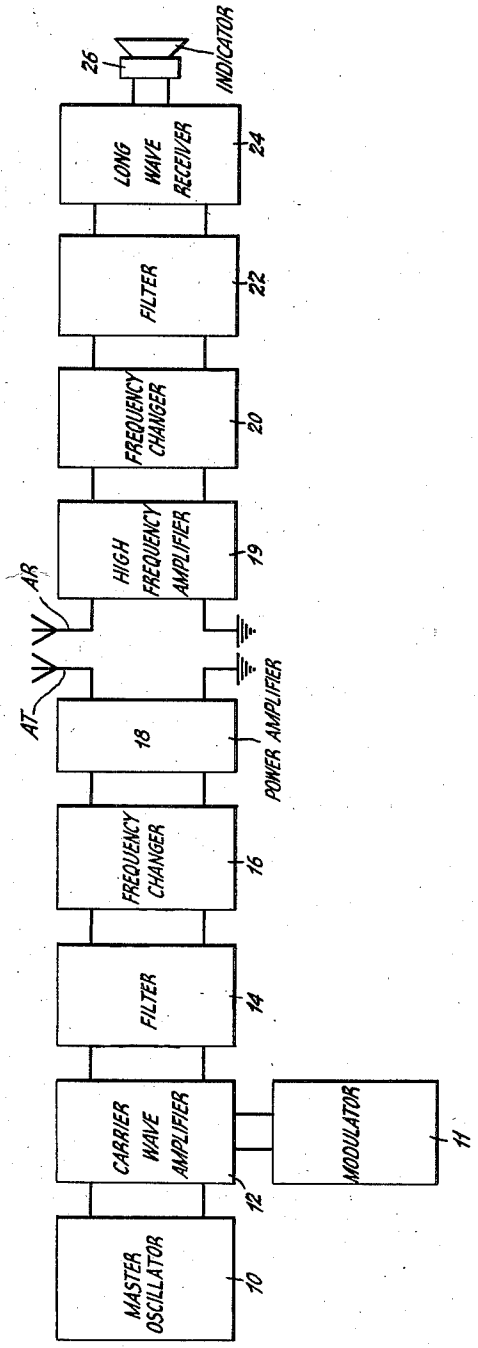

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Fig. 3




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# UNITED STATES PATENT OFFICE

2,063,582

## TRANSMITTER

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Application February 2, 1932, Serial No. 590,347
In France February 5, 1931

2 Claims. (Cl. 250—17)

According to the usually accepted theory a wave modulated in amplitude by a spectrum or range of lower frequencies, say, a wave modulated by telephone currents, may be resolved into a carrier wave of fixed frequency and two modulation bands of like intensity for symmetric frequencies.

Special efforts are usually made to maintain the equality in current or intensity by placing the carrier wave in resonance with circuits or in the middle of the passing band of filters when the latter are employed.

The means and ways underlying the present invention on the contrary consist for transmitters and receivers in not insuring the said symmetrical condition, in fact, in favoring or emphasizing one of the side bands at the expense of the other.

In this manner there is obtained an interesting and novel result which, when the ways and means here disclosed are used in the sending apparatus, consists in the reduction of the band occupied by the transmission, and when used at the receiving end it resides in the reduction of the passing band necessary for correct reproduction of the modulation frequencies.

The invention will be understood from the following detailed description thereof and therefrom when read in connection with the attached drawings, in which:

Figures 1 and 2 are current curves illustrating the manner in which modulated carrier waves are affected as they pass through a filter constructed in accordance with my invention; while,

Figure 3 shows diagrammatically a transmitter including a filter constructed in accordance with the present invention.

Fig. 1 represents the frequency-amplitude graph of a theoretical filter. Placing the carrier wave at OP chosen so that OP=1/2 MN, a modulation frequency F will give rise to side frequencies whose amplitudes will be proportional to the ordinates of points A and B, the proportionality factor becoming unity for modulation of 100 0/0.

The sum total of the amplitudes of these side frequencies, on basis of the same proportionality factor, will be proportional to 2.OP=MN provided that CD is rectilinear.

The same thing is true for another frequency such as F' resulting in points A' and B', or F'' resulting in the single point B'', as the ordinate of A'' has become negligible or zero. With this sum playing a part in the reconstitution of the initial modulating frequencies after detection, it will be seen that this reconstitution will be faithful up to frequency F''' which may be chosen equal to, or higher than, the highest modulation frequency.

A filter curve of the kind shown in Figure 2 will still do, because all that is essential is that the curve should be symmetric on either side of the reversal point P.

It may be noted that, as a matter of fact, the phase displacements introduced by the filter at different frequencies should also be kept in mind, but that in practice, if point P be chosen as hereinbefore indicated, the effects of such phase shifts, being of opposite sign upon either side of point P, will be negligible.

When applied to transmission, the invention may be carried into effect in the following way:

Suppose there is produced a carrier wave of relatively low frequency, say 30 kc, this wave being then modulated at signal frequency by any of the well known means and methods. The frequency spectrum thus constituted if impressed on a filter as described above will act upon said filter in the manner described hereinbefore. At the output end of the filter there will thus be recovered a frequency spectrum considerably reduced in width as compared with the width of the initial or original spectrum. By suitable frequency change, this spectrum is then transposed in the wave range imposed for the transmission.

So far as the application of the idea to reception is concerned, the same may be carried into practice as follows:

A receiving station or outfit may be provided in a similar way, that is to say, by using a frequency changing means followed by a filter in accordance with the instructions hereinbefore given. It will be seen that by choosing for this filter between its limits a certain width, it will be possible to reproduce acoustic frequencies correctly up to a value much higher than with the usual receiving method using both side bands. Moreover, no special correction on the low frequency after detection will have to be considered.

The invention, as will be understood, is susceptible of a great number of modifications in its practical application. Among other things it may be mentioned that it is possible to use the drooping branch of the filter curve instead of the ascending branch thereof, provided that this branch is symmetric or practically so with reference to its mean ordinate point. The invention likewise applies to all selector circuits provided that said circuits have a curve comprising

an ascending or a descending (drooping) branch answering the above condition.

In practice the filter circuit may be connected in transmitters and receivers of the type shown in Figure 3. The transmitter comprises a master oscillator 10, an amplifier 12 connected with a modulator 11, a filter circuit 14 of the type disclosed herein connected with the amplifier 12, frequency changers 16 connected with the filter 14, a power amplifier 18 connected with the frequency changers, and a load circuit AT connected with the power amplifier 18. The receiver comprises an absorption member AR connected with an amplifier 19 which feeds a frequency changer or signal demodulator 20 which, in turn, is connected with a filter 22 of the type disclosed in the present invention. The filter 22 is connected with a long wave amplifier 24 which, in turn, may feed an indicator 26.

Having thus described my invention and the operation thereof, what I claim is:

1. Transmitting means comprising, a generator of carrier waves, a modulator connected to said generator to modulate the waves generated therein, a load circuit, frequency changing means connected to said load circuit, and a filter circuit connected between said frequency changing means and said generator to transfer the modulated wave therefrom to said frequency changing means, the elements of said filter circuit being so dimensioned that the filter response is different for each sideband frequency and that the sum of the amplitudes of any upper sideband frequency and its corresponding lower sideband frequency will be substantially equal to the sum of the amplitudes of any other pair of sideband frequencies.

2. In a transmitting system, a generator of oscillations of carrier wave frequency, an amplifier coupled to said generator, a modulator coupled to said amplifier, a load circuit, frequency changing means connected to said load circuit, and a filter circuit connecting said frequency changing means to said amplifier to transfer modulated oscillations from said amplifier to said frequency changing means, the elements of said filter circuit being so dimensioned that the filter response is different for each sideband frequency and that the sum of the amplitudes of any sideband frequency and its corresponding lower sideband frequency will be substantially equal to the sum of the amplitudes of any other pair of sideband frequencies, and also equal to the double carrier frequency amplitude.

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