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INTERFERENCE ELIMINATOR

Filed May 4, 1938

Fig. 1

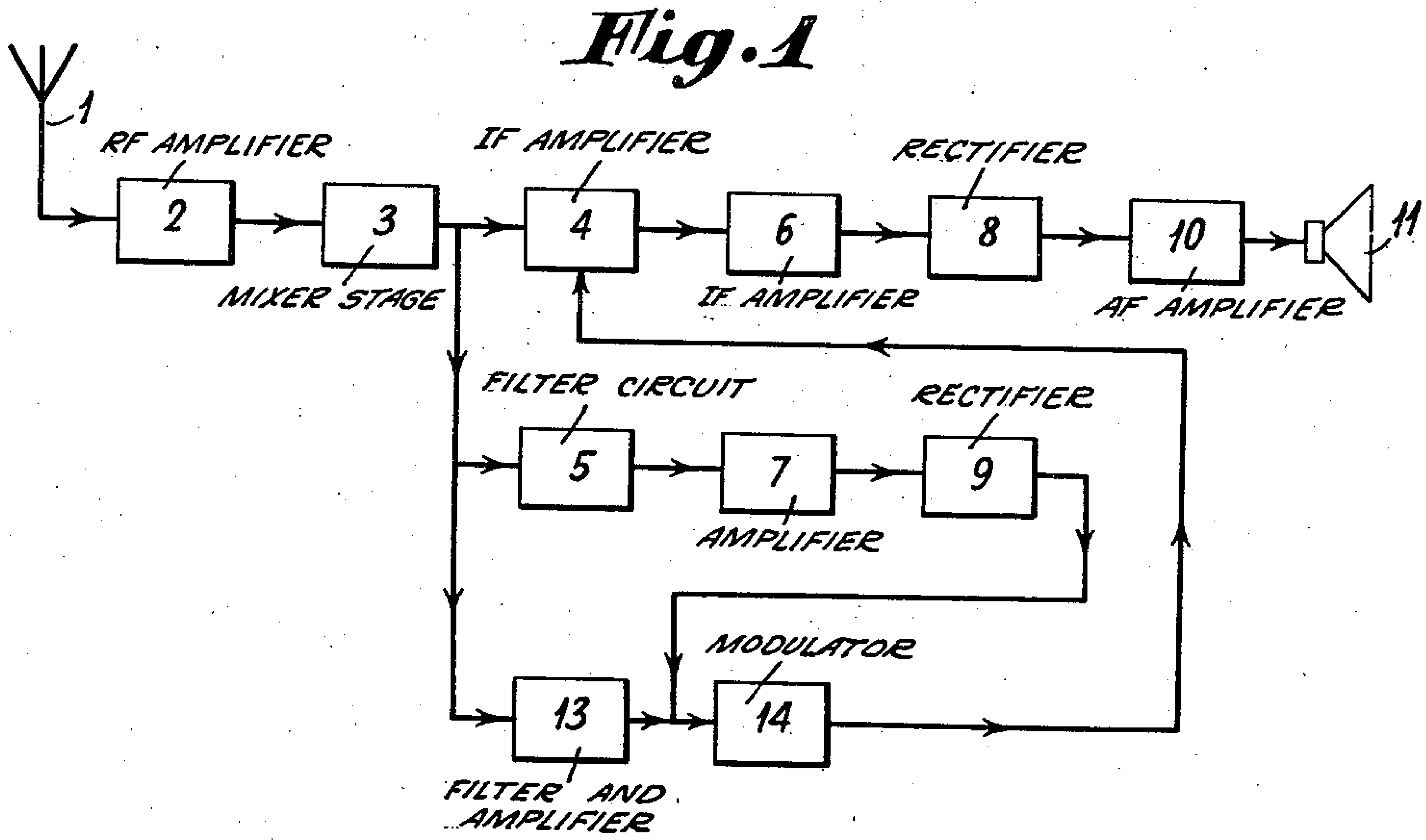
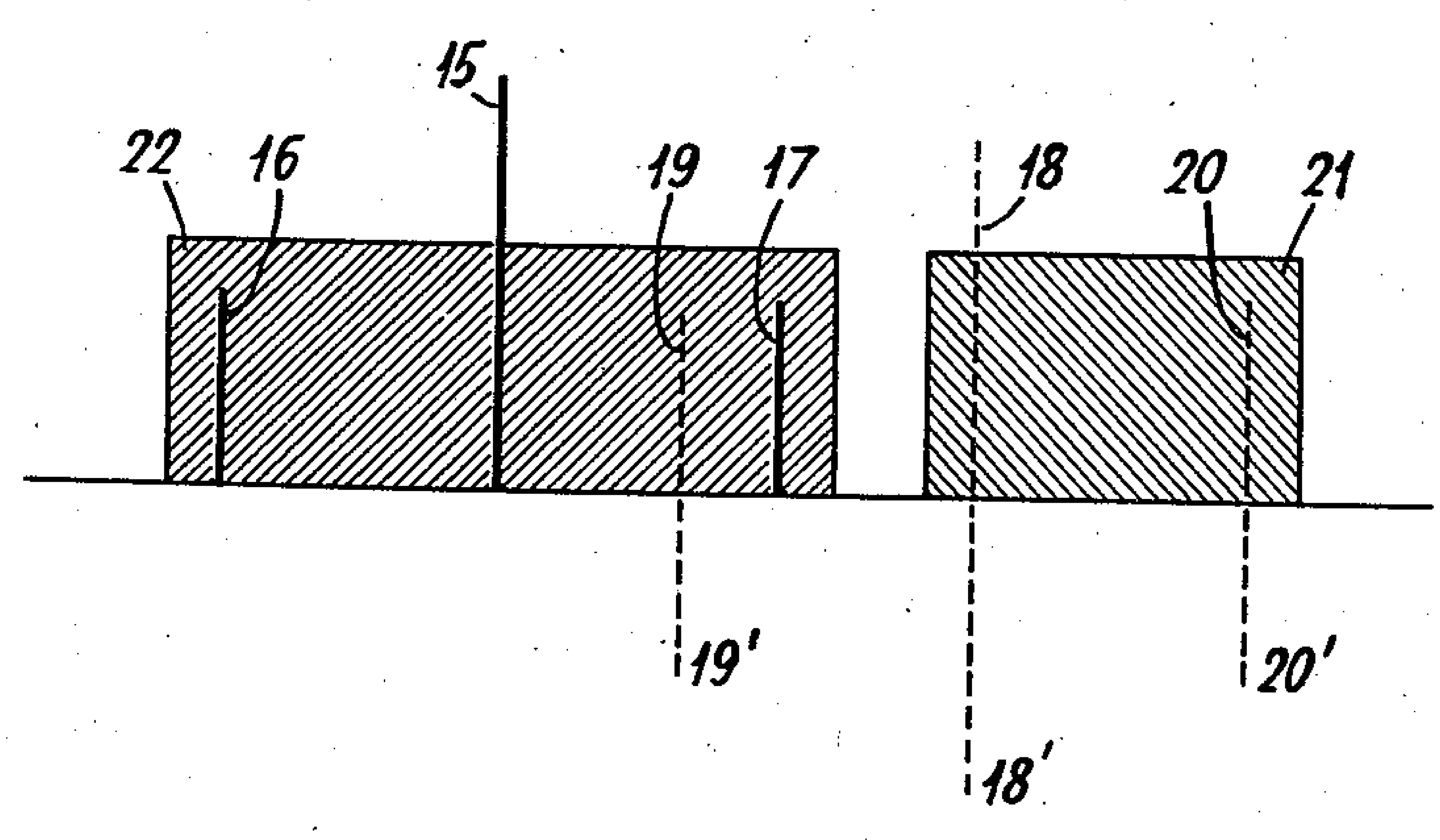


Fig. 2



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INTERFERENCE ELIMINATOR

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3 Claims. (Cl. 250—20)

The present invention is concerned with the problem of neutralizing the disturbing actions produced by a side-band of a neighboring transmitter station which overlaps into the frequency range of the side-bands of the station to be received, without incidentally reducing the bandwidth of the circuits tuned to the desired transmitter station.

According to this invention, compensation of the disturbing side-band of a neighboring transmitter is made feasible by filtering out the frequencies of the side-band of the neighboring station which causes no interference by the use of special selective means and imaging the same relative to the frequency of the carrier wave of the adjacent transmitter. The phase of the ensuing side-band is turned in such a way that it will present a phase shift of 180 degrees in reference to the disturbing frequency band of the adjacent station arising in the receiving circuit of the signals to be picked up, and that it is thereupon combined with the oscillations to be received at the same amplitude. This preferably is accomplished in a way so that the non-interfering side-band of the neighboring transmitter is demodulated conjointly with the carrier wave of the neighboring station, and that the ensuing AF is used for the modulation of an oscillation corresponding to the carrier wave of the neighboring transmitter and being of similar frequency. The other side-band which is thus recreated and which in relation to the carrier waves has a position being the mirror-image of the first side-band and which partially coincides with the frequency spectrum to be received, though containing only the disturbances, is so turned in its phase that it will compensate the frequencies which constituted the original interfering side-band of the neighboring transmitter.

In this manner particularly a compensation of all combination notes is accomplishable which originate from the carrier wave of the desired transmitter and the interfering frequencies of one of the side-bands of the adjacent station. The local carrier oscillation must be in synchronism with the carrier wave of the neighboring station, this state being suitably insurable by deriving the carrier thereof, say, by filtering with the aid of selective quartz filters followed by amplification, from the original carrier wave of the adjacent station.

Figure 1 shows an exemplified embodiment of the basic idea underlying the invention in schematic form. Fig. 2 is intended to explain the operation of the scheme.

The incoming (signal) current of RF is fed from the aerial 1 to the RF amplifier 2 and the mixer stage 3. The intermediate-frequency therein produced, on the one hand, is fed to an IF amplifier 4 of conventional construction. This amplifier is tuned to the desired IF carrier frequency 15 (Fig. 2). The pass of the band-pass filter which is indicated by the shaded area 22 is located symmetrically to the carrier and comprises the side-band frequencies 16 and 17 intended to represent the highest and lowest frequencies occurring in the frequency spectrum.

Part of the signal, on the other hand, is branched off above the mixer stage and is fed to the filter 5. This filter has a transmission range or pass which corresponds to the shaded area 21 in Fig. 2. 18 denotes the carrier of the disturbing station of neighboring wave-length, 19 and 20 are the side bands thereof. Parts of the side-band 19 are located inside the band-pass of the IF amplifier 4, and as a result their presence is annoying, that is, causes interfering actions.

Now, according to this invention the pass or range 21 presents disymmetry in reference to 18 in this sense that essentially only the side-band is passed which is at a greater distance from the desired frequency band, that is to say, in this instance the side-band between 18 and 20. It is to be noted at this juncture that the RF stages 2 and 3 must, of course, be of such a band width that the side-bands between 18 and 20 which serve for compensation will be transmitted. The side-band which lies between 18 and 19 is wholly or partly attenuated or suppressed by the filter 5. The transmitted frequencies are amplified in the amplifier 7 and rectified in the rectifier 9 which is adapted to undistorted reception of a single side band. Inasmuch as phase distortions in the reception of a single side-band decrease with the modulation percentage, means are suitably provided (not specially indicated in the drawing) whereby the modulation percentage of the interfering oscillations, at a point below the rectifier input or optionally even below the IF amplifier 5, will be reduced, say, by the addition of a synchronous carrier amplitude. The AF arising in the output circuit of the rectifier 9 is used for the modulation of an oscillation being of a frequency identical to the carrier wave of the neighboring station. With this end in view, the carrier of the neighboring-wave station is filtered out by the aid of a quartz filter 13, is thereupon raised to the desired amplitude, and finally modulated in circuit 14 with the AF resulting from the rectifier 9. The modulated RF which thus ensues is fed in proper phase and amplitude to a coupling circuit of the IF amplifier 4 in such a way that compensation of the side-band of the neighboring station causing interference with the reception of the desired signal wave is obtained. This inevitably results in also compensation of the side band of the neighboring wave station which is not responsible for troubled reception, insofar as this side band if developed at all in the light of the selective properties of the circuits here used, and in the presence of the same modulation percentage of the compensator oscillation, also of the carrier wave of the neighboring station. After compensation has been accomplished, the useful (signal) oscillations are suitably fed through additional IF amplifier stages 6, a rectifier stage 8, an AF amplifier stage 10, to a reproducer device 11 (loudspeaker).

We claim:

1. In a method of suppressing interference currents in a receiver produced by an intefering station whose channel is located with respect to the channel of a desired station so that one set of sidebands of the interfering station overlaps the channel of the desired station and the other set of sidebands of the interfering station is outside the desired channel, said method including the steps of filtering out the carrier and the non-overlapping sideband of the interfering station, detecting the filtered energy to produce therefrom currents representative of the modulation of the interfering station, utilizing the resultant currents to modulate an oscillation synchronous with the carrier of the interfering station and thereby produce a pair of sidebands identical with the received sidebands of the interfering station and combining in the receiver the newly produced sideband which lies in the channel of the desired station in opposition to the originally received sideband of the interfering station which lay within the desired channel.

2. In an arrangement for suppressing interference currents in a receiver which are produced by an interfering station whose channel is located with respect to the channel of a desired station so that one set of sidebands of the interfering station overlaps the channel of the desired station and the other set of sidebands of the interfering station lies outside the desired channel, means for receiving the energy transmitted by the desired station and the energy transmitted by the interfering station, means for segregating the carrier and the non-overlapping sideband of the interfering station, means for detecting the segregated energy and produced therefrom currents representative of the modulation of the interfering station, means for producing an oscillation synchronous with the carrier of the interfering station, means for modulating said last named oscillation by said representative currents and thereby produce two sidebands identical with the received sidebands of the interfering station and means for combining in the receiver that one of the newly produced sidebands which lies in the channel of the desired station in opposition to the overlapped originally received sideband of the interfering station.

3. An arrangement as described in the next preceding claim characterized by that the means for producing an oscillation synchronous with the carrier of the interfering station comprises a piezo-electric crystal device which is arranged with respect to the receiver so as to filter out a part of the carrier of the interfering station.

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