

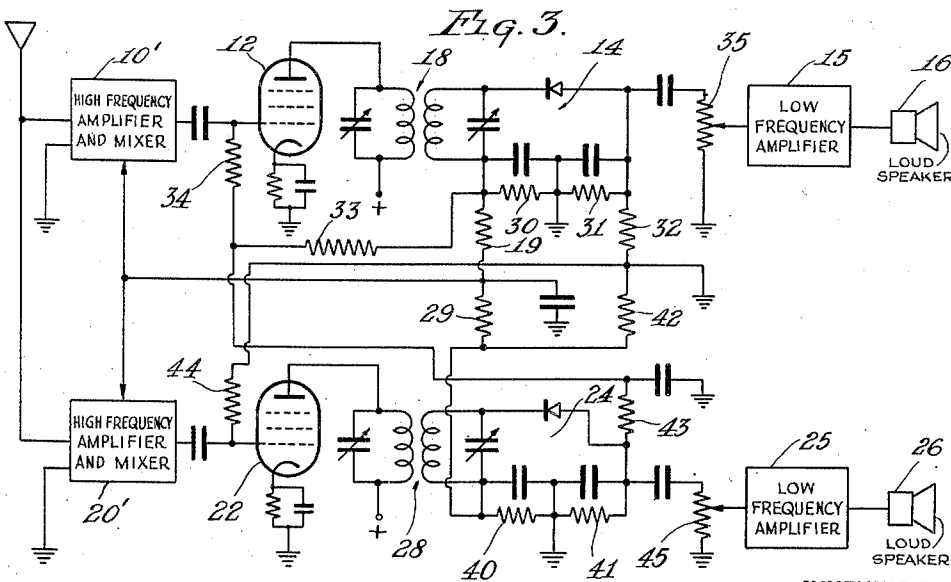
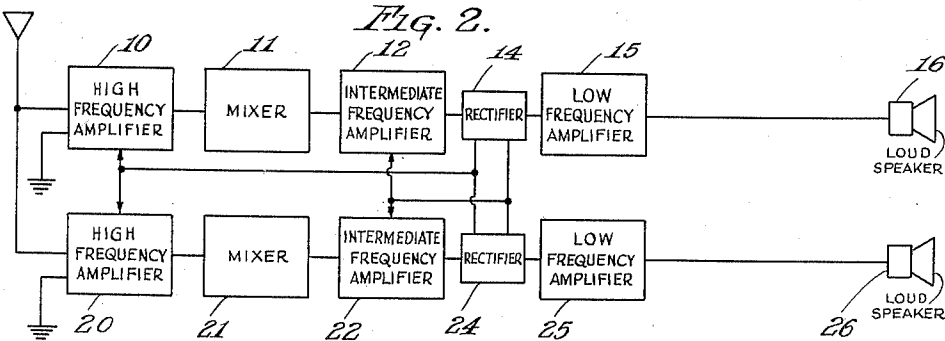
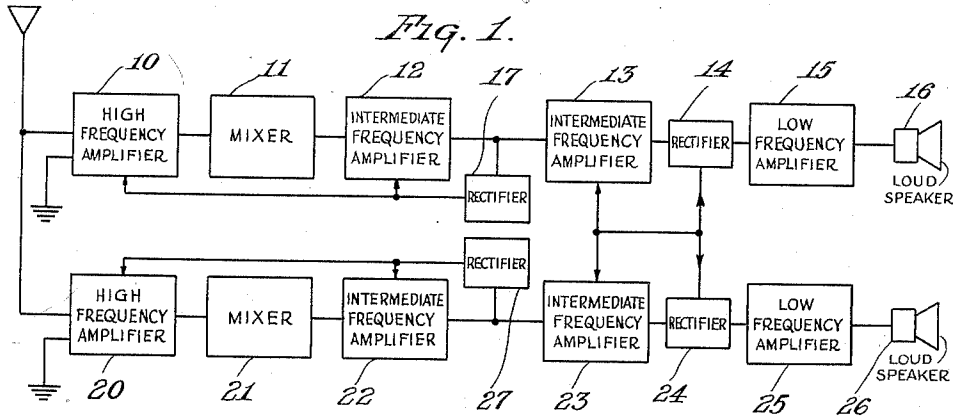
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STEREOPHONIC RECEIVING SYSTEM

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STEREOPHONIC RECEIVING SYSTEM

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This invention relates to a receiver for sound images which are taken stereophonically and transmitted separately and which are supplied through at least partly separated receiving channels to reproducing devices that are separated in space.

For transmitting stereophonically taken sound images at least two transmitting channels are required. The transmission by means of two transmitting channels may, for instance, take place by modulating and transmitting the two sound images on different carrier waves. When for a stereophonic transmission, two different carrier waves are not available, the two side bands of a single carrier wave may be utilized to constitute transmitting channels. In principle satisfactory stereophonic transmission is possible in either way.

Due to fading, however, the overall gain of the transmission channels, which may be defined as being the ratio between the signal strength on reception and that on transmission, is generally not the same for the two sound images.

If, however, the overall gain for the two sound images is not equal, distortion of the resulting sound image occurs.

The invention is based on the recognition that a normal automatic amplification control of the receiving channels is not sufficient to avoid this distortion.

According to the invention, a control oscillation is transmitted with each sound image and the amplification of at least one of the receiving channels is controlled automatically, in accordance with the intensity differences of the control oscillations, in such a manner that the influence of differences in the overall gain for the two sound images on the reproduced resulting sound image is eliminated at least for the greater part.

When the transmission of the sound images takes place through different carrier waves any of them may act as a control oscillation. If, in contradistinction thereto, a single carrier wave is used for the transmission of the two sidebands of one carrier wave, at least one additional oscillation must be emitted as a control oscillation. In this case preferably two control oscillations are added which are located on either side of the carrier wave.

The receiver is preferably designed in such a manner that each of the receiving channels is controlled in the aforesaid manner. Furthermore it is advisable that the amplification of at least one of the receiving channels of the receiver should also be controlled in accordance

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with the intensity of the incoming associated control oscillation. Excellent results are obtained by controlling the amplification of one or more stages in at least one of the receiving channels in accordance with the intensity of the incoming associated control oscillation, the amplification of one or more of the next stages being controlled in accordance with the intensity differences of the control oscillations.

Instead of control in accordance with the receiving intensity of the associated control oscillation, the amplification of at least one of the receiving channels may also be controlled automatically in accordance with the average intensity of the two incoming control oscillations.

In this case the amplification of one or more stages in at least one of the receiving channels is preferably controlled in accordance with the average intensity of the incoming control oscillations, the amplification of one or more of the next stages being controlled in accordance with the intensity differences of the control oscillations. A very simple receiver is obtained by rectifying each of the incoming and amplified control oscillations by means of a single rectifier and by so combining the rectified control oscillations as to obtain at least two control voltages appropriate for automatic control. The value of one of these control voltages depends on the intensity differences of the control oscillations and that of the other control voltage depends on the average intensity of the incoming oscillations.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawing, given by way of example.

In Fig. 1 a receiver according to the invention is represented schematically. The receiver is designed for receiving a transmission in which two stereophonically taken sound images are transmitted. This transmission takes place separately. The receiver comprises two receiving channels each of which amplifies and reproduces one of the sound images. The two sound images are transmitted on different carrier waves which act at the same time as control oscillations for the automatic amplification control. The oscillations picked up by an antenna are first of all amplified by high-frequency amplifiers 10, 20, then frequency-transformed in mixing stages 11, 21; and subsequently amplified again in intermediate-frequency amplifiers 12, 22 and 13, 23.

After that the oscillations are detected in rectifiers 14, 24, amplified in low-frequency amplifiers 15, 25 and reproduced by loudspeakers 16, 26.

Furthermore the intermediate-frequency oscillations amplified in the intermediate-frequency amplifiers 12, 22 are rectified in rectifiers 17, 27; by means of these rectified voltages, each of which is a measure of the intensity of the incoming associated carrier-wave, the amplification of the amplifiers 10, 12 and 20, 22 respectively is controlled, as indicated by arrows in the figure. From the rectifiers 14, 24 is taken a control voltage which is a measure of the difference in receiving intensity of the two carrier waves. By means of this control voltage the amplification of the intermediate frequency amplifiers 13, 23 is controlled in such a manner that the amplification of the receiving channel having the smaller carrier-wave amplitude is increased and that of the other channel is decreased. It is not necessary first of all to derive from the rectified signals a control voltage that is a measure of the intensity difference of the two carrier waves. As an alternative the output voltage of the rectifier 14 may be supplied to the amplifier 23 and the output voltage of the rectifier 24 to another amplifier, e. g. the amplifier 22. In this way a differential control can be established without first producing a differential control voltage.

In the drawing the differential control is indicated by arrows. In practice it has been found that this control permits a satisfactory stereophonic reproduction in spite of fading.

A still better result is obtained by means of the receiver schematically represented in Fig. 2. This receiver is different from that shown in Fig. 1 in that the rectifiers 17 and 27 are missing and furthermore in that there is only one set of intermediate-frequency amplifiers 12, 22.

The control voltages are now directly taken from the rectifiers 14, 24. One control voltage controls automatically the amplification of the high-frequency amplifiers 10, 20 in accordance with the average intensity of the two incoming control oscillations. The other control voltages provide for the differential control of the amplifiers 12, 22 in such a manner that the amplification of the receiving channel having the smaller control oscillation is increased and that of the channel having the larger control oscillation is reduced. In the drawing the two controls are indicated by arrows.

In Fig. 3 a diagram of a receiver shown in Fig. 2 is further elaborated.

In this event the two high-frequency amplifiers and the two mixing stages are jointly designated 10¹, 20¹. The intermediate-frequency amplifiers 12, 22 are coupled with the rectifiers 14, 24 through intermediate-frequency band-pass filters 18, 28. The output voltages of these rectifiers are set up across series-connected resistances 30, 31 and 40, 41 respectively, the junction of the two resistances 30, 31 and 40, 41 being earthed. By combining the voltages set up across these resistances different control voltages can be obtained.

Thus, for instance, a potentiometer consisting of two-series-connected resistances 19, 29 and being connected to corresponding ends of the resistances 30, 40 permits the obtainment of a control voltage which depends on the average intensity of the incoming control oscillations. By means of this control voltage the two high-frequency amplifiers 10¹ and 20¹ are controlled; this control is indicated by arrows in the drawing. The control voltages for the differential control are obtained by connecting two poten-

tiometers consisting of resistances 32, 42 and 33, 43 respectively each to opposite ends of the resistances 31, 40 and 30, 43 respectively. The control voltage taken from the potentiometer 32, 42 is supplied through a resistance 44 to the control grid of the intermediate frequency amplifier 22, whereas a control voltage taken from the potentiometer 33, 43 is supplied through a resistance 34 to the control grid of the intermediate-frequency amplifier 12.

The low-frequency oscillations are supplied through resistances 35, 45 to the low-frequency amplifiers 15, 25 and reproduced by loudspeakers 16, 26.

The circuit shown in Fig. 3 has the advantage over that shown in Fig. 1 in that each incoming carrier wave requires only one amplifier; of the two rectifiers required in total the different control voltages and, as the case may be, the low-frequency oscillations to be reproduced may be taken.

What we claim is:

1. In a stereophonic sound receiving system having stereophonic sound image components in a given intensity ratio relative to each other, first amplification channel means, means to apply a first stereophonic sound image component and a first control oscillation having an intensity proportional to the intensity of said first sound image component to said channel means, second amplification channel means, means to apply a second stereophonic sound image component and a second control oscillation having an intensity proportional to the intensity of said second sound image component to said second channel means, first and second spatially separated sound reproducing means coupled to said first and second channel means respectively, and means responsive to the difference in intensity of said control oscillations to vary the amplification of said channels relative to each other in a sense to apply said first and second sound image components to said sound reproducing means in said given intensity ratio.

2. In a stereophonic sound receiving system having stereophonic sound components in a given intensity ratio relative to each other, first amplification channel means, means to apply a first stereophonic sound image component and a first control oscillation having an intensity proportional to the intensity of said first sound image component to said channel means, second amplification channel means, means to apply a second stereophonic sound image component and a second control oscillation having an intensity proportional to the intensity of said second sound image component to said second channel means, first and second spatially separated sound reproducing means coupled to said first and second channel means respectively, means to vary the amplification of said first channel means inversely proportional to the intensity of said first control oscillation, and means responsive to the difference in intensity of said control oscillations to vary the amplification of said channels relative to each other in a sense to apply said first and second sound image components to said sound reproducing means in said given intensity ratio.

3. In a stereophonic sound receiving system having stereophonic sound image components in a given intensity ratio relative to each other, first channel means comprising first and second amplifying stages, means to apply a first stereophonic sound image component and a first control oscillation having an intensity proportional

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to the intensity of said first sound image component to said channel means, second channel means, means to apply a second stereophonic sound image component and a second control oscillation having an intensity proportional to the intensity of said second sound image component to said second channel means, first and second spatially separated sound reproducing means coupled to said first and second channel means respectively, means coupled to said first channel means to vary the amplification of said first amplifying stage inversely proportional to the intensity of said first control oscillation, and means responsive to the difference in intensity of said control oscillations to vary the amplification of said second amplifying stage in a sense to apply said first and second sound image components to said sound reproducing means in said given intensity ratio.

4. In a stereophonic sound receiving system having stereophonic sound image components in a given intensity ratio relative to each other, first amplification channel means, means to apply a first stereophonic sound image component and a first control oscillation having an intensity proportional to the intensity of said first sound image component to said channel means, second amplification channel means, means to apply a second stereophonic sound image component and a second control oscillation having an intensity proportional to the intensity of said second sound image component to said second channel means, first and second spatially separated sound reproducing means coupled to said first and second channel means respectively, means coupled to said first and second channel means to vary the amplification of said first channel means inversely proportional to the average intensity of said control oscillations, and means responsive to the difference in intensity of said control oscillations to vary the amplification of said channels relative to each other in a sense to apply said first and second sound image components to said sound reproducing means in said given intensity ratio.

5. In a stereophonic sound receiving system having stereophonic sound image components in a given intensity ratio relative to each other, first channel means comprising first and second amplifying stages, means to apply a first stereophonic sound image component and a first control oscillation having an intensity proportional to the intensity of said first sound image component to said channel means, second channel means comprising third and fourth amplifying stages, means to apply a second stereophonic sound image component and a second control oscillation having an intensity proportional to the intensity of said second sound image component to said second channel means, first and second spatially separated sound reproducing means coupled to said first and second channel means respectively, means coupled to said first channel means to vary the amplification of said

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first amplifying stage inversely proportional to the intensity of said first control oscillation, means coupled to said second channel means to vary the amplification of said third amplifying stage inversely proportional to the intensity of said second control oscillation, and means responsive to the difference in intensity of said control oscillations to vary the amplification of said second and fourth amplifying stages in a sense to apply said first and second sound image components to said sound reproducing means in said given intensity ratio.

6. In a stereophonic sound receiving system having sound image components in a given intensity ratio relative to each other, first channel means comprising first and second amplifying stages, means to apply a first stereophonic sound image component and a first control oscillation having an intensity proportional to the intensity of said first sound image component to said channel means, second channel means comprising third and fourth amplifying stages, means to apply a second stereophonic sound image component and a second control oscillation having an intensity proportional to the intensity of said second sound image component to said second channel means, first and second spatially separated sound reproducing means coupled to said first and second channel means respectively, means to produce a first control voltage proportional to the average intensity of said first and second control oscillations, means to apply said control voltage to said first and third amplifying stages, means to produce second and third control voltages proportional to the intensity difference between said first and second control oscillations, means to apply said second control voltage to said second amplifying stage, and means to apply said third control voltage to said fourth amplifying stage, said second and third control voltages being applied to said second and fourth amplifying stages in a sense to apply said first and second sound image components to said sound reproducing means in said given intensity ratio.

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