FOUR-SPEAKER ADJUSTABLE STEREO SOUND SYSTEM

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INVENTORS

FIG. 1

FIG. 2

FIG. 3

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ABSTRACT OF THE DISCLOSURE

A stereophonic sound reproducing system for automobiles including speaker units mounted in a quadrilateral pattern. A source such as a radio receiver delivers R and L signals to diagonally opposite pairs of speaker units. Balance and front-rear fader controls permit spatial variation in sound source. A second embodiment makes use of three speakers, two mounted in the front of the automobile and one in the middle rear portion. Similar balance and fader controls are provided for the three speaker embodiment.

Summary of the invention

This invention relates to stereophonic sound reproducing systems and more specifically to a system for reproducing stereophonic sound in an automobile. Systems for reproducing stereophonic sound generally consist of two loudspeakers or loudspeaker systems and enclosures, each of which is connected to one channel of a stereo signal source and placed in spaced relation along one wall of a listening area in front of the listeners. These speakers are usually spaced with a spread of 70% of the width of the listening area and the listeners must be confined to an area near the center of the space or room where they are approximately equidistant from the speakers for optimum stereophonic effect.

It is an object in making this invention to provide a loudspeaker arrangement to produce a good stereo effect over practically the entire room or interior of a listening area.

It is a further object in making this invention to provide a stereophonic reproducing system which can balance the intensity of sound in the listening area so that it need not be uncomfortably high for a listener in one location in order to provide an adequate intensity for another listener at a remote point in the listening area.

It is a still further object in making this invention to provide an adjustment in sound coverage and/or frequency response for a given listening area.

With these and other objects in view which will become apparent as the specification proceeds, our invention will be best understood by reference to the following specification and claims and the illustrations in the accompanying drawings, in which:

FIGURE 1 is a top plan view of a stereophonic sound system for an automobile showing the speaker locations; FIG. 2 is a block diagram showing the electrical circuits for the stereophonic system; and FIG. 3 is a similar block diagram of a circuit of a modified form of the invention.

One of the problems encountered in reproducing realistic stereo in a listening area is the apparent imbalance of the sound of either the left or the right channel when the listener is adjacent the speaker of one channel and remote from the speaker of the other channel. This situation is improved by the present invention by the use of two or more spaced speakers for the reproduction of each channel so that the positioning of a listener is less critical and it is possible to hear both channels in substantially all locations in the listening area.

Referring particularly to that figure, there is shown therein an automobile body 2 provided with a series of doors 4 for access thereto, a windshield 6 in the front portion, and a rear window 8. In front of the front seat 10 there is located the usual instrument panel 12 in one corner of which is mounted one loudspeaker B—1 and in the opposite or lefthand corner a second speaker A—1. In a similar manner under the rear package shelf 14 and on opposite ends thereof are located two additional speaker systems A—2 on the righthand side and B—2 on the lefthand side. It is thus immediately evident that any passenger in the vehicle sitting in either the front or the rear seats will be in effect surrounded by sound reproduced by this system. In coupling these four speakers into the stereophonic system they are electrically connected in a "cross fire" arrangement; that is the speaker in the right front corner is electrically coupled to that in the left rear corner to reproduce the same signal. Likewise the speaker in the left front corner is electrically coupled to that in the right rear to reproduce the complementary stereo signal. They have, therefore, been identified as A—1, A—2 in one group and B—1, B—2 in the second group.

FIG. 2 shows in block diagram form how the speakers are connected electrically.

A source of stereo sound 16 is provided which produces a stereo program comprising two stereo output signals, one representative of an R signal or righthand signal, and the other indicative of an L signal or lefthand signal. The output signal appears on line 18 and is applied through movable contact 20 to a variable resistance element 22, commonly referred to as a fader for controlling the proportionate amounts of signal fed to the two different speakers. Speaker B—1 is connected to one end of the resistance 22 through conductor 24 and speaker B—2 in the diagonally opposite corner of the vehicle is connected through conductor 26 to the opposite end of the resistor. Similarly the complementary signal for the other stereo wave is fed upon line 28 through movable contact arm 30 which engages a resistance 32. One terminal of this resistor is connected through conductor 34 to speaker A—2 and the opposite end through conductor 36 to speaker A—1. The two movable arms 20 and 30 are mechanically connected together so that they move simultaneously to apply different proportionate signals to the front and rear speakers. Thus by moving arms 20 and 30 to the left as shown in FIG. 2 more signal will be applied to the front speakers and movement to the right will apply more signal to the rear set.

There is also provided in the system a so-called balance control which may take various forms but is diagrammatically shown as a resistor 38 connected to the sound source 16 which has a center tap 40 which is grounded. Movement of the center tap adjusts proportionate amounts of sound between the two lines 18 and 28. Movement of the center tap changes the proportionate amount of signals fed to the A or B speakers. Thus by moving the fader control, the proportionate amount of sound can be moved forward and back in the vehicle and by changing the balance control 38 the proportionate amount of the right and lefthand signals can be changed. In such a manner the center of sound balance and stereo effect can be adjusted to any desired position in the ear body and it is not necessary for the listener to sit in any one position such as in the conventional stereo system. This system produces sound in such a manner that the listener or passenger has the illusion of large concert hall acoustics in the small interior of an automobile and feels that he is surrounded by sound.
A further modification may be in the use of a different type of speaker at the front of the car from that used in the rear in the mode of frequency response. Speakers that are more responsive to emphasize frequencies at the high end of the range may be used on the instrument panel in the front, while those on the back package ledge may be used to emphasize low frequency range. This produces an unusual effect and adds to the reality of the listener in feeling that he is surrounded by an orchestra. The system just described may be applied to the majority of automobile bodies. However, in the convertible type of body there is no package ledge in the rear for mounting the rear loudspeakers in the manner described and if a speaker is desired in this section it has heretofore been mounted in a center post which is in the middle of the rear seat. The block diagram shown in FIG. 3 illustrates the type of connections which may be used for installation in convertible models, since in that case only three speakers may be used, the same two in the front portion of the car but a single rear seat installation mounted in the center position. The sound source 16 is still provided through a balance control 38-40 and the fader controls 20-22 and 30-32. However, instead of having the lines to the rear go directly to two separate speakers, the two conductive lines 26' and 34' now feed into a crossover network 42 to provide a proper mixing of these two signals, the output of which is then connected through conductors 44 to rear speaker 46. This system is not quite as satisfactory as that shown before inasmuch as it lacks the entire surrounding of the passenger with sound but in view of necessity created by car body structure it works out well to give a real stereo response under the circumstances.

In order to prove it will be evident that we have provided a novel stereophonic system in which the center or focal point of the system can be adjusted to almost any point within the listening area without detracting from the total stereo effect by the use of a multiplicity of loudspeaker mounted at satisfactory locations and controlled in a novel manner.

What is claimed is:

1. A sound reproducing system for use with a stereophonic sound source that provides a plurality of audio frequency modulated electrical waves proportional to an L and R signal, respectively, of a stereo program comprising a quadrilateral enclosure having two side and two end portions, a plurality of speaker units, one mounted in each corner of the enclosure, an output line from the receiver upon which one of the audio frequency modulations appears connected to speaker units in opposite corners of the enclosure, a second output line from the receiver upon which another of the audio frequency modulations appear connected to opposite speaker units in the remaining corners so both sets are cross-connected to provide converging sound waves from both channels on the center of the enclosure when receiving a stereo transmission.

2. A sound reproducing system for use with a stereophonic sound source that provides a plurality of audio frequency modulated electrical waves proportional to an L and R signal, respectively, of a stereo program comprising a quadrilateral enclosure having two side and two end portions, a plurality of speaker units, one mounted in each corner of the enclosure, an output line from the receiver upon which one of the audio frequency modulations appears connected to speaker units in opposite corners of the enclosure, a second output line from the receiver upon which another of the audio frequency modulations appear connected to opposite speaker units in the remaining corners so both sets are cross-connected to provide converging sound waves from both channels on the center of the enclosure when receiving a stereo transmission, a fader control unit in each output line so that the proportionate amount of output between the two speaker units fed thereby may be varied, and a mechanical coupling between the fader control units so that they may be moved simultaneously to move the sound center from one end of the enclosure to the other.

3. A sound reproducing system for use with a stereophonic sound source that provides a plurality of audio frequency modulated electrical waves proportional to an L and R signal, respectively, of a stereo program comprising a quadrilateral enclosure having two side and two end portions, a plurality of speaker units, one mounted in each corner of the enclosure, an output line from the receiver upon which one of the audio frequency modulations appears connected to speaker units in opposite corners of the enclosure, a second output line from the receiver upon which another of the audio frequency modulations appear connected to the opposite speaker units in the remaining corners so both sets are cross-connected to provide converging sound waves from both channels on the center of the enclosure when receiving a stereo transmission, a fader control unit in each output line so that the proportionate amount of output between the two speaker units fed thereby may be varied, a mechanical coupling between the fader control units so that they may be moved simultaneously to move the sound center from one end of the enclosure to the other, and a balance control connected to the receiver to change the proportionate output from each and the balance of sound across the enclosure so that between the balance control and the fader control the center of sound may be adjusted to any point within the enclosure.

4. A sound reproducing system for use with a stereophonic sound source that provides a plurality of audio frequency modulated electrical waves proportional to an L and R signal, respectively, of a stereo program comprising a quadrilateral enclosure having two side and two end portions, a plurality of speaker units, one mounted in each corner of the enclosure, an output line from the receiver upon which one of the audio frequency modulations appears connected to speaker units in opposite corners of the enclosure, a second output line from the receiver upon which another of the audio frequency modulations appear connected to opposite speaker units in the remaining corners so both sets are crossed-connected to provide converging sound waves from both channels on the center of the enclosure when receiving a stereo transmission, the speaker units at one end of the enclosure being adapted to respond.
to reproduce a different frequency range than the speaker units in the other end.

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