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STEREOPHONIC SOUND FOR DRIVE-IN THEATRES

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2 Sheets-Sheet 1

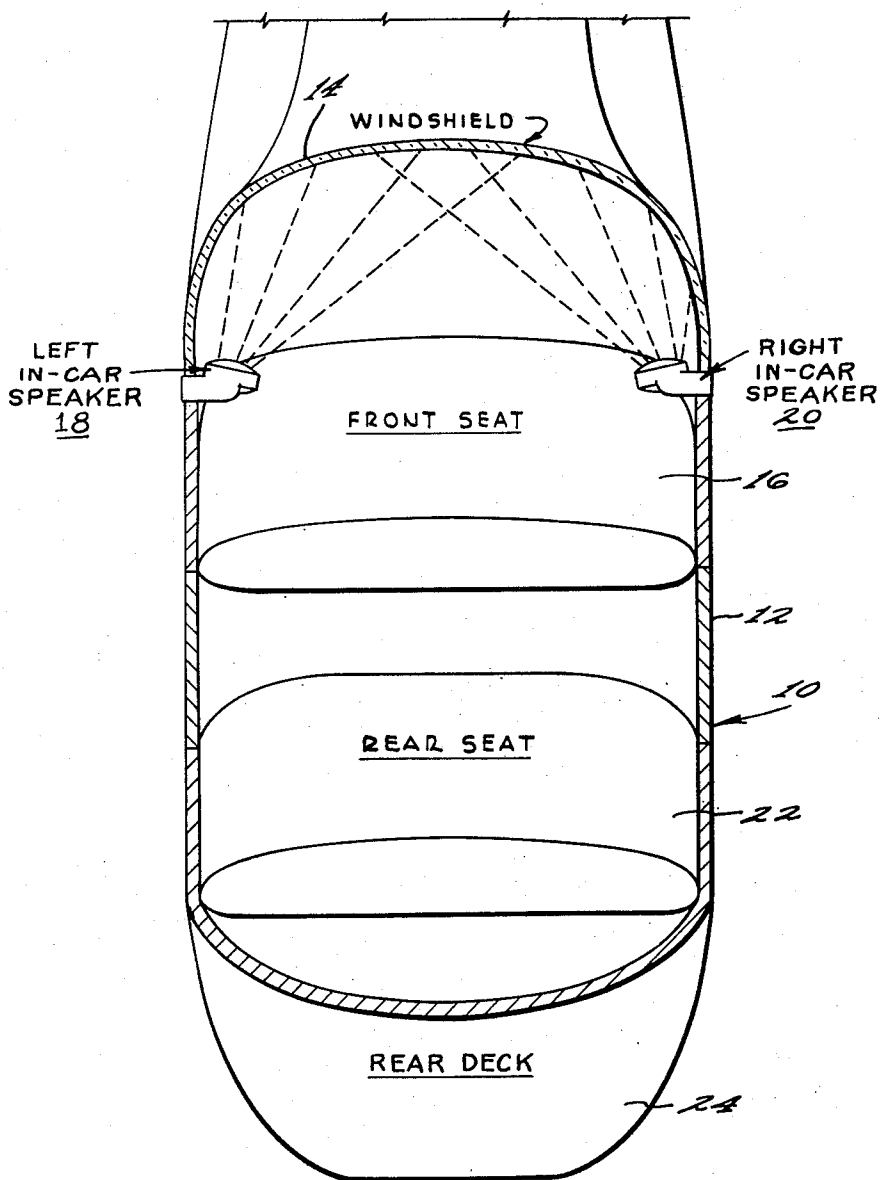


Fig. 1.

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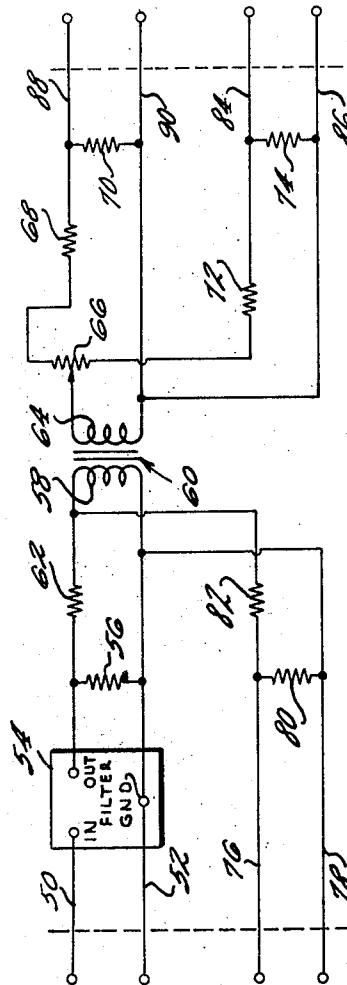
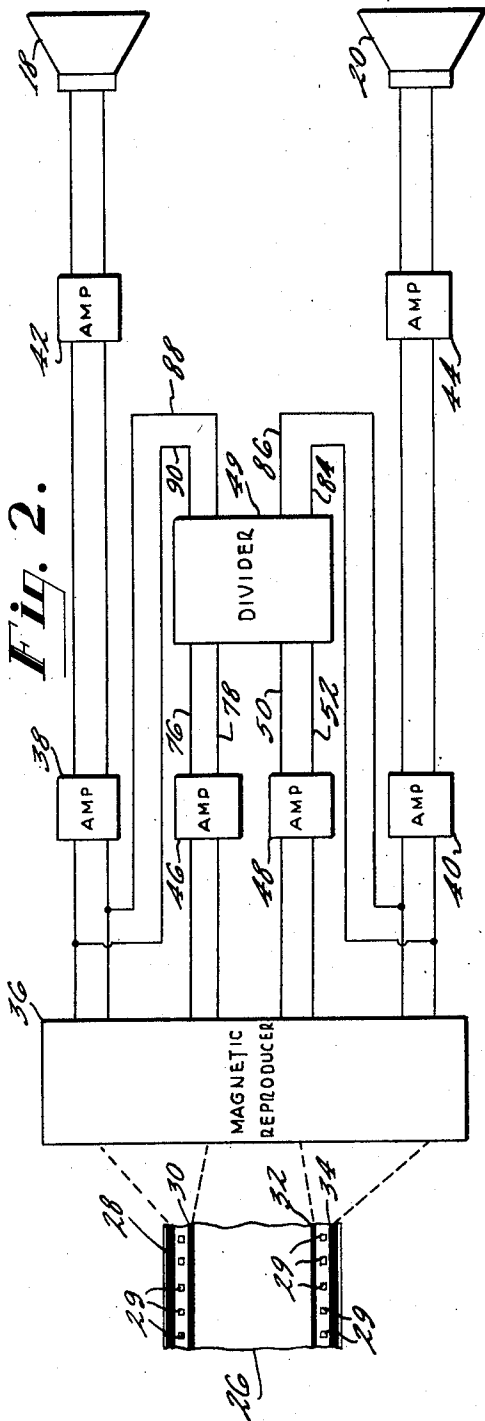
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STEREOPHONIC SOUND FOR DRIVE-IN THEATRES

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2 Sheets-Sheet 2



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STEREOPHONIC SOUND FOR DRIVE-IN THEATRES

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This invention relates to stereophonic sound systems, and more particularly to stereophonic sound systems for use in automobiles in drive-in theatres.

Stereophonic sound, generally, involves the recording of the original sound through three microphones placed respectively at the right, center and left of a set or other scene of action. The corresponding electrical signals from each of the microphones, representing the picked up sound, are generally amplified and recorded on three separate film sound tracks.

Sound may be recorded on film in various ways. For example, a variable area system may be employed in which transmitted light amplitude is a function of the amount of unexposed area in the positive print of the film. A variable density system may also be employed in which transmitted light amplitude is an inverse function of the amount of exposure in the positive print. In reproducing the sound recorded in the variable area or variable density systems, photoelectric devices are employed. The amount of light impinging upon the photoelectric device is controlled by the unexposed portion of the sound track in the variable area type of recording and by the inverse function of the density in the variable density type of recording.

Another common means of recording sound on film, which has come into common use, employs magnetic recording. Magnetic recording consists generally of magnetizing a suitable material in proportion to the instantaneous amplitude of an audio signal. In playback, the magnetized medium is generally moved past a pickup coil and causes a current to be induced which is proportional to the magnetization.

Regardless of the means employed for recording and reproducing, the recorded sound information from the sound tracks is generally translated into corresponding electrical signals. The amplified electrical signals are then generally applied to a transducer, such as a loudspeaker, where they are translated into corresponding acoustical signals to be heard by a person or audience.

In stereophonic reproduction for indoor theatres, the electrical signals are generally applied to three loudspeakers disposed at the left, right and center positions of a theatre screen. This arrangement of loudspeakers provides a spatial quality to music as well as a directional effect and enhances the realistic effect for many movie viewers.

At the present time, film producers use four track recording on a single film for stereophonic reproduction. One of the most common types of four sound track films now in use employs magnetic recording for the sound. Some motion picture producers find it uneconomical to provide certain films in more than one form. For example, a motion picture is produced either for ordinary sound reproduction requiring a single sound track, or for stereophonic reproduction requiring four sound tracks. There are many instances, such as in drive-in theatres, where it is desirable to display pictures involving a four sound track film.

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The fourth sound track on stereophonic sound films may be used for different purposes. For example, an orchestra or other musical source has a range of loudness very much greater than may be ordinarily recorded without distortion on a photographic film. It is therefore desirable to compress the original range of sounds before recording. When variable area or density systems are employed, account is kept of the amount of compression on the fourth track to be used as an automatic control for the expansion of the volume range which must be made in the production of the sounds.

When magnetic recording is employed, however, it is generally not necessary to compress the original sound signals. Therefore, the fourth sound track is not necessary to control any subsequent expansion of the sound. The fourth track on magnetically recorded sound films is used for recording sound effects, such as musical background, thunder or other sound not requiring a stereophonic effect.

When presently employed magnetic recording is used with four sound tracks, the sound output from the fourth, or effects track, is generally applied to a suppressor circuit, then to a power amplifier, and finally to a loudspeaker. A 12,000 kilocycle signal, generally accompanies the sound effects on the fourth track. The suppressor circuit is usually biased beyond cutoff and the purpose of the 12 kilocycle signal is to drive the suppressor circuit from a non-conducting to a conducting state by overcoming the cutoff bias. This permits the sound effects signal to pass to the power amplifier only at certain desired times.

In most drive-in theatres in use at the present time, a single loudspeaker in each vehicle, such as a car is generally employed to reproduce the sound information to be heard during the showing of a motion picture. Such a single loudspeaker is not readily adaptable for use with motion pictures having four sound tracks on a single film. Thus, the use of such films in drive-in theatres, without modifying the reproduction equipment, is often impractical. Even with such modification of the reproduction equipment, a viewing audience is deprived of the stereophonic effects which were originally intended to be conveyed.

It is an object of the present invention to provide a system for producing stereophonic sound in an automobile.

It is a further object of the present invention to provide a system for producing stereophonic sound for drive-in theatres.

It is still a further object of the present invention to provide means for utilizing four sound track films with two loudspeakers to produce stereophonic sound in an automobile.

In accordance with the present invention two loudspeakers are used with one disposed on the right side and one disposed on the left hand side of an automobile and within a substantially enclosed area of the automobile. Sounds from the loudspeakers are directed toward the front windshield of the automobile. Electrical signals representing the sound information recorded from the right side of a set or scene of action are applied to the loudspeaker on the right side of the automobile. Electrical signals representing the sound information recorded from the left side of the set are applied to the loudspeaker on the left side of the automobile. Electrical signals representing the sound recorded from the center of the set are equally divided between the two loudspeakers. Electrical signals from the sound effects track are equally divided between the two loudspeakers. This system provides a stereophonic effect within the enclosed area of the automobile.

Other objects and advantages of the present invention in addition to those mentioned above will become ap-

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parent and suggest themselves to those skilled in the art to which the invention is directed from a reading of the following specification in connection with the accompanying drawings, in which:

Figure 1 is a view in plan showing a form of the present invention in which two loudspeakers are directed toward the windshield of an automobile;

Figure 2 is a schematic diagram of an overall system embodying the present invention; and

Figure 3 is a schematic diagram of one form of a divider circuit, shown in Figure 1.

Referring particularly to Figure 1, there is shown an automobile 10 substantially enclosed by a frame 12 in the usual manner. A windshield 14 is disposed towards the front of the automobile. A pair of loudspeakers 18 and 20 are suitably mounted on the frame on the left and right portions of the automobile frame, as shown. These loudspeakers may be of the type ordinarily used in drive-in theatres which are detachably mounted on either the automobile frame below the windows of the automobile or on the top edge of the window glass. The speakers are mounted in such a way so that sound emanating from the speakers is directed toward the windshield. The automobile may, of course, include a front seat 16, a rear seat 22 and a rear deck 24. The dual speaker arrangement shown here, may be adapted to be used with a sound track sound film to provide stereophonic effects within the automobile, as will be described.

Referring now to Figure 2, an overall system embodying the present invention is shown by way of example. In the preferred embodiment, shown and described, the sound information is magnetically recorded on a four track film. It is understood, however, that various other methods of recording may be employed. Modification of the described embodiment to use other types of film recording will be apparent from the disclosure given herein to those skilled in the art to which the invention relates.

A film 26 includes four sound tracks 28, 30, 32 and 34. The film is provided with a plurality of openings 29. These openings are adapted to receive a series of moving sprocket teeth associated with a movie projector in a well-known manner.

The sound information from the sound track is applied to a magnetic reproducer 36, generally associated with the movie projector, which translates the sound information into corresponding electrical signals. Such magnetic reproducers may include a pickup coil in which a current is induced as the magnetized film is moved past the coil. It will be understood that the reproducer 36 has a pickup device or coil for each track and is shown in block form for convenience of illustration. Suitable magnetic reproducers are well-known in the art, and consequently are not shown nor described.

The electrical signals from the magnetic reproducer 36, resulting from the sound information of the tracks 28 and 34, are applied to amplifiers 38 and 40, respectively. After amplification, the amplified electrical signals are applied from the amplifiers 38 and 40 to power amplifiers 42 and 44, respectively. The electrical signals from the power amplifier are applied to the loudspeakers 18 and 20, respectively, where they are translated into corresponding acoustical signals. It will be seen that the sound information from one of the sound tracks 34, for example, may represent the original sound emanating from the right side of a set. This original sound information is applied to the speaker 20, disposed towards the right side of the automobile 10. It is further seen that the sound information from the second track 28, for example, may represent the original sound emanating from the left side of the set. This original sound information is applied to the loudspeaker 18 disposed towards the left side of the automobile. The system, as thus far described, is substantially similar to systems used for indoor stereophonic reproduction. It is under-

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stood that additional amplifiers may be employed at various points in the system. The relatively wide angle between a listener in a car and the two loudspeakers increases the stereophonic effect. The picture information may be recorded on the film portion between the sound tracks 30 and 32.

The sound information from track 30 which may, for example, represent the sound emanating from the center of a set and reproduced in an indoor theatre by the loudspeaker at the center of a stage, is applied to the magnetic reproducer 36 where it is translated into corresponding electrical signals. From the magnetic reproducer the electrical signals are applied to an amplifier 46.

The amplified electrical signals from the amplifier 46 is then applied to a divider 49 through leads 76 and 78. The divider provides a circuit, which equally divides its electrical signal output, as will be described. One-half of the electrical signal from the divider is fed back to the input of the amplifier 38 through leads 88 and 90, and the other half is fed back to the input of the amplifier 40 through leads 84 and 86. The amplified electrical signals from the amplifiers 38 and 40 are then applied to the power amplifiers 42 and 44, respectively. The electrical outputs from the amplifiers 42 and 44 are applied to the loudspeakers 18 and 20, respectively, where they are translated into corresponding acoustical signals.

The sound information from track 32 of the film is also applied to the magnetic reproducer 36. This track, for example, may include sound effects or other sound information. After the sound information has been translated into suitable electrical signals by the magnetic reproducer, the electrical signals are applied to the amplifier 48, and after amplification, to the divider 49 through leads 50 and 52. The divider equally divides the electrical signals from the amplifier 48, with one-half being applied to the input of the amplifier 38 through the leads 88 and 90 and the other half being applied to the input of the amplifier 40 through the leads 84 and 86. The divided electrical signals from the amplifiers 38 and 40 are then applied to the power amplifiers 42 and 44, respectively, and then to the loudspeakers 18 and 20, respectively.

A type of divider 49 which may be employed in carrying out the present invention is shown in detail in Figure 3. In this figure, the sound information from the track 32, which may represent the sound effects track, after amplification by the amplifier 48, is applied through the leads 50 and 52 to the divider circuit which includes a filter 54. The filter removes the 12 kilocycle signal, which is used to drive a suppression circuit from a cut-off state when a four sound track film is reproduced indoors, as has been described. In the present invention this 12 kilocycle signal is not necessary and it is desirable to remove it to avoid a hissing noise from appearing in the loudspeaker output. The remaining sound effects signal is utilized in the present invention and is, after the removal of the 12 kilocycle signal, applied across a load resistor 56. The voltage developed across this load resistor is applied to primary winding 58 of a transformer 60 through an impedance matching resistor 62. The voltage induced in the secondary winding 64 of the transformer is applied across a resistance network comprising a variable resistor 66 and voltage dividing resistors 68 and 70, as well as voltage dividing resistors 72 and 74.

This circuit, as described, provides the means for equally dividing the electrical signals which resulted from the sound track 32. One-half of the divided voltage is then fed back to the input circuits of the amplifier 40 through the leads 84 and 86. The other half of the divided voltages if fed back to the input circuit of the amplifier 38 through leads 88 and 90. Resistor 66 is made variable for balancing purposes so that voltages applied to the amplifiers 38 and 40 may be adjusted to equal values.

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The sound information from track 30, after reproduction and amplification is applied from the amplifier 46 across a load resistor 80 of the divider 49 through the leads 76 and 78. The electrical signals developed across the resistor 80 are applied to the primary winding 58 of the transformer 60 through an impedance matching resistor 82. The voltage induced in the secondary winding 64 is applied across the voltage dividing network comprising resistors 66, 68, 70, 72 and 74. The electrical signal voltage from the amplifier 46 is thereby equally divided, with one-half of the voltage being fed back to the input of the amplifier 38 and the other half being fed back to the input of the amplifier 40. As has been seen, the electrical outputs from the amplifiers 38 and 40 are applied to the power amplifiers 42 and 44, respectively. The electrical outputs from the amplifiers 42 and 44 are then applied to the loudspeakers 18 and 20, respectively, where they are translated into corresponding acoustical signals.

Thus it is seen that the electrical signals resulting from the sound tracks 30 and 32 are equally divided between the loudspeakers 18 and 20. The electrical signals resulting from the sound track 28 are applied directly to the loudspeaker 18 which may be disposed on the left side of the automobile 10 and the electrical signals resulting from the sound track 34 are applied to the loudspeaker 20 which may be disposed on the right side of the automobile.

The invention, as shown and described has resulted in a system in which stereophonic sound is reproduced in an automobile with the use of only two loudspeakers.

In carrying out the present invention, very accurate directional characteristics were observed based only on the volume levels of the two speakers. If the volume output of the left speaker was high, the sound appeared to come from a point well over to the left of the center of the automobile.

Although a magnetic sound track has been shown, it is understood that various other arrangements may be employed.

What is claimed is:

1. In combination with a motion picture film having a plurality of tracks for carrying sound information to be used for stereophonic reproduction, a single sound reflecting surface, a pair of sound translating devices for reproducing sound, means for directing said sound from said sound translating devices to said reflecting surface, means for applying said sound information from one of said tracks to one of said sound translating devices, means for applying said sound information from a second of said tracks to the other of said sound translating devices, and means for applying said sound information from a third of said tracks to both of said sound translating devices.

2. The invention as set forth in claim 1 wherein means are provided whereby said sound information is translated into electrical output signal voltages, and wherein said means for applying said sound information from said tracks to said sound translating devices include electrical circuitry adapted to handle said electrical output signal voltages, and means for equally dividing the signal voltages from said third track between said pair of sound translating devices.

3. In a drive-in theatre, a system for producing stereophonic sound for an automobile having a front windshield and a frame substantially enclosing an area, the combination comprising a motion picture film having a plurality of tracks for carrying sound information to be

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used for stereophonic reproduction, a pair of loudspeakers for reproducing sound, said loudspeakers being adapted to be removably mounted on opposite sides of said frame of said automobile and within the enclosed area of said automobile, means for directing said sound from said loudspeakers toward said front windshield of said automobile, means for applying said sound information from one of said tracks to one of said loudspeakers, means for applying said sound information from a second of said tracks to the other of said loudspeakers, and means for applying said sound information from a third of said tracks to both of said loudspeakers whereby a stereophonic sound effect is produced within said enclosed area of said automobile.

4. The invention as set forth in claim 3 wherein said sound information is translated into electrical output signal voltages, the signal voltages from said third track being equally divided between said pair of loudspeakers.

5. In combination with a motion picture film having four tracks for carrying sound information to be used for stereophonic reproduction, a continuous sound reflecting surface, a pair of sound translating devices for reproducing sound, means for directing said sound from said sound translating devices to be incident on said reflecting surface, means for applying said sound information from one of said tracks to one of said sound translating devices, means for applying said sound information from a second of said tracks to the other of said sound translating devices, means for applying said sound information from a third of said tracks to both of said sound translating devices, and means for applying said sound information from a fourth of said tracks to both of said sound translating devices.

6. The invention as set forth in claim 5 wherein said sound information is translated into electrical output signal voltages, the signal voltages from said third and fourth tracks being equally divided between said pair of sound translating devices.

7. In a drive-in theatre, a system for producing a stereophonic sound effect in an automobile having a front windshield and a frame substantially enclosing an area, the combination comprising a motion picture film having four tracks for carrying sound information to be used for stereophonic reproduction, a pair of loudspeakers for reproducing sound, said loudspeakers being adapted to be removably mounted on opposite sides of said frame of said automobile and within the enclosed area of said automobile, means for directing said sound from said loudspeakers towards said windshield, means for applying said sound information from one of said tracks to one of said loudspeakers, means for applying said sound information from a second of said tracks to the other of said loudspeakers, means for applying said sound information from a third of said tracks to both of said loudspeakers, and means for applying said sound information from a fourth of said tracks to both of said loudspeakers whereby a stereophonic sound effect is produced within said enclosed area of said automobile.

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