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STEREOPHONIC SOUND SYSTEM

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2 Sheets-Sheet 1

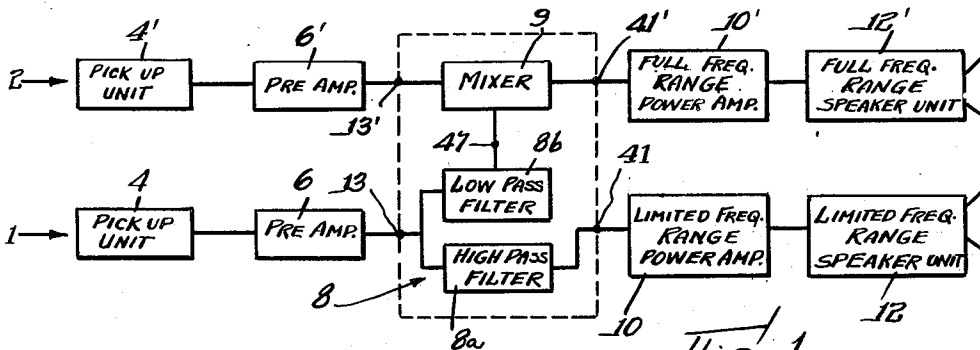
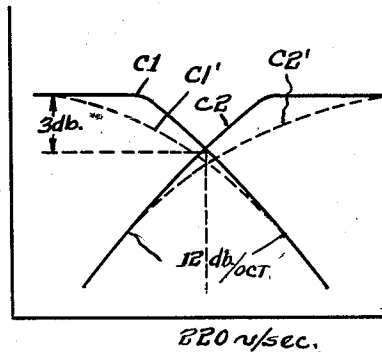
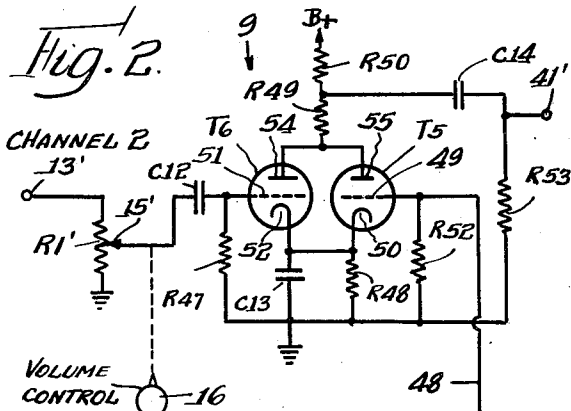


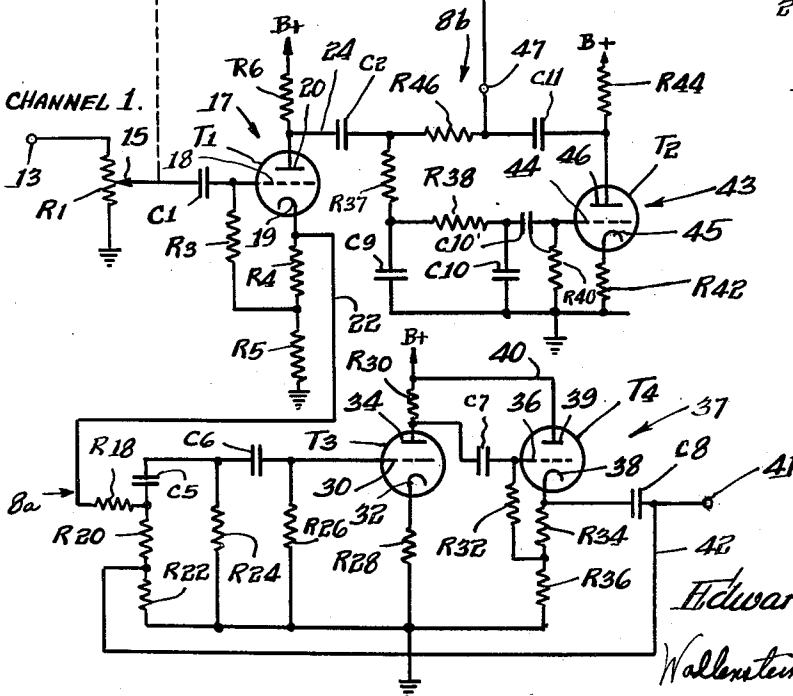
Fig. 1.

Fig. 2.



220 n/sec.

Fig. 3.



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2 Sheets-Sheet 2

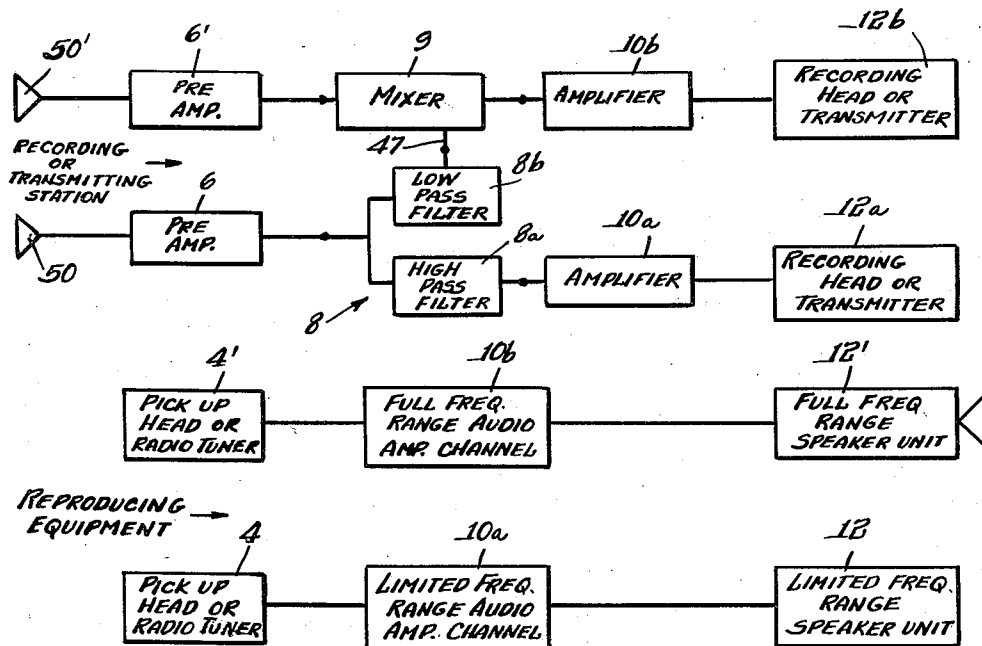


Fig. 4.

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STEREOPHONIC SOUND SYSTEM

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4 Claims. (Cl. 179—100.1)

This invention relates to high fidelity sound systems and more particularly to a new and improved binaural or stereophonic sound system.

In stereophonic-sound systems, a magnetic tape or disc-type record, or radio-transmitting system is utilized which has two or more separate sound tracks or channels respectively duplicating the sound received by a corresponding number (usually 2 or 3) rather widely spaced microphones at the recording location. A corresponding number of amplifying channels and speaker units are required to reproduce the recorded or transmitted signals, the speaker units, in such case, being spaced apart as the original microphones so that ordinary live listening conditions involving reception of sound from different directions by the respective ears of the listener is simulated.

In recent years, with the increasing popularity of high-fidelity sound equipment, manufacturers have strived to produce true high-fidelity sound equipment at prices which could be afforded by a very large segment of the American public. To a certain extent, in conventional single channel sound systems this has been achieved. However, since stereophonic sound systems require at least two complete sound channels, the cost thereof has remained way beyond the reach of a significant segment of the market.

One of the primary objects of the present invention is to provide a high-fidelity stereophonic amplifying system of high overall quality, particularly suited for home use, and which can be sold at a price substantially less than stereophonic systems of the type heretofore provided.

Another object of the present invention is to provide a unique stereophonic sound recording or radio transmitting system which enables the utilization of substantially less costly sound reproducing equipment than heretofore required.

One of the most severe and therefore the most expensive requirements placed on high fidelity sound reproducing equipment is the handling of the low frequency band of the audio frequency spectrum, this band commonly considered to extend from in the neighborhood of 10-50 cycles to 200-250 cycles per second. To obtain good low frequency response at "normal" power levels requires substantial peak power handling capabilities of the amplifiers and speakers and, along with this, large and relatively expensive transformers, speaker coils, and speaker enclosures.

In accordance with the present invention, it has been possible to provide a very high-quality stereophonic sound system wherein only one of the stereophonic sound channels need be designed substantially to operate over the entire audio frequency spectrum, the other stereophonic channel or channels are substantially less expensive being designed for operation in only the intermediate and high frequency bands. The present invention takes advantage of the non-directive quality of low frequency band sound waves due to the comparable relationship between the wave lengths of such frequencies and the dimensions of

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rooms commonly found in the home. Thus, low frequencies are disseminated throughout such rooms in a substantially non-directive pattern so that it is difficult, if not impossible to determine the direction from which such sounds emanate. On the other hand, sound waves having frequencies in the intermediate and high frequency bands have directional sound patterns. For example, for sound waves of the order of from 200 to 300 cycles per second and lower, the sound wave patterns are substantially non-directive, whereas, beginning with about 500 cycles per second and, to a much greater extent from about in the neighborhood of 900 cycles per second and above, they are substantially directive.

In accordance with one aspect of the present invention, the low frequencies are filtered out of the signal at the input end of one or more of the signal channels of a stereophonic sound reproducing system and are mixed with the low, intermediate and high frequencies of other channels thereof, whereupon the mixed signal is fed to a high-quality, full-frequency-range audio amplifier connected with a full-frequency-range speaker system. The intermediate and high frequencies remaining in the former channel or channels are fed through a corresponding limited-frequency range amplifier or amplifiers connected to a limited frequency range speaker system or systems costing substantially less than the full frequency range amplifier and speaker system of the latter channel. The overall stereophonic effect is not appreciably or noticeably diminished by the arrangement of the present invention, because, as above pointed out, the low frequency sound waves have a substantially non-directive pattern so that, in any event, the listener is not able to determine from which particular speaker system the low frequency sounds are being generated. If all the signal channels are designed to operate with low distortion and good frequency response in the intermediate and high frequency bands, the proper overall stereophonic effect will be obtained with the present invention, and with a substantial saving in the cost of the equipment, reaching, for example, in the neighborhood of two hundred dollars or more for each channel above the full frequency range channel.

In accordance with another aspect of the invention, the concept of utilizing only one of the channels of a stereophonic sound system for the low frequencies picked up by the various microphones at the recording location is applied to stereophonic signal recording or radio transmitting equipment. Consequently, the reproducing equipment need have only one wide frequency range reproducing channel capable of handling the low frequency band, the other channel being designed merely to handle the intermediate and high frequency bands.

Other features and advantages of the present invention will become apparent upon making reference to the specification to follow, the claims and the drawings wherein:

Fig. 1 is a simplified box diagram of a two channel stereophonic sound reproducing system constructed in accordance with the principles of the present invention;

Fig. 2 is a schematic diagram of the mixer and filter circuit outlined in dotted lines in Fig. 1;

Fig. 3 is a diagram of the frequency response characteristics of the high and low-pass filters utilized in the preferred filter system of the present invention; and

Fig. 4 is a simplified box diagram of both a stereophonic sound recording and sound reproducing system incorporating the present invention.

Referring now to Fig. 1, the stereophonic sound reproducing system there shown has two main signal-reproducing channels 1 and 2. Channel 1 is shown as comprising, from input to output, a pick-up unit 4, which may be a magnetic pick-up head for magnetic tape or a diamond or sapphire tipped pick-up cartridge for disc-type records, a pre-amplifier 6 for amplifying the weak

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signals generated by the pick-up unit 1, a filter circuit 8 for separating the low frequencies from the intermediate and high frequencies of signal channel 1, a limited frequency range amplifier 10 and a limited frequency range speaker system 12, both designed for operation in the intermediate and high frequency bands. The filtering circuit 8 may comprise a high-pass filter network 8a whose output is fed to the input of the limited frequency range amplifier 10, and a low-pass filter network 8b whose output is fed to a mixer 9 associated with the second channel of the sound system. Actually, a separate high-pass filter network may be omitted and the amplifier 10 designed to have high-pass filter characteristics or the filter circuit designed as a two section series filter where the low frequencies are filtered out in the first section leaving the other frequencies on the second or output section thereof.

Channel 2 comprises a pick-up unit 4' similar to pick-up unit 4, a pre-amplifier 6' corresponding to the pre-amplifier 6, the mixer 9 connected to the output of the pre-amplifier 6', a full frequency range power amplifier 10' connected to the output of the mixer 9, and a full-frequency range speaker system 12' connected to the output of the amplifier 10'. In the mixer 9, the low frequencies at the output of the low-pass filter 8b in channel 1 are mixed with the low, intermediate and high frequencies of channel 2, so that the speaker system 12' associated with the second signal channel will transmit the low frequencies picked up by the pick-up unit 4 of the first channel and the entire frequency spectrum generated in the second pick-up unit 4' of the second channel. As is conventional in stereophonic sound systems, the speaker systems 12 and 12' are positioned in spaced apart relation so that advantage may be obtained of the stereophonic effects produced by the intermediate and high frequencies emanating respectively from the two speaker systems. Now that the components of the system have been briefly introduced, those components constituting the novel portions of the stereophonic system of the present invention will now be described in more detail, it being understood that the broader aspects of the invention are not limited to the precise arrangement of components to be described.

Refer now more particularly to Fig. 2 showing the schematic diagram of the mixer and filtering circuits 8 and 9 enclosed, by dotted lines in Fig. 1. The signal input 13 to the filter circuit 8 extends to the upper end of a potentiometer R1 whose bottom terminal is grounded. The potentiometer is provided with a wiper arm 15 which is ganged for operation with a wiper arm 15' of a potentiometer R1' whose upper terminal is connected to a signal input 13' of the mixer 9 of the second channel and whose bottom terminal is grounded. The two wipers 15-15' are operated by a manual volume control knob 16, whereby the volume level of both channels may be varied simultaneously to provide automatically a balanced volume control means for the two signal channels.

Wiper 15 associated with the potentiometer R1 of the first channel is connected with a series circuit comprising a capacitor C1, a resistor R3 and a resistor R5 connected to ground. This resistor-capacitor network forms an input circuit to a phase splitter stage 17. The phase splitter stage 17 may include a triode vacuum tube or other suitable equivalent amplifying means, the vacuum tube 17 having a control grid 18, a cathode 19 and an anode 20. The control grid 18 is connected to the juncture between the capacitor C1 and the resistor R3, and the cathode 19 is connected through a resistor R4 to the juncture between resistors R3 and R5. The anode 20 is connected to the positive terminal of a source of direct current potential (B plus) through a resistor R6. The phase splitter stage 17 is provided with a first output line 22 extending from the upper or cathode end of the cathode resistor R4 to the high-pass filter circuit 8a, and a second output line 24 extending from the anode end of the plate circuit resistor R6 to the low-pass filter circuit

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8b. The circuit is designed so that the net gain of the circuit at output lines 22 and 24 is approximately one. The phase splitter stage 17 serves primarily the function of isolating the output lines 22 and 24.

The low-pass filter network 8a, to which the output line 22 extends, includes a series circuit comprising, in order, resistor R18, resistor R20 and resistor R22, the bottom terminal of the latter being grounded. Connected in series across the latter two resistors is a capacitor C5 and resistor R24. A capacitor-resistor circuit comprising capacitor C6 and resistor R26 are connected across the resistor R24. The control electrode 30 of a vacuum tube triode T3 or other suitable amplifying means is connected to the juncture between capacitor C6 and resistor R26. The tube T3 has a cathode 32 which is connected to ground through a resistor R28 and an anode 34 which is connected to the positive terminal of the B plus voltage source through a resistor R30. Tube T3 and the associated impedances form an amplifier circuit having an amplification factor greater than one, and the amplified output thereof is taken from the anode 34 of the tube through a capacitor C7 to the control electrode 36 of a triode vacuum tube or other suitable amplifying means T4 forming a cathode follower circuit 37. Resistors R32 and R36 are connected between the control grid 36 and ground, and resistor R34 extends from the cathode 38 of tube T4 to the junction point between resistors R32 and R36. The anode 39 thereof is connected through a line 40 to the positive terminal of the B plus voltage source. The output of the cathode follower circuit 37 is taken from the cathode 38 through a capacitor C8 to an output terminal 41. The terminal 41 is a terminal which is connected to the input of the limited frequency range amplifier 10 previously briefly described in connection with Fig. 1.

For the purpose of steepening the low frequency end of the output vs. frequency response characteristic C2' (Fig. 3) of the high-pass filter network 8a to form a resultant characteristic C2, a feed-back line 42 is connected from the output side of capacitor C8 to the junction point between resistors R20 and R22 at the input to the high-pass filter network. To obtain this result, some overall amplification in the high-pass filter network is required, and this is the reason for the amplifier circuit including the triode vacuum T3 and associated resistors. However, as above indicated, considering the filtering circuit as a whole and comparing the output at terminal 41 with the input at terminal 13, the circuit is designed so that the overall amplification is only one.

As above-indicated, the output of the phase splitter stage 17 leading to the low-pass filter network 8b appears on line 24 connected to the anode 20 of the tube T1. The line 24 is connected through a coupling capacitor C2 to the low-pass filter network 8b which includes a resistor R37 and a capacitor C9 connected in that order between the output side of capacitor C2 and ground. A resistor R38 and a capacitor C10 are connected in series between the junction of resistor R37 and capacitor C9, and ground, and a capacitor C10' and a resistor R40 are connected in series across capacitor C10. The control electrode 44 of a triode vacuum tube T2 or other suitable amplifying means is connected to the junction between capacitor C10' and resistor R40. A resistor R42 is connected between the cathode 45 of the tube T2 and ground. The anode 46 thereof is connected to the above-mentioned positive terminal of the B plus voltage source through a resistor R44. The amplified output of the tube T2 is coupled through a capacitor C11 to a low frequency filter output terminal 47.

In order to steepen the high frequency end of the low-pass filter network 8b, the amplified output of the amplifier circuit 43 is fed back to the input of the filter network 8b through a resistor R46 connected between the output side of the capacitor C11 to the input to the filter network at the juncture between capacitor C2 and resistor R37.

The curve C1 in the response curve shown in Fig. 3 represents the filter characteristic of the low-pass filter network 8b with the above-mentioned feed-back circuit, and the dotted curve C1' shows the response curve of the network in the absence of the feed-back circuit. The amplifier circuit 43 has an amplification factor greater than 1 in order to obtain the steepening of the filter characteristic, although, as above indicated, the overall amplification factor of the filtering circuit described obtained by comparing the amplitude of the output at the terminal 47 with the input across the terminal 13 is approximately 1.

As shown in Fig. 3 the crossover point between the high frequency end of the low-pass filter characteristic C1 and the low frequency end of the high-pass filter characteristic C2 is approximately 3 decibels below the tops of these curves which are at the same level. (These figures are given by way of example only since obviously other filter characteristics would also be satisfactory.) Also, the output characteristics decrease at approximately 12 db per octave at the adjacent ends thereof. The crossover points are designed in the described embodiment at approximately 220 cycles per second. The corresponding points of these curves at the low end of the low-pass filter 86 and the high end of the high pass filter (not illustrated) may, for example, be 10-30 cycles per second and 1300-2000 cycles per second or higher. At frequencies of 220 cycles per second and under the sound generating characteristics of conventional speaker systems is substantially non-directive. Directivity of such speaker systems begins in the neighborhood of 500 cycles per second and proceeding in the direction of increased directivity as the frequency increases from there. It is thus apparent that the filtering circuit described produces at the output terminal 41 directive frequencies in the so-called intermediate and high frequency bands (the intermediate frequency band normally being considered to extend from in the neighborhood of from about 200 to 300 cycles per second up to about 5,000 cycles per second) and non-directive low frequencies appear at the output terminal 47 of the filtering circuit.

The frequencies appearing at the output terminal 41, as above explained, are fed through the limited range power amplifier 10 and then to a limited frequency response speaker system 12. The low frequencies appearing at the terminal 47 are fed through a line 48 to one of the two inputs of the mixer circuit 9 of channel 2.

In the illustrated embodiment of the invention, the various parameters of the filter circuit 8 may be as follows:

R1 (R1')	ohms	250,000
R3	do	470,000
R4	do	1,500
R5	do	22,000
R6	do	22,000
R18	do	100,000
R20	do	120,000
R22	megohms	2.2
R24	ohms	150,000
R26	megohms	1
R28	ohms	27,000
R30	do	220,000
R32	do	470,000
R34	do	500
R36	do	22,000
R37	do	220,000
R38	do	220,000
R40	do	470,000
R42	do	1,500
R44	do	47,000
R46	do	220,000
C1	microfarads	.047
C2	do	.1
C5	micromicrofarads	6,800
C6	do	680
C7	microfarads	.022

C8	do	.01
C9	do	.01
C10	do	.015
C10'	do	.047
C11	do	.1
T1 and T2	Tube Type 12AU7	
T3 and T4	Tube Type 12AX7	

The mixer circuit 9 comprises a pair of triode vacuum tubes or other suitable amplifying means T5 and T6. Tube T6 has a control electrode 51 connected through a capacitor C12 to the wiper arm 15' of the potentiometer R1'. A resistor R47 is connected between control grid 51 and ground. The tubes T5 and T6 have cathodes 50 and 52 connected together and then to ground through a cathode self-biasing circuit comprising a resistor R48 in parallel with a capacitor C13. These tubes have anodes 54 and 55 connected together and through resistors R49 and R50 to the positive terminal of the B plus voltage source. The control electrode 49 of the tube T5 is connected to the low frequency line 48 extending to the low frequency output terminal 47 of the first channel. A resistor R52 extends between the control grid 49 and ground. The output of the mixer 9 is obviously a mixture of the low, intermediate, and high frequencies originating at the input of channel 2 and the low frequencies from the channel 1. This output is taken across the juncture between the plate circuit resistors R49 and R50, which output circuit includes a coupling capacitor C14 and resistor R53 which is grounded. The mixer circuit has an output terminal 41' connected to the junction between capacitor C14 and resistor R53.

It can be appreciated that the impedance between the output terminal 41 of the first channel and ground being across the cathode circuit of a cathode follower circuit is quite low, and this is desirable to minimize loading effects of stray capacitances present in the wiring connecting the high-pass filter section to the input of the amplifier 10. Such a cathode follower stage could be connected to the output terminal 41' of the second channel as part of the wide frequency response amplifier 10' or the mixer circuit 9. However, the mixer circuit is designed so that the impedance between the output terminal 41' and ground is quite low, although not anywhere near as low as that existing between terminal 41 and ground. One reason for not adding the cathode follower stage in the circuit illustrated is that the six triode tube sections shown may be most advantageously contained in 3-double triode envelopes, and the addition of a cathode follower stage would require an additional tube envelope.

The parameters of the mixer circuit may be as follows:

R47	ohms	470,000
R48	do	33,000
R49	do	67,000
R50	do	22,000
R52	do	47,000
R53	megohm	1
C12	microfarads	.047
C13	do	.25
C14	do	.047
T5 and T6	tube type	12AX7

As above indicated, since the limited frequency response amplifier 10 is not used to amplify the low band of frequencies of from 50 to 220 cycles, the required power for this amplifier is substantially less than that required for the wide frequency response amplifier 10'. For example, the amplifier 10 need only be an amplifier having from 12 to 15 watts undistorted output to match a wide frequency response amplifier 10' in the neighborhood of 30 watts. This factor together with the fact that amplifier 10 need only be designed to have a substantially flat response from the 220 up to 15,000 cycles could amount, for example, in an overall savings

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in amplifier cost in the neighborhood of from \$40 to \$60 or more.

The limited frequency response speaker system 12 may comprise a general purpose speaker operable in the intermediate and high frequency range, although a tweeter speaker may also be included to aid the response at the very high frequencies. For example, a good 8 inch general purpose speaker may be utilized costing in the range of from \$12 to \$25 mounted in a relatively inexpensive housing costing no more than \$25. On the other hand, the wide frequency response speaker system 12' generally requires a large, heavy and, hence expensive woofer speaker mounted in a relatively large speaker enclosure, costing, for example, as much as from \$125 to \$175 and up. It can thus be seen, that in the speaker system alone, a savings could be effected in the neighborhood of \$110 and up when using the present invention.

Thus, the embodiment of the invention just described, has provided a high quality stereophonic sound system which could be manufactured to sell for as much as \$200 less than a comparable stereophonic system designed in the usual manner.

The embodiment of the invention just described is also applicable to a stereophonic sound reproducing system wherein radio signals rather than phonograph or magnetic tape recordings are utilized as signal sources. In some cities, stereophonic signals are transmitted either on two FM stations or on one FM and one AM station. It should now be readily apparent, therefore, that the sound reproducing system shown in Fig. 1 is applicable to a two-channel radio receiving system wherein the pick up units 4 and 4' are respectively FM or AM tuners designed to receive signals from said radio stations.

In accordance with another aspect of the present invention, the removal of the low frequencies from one or more of the signal channels and the mixing of such low frequencies with the low, intermediate and high frequencies of another signal channel may be effected at the recording studio or radio station. In such case, the filter circuit 8 and mixer 9 previously described in connection with Fig. 1 would be added to the recording or transmitting equipment. The sound reproducing equipment, in the case of a two channel stereophonic system, could then comprise one limited frequency range amplifying channel and speaker unit and one full frequency range amplifying channel and speaker unit. Such a transmitting or recording and sound reproducing system is illustrated in Fig. 4. As therein shown, a pair of stereophonic signal sources 50—50' are shown at the recording studio or radio station, which signal source may respectively represent a pair of spaced microphones or, perhaps, a pair of phonograph or magnetic pick up units where the radio station is transmitting recorded music. The microphones or pick up units 50—50' are shown connected to respective pre-amplifiers 6—6'. The pre-amplifier 6 is connected to the input of a filtering circuit 8 which may be identical to the filtering circuit 8 previously described in connection with Figs. 1 through 3. The filtering circuit thus may comprise a high-pass filter network 8a whose output is connected to an amplifier 10a which may be a recording amplifier where a recording is being made or a suitable pre-amplifier leading to the modulating and power amplifier stages of a radio transmitter. Accordingly, the output of amplifier 10a is connected to the input of a recording head or radio transmitter 12a. In the latter case, the transmitter operating at a suitable carrier frequency is modulated by the audio signal fed thereto.

The filtering circuit 8 further includes a low-pass filter section 8b whose output line 47 is fed to one of the inputs of a mixer circuit 9 which may be the same mixer circuit illustrated in Fig. 2. The other input of the mixer circuit 9 is connected to the output of the above-mentioned pre-amplifier 6'. The output of the mixer 9, which comprises the low frequencies from the channel of sig-

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nal source 50 and the low, intermediate, and high frequencies of signal source 50', is connected to a suitable recording amplifier 10b corresponding to amplifier 10a. Since the cost factor of equipment at the transmitting or recording station is not a particularly important factor, the amplifiers 10a and 10b may both be full frequency range amplifiers, although, theoretically at least, only amplifier 10b need be designed to amplify frequencies in the low frequency band. The output of the amplifier 10b is fed to a recording head or transmitter 12b corresponding to the recording head or radio transmitter 12a. Where 12b is a radio transmitter it is, of course, operated at a substantially different carrier frequency than radio transmitter 12a.

The sound reproducing equipment purchased by the consumer may include the same equipment previously described in connection with Fig. 1. As shown in Fig. 4 phonograph disc or tape pickup heads or radio tuners 4 and 4' are provided for respectively providing the audio signals recorded or transmitted by the recorders or transmitters 12a and 12b. The outputs of the units 4 and 4' are respectively connected to limited frequency range audio amplifier channel 10a and full frequency range audio amplifier channel 10b which may respectively comprise the amplifiers 10 and 10' with or without the pre-amplifiers 6—6' previously described in connection with the embodiment of Fig. 1. The output of the amplifying channels 10a and 10b may be respectively fed to the same limited frequency range speaker unit 12 and full frequency range speaker unit 12' previously described.

It should be understood that numerous modifications may be made of the various forms of the invention above described without deviating from the broader aspects of the invention.

In the claims, such expressions as "limited frequency range" and "full frequency range" are utilized. When applied to amplifiers the former expression is intended to cover a low power handling amplifier relative to the power handling capabilities of the so-called full frequency range amplifier, the latter requiring higher power output because of the necessity of amplifying lower frequencies. When said former expression is utilized to describe a speaker unit, it is intended to indicate the inability of the speaker to handle frequencies without appreciable drop-off in response to frequencies at the low end of the low frequency band (e.g. frequencies below 100 cycles or less) while said latter expression when applied to a speaker unit is intended to cover a speaker unit which has a substantially flat response in this region as well as the intermediate and high frequency bands.

What I claim as new and desire to be protected by Letters Patent of the United States is:

1. In a stereophonic sound amplifier system including:
 - a first record pick-up unit for receiving a signal containing a range of audio frequencies including a low frequency band where the sound waves are substantially non-directive, and intermediate and high frequency bands where the sound waves are substantially directive, filtering means coupled to said pick-up unit for separating frequencies in said low frequency band from the frequencies in said intermediate and high frequency bands, said filtering means having a first output line at which the intermediate and high frequencies are applied and a second output line at which the separated low frequencies are applied, a limited frequency response speaker system designed primarily to generate frequencies in said intermediate and high frequency bands, and means coupling said speaker system to the first output line of said filtering means; and
 - a second record pick-up unit for receiving a second signal containing a range of audio frequencies including a low frequency band where the sound waves are substantially non-directive, and intermediate and high frequency bands where the sound waves are substantially directive, signal mixing means

having a first input coupled to said second record pick-up unit and a second input connected to said second output line of said filtering means, said signal mixing means having an output line at which all of the input signals are mixed together, and a wide frequency range speaker system designed to generate frequencies in said low, intermediate and high frequency bands, and means for coupling the latter speaker system to the output line of said signal mixing means.

2. In a stereophonic sound system: a first channel including a first stereophonic audio signal record pick-up unit for receiving a signal including low frequencies where the sound waves are substantially non-directive and intermediate and high frequencies where the sound waves are substantially directive, filtering means coupled to said first record pick-up unit for separating the low, non-directive frequencies from the intermediate and high frequencies, said filtering means having a first output line at which the intermediate and high frequencies are applied and a second output line at which the separated low frequencies are applied, a first power amplifier designed primarily to amplify the frequencies in said intermediate and high frequency bands, said power amplifier being coupled to the first output line of said filtering means, and a first limited frequency range speaker system designed primarily only to generate frequencies in said intermediate and high frequency bands and coupled to the output of said power amplifier; and a second channel including a second stereophonic audio signal pick-up unit for receiving low frequencies where the sound waves are substantially non-directive and intermediate and high frequencies where the sound waves are substantially directive, signal mixing means having a first input coupled to said second record pick-up unit and a second input connected to said second output line of said filtering means, said signal mixing means having an output line at which all of the input signals are mixed together, a second power amplifier of substantially greater power output than said first power amplifier coupled to the output line of said mixing means, said second power amplifier being designed to amplify said low, intermediate and high frequencies, and a relatively full frequency range speaker system designed to generate all of said frequencies coupled to the output of said second power amplifier.

3. In a stereophonic sound system: a first signal channel having a first record pick-up unit for receiving a first signal including a wide range of audio frequencies including a low frequency band where the sound waves are substantially non-directive, and intermediate and high frequency bands where the sound waves are substantially directive, filter circuit means having a low-pass section coupled to said first record pick-up unit of the first channel for filtering out the frequencies of said intermediate and high frequency bands and a high-pass section coupled to said first record pick-up unit for filtering out the frequencies in said low frequency band, a power amplifier designed to amplify primarily the frequencies in said intermediate and high frequency bands

and coupled to the output of said high-pass section of said filter circuit means, and a limited frequency response speaker system designed primarily to generate the frequencies in said intermediate and high frequency bands and coupled to the output of said power amplifier; and a second signal channel having a second record pick-up unit for receiving a second signal including said wide range of frequencies, a mixer circuit coupled to said second record pick-up unit and to the output of said low-pass section of said filter circuit means for providing a resultant output comprising a mixture of the low frequencies from the second signal channel and the low, intermediate and high frequencies from the first signal channel, said mixer circuit having an output line at which said resultant output is fed, a second power amplifier coupled to said output line of said mixer circuit, said power amplifier having a higher power output than said first mentioned power amplifier and being adapted to amplify frequencies in the low, intermediate and high frequency bands, and a wide frequency response speaker system connected to the output of said last mentioned power amplifier and designed to amplify the frequencies in said low, intermediate and high frequency bands.

4. In a stereophonic sound system: a first signal channel including a first record pick-up unit for receiving a first signal including a wide range of audio frequencies including a low frequency band where the sound waves are substantially non-directive, and intermediate and high frequency bands where the sound waves are substantially directive, filter circuit means having a low-pass section coupled to said first record pick-up unit of the first channel for filtering out the frequencies of said intermediate and high frequency bands and a high-pass section coupled to said first record pick-up unit for filtering out the frequencies in said low frequency band, and a limited frequency response speaker system designed primarily to generate the frequencies in said intermediate and high frequency bands and coupled to the output of said high-pass section of said filter circuit; and a second signal channel having a second record pick-up unit for receiving a second signal including said wide range of frequencies, a mixer circuit coupled to said second record pick-up unit and to the output of said low-pass section of said filter circuit means for providing a resultant output comprising a mixture of the low frequencies from the second signal channel and the low, intermediate and high frequencies from the first signal channel, said mixer circuit having an output line at which said resultant output is fed, and a wide frequency response speaker system coupled to said output line of said mixer circuit and designed to amplify frequencies in said low intermediate and high frequency bands.

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