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MONAURAL AND BINAURAL SOUND SYSTEM

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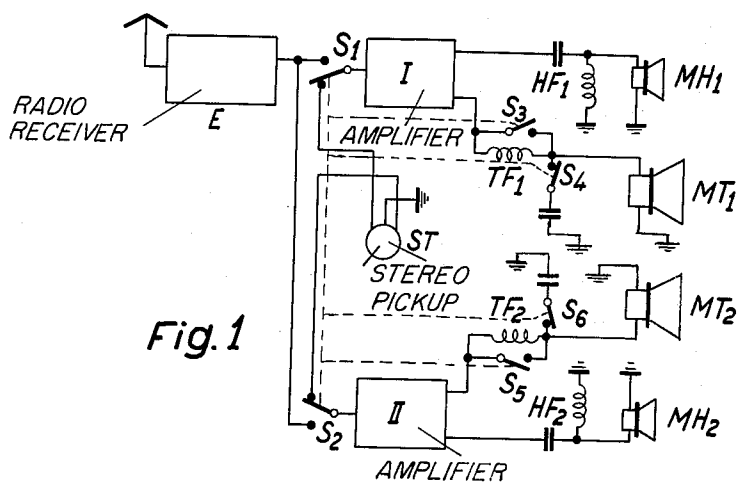


Fig. 1

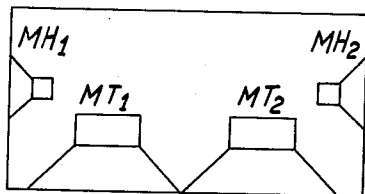


Fig. 2

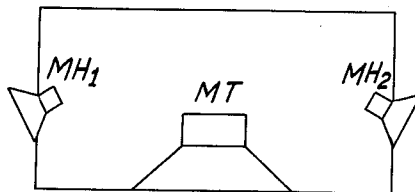


Fig. 4

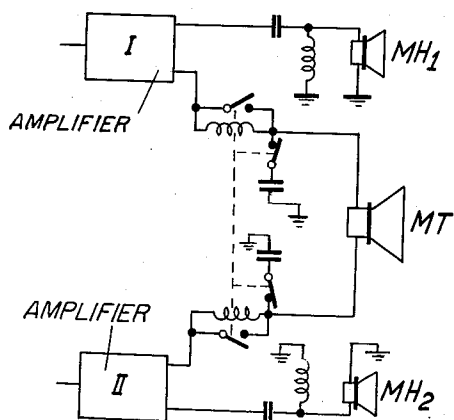


Fig. 3

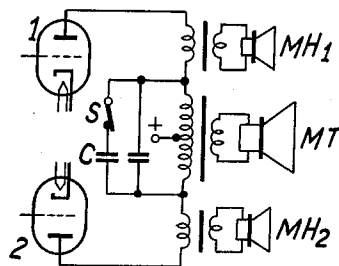


Fig. 5

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MONAURAL AND BINAURAL SOUND SYSTEM

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The present invention relates to a loudspeaker, amplifier and cross-over system for selectively reproducing either binaural or monaural sounds, and to a switching system therefor.

In order to reproduce stereo records over two channels, amplifiers and radio receivers, ordinarily, have to be altered accordingly. However, radio receivers also must be designed to be compatible with monaural reproduction because, at present, radio broadcasts are generally transmitted via only a single channel. Likewise, it is desirable that the same amplifiers be capable of single-channel reproduction.

The conditions for the most favorable reproduction are different in case of two-channel systems from those of one-channel reproduction. In two-channel reproduction, the spacing between the loudspeakers for sound propagation above about 300 cycles has to be sufficiently large in order to differentiate whether the sound is originating from the right or from the left side.

In contrast to this, it is important in case of single-channel reproduction that the medium and higher frequency sounds be radiated directly by the apparatus towards the listener as, otherwise, a disagreeable sound effect is present, due to the lack of apparent sound direction.

Heretofore, it has been possible only to fulfill either the one or the other requirement or, else, to compromise between the two requirements. For example, it would be possible to provide for the two kinds of reproduction at least partially separate loudspeakers which are spaced as required and which are selectively switched on, however, the expense thereof would be rather high.

Therefore, it is an object of the present invention to fulfill the requirement for superior two-channel and one-channel reproduction within a single apparatus without additional loudspeakers.

The invention is based on a loudspeaker arrangement which is most favorable for single-channel reproduction and, therefore, comprises at least one suitably larger loudspeaker radiating directly or indirectly forwardly for the low and medium frequency sounds, and at least two smaller loudspeakers for the medium and high frequency sounds, said latter loudspeakers being mutually spaced and radiating divergently outwardly to the sides.

It is another object of the invention, in case of stereo reproduction, to apply only the low frequencies up to about 300 cycles to the larger loudspeaker or to several such larger loudspeakers via cross-over filters, while in case of monaural reproduction, these filters are disconnected.

In such system, use is made of the known fact that the low frequencies up to about 300 cycles have virtually no influence on the apparent location of the sound source during stereophonic reproduction so that, for the two channels, a single low-frequency loudspeaker or several shunted low-frequency loudspeakers can be employed.

Using cross-over filters, the application of which for stereophonic reproduction has been known in connection with one low-frequency loudspeaker common to the two channels, the higher frequencies can be fed in case of two-channel reproduction to separate smaller loudspeakers spaced a predetermined distance from one another, whereby stereophonic spacing is provided. When the cross-over filters are disconnected in case of one-channel reproduction, the central loudspeakers for the low frequencies,

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in addition to the smaller side loudspeakers, radiate the medium and, if necessary, the higher frequency sounds in the forward direction, whereby the desired directional impression is produced. In this case, a uniform circular sound radiation pattern for all the frequencies is obtained in combination with the side loudspeakers.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

In the drawings:

FIGURE 1 shows schematically an embodiment of the invention using four loudspeakers;

FIGURE 2 illustrates schematically a top view of the loudspeaker mounting for use with the arrangement shown in FIGURE 1;

FIGURE 3 shows schematically a second embodiment of the invention, employing an arrangement of three loudspeakers.

FIGURE 4 shows schematically a top view of a mounting of the loudspeakers used in the system of FIGURE 3.

FIGURE 5 illustrates schematically another embodiment of a system according to the invention, using three loudspeakers.

In the embodiment of FIGURE 1, two related signals supplied from a stereo pickup arm ST are connected via two switches S_1 and S_2 to the inputs of two audio-frequency amplifiers I and II, respectively. These amplifiers I and II are connected via respective high-pass filters HF_1 and HF_2 to separate medium and high frequency loudspeakers MH_1 and MH_2 , respectively. Only the low frequencies up to 300 cycles are received by larger speakers MT_1 and MT_2 via low-pass filters TF_1 and TF_2 , respectively. These loudspeakers are only used as low-frequency speakers in case of two-channel reproduction.

When the switches S_1 and S_2 are placed in the other position from that shown in FIGURE 1, the inputs of the two amplifiers I and II are connected to the output of the detector (not shown) of a radio receiver E. In this case, the reproduction is monaural. The switches S_1 and S_2 are ganged and in addition are ganged with switches S_3 , S_4 , S_5 and S_6 which all are operated simultaneously to render the low-pass filters TF_1 and TF_2 ineffective. The larger loudspeakers MT_1 and MT_2 will then receive also the medium and higher frequencies in addition to the low frequencies during monaural operation. However, the high frequencies are generally radiated only to a lesser extent by these loudspeakers.

It would be possible to switch the crossover filters in such a manner that the loudspeakers MT_1 or MT_2 are selectively connected either directly to the output of the amplifiers, or to the output of the filters. However, the switching system as shown has the advantage that the switch contacts do not carry the total loudspeaker current.

The two loudspeakers MT_1 and MT_2 , as shown in the loudspeaker arrangement of FIGURE 2, are mounted on the front of a baffle cabinet, while the loudspeakers MH_1 and MH_2 are mounted on the side walls thereof. It is also possible to provide them at an oblique angle on the side walls of the baffle cabinet, as shown in FIGURE 4.

In the embodiment of FIGURE 3, only a single larger loudspeaker MT is provided which is fed by both amplifiers I and II. In this system, the two A.C. sources driving the amplifiers are connected in series with respect to the loudspeaker MT. It may be possible to connect the

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amplifiers in a shunted-circuit arrangement at the inputs of the low-pass filters TF_1 and TF_2 .

The loudspeakers of the system according to FIGURE 3 are suitably mounted as shown in FIGURE 4. The larger sound loudspeaker MT is mounted on the front wall of the baffle cabinet, while the smaller loudspeakers MH_1 and MH_2 are set at oblique angles in the side walls of this baffle cabinet and radiate their respective sounds forwardly at suitable angles.

According to the system shown in FIGURE 5, output tubes 1 and 2 of two amplifiers I and II (as shown in FIGURES 1 and 3) are connected in push-pull. If the invention is applied to this circuit arrangement, a condenser C, acting as a frequency filter, is connected via the switch S in parallel with the primary of a push-pull transformer. If the switch S is closed during two-channel reproduction, the medium frequencies are by-passed at this transformer. If the switch S is opened for monaural reproduction, the medium frequencies are radiated by the larger loudspeaker MT and, if needed, also the high frequency sounds. The loudspeakers may be arranged in the same manner as in FIGURE 4.

I claim:

1. A sound system for alternatively reproducing monaural signals or stereophonically related signals comprising, larger loudspeaker means for radiating low and medium frequencies; two smaller loudspeaker means spaced from each other and oriented mutually divergently for radiating medium and high frequencies; two amplifiers each having an input and an output; a medium-and-high-frequency pass filter connected between an output of each amplifier and an associated smaller loudspeaker means; low-pass filter means associated with said larger loudspeaker means; and switching means comprising a plurality of simultaneously operated switch section in the inputs

and outputs of the amplifiers and movable selectively into a monaural position wherein the amplifier inputs are both connected to receive the same monaural signal and the larger loudspeaker means is connected directly to the outputs of the amplifiers, and said switching means being movable to a stereo position wherein the amplifier inputs are separately connected to the stereo signals and wherein said switching means connect said low-pass filter means in series with the respective outputs and said larger loudspeaker means.

2. In a sound system as set forth in claim 1, a baffle cabinet having front and side surfaces, said larger loudspeaker means comprising at least one loud speaker mounted on the front surface, and said smaller loudspeakers being mounted on mutually spaced side surfaces and faced outwardly of the cabinet in diverging directions.

3. In a sound system as set forth in claim 1, each low-pass filter comprising a series impedance between one terminal of the larger loudspeaker means and the output of one of the amplifiers, and a capacitor from said terminal to ground, and sections of said switching means shunting each impedance and disconnecting each capacitor when in the monaural position.

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