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MONAXIAL QUADRAPHONIC RECORDING SYSTEM

Original Filed June 2, 1964

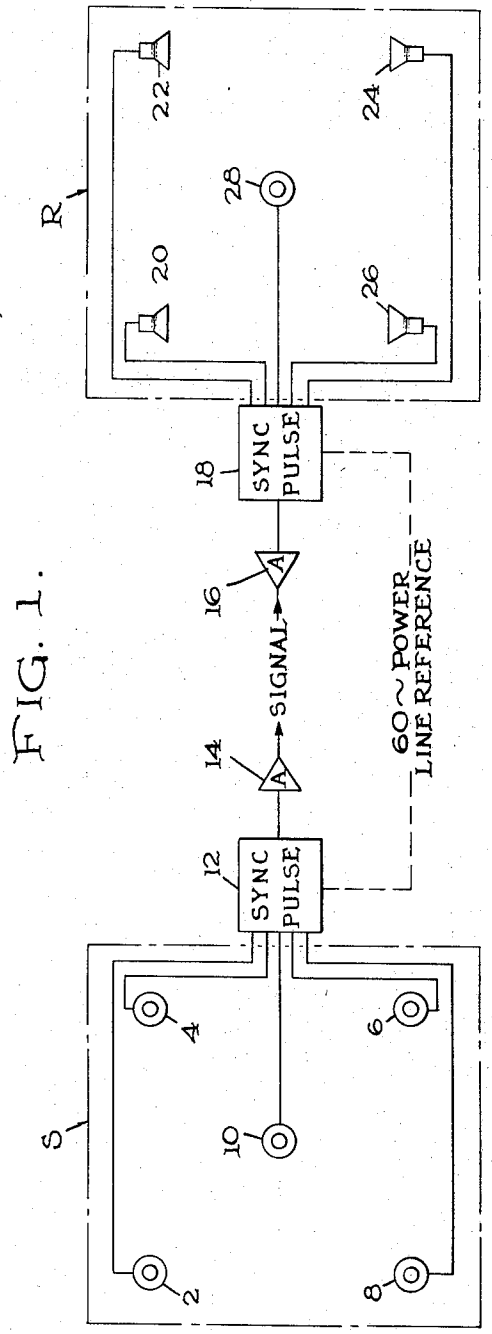


FIG. 1.

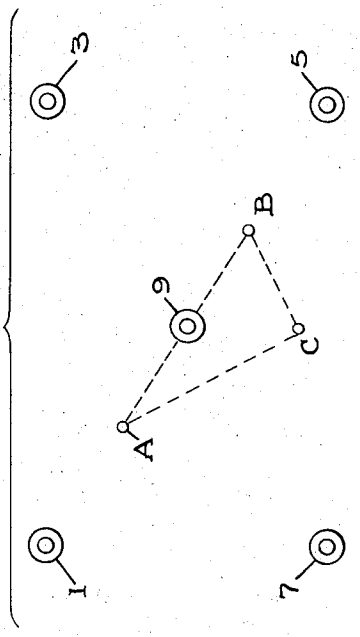


FIG. 2.

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MONAXIAL QUADRAPHONIC RECORDING SYSTEM

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1 Claim. (Cl. 179—15)

ABSTRACT OF THE DISCLOSURE

A method for recording and reproducing sound for creating a true environmental transposition of a given audio situation in which a quadrangular arrangement of microphones defining a plane is positioned in an overlying and surrounding relationship with respect to the audio sound stage from which a source of sound originates. The microphones are electronically sampled and the signal derived therefrom is transmitted to a receiver having a corresponding quadrangular arrangement of loudspeakers which define a plane overlying and surrounding an area removed from the sound stage. The audio output from the receiver is sampled in phase with the frequency that the microphones are sampled and is fed to the loudspeakers.

This is a continuation of application, Serial No. 371,923, filed June 2, 1964, now abandoned.

This invention relates to stereophonic or binaural sound and more particularly to methods and apparatus for the transmission, recording, reception and reproduction of a given audio situation.

Present systems for stereophonic reproduction embrace the basic concept of two-ear listening and therefore limit the resolution of an audio situation to binaural or right-left principles. Assuming the listener as a monaxial (single axis) reference point in terms of a given audio situation, when he is positioned midway between the sound source in front of him, with two, three or any number of loudspeakers stretching across from left to right, he is provided with a depth concept only in relation to the distance the outlying speakers are to the right or to the left of him. This indicates a single reference axis having only right and left resolution. A true environmental transposition of a given audio situation, however, is unquestionably a three dimensional problem since sound has breadth and depth. It follows, therefore, that proper resolution of an audio situation must take into account the depth concept. This minimaliy demands a triangulation framing of the sound area, and ideally requires a quadratic placement of microphones about the audio situation taking place.

It is an object of the present invention to provide a transposition of an audio situation by a unique arrangement of translating means whereby a listener need not position himself between a set of loudspeakers in order to obtain a desired effect.

According to one aspect of the invention, therefore, a translating system is provided for sampling the signal from a set of microphones formed in a predetermined pattern surrounding a given audio situation and reproducing the sound for a precise environmental projection which we can term, monaxial quadraphonics. Since the human ear can hear only those sound up to about 19,000 cycles, it becomes evident that a sampling of the outputs and inputs of the microphones and loudspeakers, respectively, at a rate above that frequency will convey the impression of true environmental sound. Thus, in carrying out the invention it will be understood that the human ear functions in much the same way as the eye when it receives the sensation of continuity from a sweep rate of individual camera "stills" (26 frames per second).

It is another object to provide resolution of an audio environmental situation in three dimensions by electronically sampling the outputs of the monaxial quadraphonic microphone arrangement of the present invention for transmission on a single channel carrier frequency.

A better understanding of the invention will be had after reading the following detailed description with reference to the appended drawings in which:

FIG. 1 is a block diagram of an embodiment of the present invention; and

FIG. 2 is a schematic diagram depicting the monaxial quadraphonic arrangement of the translating devices.

In FIG. 1 a quadrangular arrangement of microphones **2, 4, 6, 8** are shown surrounding a central or axial microphone **10** as will be more fully explained below. Connected to the outputs of the microphone is an electronic sampling device **12**. In practice, a Burroughs Beam Switching Tube has been found to be effective in carrying out the sampling function of the invention. The sampled signal is then fed to an amplifier or preamplifier **14** for ordinary wave transmission or the signal can be recorded as on conventional magnetic tape or phonograph records. Depending upon the mode of transmission, as previously described, the signal is picked up and fed through conventional amplifier or preamplifier means **16** and then sampled again at the same rate as the transmitted signal and fed to a quadrangular arrangement of loudspeakers **20, 22, 24** and **26** corresponding to the microphones **2, 4, 6, 8**. Loudspeaker **28** corresponding to microphone **10** serves as the axial speaker or monaxial reference for the quadrangular speaker arrangement. This fifth or monaxial speaker **28** and, similarly, the microphone **10** are important in finalizing the environmental transposition of sound from the source areas S to the receiving area R. For example, in FIG. 2, A, B and C represent three performing actors defining an audio situation unfolding beneath the quadrangular arrangement of microphones or, more accurately, the monaxial quadraphonic system **1, 3, 5, 7** and **9**. It will be seen that there are ten possible acoustical resolution of the action taking place, viz: (1) **9–1–3**, (2) **9–3–5**, (3) **9–5–7**, (4) **9–7–1**, (5) **1–5–7**, (6) **3–1–7**, (7) **3–5–7**, (8) **1–3–5**, (9) **1–3–5–7**, and (10) **1–3–5–7–9**. Each combination provides breadth and depth concept plus ten separate perspectives from which to position the axial reference (the listener). With axial reference provided centrally in the receiving or listening areas, as in the case of the present monaxial quadraphonic speaker system, there is no requirement for the listener to position himself midway between a set of speakers in order to obtain the desired audio environmental effect.

It is important also that the microphones **2, 4, 6, 8** and **10** provide constantly energized output and, further, that the sampling tube **18** at the output of the receiver amplifier **16** feeds the resultant signal in a sequence complementary to the microphone sampling tube **12**. By this operation, then, all of the energy and only that energy received by microphone **2**, for example, is reproduced by speaker **20**. The sweep rate for the tubes **12** and **18** is kept at an ultrasonic frequency in order to prevent any physical response from both the microphones and loudspeakers. Further, since the microphones **2, 4, 6, 8** and **10** all lose equal amount of time and power by virtue of the sampling process, no "unbalance" has been introduced. Because the microphones and loudspeakers are incapable of responding to supersonic frequencies, it follows that they cannot lose power at a rate which is faster than their response time. A 60-cycle power frequency provides the required sync pulse to slave the receiver or reproducing sweep rate to the transmitting or recording sweep rate. Since all of the microphones and speakers receive uniform spaced sampling, there is no possibility of misinterpreting the acoustical perspective involved. The

only maleficence associated with the sampling would be a ⅓ drop in volume which could readily be compensated for at the source area by merely increasing the amplifier volume; this is a constant.

With the present invention, a listener at the receiving end of the system can orient himself in whatever position he chooses to place himself with respect to the sound stage. For example, he can elect to place the sound stage to his left, to his right or directly behind himself by merely adjusting the sync pulse at the receiver amplifier.

Although only one embodiment of the invention has been depicted and described, it will be apparent that this embodiment is illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claim.

That which is claimed is:

1. A method for acoustically framing a sound stage area having a source of sound originating therein comprising the steps of: establishing a quadrangular arrangement of microphones defining a plane overlying and surrounding said sound stage area including a single microphone at the center of said plane, electronically sampling said microphones in sequence at an ultrasonic frequency rate, transmitting the signal derived from the sequential sweeping of said microphones, establishing a quandrangular arrangement of loudspeakers corresponding to said microphones and defining a plane overlying and surrounding an area removed from said sound stage area, electronically sampling said transmitted signal at an ultrasonic frequency rate, and feeding said sampled signal to said loudspeakers.

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