

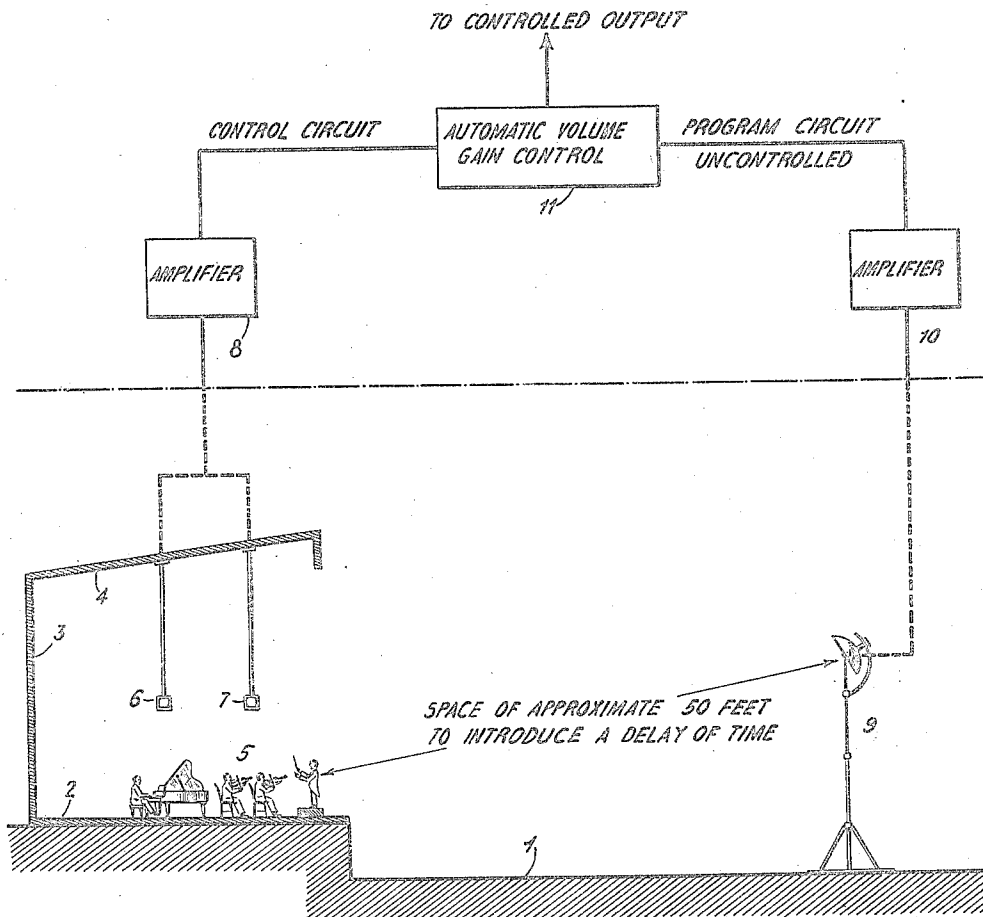
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ACOUSTIC TIME DELAY SYSTEM

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## ACOUSTIC TIME DELAY SYSTEM

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2 Claims. (Cl. 179—1)

This invention relates to the art of communication, and more particularly to acoustics. It provides a novel means by which a desired time delay is obtained in a system comprising a combined acoustical path and electrical circuit.

An object of this invention is to provide a simple and efficient means to obtain, within a chamber wherein sounds are produced and reproduced, a delay in transmission in one program circuit with respect to another or to the original.

Another object of this invention is to produce within a radio broadcasting studio a transmission time delay of an uncontrolled program circuit for the purpose of obtaining complete control of the electrical circuit before the uncontrolled program enters the outgoing radio broadcast transmitting circuit.

Another object of this invention is to obtain by novel means a time delay within wider limits than was heretofore possible, for compliance with modern high quality requirements of radio broadcasting.

Still another object of this invention is the independence of the system from the acoustical conditions created by the enclosure within which this invention may be operating.

Another object is to obtain uniform and identical signal fidelity, regardless of the length of the delay paths, within reasonable limits by using uni-directional focusing microphones.

A feature of this invention is the arrangement and combination of a plurality of both non-directional microphones and directional focusing microphones.

Methods of producing acoustical time delays have been known heretofore. Such devices consist essentially of a series of enclosed acoustical paths, transducers and filters. These methods, being cumbersome in operation and high in cost, are barred from extensive application in modern radio broadcasting.

The principle upon which this invention is based lies in the arrangement of one or a multiplicity of pick-up points at unequal distances from the common source of sound, which are located at different distances from each other to produce any such time delay as may be desired for artificial reverberation, echo, automatic gain control and the like. The time delay is obtained over the path extending from the source where the sound originates to the point of pick-up, the delay being the result of the open acoustical path length difference between the two points of pick-up and the source of sound.

A specific embodiment of the present inven-

tion as applied to automatic volume control is best described and illustrated by the drawing, indicating a typical sound producing chamber comprising a floor 1, a raised platform 2, a wall 3, and ceiling 4. The source of sound is indicated at 5, the control circuit pick-up microphones are indicated at 6 and 7. These microphones are electrically connected to an amplifier 8. From the amplifier 8 the control circuit then enters the common control equipment. The program circuit pick-up is accomplished by locating one or more directional focusing microphones 9 at distances from the source of sound greater than those of the control microphones. The control equipment and associated apparatus may be located in the same room or at a remote point.

As illustrated and mentioned above, the program pick-up is accomplished by one or more directional microphones located at different distances from the source of sound, and then sufficiently amplified by the amplifier 10. The program circuit energy then enters the automatic gain control equipment through the program input. To provide sufficient energy for the control input, one or a number of non-directional microphones are located as close to the source of sound as is feasible. The amplified output is made equal to that of the program circuit energy and applied to the control equipment input; both circuits from the microphones thus enter the automatic gain control unit from which the controlled output is then passed on to any utilization circuit such as the radio broadcasting transmitter.

Continuous automatic gain control must be effected at a rate of change which lies below audibility. For this reason, all automatic gain control devices include an inertial system which causes control action delay to a certain extent. In present day practice the action of the inertial system, compromising between minimum delay and optimum quality performance, extends over a time period of approximately 1/20th of a second.

By means of the present invention the automatic gain control receives the same program at equal volume levels from two or more microphone pick-up points over circuits which are isolated from each other electrically. With acoustical paths of unequal lengths between the respective microphone pick-up points, with respect to the source of sound, a time difference is obtained at the automatic gain control device between the arrival of the signals on the control and program circuits. The longer acoustical

path is in the program circuit. It is also desirable to have this acoustical path greater for reasons of orchestral balance. With respect to the automatic gain control, only the time difference exists and not the time relation of either of the circuits to the source of sound. Therefore, the control circuit may be considered to be leading the program circuit by a considerable time element. This circumstance is utilized to effectively offset the inertia of the control circuit. A practical system for utilizing the control delay and obtaining a sufficient time coincidence of control action with the uncontrolled program circuit, may be had by providing an acoustical path length difference of approximately 50 feet, which results in a delay of approximately 1/20th of a second. Whenever desired, this circuit may be reversed; that is, the uncontrolled program circuit is made to lead the controlled circuit, instead of lagging, by changing over the electrical connections, or, in other words, simply changing the electrical arrangement.

I claim:

1. An arrangement for obtaining a time delay in an outgoing radio broadcasting program originating in a studio, including the combination of a plurality of non-directional microphones

located substantially near the source of sound within said studio, a directional focusing microphone having a parabolic shape and located at a higher elevation than said non-directional microphones and at a substantial distance of approximately fifty feet from said non-directional microphones, means for electrically combining the circuits of said non-directional and directional microphones into a common controlled output.

2. An arrangement for obtaining a time delay in an outgoing radio broadcasting program originating in a studio, including the combination of a plurality of non-directional microphones located substantially near the source of desired sound within said studio, and at least one directional focusing microphone having a parabolic shape and located at a higher elevation than said non-directional microphones at a substantial distance of approximately fifty feet, said directional focusing microphone being focussed so as to pick up energy from the source of said desired sound, means for electrically combining the circuits of both the non-directional and directional microphones in a common controlled output.

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