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2,348,629

PUBLIC ADDRESS SYSTEM

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FIG. 1

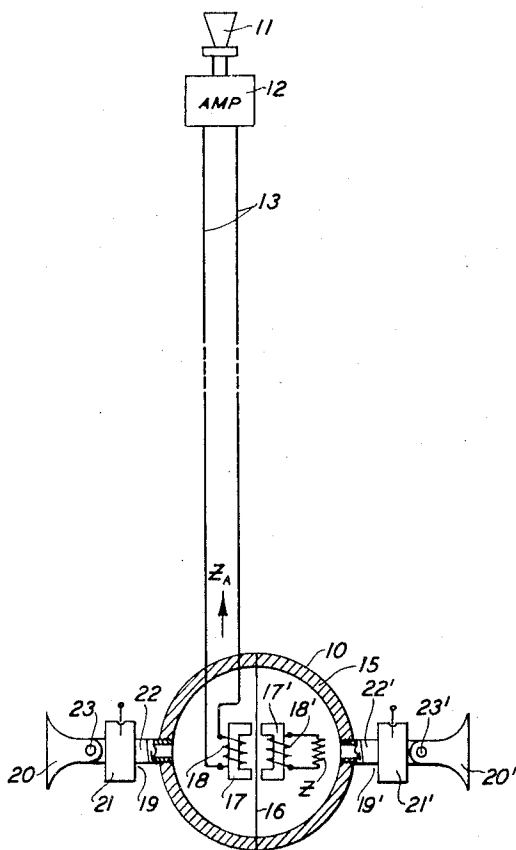


FIG. 2

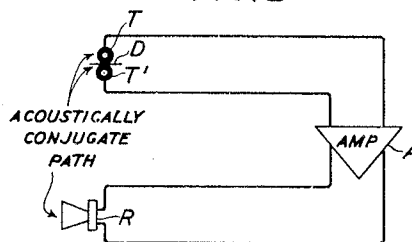
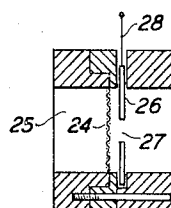


FIG. 3



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PUBLIC ADDRESS SYSTEM

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6 Claims. (Cl. 179—1)

This invention relates to public address systems.

In public address systems, particularly for a hall, an auditorium, or an out-of-doors gathering, the microphone for the speaker or singer is usually located in the sound field of one or more of the sound wave reproducers or loud-speakers reproducing at amplified levels the sound wave or vocal input to the microphone. Under such a condition a portion of the amplified acoustic energy is or may be fed back to the microphone whereby undesired "singing," echo or reverberant effects are introduced in the amplified acoustic output of the system.

An object of this invention is to minimize the deleterious effects of such acoustic feedback.

In accordance with this invention, a microphone is interconnected electrically with a sound wave reproducer or loud-speaker through an amplifier, for example, of the electronic type. The microphone is located in the sound field of the loudspeaker whereby acoustic energy radiated by the latter is effective on the microphone. The microphone comprises a single vibratory member or diaphragm arranged to receive on one surface only the acoustic energy to be amplified and radiated, but to receive such radiated energy on each surface over acoustic paths adjustable in length and attenuation so as to cause such fed back radiated energy to act with equal magnitude but in phase opposition on opposite surfaces of the diaphragm.

A more complete understanding of the invention will be obtained from the detailed description that follows taken in conjunction with the appended drawing wherein:

Fig. 1 illustrates a public address system in which the effect of acoustic feedback from the sound reproducer or loud-speaker to the microphone is minimized;

Fig. 2 is a simplified showing of the arrangement of Fig. 1; and

Fig. 3 illustrates one form the acoustic attenuator associated with the microphone of Fig. 1 may take.

The arrangement of Fig. 1 comprises an acoustic energy pick-up device or microphone 10, a sound wave reproducer or loud-speaker 11, an audio frequency amplifier 12, and a transmission path or line 13 interconnecting the microphone and the loudspeaker through the line. The microphone and the loud-speaker are located in the same room or auditorium and may even be positioned in physically close proximity, whereby a portion of the acoustic energy radiated by the

loud-speaker when the microphone is actuated by sound waves has access to or is fed back to the microphone through the surrounding air, that is, the microphone is in the sound field of the loud-speaker.

The simplified showing in Fig. 2 of the arrangement of Fig. 1 likens the microphone 10 to a double element microphone having variable impedance elements T, T' on opposite sides of a common diaphragm D. Acoustic energy it is desired to amplify and radiate through the loud-speaker R will be directed against one side only of the diaphragm D and the current flow or change in current flow effective at the input terminals of the amplifier A will be a measure of the resultant of the impedance changes of the elements T, T'. If the air paths between the diaphragm of the loud-speaker R and the opposite sides of the diaphragm D are acoustically conjugate, whereby motion of the former diaphragm would result in no motion of the latter diaphragm, no currents will appear in the loud-speaker that are the result of acoustic energy radiated from the loud-speaker and acting on the diaphragm D.

With reference once again to Fig. 1, the microphone comprises a symmetrical, for example, spherical, hollow housing or enclosure 15, a thin magnetic diaphragm 16 being clamped at its marginal portion between opposed portions of the housing. Similar magnet structures 17, 17' are arranged in spaced relation to opposite sides of the diaphragm, each having a coil or winding 18, 18' thereon. The winding 18 is connected to the line 13 and the winding 18' may be connected to an impedance Z of value equivalent to the impedance Z_A, looking into the line which is terminated in the input terminals of the amplifier. Acoustic energy or sound waves have access to the opposite sides of the diaphragm through a pair of diametrically opposite conduits 19, 19' each comprising a mouthpiece or horn 20, 20', an adjustable acoustic impedance or attenuator 21, 21', and a sound wave tube 22, 22'. Each mouthpiece 45 may be coupled to the sound wave tube through a joint 23, 23' enabling the adjustment of the mouthpiece to different positions or angles with respect to the loud-speaker. Each acoustic attenuator, as illustrated in greater detail in Fig. 3, 50 may include an acoustic resistance 24 extending across the sound passage 25, and an iris shutter 26 on one side thereof. The resistance 24 may be a screen of fine mesh wire gauze or silk cloth. The area of the iris shutter central opening 27 and, therefore, the effective area and the effective

resistance of the screen, may be adjusted externally by means of a manually operable slide 28 in well-known manner.

In using the arrangement of Fig. 1 for amplified dissemination of the vocal energy of a speaker or singer, the latter speaks or sings into one of the mouthpieces, for example, into mouthpiece 20'. In such case, the sound waves traverse the conduit 19' and impinge on the diaphragm 16 causing it to vibrate. Consequent variation in the reluctance of the magnetic path including the diaphragm and magnet structure 17 induces in the coil 18 currents corresponding to the diaphragm vibration. These currents are amplified by the amplifier 12 and translated into sound waves corresponding to the original sound waves but greatly amplified. Since the microphone is in the sound field of the loud-speaker, a portion of these amplified sound waves will be fed back to the microphone. Regardless of the position of the loud-speaker relative to the microphone, sound waves originating at the loud-speaker have access to both sides of the diaphragm through the conduits 18, 19'. If the lengths of the air paths between the loud-speaker diaphragm and the opposite surfaces of the diaphragm are the same, the acoustic energy fed back to the microphone will be balanced out because of equal (magnitude) but opposed (180 degrees out-of-phase) effects on the opposite sides of the diaphragm. If the loud-speaker is so positioned with respect to the microphone that the lengths of the air paths from the loud-speaker to opposite sides of the diaphragm are different, whereby the magnitudes of the fed back energy incident on opposite sides of the diaphragm are different, or the magnitudes are the same but not in phase opposition, such differences may be equalized by adjusting the angular relationship of the mouthpieces to the loud-speaker and/or adjusting the iris shutter opening to alter the amount of acoustic attenuation in the conduits 18, 19'.

Although the invention has been disclosed with reference to a single embodiment, it is evident that it is not limited thereto and that modifications therein may be made without departing from the inventive concept.

What is claimed is:

1. In combination, a loud-speaker, a microphone located in the sound field of said loud-speaker, and means interconnecting said loud-speaker and said microphone so that sound waves translated by said microphone are reproduced in amplified form by said loud-speaker, said microphone comprising a single diaphragm centrally located in a symmetrical enclosure and oppositely disposed sound wave conduits coupling opposite sides of the diaphragm with said sound field, each of said conduits including an adjustable mouthpiece at its outer end and a variable acoustic impedance intermediate the diaphragm and mouthpiece for equalizing the effects upon opposite sides of said diaphragm of sound waves received from said loud-speaker.

2. In combination, a loud-speaker, a microphone located in the sound field of said loud-speaker, an audio frequency amplifier interconnecting said loud-speaker and microphone, said microphone translating sound waves into corresponding currents to be amplified in said ampli-

fier and converted by said loud-speaker into corresponding sound waves at amplified levels, said microphone comprising a single diaphragm of magnetic material centrally positioned in a symmetrical enclosure, a pair of oppositely disposed sound wave conduits each coupling one side of the diaphragm with said sound field, sound waves to be translated by the microphone being directed essentially against one side of the diaphragm only through one of said conduits, magnet structure disposed in spaced relation to and on each side of the diaphragm, a coil individual to each such structure and adapted to have currents induced therein upon vibration of the diaphragm and consequent variation in the reluctance of the magnetic path including said diaphragm and magnet structure, one of said coils being connected to the input side of said amplifier and the other of said coils being terminated in an impedance equivalent to the input impedance of said amplifier.

3. In combination, a loud-speaker, a microphone located in the sound field of said loud-speaker, and means interconnecting said loud-speaker and said microphone so that the sound waves translated by said microphone are reproduced in amplified form by said loud-speaker, said microphone comprising a single diaphragm and oppositely disposed sound wave conduits connecting opposite sides of the diaphragm with said sound field, sound waves it is desired to amplify and radiate from said loud-speaker being directed essentially against one side only of the diaphragm through one of said conduits, said conduits including means for adjusting the effective acoustical length of the acoustic paths between the loud-speaker and the opposite sides of said diaphragm whereby sound waves originating at the loud-speaker have equal and opposed effects on the opposite sides of the diaphragm regardless of the relative position of the loud-speaker and microphone.

4. In combination, a loud-speaker, a microphone located in the sound field of said loud-speaker and means interconnecting said loud-speaker and said microphone whereby the sound waves translated by said microphone are reproduced in amplified form by said loud-speaker, said microphone comprising a single diaphragm and oppositely disposed sound wave conduits connecting opposite sides of the diaphragm with said sound field, sound waves it is desired to amplify and radiate from said loud-speaker being directed essentially against one side only of the diaphragm through either one of said conduits, said conduits including means for adjusting the effective acoustical lengths of the acoustical paths between the loud-speaker and the opposite sides of said diaphragm whereby sound waves originating at the loud-speaker have equal and opposed effects on the opposite sides of the diaphragm regardless of the relative position of the loud-speaker and microphone.

5. The combination of claim 4 in which the adjusting means in each conduit includes a variable acoustic impedance.

6. The combination of claim 4 in which the adjusting means in each conduit includes a variable acoustic resistance.

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