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HEARING AID NOISE SUPPRESSOR

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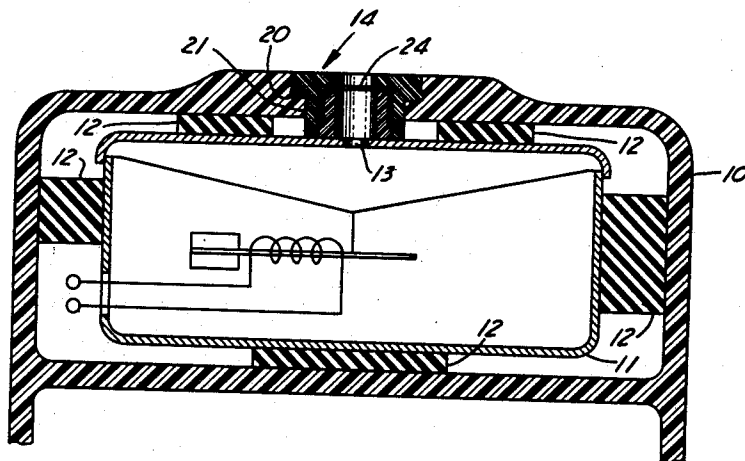


Fig. 1.

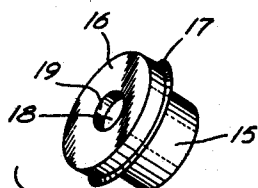
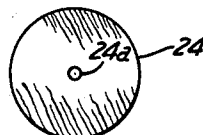


Fig. 2a

Fig. 2.

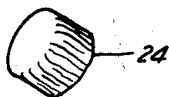
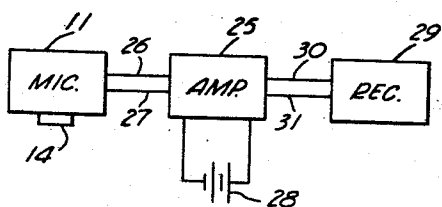


Fig. 3.

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HEARING AID NOISE SUPPRESSOR

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5 Claims. (Cl. 179-107)

This invention relates to the field of acoustic instruments and more particularly to apparatus for use with hearing air components.

Wearers of hearing aids quite often complain that when they are present in strong winds, the rushing noise produced by the wind far over shadows the normal sounds which they desire to have amplified and eventually hear and as a consequence, the hearing aid often is of little value or is quite annoying. Certain metallic sounds, that is, sounds which are produced by metal objects striking each other, also produce undesirable sounds such that the background noises quite often over shadow the normal conversations or media which is to be amplified, thereby greatly reducing the effectiveness of the hearing aid. For a general definition of these sounds, it may be said they are "sharp background noises" in that they tend to override the sound which the wearer is attempting to hear.

Numerous ways of attempting to overcome this problem have been attempted, some of which include recessing the opening in the hearing aid housing to the microphone or providing a slightly raised portion of the housing around the aperture to the microphone to form a sort of "wind shield." The purpose of such devices is to cause the wind to be deflected and not impinge upon the working elements of the microphone. However, arrangements such as this while somewhat helpful under normal conditions, are inadequate where strong winds prevail and they have very little effect upon the sharp metallic sounds.

The present invention is directed to a means of overcoming these noises or suppressing the noises so that the noise and the conversation or other sounds which are to form some means of intelligence are brought closer to the normal situation. The present invention contemplates using a very thin diaphragm made of animal tissue such as the blind intestine of sheep (referred to as fish skin) or some other similar material. The diaphragm is stretched across a pair of tubular or hollow cylindrical members where it is stretched and held tightly and the tubular members are then held in acoustic sealing relationship with the microphone. Wearers of hearing aids incorporating this device claim that the background noises are drastically reduced and that they can hear normal sounds with ease because of the suppression of the sharp background noises.

It is therefore a general object of the present invention to provide a device which may be used with a hearing aid microphone to improve the quality of the sound emitted by the hearing aid receiver.

It is yet another object to the present invention to provide structure for use with a hearing aid which reduces sharp background noises so that they appear in the relative magnitude as heard by a normal unaided ear.

It is still a further object of this invention to provide structure to be used with a hearing aid microphone which incorporates a thin animal membrane to reduce noises caused by wind and metallic objects struck together.

It is still another object of this invention to provide an increased usefulness of a hearing aid by using structure which reduces background noises and yet does not take an appreciable amount of additional power to drive the hearing aid.

It is still a further object of the present invention to

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provide mechanism for attaching the device for improving hearing in a manner which is readily connected and disconnected.

These and other objects and advantages of my invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a partial sectional view of a behind-the-ear hearing aid showing a microphone and the noise suppressing apparatus in place within the housing of the hearing aid;

FIG. 2 is an exploded view of the noise suppressing device;

FIG. 2a is a top view of the diaphragm which has been modified; and

FIG. 3 is a block diagram of a hearing aid circuit using the invention and showing the relative placement of the device with respect to the hearing aid circuit components.

FIG. 1 shows a hearing aid housing 10 which is generally formed of some type of plastic material and to illustrate the general placement of parts, a "behind-the-ear" hearing aid is shown in partial sectional view with a microphone 11 contained therein. Microphone 11 is surrounded by a plurality of rubber blocks 12 which provide isolation from vibrations for the microphone. That is, the rubber blocks 12 isolate the microphone from the hearing aid housing to reduce feedback which is generally attributed to vibrations of the hearing aid receiver in the same housing. It is understood that microphone 11 which is shown in diagrammatic form may be any type of hearing aid microphone which generally receives its sound producing energy through an aperture such as aperture 13 in microphone 11. A background noise suppressing device 14 comprises a hollow cylindrical member 15 which is provided with a collar 16 at one end of the hollow cylindrical member. The collar 16 has a flange 17 which is located at the edge of collar 16 which is the farthest away from the outside surface of collar 16. A bore 18 is formed within the hollow cylindrical member 15. In some applications a cylindrical opening 19 of smaller diameter than the bore 18 is formed in cylindrical member 15 so that a slight inwardly directed ridge is formed therein for reasons to be explained later. Flange 17 is formed to cooperate with an annular recess 20 which is formed in housing 10 and concentric with a bore 21 also formed in housing 10. Annular recess 20 is of a slightly larger diameter than a bore leading from the edge of housing 10 inwardly towards microphone 11, which accommodates collar 16 when device 14 is in use. Bore 21 is concentric with aperture 13 in microphone 11 and cylindrical member 15 is then seated in bore 21 and flange 17 is snapped into cooperating annular recess 20 to hold the member in place.

Another cylindrical member 22 is also formed of a material generally of the plastic family and has an outer diameter which is smaller than bore 18 of cylindrical member 15. Cylindrical member 22 has an inner bore 23 which extends through the entire member 22. Hollow cylindrical members 15 and 22 are generally concentrically aligned about a longitudinal axis defined by the longitudinal members and a diaphragm 24 is placed over the end of cylindrical member 22 so that diaphragm 24 may be pressed into cylindrical member 15 until it is adjacent opening 19. Diaphragm 24 is stretched taut across cylindrical member 22 and generally has the qualities of a thin animal membrane, one such material being sold under the trademark "Silver Lite" by the Julius Schmidt Company of New York City. In other words, diaphragm 24 is stretched over cylindrical mem-

ber 22 much in the manner of a drum head when in place with cylindrical member 15. For some applications it may be desirable to furnish cylindrical member 22 with an annular ridge 25 at the end opposite the end the diaphragm 24 is to be rolled over. Thus upon inserting cylindrical member 22 within cylindrical member 15 any lateral movement is controlled and a better fit may be obtained.

It has generally been found that the overall power required to operate the hearing aid must be increased a slight amount to compensate for the use of the diaphragm and associated cylindrical members. However, recovery of this slight increase in power may be had by piercing diaphragm 24 with an instrument to produce a hole 24a therein having a diameter of 0.001 to 0.002 inch (see FIG. 2a). Generally speaking, the inner diameter of cylindrical member 22 would be approximately $\frac{3}{32}$ to $\frac{1}{8}$ inch. It is understood, of course, that this diameter may vary somewhat with the aperture opening 13 in microphone 11.

FIG. 3 shows that the noise suppressing device 14 is in place over microphone 11 and that microphone 11 is connected to an amplifier 25 through a pair of leads 26 and 27 to convey the electrical energy to amplifier 25. Amplifier 25 is energized by a battery 28 and a receiver 29 is energized by amplifier 25 through a pair of leads 30 and 31. Thus the unwanted noises and inaudible sounds are not transmitted to the microphone 11 and, therefore, the sound which is amplified by amplifier 25 does not emerge from receiver 29. In other words, the diaphragm 24 when in operable position between hollow cylindrical members 15 and 22 acts to keep out the sharp background noises but emit the intelligent sounds. It will be readily understood that either cylindrical member 15 or 22 or both may be fixedly fastened to microphone 11 about aperture 13. In other words, the openings are generally concentrically aligned. However, if the embodiment is one that utilizes the snap fit, then sufficient pressure may be applied to microphone 11 about aperture 13 so that a seal is effected between members 22 or 15 and the microphone thereby obviating the necessity of cementing or fixedly fastening the members to the microphone. It is intended that these snap fits would be the most convenient means of using the invention and would afford an easy means of replacing the diaphragm should it become perforated or destroyed.

From the foregoing description of the invention it will be quite apparent that new apparatus has been provided which will increase the intelligence of the sounds heard by a hearing aid wearer and the sharp background noises will be reduced. The apparatus does not require a substantial increase in power and for certain applications it may be desirable to keep the power setting the same and place a slight opening in the diaphragm. From the arrangement which has been shown and described it should also be apparent that the device may be easily inserted and removed from a hearing aid housing to greatly facilitate the replacement should damage be done to the diaphragm.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of this invention which consists of the matter shown and described herein and set forth in the appended claims.

What is claimed is:

1. A mechanical device for reducing background noise caused by wind effects and metallic sounds to be used with a hearing aid microphone located within the housing of the hearing aid where an aperture in the housing is disposed in spaced and confronting relation with an aperture in the microphone, said device comprising:

(a) a first hollow cylindrical member defining a longitudinal axis, said cylindrical member aligned with the aperture of the microphone;

(b) a second hollow cylindrical member defining a longitudinal axis concentrically aligned with that of said first hollow cylindrical member and having a greater inner diameter than the outer diameter of said first hollow cylindrical member, both of said members having their longitudinal axes aligned with the aperture in the housing, at least one member of which is of sufficient length to communicate with said housing aperture;

(c) and a sound responsive diaphragm constructed of extremely thin animal tissue stretched tightly over the end of said first hollow cylindrical member which is adjacent the housing aperture and is held in place between said cylindrical members, at least one of said members being fixedly secured to the microphone for reducing said background noises.

2. A mechanical device for reducing sharp background noises to be used with a hearing aid comprising:

(a) a hearing aid having components including at least a microphone, amplifying means, and a receiver;

(b) a housing having an aperture disposed in spaced and confronting relation with said microphone;

(c) a first hollow cylindrical member defining a longitudinal axis communicating with said microphone;

(d) a second hollow cylindrical member defining a longitudinal axis concentrically aligned with that of said first hollow cylindrical member and having a greater inner diameter than the outer diameter of said first hollow cylindrical member, both of said members having their longitudinal axis aligned with the aperture in the housing, at least one member of which is of sufficient length to communicate between said aperture and said microphone;

(e) a sound responsive diaphragm constructed of extremely thin animal tissue stretched tightly over the end of said first hollow cylindrical member which is adjacent the housing aperture and is held in place between said cylindrical members in drum head fashion;

(f) and mechanism for fixedly securing at least one of said members to the microphone so that an acoustic seal is formed between said microphone and said sound responsive diaphragm.

3. The invention as set forth in claim 2 wherein said diaphragm has a hole formed therein having a diameter of approximately 0.001 to 0.002 of an inch thereby lowering the amount of power required to drive the hearing aid receiver.

4. A mechanical device for reducing sharp background noises to be used with a hearing aid comprising:

(a) a hearing aid having components including at least a microphone with an aperture formed therein, amplifying means, and a receiver;

(b) a housing having an aperture disposed in spaced and confronting relation with said aperture in said microphone;

(c) a first hollow cylindrical member defining a longitudinal axis concentrically aligned with, and communicating with the aperture of said microphone;

(d) a second hollow cylindrical member defining a longitudinal axis concentrically aligned with that of said first hollow cylindrical member and having a greater inner diameter than the outer diameter of said first hollow cylindrical member, both of said members having their longitudinal axes aligned with the aperture in the housing, at least one of said members being of sufficient length to extend between said apertures;

(e) and a sound responsive diaphragm constructed of extremely thin animal tissue stretched tightly over the end of said first hollow cylindrical member which is adjacent the housing aperture and is held in place between said cylindrical members in drum head

fashion, at least one of said members being fixedly secured to the microphone, for reducing sharp background noises.

5. The invention as set forth in claim 4 wherein said second hollow cylindrical member is formed with a flange member on the end adjacent said diaphragm and wherein said housing has a cooperating circular recess into which said flange is snap fitted to position said first and second

members in operable communicating position with said microphone.

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