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ACOUSTIC NOISE ATTENUATING APPARATUS

Filed March 31, 1966

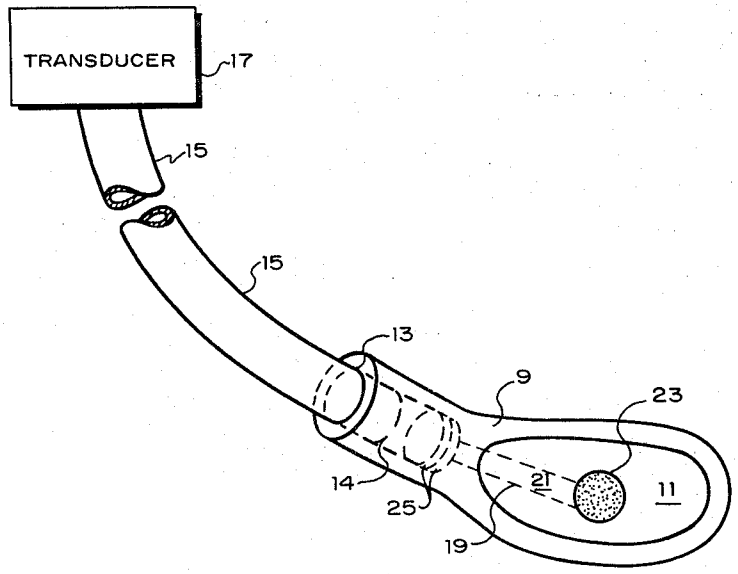


Figure 1

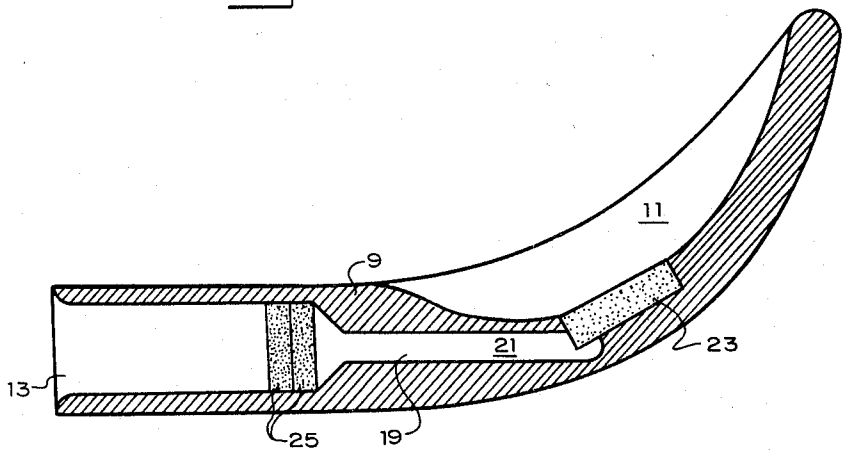


Figure 2

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ACOUSTIC NOISE ATTENUATING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A noise-reducing adapter for an acoustic tube is disposed to couple acoustic energy from a source to a remote acoustic transducer and includes an acoustic attenuator for reducing the level of background noise and increased voice signal to the level of voice signal coupled to the acoustic tube in the absence of the adapter.

The main object of the present invention is to provide a background noise-reducing adapter for the acoustic coupling tube of a miniature microphone of the type which is disposed away from the speaker's mouth.

In accordance with the illustrated embodiment of the present invention, a cup-like adapter is positioned at the mouth end of an acoustic coupling tube close to the speaker's mouth. The adapter includes an internal acoustic canal which communicates at its inlet end with the cup-like portion of the adapter and at the outlet end with the acoustic coupling tube of the microphone. The inlet end of the acoustic canal is coupled to the cup-like portion through a porous element and the outlet end is coupled to the acoustic tube through acoustic attenuator elements.

Other and incidental objects of the present invention will be apparent from a reading of this specification and an inspection of the accompanying drawing in which:

FIGURE 1 is a perspective view of the adapter on the present invention attached to the acoustic coupling tube of an acoustic transducer; and

FIGURE 2 is a side sectional view of the adapter showing its internal construction.

Referring to the perspective and side-sectional views of the adapter shown in FIGURES 1 anl 2, there is shown an adapter body **9** having a generally cupped portion **11** and an internal bore **13** at the end of the adapter body remote from the cupped portion **11**. The dimensions of the internal bore **13** are selected to snugly receive the end of the acoustic coupling tube **15** which is remote from the end coupled to transducer **17**. Transducer **17** may be a microphone which produces an electrical output in response to applied acoustic signals. An acoustic canal **19** within the body **9** has an inlet port **21** which communicates with the cup portion **11** at an inner surface region thereof and which is covered by porous element **23**. One or more acoustic attenuator elements **25** are disposed at the outlet end of the acoustic canal **19** where it communicates with the internal bore **13**.

When operating the transducer (e.g. a microphone) under normal conditions, the transducer is positioned adjacent the speaker's ear or temple region, as by attachment to an eyeglass frame or by clip over the head or around the ear. The end **14** of the acoustic coupling tube **15** is then disposed near the speaker's mouth without the

adapter body **9** attached to tube **15**. Acoustic energy is thus coupled from the speaker's mouth to the remote transducer **17** along coupling tube **15**. However, when operating the transducer **17** in areas of high-level background noise, the speaker's voice signal may be lost in the background noise which is coupled to the transducer **17** along with the speaker's voice.

According to the present invention, the adapter body **9** shown in FIGURE 2 is then slipped onto the end **14** of the coupling tube **15**, as shown in FIGURE 1, with the cupped portion **11** closely disposed in front of the speaker's mouth. By a capturing effect, the cupped portion increases the amount of voice signal coupled into tube **15** and hence increases the level of the voice signal emanating from the small area of the speaker's mouth relative to the background noise level in the same region covered by the cupped portion **11**. The acoustic energy including voice signal and background noise components in the region of the cupped portion **11** is coupled through inlet port **21** of canal **19** and acoustic attenuator element or elements **25** to the coupling tube **15** and, in turn, to transducer **17**. The voice signal in coupling tube **15** is thus attenuated by elements **25** to about the level which normally occurs without adapter body **9** in place but, more importantly, the background noise level is also attenuated by the same amount. Thus, noise ratio of voice signal level to background noise level in coupling tube **15** is improved with the adapter **9** in place by an amount approximately equal to the attenuation factor of the elements **25**. These elements **25** typically yield about 10 db reduction of background noise level below voice signal level and may be wafers of sintered metallic particles or other suitable acoustic resistance material having a total thickness of about 3 to 8 hundredths of an inch. Acoustic attenuators of thicker dimension and providing attenuation of approximately 20 db may be used in cases of extremely high background noise level. The porous element **23** which covers inlet port **21** of canal **19** aids in reducing the acoustic hissing sounds produced by certain consonants spoken into the closely disposed cupped portion **11** of the adapter body **9**. This porous element may be a wafer typically about one-sixteenth of an inch thick of polyurethane open-cell foam having about 80 pores or cells per linear inch of sound path through the wafer.

Therefore, the apparatus of the present invention provides a simple, passive means for reducing undesirable background noise well below the level of desired audible signals coupled to a microphone or similar transducer.

I claim:

1. A noise-reducing adapter for use with an acoustic transducer which is worn by a speaker and which has an acoustic coupling tube with an input end that is normally disposed away from and to the side of the speaker's mouth, the adapter comprising:

an elongated body having an internal bore at one end which is capable of receiving the input end of an acoustic coupling tube in operable engagement with said body;

the body including an inwardly concaved cup portion near the other end of the body remote from said one end;

an acoustic energy passage of smaller bore than said internal bore extending substantially lineally from said internal bore at one end to said inwardly concaved

cup portion near the other end for acoustically coupling the internal bore to the cup portion; and

an acoustic energy attenuator element disposed in said internal bore adjacent the transition to said smaller bore of the acoustic energy passage for attenuating acoustic energy passing therethrough to enhance the ratio of the speaker's voice signal to background noise coupled to a remote acoustic transducer.

2. A noise-reducing adapter as in claim 1 wherein:

said acoustic energy passage extends substantially axially in line with said internal bore and communicates in acoustic energy coupling relationship with the inwardly concaved cup portion substantially at the innermost recess thereof; and

said inwardly concaved cup portion is disposed with a normal to the surface of the inwardly concaved cup portion near the innermost recess thereof at an acute angle with respect to said passage, whereby said body extends the acoustic energy passage of an acoustic tube having an input end disposed away from and to the side of a speaker's mouth to a position substantially directly in front of the speaker's mouth.

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