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## (54) Contact microphone.

(57) The device for transducing noise generated inside a body, in particular for transducing voice, for the detection outside of the body with a great damping of environmental noise consists essentially of a sheet element operating as a transducer associated with a supporting body adapted to provide a pressure between said sheet element and a contact surface forming a portion of the noise generating body so as to not transduce directly the noise as an acoustic phenomenon through the air but as a vibration affecting said contact surface and generated by the noise itself.

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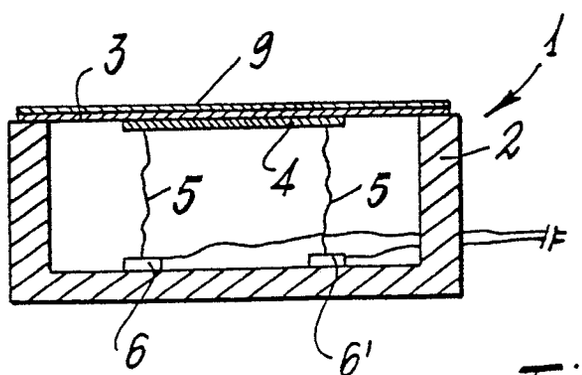


Fig. 2

# Device for transducing noise generated inside a body, in particular voice, providing a great damping of environmental noise

The present invention relates to a device for transducing noise generated inside a body, in particular voice, with a substantial damping of environmental noise.

The core of the invention is to provide a noise transducing device so designed and arranged as to transudce noise not directly as an acoustic phenomenon through the air, but as a vibration of a surface of the noise generating body.

Typical applications of the transducing device according to the invention would be voice communications through a highly noisy environments (such as 110-120 dB's), e.g. the inside environment of tanks, airplanes and the like, sports fields, engine testing rooms, machine rooms of ships and any other environments in which it would be necessary to voice communicate in the presence of a noise so great as to practically hinder such a communication; the detection of noise generated in a separated environment, such as the heart beat of a foetus or the voices of persons standing in separated and adjoining rooms; and the analysis of a given part of a machinery item.

There are already known noisy environment microphones, the so-called "noise cancelling microphones", specifically designed for improving voice communications.

These microphones are based on the fact that the sound waves of the environment noise will enter two opposite slots of the microphone so as to impinge on the two opposite sides of the microphone membrane and cancel at least partially, whereas voice will mainly enter only one of the slots, to impinge against the membrane and cause it to vibrate. These presently commercially available microphones mainly comprise a small electrodynamic including a coil rigid with the membrane and lying in a permanent magnetic field.

In this connection, even if it is not actually similar to the subject device, there is also mentioned the laringophone, which is conventionally formed by two microphone elements which are pressed as a pliers on the laryinx region but which, on the other hand, has great drawbacks hindering a broad diffusion thereof. In fact, as is known, the main drawback of the laringophone is that it causes troubles to the operator upon long use. The signal/noise ratio, moreover, that is the ratio of the sound level of the voice signal and the sound level of the environment noise, is less than that of the cancellation microphone. The laringophone, furthermore, has the drawback that it is not able of transmitting the sound "S".

Thus, the main object of the present invention is to overcome the above mentioned drawbacks, by providing a device for transducing noise, in particular voice, which includes contemporaneously the following features:

- a great damping or roll-off of the environment noise;
- a great signal/noise ratio which, in the subject application as a voice transducer, does not require any large vocal effort by the speaker;
- a highly reliable operation and absence of maintenance;
- a very high resistance against impacts and atmospheric, chemical and the like agents;
- a good resistance to thermal changes; and
- a comparatively simple structure and a low making cost.

This and other objects of the invention will become more apparent to those skilled in the art from the following disclosure.

More specifically, the device for transducing noise generated inside a body, in particular voice, with a great damping of environment noise, according to the invention, is essentially characterized in that said device comprises a sheet like element adapted to operate as a transducer proper and associated with a supporting body provided for exerting a pressure between said sheet like element and a contact surface forming a part of said noise generating body, the electric output signal from said sheet like element being conventionally applied to an amplifier, noise analyzer or the like apparatus.

From carried out tests it has been found that very good results could be obtained by using, as the transducer, a conventional piezoelectric buzzer, associated with a hollow body providing a pressure support member for said buzzer.

Advanteously, the outer surface of the sheet like element can be coated by a removable and replaceable film material layer, so as to provide the possibility of using the device by lot of speakers or users without any dangers of transmitting infectious diseases. Moreover, if the sheet like element-support member assembly is to be used in an environment having a pressure greater than the atmospheric pressure, then the device can be constructed with a pressurized tight construction.

The invention is illustrated, by way of an indicative but non limitative example, in the figures of the accompanying drawings, where:

- figure 1 shows the device used as a voice transducer;

- figure 2 is an enlarged cross-sectional view of the device shown in figure 1; and

- figures 3 and 4 are phonometric diagrams to compare the performance, in particular the signal/noise ratio, of two types of conventional microphones with the device according to the invention, as applied as a voice transducer.

With reference to figures 1 and 2, the device - indicated overally at the reference number 1 - comprises a supporting hollow body 2, made of a great weight material, on the opening of which there is applied a conventional buzzer, consisting of a sheet like element 3 thereto there is coupled a ceramics layer 4, in which there is embedded a contact member (not shown) of omega shape, from the two end portions whereof two wires 5,5′ extend said wires ending on a pair of small rods 6,6′ rigid with the bottom of the hollow body 2. From the rods 6,6′ there extend two further wires which, in the embodiment being disclosed, end with a conventional headphone 7 which is coupled to a receiving-transmitting device 8.

As is shown in figure 1, the device 1 is so arranged as to contact a cheek of the speaker, or operator, and is herein pressed at its proper position by means of a harness assembly supported by the head-phone 7. In this connection, it should however pointed out that the sensivity of the device according to the invention is such that the device 1 can be arranged to contact other parties of the speaker's body, provided that they are subjected to voice generated vibration, such as the front, and this with comparatively good results.

The sheet like element, if desired, can be coated by a film material 9 to be removed and replaced according to requirements.

If the subject transducer is to be used in an environment with a pressure greater than the atmospheric pressure, then the assembly 2,3 can be tight constructed and the hollow defined by the body 2 can be pressurized so as to compensate, in use, the outer pressure.

Likewise, and in particular applications, in the hollow defined by the body 2 a negative pressure can be generated adapted to fit a possible negative pressure of the outer environment.

With reference to figures 3,4 there has been firstly compared herein a cancellation microphone, of the above mentioned type, with a sample Larson & Davis microphone, as used in the phonometry field, meeting the requirements of Class 1 of the International Standar IEC, corresponding to the CEI 29-I Standard.

On the top of figure 3 there has been shown the recording of the sample microphone level on a calibrated scale, at the bottom there being shown the recording relating to the cancellation microphone. During the first half of the recording, the operator did not talk; during the second part he was talking with the voice level of a normal conversation: the recordings of fig. 3 show that there is no appreciable difference either with or without voice, which demonstrates that this voice can be hardly heard.

Likewise there have been compared the sample microphone and the transducer according to the present invention in a voice transducing application. At the top of figure 4, there has been shown, as in the case of figure 3, the recording of the level of the sample microphone, whereas at the bottom there has been shown the recording relating to the inventive transducer, used as a voice transducer. The recording has been made either with and without voice, as mentioned with reference to figure 3. From figure 4 it is possible to see the great difference of the voice level, with respect to the non voice condition, of the transducer according to the invention, whereas the sample microphone shows the same isensitivenness of figure 3.

In conclusion, of the three tested devices, that according to the invention had a signal/noise ratio of about 10 dB's, against a value from 0 to 2 dB's for the other two devices.

With respect to the other applications, for detecting noises coming from a separated environment or generated by inner parts of machines, it should be easy to verify that, also in this case, the signal transduced by the device according to the invention, is remarkably more intelligible than that of other presently commercially available devices.

In the shown embodiment, the hollow body 2 has a cylindrical shape; however it may have any other shape suitable for the application of the subject device and the hollow of said body will be designed depending on the frequency response to be obtained. This hollow, moreover, may hold microcircuits printed by the SMD method, for example, in order to switch on and off the control system.

## Claims

1. A device for transducing noise generated inside a body, in particular voice, with a great damping of environment noise, characerized in that said device consists of a sheet like element operating as a transducer proper associated with a supporting body adapted to provide a pressure between said sheet like element and a contact surface forming a portion of said noise generating body, the output electric signal from said sheet like element being conventionally applied to an amplifier, noise analyzer and the like.

2. A device according to claim 1, characerized in that said support body consists of a hollow body on an opening of which there is arranged said sheet like element.

3. A device, according to claim 2, characterized in that said support body is made of a high weight material, advantageously iron.

4. A device according to the preceding claims, characterized in that the hollow of said body is designed depending on the frequency response to be obtained.

5. A device according to the preceding claims, characterized in that said hollow body has any suitable shape depending on the application of sadi device.

6. A device according to the preceding claims, characterized in that said hollow of said body holds printed microcircuits for any uses.

7. A device according to the preceding claims, characterized in that said transducing operating sheet like element advantageously consists of a conventional buzzer.

8. A device according to the preceding claims, characterized in that the outer surface of the sheet like element is coated by a removable and replaceable film material layer.

9. A device according to the preceding claims, characterized in that the hollow body-sheet like element assembly is constructed with a tight costruction.

10. A device according to the preceding claims, characterized in that the hollow defined by the hollow body is either pressurized or de-pressurized.

11. A device according to the preceding claims, characterized in that said device comprises means for affixing its support in contact with the surface of the noise generating body.

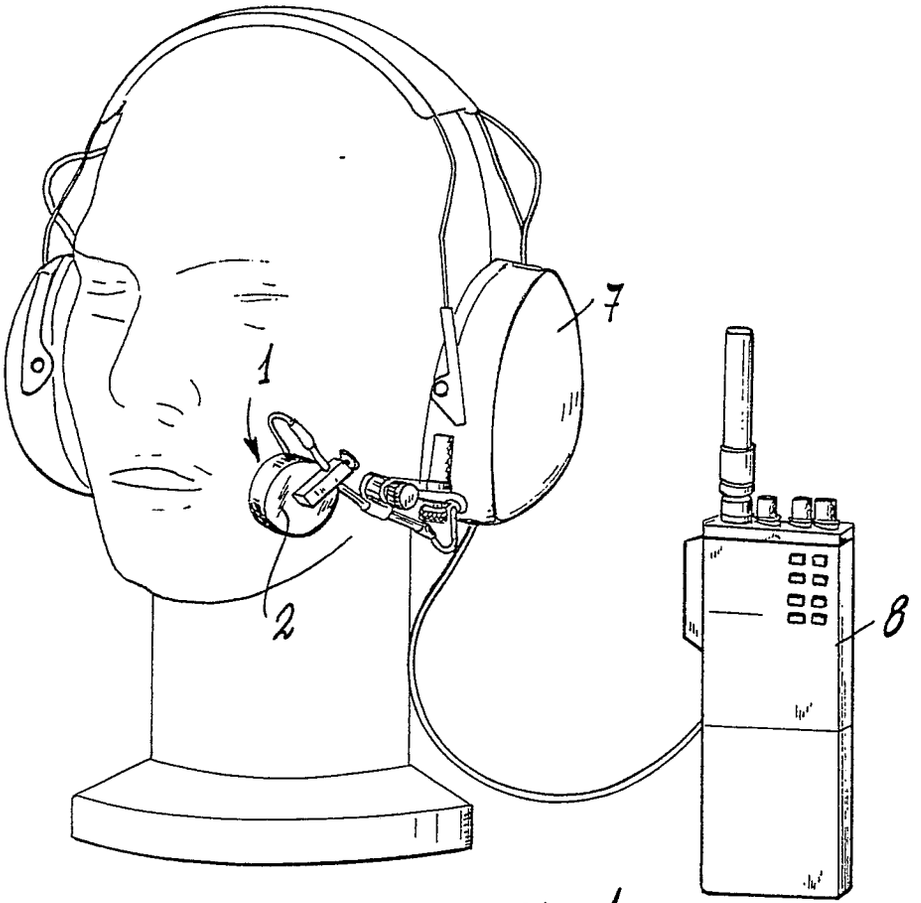


Fig. 1

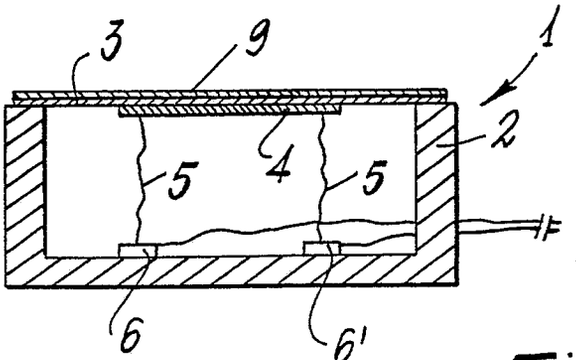


Fig. 2

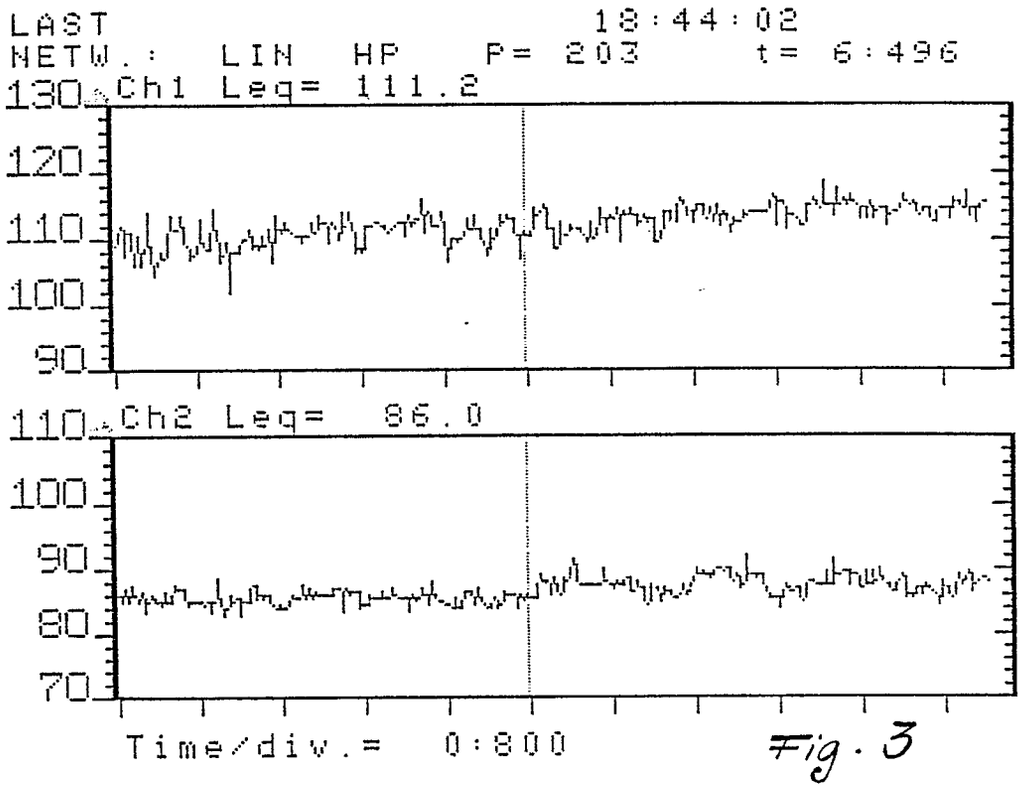
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Fig. 3

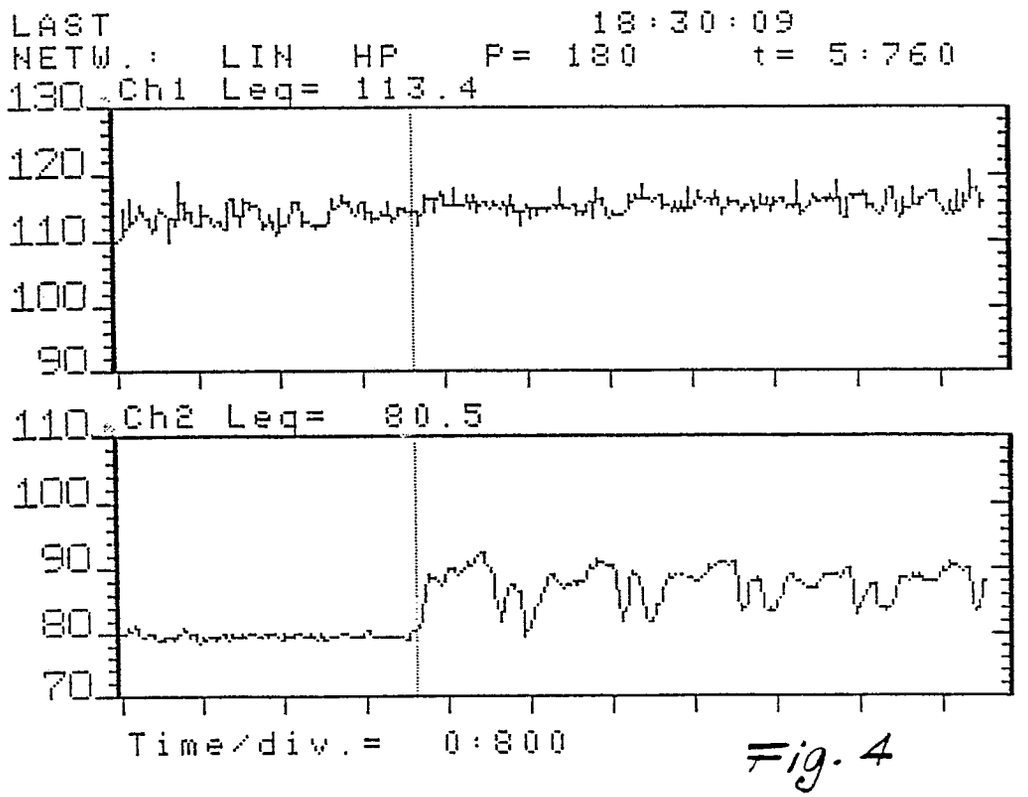
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Fig. 4