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(54) Communication system for noisy environments

(57) The invention relates to a communication system for noisy environments comprising a communication device, at least one sound device comprising sound transmitting means and sound receiving means, sound detecting means for detecting one or more detecting signals in the proximity of said sound transmitting means, and a noise-controlling device comprising a first device for internal signal noise control connected to said communication device or said sound device and a second device for external signal noise control connected to said communication device or said sound device and said sound detecting means, where at least one connection connects said first device for internal signal noise control and said second external signal noise control connected to said communication device, where said noise-controlling device receives one or more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device.

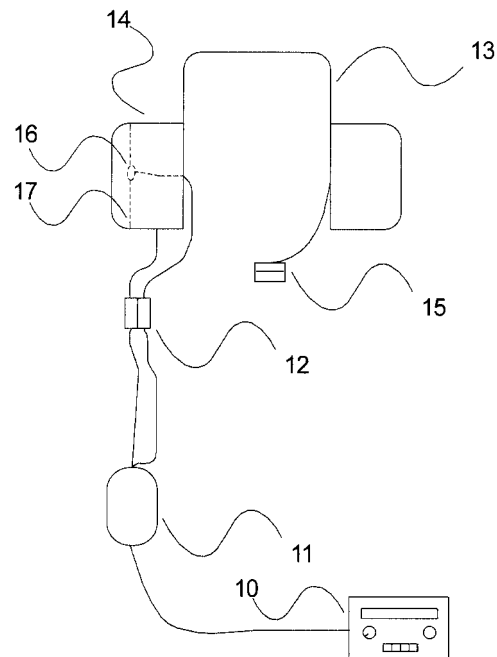


Fig. 1

Description

Background of the invention

[0001] The invention relates to a communication system for noisy environments according to claim 1 and 7, a noise-controlling device according to claim 11 and 12, a cable according to claim 15, a unit for supplementary mounting according to claim 16, a remote control, a method for controlling noise according to claim 20 and use thereof according to claim 21 and 22.

[0002] An example of communication in a noisy environment is in the cockpit of an airplane. In the airplane, communication can take place between the pilot of the airplane and the air-traffic controller in an airport over a radio connection. Also, the communication can be between pilots on the airplane or between pilot and passengers on the airplane. The communication system will often contain two subsystems: A system to facilitate internal communication on the airplane and a system to facilitate external communication. The communication system will also contain a third subsystem allowing manual or automatic shifts between the two subsystems whenever necessary.

[0003] The sources of noise in airplane communication are many but can be divided into two categories: Internal and external noise.

[0004] The largest internal noise source in communication often occurs due to the link between the radio on the airplane and other radios. This is due to the choice of radio communication principle in airplanes. Communication takes place on the VHF frequency band between 108 and 138 MHz with the use of AM modulation. This is advantageous for the skilled air-traffic controller, since he can often hear and understand communication from more than one airplane at the same time, because AM modulated signals do not suppress other signals. This, however, means that an AM modulated signal will often be disturbed by a layer of noise and that it is generally difficult to obtain a high-quality communication sound with the use of AM modulation.

[0005] Another reason is the life span of airplanes, which is normally quite long (e.g. 30 to 40 years), and the airplane radio can thereby be equally old. The old age of the radio in general, and the components and the amplifier principles in particular, often mean that the communication quality leaves much to be desired.

[0006] Also, the quality of the equipment used by the air-traffic controller has a major effect on communication, and especially air-traffic controllers in smaller airports will often have low-quality equipment.

[0007] The external noise sources are placed around the person or persons involved in the communication on an airplane. Among the sources are several of a reparative nature e.g. noise from the airplane engines, the propellers, the generator system, the exhaust, the gyro-compass and the wind.

[0008] In the art, different measures have been taken

to enhance the quality of communication on airplanes. One classic measure relates to the structure of the headset which a pilot normally wears during a flight. The loudspeakers in the headset are built into noise-isolated encapsulations to lower the level of external noise in the pilot's ears.

[0009] In modern communication systems and headsets, the microphone actually consists of two microphones. One microphone points towards the mouth of the pilot and the other points away from his mouth. The idea is that the first microphone picks up the sounds of the pilot and the second microphone the noise from the surroundings. With the signal from the second microphone it is possible to create an inverted noise signal in the communication system and, if put together, remove the noise from the signal received by the pilot in the loudspeakers of the headset.

[0010] In a more advanced modern communication system, the two microphones are complemented by a third microphone placed next to one of the loudspeakers. With the signal from the third microphone it is possible to invert and remove or at least suppress noise as the user perceives it in his ears.

[0011] The problem with modern communication systems is, however, that the removal or suppression of one source of noise only makes the rest of the noise sources more audible to the user of the system e.g. the pilot.

[0012] The noise experienced by the user of the system is dangerous in more than one way. Of course, the noise increases the risk of misunderstandings during communication between e.g. a pilot on an airplane and an air-traffic controller. But it also increases the stress level on the pilot and generally has a wearisome effect. These things all increase the risk of errors by the pilot or the air-traffic controller considerably.

The invention

[0013] When, as stated in claim 1, a communication system for noisy environments comprising a communication device, at least one sound device comprising sound transmitting means and sound receiving means, sound detecting means for detecting one or more detecting signals in the proximity of said sound transmitting means, and a noise-controlling device comprising a first device for internal signal noise control connected to said communication device or said sound device and a second device for external signal noise control connected to said communication device or said sound device and said sound detecting means, where at least one connection connects said first device for internal signal noise control and said second external signal noise control connected to said communication device, where said noise-controlling device receives one or more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device, it is possible to remove or suppress noise

in a communication system.

[0014] This is especially advantageous with the removal or suppression of both internal and external noise signals from the communication between users. This means that the user is more likely to communicate without errors or without having to hear the communicated words more than once to understand the contents.

[0015] Less noise-filled communication also means that the user does not get stressed or tired quite as fast as if the communication is filled with internal or external noise. This allows the user more strength to cope with sudden situations e.g. emergency situations.

[0016] In general, the invention can be used in many other areas where communication takes place in a noisy environment. Examples of such areas can be communication in helicopters, between motor vehicles such as riders of one or more motorbikes e.g. police officers. A further example is during communication between military personnel in an armoured vehicle or between the armoured vehicle and the surroundings. Also in the communication between racing vehicles and the surroundings the invention can be used with advantage.

[0017] When, as stated in claim 2, said communication device is a radio communication device, an advantageous embodiment of the invention has been obtained.

[0018] In particular, it is possible to compensate for semiconductor noise in the communication device since semiconductor noise and internal noise will often be in the form of white noise and hereby be controlled by the noise-controlling device.

[0019] When, as stated in claim 3, said sound device is a headset, it is possible to reduce the space within which sounds are measured to only comprise the space encapsulated by the headset. In a preferred embodiment of the invention, it is sufficient to carry out measurements in only one of the encapsulated spaces of a headset. In the encapsulated space, it will be possible to perform accurate measurements of noise levels and removal of the same. It is also possible to perform measurements and removal actions without having an encapsulated space but with less chance of success.

[0020] When, as stated in claim 4, said sound transmitting means is a loudspeaker, an advantageous embodiment of the invention has been obtained.

[0021] When, as stated in claim 5, said sound receiving means comprise one or more microphones, an advantageous embodiment of the invention has been obtained.

[0022] When, as stated in claim 6, said noise-controlling device comprises a Digital Signal Processor DSP, it is possible to narrow down the size of the noise-controlling device to a minimum since the number of components may be reduced. This also means that power in the noise-controlling device is low.

[0023] The sound quality in the individual headsets is often quite poor. Optimizations have been carried out in order to reproduce sounds with as much force as pos-

sible. If music is played in the headset, the sound will be pretty bad as it will lack bass and treble. In order to improve the sound quality, it is advantageous to carry out a minor tuning/alignment of the frequency spectrum so that both the deep sounds from e.g. a man and the light sounds from e.g. a woman resemble real voices. This tuning/alignment may be carried out by the DSP processor or by applying a simple analogue technique involving filters made by the DSP unit. Measurements by the headset must be carried out in order to determine the typical frequency changing stage.

[0024] When, as stated in claim 7, a communication system comprises a communication device, at least one sound device comprising sound transmitting means, a noise-controlling device comprising a device for adaptive internal signal noise control, where at least one connection connects said noise controlling device to said communication device and said sound device, where said noise-controlling device receives one or more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device, an advantageous embodiment of the invention has been obtained.

[0025] It is particularly advantageous to use the invention in connection with systems involving transmission of signals from a communication device, such as national low frequency broadcasting transmitter, voices or other audible sounds over the Internet or voices or other audible sounds over anything, to a sound device, such as a loudspeaker and thereby perform internal noise control between the two devices by means of a separate device.

[0026] The invention may enhance or regenerate the quality of signals which have been disturbed by distance damping (dB) during the transmission. Furthermore, it may enhance or regenerate signals which have been disturbed by external sources e.g. atmospheric disturbances or disturbances from other signals.

[0027] The device for adaptive internal signal noise-control adapts to a given signal by means of a DSP real-time operative system. This means that the user does not have to perform any or only very few manual adjustments in connection with the use of the system in relation to a given application.

[0028] When, as stated in claim 10, said noise-controlling device comprises controlling means for detecting the presence of a connection between said sound detecting means and said second device for external signal noise-control, it is possible for the noise-controlling device to decide how to react. In particular, it is possible to remove the second device from the signal path if there are no sound detecting means connected to the noise-controlling device and thereby ensure that only the parts of the noise-controlling device which are necessary for the functioning of the device are active. By this, energy efficiency is achieved as well as increased speed by the DSP since it only has to control the internal

noise of the signals.

[0029] When, as stated in claim 13, that said additional means are storage means for storage of sound such as speech, it is possible to provide a user of the communication system with built-in functions involving sound signals where the resulting sounds, e.g. in the headset of a user, are noise-controlled. The sounds to be stored may be speech including several instructions to be followed such as communication between an air-traffic controller and a pilot on an airplane. Since its very important that the pilot understands all instructions, the sounds can be stored and replayed at a later point. However, to ensure that the stored speech is understandable to the pilot, it is important that the stored sounds are noise-controlled before the pilot receives them in his headset. If the sounds are not noise-controlled, it is likely that the pilot has to pay closer attention to understanding the instructions and less to flying the airplane.

[0030] When, as stated in claim 14, said additional means are storage means for storage of prerecorded sound such as speech, it is possible to provide a user of the communication system with built-in functions involving prerecorded sounds, where the resulting sounds, e.g. in a headset of the user, are noise-controlled. The prerecorded sounds may be information on e.g. the time rendered to a pilot on an airplane.

Drawings

[0031] The invention will be described below with reference to the drawings in which

fig. 1 illustrates a communication system according to the invention,

fig. 2 illustrates a communication system according to the invention schematically,

fig. 3 illustrates a noise-controlling system according to the invention schematically,

fig. 4 illustrates a noise-controlling system with sound storage,

fig. 5 illustrates a noise-controlling system with sound storage and a timer system,

fig. 6 illustrates a communication system with a remote control build into a knee board,

fig. 7 illustrates encapsulation of a headset with a microphone inserted and

fig. 8 illustrates a cable clip.

Detailed description

[0032] The examined technique concerns a commu-

nication system as illustrated in fig. 1.

[0033] The communication system illustrated in fig. 1 comprises a communication device 10, usually a radio, with the ability to transmit and receive communication from other radios. The communication system may also comprise an intercom system to facilitate communication within a smaller physical area e.g. on an airplane.

[0034] The communication device is connected to a sound device 13 through a noise-controlling system 11. The sound device 13 normally consists of at least one loudspeaker and at least one microphone e.g. a pilot headset.

[0035] In figure 2, the communication system is illustrated schematically and in figure 3 the noise-controlling system is illustrated.

[0036] The noise-controlling system 11 consists of a first 20 and a second device for noise control 21 connected to each other, the communication and sound devices being serially connected. The mutual order of the first and second devices is not important. The second device may easily make up the first device of the noise-controlling system and be met by the signal from the communication device.

[0037] The first device 20 is for internal signal noise control and the second device 21 is for external signal noise control. The internal noise can also be referred to as electric noise and the external noise as acoustic noise.

[0038] The noise control is possible by use of digital signal processor DSP.

[0039] The first device 20 for internal signal noise control works by analyzing and removing the background noise. Hereby, it is possible to increase the signal/noise levels considerably. Apart from removing undesirable static noise from the wind and atmospheric disorder, the DSP must be able to actively filter a given signal that has been distorted for a number of reasons.

[0040] All these signals contain undesirable distortion and noise. With the DSP technique, these errors may be removed or simply "corrected" again.

[0041] A number of audio-improving functions are required in order to improve and thereby separate the desired communication from undesired background noise of e.g. atmospheric disorder or white noise from the various radio receivers and amplifiers on an airplane. At the same time, a number of simultaneous DSP techniques are required which, in turn, require a powerful DSP processor.

[0042] One of the possibilities of removing broadband noise is referred to as "Linear Time Varying Wiener Filter". It is a technique that involves static processing of a signal and identification and removal of background noise. This will enhance the desired sounds and reduce static background noise. A linear adaptive filter is essentially a "Linear time-varying filter". This means that the output $y(t)$ is a linear combination of the filter input values:

$$(t), x(t-1) \dots x(t-L+1)$$

[0043] The value L corresponds to the order to which the filter belongs. In other words, the equation will be as follows:

$$y(t) = w_0 x(t) + w_1 x(t-1) + \dots + w_{L-1} x(t-L+1)$$

w_0 to w_{L-1} define the shape of the filter and are called "input response".

[0044] By varying the "filter taps" with time, it is fairly possible to control the filter output. This means that a desired output signal $d(t)$ may be compared with the actual output signal $y(t)$ and thereby define an error as:

$$e(t) = d(t) - y(t).$$

[0045] The adopted adaptive algorithm is called "Least Mean Square" (LMS) and may be expressed by:

$$\sum_1 e(t)^2$$

[0046] Naturally, the filter is not able to provide an output signal which is completely independent of the input signal $x(t)$. This is due to the fact that the input signal $x(t)$ has to be correlated with the output signal $d(t)$ in order to make it possible to make the output signal filter equal to $d(t)$. If e.g. $x(t)$ and $d(t)$ are completely dependent on each other, the result will be that "filter taps" equal zero and the error signal equals the desired output signal because the output from the filter is zero.

[0047] The DSP technique known as "deconvolution" may also be applied. The technique is often used to e.g. remove undesirable echoes from a signal. A late version of the signal is fed into the adaptive filter, thereby making the DSP technique capable of recognizing and removing undesirable echoes and tones from e.g. atmospheric disorder etc. It should be noted that the pilot needs to be able to pick up Morse signals and identifications of radio beacons. They Morse their identification with a two or three digit Morse signal. It must be ensured that the filter does not remove such Morse signals. This may be done by applying another technique known as "line enhancing". This technique does the exact opposite of the "deconvolution" which is to enhance the periodic signal or tone buried by the background noise.

[0048] A combination of these filters, even if pointed in opposite directions, may be able to utilize the advantages of both filters. This is made possible by analyzing the input signal on a current basis and subsequently determining whether it involves a desired signal (Morse or the like) or whether it involves an undesired signal (atmospheric disorder).

[0049] In order to obtain an automatic gain control

(AGC function), it is possible to apply another technique referred to as "Homomorphic Signal Processing". The AGC function may be problematic if the volume control on the airplane radio is turned down too low. The DSP processor requires a certain audio level in order to operate. Thus, the pilot must adjust the volume control on all airplane radios to normal level. If the level is too low or too high, the DSP system will not be able to operate optimally.

[0050] The second device for external noise control 21 works by actively reducing the noise in the pilot's headset by using DSP-generated counter noise which is able to reduce certain sources of noise. This increase the effect of the passive sound in the headset even further.

[0051] A strategically placed sound detecting device 16 such as a microphone measures the actual noise level and the DSP processor generates exactly the same level of counter noise.

[0052] This technique is referred to as "Noise Cancellation" and makes use of a reference signal from a measuring microphone. This measuring microphone featuring an extra cable 60 must be incorporated in the pilot's headset 14 either during manufacturing or by supplementary mounting. The microphone must be placed as close as possible to the pilot's ear (one microphone is sufficient).

[0053] The pilot's headset microphone 15 cannot be used as a measuring microphone because it is noise-cancelled. The microphone is double. One microphone points away from the pilot's mount while the other points towards the mouth and only the difference between the two microphone signals is transmitted to the airplane radio. This means that a signal from the environment will be just as powerful in both microphones, despite the fact that the sounds of the pilot will be more powerful towards one of the microphones which is naturally the one pointing towards the pilot's mouth. In this manner, any sounds transmitted from the airplane will be relatively free of noise.

[0054] The measuring microphone is used to generate a reference signal. By feeding the reference signal to the adaptive filter, the filter may reconstruct the noise and the DSP processor may then generate counter noise on the basis of a counter technique that may reduce noise from e.g. engines and exhaust. The objective is to obtain an ENR reduction of at least 10 dBa and preferably more.

[0055] In an embodiment of the invention, the noise-controlling system has means for detecting the presence of a connection between the measuring microphone and the second device for external signal noise-control. If the connection is not present, the second device is turned off. Hereby, the first device for internal signal noise control works alone in the noise-controlling device until a connection to a microphone is detected.

[0056] For safety reasons, the invention also has a failsafe mode to be used in case of a malfunction by the

noise controlling device. To ensure continuous communication between e.g. a pilot and an air controller, the noise controlling device is shortcircuited in the failsafe mode. The failsafe mode can also be used in case of a low power situation in a noise controlling device powered by a battery.

[0057] In fig. 4, a storage system 40 is illustrated. The storage system comprises a ring buffer wherein the last 40 seconds of communication are always stored. Each reproduction of 5 seconds may therefore make up one block in the ring buffer. Thus, if reproduction of the last 20 seconds is desired, the button 41 is pressed four times. The air-traffic controller's instructions are repeated and maybe written down and subsequently repeated to the air-traffic controller on the ground.

[0058] The ring buffer is overwritten after a period of 40 seconds. This type of memory must be SRAM since it is not limited to a certain number of writings as is the case with e.g. flash memory.

[0059] In fig. 5, a timer system 50 is illustrated. The timer system is used when the weather conditions only permit flying by means of the instruments. The pilot uses a timer system by means of which he may carry out the necessary maneuvers prior to landing.

[0060] Usually, the pilot has a stop watch mounted on top of the control panel. The disadvantage of this is that the pilot has to divert his eyes away from important instruments during one of the most crucial moments which is during landing. However, if the function of the stop watch was only reported orally in the pilot's headset, he would be able dedicate all his attention to the important instruments. This function of the stop watch would be carried out by means of synthetic/sampled voices presented in the pilot's headset. The level must be somewhat lower than that of the audio from the radio in order not to disturb radio communication.

[0061] The pilot uses a button 51 placed on the air-plane control panel. Once the pilot presses one time on the stop watch button, a faint beep can be heard followed by a fainter beep for every second and after 30 seconds, the first reported time is rendered.

[0062] The reported time is rendered every 30 seconds in the following manner:

1. Thirty seconds
2. One minute
3. One minute thirty seconds
4. ... and so forth for a period of up to five minutes

[0063] The stop watch automatically stops after a period of five minutes or if the pilot presses the stop watch button again. If the pilot stops time with another press on the button, two beeps are rendered. Thereby, it is easy to determine whether the stop watch has been activated or not. At the same time, it is necessary with a small display showing the time. The display must be placed in the control means featuring the two buttons for remote control.

[0064] In one embodiment of the invention, a remote control 62 with a display is used to control one or more of the systems, and in particular the stop watch or the storage systems 40, 50. The remote control 62 may be designed in such a manner that it is connected with the systems through a cable or alternatively wirelessly 64. The remote control 62 will be provided with means for fixation in order to be able to place it onto desired surfaces. The means for fixation may include e.g. Velcro placed on the back of the remote so that it may be fixed onto other desirable places provided with Velcro as well. Examples of such other places may be onto the pilot's flying suit, onto the pilot's knee board 61 or directly onto the yoke of the air plane.

[0065] In figure 6 a particularly advantageous embodiment of the invention is illustrated. The remote control may be incorporated in the pilot's knee board and in particular in the fixation mechanism for paper 63 which is often featured by such a knee board. There are knee boards on the market which may be mounted directly onto the yoke and steering post of the air plane which makes it particularly advantageous with an incorporated remote control as easy access for the pilot provides him with the opportunity gain a complete overall picture of the situation within a matter of seconds.

[0066] In fig. 7, a microphone supporting unit 17 in plastic is used to hold the microphone in place in the headset. This unit works both as a holder for the microphone and as a unit fixing the microphone inside the headset. The microphone must be quite flat and feature a cable 60. Some kind of encapsulation of the cable and the microphone must be made to obtain a nice finish and a strain relief of the cable. It is important that the plastic material be manufactured in such a manner that mechanical resonance be avoided in the desired operating area.

[0067] The microphone supporting unit comprises spring arms that may be pressed together during assembly.

[0068] The person doing the assembly only has to press the four spring arms away from each other, place the microphone supporting unit in the space next to the loudspeaker in the headset — and then let go of the four plastic arms. The microphone supporting unit is now in place and the microphone is inserted in the unit and the headset is subsequently provided with a small cushion.

[0069] The weight of the item must be kept at a minimum in order to avoid any significant increase in the weight of the headset.

[0070] In fig. 8, a cable clip is shown. The cable from the microphone must run along the normal cable of the headset. In order to hold these cables together, a simple cable clip is made in soft plastic.

[0071] A number of cable clips are complimentary. They must be designed in such a manner that they are hardly visible on the outside of the cables. Also, it is important that the surface of these clips is smooth order to slide easily over all kinds of fabric such as e.g. a shirt or

a pair of pants so that the person wearing these clothes feels that he can move around freely. Essentially, the clip is designed in the shape of an open eight 70, 71. In order to mount the cable, the eight may be opened on the one side 72, 73, the cable placed in the clip whereupon the eight is closed again.

[0072] The cable clip must be designed to fit each cable optimally. It must be fixed firmly onto the cable and hold the cables together and resist a possible pull attempting to separate them.

[0073] While the invention has been described and illustrated herein with reference to the preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made without departing from the spirit and scope of the invention as characterized in the claims.

List

[0074]

- 10. Communication device
- 11. Noise-controlling device
- 12. Cable clip
- 13. Sound device e.g. a headset
- 14. Encapsulated space e.g. in a headset
- 15. Microphone
- 16. Sound detecting means
- 17. Holding means e.g. a spring
- 20. First device for internal signal noise control
- 21. Second device for external signal noise control
- 40. Storage
- 41. Start/stop for storage
- 50. Timer
- 51. Start/stop for timer
- 60. Cable connection to sound detecting device
- 61. Knee board
- 62. Remote control
- 63. Paper
- 64. Wired or wireless connection
- 70. First cable holding part
- 71. Second cable holding part
- 72. Opening in first cable holding part
- 73. Opening in second cable holding part

Claims

1. Communication system for noisy environments comprising

a communication device (10),

at least one sound device (13) comprising

sound transmitting means and

sound receiving means (15),

sound detecting means (16) for detecting one or more detecting signals in the proximity of said sound transmitting means, and

a noise-controlling device (11) comprising

a first device (20) for internal signal noise control connected to said communication device (10) or said sound device (13) and

a second device (21) for external signal noise control connected to said communication device (10) or said sound device (13) and said sound detecting means (16),

where at least one connection connects said first device (20) for internal signal noise control and said second device (21) for external signal noise control, where said noise-controlling device (11) receives one or more signals from said communication device (10) or said sound device (13), and transmits the noise-controlled form of said one or more signals to said communication device (10) or said sound device (13).

- 2. Communication system according to claim 1, **characterized in that** said communication device (10) is a radio communication device.
- 3. Communication system according to claim 1, **characterized in that** said sound device (13) is a headset.
- 4. Communication system according to claim 1, **characterized in that** said sound transmitting means are one or more loudspeakers.
- 5. Communication system according to claim 1, **characterized in that** said sound receiving means (15) comprise one or more microphones.
- 6. Communication system according to claim 1, **characterized in that** said noise-controlling device (11) comprises a Digital Signal Processor DSP.
- 7. Communication system comprising

a communication device,

at least one sound device comprising
sound transmitting means,

a noise-controlling device comprising
a device for adaptive internal signal noise control,

where at least one connection connects said noise controlling device to said communication device

and said sound device,
 where said noise-controlling device receives one or more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device. 5

8. Communication system according to claim 7, **characterized in that** said noise-controlling device comprises a second device for external signal noise control 10

9. Communication system according to claim 8, **characterized in that** said sound detecting means for detecting one or more detecting signals in the proximity of said sound transmitting means is connected to said second device for external signal noise control. 15

10. Communication system according to claim 7, 8 or 9, **characterized in that** said noise-controlling device comprises controlling means for detecting the presence of a connection of said sound detecting means to said second device for external signal noise control. 20 25

11. Noise-controlling device (11) for mounting in a communication system comprising sound detecting means (16) for detecting one or more detecting signals in the proximity of sound transmitting means, 30

a first device (20) for internal signal noise control with one or more connections to a communication device or a sound device, and 35

a second device (21) for external signal noise control with one or more connections to a communication device or a sound device and said sound detecting means (16), 40

where at least one connection connects said first device (20) for internal signal noise control and second device (21) for external signal noise control, where said noise-controlling device (11) receives one or more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device. 45 50

12. Noise-controlling device (11) for mounting in a communication system comprising

sound detecting means (16) for detecting one or more detecting signals in the proximity of sound transmitting means, 55

a first device (20) for internal signal noise

control with one or more connections to a communication device or a sound device,

a second device (21) for external signal noise control with one or more connections to a communication device or a sound device and said sound detecting means (16), and

additional means (40, 50) with one or more connections to said first device (20) for internal signal noise control and/or said second device (21) for external signal noise control,

where at least one connection connects said first device (20) for internal signal noise control and said second device (21) for external signal noise control, where said noise-controlling device (11) receives one or more signals from said communication device or said sound device, transmits the noise-controlled form of said one or more signals to said communication device or said sound device and where said sound device also receives a noise-controlled signal or signals from said additional means.

13. Noise-controlling device according to claim 12, **characterised in that** said additional means (40) are storage means for storage of sound such as speech.

14. Noise-controlling device according to claim 13, **characterised in that** said additional means (50) are storage means for storage of prerecorded sound such as speech.

15. Cable connecting a communication device and a sound device comprising a noise-controlling device, according to claim 11 or 12, placed in one or more of the signal paths of said cable.

16. Unit for supplementary mounting in a communication system comprising

a cable for connecting a communication device and a sound device,

sound detecting means (16) for detecting one or more detecting signals in the proximity of sound transmitting means,

a first device (20) for internal signal noise control with one or more connections to a communication device or a sound device,

a second device (21) for external signal noise control with one or more connections to a communication device or a sound device and said

sound detecting means (16),

where at least one connection connects said first device (20) for internal signal noise control and said second device (21) for external signal noise control, where said noise-controlling device (11) receives one or more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device.

17. Unit for supplementary mounting according to claim 16, **characterized in that** the connection between the sound detecting device and the second device for external signal noise control, has one or more attachments (12) to said cable.

18. Unit for supplementary mounting according to claim 16, **characterized in that** the sound detecting device is mounted in the encapsulation (14) containing said sound transmitting means in a flexible manner.

19. Remote control in a noise controlling device according to claim 11-14 comprising one or more actuating means, such as push buttons, and at least one display for controlling of one or more functions in said noise controlling device (11).

20. Method for controlling noise in a noisy environment comprising

a communication device

at least one sound device comprising

sound transmitting means and

sound receiving means,

sound detecting means detecting one or more detecting signals in the proximity of said sound transmitting means,

a noise-controlling device comprising

a first device for internal signal noise control connected to said communication device or said sound device and

a second device for external signal noise control connected to said communication device or said sound device and said sound detecting means,

where at least one connection is established to said first device for internal signal noise control and second device for external signal noise control, where said noise-controlling device receives one or

more signals from said communication device or said sound device, and transmits the noise-controlled form of said one or more signals to said communication device or said sound device.

21. Use of a noise-controlling system according to claim 11 or claims 12-14 in a communication system according to claims 1-10 for performing a method of claim 20.

22. Use of a remote control in a noise controlling device according to claim 11-14 where said remote control is build into a part of an airplane.

23. Use of a remote control according to claim 22 where said remote control (62) totally or partly is build into a knee board (61) or a similar board for a pilot.

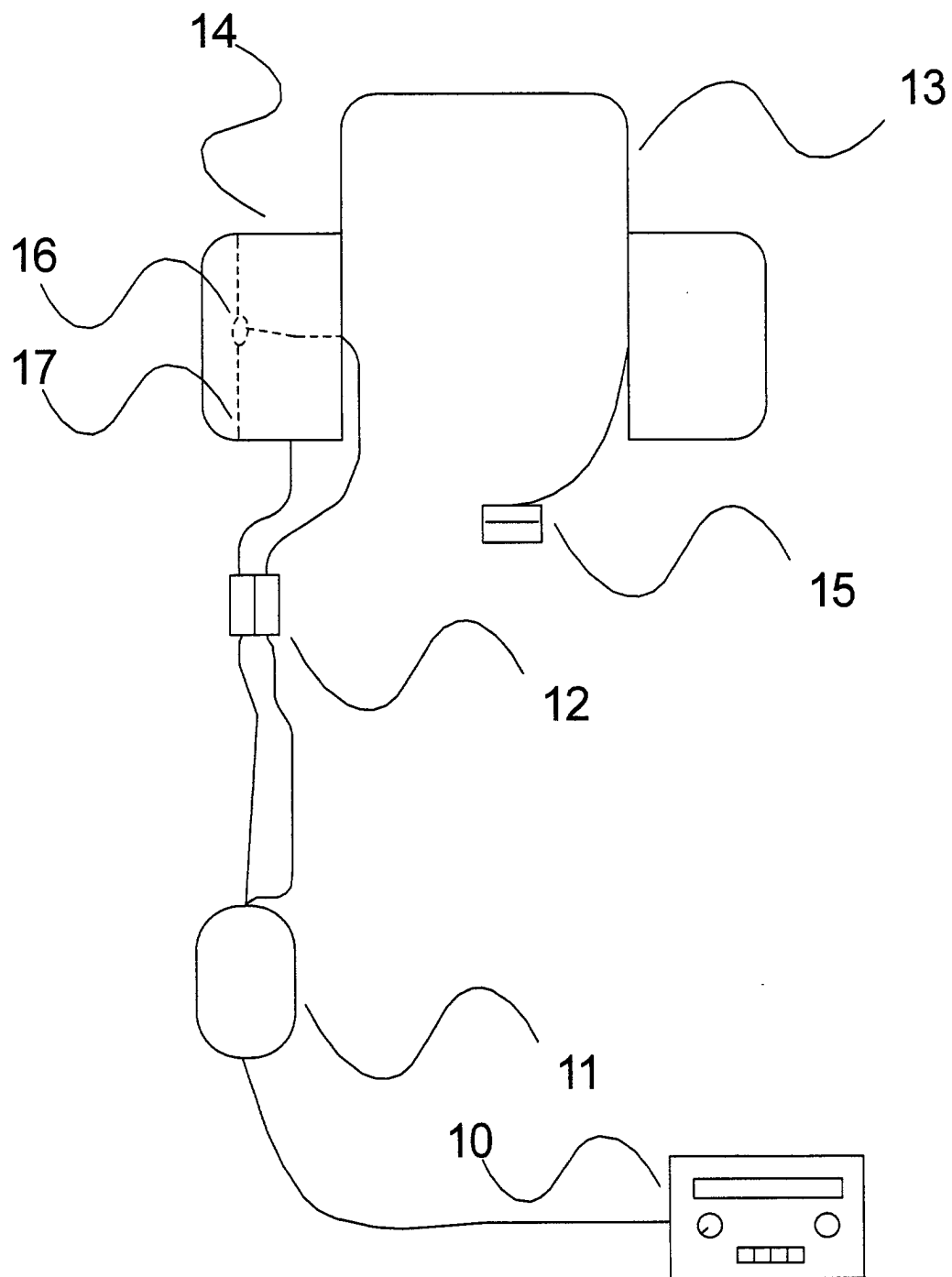


Fig. 1

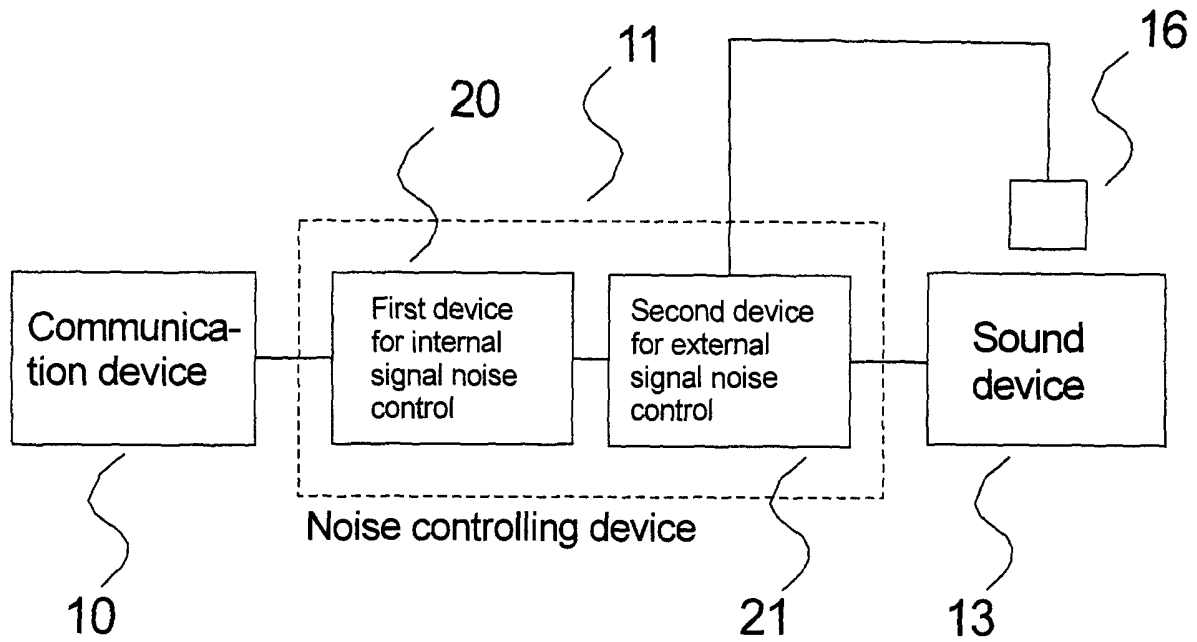
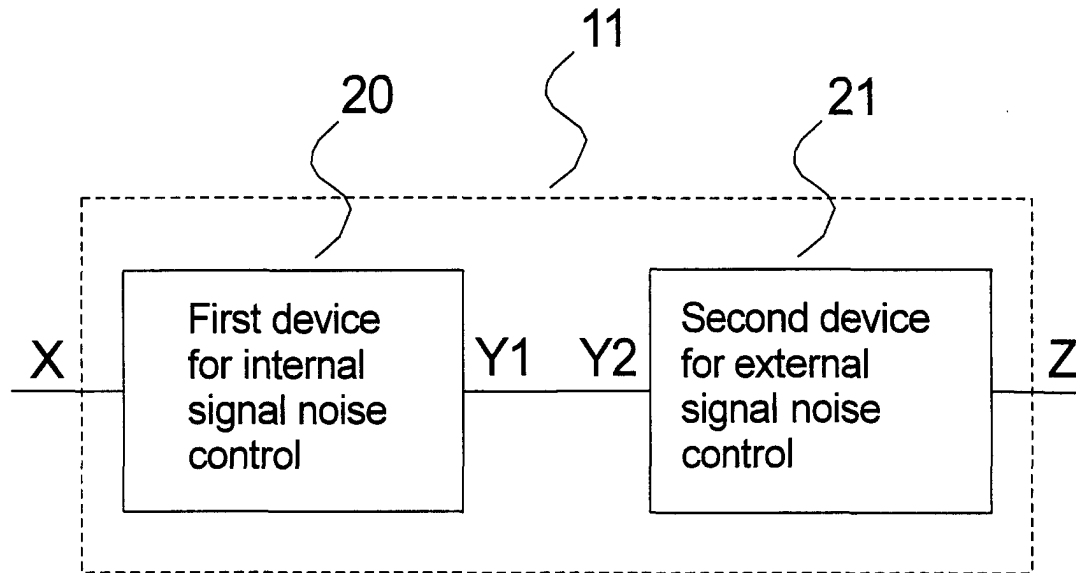


Fig. 2



Noise controlling device

Fig. 3

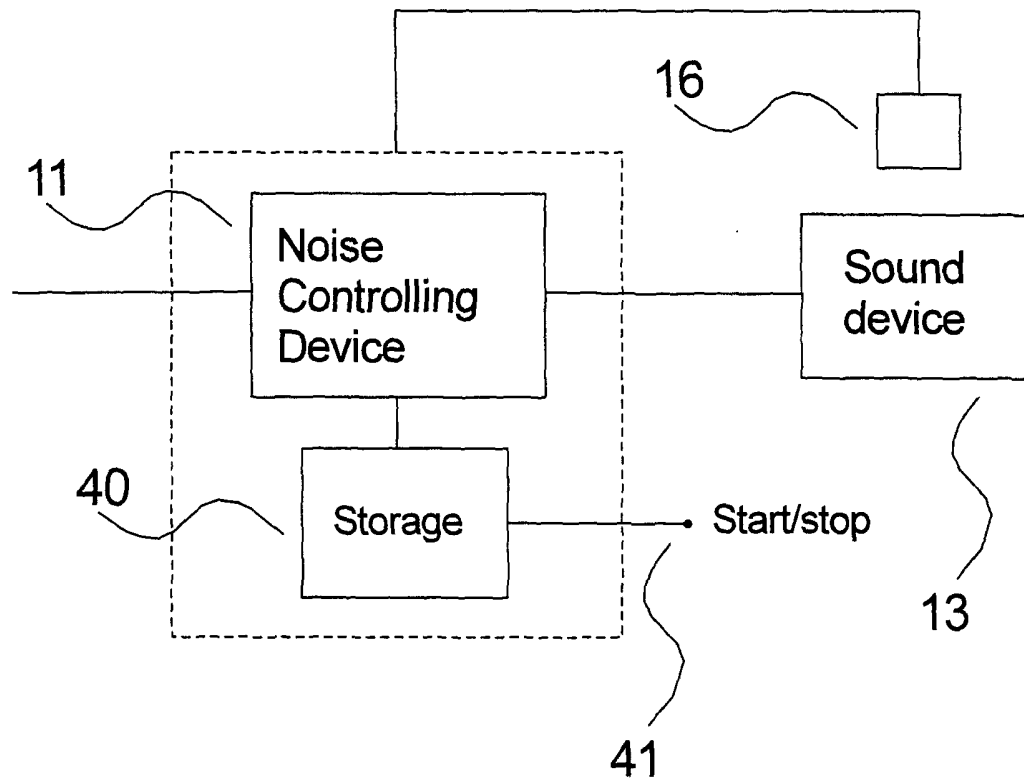


Fig. 4

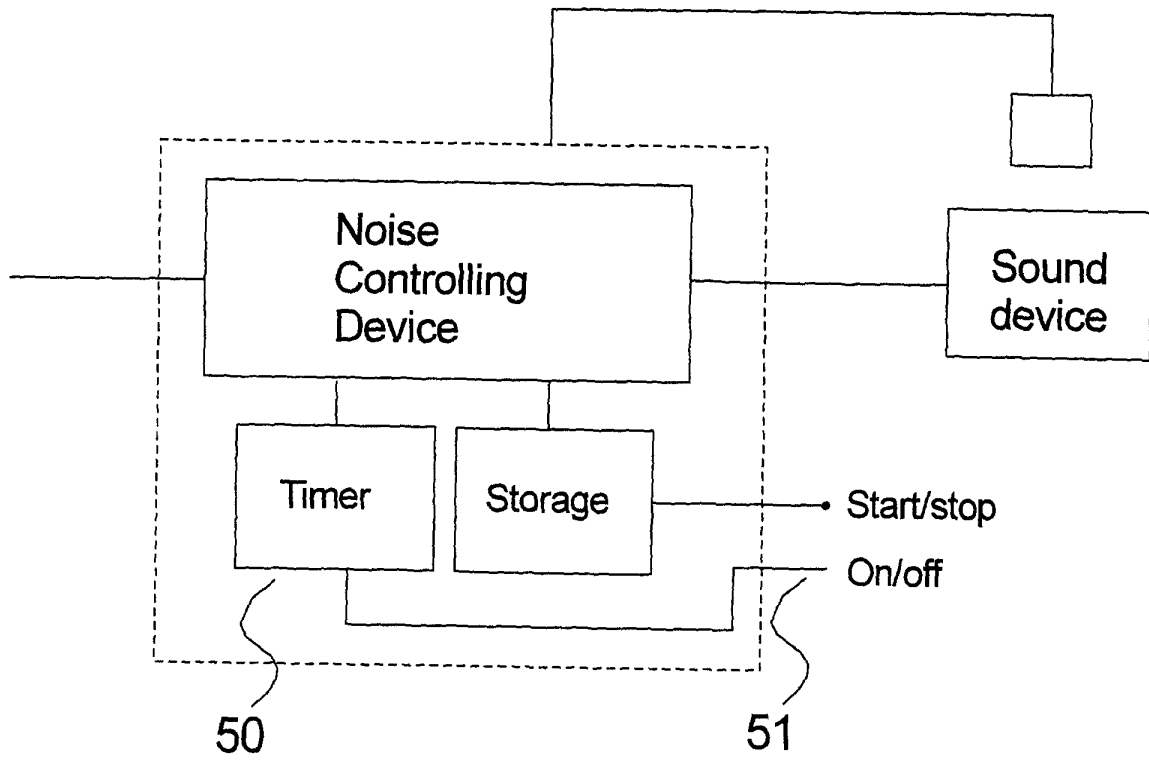


Fig. 5

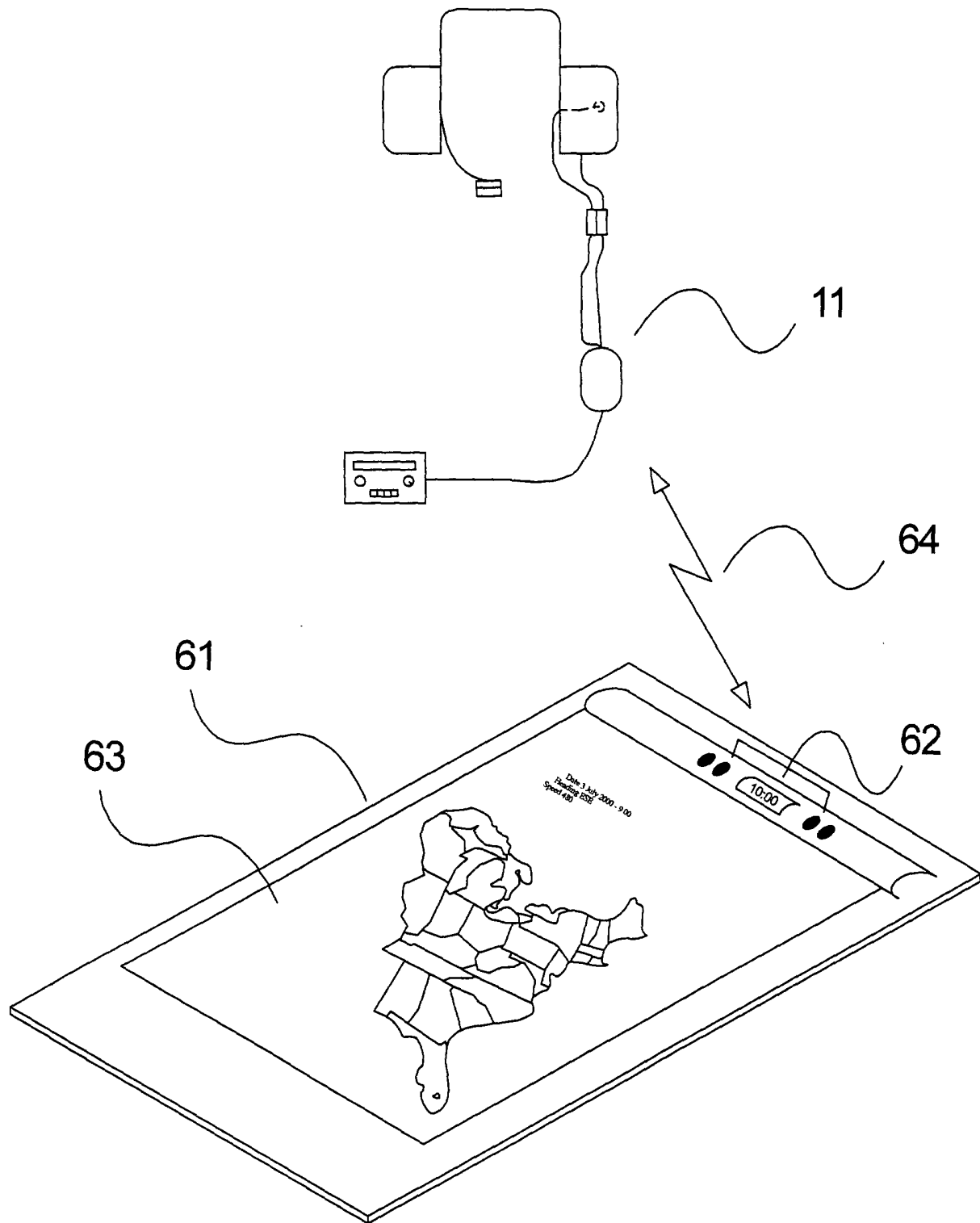


Fig. 6

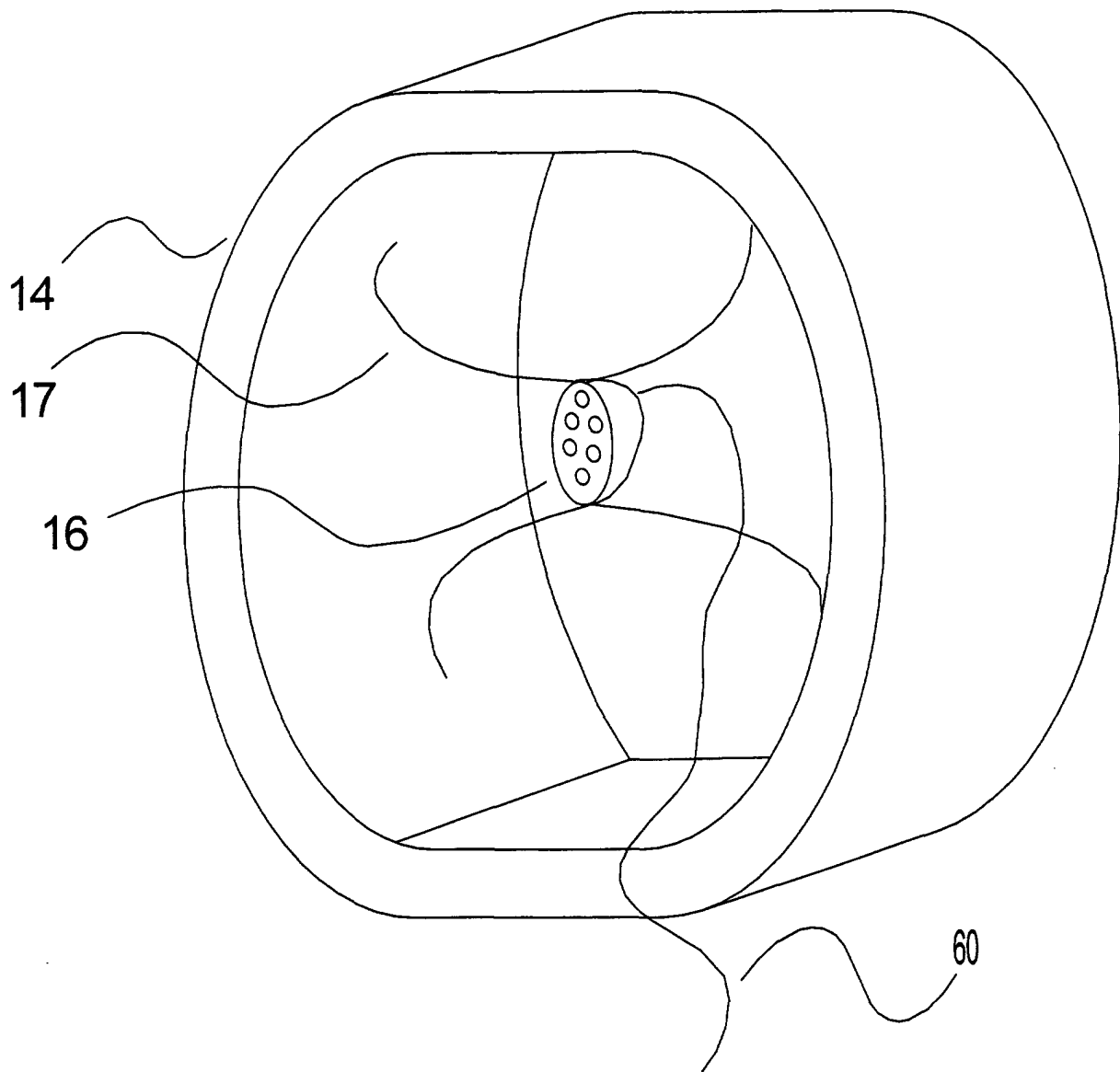


Fig. 7

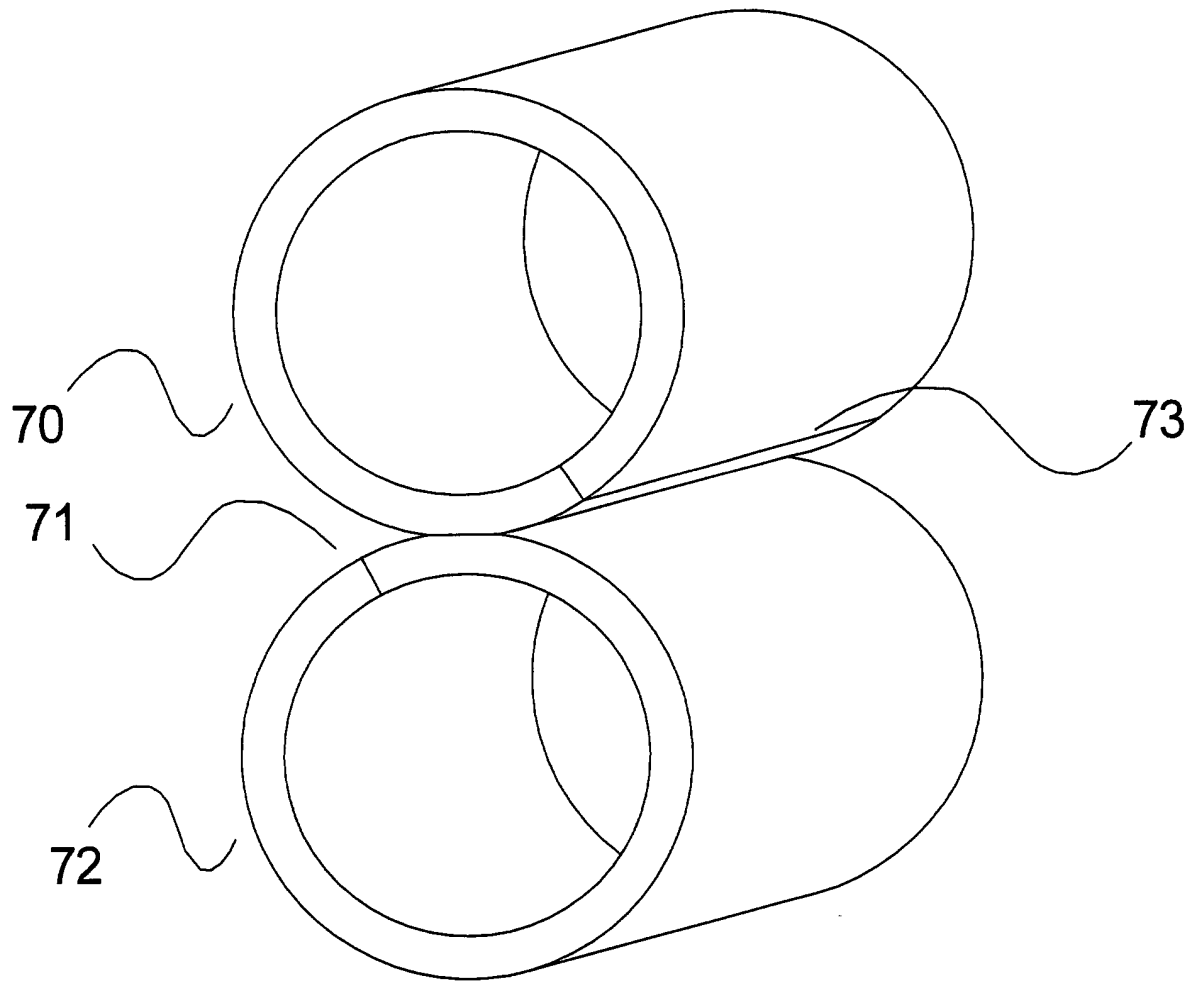


Fig. 8



European Patent
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Application Number
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Place of search THE HAGUE		Date of completion of the search 20 February 2001	Examiner Zanti, P
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