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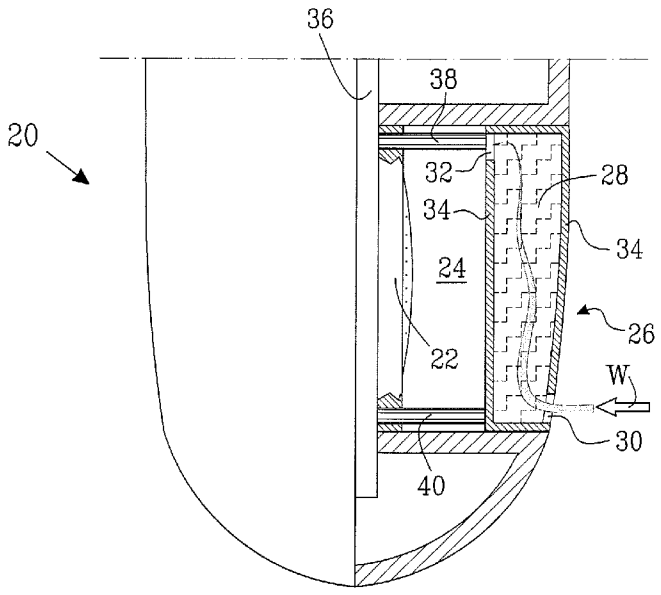
(54) **Title:** IMPROVED WIND NOISE REDUCTION BARRIER



(57) **Abstract:** The present invention relates to a sound receiving device (10) and a microphone unit (20) for such a sound receiving device. In the microphone unit (20) there is provided a microphone, an air filled chamber and a wind noise barrier covering the chamber for providing a wind shield and having at least one air passage channel connecting the exterior of the device with the air filled chamber and having an inlet facing the exterior of the device and an outlet facing the air filled chamber. The air passage channel comprises at least one turn for reducing the influence of the wind on the microphone. The invention provides enhanced wind noise reduction.

WO 2008/061808 A1

IMPROVED WIND NOISE REDUCTION BARRIER

TECHNICAL FIELD OF THE INVENTION

The present invention generally relates to the field of receiving of sound using microphones. The present more particularly relates to a sound receiving device and a microphone unit for such a sound receiving device.

BACKGROUND ART

Microphones used for portable electronic equipment may be directional or omni-directional. They may at times be used in open air, for instance when used in relation to cellular phones. However in certain weather conditions, there might be a wind blowing. This wind may be picked up by a microphone and thus produces an unwanted wind noise, which may be very irritating for a user. If a microphone is used in a phone session, this wind noise may make it impossible to hear what a party is saying.

Conventionally, several types of so-called "omni-directional microphones" have been used in portable electronic communication devices such as cellular phones or accessories to such phones. However, although these microphones are considered to be less sensitive to wind-noise from air blowing into the microphone compared to so-called "directional microphones", wind-noise is often still a problem. Therefore, noise cancelling algorithms are sometimes used to reduce this problem. However, a drawback is that due to power consumption, noise cancelling algorithms are not always suitable in portable devices having limited battery capacity. It is furthermore possible that the device where wind noise is to be reduced has no power supply at all.

There have therefore been investigations concerning the use of wind noise barriers. Such wind screen barriers are then normally provided in the form of porous membranes. Examples of such barriers are for instance given in US 4,966,252, US 5,442, 713 and US-2,536,261.

Such barriers are therefore of interest to be provided in accessories like portable hands-free devices in relation to cellular phones, for instance for head sets.

One such head set with a wind screen barrier is described in WO 2005/067653. Here a microphone is placed in an air filled chamber, where the chamber is surrounded by a wind screen barrier.

These barriers all allow the wind noise to be reduced. However there is room for improvement, in order to even further reduce the noise introduced by a nature.
The present invention is therefore directed towards providing an improved wind screen barrier.

SUMMARY OF THE INVENTION

The present invention is thus directed towards providing improved wind noise reduction.

Accordingly, an object of the present invention is to provide a microphone unit that provides improved wind noise reduction.

According to a first aspect of the invention, this is achieved by a microphone unit for a portable sound receiving device, comprising
a microphone,
an air filled chamber, and
a wind noise barrier covering the chamber for providing a wind shield and having at least one air passage channel connecting the exterior of the device with the air filled chamber and having at least one inlet facing the exterior of the device and at least one outlet facing the air filled chamber,
wherein said channel comprises at least one turn for reducing the influence of the wind on the microphone.

A second aspect of the present invention is directed to a microphone unit including the features of the first aspect, wherein the walls of each channel are made of an airtight material.

A third aspect of the present invention is directed to a microphone unit including the features of the first aspect, wherein each channel is filled with a porous wind reduction material.

A fourth aspect of the present invention is directed to a microphone unit including the features of the first aspect, wherein the barrier has an outer surface facing the exterior, an

inner surface facing the chamber, a first end attached to one end of the chamber and a second end provided at a second opposite end of the chamber.

A fifth aspect of the present invention is directed to a microphone unit including the features of the fourth aspect, wherein the channel stretches within the barrier essentially aligned with the inner and outer surfaces of the barrier.

A sixth aspect of the present invention is directed to a microphone unit including the features of the fourth aspect, wherein there is only one channel.

A seventh aspect of the present invention is directed to a microphone unit including the features of the sixth aspect, wherein the inlet is provided at the first end of the barrier and the outlet is provided at the second end of barrier.

An eighth aspect of the present invention is directed to a microphone unit including the aspects of the sixth aspect, wherein the chamber has a bottom surface and there is a rotational-symmetrical axis of the chamber provided through the bottom surface and the centre of the chamber that is perpendicular to the bottom surface, where the channel is provided symmetrically around said rotational-symmetrical axis

A ninth aspect of the present invention is directed to a microphone unit including the features of the eight aspect, wherein the inlet is coaxial with the axis and the outlet is distanced from and provided symmetrically around the axis.

A tenth aspect of the present invention is directed to a microphone unit including the features of the eighth aspect, wherein the inlet is distanced from and provided symmetrically around the axis and the outlet is coaxial with the axis.

An eleventh aspect of the present invention is directed to a microphone unit including the features of the fourth aspect, wherein there are several channels provided in the barrier.

A twelfth aspect of the present invention is directed to a microphone unit including the features of the eleventh aspect, wherein the inlet of each channel provided at the outer surface of the barrier is aligned with the corresponding outlet on the inner surface of the barrier.

A thirteenth aspect of the present invention is directed to a microphone unit including the features of the eleventh aspect, wherein the chamber has a bottom surface and there is a rotational-symmetry axis provided through the bottom surface and the centre of the chamber that is perpendicular to the bottom surface and the channels are provided symmetrically around the axis.

A fourteenth aspect of the present invention is directed to a microphone unit including the features of the first aspect, wherein the microphone is provided in the air filled chamber.

A fifteenth aspect of the present invention is directed to a microphone unit including the features of the fourteenth aspect, wherein the chamber has a bottom surface, there is an axis provided through the bottom surface and the centre of the chamber that is perpendicular to the bottom surface and where the barrier provides all walls and ceilings of the chamber, wherein the microphone is angled away from this axis.

A sixteenth aspect of the present invention is directed to a microphone unit including the features of the fifteenth aspect, wherein the microphone is directional.

A seventeenth aspect of the present invention is directed to a microphone unit including the features of the fifteenth aspect, wherein the microphone is angled by about forty-five degrees to said axis.

An eighteen aspect of the present invention is directed to a microphone unit including the features of the fifteenth aspect, wherein the microphone is angled by about ninety degrees to said axis.

A nineteenth aspect of the present invention is directed to a microphone unit including the features of the first aspect, wherein the microphone is in contact with the air filled chamber via a sound channel.

A twentieth aspect of the present invention is directed to a microphone unit including the features of the first aspect, wherein there is an additional chamber providing an additional air volume beneath the air-filled chamber, being in contact with the air-filled chamber via a passage in the form of a vent.

Another object of the present invention is to provide a portable sound receiving device that provides improved wind noise reduction.

This object is according to a twenty-first aspect of the present invention achieved by a portable sound receiving device comprising
a microphone unit, having
a microphone,
an air filled chamber, and
a wind noise barrier covering the chamber for providing a wind shield and having at least one air passage channel connecting the exterior of the device with the air filled chamber and having at least one inlet facing the exterior and at least one outlet facing the air filled chamber,
wherein said channel comprises at least one turn for reducing the influence of the wind on the microphone.

A twenty-second aspect of the present invention is directed to a portable sound receiving device including the features of the twenty-first aspect wherein the device is a portable communication device.

A twenty-third aspect of the present invention is directed to a portable sound receiving device including the features of the twenty-second aspect, wherein the portable communication device is an accessory to another portable communication device.

A twenty-fourth aspect of the present invention is directed to a portable sound receiving device including the features of the twenty-third aspect, wherein it is a hands-free unit.

The present invention is furthermore directed towards a microphone unit and portable sound receiving device including such a microphone unit, where the microphone unit comprises:
a microphone,
an air filled chamber,
a wind noise barrier covering the chamber for providing a wind shield, and
a sound channel connecting the microphone with the air filled chamber.

The microphone unit may also here be equipped with an additional chamber providing an additional air volume beneath the air-filled chamber, being in contact with the air-filled chamber via a passage in the form of a vent.

The present invention has a number of advantages. It allows enhanced wind noise reduction through changing the wind noise direction and enhancing the air resistance. The invention is further more cheap and simple to produce.

These and other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described in relation to the enclosed drawings, in which
fig. 1 shows a front view of an accessory according to the present invention in the form of a portable sound recording device, which as an example is provided in the form of a headset;
fig. 2 shows a side view of a microphone unit provided in the head set of fig. 1 according to a first embodiment of the present invention,
fig. 3 schematically shows a perspective view of a barrier in the microphone unit according to the first embodiment,
fig. 4 shows a side view of a microphone unit provided in the head set of fig. 1 according to a second embodiment of the present invention,
fig. 5 shows a side view of a microphone unit provided in the head set of fig. 1 according to a third embodiment of the present invention
fig. 6 schematically shows a perspective view of a barrier in the microphone unit according to the third embodiment,
fig. 7 shows a side view of a microphone unit provided in the head set of fig. 1 according to a fourth embodiment of the present invention,
fig. 8 schematically shows a perspective view of a barrier in the microphone unit according to the fourth embodiment where a section has been cut-away,
fig. 9 shows a side view of a microphone unit provided in the head set of fig. 1 according to a fifth embodiment of the present invention,
fig. 10 schematically shows a perspective view of a barrier in the microphone unit according to the fifth embodiment where a section has been cut-away,
fig. 11 shows a side view of a first alternative orientation of a microphone in the head set of fig. 1, and
fig. 12 shows a side view of a second alternative orientation of a microphone in an alternatively shaped head set.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention can be advantageously applied to all types of microphones to reduce sensitivity to wind-noise, i.e. to both directional and omni-directional microphones. Wind-noise is a significant problem particularly in directional microphones, which are more sensitive to this disturbance. However, also omni-directional microphones are sensitive to wind-noise.

In fig. 1 there is shown a sound recording device according to the present invention in the form of a head set 10 which is provided with an ear piece 12 intended to be connected to the ear of a user, a first arm 14 to be provided round the ear of the user and a second arm 16. The second arm 16 has a rounded distal end as well as an ear piece facing end connected to the ear piece 12. There is also shown a longitudinal axis A1 going through the middle of the second arm 16 along the length of this arm 16 in a direction from the ear piece facing end towards and through the rounded distal end. At this rounded distal end there is provided a microphone unit 20. In use the head set 10 is to be connected to the head of the user and provide sounds to the ear (via the ear piece 12) and receive sound from the user via the microphone unit 20. The sounds may here be forwarded from the head set 10 to a portable communication device like a cellular phone. A head set is just one example of an accessory in which the present invention is provided. The invention is not limited to these, but can be applied on any type of accessory or portable sound recording device where sound is to be recorded via a microphone.

Fig. 2 shows a side view of the microphone unit 20 according to a first embodiment of the present invention. In the microphone unit 20 there is provided a microphone 22, which may be mounted on a circuit board 36 (PCB) of the device provided in the second arm, The microphone 22 is furthermore provided in an air filled chamber 24, which chamber has two opposing walls provided on opposite sides of the microphone 22. A first wall may be provided close to the rounded distal end of the second arm provided essentially perpendicular to the longitudinal axis of the second arm and a second wall may be provided in parallel with the first wall and distanced from this first wall in a direction towards the ear piece end. Both these walls may stretch out from the circuit board 36 towards an outer surface of the second arm. The chamber 24 is covered by a wind screen barrier 26. The barrier 26 is attached to the circuit board 36 via two studs 38 and 40. The barrier 26 is in the first embodiment provided with an outer surface facing outwards to an area that is external of the head set and that is adapted in shape to the surrounding casing of the second arm in order to provide a uniform exterior of the head set. The barrier 26 also has an inner surface that is essentially parallel

with the outer surface and faces the air filled chamber 24. The barrier 26 also has a first end provided at the first wall and a second end provided at the second wall. The barrier 26 includes one air passage channel 28 that connects the exterior of the head set with the chamber 24. It therefore has an inlet 30 that is provided at the first end for interfacing the exterior and an outlet 32 provided at the second end for interfacing the chamber 24. The channel 28 is filled with a porous material such as a polymer, metal, plastic etc. which may be a solid material that has holes in it. However, it may also be foam. This material has wind noise reduction properties. The channel 28 then stretches from the first to the second end within the barrier and essentially parallel with the inner and outer surfaces of the barrier 36. The channel 28 does furthermore have walls 34, which are airtight. The wall may here be solid but it may also be flexible. In this embodiment the walls 34 thus face the chamber 24 and the exterior. The channel 28 does furthermore have at least one turn and in the present embodiment two turns. The microphone, which may with advantage be directional but can also be omni-directional, is directed towards the barrier 26, which in turn is directed in a direction from where speech of the user may be picked up when the user wears the head set.

Fig. 3 schematically shows a perspective view of the barrier 26 in the microphone unit according to the first embodiment. As can be seen the wind W can enter the barrier 26 at the first end and exit at the second end.

Because of this construction of the microphone unit 20 there are several advantages obtained. Sound is picked up from the mouth of the user, while at the same time the wind noise is reduced. There are two things that influence the reduction of the wind noise. One first thing is that sound is transported a long way inside the barrier, i.e. the structure with a channel guarantees that the sound travels a long way in the porous material. This enhances the air resistance, which lowers the wind noise. The direction of the wind blown into the channel is furthermore changed. By making the wind direction change a further wind noise reduction is achieved. By placing the microphone so that it is not provided directly below the outlet 32, it is furthermore ensured that the wind noise will be very low.

In fig. 4 there is shown another side view of a microphone unit 20 according to a second embodiment of the present invention. As in fig. 2, the structure here includes an omni-directional microphone. However, the microphone may also be directional. The chamber and the microphone are here provided in the same way as in fig. 2. However there are a few differences. In fig. 4, there is shown a rotational-symmetry axis A2 associated with the chamber and going through the middle of the chamber 24, in a direction from the bottom side

(here PCB 36) towards the barrier 26. The axis A2 is furthermore essentially perpendicular to the bottom side and may with advantage cross the barrier 26 in the middle between the first and second ends. Also the barrier has a different configuration. Here the inlet 30 coincides or is coaxial with the axis A2, while the outlet 32 is distanced from the axis A2 and provided symmetrically around. This is indicated in fig. 4 through the outlet being provided at both the first and the second end.

In fig. 5 there is shown another side view of a microphone unit 20 according to a third embodiment of the present invention. The structure here includes an omni-directional microphone. However, the microphone may also be directional. Here the chamber 24 is provided at the rounded end of the second arm. The chamber 24 here has a bottom surface, which may be provided through the casing of the second arm. Here the barrier 26 can make up all of the walls of the chamber, which meet at the top provided at the rounded end of the second arm. In this way the bottom surface and the barrier define and enclose the chamber 24. For this reason the barrier 26 may have a hemispherical shape. Also here there is shown a rotational-symmetry axis A2 going through the middle of the chamber 24, in a direction from the bottom side towards the barrier 26. The axis A2 is furthermore essentially perpendicular to the bottom side and may with advantage cross the barrier 26 in the middle, i.e. at the top of a hemisphere. The channel 28 in the barrier 26 is here provided symmetrically around the axis A2 and the inlet 30 is provided all around the bottom surface of the chamber 24, which makes up the first end. The inlet 30 is thus distanced from and provided symmetrically around this axis A2.. The outlet 32 is provided at a second end of the barrier 26, which is here at the top of the hemisphere. As is shown in fig. 5, the outlet 30 faces the chamber 24 and is aligned or coaxial with the axis A2. Here the channel 28 is in the same way as previously filled with a porous wind reduction material and has walls that are airtight. The channel 28 is also here provided along the inner and outer surfaces of the barrier 26. The outlet 32 is here provided at the central top of the rounded end, while the inlet 30 is provided close to the bottom surface of the chamber 24, which guarantees that the sound will travel a long distance inside the channel 28 with the porous material..In this embodiment the microphone 22 is further provided in a separate microphone chamber 46 which is in contact with the air filled chamber 22 via a sound channel 44.

Fig. 6 schematically shows a perspective view of the barrier 26 in the microphone unit according to the third embodiment. As can be seen the wind W can enter the barrier 26 at the first end and exit at the second end.

This embodiment has the same advantages as the second embodiment. By providing the microphone so that it can communicate with the air filled chamber with a sound channel further influences of the wind noise in the microphone performance are reduced. Other advantages with providing the microphone in a separate chamber are that it is easier to make the necessary seals because of less integration. It is also possible to have a bigger effective air volume within the same outer dimensions. Yet another advantage is that you have a greater freedom in designing where the microphone is to acoustically enter the air volume provided by the chamber.

It should here be realised that the microphone unit according to the second embodiment may be provided with an inlet and outlet designed as in the third embodiment. In the same way the microphone unit of the third embodiment may be provided with an inlet and an outlet in the same way as in the second embodiment.

Fig. 7 shows a fourth embodiment of a microphone unit 20 according to the present invention that has a microphone 22 provided in a chamber 24 below a barrier 26 with a symmetry axis A2 in the same way as in the second embodiment shown in fig. 4, where the microphone 22 is with advantage an omni-directional microphone. In fig 7, there are a few differences as compared with fig. 4. The barrier 26 is here internally differently configured. It is provided with several channels 28 passing through the barrier 26, each with airtight walls, porous wind reduction material and with at least one turn. The number of turns may vary, but in the present example there is only one turn. Here the inlet 30 of a channel provided at the outer surface of the barrier 26 is furthermore aligned with the corresponding outlet 32 provided at the inner surface of the barrier 26. The channels 28 are here provided symmetrically around the axis A2. The part of each channel 28 before the turn that is connected with the inlet 30 is provided at an angle to the axis A2 of above zero degrees but below ninety degrees, while the part of each channel after the first turn connected with the outlet 32 is provided at an angle above zero degrees but below ninety degrees. These angles are furthermore normally equal..Several channels do in this way also provide a combined distance that sound travels in the barrier 26 that is long. In this way the air resistance is also raised and a substantial wind noise reduction is obtained.

Fig. 8 schematically shows a perspective view of the barrier 26 in the microphone unit according to the fourth embodiment where a section has been cut-away. From this figure the symmetrical shape of the channels are clearly visible.

Fig. 9 shows a fifth embodiment of the microphone unit according to the present invention. Here the microphone 22 is connected to the chamber with a sound channel 44 as in fig. 5. Also the chamber 24 and the barrier 26 have the same general shape and the chamber is provided with a rotational-symmetrical axis A2 as in fig. 5. However, channels 28 through the barrier are provided in the same way as in fig. 7, i.e. symmetrically around the axis A2.

Fig. 10 schematically shows a perspective view of the barrier 26 in the microphone unit according to the fifth embodiment where a section has been cut-away. From this figure the symmetrical shape of the channels are clearly visible.

Fig. 11 shows another variation of the present invention. Here the microphone 22 is directional and provided in the chamber 24 as in the first, second and fourth embodiments. However the chamber 24 and barrier 26 are both shaped according to the third and fifth embodiments. The microphone 22 is furthermore angled away from the axis A2 so that the direction from which it receives sound is angled in relation to the axis A2 with an angle α that is here about 45 degrees. This is done in order to make the microphone 22 be directed towards the end were sound from a mouth of the user would be emitted. Here the channels through the barrier 26 are not shown. These channels may be provided according to any previously described way. The angle α may of course be selected differently. It is however generally angled for being directed towards a direction where it is suitable to pick up sound from the mouth of the user.

Fig. 12 shows another variation of the present invention. Here the microphone 22, which is also directional, is provided in the chamber as in fig. 11. The barrier 26 can be provided according to any previously described way. However, the whole microphone unit 22 has been angled away from the longitudinal axis A1 of the second arm so that the axis A2 is angled away from the longitudinal axis A1 with an angle β that is here about forty-five degrees. The microphone 22 is here angled in relation to the axis A2 with an angle α that is here about ninety degrees. This direction of the microphone has an angular relationship of about forty-five degrees to the longitudinal axis A1 of the second arm. Also this directs the microphone 22 so that it may be directed towards the end were sound from a mouth of the user would be emitted. The angles α and β may of course be selected differently. The angle β is here normally selected for providing an ergonomical or aesthetical design of the head set and the angle α is then selected for directing the microphone towards a direction where it is suitable to pick up sound from the mouth of the user for the selected angle β.

According to another variation of the present invention there is an additional chamber providing an air volume beneath the bottom surface of the air-filled chamber. This additional chamber is in contact with the air filled chamber via a passage in the form of a vent.

It should here be realised that the present invention may be varied in many more ways than the ones described. It is for instance not necessary to use a second arm as shown in fig. 1. In fact the present invention may be provided in other types of hands-free devices than in head-sets. It is in fact not limited to hands-free devices at all but can be provided in any accessory to portable communication devices, such as for instance cellular phones. The invention is not limited to accessories either but can be provided in any portable device where sound is to be recorded. Thus it may also be provided in for instance a cellular phone or in a lap top as well.

It should also be realised that the use of a sound channel between the microphone and the air filled chamber can be provided by itself, i.e. without a barrier that has one or more of the previously described channels in it. The sound channel may also be combined with a microphone unit according to any of the first, second and fourth embodiments of the invention.

Neither is the invention limited to symmetrical barriers or to symmetrical microphone units or hemispherical shapes. Therefore, although the invention has been described with reference to particular preferred embodiments, it is to be understood by those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention.

Claims

1. Microphone unit (20) for a portable sound receiving device (10), comprising
a microphone (22),
an air filled chamber (24), and
a wind noise barrier (26) covering the chamber for providing a wind shield and having at least one air passage channel (28) connecting the exterior of the device with the air filled chamber and having at least one inlet (30) facing the exterior of the device and at least one outlet (32) facing the air filled chamber,
wherein said channel (28) comprises at least one turn for reducing the influence of the wind on the microphone.

2. Microphone unit (20) according to claim 1, wherein the walls (34) of each channel (28) are made of an airtight material.

3. Microphone unit (20) according to claim 1 or 2, wherein each channel (28) is filled with a porous wind reduction material.

4. Microphone unit (20) according to any of claims 1 - 3, wherein the barrier has an outer surface facing the exterior, an inner surface facing the chamber, a first end attached to one end of the chamber and a second end provided at a second opposite end of the chamber.

5. Microphone unit (20) according to claim 4, wherein the channel stretches within the barrier essentially aligned with the inner and outer surfaces of the barrier.

6. Microphone unit (20) according to claim 4 or 5 wherein there is only one channel (28).

7. Microphone unit (20) according to claim 6, wherein the inlet (30) is provided at the first end of the barrier and the outlet (32) is provided at the second end of barrier.

8. Microphone unit (20) according to claims 6 or 7, wherein the chamber has a bottom surface and there is a rotational-symmetrical axis (A2) of the chamber provided through the bottom surface and the centre of the chamber that is perpendicular to the bottom surface, where the channel (30) is provided symmetrically around said rotational-symmetrical axis.

9. Microphone unit (20) according to claim 8, wherein the inlet is coaxial with the axis and the outlet is distanced from and provided symmetrically around the axis.

10. Microphone unit (20) according to claim 8, wherein the inlet is distanced from and provided symmetrically around the axis and the outlet is coaxial with the axis.

11. Microphone unit (20) according to claim 4, wherein there are several channels (28) provided in the barrier (26).

12. Microphone unit (20) according to claim 11, wherein the inlet (30) of each channel (28) provided at the outer surface of the barrier (26) is aligned with the corresponding outlet (32) on the inner surface of the barrier.

13. Microphone unit (20) according to claim 11 or 12, wherein the chamber has a bottom surface and there is a rotational-symmetrical axis (A2) of the chamber provided through the bottom surface and the centre of the chamber that is perpendicular to the bottom surface and the channels are provided symmetrically around the axis.

14. Microphone unit (20) according to any of claims 1 – 13, wherein the microphone (22) is provided in the air filled chamber (24).

15. Microphone unit (20) according to claim 14, wherein the chamber has a bottom surface, there is an axis (A2) provided through the bottom surface and the centre of the chamber that is perpendicular to the bottom surface and where the barrier provides all walls and ceilings of the chamber, wherein the microphone (22) is angled (α) away from this axis.

16. Microphone unit (20) according to claim 15, wherein the microphone is directional.

17. Microphone unit (20) according to claim 15 or 16, wherein the microphone is angled by about forty-five degrees to said axis (A2).

18. Microphone unit (20) according to claim 15 or 16, wherein the microphone is angled by about ninety degrees to said axis (A2).

19. Microphone unit (10) according to any of claims 1 - 13, wherein the microphone is in contact with the air filled chamber via a sound channel (44).

20. Microphone unit (10) according to any previous claim, wherein there is an additional chamber providing an additional air volume beneath the air-filled chamber (24), being in contact with the air-filled chamber via a passage in the form of a vent.

21. Portable sound receiving device (10) comprising
a microphone unit (20) having
a microphone (22),
an air filled chamber (24), and
a wind noise barrier (26) covering the chamber for providing a wind shield and having
at least one air passage channel (28) connecting the exterior of the device with the air filled chamber and having at least one inlet (30) facing the exterior and at least one outlet (32) facing the air filled chamber,
wherein said channel comprises at least one turn for reducing the influence of the wind on the microphone.

22. Portable sound receiving device according to claim 21, wherein the device is a portable communication device.

23. Portable sound receiving device according to claim 22, wherein the portable communication device is an accessory to another portable communication device.

24. Portable sound receiving device according to claim 23, wherein it is a hands-free unit.

25. Microphone unit (20) for a portable sound receiving device (10), comprising
a microphone (22),
an air filled chamber (24),
a wind noise barrier (26) covering the chamber for providing a wind shield, and
a sound channel (44) connecting the microphone with the air filled chamber.

26. Microphone unit (20) according to claim 25, wherein there is an additional chamber providing an additional air volume beneath the air-filled chamber (24), being in contact with the air-filled chamber via a passage in the form of a vent.

27. Portable sound receiving device (10) comprising

a microphone unit (20) having

a microphone (22),

an air filled chamber (24), and

a wind noise barrier (26) covering the chamber for providing a wind shield, and

a sound channel (44) connecting the microphone with the air filled chamber.

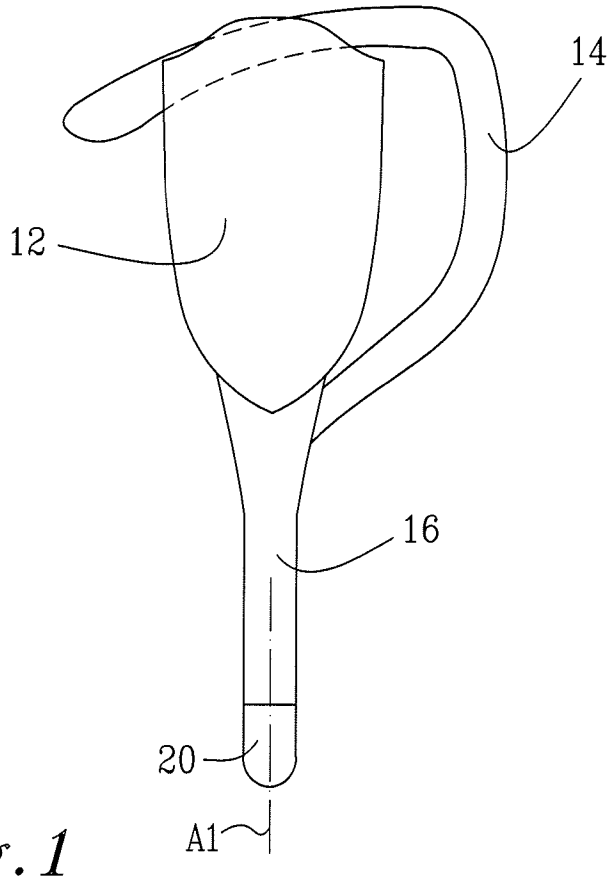


Fig. 1

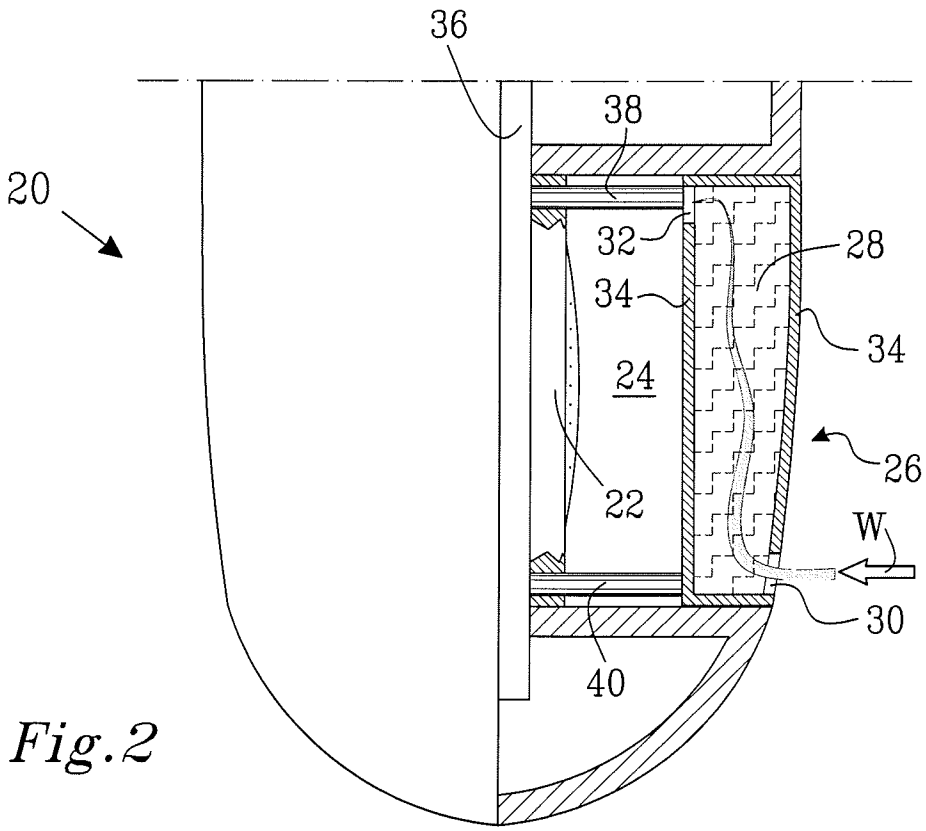


Fig. 2

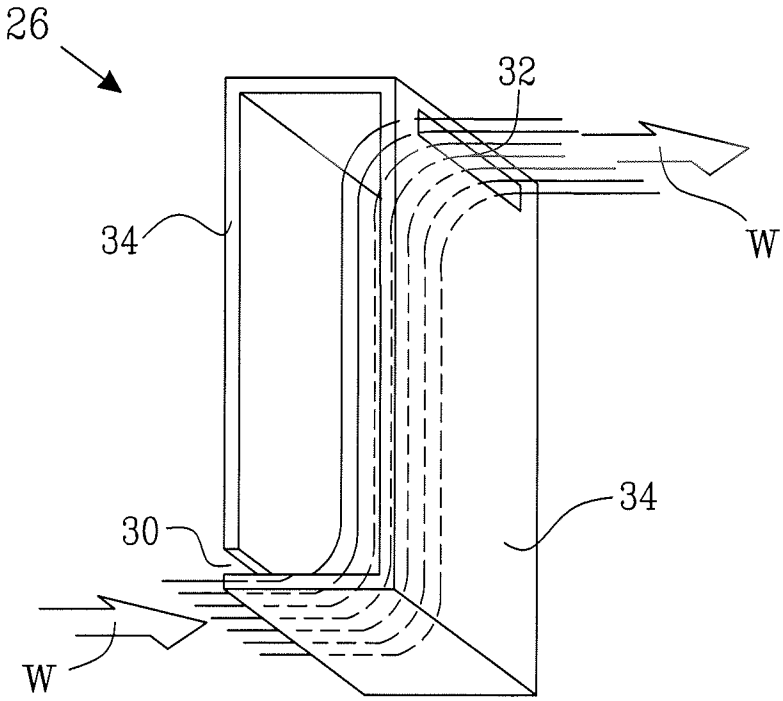


Fig.3

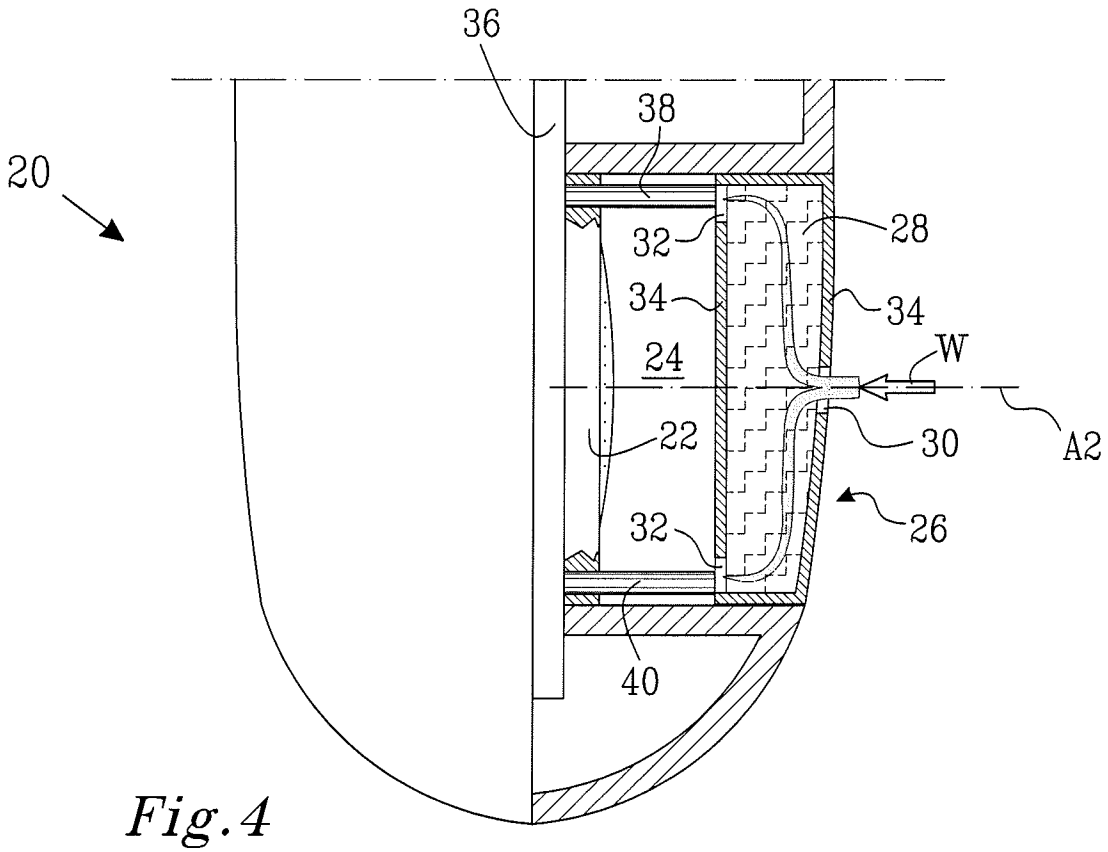


Fig.4

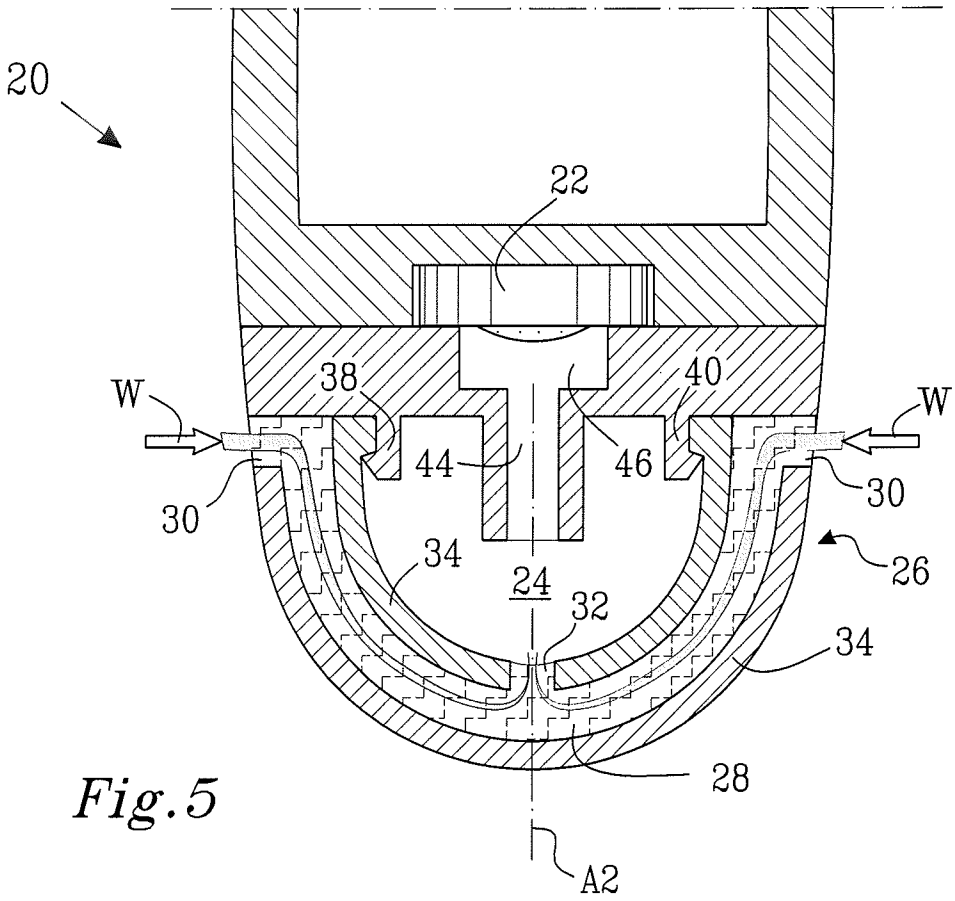


Fig.5

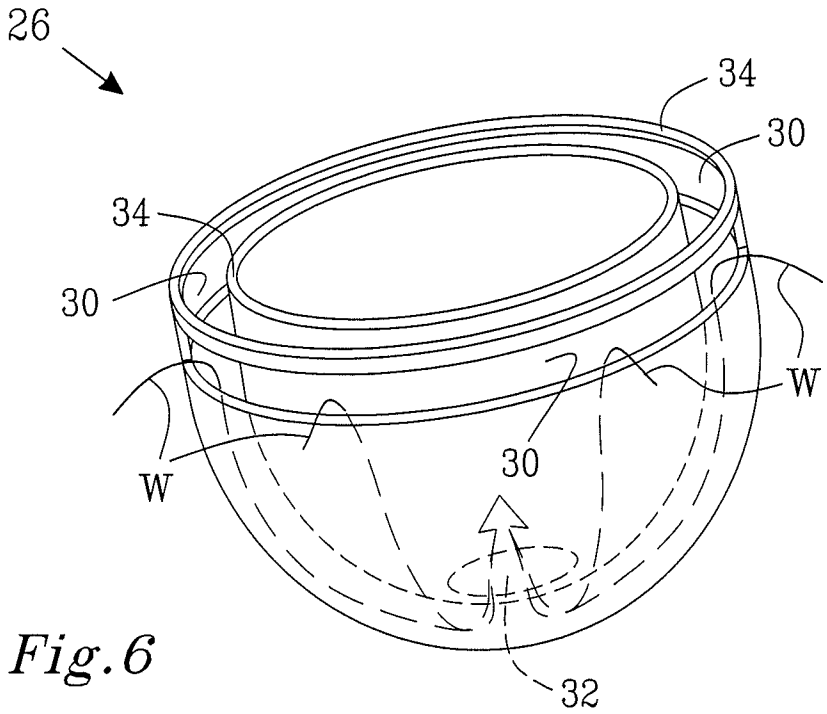


Fig.6

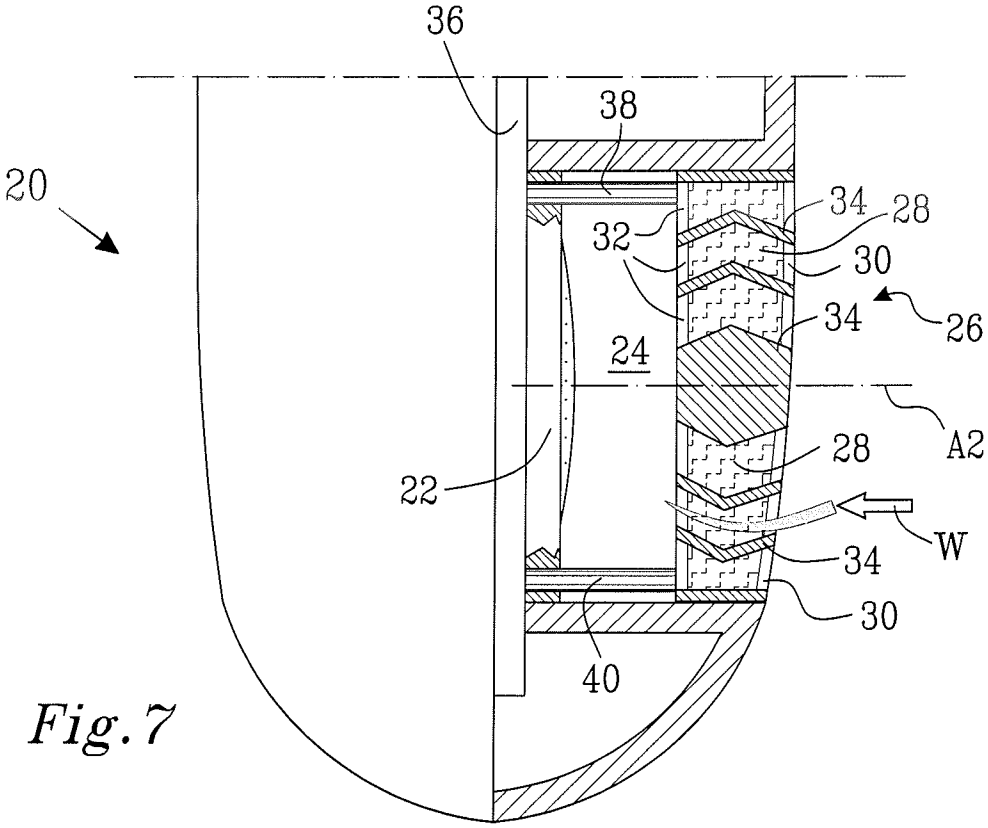


Fig. 7

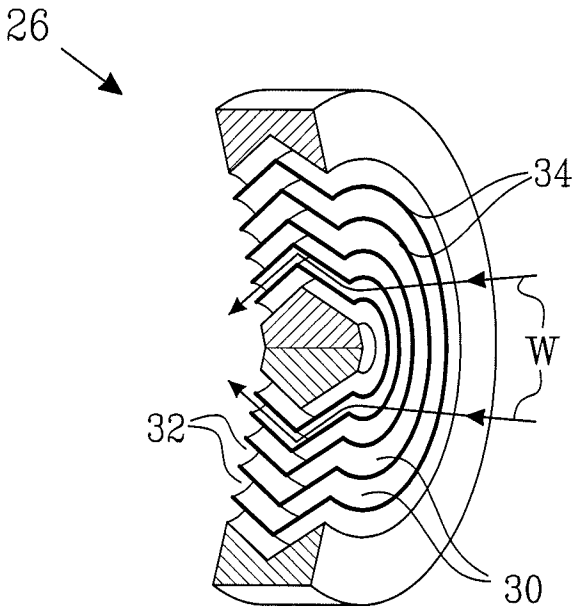


Fig. 8

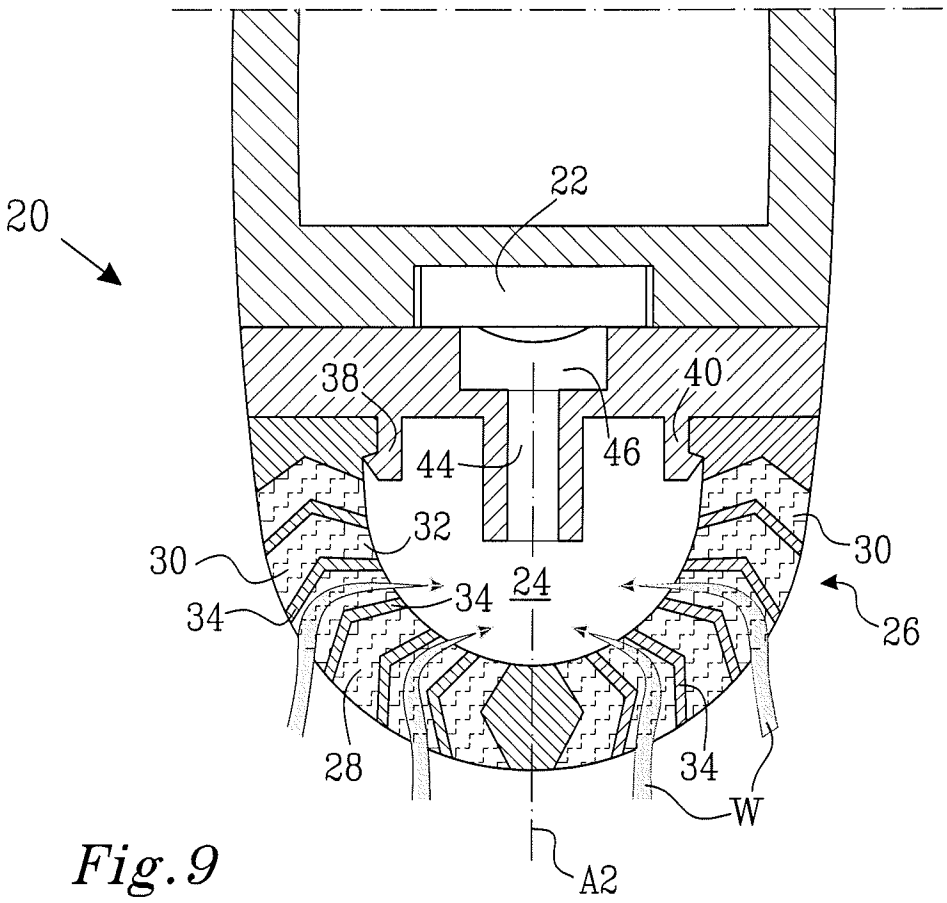


Fig. 9

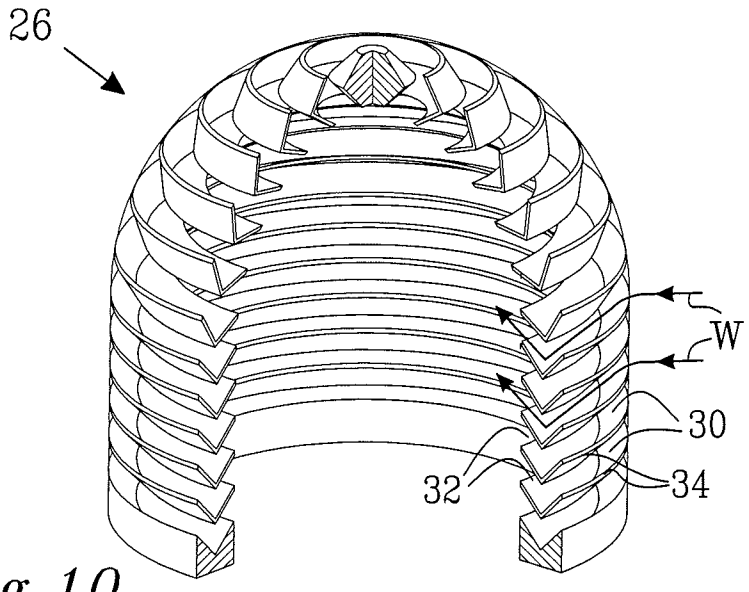


Fig. 10

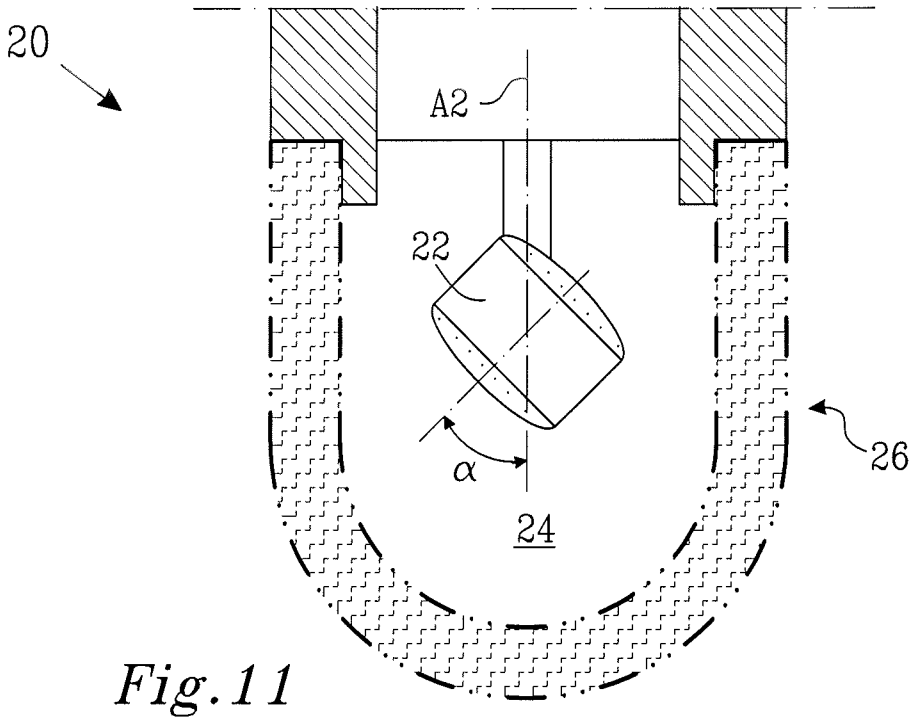


Fig.11

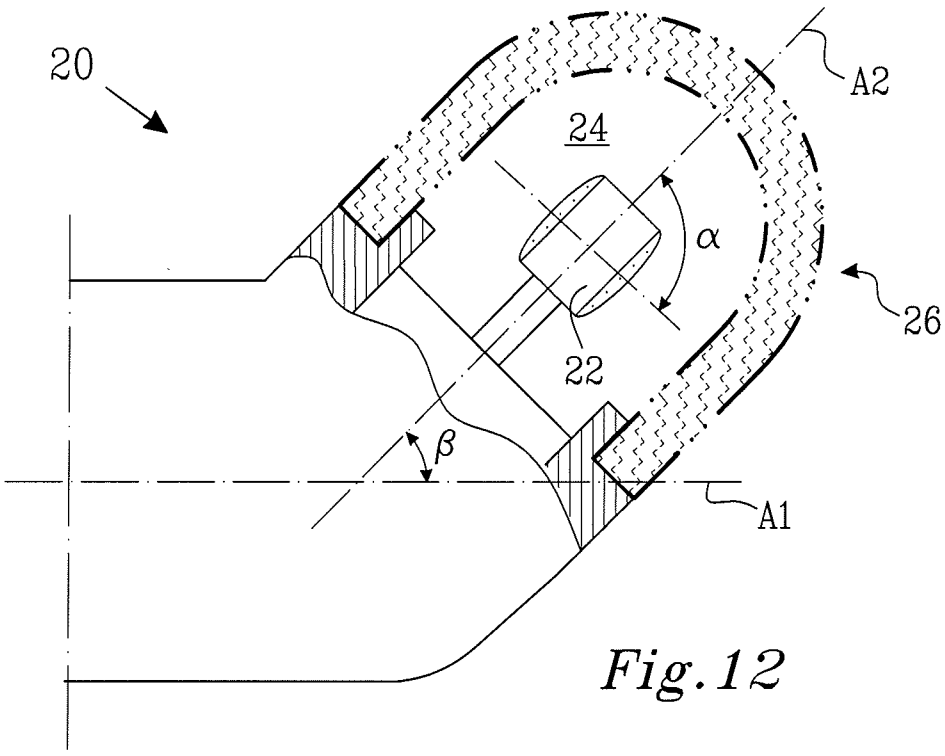


Fig.12

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/053928

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04R1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 684 880 A (LAZZERONI JOHN J [US] ET AL) 4 November 1997 (1997-11-04) column 7, line 65 - column 8, line 15; figure 3	1-27
X	EP 1 349 426 A2 (SIEMENS HEARING INSTR INC [US]) 1 October 2003 (2003-10-01) figure 1	1-27
X	GB 2 315 633 A (NIPPON ELECTRIC CO [JP]) 4 February 1998 (1998-02-04) abstract; figures 1,2	1-27
A	EP 1 113 701 A (THOMSON BRANDT GMBH [DE]) 4 July 2001 (2001-07-04) paragraph [0018]; figure 2	1-27

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 July 2007	08/08/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Brandt, Isabelle

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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