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(54) **Wind noise reduction for microphone**

Verminderung von Windgeräuschen für ein Mikrophon

Réduction des effets des bruits du vent pour un microphone

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a transmitter portion of a portable electronic communication device and is concerned with reducing wind-noise produced by an undesired air stream blowing into a microphone.

[0002] Conventionally, several types of so-called "non-directional microphones" have been used in transmitters provided in portable electronic communication devices such as cellular 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 electronic devices having limited battery capacity.

[0003] Moreover, non-directional microphones also suffer from low signal to ambient ratio, whereby noise or background sound can negatively influence voice. Therefore, there is also a need to improve this, for instance by using a directional microphone, which has a better signal to ambient ratio compared to a non-directional microphone. However, since a directional microphone is sensitive to wind noise, to be able to use the advantage compared to a non-directional microphone, wind noise sensitivity needs to be reduced. Due to large power consumption noise cancelling algorithms are not suitable in portable devices as described above. Because of that, non-directional microphones have not found wide-spread application among portable electronic devices of today.

[0004] For example US 5 442 713 discribes a packaging scheme for a microphone which reduces the sensitivity of the microphone in wind noisy environments.

[0005] Thus, there is a need of a microphone, in particular a directional microphone, for a portable electronic device having low power consumption, good signal to ambient ratio, and being resistant to wind noise.

SUMMARY OF THE INVENTION

[0006] The present invention is thus directed towards providing a microphone unit, in particular a directional microphone unit, for a portable electronic device that has low power consumption, good signal to ambient ratio, which device is resistant to wind noise.

[0007] Accordingly, an object of the invention is to provide a microphone for a telephone-transmitter to reduce wind-noise.

[0008] According to a first aspect of the invention, this is achieved by locating a microphone in a chamber provided with at least one sound passage, wherein one or more element(s) is/are provided in the sound passage(s) to decrease the speed of the air stream.

[0009] A microphone unit according to the invention includes, in front of a microphone pick up of the microphone unit a chamber. The chamber has a predetermined sectional area and volume, which together with the total sectional area and volume of the sound passages, reduces the influence of the undesired air stream.

[0010] A second aspect of the present invention is directed to a microphone unit for a portable electronic device, comprising a microphone pick up located within a microphone pick up housing forming a chamber. The chamber being provided with at least one sound passage opening for receiving sound from outside the device, wherein said at least one sound passage opening is provided with at least one wind noise reduction element.

[0011] A third aspect of the present invention is directed to a microphone unit including the aspects of the second aspect, wherein said wind reduction element comprises a mesh having one layer.

[0012] A fourth aspect of the present invention is directed to a microphone unit including the aspects of the second aspect, wherein said wind noise reduction element comprises a mesh having a plurality of layers.

[0013] A fifth aspect of the present invention is directed to a microphone unit including the aspects of the third or the fourth aspect, wherein the ratio between the chamber size and the density of the mesh is arranged to maintain the directional pick up pattern of the microphone used.

[0014] A sixth aspect of the present invention is directed to a microphone unit including the aspects of the second to the fifth aspect, wherein the mesh is made of metal.

[0015] A seventh aspect of the present invention is directed to a microphone unit including the aspects of the second to the sixth aspect, wherein the mesh is made of polymer material such as nylon.

[0016] An eighth aspect of the present invention is directed to a microphone unit including the aspects of the second to the seventh aspect, wherein said housing extending in a longitudinal direction is a cylinder having a jacket surface and a side surface.

[0017] A ninth aspect of the present invention is directed to a microphone unit including the aspects of the eight aspect, wherein said sound passage opening is a hole extending in the longitudinal direction in said mantle surface.

[0018] A tenth aspect of the present invention is directed to a microphone unit including the aspects of the eight or ninth aspect, wherein said hole is a hole in said side surface.

[0019] An eleventh aspect of the present invention is directed to a microphone unit icluding any one of the first to the tenth aspect, wherein said micophone unit is a directional microphone.

[0020] A twelveth aspect of the present invention is directed to a microphone unit according to any one of the first to the tenth aspects, wherein said microphone unit is non-directional.

[0021] 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

[0022]

Fig. 1 is a schematic sectional view, of the microphone unit of the invention;
Fig. 2 is a perspective view, of the microphone unit of the invention;
Fig. 3 is a schematic view of a mesh which was used to reduce wind-noise; and

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] The present invention can be advantageously applied to all types of microphones to reduce sensitivity to wind-noise. Wind-noise is a significant problem particularly in directional microphones, which are more sensitive to this disturbance. Accordingly, the invention will be described with reference to an electret condenser type directional microphone is used, but is not in any sense limited thereto.

[0024] In Fig. 1 a main part 1 of a cellular phone transmitter unit is provided with a directional microphone pick up 2. The microphone pick up 2 is surrounded by a pick up housing 3 forming a chamber 4 having a predetermined cross-sectional area and a predetermined volume, which chamber 4 encloses the microphone pick up 2. The chamber 4 includes at least one sound passage opening 5, preferably a plurality of sound passage openings 5', 5' ', 5 ' ' ', each opening 5', 5' ', 5' ' ' provided with a wind noise reduction element 6. The number of wind noise reduction elements 6', 6' ', 6' ' ' can be any suitable number and is by no means limited to a particular number. The microphone pick up 2, the housing 3, the sound passage openings 5', 5' ', 5' ' ' and the noise reduction element 6', 6' ', 6' ' all together provide a directional microphone unit 10, which can be positioned in connection to a mouthpiece (not shown) provided in a front panel (not shown) of a portable electronic device (not shown). This is not shown in more detail since it is well known for a person skilled in the art of portable electronic devices.

[0025] Now is referred also to Fig. 2. Preferably, the housing 3 has the shape of a cylinder, provided with a number of relatively large sound passage openings (holes) arranged in all directions, for instance extending in a longitudinally direction of a jacket surface 7. Preferably, there is also provided a sound passage 5 opening in a side surface 8.

[0026] In a microphone unit 10 according to the invention, part of the air stream which includes wind-noise is interrupted or blocked by the mouthpiece (not shown), and part is able to pass through the sound passage openings 5, 5', 5" to enter the chamber 4. Because of the interaction bewteen chamber 4 volume, openings 5, 5', 5" and wind noise reduction element 6, the air particle velocity, forming the wind, is not easily able to enter the chamber and produce wind-noise in the microphone pick up unit.

[0027] Now is referred to Fig. 3. The wind noise reduction element 6 could for instance comprise one single layer such as a mesh made of metal, or polymer material. The mesh can be of conventional type comprising wires 12 with openings 13. The mesh can also be made of textile fabrics such as cotton fabric or the like.

[0028] Typically, the ratio between the chamber size and the density of the mesh is arranged to maintain a desired level of directionality from the microphone pick up unit. Similarly the cross-sectional area and volume of the chamber may be determined experimentally to achieve the desired reduction in wind-noise.

[0029] Because the sensitivity of a microphone with respect to an air stream has, in general, a proportional relationship with the speed of the impinging air stream, it has been found that by decreasing the speed of the air stream as just described, wind-noise due to the air stream can be reduced to an almost negligible level. However, it has been found that the sound or speaking voice signal or sound wave is transmitted in a normal manner so that the reproduced speaking voice is not adversely affected.

[0030] Accordingly, it is seen that the inventive microphone unit provides greatly reduced sensitivity to wind-noise, is non-expensive, since no electronics or software is required, and offer good overall frequency response characteristics. The microphone unit is small in size, typically two to three times the size of the miniature microphone capsule. The reduction can vary from 15-30 dB depending on the amount of directionality that must be maintained. More reduction implies less directionality.

Claims

1. Microphone unit (10) for mobile equipment, **characterized by**:

   - a microphone pick up housing (3) having a cylindrical shielding surface (7) defining a cylindrical chamber (4) therein wherein the cylindrical shielding surface has at least three elongated sound passage openings (5,5',5") there through, wherein a length of each of the elongated sound passage openings (5,5',5 ") in a longitudinal direction of the cylindrical chamber (4) is greater than a width thereof in a direction orthogonal with respect to the longitudinal direction, and wherein the at least three elongated sound passage openings (5,5',5") are aligned in the longitudinal direction;
   - a microphone pick up (2) located in the cylindrical chamber (4) defined by the microphone pick up housing (3), wherein the microphone pick up (2) is surrounded by the at least three elongated sound passage openings (5,5',5"); and

- a noise reduction element (6,6',6") covering the elongated sound passage openings (5,5',5");
wherein the microphone pick up (2) comprises a directional condenser type microphone pick up (2) that is surrounded by the at least three elongated sound passage openings (5,5',5"); and
wherein the directional condenser type microphone pick up (2) is canted at an angle relative to the longitudinal direction of the cylindrical chamber (4).

2. Microphone unit (10) according to claim 1, wherein said noise reduction element (6,6',6") comprises a mesh having one layer.

3. Microphone unit (10) according to claim 1, wherein said noise reduction element (6,6',6") comprises a mesh having a plurality of layers.

4. Microphone unit (10) according to any one of claims 2-3, wherein the mesh is made of metal.

5. Microphone unit (10) according to any one of claims 2-4, wherein the mesh is made of polymer material such as nylon.

6. Microphone unit (10) according to any one of the previous claims, wherein the said microphone pick up housing (3) has a side surface (8) that is perpendicular with respect to the longitudinal direction and herein the side surface (8) has a sound passage opening (5) there through.

Patentansprüche

1. Mikrofoneinheit (10) für eine mobile Anlage, **gekennzeichnet durch**:

- ein Mikrofonaufnahmegehäuse (3), das eine zylindrische Abschirmfläche (7) aufweist, die darin eine zylindrische Kammer (4) festlegt, wobei die zylindrische Abschirmfläche dort hindurch mindestens drei langgestreckte Schalldurchlassöffnungen (5, 5', 5") aufweist, wobei eine Länge einer jeden der langgestreckten Schalldurchlassöffnungen (5, 5', 5") in einer Längsrichtung der zylindrischen Kammer (4) größer als ihre Breite in einer Richtung senkrecht mit Bezug auf die Längsrichtung ist und wobei die mindestens drei langgestreckten Schalldurchlassöffnungen (5, 5', 5") in der Längsrichtung ausgerichtet sind,
- eine Mikrofonaufnahmevorrichtung (2), die in der zylindrischen Kammer (4) angeordnet ist, die **durch** das Mikrofonaufnahmegehäuse (3) festgelegt ist, wobei die Mikrofonaufnahmevorrichtung (2) von den mindestens drei langgestreckten Schalldurchlassöffnungen (5, 5', 5") umgeben ist, und
- ein Geräuschverminderungselement (6, 6', 6"), das die langgestreckten Schalldurchlassöffnungen (5, 5', 5") abdeckt,
wobei die Mikrofonaufnahmevorrichtung (2) eine Aufnahmevorrichtung (2) eines Richtmikrofons vom Kondensatortyp aufweist, die von den mindestens drei langgestreckten Schalldurchlassöffnungen (5, 5', 5") umgeben ist, und
wobei die Aufnahmevorrichtung (2) eines Richtmikrofons vom Kondensatortyp unter einem Winkel mit Bezug auf die Längsrichtung der zylindrischen Kammer (4) schräggestellt ist.

2. Mikrofoneinheit (10) nach Anspruch 1, wobei das Geräuschverminderungselement (6, 6', 6") ein Netz umfasst, das eine Schicht aufweist.

3. Mikrofoneinheit (10) nach Anspruch 1, wobei das Geräuschverminderungselement (6, 6', 6") ein Netz umfasst, das mehrere Schichten aufweist.

4. Mikrofoneinheit (10) nach einem der Ansprüche 2 - 3, wobei das Netz aus Metall besteht.

5. Mikrofoneinheit (10) nach einem der Ansprüche 2 - 4, wobei das Netz aus einem Polymermaterial, wie z.B. Nylon, besteht.

6. Mikrofoneinheit (10) nach einem der vorhergehenden Ansprüche, wobei das Mikrofonaufnahmegehäuse (3) eine Seitenfläche (8) aufweist, die senkrecht mit Bezug auf die Längsrichtung ist und wobei die Seitenfläche (8) hierin eine Schalldurchlassöffnung (5) dort hindurch aufweist.

Revendications

1. Unité de microphone (10) pour un équipement mobile, **caractérisée par**:

- un logement de prise de microphone (3) comportant une surface de blindage cylindrique (7) définissant une chambre cylindrique (4) à l'intérieur de celui-ci, dans laquelle la surface de blindage cylindrique comporte au moins trois ouvertures de passage de son allongées (5, 5', 5") à travers celle-ci, dans laquelle une longueur de chacune des ouvertures de passage de son allongées (5, 5', 5") dans un sens longitudinal de la chambre cylindrique (4) est supérieure à une largeur de celle-ci dans un sens orthogonal au sens longitudinal, et dans laquelle les au moins trois ouvertures de passage de son allongées

(5, 5', 5") sont alignées dans le sens longitudinal ;
- une prise de microphone (2) située dans la chambre cylindrique (4) définie par le logement de prise de microphone (3), dans laquelle la prise de microphone (2) est entourée par les au moins trois ouvertures de passage de son allongées (5, 5', 5") ; et
- un élément de réduction de bruit (6, 6', 6") recouvrant les ouvertures de passage de son allongées (5, 5', 5") ;
dans laquelle la prise de microphone (2) comprend une prise de microphone de type à condensateur directionnel (2) qui est entourée par les au moins trois ouvertures de passage de son allongées (5, 5', 5") ; et
dans laquelle la prise de microphone de type à condensateur directionnel (2) est inclinée à un angle par rapport au sens longitudinal de la chambre cylindrique (4).

2. Unité de microphone (10) selon la revendication 1, dans laquelle ledit élément de réduction de bruit (6, 6', 6") comprend un maillage comportant une couche.

3. Unité de microphone (10) selon la revendication 1, dans laquelle ledit élément de réduction de bruit (6, 6', 6") comprend un maillage comportant une pluralité de couches.

4. Unité de microphone (10) selon l'une quelconque des revendications 2 et 3, dans laquelle le maillage est constitué de métal.

5. Unité de microphone (10) selon l'une quelconque des revendications 2 à 4, dans laquelle le maillage est constitué d'un matériau polymère comme du nylon.

6. Unité de microphone (10) selon l'une quelconque des revendications précédentes, dans laquelle ledit logement de prise de microphone (3) comporte une surface latérale (8) qui est perpendiculaire au sens longitudinal et dans laquelle la surface latérale (8) comporte une ouverture de passage de son (5) à travers celle-ci.

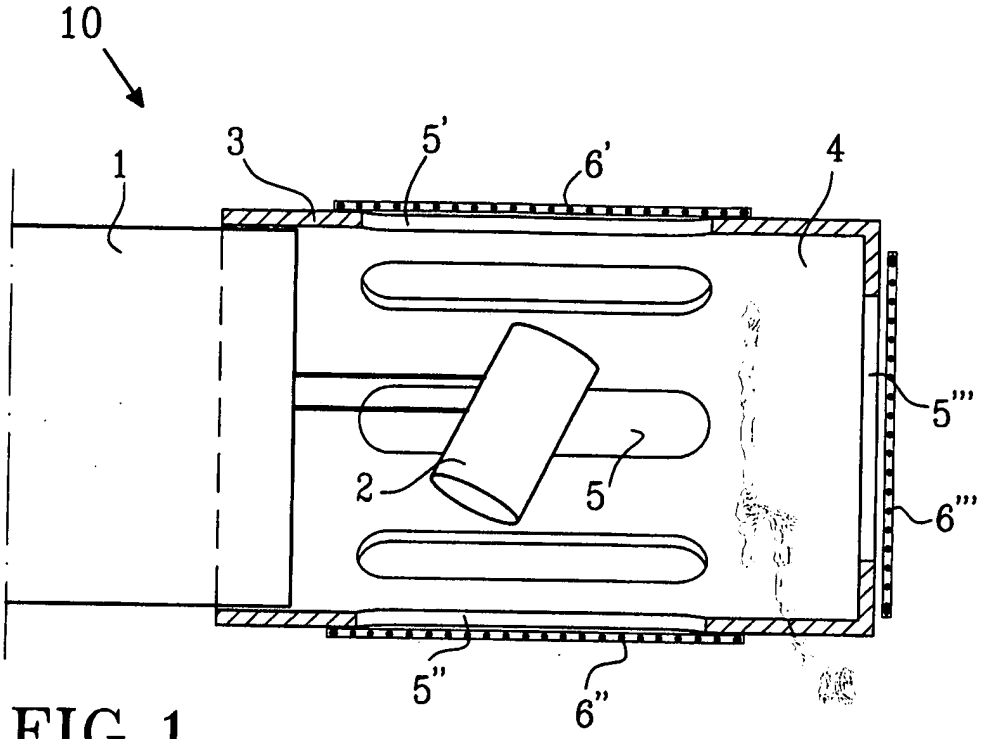

FIG.1

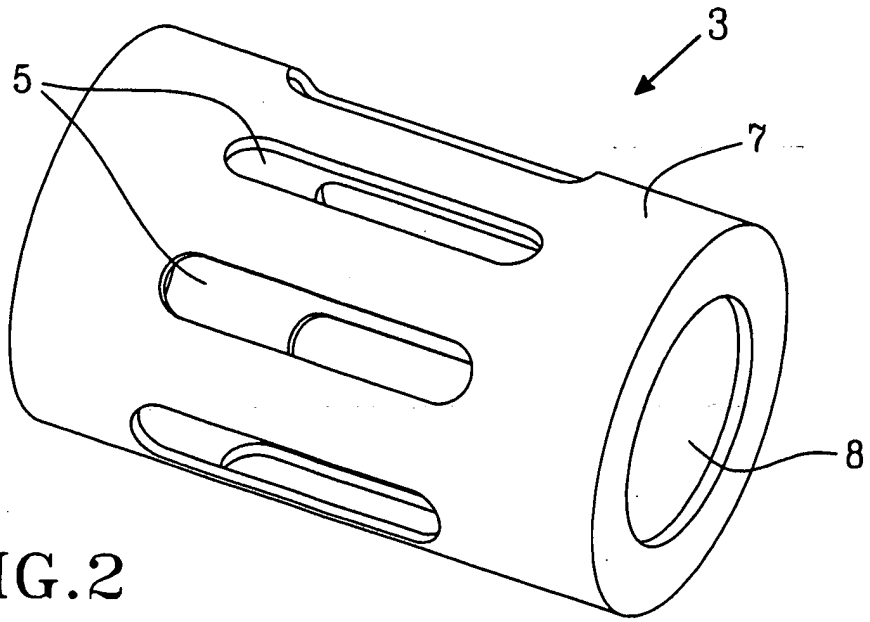

FIG.2

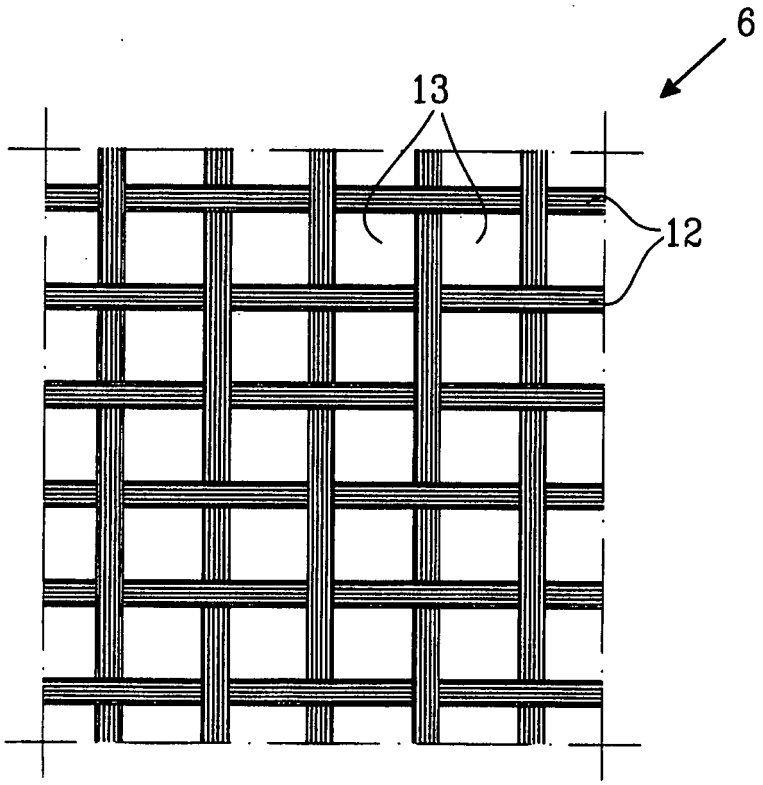

FIG.3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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